

Sones Pond
2008 Trophic Status Index Study
Loyalsock Creek Watershed
Forks Township, Sullivan County

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Introduction

There are numerous lakes, impoundments, and wetland systems scattered across the landscape in the northern portions of Sullivan County. The abundance of lakes and impoundments in the area are attributed to the glaciated topography of the region. Prior to 2007, the Department had conducted few lake assessments in this part of the region. However, six lakes have been surveyed within the past two years. A number of these lakes have documented acid problems and elevated mercury levels in fish are common. The Department intends to continue targeting this area for lake surveys in order to document aquatic impacts and public health risks associated with acid deposition and mercury contamination and the Sones Pond survey is part of that initiative.

Sones Pond is located in the Loyalsock State Forest and was built in the 1930's during the construction of state forest roads (Department of Conservation and Natural Resources; (DCNR)). The dam was constructed on Coal Run and probably flooded a natural wetland, but it was cleared of stumps and logs and then dredged by the Civilian Conservation Corps (CCC) in the 1940's (Hollender and Wilberding 1988). Sones Pond was dedicated as a state forest fishing area in the late 1960's and restrooms, picnic facilities, and a boat access area were constructed to facilitate public use. There are no records that indicate the Department has ever surveyed Sones Pond, but the PA Fish and Boat Commission conducted surveys in 1943, 1970, and 1988. The impoundment is currently managed as a day use facility by DCNR and is open to the public for fishing and non motorized boating.

Coal Run is a tributary to Loyalsock Creek and is classified in Chapter 93 as cold water fishes (CWF). According to the Pennsylvania Integrated Monitoring and Assessment Report (2008), Coal Run is meeting its designated use for aquatic life. However, there are no records that indicate the stream has ever been sampled.

The Department is obligated by the Clean Water Act and Clean Streams Law to assess all lakes and impoundments in the state to determine whether their conditions are attaining designated uses for aquatic life, recreation, and public health. Aquatic life use is assessed by conducting trophic status index (TSI) studies, evaluating Chapter 93 water quality standards, and conducting fisheries surveys where recent fisheries data are not available. Recreational use is assessed by conducting aquatic macrophyte surveys, fisheries surveys, and sometimes bacteria collections in lakes that permit swimming. In lakes where no boating or swimming is permitted, a fisheries assessment is used to assess recreation. Human health assessments are conducted by evaluating fish tissue for contaminants, water quality for bacteria, and any other use that the lake may be designated (e.g. public water supply).

During the spring, summer, and fall of 2008, I conducted a lake assessment on Sones Pond with assistance from John Ryder. The purpose of the survey was to assess the water quality and fish population conditions to determine aquatic life, recreation, and human health use attainment. We did not conduct an aquatic macrophyte survey following DEP protocol, but we conducted a qualitative assessment of the plant community. Thorough sampling of aquatic plants for cataloging purposes may occur in future years as time permits.

Drainage Basin Description

The Bureau of Dam safety records indicate Sones Pond is an eight hectare (20 acre) impoundment located at the headwaters of Coal Run in Forks Township, Sullivan County (Figure 1). However, my estimate of the surface acreage using aerial photography and previous studies by PFBC (Hollender and Wilberding 1989) is 5.6 hectares (14 acres). The drainage area is 1.29 km² (0.5 mi²) and 97% of the impoundment's watershed is forested. The mean annual precipitation is 99 cm (39 inches) and the mean basin elevation is 582 meters (1910 ft.; USGS stream stats). Coal Run is part of the Lower West Branch Susquehanna River (HUC 02050206) drainage and is located in the Mountainous High Plateau Section of the Ridge and Valley province. The topography in the Mountainous High Plateau Section is described as broad flat-topped mountains with steep slopes and deep angular valleys (Shultz 1999).

Sones pond is a mountaintop impoundment that is located on a plateau that separates the Little Loyalsock and Loyalsock Creek drainages. Soil associations in the lake's drainage basin are Wellsboro, Norwich, and Morris in level areas and Oquaga and Arnot on slopes. Soils underlying the lake bed are Morris (Ms) and Norwich (No) soils. All of the soils in the watershed range from very to moderately acidic ((USDA 1986; Table 1). The bedrock geology that underlies the watershed is Pottsville (64%) and Mauch Chunk (36%) sandstone formations (Berg and Dodge 1981).

