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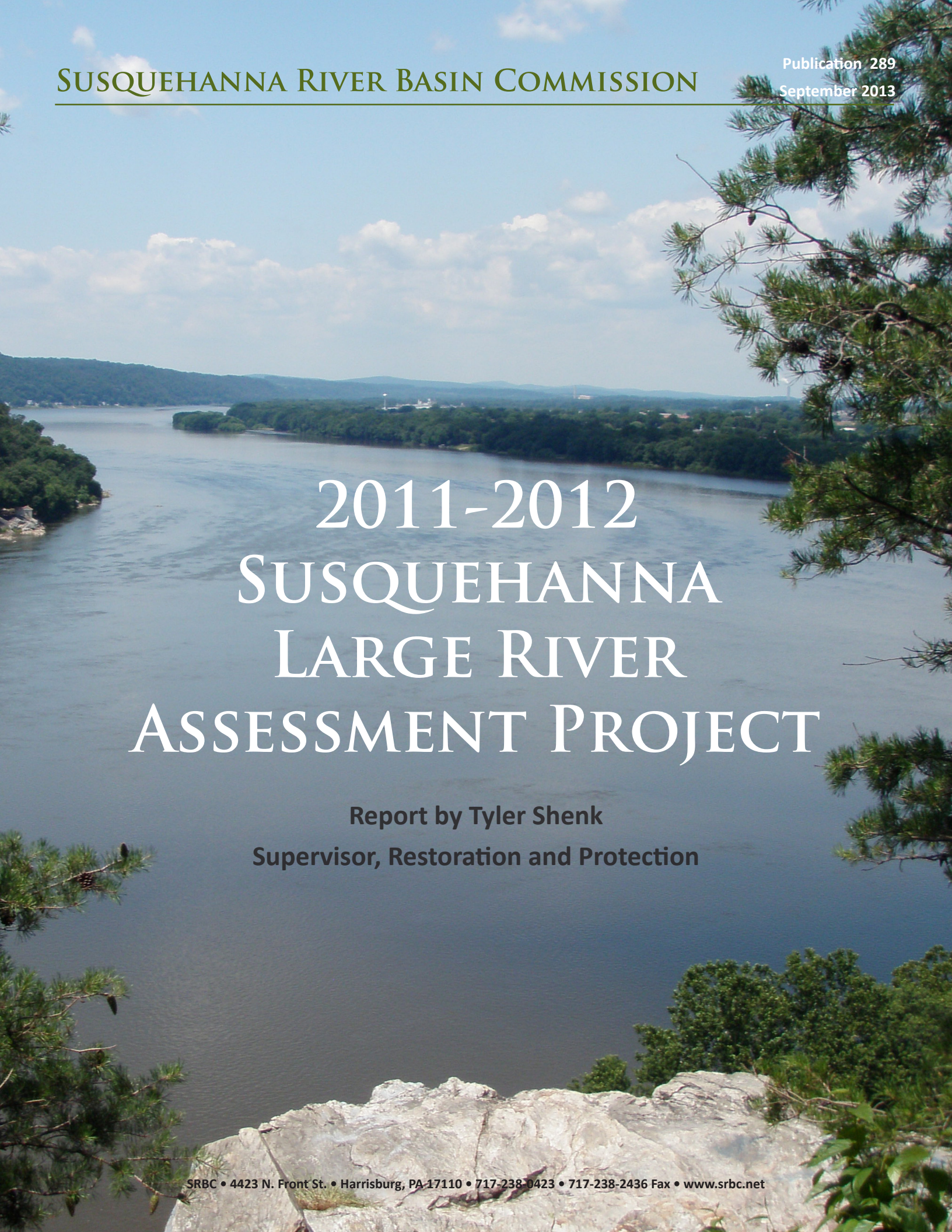

2011-2012 Susquehanna Large River Assessment Project

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Abstract

Historically, only a few studies were ever conducted to evaluate the conditions of large river systems. In recent years, however, that has changed in light of new and expanded methods expressly designed to allow for large river assessments. Many federal, state, and local entities that are interested in the role of larger rivers on industry, power generation, drinking water supply, recreation, and other issues are now able to bring focus to larger river systems. In particular, for the past ten years, the Susquehanna River Basin Commission (SRBC) has been applying expanded technology and methods to monitor the mainstem Susquehanna River.

SRBC conducted a pilot study to determine appropriate methods for biologically assessing the large rivers of the Susquehanna River Basin (basin) in 2002. Based on the results of that survey, SRBC determined at that time a combination of rock basket samplers and traditional Rapid Bioassessment Protocol (RBP) methods was the most efficient and consistent collection method to sample the Susquehanna River. These methods were implemented in the 2005 Susquehanna Large River Assessment Project (Hoffman, 2006) at 25 stations on the mainstem Susquehanna River and at the mouths of its major tributaries: the West Branch Susquehanna River, the Juniata River, and the Chemung River.

The U.S. Environmental Protection Agency (USEPA) has developed a field operations manual for the National River and Stream Assessment (NRSA) program, detailing data collection methods for both wadeable and nonwadeable streams (USEPA, 2008). In 2007, SRBC adapted this protocol for the 25 stations previously sampled. In subsequent years, SRBC has sampled a variety of subsets of the original 25 stations until 2012, when the station list was modified slightly to boost the data set by integrating with other ongoing SRBC projects. In Fall 2011, SRBC staff sampled five stations. In 2012, 13 stations were sampled. This report will cover both 2011 and 2012 data.

Composite benthic macroinvertebrate samples were collected at each station from three D-frame net sweeps at each of 10 transects. Field and laboratory water quality samples and overall observations also were collected at each site.

Macroinvertebrate analysis shows four of the sites were designated as slightly impaired, 13 sites were moderately impaired, and one site was severely impaired. Only 2.1 percent (8 of 378) of water quality values exceeded their respective limits, indicating fairly good water quality in the Susquehanna River.

