

Results for 2009 New York – Pennsylvania Stream Assessments

Sites that represent the best available suite of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. All other locations within that grouping are compared to the reference site. In 2009, Little Snake Creek (LSNK 7.6) was the reference site to which all other Group 1 and 2 New York – Pennsylvania interstate streams were compared. Located near Brackney, Pa., LSNK 7.6 represented the best combination of biological, water quality, and habitat conditions in the Northern Appalachian Plateau and Uplands Ecoregion. New York – Pennsylvania sampling stations consisted of 13 sites located near or on the border of these states. Of these 13 sites, the macroinvertebrate communities of four sites (31 percent) were nonimpaired. Five stations (38 percent) were slightly impaired, and four sites (31 percent) were designated as moderately impaired. The metrics that most often scored poorly were percent Chironomidae and percent dominant taxa. Macroinvertebrate sampling did not occur at NFCR 7.6 in 2009 due to access issues, but will resume in 2010, if possible.

Fish community data were collected and analyzed at 11 Group 1 and 2 stations in 2009. Staff will collect fish data at HLDN 3.5, NFCR 7.6, and TROW 1.8 during 2010. A narrative description of fish IBI scoring categories is presented in Appendix B. Of the 11 sites where fish sampling took place, five sites received good fish IBI scores, five sites scored fair, and one site scored poor (Appendix B, Table B2).

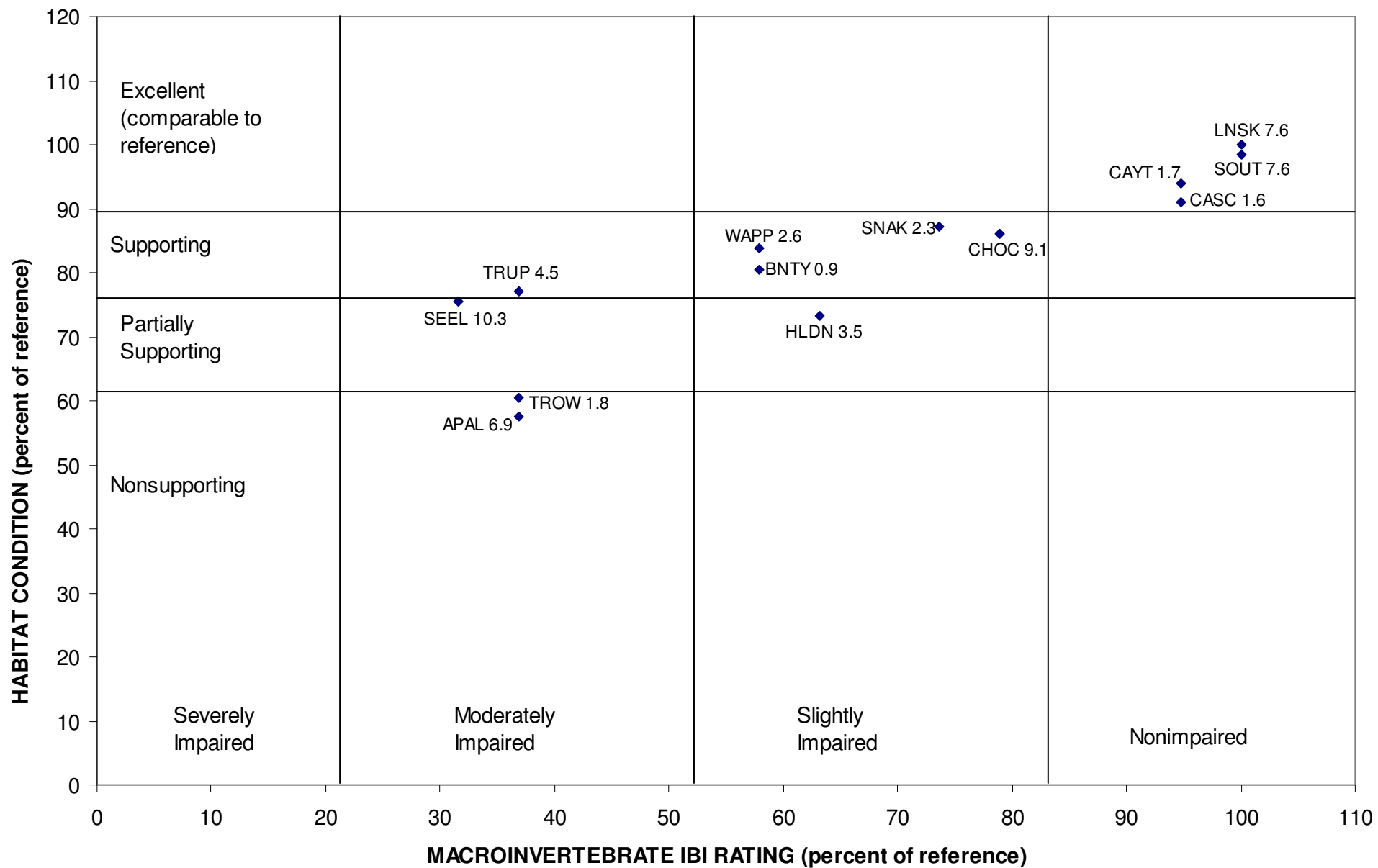
The fishes caught in the highest abundance in the stations along the New York – Pennsylvania border included central stonerollers (*Campostoma anomalum*), sculpins (*Cottus spp.*), and blacknose dace (*Rhinichthys atratulus*). The most widespread fishes encountered were white suckers (*Catostomus commersonii*), sculpins (*Cottus spp.*), and cutlips minnows (*Exoglossum maxillingua*), which were captured at ten, nine, and nine sites respectively. Of the 29 species of fishes encountered in the New York – Pennsylvania stations, eight were considered introduced species (28 percent). TRUP 4.5 had the highest catch per unit effort, with 8.30 individuals captured per minute.

Highest scoring site and respective value for each metric (for PA-NY streams)

Metrics	Highest Scoring Site	Value
Number of native species	TRUP 4.5	12
Number of benthic species	SEEL 10.3	5
Percent abundance of dominant species	SOUT 7.6	26%
Percentage of tolerant species (EPA)	CAYT 1.7	20%
Number of individuals per square meter	LSNK 7.6	0.36

Habitat was not evaluated at NFCR 7.6 in 2009 due to access issues. Out of the 13 remaining habitat classifications, four sites (31 percent) were rated excellent, and five sites (38 percent) were rated supporting. Two sites (15 percent) received partially supporting ratings and two sites were rated nonsupporting.

The chart below summarizes the macroinvertebrate community and habitat data for the New York – Pennsylvania interstate streams sites.