Methods

Water samples were collected at two stations on April 16, July 23, and October 22, 2008 to capture spring, summer, and fall conditions. A fisheries survey and fish tissue sample was collected on September 18, 2008. Water collection points were established at the midpoint of the impoundment (Station 1) and near the dam (Station 2; Figure 2). Water samples were only collected 1-meter below the surface at both stations because the maximum depth of water was less than 3-meters. All water samples were collected with a Kemmerer bottle and plankton samples were collected with a Wisconsin plankton net (80 µm mesh size). Lake profile field measurements were collected for dissolved oxygen, pH, specific conductance, and temperature at half-meter intervals from surface to bottom using a Hydrolab Quanta. A secchi disc measurement was also taken at each station.

Water samples were tested for total nitrogen (TN), nitrites (NO₂), nitrates (NO₃), ammonia (NH₄), total phosphorous (TP), ortho phosphorous (OP), total organic carbon (TOC), total suspended solids (TSS), total dissolved solids (TDS), specific conductance (SPC), pH, alkalinity (ALK), total aluminum (Al), total manganese (Mn), total magnesium (Mg), total iron (Fe), total calcium (Ca), total sulfate (Su), and color. Filtered samples were analyzed for chlorophyll-*a* and plankton samples were identified and quantified. All samples were processed by the DEP Bureau of Labs and were analyzed according to American Public Health Association (1992) methods.

Figure 1 – Location of Sones Pond in Forks Township, Sullivan County.