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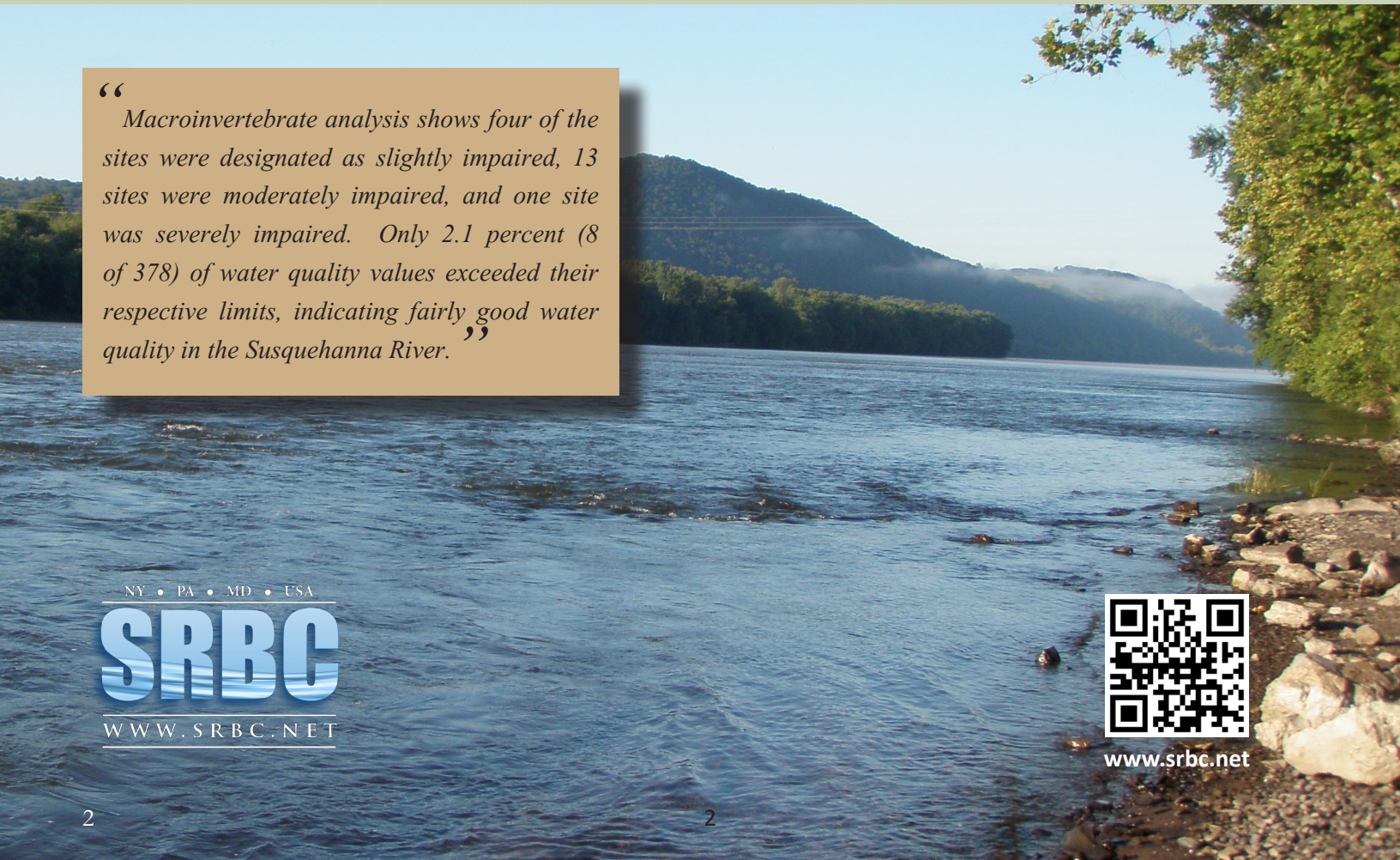

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Introduction

SRBC has been performing biological assessments throughout the basin since the late 1970s. When USEPA introduced the first version of the RBP manual (Plafkin and others, 1989), SRBC adopted those methods for use in its interstate stream monitoring program and its rotating subbasin surveys. However, neither the previous nor current RBP methods (Barbour and others, 1999) used by SRBC in the aforementioned surveys accurately depicted the biological integrity of the basin's large rivers: the mainstem Susquehanna, Chemung, West Branch Susquehanna, and Juniata Rivers. Thus, in 2002, SRBC initiated a pilot project to determine proper methods of biologically assessing the large rivers in the basin. From this pilot project, staff determined that a combination of rock-filled basket samplers and traditional RBP methods was the most effective and consistent collection method for sampling the Susquehanna River (Hoffman, 2003).

In summer 2005, SRBC staff collected biological and water quality data at 25 stations on the mainstem Susquehanna River and at the mouth of its major tributaries using the methodology described above. In 2007, staff changed the methodology to reflect the methods drafted by USEPA for NRSA (USEPA, 2008). These methods have been used for the past six years.

Although the NRSA data collection includes fish, physical habitat, toxicology, and other parameters in addition to benthic macroinvertebrates, SRBC staff chose to focus efforts on benthic macroinvertebrate sampling. Benthic macroinvertebrates were used to assess biological conditions for several reasons. Benthic macroinvertebrates are sensitive to numerous stressors, have a wide range