Results for 2009 Pennsylvania – Maryland Stream Assessments

Sites that represent the best available suite of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. All other locations within that grouping are compared to the reference site. In 2009, Falling Branch Deer Creek (FBDC 4.1) was the reference site to which all other Group 1 and 2 Pennsylvania – Maryland interstate streams were compared. Located in Harford County, Md., FBDC 4.1 represented the best combination of biological, water quality, and habitat conditions in the Northern Piedmont Ecoregion (Omernik, 1987). Pennsylvania – Maryland sampling stations consisted of nine sites located on or near the border of these states. Of these nine sites, the macroinvertebrate communities of four sites (44 percent) were designated nonimpaired, using RBP III protocol designations. Four additional stations were slightly impaired, and one site (11 percent) was designated moderately impaired. The metrics that most often scored poorly were the Hilsenhoff Biotic Index and EPT Index, indicating that organic pollution may be the largest source of impairment within the Pennsylvania – Maryland region.

Fish community data were collected and analyzed at seven Group 1 and 2 stations in 2009. LPGA 2.5 and SCTT 3.0 will be electrofished in 2010. Of the seven sites where fish sampling took place, four sites (57 percent) received good fish IBI scores and three sites (43 percent) scored fair (Appendix B, Table B3).

The fishes caught in the highest abundance in the stations along the Pennsylvania – Maryland border included blacknose dace (*Rhinichthys atratulus*), American eels (*Anguilla rostrata*), and creek chubs (*Semotilus atromaculatus*). The most widespread fishes encountered were white suckers (*Catostomus commersonii*) and tessellated darters (*Etheostoma olmstedii*), which were captured at seven and six sites, respectively. Of the 31 species of fishes encountered in the Pennsylvania-Maryland stations, five were considered introduced species (16 percent). FBDC 4.1 had the highest catch per unit effort, with 10.77 individuals captured per minute.

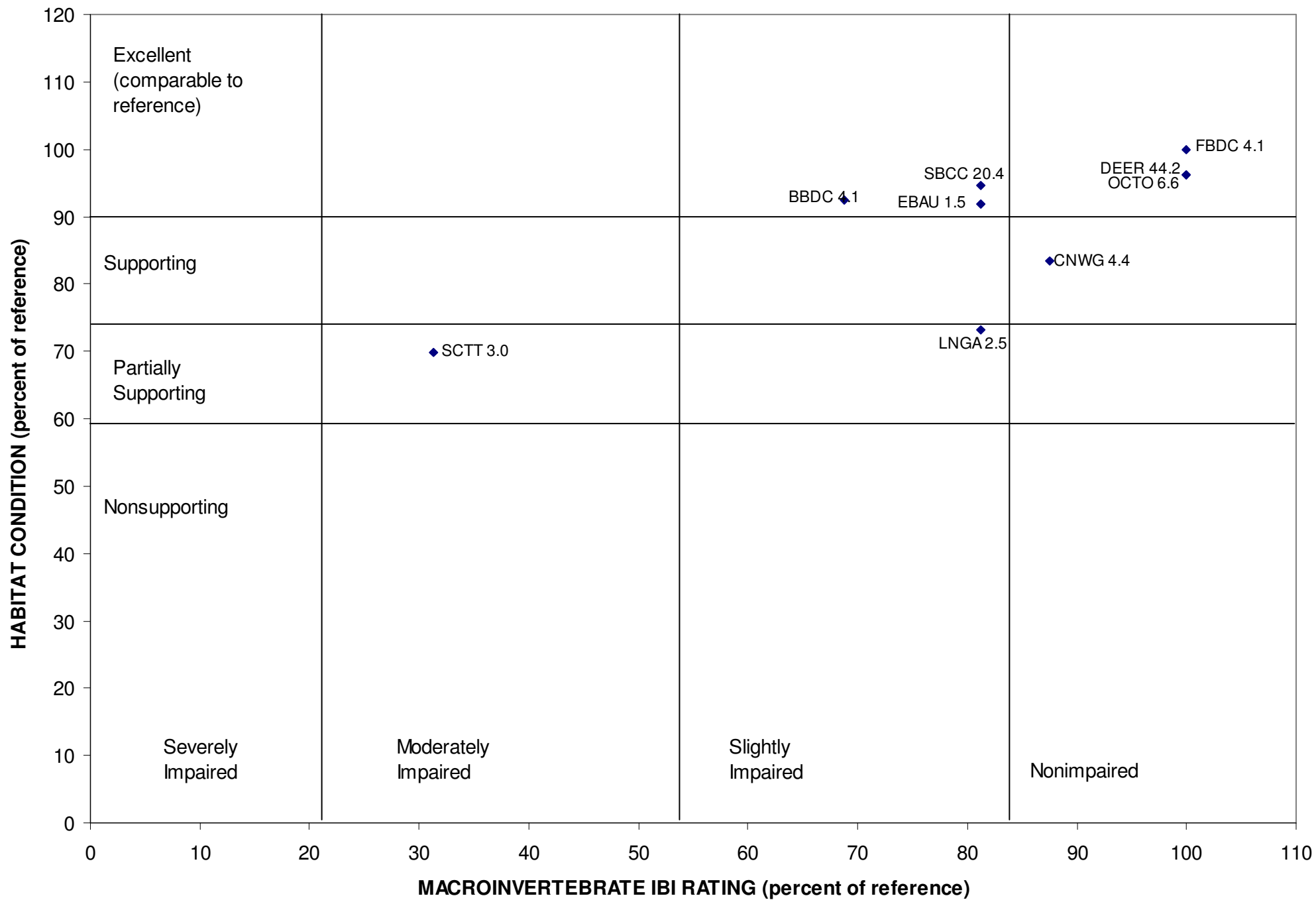
Highest scoring site and respective value for each metric (for PA-MD streams)

Metrics	Highest Scoring Site	Value
Number of native species	DEER 44.2	15
Number of benthic species	OCTO 6.6	4
Percent abundance of dominant species	DEER 44.2	13%
Percentage of tolerant species (EPA)	EBAU 1.5	25%
Number of individuals per square meter	FBDC 4.1	1.77

Six (67 percent) of the Pennsylvania – Maryland border sites had excellent habitats, while one (11 percent) had supporting habitat, and two (22 percent) had partially supporting habitat ratings.

As noted above, the reference site for this group of streams was Falling Branch Deer Creek (FBDC 4.1). DEER 44.2 also earned a good fish IBI score, nonimpaired macroinvertebrate IBI rating, and an excellent habitat assessment.

The chart below summarizes the biological and habitat data for the Pennsylvania - Maryland interstate streams sites.