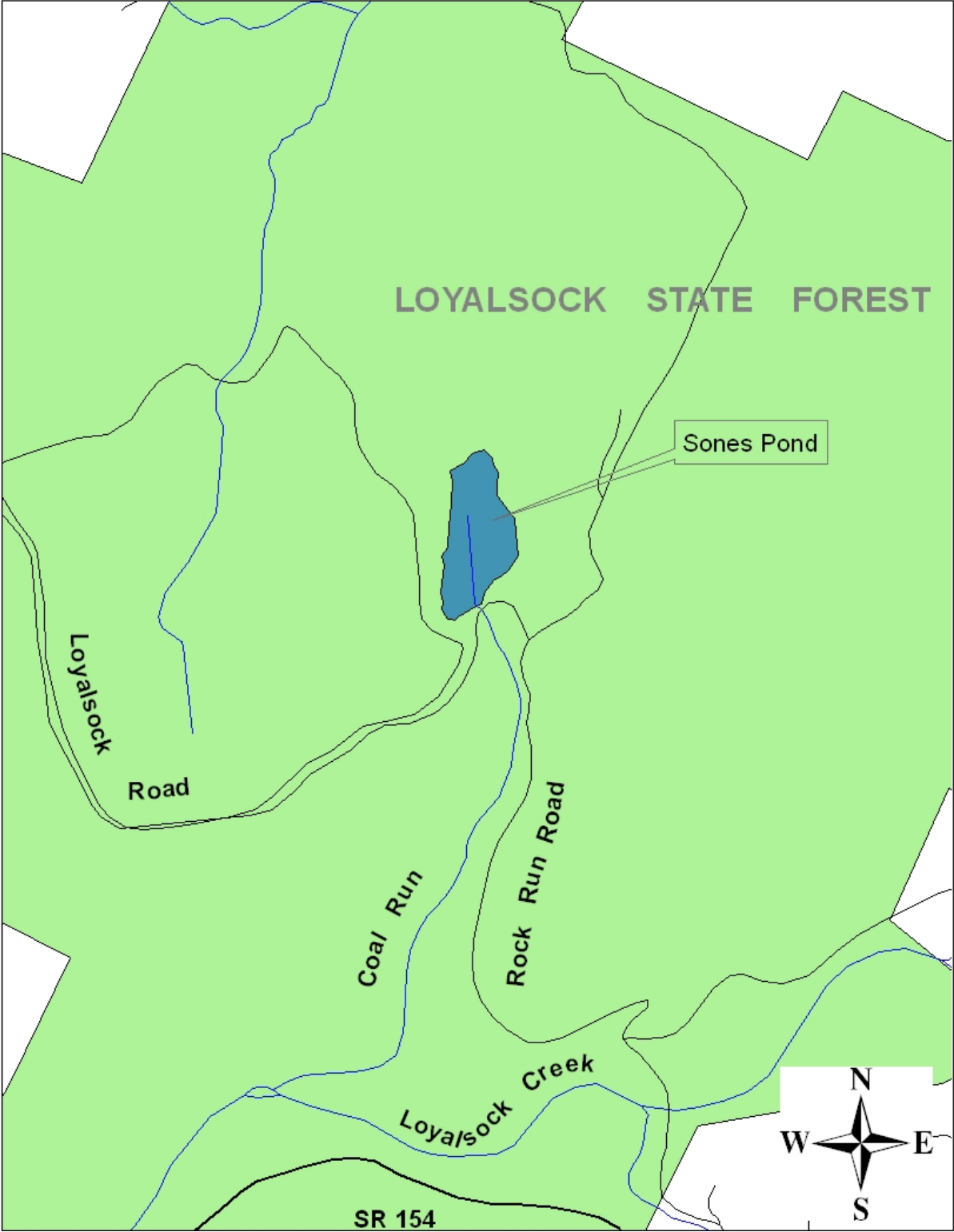
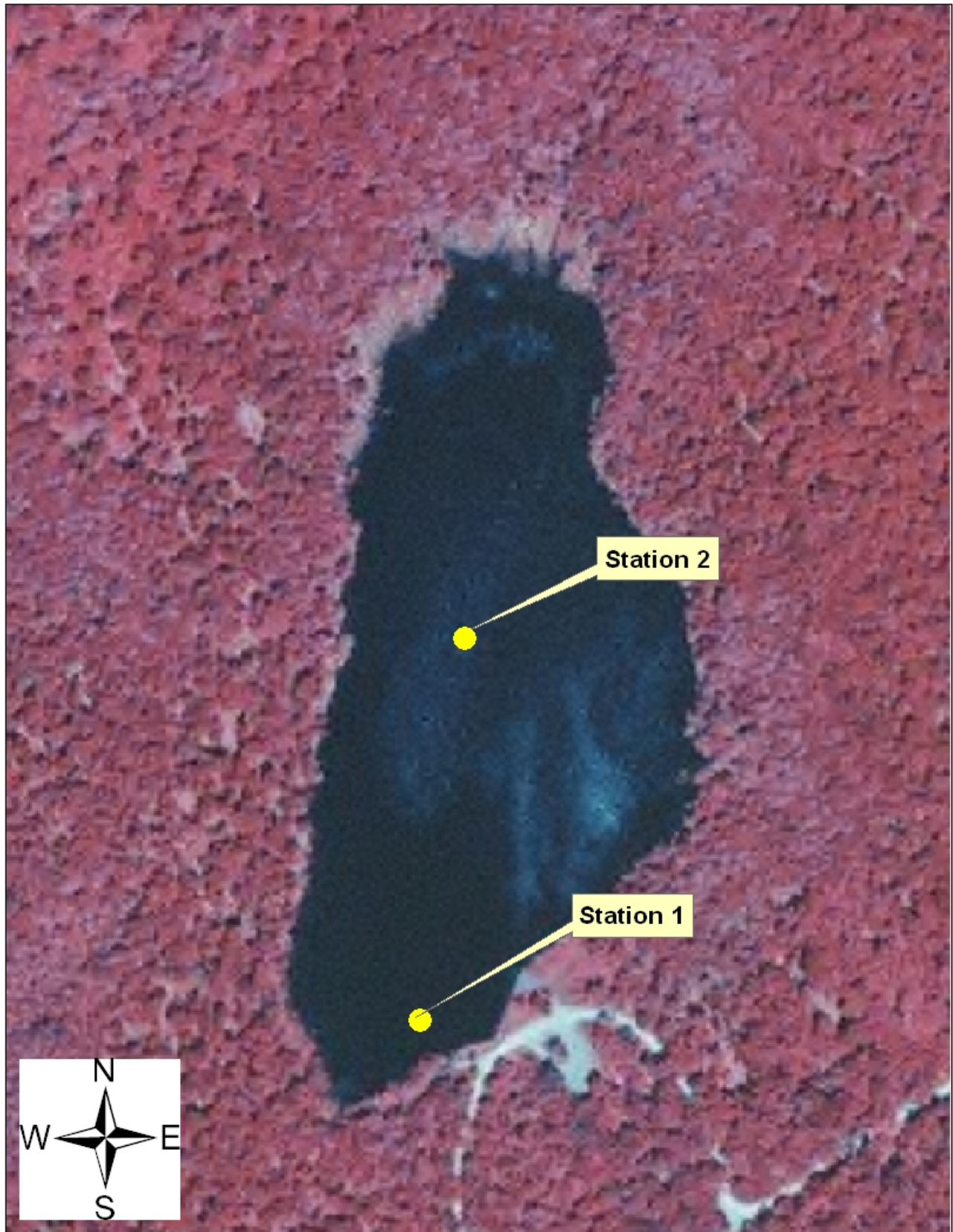


Table 1 – The soil types mapped in the Sones Pond watershed and their characteristics in respect to landscape (i.e. slope), drainage, depth to water table, amount of rocks exposed on the surface, and soil acidity (USDA 1986).

