The Macroinvertebrate Communities of
the Great Swamp Watershed
Part II: Summer, 2011: Results

A Report to the
Ten Towns Great Swamp Management Committee

Leland W. Pollock, Ph.D.
Department of Biology
Drew University

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Macroinvertebrate Communities of the Great Swamp, 2011 Results

Executive Summary

In late May, 2011, sampling of macroinvertebrate (MIV) communities was performed at 17 sites spread among the 5 streams that drain the Great Swamp Watershed. To provide a context for this year's analysis, the 2000s generally have been distinctly wetter than the average for the past century. Despite annual ups and downs in individual years, we have offered this shift toward improved precipitation as a plausible explanation for the trend toward modest improvement in nearly all B-IBI scores we have observed since 2000. The rainfall pattern for 2011 reveals it to have had a particularly high precipitation preceding our late May sampling period, followed by massive rainfalls associated with Hurricane Irene.

Between 9 am and 4 pm on May 27, 2011, we used field meters to monitor temperature, dissolved oxygen (DO), pH, total dissolved substances (TDS), and turbidity at all 17 sites. We also completed an EPA "high gradient" habitat assessment form (Barbour et al., 1999) at each site. As usual, highest TDS values were associated with the stressed stream, Loantaka Brook. Our results agree with Edwards (2008) and are consistent with upstream road salt concentrations as a source of these high values. TDS readings measured during our annual surveys in this stream have been increasing steadily since 2008 (to 906 mg/L at LB4). The same is true at BB2 (to 592 mg/L below the Chatham Township Sewage Treatment Plant) and at GB5 (to 498 mg/L just below Foote's Pond in Morristown). A jump in turbidity continues to occur between PR3 and PR2 and that persists, though at reduced level, downstream at PR1. The source of silting must occur somewhere upstream from PR2. As in the past, highest temperatures were associated with sites just below dammed impoundments. High temperatures added to high TDS at GB5 create doubly stressful conditions for macroinvertebrates there.

A total of 3789 individuals were examined in 2011, representing 116 species. Simuliidae (blackfly larvae) and caddisfly larvae of the family Hydropsychidae are among groups that often dominate MIV communities. Both had markedly reduced abundance in 2011 compared to 2010. Community quality, as reflected in B-IBI scores, matched (4 instances) or exceeded (10 instances - by just 2 points in 4 cases, by 4 points in 3 cases, by 6 points in 3 more) 2010 results at 14 of our 17 sites. Greatest improvement over 2010 was observed at the lower 3 Great Brook sites, and at LB3, and PR1. Lower B-IBI scores were found at BB1 and PB3 by 2 points, and at

PB2 by 8 points. The 8 point decline at PB2 is striking in a year of otherwise good B-IBI scoring across the watershed. PB2 happens to host a community with compositional features that fall just at threshold values for several B-IBI components. B-IBI scores there have oscillated up and down with more frequency than at other PB sites. We should avoid overly-interpreting disappointing 2011 results because at this site, 4 relatively minor changes happened to cross 2-point thresholds all in the same year and led to an initially alarming 8 point reduction.

Sites along Great Brook also have shown considerable variation in B-IBI score in recent years – especially since 2006 as our sampling period has shifted from June into late May. One feature common to all the GB cases was an improvement in the B-IBI dominance (DOM) component in 2011. Examining data for taxa often found at these sites in large numbers (i.e., are potential contributors to dominance), we find that blackfly larvae (Simuliidae) in particular were less abundant in Great Brook sites in 2011. This difference drove B-IBI scores up by 2 points. Also, in 2011 another characteristic contributed 2 additional points to improved B-IBI scores. It was the proportion of the community comprised of predators (PPRED). Specifically, the predatory chironomid larva, *Cardiocladius obscurus*, was much more abundant in 2011. This species is preys on blackfly larvae in particular. Reciprocal changes in this predator/prey relationship help to explain the doubled impact (i.e., 4-points) on B-IBI scores at GB sites over recent years.

The primary contributor to an increase in predators (PPRED) at GB5 in 2011 was the presence of 46 *Dugesia* (flatworms) – seen in this stream during these surveys for the first time since sampling shifted from June into late May. The impoverished site, LB3, below the Morris Township sewage treatment facility, improved in dominance (DOM) by including no hydropsychid caddisflies in 2011, as compared to 128 individuals in 2010. Fewer hydropsychids also helped improve the dominance component at PR1, while the addition of just seven *Cardiocladius* individuals was enough to improve its PPRED component.

All in all, 2011 was a year of mostly improved community quality scores.

See Appendix 11-2 for Stream Summaries and suggestions for further action.

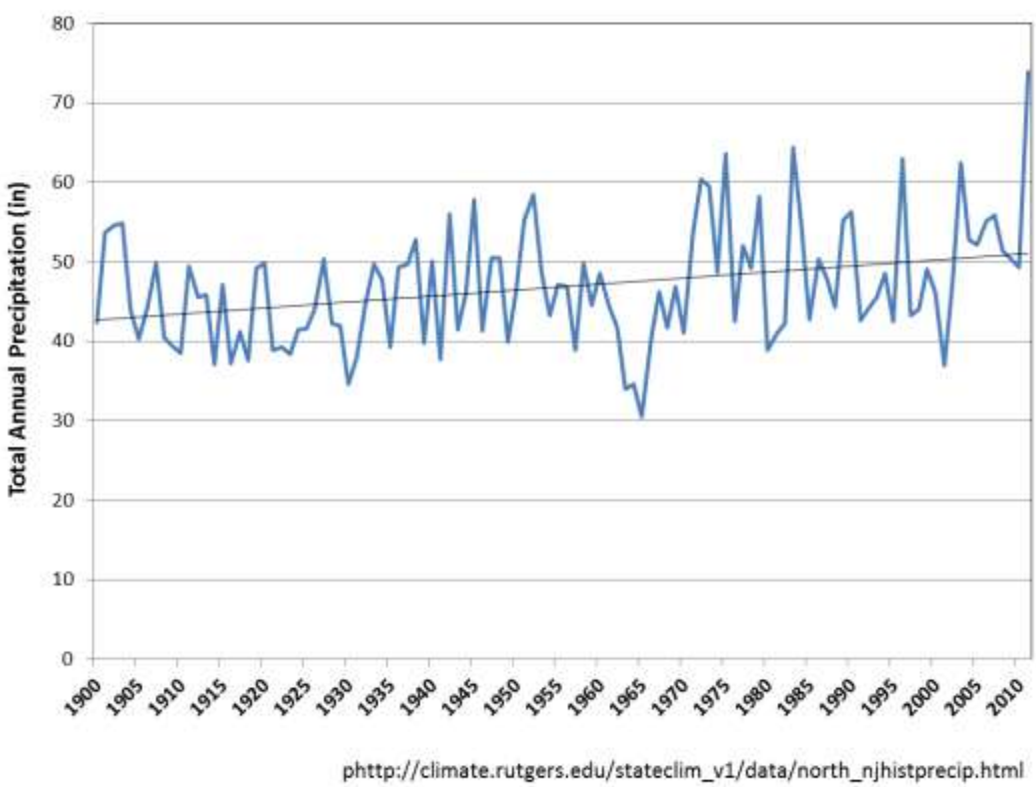
Introduction: The 2010 Great Swamp Watershed Study

In late May, 2011, sampling of macroinvertebrate (MIV) communities was performed at 17 sites spread among the 5 streams that drain the Great Swamp Watershed. See Pollock (2000) for a complete description of the sampling sites and the methodology that was used during this survey (techniques based on the EPA Rapid Bioassessment Protocols (Barbour et al., 1999)). Subsequent modifications of those 2000 protocols used for several years now include: (1) 4 (rather than 3) replicate subsamples are taken and pooled at each site, and (2) composite materials collected at each site are preserved and returned to the laboratory for processing.