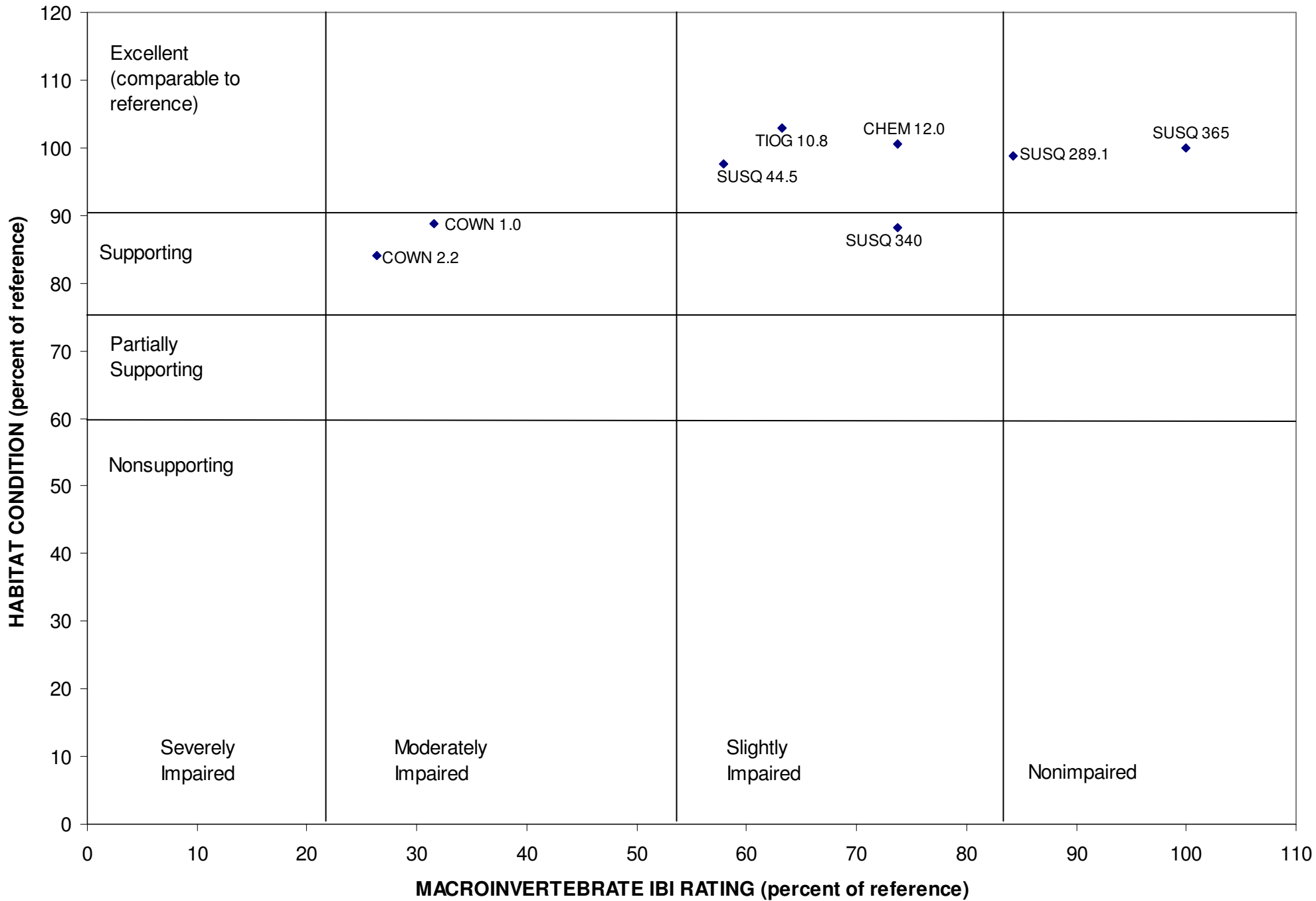


Results for 2009 River Site Assessments

Sites that represent the best available suite of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. All other locations within that grouping are compared to the reference site. Specifically, in the large river classification, the Susquehanna, Chemung, Cowanesque, and Tioga Rivers at seven sites on the New York – Pennsylvania border and one site in southern Pennsylvania are examined as a reference group. In 2009, the Susquehanna River in Windsor, N.Y., (SUSQ 365) was the reference site to which all other large river sites were compared. This site on the Susquehanna River represented the best combination of biological, water quality, and habitat conditions of the eight sites sampled. The Susquehanna River downstream of the Conowingo Dam (SUSQ 10) was not included in this analysis because conditions prevented adequate macroinvertebrate collection and habitat assessment. The macroinvertebrate communities at two river sites (25 percent) received nonimpaired IBI ratings. Four river sites (50 percent) were slightly impaired, and two sites were designated as moderately impaired. Physical habitat at five river sites (63 percent) was excellent, while three sites (37 percent) were supporting.

The Susquehanna River at Windsor, N.Y., (SUSQ 365) possessed the best macroinvertebrate IBI rating and physical habitat was rated excellent. The Susquehanna River at Sayre, Pa., also received a nonimpaired macroinvertebrate IBI rating and excellent habitat assessment. The other two sites on the Susquehanna River (SUSQ 44.5 and SUSQ 340) received slightly impaired macroinvertebrate IBI ratings. The lowest macroinvertebrate IBI ratings of all interstate large river stations were located at the two sites on the Cowanesque River. Sampling on the Cowanesque River takes place directly downstream of the Cowanesque Reservoir in the river's primary recovery zone. COWN 2.2 is located directly below the outflow of the reservoir. This site received the lowest macroinvertebrate IBI rating and physical habitat assessment. Concerns with water quality also were observed. However, approximately one mile downstream on the Cowanesque River (COWN 1.0), minor improvements in the macroinvertebrate community and physical habitat were observed, indicating that this waterway shows recovery over a short distance after being impounded. The Tioga River is sampled near Lindley, N.Y. Water quality at TIOG 10.8 shows evidence of the abandoned mine drainage that influences the headwaters of this river, as total aluminum and manganese exceeded water quality standards in multiple sampling quarters. However, excellent physical habitat is present at this site and the macroinvertebrate community received a slightly impaired IBI rating. The Chemung River near Chemung, N.Y., also had metals concentrations exceeding water quality standards. However, the macroinvertebrate community at CHEM 12.0 received a slightly impaired macroinvertebrate IBI rating and physical habitat was rated excellent. Overall, the lowest scoring macroinvertebrate IBI metrics among large river interstate stations were Hilsenhoff Biotic Index, percent dominant taxa, and EPT taxa. For more in depth information regarding the Chemung and Susquehanna Rivers, refer to the Large River Assessment Project on the SRBC web site (www.srbc.net).

The chart below summarizes the biological and habitat data for the river interstate streams sites stations.