Soil Type	Slope	Drainage	Water Table (inches)	Surface Rocks	Acidity
Norwich (NoB)	0-8% slope	Poorly Drained	High - (0-6 in) during wet periods	3-15% of surface	Strong-Moderate
Oquaga Extremely Stony	OsB, OgB: 3-8% OsD: 8-25%	Well Drained	Very Low	15-50%	Very Strong to Moderate
Arnot-Rock (AsD)	3-25%	Well Drained	Very Low	15-50%	Moderate - Extreme
Norwich (NoB)	0-8% slope	Poorly Drained	High - (0-6 in) during wet periods	3-15% of surface	Strong-Moderate
Wellsboro Very Stony	WgB: 3-8% slope WgD: 15-25% slope	Poorly Drained	Seasonally High (12-36 in.)	3-15% of Surface	Very Strong to Moderate
Morris Very Stony	MsB: 3-8% slope	Somewhat Poorly Drained	6-12 in. during wet periods	3-15% of Surface	Very Strong to Moderate

Figure 2 – Sones Pond sampling stations located in Forks Township, Sullivan County.



The trophic condition of the impoundment was determined using a Carlson trophic status index (TSI; Carlson 1977) for total phosphorous (TSI-TP), chlorophyll-*a* (TSI-CHL), and secchi depth (TSI-SD). Chapter 93 water quality criteria were also evaluated for the lake's designated use.

We conducted a nighttime electrofishing survey along the entire shoreline of the impoundment to document species composition and collect a representative fish tissue sample. John Ryder and I used a pulsed-DC (200-250 V, 3-6 A) electrofishing boat to conduct the assessment. Due to expected low catch rates in the lake and a small shoreline length, we modified the DEP sampling protocol for lake fisheries (2008) by electrofishing the entire shoreline in two timed runs and netted all fish. We took exact lengths of all gamefish and the remaining fish in the sample were counted and measured in 25-mm increments. Fish samples with an adequate sample size were summarized to calculate length frequencies, proportional stock density (PSD), and catch per unit effort (CPUE; Anderson and Neumann 1996).

We collected a 5-fish sample for tissue analysis and processed the sample according to Pennsylvania's Surface Water Quality Monitoring Network document (PA DEP 2005; <http://www.depweb.state.pa.us/watersupply/cwp>).

Results

Lake Information

Major Basin: West Branch Susquehanna River
Minor Basin: Coal Run
Subbasin: 10B
HUC: 02050206
Location: Forks Township, Sullivan County
Latitude 41^o 28' 18.29" Longitude: 76^o 30' 55.26"
PA Quad: Eagles Mere
Chapter 93: CWF
Lake Use: Recreation

Morphology at Normal Pool

Surface Area (normal pool):	5.6 hectares	(14 acres)
Shoreline Length:	1.09 kilometers	(0.67 miles)
Shoreline Development:	1.3	
Mean Depth:	0.46 meters	(1.5 ft.)
Drainage Area:	1.29 square kilometers	(0.5 mi ²)
Elevation:	552 meters	(1811 ft.)
Volume:	120,881 m ³	98 acre-feet
Retention time:		65.8 days

Water Quality

The maximum depths measured at Station's 1 and 2 were 2.6 and 2.25 meters, respectively. The field pH ranged from 4.2 to 5.3 units with lowest values occurring in the fall. The lake remained mixed throughout the year and dissolved oxygen levels were adequate to support fish (> 4.0 ppm) throughout the water column. Specific conductance was low and averaged 20 µmho and temperatures did not vary from surface to bottom (Table 2).

Nutrient concentrations were low with total phosphorous (P) concentrations only reported once above the reporting limit (0.01 mg/L) at Station 1 in the summer. The average estimated value below the reporting limit and above the method detection limit for summer and fall samples was 0.009 mg/L. (Note: Reporting procedures were changed in May 2008. The lab usually reports values > 0.01 mg/L for Total P, but estimated values < 0.01 are reported for lake samples if concentrations are above the method detection limit.) The total nitrogen (N) concentrations were similar at both stations with a mean of 0.21 mg/L. The N:P ratio for samples ranged from 14 to 28 indicating a phosphorous limited system. Total nitrate (NO₃) and total nitrite (NO₂) were not detected in the samples, and total ammonia (NH₄) was only detected in the Station 2 summer sample. Undetectable concentrations of nitrates and nitrites and very low concentrations of ammonia indicated total nitrogen was primarily organic.