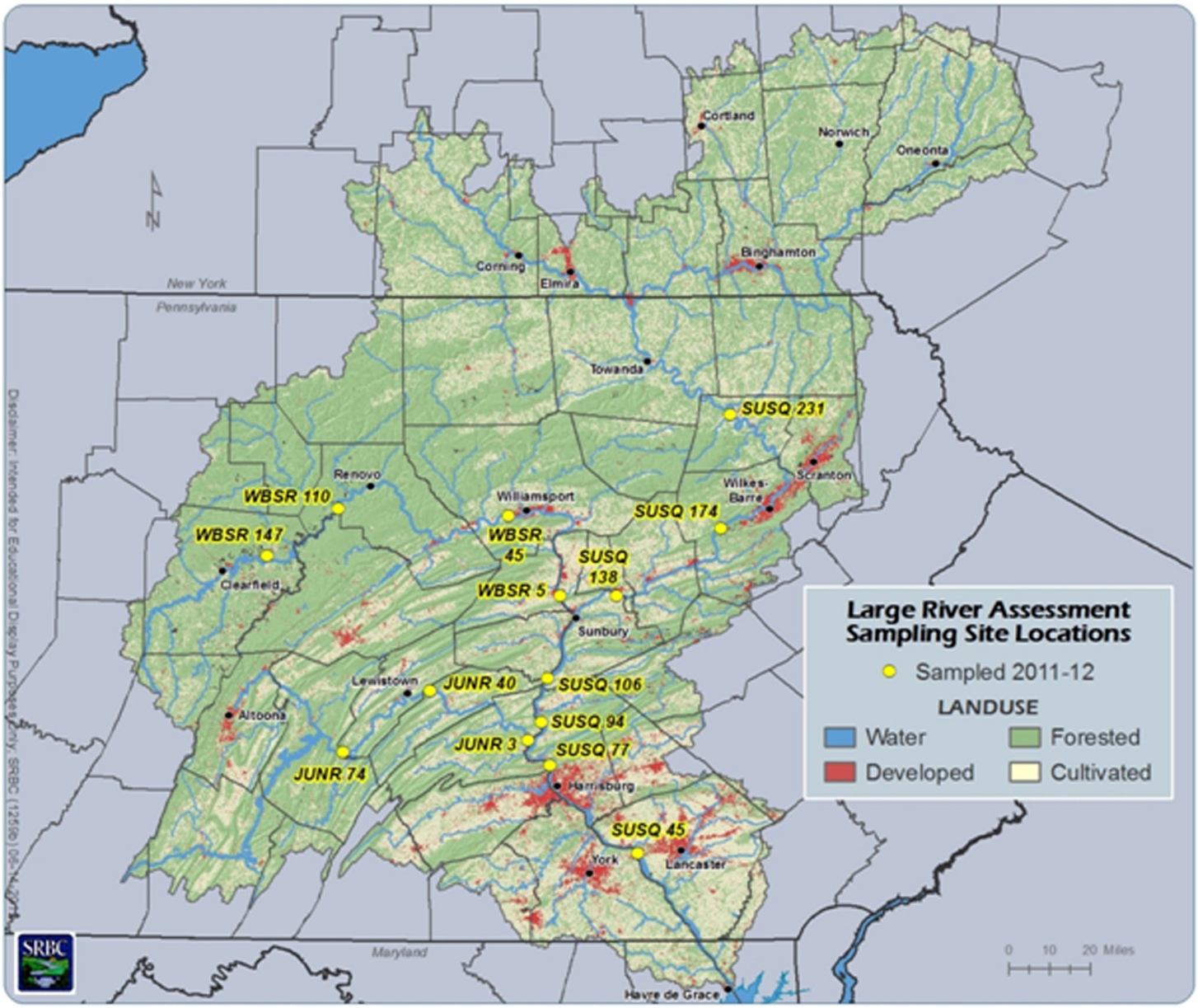


Figure 1. Susquehanna River Site Locations

of documented pollution tolerances, and are found in the many habitats throughout lotic systems (Flotemersch and others, 2001a). Additionally, SRBC has background macroinvertebrate data from various sites on the large rivers of the basin from subbasin surveys and interstate streams monitoring, as well as the previous river assessment studies.

Geography

The Susquehanna River Basin is the largest river basin on the east coast of the United States, draining 27,510 square miles. The Susquehanna River originates at Otsego Lake in Cooperstown, N.Y., and flows 444 miles through New York, Pennsylvania, and Maryland to the Chesapeake Bay at Havre de Grace, Md.

The geographic scope of the Large River Assessment stretched from Mehoopany Pa., to Columbia, Pa., and encompassed a total of 18 samples taken over two years at 14 stations: three in the Middle Susquehanna Subbasin, three on the Juniata River, four in the West Branch Susquehanna River Subbasin, and four in the Lower Susquehanna Subbasin. Downstream of Columbia, Pa., the river flows through a series of dams and reservoirs, which this protocol is not designed to assess.

Methods

Data Collection

In Fall 2011 and Fall 2012, SRBC staff collected macroinvertebrate samples using D-frame nets on the mainstem Susquehanna River and its largest tributaries. Field chemistry measurements were taken at each site, and chemical water quality samples also were collected for laboratory analysis. Macroinvertebrate samples were labeled with the site number, the date, and the number of bottles used.

In 2012, SRBC modified its Large River site list to expand coverage up the main tributaries, Chemung River, West Branch Susquehanna, and Juniata River, as well. See Figure 1 and Table 1 for sites sampled.

Table 1. 2011-2012 Susquehanna River Station Locations

Site	Subbasin	Latitude	Longitude	Description
SUSQ 231	Middle	41°34'42.50"N	76° 3'33.21"W	Upstream of bridge at Mehoopany Creek, Pa.
SUSQ 174	Middle	41°10'38.64"N	76° 6'30.60"W	At boat access upstream of Shickshinny, Pa.
SUSQ 138	Middle	40°56'31.70"N	76°36'4.01"W	At boat access near Danville, Pa.
WBSR 147	West Branch	41° 4'41.11"N	78°14'7.05"W	At boat access near Deer Creek, Pa.
WBSR 110	West Branch	41°14'49.97"N	77°54'16.25"W	Upstream of boat access upstream of Keating, Pa.
WBSR 45	West Branch	41°13'32.78"N	77° 6'26.52"W	Upstream of boat access near Linden, Pa.
WBSR 5	West Branch	40°56'29.11"N	76°51'55.10"W	At boat access near Lewisburg, Pa.
SUSQ 106	Lower	40°39'5.83"N	76°55'21.36"W	Downstream of boat access near McKees Half Falls, Pa.
SUSQ 94	Lower	40°29'44.88"N	76°57'5.75"W	At boat access at Montgomery Ferry, Pa.
SUSQ 77	Lower	40°20'36.60"N	76°54'42.26"W	At boat access at Fort Hunter, Pa.
JUNR 74	Juniata	40°23'9.59"N	77°52'22.91"W	At boat access in Mt. Union, Pa.
JUNR 40	Juniata	40°36'16.87"N	77°28'12.81"W	At boat access in Lewistown Narrows, Pa.
JUNR 3	Juniata	40°25'50.99"N	77° 0'47.69"W	At boat access near Amity Hall, Pa.
SUSQ 45	Lower	40° 1'49.47"N	76°30'33.87"W	At boat access downstream of bridges in Columbia, Pa.

Chemical water quality

Water samples were collected at each sampling site with a depth-integrated sampler to measure nutrient and metal concentrations in the river. Field water quality measurements included water temperature, dissolved oxygen, conductivity, and pH. All field measurements were collected instream with a multi-meter sonde that was calibrated every day.

A list of laboratory parameters is located in Table 2. Samples were iced and sent for analysis to ALS Environmental, Middletown, Pa.

Macroinvertebrates

Ten equidistant transects were established along a one-kilometer sampling reach at each of the sites. Each transect was located along alternating banks; for example, transects two, four, six, eight, and ten were located on the right bank, while transects one, three, five, seven, and nine were located on the left bank. To collect benthic macroinvertebrates (organisms that live on the stream bottom, including aquatic insects, crayfish, clams, snails, and

Table 2. Parameters for Laboratory Analysis

Parameter
Alkalinity, mg/l[a]
Total Nitrogen, mg/l
Total Nitrite, mg/l
Total Nitrate, mg/l
Total Phosphorus, mg/l
Total Orthophosphate, mg/l
Total Organic Carbon, mg/l
Total Hardness, mg/l
Total Magnesium, mg/l
Total Suspended Solids, mg/l
Total Sodium, mg/l
Total Chloride, mg/l
Total Sulfate, mg/l
Total Iron, µg/l[b]
Total Manganese, µg/l
Total Aluminum, µg/l
Turbidity, NTU[c]
Total Calcium, mg/

[a] mg/l = milligrams per liter

[b] µg/ micrograms per liter

[c] nephelometric turbidity units

worms), staff used a D-frame net with 500-µm mesh to collect three samples within a 10-meter area surrounding each transect, to a depth of 0.5 meters. Samples were taken from multiple habitats, including bottom substrate, woody debris, undercut banks, and macrophytes. A total of 30 samples were then composited into a single sample, which was preserved in the field in 95-percent denatured ethyl alcohol. After sampling was completed at a given site, all equipment that came in contact with the sample was examined carefully, picked free of algae or debris, rinsed thoroughly, and sprayed with 10-percent bleach solution before sampling at the next site. Additional organisms that were found on examination were placed into the sample containers.