Habitats & Environmental Monitoring

To provide a context for this year's analysis, in Figure 11-1, we use data (source: http://climate.rutgers.edu/stateclim _v1/data/ north_njhisttemp.html) to show overall patterns in annual precipitation in Northern New Jersey since 1900. The trend toward overall increase in annual rainfall over this time period is clear. But within the larger picture, shorter-term, up-and-

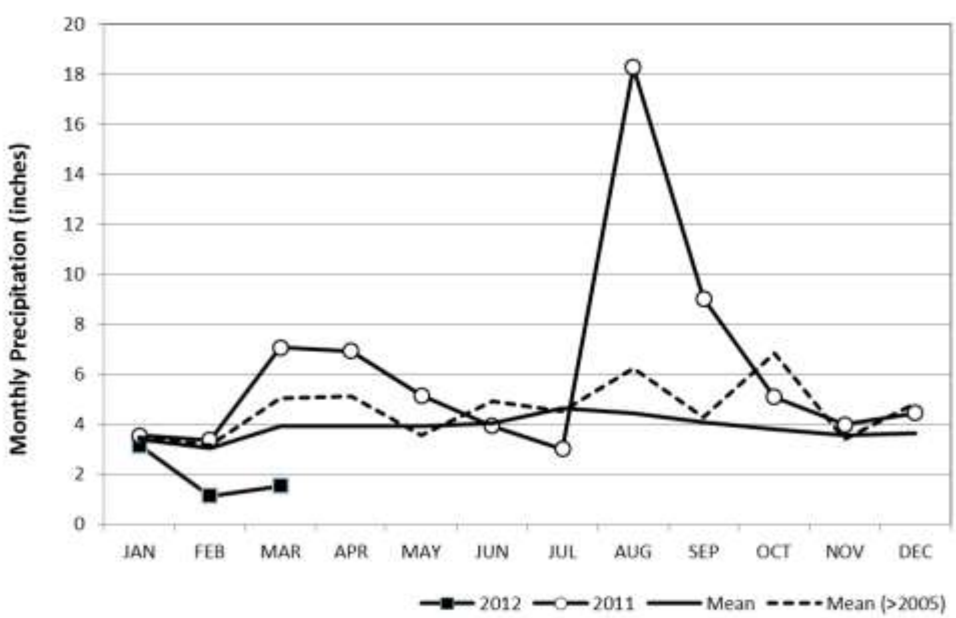
Figure 11-1. Northern New Jersey
Annual Precipitation (in)



down patterns of drier vs. wetter conditions are also present. For example, the 1990s were relatively dry while overall the 2000s have been distinctly wetter. Despite annual ups and downs in individual years, we have offered this shift toward improved precipitation as a plausible explanation for the trend toward modest improvement in nearly all B-IBI scores we have observed since 2000.

Examining Figure 11-2, we can also view recent precipitation patterns from the perspective of monthly rainfall amounts. The mean monthly values (1895-2011) can be used as a baseline against which mean values of monthly precipitation since 2005 can be seen to have been well above average in nearly every month. Also against this background, the curve for 2011 illustrates the particularly high precipitation conditions that preceded our late May sampling period, followed by the massive rainfalls associated with Hurricane Irene. In sharp contrast to this 2011 pattern, monthly precipitation to date in 2012 falls strikingly below average. It remains to be seen how the very wet 2011 (including the impact of Irene) followed by a very dry start to 2012 will affect our 2012 observations.

Figure 11-2. Northern New Jersey Monthly Precipitation (inches)



Source: http://climate.rutgers.edu/stateclim_v1/data/north_njhistprecip.html

Between 9 am and 4 pm on May 27, 2011, we used field meters to monitor temperature, dissolved oxygen (DO), pH, total dissolved substances (TDS), and turbidity at all 17 sites. We also completed an EPA "high gradient" habitat assessment form (Barbour et al., 1999) at each site. Refer to Table 11-1 for site-specific values for these variables. Table 11-2 shows three-year comparisons for key variables. The winter/spring period preceding our 2011 sampling was characterized by high levels of precipitation (see discussion above). Watershed-wide TDS was higher than in 2010, as was dissolved oxygen. Values for other parameters were intermediate among those from the last three years.

As we have seen each year, highest TDS values were associated with the stressed stream, Loantaka Brook. Our results agree with Edwards (2008) and are consistent with upstream road salt concentrations as a source of these high values. TDS readings measured during our annual surveys in this stream have been increasing steadily since 2008 (to 906 mg/L at LB5). The same is true at BB2 (to 592 mg/L below the Chatham Township Sewage Treatment Plant) and at GB5 (to 498 mg/L just below Foote's Pond in Morristown). Edwards & Curran (2011) observed even higher TDS readings during some of their samples taken from Great Brook in February – the height of the road-salt application period. The New Jersey DEP water quality standard for surface waters sets a TDS limit of 500 mg/L for FW2 waters (including all those in the watershed). It is disturbing to find values well into the spring/summer period still near or above the state limit in 3 Great Swamp streams. Measurements are taken during our annual surveys provide a general context for our review of stream biota. They support more rigorous, on-going GSWA efforts to identify the source(s) of high and growing TDS -- at the GB5 site especially. High readings at the BB2 site must be associated with effluent release from the treatment facility. In Table 11-2 we can see that TDS levels during our recent surveys have been near, at, or above the state standard at this location.

Table 11-2 also shows that a jump in turbidity continues to occur between PR3 and PR2 and that it continues, though at reduced level, downstream at PR1. This appears to locate the source of silting somewhere upstream from PR2. Likely sources include run-off from Mt. Kemble Avenue, large parking lots for commercial establishments and Interstate 287 above PR2, with possible additional downstream contribution from eutrophic Osborn Pond above PR1. This year, turbidity was also high at GB3, just below Silver Lake, and at BB1, just downstream from

Southern Boulevard and a eutrophic golf-hazard pond. In both of these cases, organic detritus associated with pond productivity and high rainfall is probably, but not demonstrably, the source.

In Great Swamp streams in late spring/early summer, pH does not appear to be a very important limiting variable. All readings in 2012 fell comfortably close to or within the 7-8 unit range.

As in the past, highest temperatures were associated with sites just below dammed impoundments – at BB1 (golf course hazard pond), GB5 (below Foote's Pond in Morristown), and PR1 (below Osborn Pond). Temperature was also high at PR2 (associated with an open canopy stretch both above and below I-287). Overall, temperatures were cooler during 2012 than during the preceding two years.

High temperatures added to high TDS at GB5 create doubly stressful conditions for macroinvertebrates there. To repeat our comments from last year (Pollock, 2011): "despite impressive attempts to upgrade landscape features surrounding this water body, including the replacement of its dam, the pond remains shallow, highly productive, and silty. Often, stringy green filamentous algae is so abundant covering rocks at this site that they prevent the water-current meter's propeller from turning properly. Ultimately, upstream golf course and dense suburban properties may contribute to nutrient enrichment here along with other runoff such as road salt. But it is likely that the quantity of decomposing organic matter *in situ* presently within Footes Pond will continue to sustain this eutrophy."

For the second year in a row, BB1 had very low dissolved oxygen. This location has intermittent water flow and lies downstream from a very productive golf course water hazard. Decomposition of organic debris and poor water turnover no doubt account for this problem. In 2010, dissolved oxygen at this site fell below the 5 mg/L state minimum for non-trout FW2 waters. This year, its value was just above this limit.

As usual, the upper two Loantaka Brook sites, LB3 and LB4, scored worst in habitat quality, while upper Passaic River sites, PR3 and IG1 were highest.