Total alkalinity was not detected (endpoint 4.5), except for the Station 1 summer sample (ALK = 0.6 mg/L). Lab pH was similar between stations and ranged from 5.0 to 5.6 with a median of 5.1 units. Total suspended solids concentrations hovered around the detection limit of 5 mg/L, with highest values of 8 mg/L occurring in the fall. The mean concentration of total dissolved solids was 21 mg/L and the mean concentration of total organic carbon was 3.8 mg/L. Color was 15 PT/C in the spring and 10 PT/C in the summer.

Visibility was similar in spring and fall with measurements completely to the lake bottom. Summer secchi measurements at Station 1 and Station 2 were 2.3 and 2.1 meters which was 88% and 91% of the lake depth, respectively. Chlorophyll-*a* samples represented low production with 1.8 µg/L in the spring at both stations, 7.5 µg/L (Station 1) and 4.3 µg/L (Station 2) in the summer, and 1.7 µg/L (Station 1) and below detection (Station 2) in the fall. The seasonal results of all lab samples are listed in Table 3.

Metals and total sulfate

Total aluminum concentrations were detected in the spring at both stations and were 257 and 250 µg/L at Station 1 and 2 respectively. The mean total iron concentration was 121 µg/L and concentrations were highest in the summer with a mean of 236 µg/L. The mean total manganese concentration was 92 µg/L and the mean total magnesium concentration was 0.49 mg/L. Total sulfate was not detected (>15 mg/L) in the spring and summer, but was extremely high and unexplained in the fall (mean = 413 mg/L;(Table 3)).

Table 2 – The temperature (⁰C), dissolved oxygen (ppm), specific conductance (umhos), and pH (units) profiles for Sones Pond located in Forks Township, Sullivan County.

	Temperature		Dissolved Oxygen		Specific Conductance		pH	
	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2
16-Apr-08								
Surface	11.5	10.9	9.6	9.8	22	22	5.3	5.3
0.5 M	10.8	10.6	9.7	9.9	22	22	5.2	5
1.0 M	10.8	10.4	9.6	9.9	22	23	5.1	5
1.5 M	9.8	10.4	9.8	9.8	22	23	5.1	5
2.0 M	9.8		9.8		22		5.1	
23-Jul-08								
Surface	26.0	26.0	7.5	7.8	16	16	4.6	4.3
0.5 M	26.0	26.0	7.5	7.8	16	16	4.6	4.3
1.0 M	26.0	26.0	7.5	7.8	16	17	4.6	4.3
1.5 M	26.0	26.0	7.3	7.8	16	16	4.5	4.2
2.0 M	26	26	7.4	4.5	16	17	4.4	4.3
22-Oct-08								
Surface	9.0	9.2	12.3	11.5	21	21	4.3	4.2
0.5 M	9.0	9.2	10.5	10.4	21	21	4.3	4.2
1.0 M	9.0	9.2	10.3	10.3	21	22	4.3	4.3
1.5 M	9.0	9.2	10.2	10.2	21	22	4.3	4.2
2.0 M	9	9.2	10.2	10.2	21	22	4.2	4.3

Table 3 – The seasonal water quality results for Sones Pond located in Forks Township, Sullivan County. Values with < were below the detection limit, and * = not analyzed.

Variable	Spring		Summer		Fall	
	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2
Maximum Depth (m)	2.5	2.3	2.6	2.3	2.4	2.0
Secchi Depth (m)	2.5	2.3	2.3	2.1	2.4	2.0
Lab pH (units)	5.0	5.0	5.6	5.5	5.0	5.1
Alkalinity (mg/L)	0	0	0.6	0.0	0.0	0.0
Specific Conductance (mg/L)	26.9	26.7	21.3	21.6	26.3	26.0
Total Nitrogen (mg/L)	0.16	0.14	0.31	0.28	0.21	0.18
Nitrite - N (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nitrate - N (mg/L)	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Ammonia - N (mg/L)	< 0.02	< 0.02	< 0.02	0.03	< 0.02	< 0.02
Total Phosphorous (mg/L)	< 0.01	< 0.01	0.011	0.009	0.009	0.007
Ortho Phosphorous (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total Dissolved Solids (mg/L)	24	28	34	28	30	34
Total Suspended Solids (mg/L)	< 5	6	6.0	< 5	8	8
Total Aluminum (ug/L)	257	250	< 200	< 200	< 200	< 200
Total Sulfate (mg/L)	< 15	< 15	< 15	< 15	409.6	416.5
Total Iron (ug/L)	106	75	265	207	37	36
Total Manganese (ug/L)	109	108	71	77	92	93
Total Magnesium (mg/L)	0.46	0.45	0.47	0.49	0.50	0.56
Total Calcium (mg/L)	*	*	*	*	2.2	2.1
Total Organic Carbon (mg/L)	3.3	3.3	3.6	4.0	5	4.2
Chlorophyll-a (ug/L)	1.8	1.8	7.5	4.3		
Color (PT/C)	15	15	10	10	*	*