Subsampling and sorting procedures were based on the most recent RBP document (Barbour and others, 1999). In the laboratory, composite samples were sorted into 300-organism subsamples when possible, using a gridded pan and a random numbers table. The organisms contained in the subsamples were identified to genus (except Chironomidae and Oligochaeta) when possible and enumerated.

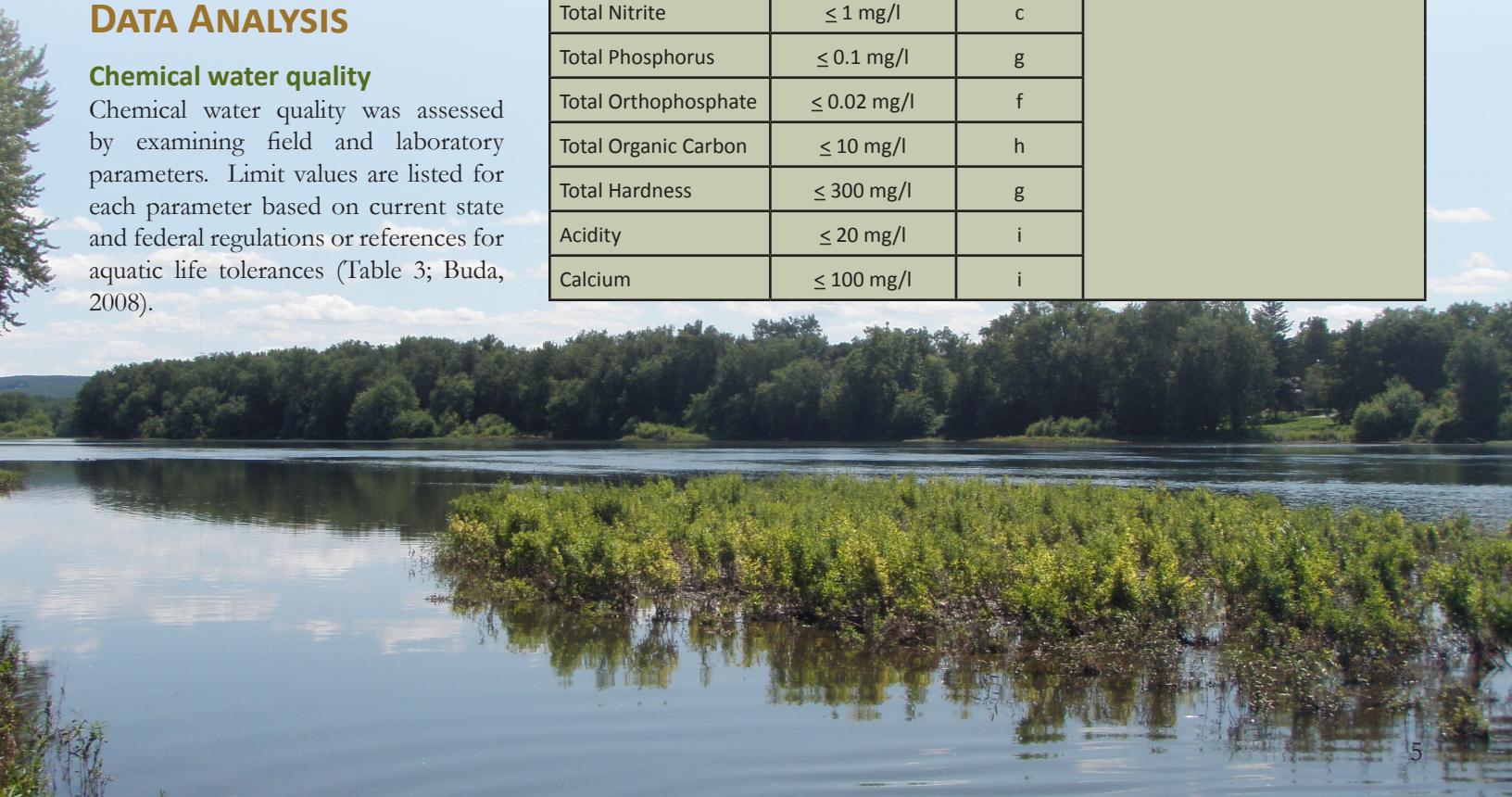
Data Analysis

Chemical water quality

Chemical water quality was assessed by examining field and laboratory parameters. Limit values are listed for each parameter based on current state and federal regulations or references for aquatic life tolerances (Table 3; Buda, 2008).

Table 3. Chemical Water Quality

Water Quality - Standards			
Parameter	**Limit**	**Reference Code**	**Reference**
Temperature	≤ 30.5 ºC	a	a. http://www.pacode.com/secure/data/025/chapter93/s93.7.html b. http://www.pacode.com/secure/data/025/chapter93/s93.8c.html c. http://www.dec.ny.gov/regs/4590.html#16132 d. http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.03-3.htm. e. http://www.uky.edu/WaterResources/Watershed/KRB_AR/wq_standards.htm f. http://water.usgs.gov/pubs/circ/circ1225/images/table.html g. http://www.uky.edu/WaterResources/Watershed/KRB_AR/krww_parameters.htm h. Hem (1970)
Dissolved Oxygen	≥ 4 mg/l	a	
pH	≥ 6.0 and ≤ 9.0	a	
Alkalinity	≥ 20 mg/l	a	
Total Chloride	≤ 250 mg/l	a	
Total Dissolved Solids	≤ 500 mg/l	c	
Total Sulfate	≤ 250 mg/l	a	
Total Iron	≤ 1.5mg/l	a	
Total Manganese	≤ 1.0 mg/l	a	
Total Aluminum	≤ 0.75 mg/l	b	
Total Magnesium	≤ 35 mg/l	c	
Total Sodium	≤ 20 mg/l	c	
Total Suspended	≤ 25 mg/l	a	
Turbidity	≤ 50 NUT	d	
Water Quality - Recommended Life Tolerances and Background Levels			
Parameter	**Limit**	**Reference Code**	
Conductivity	≤ 800 µmhos/cm	e	
Total Nitrogen	≤ 1 mg/l	f	
Total Nitrate-N	≤ 0.6 mg/l	f	
Total Nitrite	≤ 1 mg/l	c	
Total Phosphorus	≤ 0.1 mg/l	g	
Total Orthophosphate	≤ 0.02 mg/l	f	
Total Organic Carbon	≤ 10 mg/l	h	
Total Hardness	≤ 300 mg/l	g	
Acidity	≤ 20 mg/l	i	
Calcium	≤ 100 mg/l	i	



Macroinvertebrate analysis

A series of macroinvertebrate metrics was calculated for each sample, and assessments of the sites were performed. Benthic macroinvertebrate samples were assessed using procedures described by Barbour and others (1999), Klemm and others (1990), and Plafkin and others (1989). Using these methods, staff calculated a series of biological indexes for each station. The metrics used in this survey are summarized in Table 4. Metric 2 (Shannon-Wiener Diversity Index) followed the methods described in Klemm and others (1990), and all other metrics were derived from Barbour and others (1999).

