Comparison to Historical Data

The data collected from the Lower Susquehanna River Subbasin in 2011 were compared to the data collected in 1996 and 2005. The number of sites sampled in all three years was similar. The results for biological, habitat, and water quality conditions for these three years are depicted in Figures 8 through 10. A comparison of condition categories throughout these surveys is shown in Table 4.

Biology

Overall, the 2011 biological results are similar to those observed in 1996, with the healthiest results being demonstrated in 2005 (Figure 8). The percentage of moderately impaired sites has steadily increased from 1996 (18 percent) to 2011 (27 percent), while the percentage of severely impaired sites has decreased from 1996 (4 percent) to 2011 (2 percent). Two of the four sites identified in 1996 as severely impaired—CODO 22.4 on Codorus Creek and WCON 35.5 on Conewago Creek—are currently classified as slightly impaired. The third site, SHAM 2.7 on Shamokin Creek, is now classified as moderately impaired, while the fourth site, PAXT 0.5 on heavily urbanized Paxton Creek, is still classified as severely impaired. A new site sampled for the first time in 2011, WICO 27.0 on Wiconisco Creek, was also classified as severely impaired.

Biological condition categories determined in 2011 were compared to those determined in the previous sampling event (either 1996 or 2005) for each site (Table 4). In the Northern Piedmont ecoregion, the majority of sites (average of 48 percent) demonstrated no change in biological condition categories. Degraded condition categories were noted at an average of 26 percent of sites, while improved condition categories were noted at an average of 18 percent of sites.

In the Blue Ridge and Ridge and Valley ecoregion, most sites (average of 41 percent) exhibited no change in biological condition category. Degraded condition categories were observed at an average of 25 percent of sites, and the same amount of sites showed condition category improvement.

Habitat

Like the trends observed for the biological data, the 2011 habitat results are most similar to those observed in 1996, when the number of sites with the highest habitat rating occurred (Figure 9). The percentage of sites with excellent habitat decreased from 56 percent in 1996 to 33 percent in 2005 before rebounding to 48 percent in 2011. Across sites, 79 percent of sites in 2011 either had excellent or supporting habitat, compared to 89 percent in 2005 and 82 percent in 1996. Twenty percent of sites in 2011 were classified as having partially supporting or nonsupporting habitat, compared to 11 percent in 2005 and 18 percent in 1996.

Habitat is the condition that can be more difficult to compare between sampling event years due to greater variability in assessments. However, in the Northern Piedmont ecoregion, an average of 50 percent of sites demonstrated stable habitat condition categories from the previous sampling event. An average of 26 percent of sites experienced a degradation, and an average of 20 percent demonstrated an improvement in habitat condition categories.

In the Blue Ridge and Ridge and Valley ecoregion, an average of 40 percent of sites maintained stable habitat condition categories, while an average of 31 percent of sites showed a degradation in condition categories. An average of 25 percent of sites exhibited an improvement in condition category.

Table 4. Comparison of Condition Categories (1996, 2005, and 2011 data)

		Percent of sites and pattern of changing Condition Categories (1996, 2005, and 2011 data)[1]								
		Biology			Habitat			Water Quality		
	Watershed Size	Improved	Degraded	No Change	Improved	Degraded	No Change	Improved	Degraded	No Change
Northern Piedmont sites	< 100 sq mi	17	40	30	27	10	53	10	3	77
	> 100 sq mi	18	12	65	12	41	47	24	0	76
	Mean	**18**	**26**	**48**	**20**	**26**	**50**	**17**	**2**	**77**
Blue Ridge and Ridge and Valley sites	< 100 sq mi	30	16	41	22	22	46	14	14	62
	> 100 sq mi	20	33	40	27	40	33	13	27	60
	Mean	**25**	**25**	**41**	**25**	**31**	**40**	**14**	**21**	**61**
Mainstem sites[2]		--	--	--	--	--	--	--	--	--

[1] Percentage differentials result from sites that were not included in analysis because of incomplete data.

[2] Mainstem sites were not sampled in 2011.

Figure 8. Historical Biological Condition Categories Among Sampled Sites in the Lower Susquehanna Subbasin Surveys

Figure 9. Historical Habitat Condition Categories Among Sampled Sites in the Lower Susquehanna Subbasin Surveys

Water Quality

Trends in water quality condition categories are illustrated in Figure 10. Lower water quality conditions were observed at 8 percent of sites in 2011, which is an improvement from the 2005 finding of 15 percent. The 2011 findings, however, were similar to the 8 percent observed in 1996. Higher water quality was observed at only 2 percent of sites in 2011, compared to 6 percent in 2005, and similar to the 2 percent in 1996. Stations with middle water quality were observed at 90 percent of sites in 2011, which is similar to the 89 percent in 1996 and more than the 77 percent in 1995.