Plankton Results

There were 29 different genera identified in the plankton samples, but there were only 18 genera that were quantified in a 1 ml sub-sample. Diatoms were most abundant in the spring with *Tabellaria* being the dominant taxa. Flagellates were most abundant in the summer with *Peridium* being the dominant taxa. Green algae were the most abundant in the fall with *Mougeotia* the dominant taxa (Table 4).

Trophic Status Index

The Carlson TSI results using phosphorous, chlorophyll-*a*, and secchi depth were dissimilar. Annual TSI results for phosphorous and chlorophyll-*a* indicated the impoundment was oligotrophic, and results for secchi depth indicated the lake was mesotrophic.

The TSI scores for total phosphorous (TSI-TP) in the spring could not be calculated because values < 0.01 mg/L were not reported. The summer and fall TSI-TP ranged from 32-38 with a mean of 36, indicating an oligotrophic condition.

Table 4 –Results of plankton samples collected at Station 1 in Sones Pond located in Forks Township, Sullivan County. An * indicates present in taxa scan, but not quantified in 1-ml sub-sample.

	Organisms per Liter (L)		
	Spring	Summer	Fall
Green Algae			
<i>Mougeotia</i>	144	33	1908
<i>Staurastrum</i>	36	*	36
<i>Eurastrum</i>		*	
<i>Closterium</i>	36		180
<i>Closteriopsis</i>		67	
<i>Cosmarium</i>			*
<i>Meridion</i>	36		
<i>Micrasterias</i>			*
<i>Botryococcus</i>		33	*
Diatoms			
<i>Asterionella</i>	72		
<i>Synedra</i>			36
<i>Melosira</i>	324		
<i>Surrirella</i>	*		*
<i>Tabellaria</i>	4464	*	360
Rotifers			
<i>Keratella</i>	*	67	144
<i>Polyartha</i>		33	36
<i>Monostyla</i>			*
<i>Trichocerca</i>		*	
<i>Ascomorpha</i>		*	*
Crustaceans			
<i>Copepod</i>	*	67	*
Nauplius of <i>Copepod</i>	*	33	*
<i>Daphnia</i>		*	
<i>Bosmina</i>		*	*
Flagellates			
<i>Ceratium</i>	36	403	180
<i>Dinobryon</i>	20		
<i>Synura</i>	*		
<i>Peridinium</i>	36	638	108
<i>Vorticella</i>			*
<i>Chryptomonas</i>	36	33	

The TSI scores for chlorophyll-*a* (TSI-CHL) in the fall could not be calculated for Station 2 because the chlorophyll-*a* concentration was below the detection limit (1 ug/L). Therefore, the mean TSI score for chlorophyll-*a* determined from a range of expected values to account for concentrations between 0 and 1 ug/L. The TSI-CHL varied from <30 to 50 and highest values occurred during the summer growing season. The annual TSI-CHL ranged from 34 to 39 and indicated an oligotrophic condition.

The TSI scores for secchi depth (TSI-SD) were similar throughout the year with a mean score of 48. The TSI-SD score indicated that the lake was mesotrophic. However, there is not much utility in the TSI-SD score in shallow lakes because calculations are dependent upon depth. The lake was too shallow to get a score less than 47, even though visibility was 100% in the spring and fall (Table 5).

Table 5 – The Trophic Status Index (TSI) for phosphorous (TSI-P), chlorophyll-*a* (TSI-CHL), and secchi depth (TSI-SD) for Sones Pond. The mean was calculated for all reported values at both stations.