A reference condition approach was used to determine impairment levels for each site. One reference site was chosen from the sites sampled on the basis of macroinvertebrate metrics and water quality to represent the best combination of conditions. This Large River data report is the first to look at the past six years (2007-12) as a whole and use the reference conditions for that time period, further highlighting changes at sites between years due to natural variance of conditions. The 300-organism subsample data were used to generate scores for each of the seven metrics at each site. Scores for metrics 1-4 were converted to a biological condition score, based on the percent similarity of the site's metric score relative to the metric score at the chosen reference site. Scores for metrics 5-7 were based on set scoring criteria developed for the percentages (Plafkin and others, 1989; Ohio Environmental Protection Agency, 1987). The sum of the biological condition scores constituted the total biological score for the sample, and total biological scores were used to assign each sample to a biological condition category (Table 5).

Table 4. Summary of Metrics Used to Evaluate the Overall Biological Integrity of River Benthic Macroinvertebrate Communities

Metric	Description
1. Taxonomic Richness (a)	The total number of taxa present in the 300-organism subsample. Number decreases with increasing disturbance or stress.
2. Shannon-Wiener Diversity Index (b)	A measure of biological community complexity based on number of equally or nearly equally abundant taxa in the community. Index value decreases with increasing stress.
3. Hilsenhoff Biotic Index (a)	A measure of the organic pollution tolerance of a benthic macroinvertebrate community. Index value increases with increasing stress.
4. EPT Index (a)	The total number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) taxa present in the 300-organism subsample. The index decreases with increasing stress.
5. Percent Ephemeroptera (a)	The percentage of Ephemeroptera in a 300-organism subsample. Percentage decreases with increasing stress.
6. Percent Dominant Taxa (a)	A measure of community balance at the lowest positive taxonomic level. Percentage increases with increasing stress.
7. Percent Chironomidae (a)	The percentage of Chironomidae in a 300-organism subsample. Percentage increases with increasing stress.

Sources: (a) Barbour and others, 1999 (b) Klemm and others, 1990

Table 5. Summary of Criteria Used to Classify the Biological Conditions of Sample Sites

SAMPLING AND ANALYSIS

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TOTAL BIOLOGICAL SCORE DETERMINATION

Metric	Biological Condition Scoring Criteria			
	6	4	2	0
1. Taxonomic Richness (a)	> 80%	79-60%	59-40%	< 40%
2. Shannon Diversity Index (a)	> 75%	74-50%	49-25%	< 25%
3. Hilsenhoff Biotic Index (b)	> 85%	84-70%	69-50%	< 50%
4. EPT Index (a)	> 90%	89-80%	79-70%	< 70%
5. Percent Ephemeroptera (c)	> 25%	10-25%	1-9%	< 1%
6. Percent Dominant Taxa (c)	< 20%	20-30%	31-40%	> 40%
7. Percent Chironomidae (c)	< 5%	5-20%	21-35%	> 35%
Total Biological Score (d)				

↓

BIOASSESSMENT

Percent Comparability of Study and Reference Condition Total Biological Scores (e)	Biological Condition Category
> 83%	Nonimpaired
79-54	Slightly Impaired
50-21	Moderately Impaired
< 17%	Severely Impaired

(a) Score is study site value/reference site value X 100
(b) Score is reference site value/study site value X 100
(c) Scoring Criteria evaluate actual percentage contribution, not percent comparability to the reference station
(d) Total Biological Score = the sum of Biological Condition Scores assigned to each metric
(e) Values obtained that are intermediate to the indicated ranges will require subjective judgment as to the correct placement into a biological condition category

Results

Water Quality

In both 2011 and 2012, the water quality at most of the sampling sites met the water quality standards. Only 2.1 percent (8 of 378) of water quality values exceeded their respective limits. The majority of the exceedances were for nitrate. Exceedances are summarized in Table 6.

Table 6. Number of Exceeds per Parameter

Parameter	Limit	Number of Exceedances
Nitrate	>1.0 mg/L	4
Alkalinity	<20 mg/L	1
Total Phosphorus	>0.1 mg/L	1
Total Suspended Sediment	>25 mg/L	1

Biological Conditions

In 2011 and 2012 staff collected macroinvertebrates at 18 sites. Slightly impaired conditions were found at four sites (22 percent), and moderately impaired conditions were found at 13 sites (72 percent), and one site (6 percent) was rated as severely impaired.

(Left and Above) The abundance of macroinvertebrates belonging to the orders *Ephemeroptera* (mayfly), *Plecoptera* (stonefly), and *Trichoptera* (caddisfly) constitute the EPT Index of a stream.
Photo credits: Robert Henricks

Discussion

In late Summer 2011, the Susquehanna River Basin was hit with near record rainfall twice within the span of just over a week. The heaviest remnants of Hurricane Irene stayed mostly east of the basin, but it did rain enough to make the streams and river swell in late August. Then, in early September, remnants from Tropical Storm Lee arrived and stalled over the basin, dropping record rainfall on many parts of the basin, in some areas totaling more than 15 inches. Record floods were recorded all over the basin on many tributaries. The Susquehanna River reached historical flows at many of its gages in both New York and Pennsylvania (see Figure 3).

These large flow events limited sampling in 2011 and may have played a role in some of the change in conditions at certain sites either due to scour or sediment deposition within the previously designated reaches.