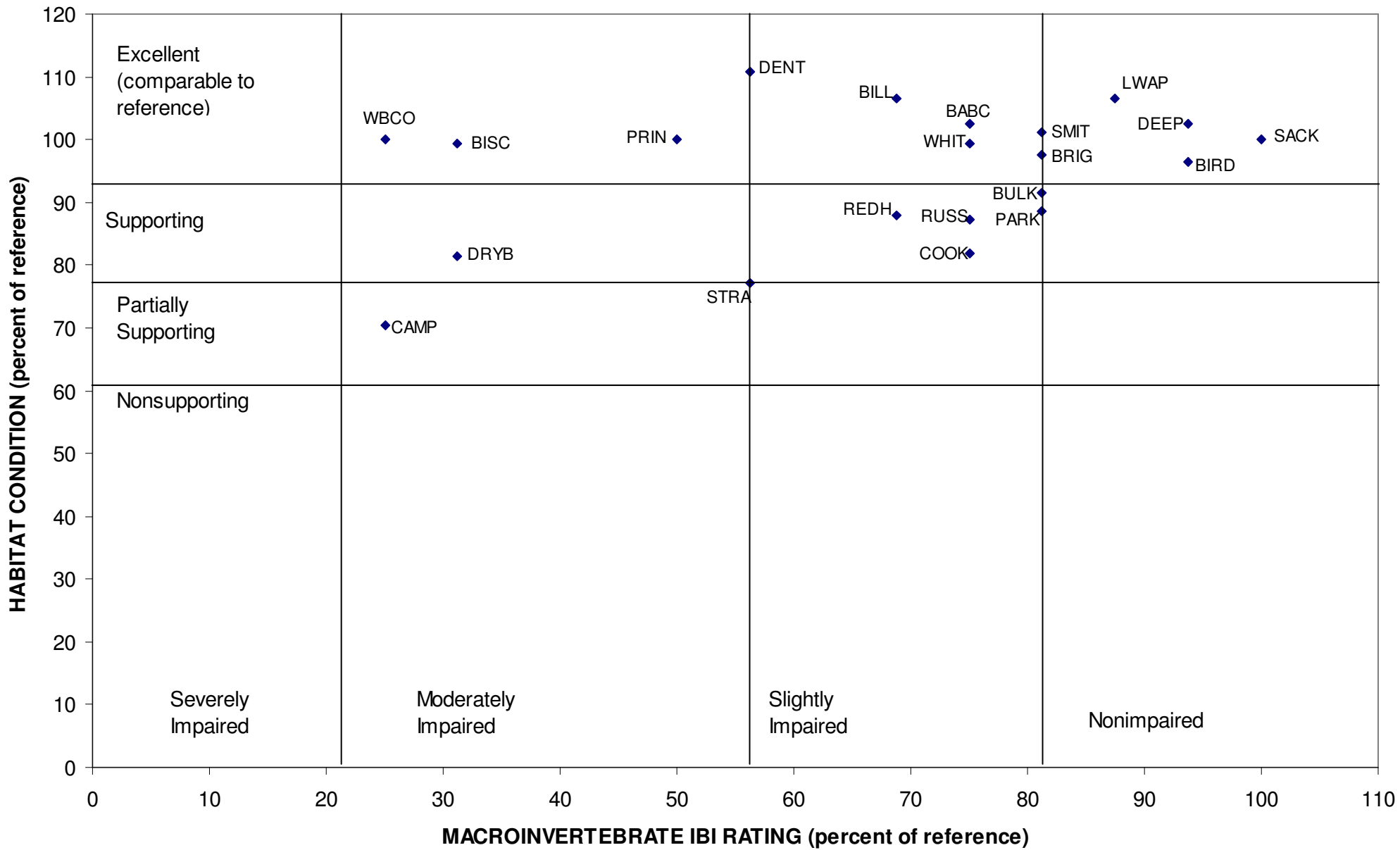
Results for 2009 Group 3 Site Assessments

Sites that represent the best available suite of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. All other locations within that grouping are compared to the reference site. Specifically, in the Group 3 classification, many smaller streams along the New York – Pennsylvania border are examined. In 2009, Sackett Creek (SACK) in Tioga County, N.Y., was the reference site to which all other Group 3 streams were compared. SACK has shown a steady improvement in macroinvertebrate IBI ratings over the past five years, and scored the best among all 21 Group 3 stations in 2009. Physical habitat was excellent at SACK and no field chemistry parameters exceeded acceptable limits. Including SACK, six Group 3 stations (29 percent) received a nonimpaired macroinvertebrate IBI rating. Nonimpaired macroinvertebrate communities were found at Bird Creek (BIRD), Briggs Hollow (BRIG), Deep Hollow Brook (DEEP), Little Wappasening Creek (LWAP), and an unnamed tributary to Smith Creek (SMIT). Nine Group 3 stations (43 percent) received a slightly impaired macroinvertebrate IBI rating, while six additional stations were rated moderately impaired. Camp Brook and the White Branch Cowanesque River stations received the worst macroinvertebrate IBI ratings of all Group 3 stations. CAMP and WBCO scored poorly for percent dominant taxa, Hilsenhoff Biotic Index, EPT Index, and taxonomic richness metrics.

Physical habitat was rated excellent at 13 Group 3 stations (62 percent). Five stations (24 percent) received supporting physical habitat scores and habitat at three stations (14 percent) received partially supporting scores.

Alkalinity was the only field chemistry parameter to exceed acceptable limits at two (DEEP and DENT) out of 21 Group 3 stations.

The chart below summarizes the biological and habitat data for the Group 3 interstate streams sites.



Water Quality Trends Analysis

Trends in water quality for the entire period of record (1986-2009) were analyzed using a Seasonal Kendall Test. Concentrations of each nine constituents were flow-adjusted. S-ESTREND, Version 1.2 software was used to analyze trends in water quality. Detailed results of trends analysis are presented in Appendix A, Tables A1-9. Only total nitrogen and phosphorus concentration data were sufficient for trends analysis at Seeley Creek (SEEL 10.3). Seeley Creek was only sampled annually from 1988 to 1998, while other Group 1 sites were sampled quarterly.

Number of stations that were increasing, decreasing, or showed no trend for constituents of concern

Constituent	Increasing	None	Decreasing	NA
Total Solids	3	14	3	1
Total Nitrogen		5	1	15
Total Ammonia		7	11	3
Total Phosphorus		8	13	
Total Chlorides	11	9		1
Total Sulfate		2	18	1
Total Iron		11	9	1
Total Manganese		11	9	1
Total Aluminum		18	2	1

Total Suspended Solids

Trend analysis results for total suspended solids are presented in Appendix A, Table A1. Flow-adjusted concentration values at three stations (14 percent), BNTY 0.9, CAYT 1.7, and TIOG 10.8, showed significant, decreasing trends. Three additional stations (DEER 44.2, OCTO 6.6, and SUSQ 365) showed significant, increasing trends, while 14 sites (67 percent) showed no significant trends.