Phosphorous	Spring	Summer	Fall	Annual
Station 1	< 37	39	36	38
Station 2	< 37	36	32	34
TSI				36

Chlorophyll-<i>a</i>	Spring	Summer	Fall	Annual
Station 1	36	50	36	41
Station 2	36	45	< 30	27 - 37
TSI				34 - 39

Secchi Depth	Spring	Summer	Fall	Annual
Station 1	47	48	47	47
Station 2	48	49	50	49
TSI				48

Fisheries

The abundance and diversity of fish were low and we only collected six species. The sample was dominated by acid tolerant species, and included Bluespotted sunfish (*Enneacanthus gloriosus*), pumpkinseed sunfish (*Lepomis gibbosus*), chain pickerel (*Esox niger*), brown bullhead (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), and largemouth bass (*Micropterus salmoides*). Brown bullhead was the dominant species with a catch per unit effort (CPUE) of 81.8. The size structure of the brown bullhead population was poor and 83% of the catch was 200-225 mm (8-9 inches) in length. Chain pickerel was the dominant gamefish species collected with a catch per unit effort (CPUE) of 15.2. However, the CPUE of chain pickerel in the impoundment was underreported due to the difficulty in capturing them with electrofishing gear. We only collected 3 largemouth bass and all of them were young of year. The total CPUE of all species was 197 (Table 6) and the number of fish per

meter of shoreline was 0.11. The size structure of the fish community was poor and all sportfish were below quality length, with the exception of one chain pickerel. The only species with a sample adequate for PSD calculation was yellow perch. In this case, the PSD for yellow perch was 0 and none of the yellow perch collected were at a length that is a preferred size by anglers.

Table 6 – The species and catch-per-unit effort (CPUE) of fish collected from Sones Pond on September 15, 2008.

Fish Species	Scientific Name	CPUE
Largemouth bass	<i>Micropterus salmoides</i>	4.5
Chain Pickerel	<i>Esox niger</i>	10.6
Bluespotted Sunfish	<i>Enneacanthus gloriosus</i>	33.3
Brown Bullhead	<i>Ameiurus nebulosus</i>	81.8
Yellow Perch	<i>Perca flavescens</i>	59.1
Pumpkinseed Sunfish	<i>Lepomus gibbosus</i>	7.6

Fish Tissue

We collected 5 brown bullhead and submitted tissue to the lab for heavy metals analysis. We selected brown bullhead because they were the dominant species and because we could not collect an adequate sample of chain pickerel that were similar in size. The fish tissue sample had 0.14 ppm of mercury (Hg), 0.69 ppm of copper, 0.03 ppm of lead, and 0.18 ppm of chromium. Cadmium and selenium were not reported above the detection limit (Table 7). Mercury concentrations measured in the fish tissue sample were within the statewide fish consumption advisory of one meal per week (< 0.2 ppm).

Table 7 – The concentration of heavy metals measured in brown bullhead tissue collected from Sones Pond in Forks Township, Sullivan County on September 15, 2008.

Variable	Symbol	Concentration (ppm)
Cadmium	Cd	< 0.005
Chromium	Cr	0.182
Copper	Cu	0.692
Lead	Pb	0.026
Mercury	Hg	0.140
Selenium	Se	< 1

Discussion

Sones Pond is basically a high mountain, shallow impoundment that was constructed in a palustrine wetland system. The lake's location, chemistry, and fish community limits some aspects of recreational use, but it still provides other opportunities for wildlife observation and aesthetics.

Aquatic Life and Chapter 93

Sones Pond is required to meet the Chapter 93 designated criteria for CWF in order to meet the attainment threshold for aquatic life use. This requires compliance with the statewide list plus dissolved oxygen specific for CWF (DO₁). Specific criteria outlined in Chapter 93 require a pH from 6 to 9 inclusive and minimum dissolved oxygen concentrations of 5 mg/L throughout the water column under unstratified conditions. Based upon the specified criteria, all stations were in violation of §93.7 of the Chapter 93 water quality standards for pH but were in compliance with DO criteria.

The pH violation of Chapter 93 criteria for Sones Pond will require listing on the integrated list as an impairment. Atmospheric deposition is responsible for low pH. Although naturally acidic lakes occur in the region and low alkalinity (< 20 mg/L) was expected, observations of a pH < 5, alkalinity < 1, and detectable aluminum during higher spring flows all indicate that acid precipitation was the cause for impairment. In addition, historical water quality data collected by PFBC in 1970 and 1988 demonstrated reductions in pH and loss of buffering capacity in the watershed (Table 8). Our observation of a poorly structured, acid-tolerant fish community, dominance of an acid-tolerant plant (bladderwort), and underlying geology of the Pottsville sandstone formation also supported the impairment decision.