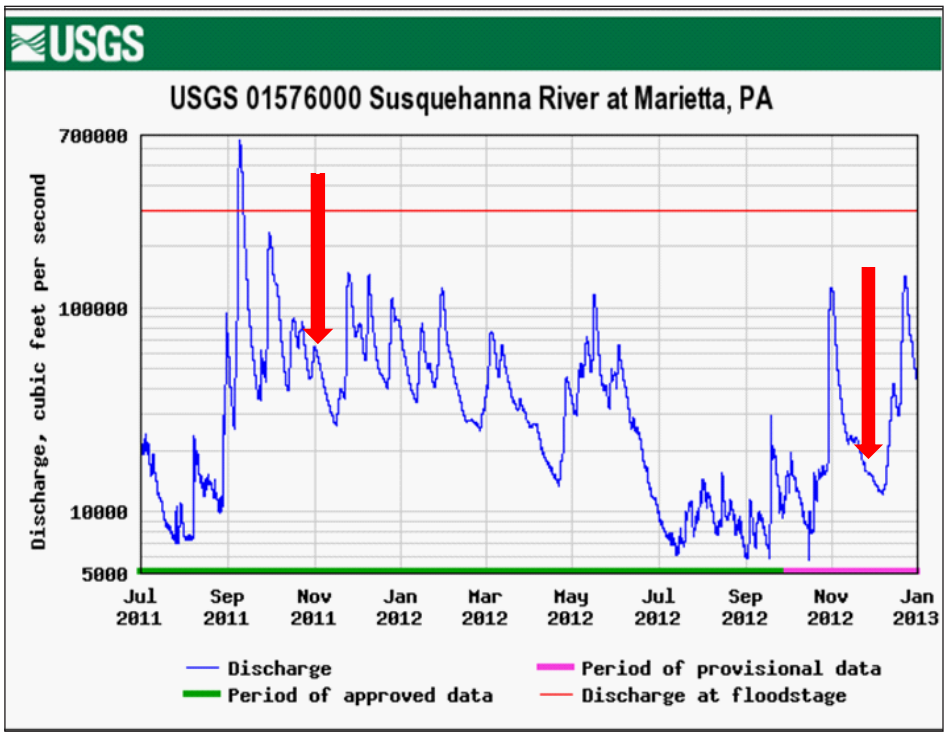

Figure 3. Hydrograph of Discharge of Susquehanna River at Marietta, Pa., from July 2011 to January 2013 (red arrows indicate sampling dates)

Water Quality

The assessments conducted during the 2011/12 Large River Project, when compared to the results of the previous large river assessments from 2007 through 2010 (Hoffman, 2008; Shenk, 2009; Shenk, 2010; Shenk, 2011) and the Upper and Middle Susquehanna Subbasin Surveys (Buda, 2008; Buda, 2009) show that most of the water quality parameters in the mainstem of the Susquehanna River and the mouths of most of its larger tributaries are below established water quality standards or recommended life tolerances. Nitrate is the only parameter to have more than one site exceed the recommended limit, and all four exceedances were on the Juniata River, at one site in 2011 and at all three sites sampled in 2012. As noted in previous SRBC studies, Juniata River Subbasin Survey Year-1 (Campbell, 2011), the Juniata River has had long standing issues with high levels of nitrate. The causes can range from high fertilizer use in heavy agricultural areas to other land uses found throughout the watershed.

In 2003, SRBC established the Early Warning System (EWS) program for public water suppliers in Pennsylvania with intakes in the Susquehanna River and expanded the system in the New York portion of the basin in 2006. Currently, nine stations monitor a minimum of pH, temperature, and turbidity at critical locations along the Susquehanna River using online analyzers that transmit the data in real-time to water treatment plants and SRBC. The EWS project provides water suppliers not only notice of possible contamination events but also current conditions of the rivers. Because of this, SRBC aligned four of the Large River sites very near four of the EWS sites. Sites SUSQ 138, WBSR 5, SUSQ 77, and SUSQ 45 all have real-time field water quality data to show conditions around the sampling date. When using these data and comparing the 2011 and 2012 data at some of the sites, it can help provide possible causes to the observed conditions. SUSQ 45 was sampled in both 2011 and 2012, and although the turbidity conditions (large increase in weeks preceding 2011 sampling) reflect flow conditions mentioned above, dissolved oxygen and temperature show no extreme values in the weeks previous to both 2011 and 2012 sampling events (see Figures 4, 5 and 6).

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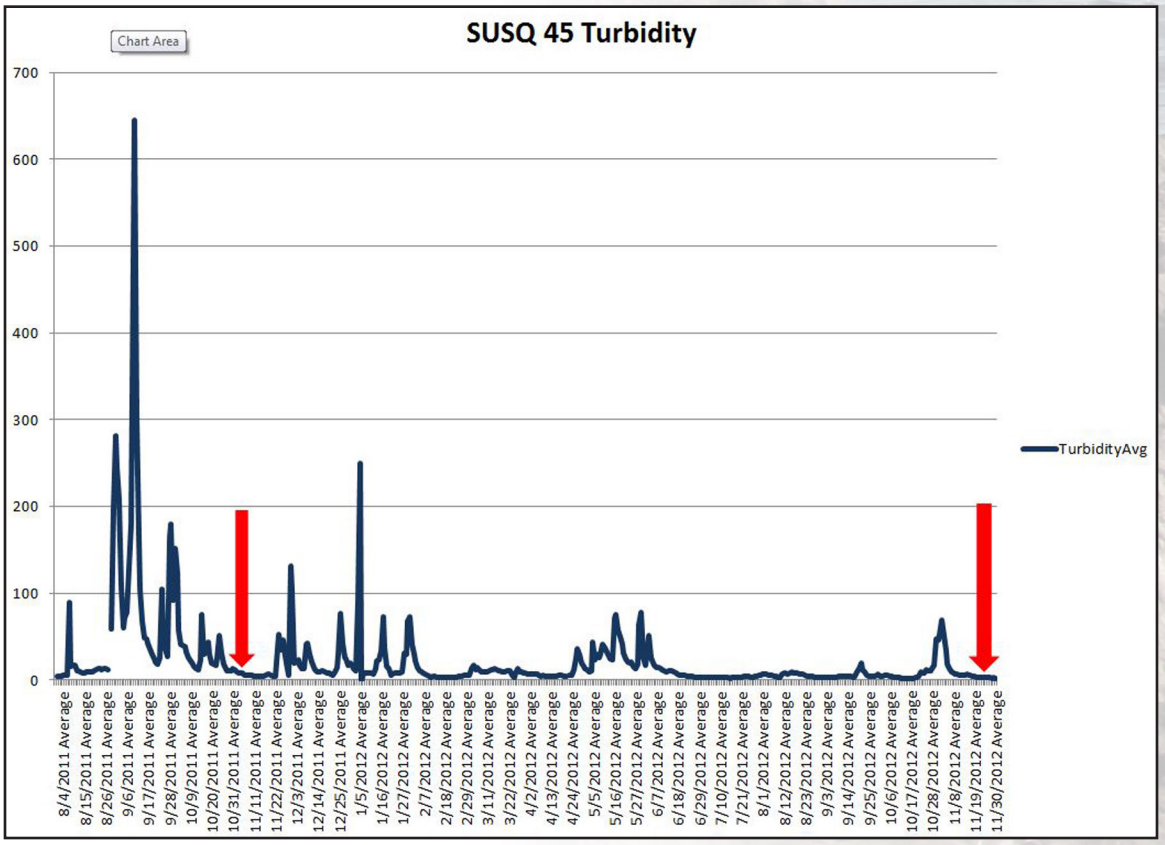

Figure 4. Turbidity Readings at EWS Station near SUSQ 45. Continuous turbidity data for the 2011-12 sampling years shows conditions leading up to sampling events highlighted by red arrows.