Macroinvertebrate Survey

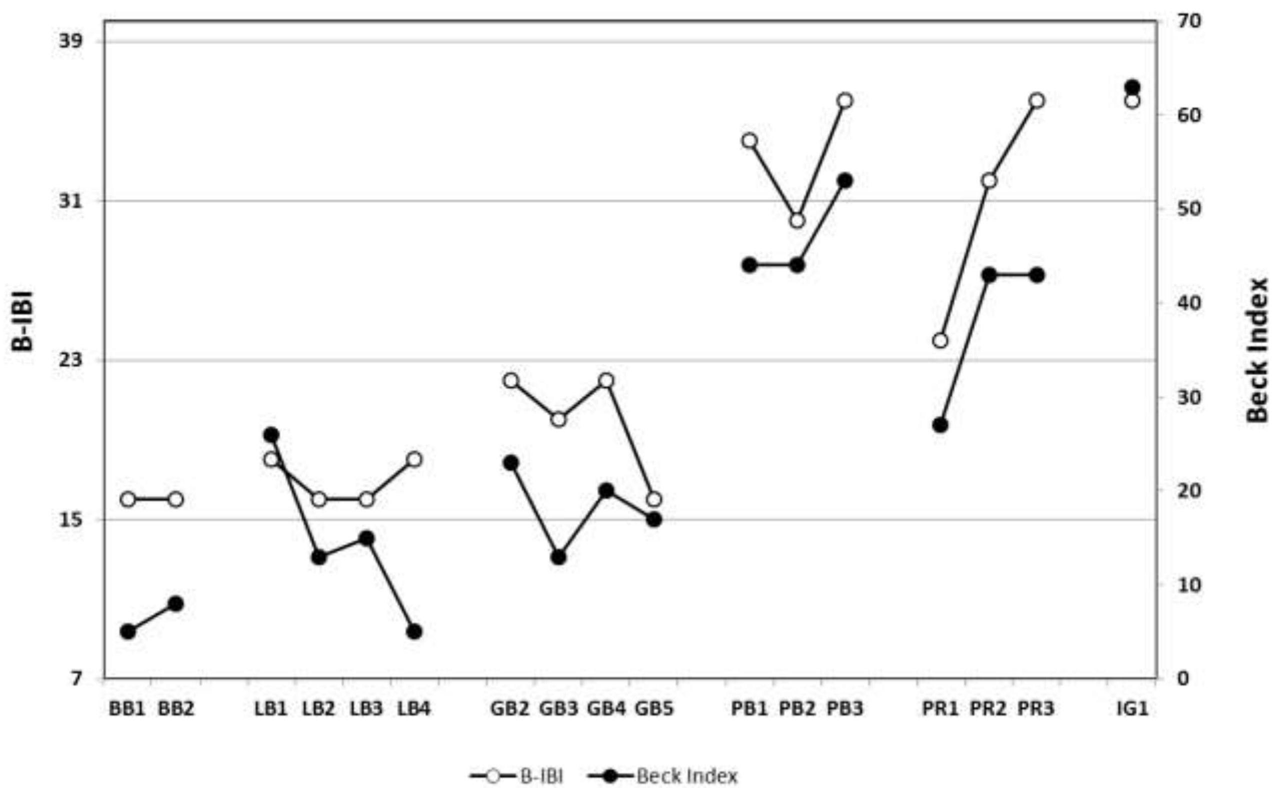
Data in Appendix 11-1 show that a total of 3789 individuals (3942 in 2010) were examined in 2011, representing 116 species (105 in 2010). Two among the groups that often dominate macroinvertebrate communities had reduced abundance in 2011 compared to 2010: Simuliidae (blackfly) larvae – 268 individuals in 2011, 632 individuals in 2010; Hydropsychidae caddisfly larvae – 339 individuals in 2011, 817 individuals in 2010.

Adjusted Beck Index values for 2011 are compared to those of previous years in Table 11-3. Beck Index results for individual sites from 2011 were lower than corresponding B-IBI Index values as seen in Figure 11-3. The organic pollution focus of Beck's Index appears less sensitive to the non-point source stress from sediment loading, which is the more common source of stress in the Great Swamp watershed (see Pollock 2000). A more detailed treatment of the B-IBI Index results will follow.

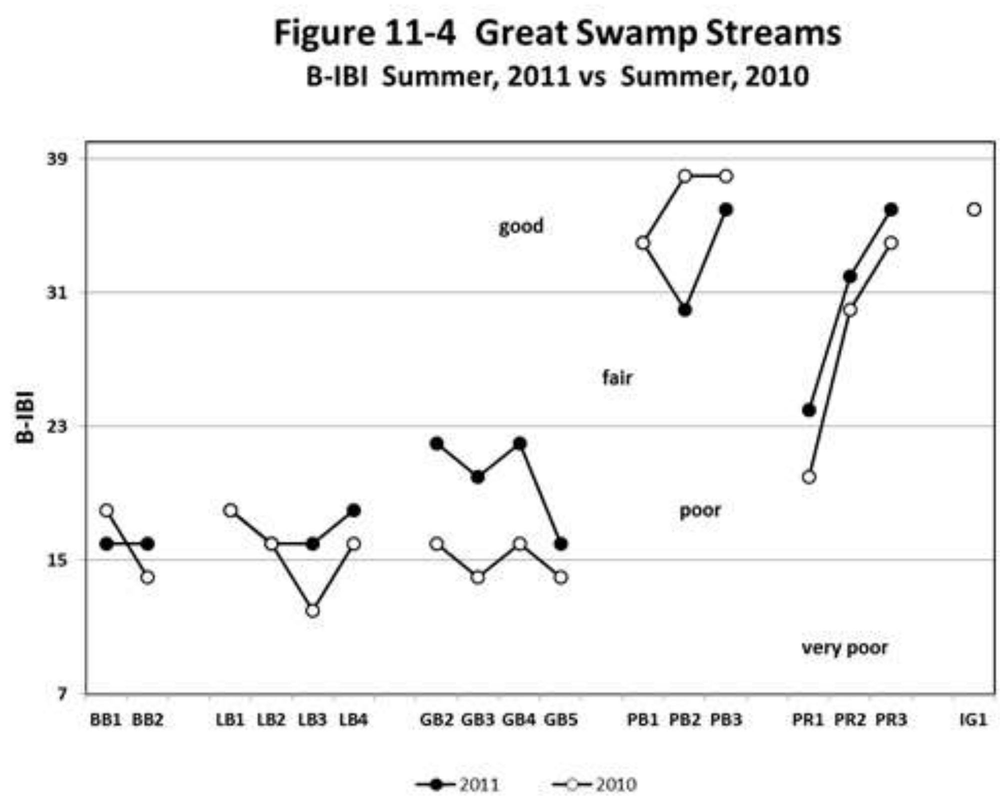
Community quality, as reflected in B-IBI scores, matched (4 instances) or exceeded (10 instances - by just 2 points in 4 cases, by 4 points in 3 cases, by 6 points in 3 more) 2010 results