Table 8 – Surface water quality sample results from July 2008 compared with historical pH, total alkalinity, and specific conductance measurements collected by PA Fish and Boat Commission on September 18, 1970 and July 27, 1988.

Year	pH (units)	Total Alkalinity (mg/L)	Specific Conductance (umhos)
1970	5.5	12	
1988	4.6	0	38
2008	4.3	0	16

The nutrient condition determined by the Carlson TSI for phosphorous and chlorophyll-*a*, depicted oligotrophic conditions. However, acidic conditions and limited buffering capacity were the overriding factors that limited lake production. Although the N:P ratio suggested phosphorous was the limiting nutrient, low concentrations of alkalinity, chlorophyll-*a*, and conductivity were all indicators of a carbon-limited system. Absence of dissolved carbon limits buffering capacity from episodic events which, in turn, limits algal production and subsequent fish production. The fisheries assessment confirmed that abundance was low and that the community was dominated by acid tolerant species. Therefore, the nutrient condition

of the lake was limited by the absence of dissolved carbon which was limited by the problems associated with acid precipitation.

Recreation

According to DCNR, the primary recreational use of Sones Pond is fishing and boating. The Department uses vegetation density and fisheries assessments to evaluate recreational use for boating and fishing. We did not conduct a vegetation assessment, but we did not observe any areas where plant density was high or posed a threat to boating. However, we observed that the dominant plant in the lake was bladderwort (*Utricularia* spp). Bladderwort is an acid tolerant plant that is a free floating and has the potential to create nuisance problems for anglers and boaters.

There is not much to say about the fish community in Sones Pond. The pond was dominated by brown bullhead and chain pickerel and the size structure of the fish community was poor. It was apparent that the fish community in the lake was primarily tolerant to acidic conditions and abundance was extremely low when compared with other lakes in the region. Means (2004) recorded an average CPUE of 704.7 (n=20 lakes) for total catch, with the lowest CPUE of 321, for lakes in the region. In comparison, the Sones Pond total catch CPUE was 197. The fish community observed in Sones Pond reflected the water quality conditions that were present in the lake. As a result, water quality has severely impaired fishing opportunities and the use established by DCNR.

The Department typically uses results from bacteria samples and plant assessments, with supplemental information from the fisheries assessment, to support use attainment decisions for recreation. However, since the designated recreational use of Sones Pond is fishing, the lake is impaired. A TMDL developed for the aquatic life use impairment should be adequate to address the recreational impairment. Therefore, no additional TMDL should be necessary to address the recreational impairment.

It should be noted that there are other recreational opportunities that are still available. Sones Pond is a very scenic high mountain impoundment that provides an excellent opportunity to canoe or kayak, have a picnic, or observe wildlife. Unfortunately, water quality has degraded the fishing opportunities that are the primary use of the lake.

Human Health

A complete lake assessment requires collection of fish tissue to determine if contaminants are present above the statewide consumption advisory of one meal per week. The poorly structured fish community and low capture rate of chain pickerel limited the fish tissue sample to brown bullhead. Although mercury concentrations found in brown bullhead did not exceed the statewide fish consumption advisory of one meal per week, I suspect chain pickerel may have triggered an advisory if we could have collected an adequate sample. Nonetheless, the poor water quality in the lake limits a viable sport fish community and any subsequent risks for mercury exposure from consumption. Therefore, Sones Pond fish tissue

samples meet the statewide fish consumption criteria and the impoundment is attaining the designated use for human health.

Conclusion

Sones Pond is an acidified lake that has low nutrients and a poorly –structured, acid- tolerant fish community. Although Sones Pond would not be expected to be productive, based upon limitations in lake morphology, underlying geology, and land use in the watershed, the buffering capacity of the reservoir has been degraded by atmospheric deposition resulting in low pH and elevated metals. Characteristics of the fish population limit angling opportunities and the designated purpose of the impoundment. Water quality conditions in Sones Pond are conducive to mercury uptake in the food chain. However, there is limited risk of exposure because the abundance of sport fish targeted by anglers is low and mercury levels measured in the most abundant species (brown bullhead) do not exceed the statewide fish consumption advisory level (0.2 ppm).

Based upon the findings in this report, Sones Pond will be placed on the Pennsylvania Integrated and Monitoring Assessment Report on List 5 (Pollutants; one of more uses requiring a TMDL) for impairment of aquatic life and recreational uses due to low pH from atmospheric deposition. Sones Pond is attaining its designated use for human health and should be placed on List 2 (at least one use attained).

References

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