Total Nitrogen

Trends analysis results for total nitrogen are presented in Appendix A, Table A2. Laboratory analysis of total nitrogen has only been completed for the interstate streams project since 2000. Therefore, the nine year data-set was not sufficient for trends analysis in 15 of 21 stations. Flow-adjusted concentration values at one station (5 percent), EBAU 1.5, showed significant, decreasing trends. Five additional stations had sufficient data to perform trends analysis, but these stations did not show any significant trends.

Total ammonia

Trends analysis results for total ammonia are presented in Appendix A, Table A3. No stations showed increasing trends in flow-adjusted concentrations of ammonia. Eleven stations (52 percent), CAYT 1.7, CHEM 12.0, COWN 2.2, DEER 44.2, EBAU 1.5, OCTO 6.6, SCTT 3.0, SUSQ 289.1, SUSQ 340, SUSQ 365, and TIOG 10.8, showed significantly decreasing

trends in flow-adjusted concentrations of total ammonia. Seven stations (33 percent) showed no significant trends.

Total phosphorus

Trends analysis results for total phosphorus are presented in Appendix A, Table A4. Flow-adjusted concentrations of total phosphorus at 13 stations (62 percent) showed significantly decreasing trends. These stations included CASC 1.6, CHEM 12.0, DEER 44.2, LSNK 7.6, OCTO 6.6, SCTT 3.0, SEEL 10.3, and TIOG 10.8, as well as all stations on the Susquehanna River. Trends in concentrations of phosphorus were not significant at eight stations (38 percent).

Total chloride

Trends analysis results for total chloride are presented in Appendix A, Table A5. Flow-adjusted concentrations of total chloride showed significant, increasing trends at 11 stations (52 percent). The stations with increasing trends included CHEM 12.0, CNWG 4.4, DEER 44.2, LNGA 2.5, OCTO 6.6, and TRUP 4.5, as well as all stations on the Susquehanna River. Trends in concentrations of chloride were not significant at nine stations (43 percent).

Total sulfate

Trends analysis results for total sulfate are presented in Appendix A, Table A6. Flow-adjusted concentrations of total sulfate showed significantly increasing trends at 18 stations (86 percent). No significant trends in concentrations of sulfate were observed at CASC 1.6 and SCTT 3.0 (10 percent of stations), while data at SEEL 10.3 were insufficient for trends analysis.

Total iron

Trends analysis results for total iron are presented in Appendix A, Table A7. Flow-adjusted concentrations of total iron showed significantly decreasing trends at nine stations (43 percent). Stations with decreasing trends of iron concentrations included CASC 1.6, CAYT 1.7, CNWG 4.4, DEER 44.2, LNGA 2.5, LSNK 7.6, OCTO 6.6, SUSQ 44.5, and SUSQ 340. No significant trends in concentrations of iron were observed at 11 stations (52 percent).

Total manganese

Trends analysis results for total manganese are presented in Appendix A, Table A8. Flow-adjusted concentrations of total manganese showed significantly decreasing trends at nine stations (43 percent). Stations with decreasing trends of manganese concentrations included CASC 1.6, CHEM 12.0, CNWG 4.4, DEER 44.2, LSNK 7.6, SCTT 3.0, SUSQ 10.0, SUSQ 44.5, and TIOG 10.8. No significant trends in concentrations of manganese were observed at 11 stations (52 percent).

Total aluminum

Trends analysis results for total aluminum are presented in Appendix A, Table A9. Flow-adjusted concentrations of total aluminum showed significantly decreasing trends at two stations (10 percent). No significant trends in concentrations of aluminum were observed at 18 stations (86 percent).

Appendix A. Statistical Trend Results by Water Quality Constituent

Table A1. Trend Statistics in Flow-Adjusted Concentrations for Total Suspended Solids

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	-2.579	-1.984	0.029	down
CASC 1.6	Cascade Creek	na	na	na	none
CAYT 1.7	Cayuta Creek	-0.208	-0.118	0.915	down
CHEM 12.0	Chemung River	0.212	0.092	0.875	none
CNWG 4.4	Conowingo Creek	-0.806	-0.414	0.952	none
COWN 1.0	Cowanesque River 1.0	-2.350	-1.794	0.179	none
COWN 2.2	Cowanesque River 2.2	-0.233	-0.188	0.639	none
DEER 44.2	Deer Creek	1.784	1.230	0.002	up
EBAU 1.5	Ebaughs Creek	-0.145	-0.088	0.848	none
LNGA 2.5	Long Arm Creek	-1.078	-0.700	0.449	none
LSNK 7.6	Little Snake Creek	-2.371	-2.635	0.064	none
OCTO 6.6	Octoraro Creek	1.325	0.736	0.035	up
SCTT 3.0	Scott Creek	-0.925	-0.409	-0.409	none
SEEL 10.3	Seeley Creek	na	na	na	na
SUSQ 10.0	Susquehanna River 10.0	-1.139	-0.658	0.311	none
SUSQ 44.5	Susquehanna River 44.5	0.180	0.097	0.671	none
SUSQ 289.1	Susquehanna River 289.1	0.106	0.068	0.907	none
SUSQ 340	Susquehanna River 340	0.181	0.142	0.788	none
SUSQ 365	Susquehanna River 365	1.288	0.947	0.029	up
TIOG 10.8	Tioga River	-1.147	-0.831	0.005	down
TRUP 4.5	Troups Creek	0.245	0.147	0.677	none

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A2. Trend Statistics in Flow-Adjusted Concentrations for Total Nitrogen

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	na	na	na	na
CASC 1.6	Cascade Creek	na	na	na	na
CAYT 1.7	Cayuta Creek	na	na	na	na
CHEM 12.0	Chemung River	na	na	na	na
CNWG 4.4	Conowingo Creek	0.205	1.932	0.080	none
COWN 1.0	Cowanesque River 1.0	na	na	na	na
COWN 2.2	Cowanesque River 2.2	na	na	na	na
DEER 44.2	Deer Creek	0.006	0.111	0.943	none
EBAU 1.5	Ebaughs Creek	-0.120	-1.907	0.039	down
LNGA 2.5	Long Arm Creek	na	na	na	na
LSNK 7.6	Little Snake Creek	na	na	na	na
OCTO 6.6	Octoraro Creek	0.022	0.337	0.959	none
SCTT 3.0	Scott Creek	na	na	na	na
SEEL 10.3	Seeley Creek	0.001	0.317	1.000	none
SUSQ 10.0	Susquehanna River 10.0	na	na	na	na
SUSQ 44.5	Susquehanna River 44.5	na	na	na	na
SUSQ 289.1	Susquehanna River 289.1	na	na	na	na
SUSQ 340	Susquehanna River 340	na	na	na	na
SUSQ 365	Susquehanna River 365	na	na	na	na
TIOG 10.8	Tioga River	na	na	na	na
TRUP 4.5	Troups Creek	-0.029	-7.352	0.182	none