Figure 11-3 Great Swamp Streams

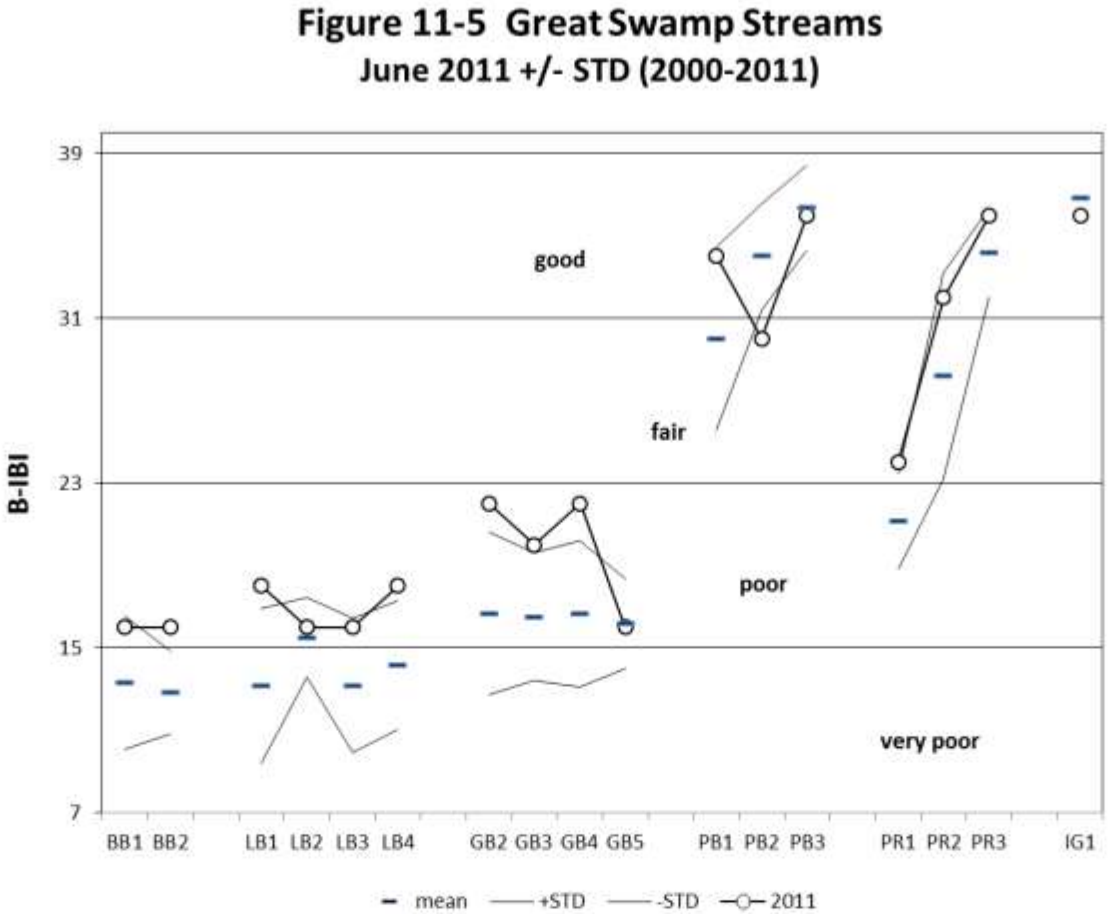
B-IBI vs Beck Index, Summer, 2011



at 14 of our 17 sites (see Fig. 11-4). Greatest improvement over 2010 was observed at the lower 3 Great Brook sites, and at LB3, and PR1. Lower B-IBI scores were found at BB1 and PB3 by 2 points, and at PB2 by 8 points. Because of the method used in calculating the B-IBI score, we have routinely considered a change in any direction of only 2 points as not particularly noteworthy. Specific causes of change in B-IBI scores between 2010 and 2011 can be explored in Table 11-4.



We can put the community changes seen in 2011 into broader perspective by viewing them, in Fig. 11-5, relative to 2000-2011 mean values, plus or minus 1 standard deviation. Using this criterion, only PB2 was significantly low, while BB2, LB1, LB4, and GB2 & 4 sites all fared much better than average. Seven additional sites were at or close to 1 STD above their mean values: BB1, LB3, GB3, PB1, PR1, PR2, and PR3. All in all, 2011 can be considered a good year for the macroinvertebrates of the Great Swamp.



Combining these strategies for identifying sites of particular interest in 2011, we include PB2 for its 8-point decline, and LB3, GB2, GB3, GB4, and PR1 for their 4-or-more-point improvements. Table 11-5 compares B-IBI components at these sites for 2010 and 2011.

Given overall positive results in 2011, the 8 point decline at PB2 is striking. Visually, PB2 is in an especially attractive and “natural” setting, and no changes in its immediate surroundings, upstream, or in-stream state were obvious. Consulting Table 11-2 that compares environmental observations over the past 3 years, we see no noteworthy changes in the conditions we monitored over the period.

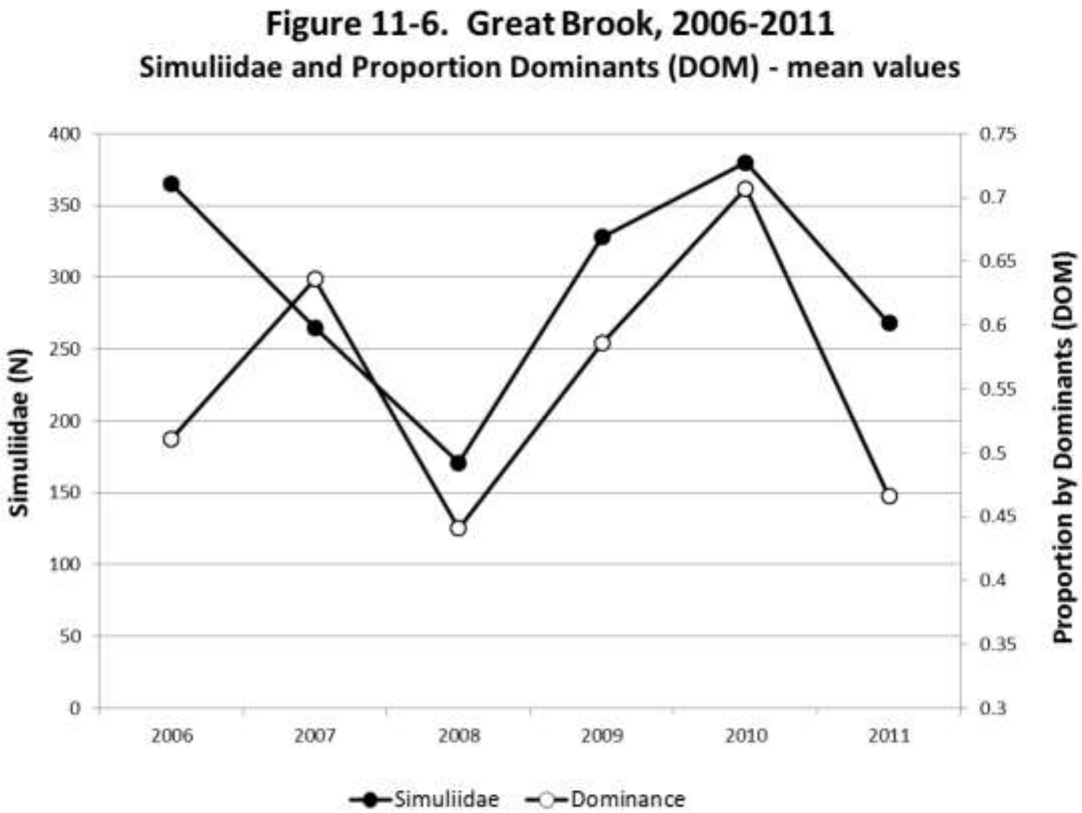
In Table 11-5, double-line boxes mark reduced-score B-IBI categories for 2011 at PB2. Just above these scores we find the columns of descriptive data that generated them. Changes for the worse occurred in 2011 including declines in: the negative factor, dominance - DOM (from 43.2% in 2010 to 54.9% in 2011), and in the 3 positive factors - the proportion of the community comprised of predators - PPRED (from 10.3% in 2010 to 8.7% in 2011), emphemeropteran (mayfly) types - #EPHEM (from 6 in 2010 to 5 in 2011), and in plecopteran (stonefly) types - #PLEC (from 6 in 2010 to 4 in 2011). But in truth, none of these changes appear to be as stark in the field as they are in their impact on the Index.

This illustrates issues inherent in using an index based on 8 individual characteristics, each of which earns a point score of 1, 3, or 5 based on designated cut-off thresholds. For example, 12 to 20 individual taxa present in a community would earn a score of 3 in the category TAXA. If there were more than 20 taxa present, the community would score 5 in this good quality character. But if less than 12 occurred, the score would be 1. If a community hosting 31 taxa in one year fell to just 20 the next, it's B-IBI score would fall by 2 points from 5 to 3. In this case, viewing a community that dropped in diversity by about 1/3 would suggest that something really unfortunate had happened at that site. On the other hand, a community with 21 taxa in year one but 20 taxa in year two would have lost just one taxon, yet its B-IBI score would have fallen by the same 2 points as in the first example. This loss would be relatively insignificant. (It is for this reason that we don't treat an annual change of just 2 points up or down as particularly noteworthy).

In fact, PB2 happens to host a community with compositional features that fall just at threshold values (i.e., at the 3/5 borderline) for several B-IBI components. Figure 11-6f shows that B-IBI scores there have oscillated up and down with greater amplitude than at other PB sites. Just last year, the B-IBI score at PB2 was more than 1 STD *above* the mean. So we should avoid over-interpretation when, as at PB2 in 2011, 4 relatively minor changes all happen to cross 2-point thresholds all in the same year and lead to a potentially alarming 8 point reduction. To carry this discussion of the potential for being misled by B-IBI results one step further, it would be possible theoretically that a single individual predatory stonefly larva found in the community in one year but absent in the next, *could* potentially cross three 2-point B-IBI thresholds simultaneously – for TAXA, PPRED, and #PLEC and produce a 6 point B-IBI reduction all by itself. So B-IBI score changes should catch our attention because they *could* signal significant change in environmental conditions up or down. However, they also could be far less important artifacts of our analytic device as the "unstable" nature of B-IBIs at PB2 appear to be. The 8-point decrease in PB2's B-IBI score places this site "on notice" for our attention during the 2012 sampling period. But given the modest nature of community changes that produced this result and lacking of any evidence for surrounding environmental deterioration there, it will not be surprising to see the B-IBI score bounce back even by several points next year.