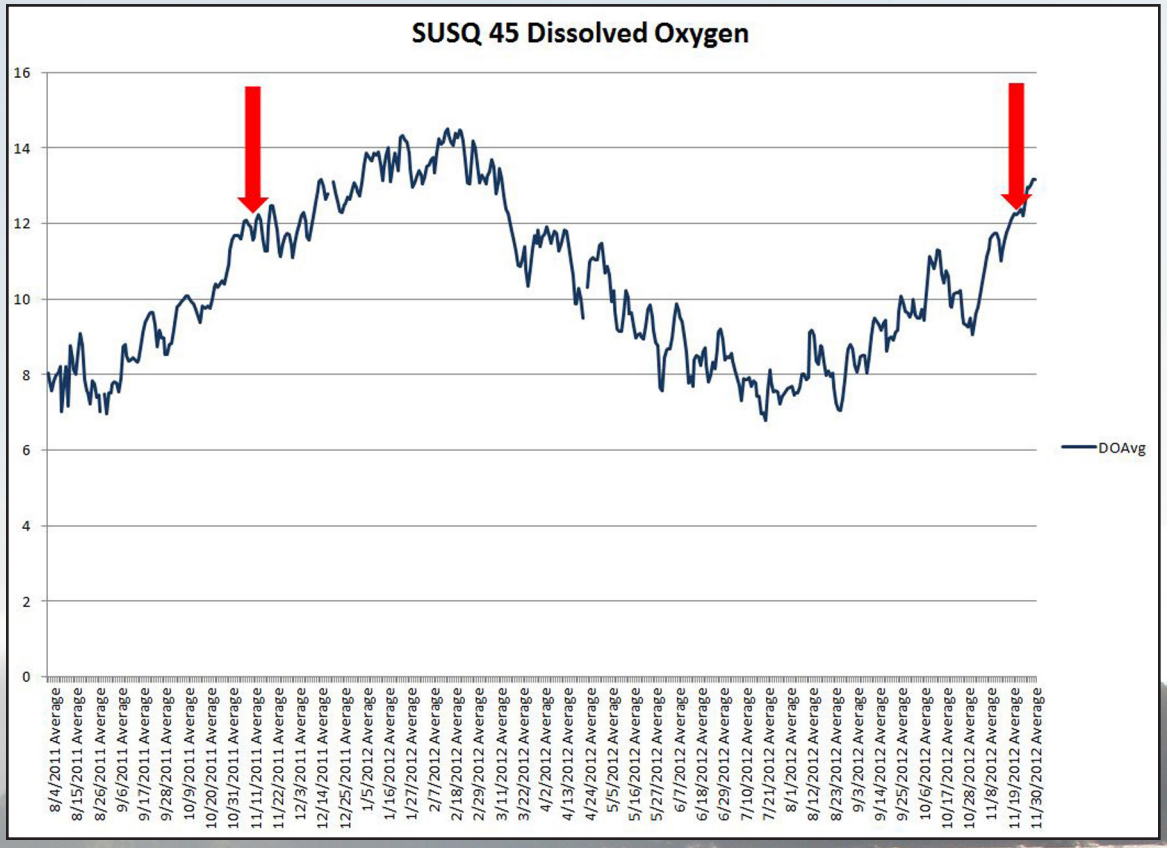

Figure 5. Dissolved Oxygen Readings at EWS Station near SUSQ 45 (red arrows indicate sampling dates)

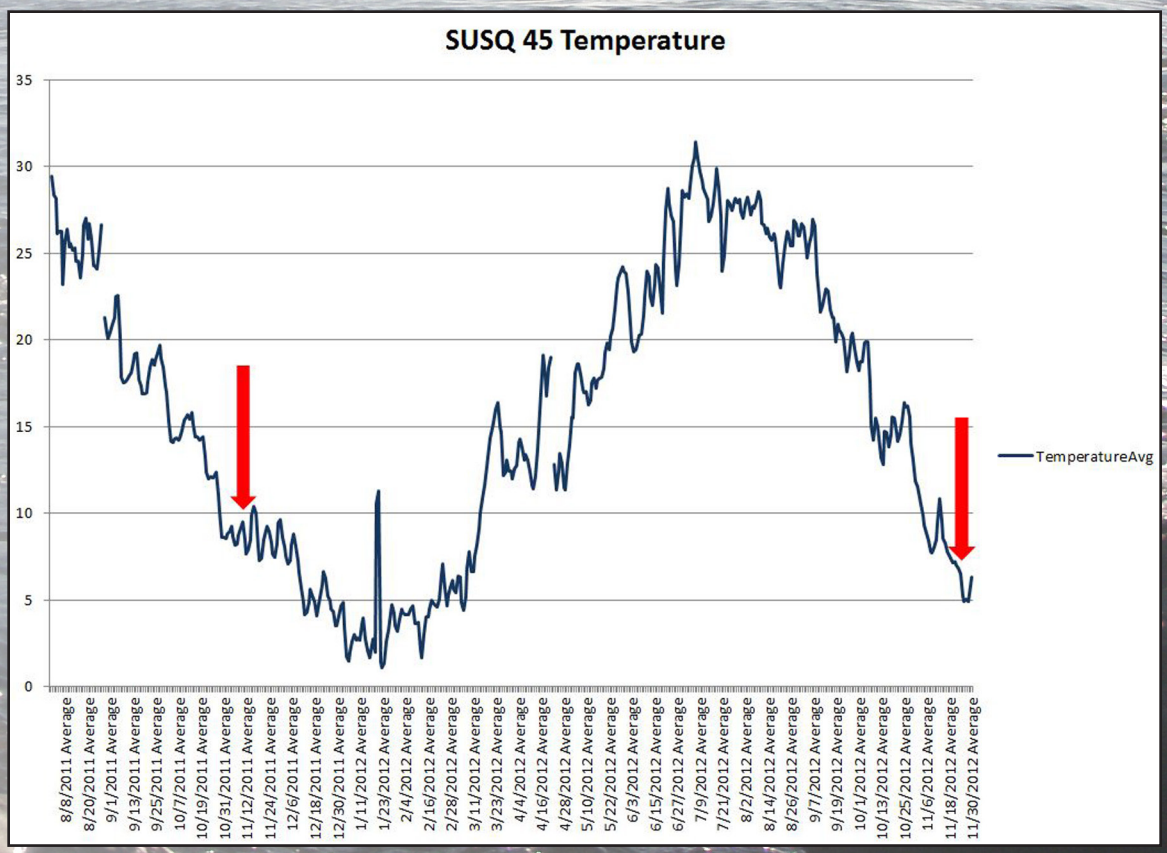

Figure 6. Temperature Readings at EWS Station near SUSQ 45 (red arrows indicate sampling dates)