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A3. Trend Statistics in Flow-Adjusted Concentrations for Total Ammonia

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	0.000	0.000	0.621	none
CASC 1.6	Cascade Creek	na	na	na	na
CAYT 1.7	Cayuta Creek	0.000	0.000	0.019	down
CHEM 12.0	Chemung River	-0.001	-3.333	0.002	down
CNWG 4.4	Conowingo Creek	0.000	0.000	0.199	none
COWN 1.0	Cowanesque River 1.0	-0.002	-4.773	0.316	none
COWN 2.2	Cowanesque River 2.2	-0.002	-3.077	0.021	down
DEER 44.2	Deer Creek	0.000	0.000	0.026	down
EBAU 1.5	Ebaughs Creek	0.000	0.000	0.013	down
LNGA 2.5	Long Arm Creek	na	na	na	na
LSNK 7.6	Little Snake Creek	0.000	0.000	0.183	none
OCTO 6.6	Octoraro Creek	0.000	0.000	0.036	down
SCTT 3.0	Scott Creek	-0.009	-11.458	0.001	down
SEEL 10.3	Seeley Creek	na	na	na	na
SUSQ 10.0	Susquehanna River 10.0	-0.001	-1.726	0.281	none
SUSQ 44.5	Susquehanna River 44.5	0.000	0.000	0.107	none
SUSQ 289.1	Susquehanna River 289.1	-0.001	-3.333	0.005	down
SUSQ 340	Susquehanna River 340	0.000	0.000	0.004	down
SUSQ 365	Susquehanna River 365	0.000	0.000	0.023	down
TIOG 10.8	Tioga River	-0.002	-4.167	0.001	down
TRUP 4.5	Troups Creek	0.000	0.000	0.258	none

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A4. Trend Statistics in Flow-Adjusted Concentrations for Total Phosphorus

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	-0.001	-4.006	0.080	none
CASC 1.6	Cascade Creek	-0.002	-10.147	0.018	down
CAYT 1.7	Cayuta Creek	-0.001	-0.582	0.780	none
CHEM 12.0	Chemung River	-0.001	-1.980	0.019	down
CNWG 4.4	Conowingo Creek	-0.001	-2.140	0.201	none
COWN 1.0	Cowanesque River 1.0	-0.001	-2.493	0.436	none
COWN 2.2	Cowanesque River 2.2	-0.001	-2.299	0.073	none
DEER 44.2	Deer Creek	-0.001	-4.459	0.014	down
EBAU 1.5	Ebaughs Creek	-0.001	-1.497	0.098	none
LNGA 2.5	Long Arm Creek	-0.001	-2.728	0.149	none
LSNK 7.6	Little Snake Creek	-0.002	-9.330	0.002	down
OCTO 6.6	Octoraro Creek	-0.002	-2.284	0.010	down
SCTT 3.0	Scott Creek	-0.007	-9.573	0.017	down
SEEL 10.3	Seeley Creek	-0.001	-5.536	0.037	down
SUSQ 10.0	Susquehanna River 10.0	-0.001	-2.562	0.010	down
SUSQ 44.5	Susquehanna River 44.5	-0.001	-2.893	0.009	down
SUSQ 289.1	Susquehanna River 289.1	-0.001	-2.534	0.001	down
SUSQ 340	Susquehanna River 340	-0.001	-4.450	0.0004	down
SUSQ 365	Susquehanna River 365	-0.001	-4.197	0.001	down
TIOG 10.8	Tioga River	-0.001	-2.675	0.022	down
TRUP 4.5	Troups Creek	0.000	-1.563	0.082	none

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A5. Trend Statistics in Flow-Adjusted Concentrations for Total Chloride

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	-0.046	-0.459	0.837	none
CASC 1.6	Cascade Creek	-0.067	-3.371	0.163	none
CAYT 1.7	Cayuta Creek	0.394	1.476	0.251	none
CHEM 12.0	Chemung River	0.703	2.276	0.0002	up
CNWG 4.4	Conowingo Creek	0.290	1.623	0.00004	up
COWN 1.0	Cowanesque River 1.0	-0.126	-1.199	0.275	none
COWN 2.2	Cowanesque River 2.2	-0.072	-0.715	0.225	none
DEER 44.2	Deer Creek	0.842	3.827	0.000002	up
EBAU 1.5	Ebaughs Creek	0.453	1.704	0.200	none
LNGA 2.5	Long Arm Creek	0.174	1.243	0.005	up
LSNK 7.6	Little Snake Creek	0.129	0.855	0.484	none
OCTO 6.6	Octoraro Creek	0.326	2.170	0.000	up
SCTT 3.0	Scott Creek	-0.053	-0.144	0.929	none
SEEL 10.3	Seeley Creek	na	na	na	na
SUSQ 10.0	Susquehanna River 10.0	0.341	1.895	0.012	up
SUSQ 44.5	Susquehanna River 44.5	0.396	2.176	0.0005	up
SUSQ 289.1	Susquehanna River 289.1	0.491	2.616	0.001	up
SUSQ 340	Susquehanna River 340	0.448	3.734	0.0002	up
SUSQ 365	Susquehanna River 365	0.526	4.049	0.0001	up
TIOG 10.8	Tioga River	0.043	0.432	0.401	none
TRUP 4.5	Troups Creek	0.315	2.172	0.006	up

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A6. Trend Statistics in Flow-Adjusted Concentrations for Total Sulfate

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	-0.689	-3.443	0.0001	down
CASC 1.6	Cascade Creek	-0.075	-0.396	0.104	none
CAYT 1.7	Cayuta Creek	-0.800	-3.810	0.00009	down
CHEM 12.0	Chemung River	-0.807	-3.067	0.00007	down
CNWG 4.4	Conowingo Creek	-0.250	-1.282	0.005	down
COWN 1.0	Cowanesque River 1.0	-0.805	-4.879	0.028	down
COWN 2.2	Cowanesque River 2.2	-0.752	-3.758	0.00009	down
DEER 44.2	Deer Creek	-0.519	-2.595	0.004	down
EBAU 1.5	Ebaughs Creek	-0.347	-1.733	0.007	down
LNGA 2.5	Long Arm Creek	-0.883	-4.416	0.008	down
LSNK 7.6	Little Snake Creek	-0.172	-0.860	0.026	down
OCTO 6.6	Octoraro Creek	-0.159	-0.794	0.023	down
SCTT 3.0	Scott Creek	-0.247	-1.072	0.074	none
SEEL 10.3	Seeley Creek	na	na	na	na
SUSQ 10.0	Susquehanna River 10.0	-0.973	-2.948	0.031	down
SUSQ 44.5	Susquehanna River 44.5	-0.914	-2.406	0.0004	down
SUSQ 289.1	Susquehanna River 289.1	-0.500	-2.500	0.003	down
SUSQ 340	Susquehanna River 340	-0.495	-2.474	0.010	down
SUSQ 365	Susquehanna River 365	-0.375	-1.875	0.018	down
TIOG 10.8	Tioga River	-1.445	-4.378	0.00003	down
TRUP 4.5	Troups Creek	-0.653	-3.267	0.0003	down