Sites along Great Brook also have shown considerable variation in B-IBI score in recent years – especially since 2006 as our sampling period has shifted from the second week in June toward dates in late May. Interpretation of this variability, including noteworthy improvement of scores in 2011, deserves closer examination. A review of the components comprising B-IBI scores at Great Brook sites over the last two years, in Table 11-5 (where improvements in B-IBI components are boxed by heavy solid lines), shows that one feature common to all cases was an improvement in the dominance (DOM) component in 2011. Dominance is defined as the proportion of the total community comprised of the two most abundant species. High levels of dominance in macroinvertebrate communities reflect stressful conditions that concentrate competitive advantage in a few tolerant species. A better score in this feature in 2011 shows that that the combination of the two most abundant species comprised a smaller proportion of the community then than they did in 2010. Examining Appendix 11-1 for Great Swamp taxa that are often found in large numbers (i.e., are potential contributors to dominance), we find that blackfly larvae (Simuliidae) in particular were much less abundant in the watershed (632 in 2010; 268 in 2012) and at Great Brook sites (380 individuals in 2010, 111 in 2011). The shift to earlier sampling from 2006 onward has brought us closer to the annually varying point of blackfly metamorphosis to emerging adults. The relationship between remaining blackfly larvae and community dominance (DOM) during this period is shown in Figure 11-6.

Further examination of Table 11-4 shows that at three of the four GB sites, another characteristic contributing 2 more points to improved B-IBI scores was the proportion of the community comprised of predators (PPRED). Again, examining Appendix 11-1 for predatory types that may have increased significantly in 2011 compared to 2010, we find the predatory chironomid larva, *Cardiocladius obscurus*, meets this criterion in the watershed (21 in 2010, 97 in 2012) and at Great Brook (3 in 2010, 48 in 2011). Simpson & Bode (1980) indicate that this species is “an engulfer, preying on blackfly larvae (Diptera: Simuliidae). We found a close

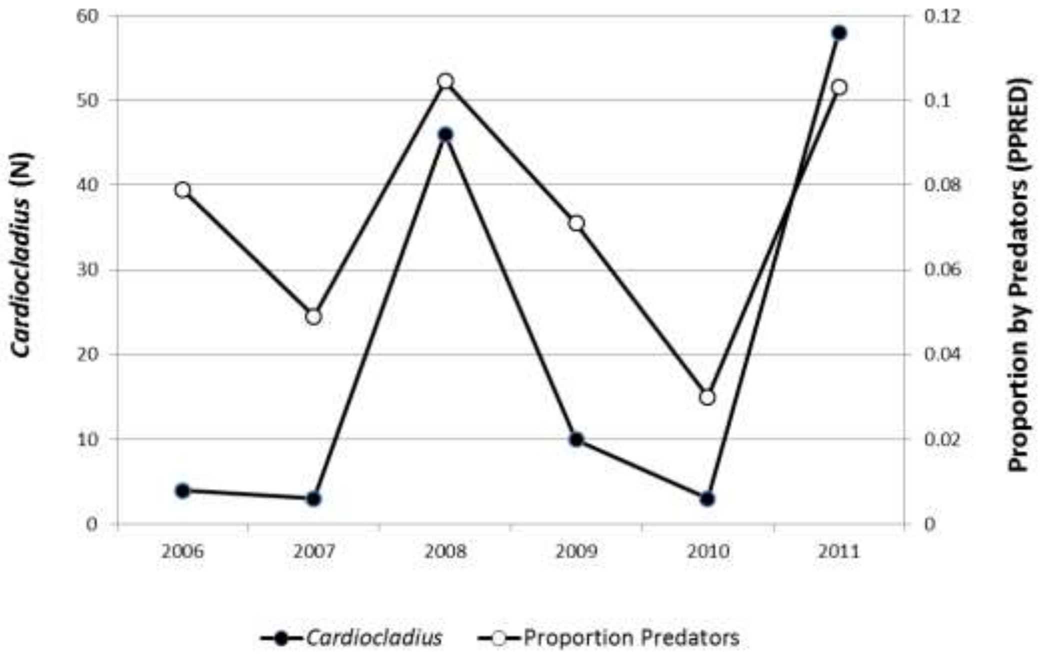


association between these larvae and blackfly larvae, thus the occurrence of blackflies may play an important role in determining the distribution of *Cardiocladius*." In Figure 11-7 we see the matching relationship between *Cardiocladius* abundance and the PPRED component of B-IBI at Great Brook from 2006-2011.

Predators typically experience increases and decreases that match those of their prey – but in delayed phase. Prey increase can stimulate production of more predators. That, in turn, can contribute to subsequent prey reduction – that leads to less support for predators. And so on.

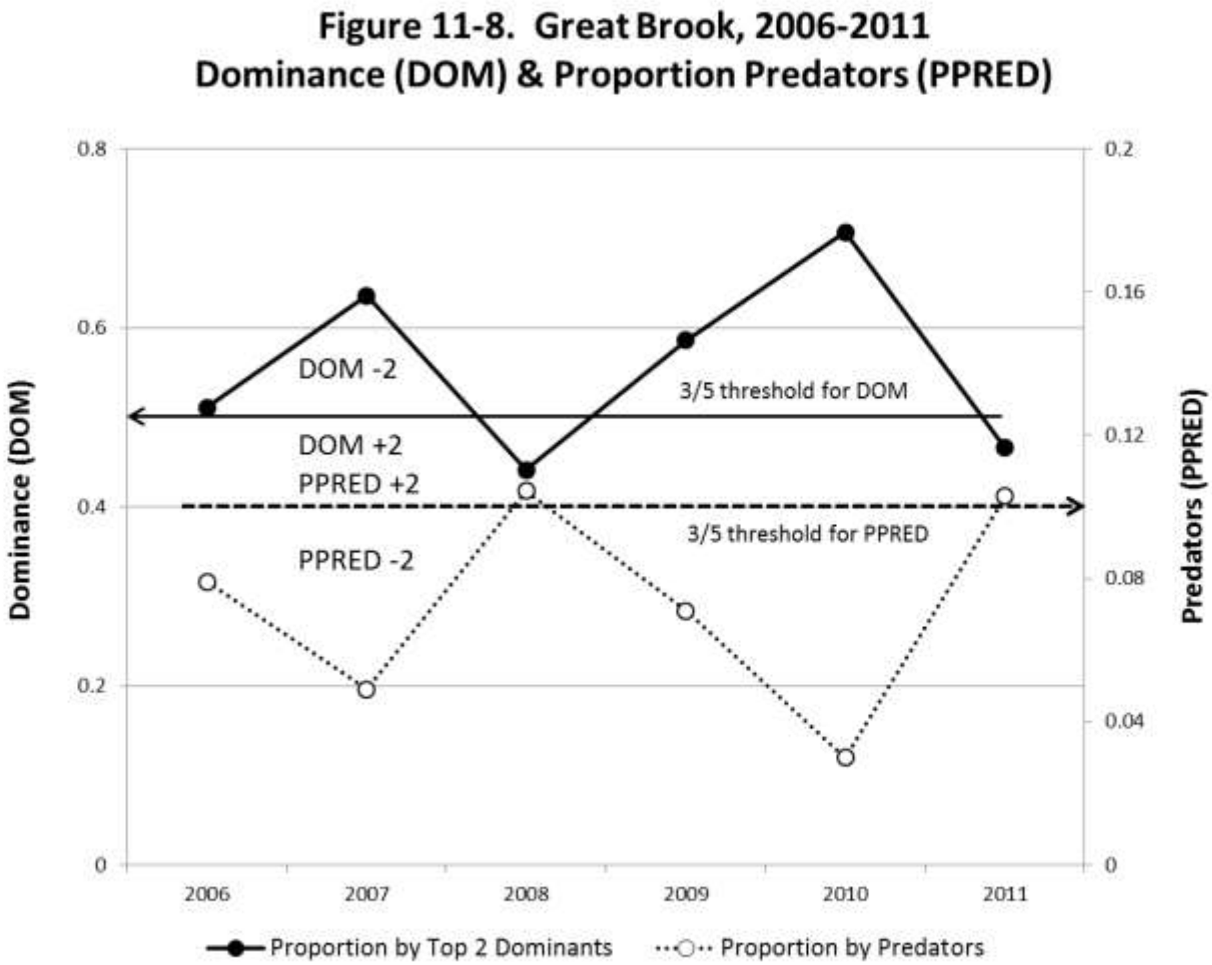
Increased presence of a comparatively abundant predator (a potential 2-point contributor to B-IBI via PPRED) is associated with a reduced number of its prey - an important dominant species (a second potential 2-point contributor to B-IBI via DOM). Figure 11-8 diagrams the relationship of these 2 B-IBI components in the 2006-2011 period. Threshold values for each component are indicated by arrows. Depending on where these two linked species are in their just-out-of-phase cycles in a given year, the total B-IBI number can raise or fall by 4 points from this relationship alone.