Since the previous sampling event, an average of 77 percent of sites in the Northern Piedmont ecoregion experienced no change in water quality ratings. An average of 17 percent showed rating improvement, and only an average of 2 percent showed rating degradation. In the Blue Ridge and Ridge and Valley ecoregion, an average of 61 percent of sites showed no water quality rating change. An average of 21 percent demonstrated a rating degradation, and an average of 14 percent demonstrated rating improvement.

Figure 10. Historical Water Quality Categories Among Sampled Sites in the Lower Susquehanna Subbasin Surveys

SRBC staff measures flow at South Branch Codorus Creek, Adams Co., Pa.

General Trends

Overall, most regions experienced both improvements and degradation in the three condition categories among their sites, but a large percentage of condition categories remained stable in the six years since the last subbasin survey. Approximately 39 percent of all 2011 sites with historical data did not see a change in biological condition categories, with 24 percent of the sites showing degradation, and 21 percent showing improvement. Approximately 44 percent of all sites showed no condition category change for habitat, with 23 percent showing degradation, and 21 percent showing improvement. Approximately 65 percent of all sites showed no change in water quality condition categories, with 10 percent showing degradation, and 13 percent showing improvement. Percentages that are unaccounted for are comprised of sites that were new in 2011 or were not sampled in 2011.

Water quality data collected during the last three surveys in 1996, 2005, and 2011 were compared to determine what sites have chronic issues exceeding levels of concern and what parameters are involved (see Table 5). Consistent with patterns observed in the past subbasin surveys, nitrate and total nitrogen were the parameters that were consistently elevated at many of the sites (85 and 83 sites, respectively). These sites are evenly split among the Northern Piedmont and Ridge and Valley ecoregions for nitrate, but are slightly more prominent in the Northern Piedmont for total nitrogen.

The third most common parameter seen at levels of concern in the last three surveys was orthophosphate, which was observed consistently at seven sites, with five of those sites located in the Northern Piedmont. Total phosphorus was the next most prevalent parameter, with consistently elevated levels occurring at three sites in the subbasin, mostly in the Northern Piedmont. Low total alkalinity occurred at 11 sites in the subbasin, predominantly in the Blue Ridge/Ridge and Valley.

Of the five sites previously mentioned as having five or six parameters exceeding levels of concern in 2011, all of them have had consistent issues throughout the history of the subbasin surveys. The Conestoga River (CNTG 0.9) always has had issues with nitrate, total nitrogen, orthophosphate, total phosphorus, and total sodium. Mahanoy Creek (MHNY 0.3) has had consistent issues with nitrate, total nitrogen, hardness, manganese, magnesium, and sulfate. Mill Creek (MILL 0.3) has had issues with total nitrogen, orthophosphorus, sodium, and hardness. Pequea Creek (PQEA 15.2) has had consistent issues with nitrate, total nitrogen, orthophosphorus, and total phosphorus. Yellow Breeches Creek (YLBR 0.1) has had consistent issues with nitrate and total nitrogen.

Another site that had several recurring issues was Shamokin Creek (SHAM 2.7). Nitrate, iron, and manganese were consistently elevated at this site throughout surveys.

Table 5. List of Sites with Parameters Chronically Exceeding Levels of Concern (1996, 2005, and 2011 Data)

Parameter	Number of Exceeding Measurements	Value [a]			Number of Sites with Chronic Issues			
						Within each ecoregion		
		Minimum	Maximum	Median	Total	Northern Piedmont	Blue Ridge/Ridge and Valley	Mainstem [b]
Nitrate	263	0.61	12	3.69	85	42	42	1
Total Nitrogen	253	1.01	12.3	4	83	43	38	2
Orthophosphate	124	0.02	0.445	0.052	7	5	1	0
Total Phosphorus	49	0.1	0.902	0.147	3	2	1	0
Sodium	37	20.6	80.5	30.6	7	5	2	0
Alkalinity	36	0	19.4	11	11	1	10	0
Hardness	10	300	432.7	322	3	1	2	0
Iron	7	1.63	3.03	1.93	1	0	1	0
Manganese	6	1.71	2.91	2.31	2	0	2	0
Sulfate	3	305	381	325	1	0	1	0
Calcium	3	102	111	105	0	0	0	0
pH	3	4.25	5.95	4.5	0	0	0	0
Magnesium	3	46.1	47.3	46.2	1	0	1	0
Conductance	3	822	940	883	0	0	0	0
Acidity	2	22	24	23	0	0	0	0

Aluminum, TSS, TDS, and Turbidity not reported since they were not collected all three years.

[a] All values are in mg/l except for pH (standard pH units) and conductivity (µmhos/cm).

[b] Mainstem sites were not sampled for chemistry in 2011, so comparisons are only from 1996 to 2005.