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A7. Trend Statistics in Flow-Adjusted Concentrations for Total Iron

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	1.844	3.235	0.235	none
CASC 1.6	Cascade Creek	-65.186	-13.811	0.00006	down
CAYT 1.7	Cayuta Creek	-4.379	-2.737	0.041	down
CHEM 12.0	Chemung River	-17.080	-7.491	0.075	none
CNWG 4.4	Conowingo Creek	-18.069	-5.867	0.001	down
COWN 1.0	Cowanesque River 1.0	-8.976	-3.069	0.416	none
COWN 2.2	Cowanesque River 2.2	5.535	2.236	0.360	none
DEER 44.2	Deer Creek	-7.619	-4.931	0.019	down
EBAU 1.5	Ebaughs Creek	-2.463	-1.231	0.565	none
LNGA 2.5	Long Arm Creek	-23.907	-6.990	0.023	down
LSNK 7.6	Little Snake Creek	-36.391	-7.480	0.001	down
OCTO 6.6	Octoraro Creek	-12.214	-4.105	0.001	down
SCTT 3.0	Scott Creek	-46.123	-19.502	0.052	none
SEEL 10.3	Seeley Creek	na	na	na	na
SUSQ 10.0	Susquehanna River 10.0	-4.784	-1.679	0.555	none
SUSQ 44.5	Susquehanna River 44.5	-19.423	-4.586	0.008	down
SUSQ 289.1	Susquehanna River 289.1	-8.646	-3.735	0.131	none
SUSQ 340	Susquehanna River 340	-9.382	-3.694	0.024	down
SUSQ 365	Susquehanna River 365	-4.822	-1.884	0.068	none
TIOG 10.8	Tioga River	-3.889	-1.684	0.328	none
TRUP 4.5	Troups Creek	9.600	4.752	0.309	none

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A8. Trend Statistics in Flow-Adjusted Concentrations for Total Manganese

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	0.000	0.000	1.000	none
CASC 1.6	Cascade Creek	-14.937	-18.671	0.00003	down
CAYT 1.7	Cayuta Creek	0.000	0.000	0.325	none
CHEM 12.0	Chemung River	-2.000	-3.226	0.001	down
CNWG 4.4	Conowingo Creek	-1.333	-3.333	0.008	down
COWN 1.0	Cowanesque River 1.0	0.289	0.289	1.000	none
COWN 2.2	Cowanesque River 2.2	2.452	2.567	0.132	none
DEER 44.2	Deer Creek	-0.634	-2.587	0.013	down
EBAU 1.5	Ebaughs Creek	-0.500	-1.471	0.270	none
LNGA 2.5	Long Arm Creek	-1.603	-2.717	0.096	none
LSNK 7.6	Little Snake Creek	-5.863	-7.923	0.007	down
OCTO 6.6	Octoraro Creek	-0.615	-1.415	0.164	none
SCTT 3.0	Scott Creek	-18.477	-32.702	0.015	down
SEEL 10.3	Seeley Creek	na	na	na	na
SUSQ 10.0	Susquehanna River 10.0	-2.447	-2.110	0.007	down
SUSQ 44.5	Susquehanna River 44.5	-2.979	-3.116	0.001	down
SUSQ 289.1	Susquehanna River 289.1	0.214	0.794	0.349	none
SUSQ 340	Susquehanna River 340	0.000	0.000	0.977	none
SUSQ 365	Susquehanna River 365	0.182	0.699	0.478	none
TIOG 10.8	Tioga River	-6.042	-2.549	0.003	down
TRUP 4.5	Troups Creek	0.000	0.000	0.502	none

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Table A9. Trend Statistics in Flow-Adjusted Concentrations for Total Aluminum

Station	Stream name	Trend	Trend percentage	P value	Significance
BNTY 0.9	Bentley Creek	0.000	0.000	0.235	none
CASC 1.6	Cascade Creek	0.000	0.000	0.629	none
CAYT 1.7	Cayuta Creek	0.000	0.000	0.395	none
CHEM 12.0	Chemung River	0.000	0.000	0.976	none
CNWG 4.4	Conowingo Creek	-1.083	-0.463	0.042	down
COWN 1.0	Cowanesque River 1.0	0.000	0.000	0.280	none
COWN 2.2	Cowanesque River 2.2	0.000	0.000	0.669	none
DEER 44.2	Deer Creek	0.000	0.000	0.374	none
EBAU 1.5	Ebaughs Creek	0.000	0.000	0.533	none
LNGA 2.5	Long Arm Creek	-13.800	-5.111	0.014	down
LSNK 7.6	Little Snake Creek	0.000	0.000	0.943	none
OCTO 6.6	Octoraro Creek	0.000	0.000	0.084	none
SCTT 3.0	Scott Creek	0.000	0.000	0.181	none
SEEL 10.3	Seeley Creek	na	na	na	na
SUSQ 10.0	Susquehanna River 10.0	0.000	0.000	0.247	none
SUSQ 44.5	Susquehanna River 44.5	-3.817	-1.416	0.263	none
SUSQ 289.1	Susquehanna River 289.1	0.000	0.000	0.518	none
SUSQ 340	Susquehanna River 340	0.000	0.000	0.757	none
SUSQ 365	Susquehanna River 365	0.000	0.000	0.702	none
TIOG 10.8	Tioga River	0.000	0.000	0.137	none
TRUP 4.5	Troups Creek	0.000	0.000	0.248	none

Trend – Slope or trend direction in raw units
Trend percentage – Slope expressed as a percent
P value – Significance of the trend (P < 0.05 considered significant)
Significance – Indication if the trend is increasing, decreasing, or no trend

Appendix B. Fish Community Data and IBI Analyses

Table B1. Narrative Descriptions of Stream Biological Integrity Associated with Each of the IBI Categories (Roth and others, 2000)

Good	IBI score 4.0 – 5.0	Comparable to reference streams considered to be minimally impacted. On average, biological metrics fall within the upper 50% of reference site conditions.
Fair	IBI score 3.0 – 3.9	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of these minimally impacted streams. On average, biological metrics are within the lower portion of the range of reference sites (10 th to 50 th percentile).
Poor	IBI score 2.0 – 2.9	Significant deviation from reference conditions, with many aspects of biological integrity not resembling the qualities of minimally impacted streams, indicating some degradation. On average, biological metrics fall below the 10 th percentile of reference site values.
Very Poor	IBI score 1.0 – 1.9	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of minimally impacted streams, indicating severe degradation. On average, biological metrics fall below the 10 th percentile of reference site values; most or all metrics are below this level.