Figure 11-7. Great Brook, 2006-2011
***Cardiocladius* and Proportion by Predators (PPRED) - mean values**



As an example, years high in *Cardiocladius* population (but low in blackfly larvae) across the watershed, in Figure 11-9, correspond to high mean B-IBI scores at Great Brook sites, ($r = 0.8287$, $p<0.05$). We do not claim to understand the environmental conditions that control the abundance of blackfly larvae or the degree to which *Cardiocladius* impacts blackfly populations. However, it appears that much of the variability in Great Brook B-IBI scores may be explained by the doubled impact (i.e., 4-points) created by predator/prey fluctuations involving *Cardiocladius* and its prey, Simuliidae larvae.

The primary contributor to an increase in predators (PRED) at GB5 in 2011 was the presence of 46 *Dugesia* (flatworms) – seen in this stream for the first time since sampling shifted from June into late May. The impoverished site, LB3, below the Fanok Road sewage treatment



facility, improved in dominance (DOM) by including no hydropsychid caddisflies in 2011, as compared to 128 individuals in 2010. Fewer hydropsychids helped improve the dominance component at PR1 as well, while the addition of just seven *Cardiocladius* individuals was enough to improve its PPRED component. Remaining components of change in 2011 appear to be relatively minor, borderline shifts in the presence or absence of various groups.

Finally, observing changes in B-IBI values for each site since 2000 (see Fig. 11-10a-g) helps to view this year's results in another perspective – as part of trend patterns. Nearly all sites display a degree of oscillation as B-IBI components reflect observed changes in community composition over this period. The trend in nearly all cases is to hold steady or gently improve. This year, only the PB2 site, discussed in detail above, declines in noteworthy fashion. Another general pattern visible in these figures is that in all but Great Brook sites, the degree of variability in B-IBI score appears to have reduced – especially since 2006 when sampling shifted to a slightly earlier date each year.

For a final summary view, in Figure 11-11, we plot average values for all the sites in each stream. Trend lines highlight the improving progression for Great Swamp stream communities.

Figure 11-9. Great Brook, 2000-2011
Great Brook B-IBI vs *Cardiocladius obscurus*

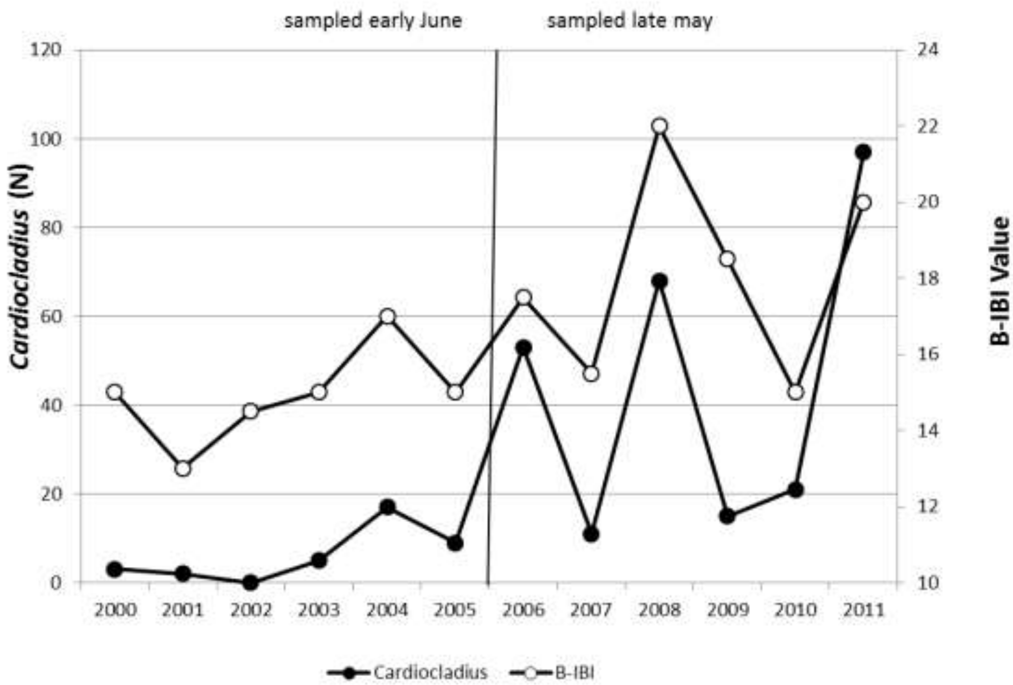


Figure 11-9. Great Brook, 2000-2011
Great Brook B-IBI vs *Cardiocladius obscurus*