Macroinvertebrate Communities

Mainstem Susquehanna

The most upstream sites on the mainstem of the Susquehanna River that were sampled, sites SUSQ 231, SUSQ 174, and SUSQ 138, are located in the Middle Susquehanna Subbasin, which encompasses the stretch of the Susquehanna River from the confluence with the Chemung River, in Athens, Pa., to the confluence with the West Branch of the Susquehanna River, in Sunbury, Pa. The Middle Susquehanna Subbasin drains approximately 3,700 square miles with main land uses of forested, agricultural, urban, and abandoned mine drainage (AMD) areas. Site SUSQ 231 is located near Mehoopany, Pa., and was rated as moderately impaired with very low taxa richness and very few Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) (EPT) taxa. SUSQ 231 was last sampled in 2007 and 2008 and both times was rated as only slightly impaired when compared to six years worth of data.

SUSQ 174, located near Shickshinny, Pa., downstream of major urban areas of Wilkes-Barre/Scranton, was rated as moderately impaired with very low number of taxa, low EPT taxa, and low diversity. Historically, SUSQ 174 was sampled in 2007, 2008, and 2010, never rating above moderately impaired with the same recurring deficiencies. SUSQ 138, near Danville, Pa., was sampled in both 2011 and 2012. In 2011, the site was rated as slightly impaired, but in 2012, it was rated as severely impaired due to a significant decrease score in percent EPT individuals, percent Chiromidae, and percent dominant taxa. Historically, SUSQ 138 was rated at nonimpaired in 2007 and slightly impaired in 2008 and 2010.

The four other sites sampled on the mainstem of the Susquehanna River are located in the Lower Susquehanna Subbasin. The lower portions of the Susquehanna River flow from the confluence with the West Branch and mainstem in Sunbury, Pa., to where the river meets the Chesapeake Bay in Havre de Grace, Md. This portion of the watershed has a significant amount of agricultural land uses along with a few densely developed areas, including Harrisburg, Pa., which lies adjacent to the river. The most downstream site is located 45 miles upstream from the Chesapeake Bay because hydroelectric dams on that section of the Susquehanna turn the river into a series of pooled reservoirs, making it impossible for SRBC staff to assess that section using current protocols.

SUSQ 106, located near McKees Half Falls, Pa., was rated as moderately impaired due to low diversity and EPT taxa. This is a slight decrease from the last time it was sampled in 2007 when it was slightly impaired, but with similar issues. SUSQ 94 was sampled in 2011 and was rated as slightly impaired similarly to 2007 and 2008, with low taxa richness and very low EPT taxa.

SUSQ 77, located near Fort Hunter, Pa., was sampled in 2012 and rated as moderately impaired due to low scores in EPT taxa and dominant taxa. In 2007, SUSQ 77 was rated as nonimpaired and in 2008 as slightly impaired. Percent dominant taxa and EPT taxa have always been the low scoring metrics; however, all metrics have decreased proportionally over the years, and the ratings may consequently not be showing a specific reason for the decline other than variability in seasonality or other factors. SUSQ 45 is located near Columbia, Pa., and was sampled in both 2011 and 2012. In 2011, it was rated as slightly impaired and in 2012 as moderately impaired. The metrics with the greatest decrease in score were in percent EPT and percent Chironomidae, while other metrics only decreased slightly. In 2007 and 2008, SUSQ 45 rated as only slightly impaired with similar scores as 2011.

West Branch Susquehanna River

The West Branch Susquehanna drains approximately 6,982 square miles from Carrolltown to Northumberland, Pa. Agricultural lands are most abundant near the mouth in the southeastern area, and the few urban areas are mostly small in size. Resource extraction is prominent in the subbasin with many streams severely impacted by mine drainage.

In 2012, three new sites were added to the upper reaches of the West Branch Susquehanna River, WBSR 147, WBSR 110, and WBSR 45. WBSR 147 is located near Deer Creek, Pa., and was rated as moderately impaired with below average scores on all metrics except diversity. WBSR 110, near Keating, Pa., was also rated as moderately impaired with taxa richness, percent Ephemeroptera, and EPT taxa scoring low. WBSR 45, located near Linden, Pa., just upstream of the larger urban area of Williamsport, Pa., was rated as moderately impaired due to percent Chironomidae and EPT taxa.

WBSR 5, located near Lewisburg, Pa., has been a long-standing site that was sampled in five of the last six years. In both 2011 and 2012, it was rated as moderately impaired due to low taxa richness and EPT taxa. In 2007 and 2010, it was also rated moderately impaired, while in 2008, it was only slightly impaired with a small increase in a couple metric scores, but very similar numbers overall.

Juniata River

The Juniata River is the last large tributary to the Susquehanna River. The Juniata Subbasin drains approximately 3,400 square miles from west of Bedford to Duncannon, Pa. The mixed land use in the Juniata River Subbasin primarily includes forested areas concentrated on the ridges, with agricultural and urban areas in the valleys. Two sites were added on the Juniata River in 2012, JUNR 74 and JUNR 40.

JUNR 74 is located near Mt. Union, Pa., and was rated as moderately impaired with EPT taxa and percent dominant taxa scoring low. JUNR 40 is located in Lewistown Narrows, Pa., and was rated as slightly impaired with high marks in all but EPT taxa.

JUNR 3 is a long-term site located near Amity Hall, Pa., that has been sampled five of the last six years. It has been rated as moderately impaired each year it has been sampled with 2011 and 2012 receiving the exact same score. Percent dominant taxa and EPT are recurring issues. Some of this may be attributed to the long pool setting that is often caused from back up from the confluence of the mainstem Susquehanna River, thus impairing the habitat.

Macroinvertebrate sampling is dependent on safe river levels. Due to varying river conditions, SRBC staff is not always able to access the sites at the same time each year. Although the conditions described above do show that the chemical characteristics preceding the sampling are often very similar, seasonality could be a possible reason for variance across sampling the same site over the years.

Future Goals

The assessments of the Susquehanna River sites are fairly consistent between this study and past studies. The 2007, 2008, 2009, 2010, and 2011-12 Large River Assessment projects used the same protocol with very similar end results. While staff used different protocols in 2005, the results even then were very similar. Future studies will continue, river conditions permitting. SRBC is also considering ways to expand this Large River Assessment project, particularly in adapting lake and reservoir protocols to help assess the last 45 miles of reservoirs, as well as collecting fish community data at the current stations. SRBC also has an interest in integrating the Large River monitoring project with other SRBC monitoring efforts, particularly ongoing source water monitoring.

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