Table B2. Fish Community Data of Pennsylvania – New York Group 1 and 2 Interstate Streams

SCIENTIFIC NAME	COMMON NAME	Tolerance	Native (N) or Introduced (I)	Benthic Species	APAL 6.9	BNTY 0.9	CASC 1.6	CAYT 1.7	CHOC 9.1	LSNK 7.6	SEEL 10.3	SNAK 2.3	SOUT 7.6	TRUP 4.5	WAPP 2.6
Campostoma anomalum	central stoneroller	Tolerant	N		1				11	9	11	1	1	64	5
Cyprinella spiloptera	spotfin shiner	Tolerant	N						2				1		
Exoglossum maxillingua	cutlip minnow	Intolerant	N		5	1		1	23	1	11	1	1	10	
Notropis amoenus	comely shiner	Tolerant	N			1	1							3	
Rhinichthys atratulus	eastern blacknose dace	Tolerant	N			10	24		4	26	27			5	4
Rhinichthys cataractae	longnose dace	Moderate	N			1				4	3			12	
Semotilus atromaculatus	creek chub	Tolerant	N				16		3	18				11	
Semotilus corporalis	fallfish	Moderate	N										1		
Catostomus commersonii	white sucker	Tolerant	N		2	12		1	4	4	3	2	9	26	3
Amelurus nebulosus	brown bullhead	Tolerant	N			5			2						
Noturus insignis	margined madtom	Moderate	N	x					3		2	3	2	4	
Oncorhynchus mykiss	rainbow trout	Intolerant	I										1		
Salmo trutta	brown trout	Intolerant	I								1				
Ambloplites rupestris	rock bass	Moderate	I						3				10		
Lepomis gibbosus	pumpkinseed	Moderate	N			1	1						4		1
Lepomis macrochirus	bluegill	Tolerant	I												2
Micropterus dolomieu	smallmouth bass	Moderate	I					2				1	5		1
Micropterus salmoides	largemouth bass	Moderate	I				1								
Etheostoma flabellare	fantail darter	Moderate	N	x		3					5				
Etheostoma olmstedii	tessellated darter	Moderate	N	x	3				2		1			2	1
Etheostoma zonate	banded darter	Intolerant	I	x	1			3			4		1		
Luxilus cornutus	common shiner	Moderate	N				3						1		
Notemigonus crysoleucas	golden shiner	Tolerant	N-CHECK											1	
Notropis procne	swallowtail shiner	Moderate	N									1			
Pimephales promelas	fathead minnow	Tolerant	I						12	15	1			48	
Pimephales notatus	bluntnose minnow	Moderate	N		2				4	4			1	1	
Hypentelium nigricans	northern hog sucker	Moderate	N							1					
Salvelinus fontinalis	brook trout	Intolerant	N							1					
Cottus bairdii	mottled sculpin	Moderate	N	x		6		6	7	15	50	1	1	3	12

Table B3. Fish Community Data of Pennsylvania – Maryland Group 1 and 2 Interstate Streams

SCIENTIFIC NAME	COMMON NAME	Tolerance	Native (N) or Introduced (I)	Benthic Species	BBDC 4.1	CNWG 4.4	DEER 44.2	EBAU 1.5	FBDC 4.1	OCTO 6.6	SBCC 20.4
<i>Anguilla rostrata</i>	American eel	NOTYPE	N		4		17	16	2	74	
<i>Campostoma anomalum</i>	central stoneroller	Intolerant	N			6					
<i>Clinostomus funduloides</i>	rosyside dace	Intolerant	N		12		17	1	37		
<i>Cyprinella spiloptera</i>	spotfin shiner	Intolerant	N							4	
<i>Exoglossum maxillingua</i>	cutlip minnow	Intolerant	N		4	2	23	17		6	
<i>Notropis amoenus</i>	comely shiner	Intolerant	N			1					
<i>Rhinichthys atratulus</i>	eastern blacknose dace	Tolerant	N		30		11	17	48		12
<i>Rhinichthys cataractae</i>	longnose dace	Intolerant	N			4	2	8			
<i>Semotilus atromaculatus</i>	creek chub	Tolerant	N		11		6		47		9
<i>Semotilus corporalis</i>	fallfish	Intolerant	N			6	5	1		1	
<i>Catostomus commersonii</i>	white sucker	Tolerant	N		2	6	23	2	26	1	3
<i>Ameiurus natalis</i>	yellow bullhead	NOTYPE	N								2
<i>Amelurus nebulosus</i>	brown bullhead	Tolerant	N							1	
<i>Noturus insignis</i>	marginied madtom	Intolerant	N	x		3	17			4	
<i>Salmo trutta</i>	brown trout	NOTYPE	I		13			3			
<i>Ambloplites rupestris</i>	rock bass	NOTYPE	I							2	
<i>Lepomis auritus</i>	redbreast sunfish	Intolerant	N			2	1		3	10	
<i>Lepomis gibbosus</i>	pumpkinseed	Tolerant	N			1	1		2	12	
<i>Lepomis macrochirus</i>	bluegill	Tolerant	I						3	5	
<i>Micropterus dolomieu</i>	smallmouth bass	NOTYPE	I			8					
<i>Etheostoma blennioides</i>	greenside darter	NOTYPE	N	x						1	
<i>Etheostoma flabellare</i>	fantail darter	NOTYPE	N	x							5
<i>Etheostoma olmstedii</i>	tessellated darter	Tolerant	N	x	1	1	7	2	18	12	
<i>Percina peltata</i>	shield darter	Intolerant	N	x							1
<i>Etheostoma zonate</i>	banded darter	NOTYPE	I	x	7		2	2		3	
<i>Nocomis micropogon</i>	river chub	Intolerant	N				18				
<i>Notemigonus crysoleucas</i>	golden shiner	Tolerant	N			4	18				
<i>Notropis procne</i>	swallowtail shiner	Intolerant	N							1	
<i>Pimephales notatus</i>	bluntnose minnow	Tolerant	N							1	1
<i>Hypentelium nigricans</i>	northern hog sucker	Intolerant	N				3	2			
<i>Salvelinus fontinalis</i>	brook trout	Intolerant	N					1			