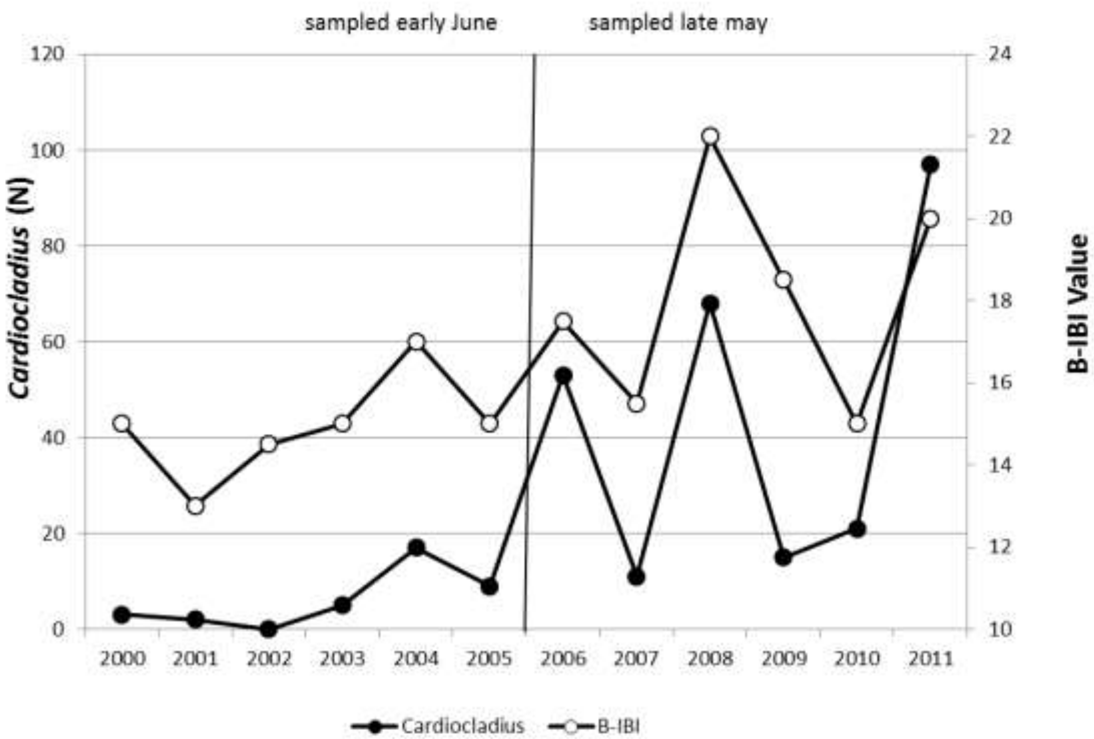


Fig. 011-10a. Black Brook
B-IBI Score, 2000-2011

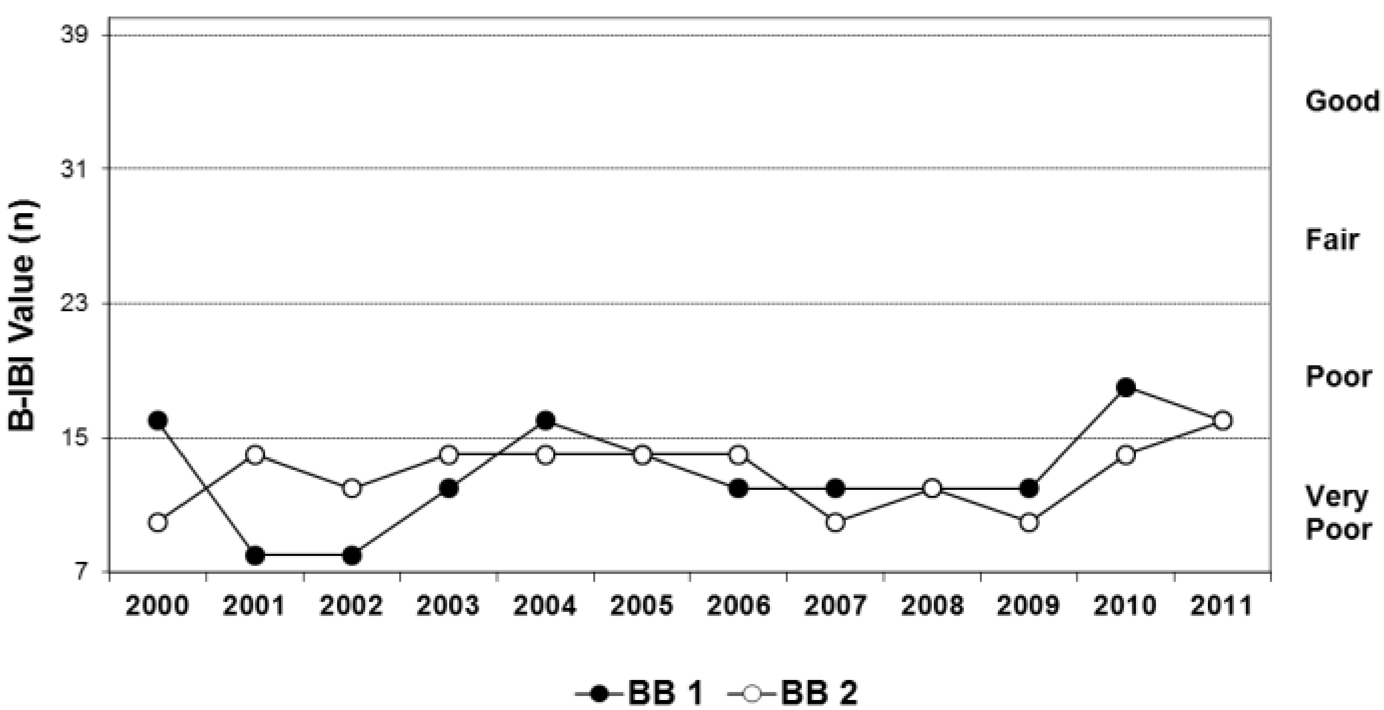


Fig. 11-10b. Loantaka Brook B-IBI Score, 2000-2011

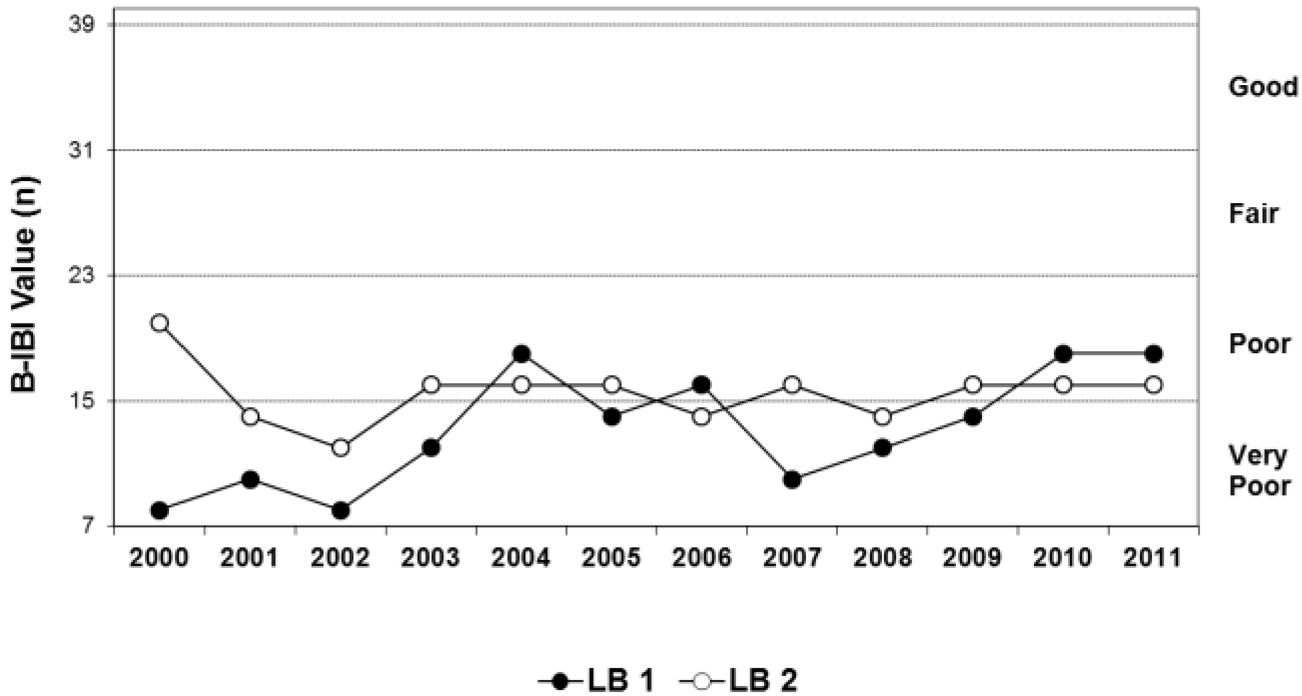


Fig. 011-10c. Loantaka Brook B-IBI Score, 2000-2011

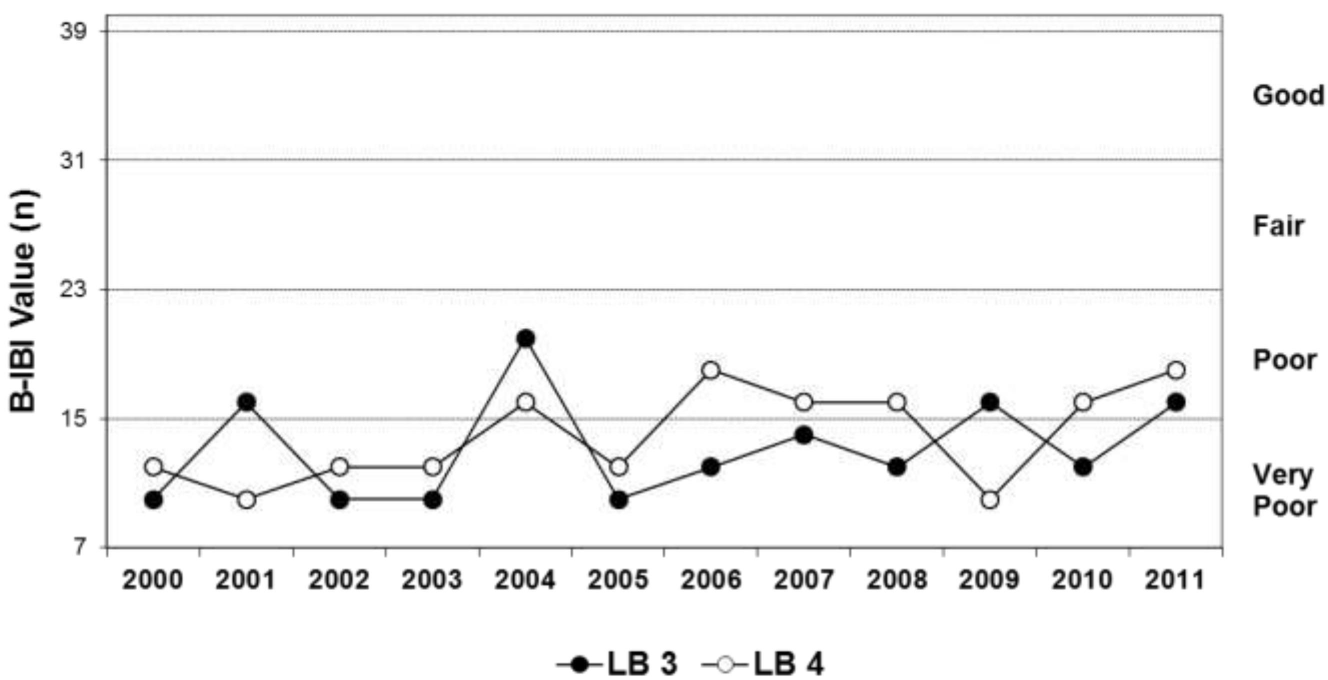


Fig. 11-10d. Great Brook B-IBI Score, 2000-2011

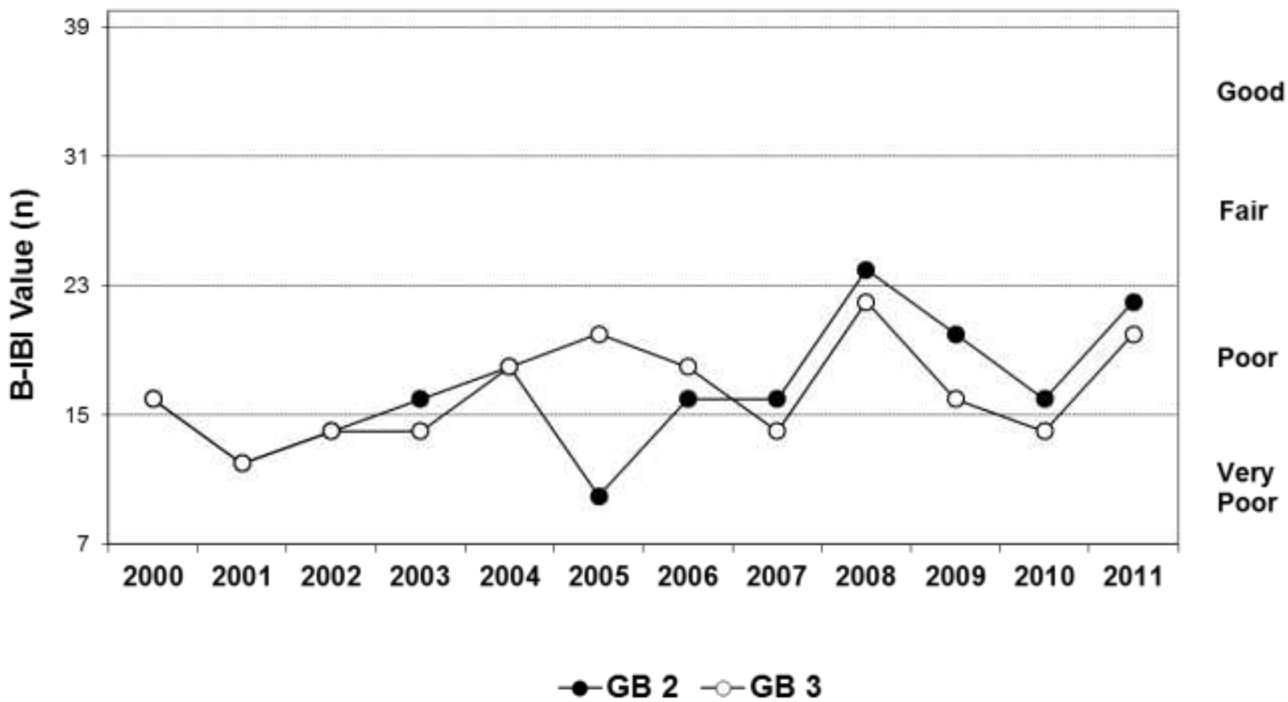


Fig. 11-10e. Great Brook B-IBI Score, 2000-2011

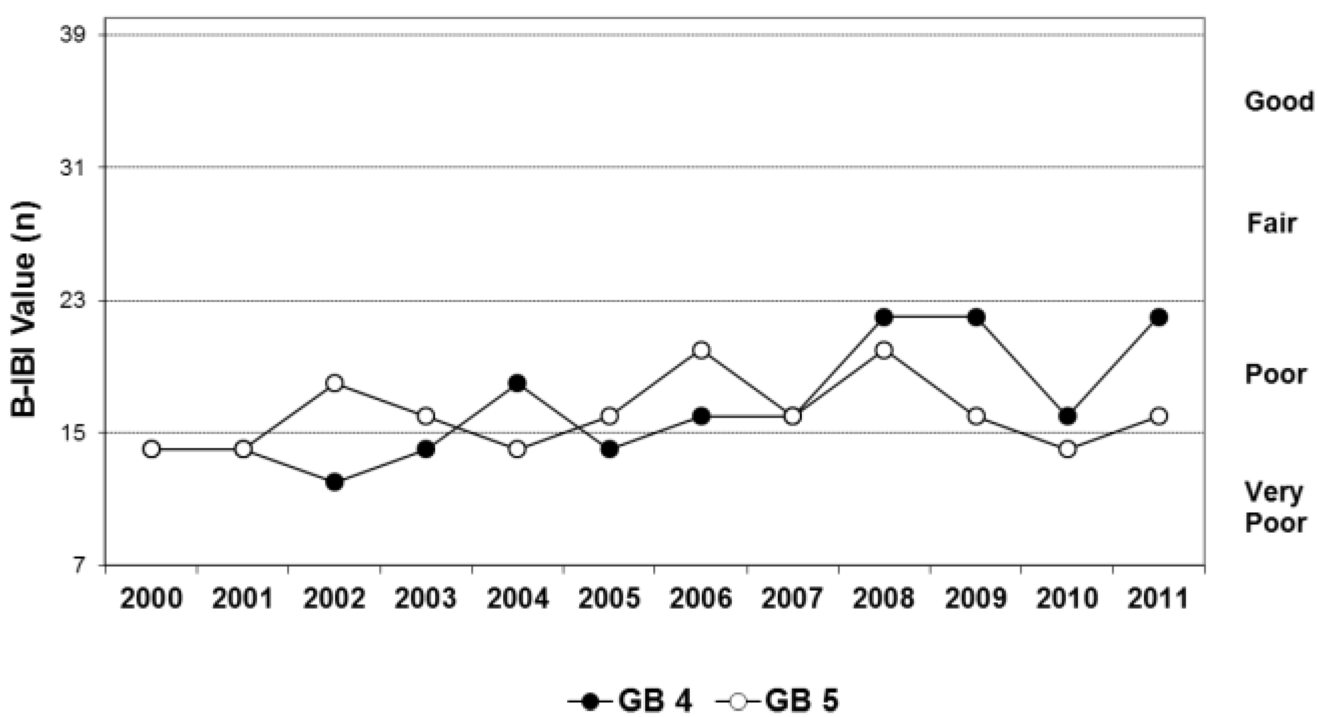


Fig. 11-10f. Primrose Brook B-IBI Score, 2000-2011

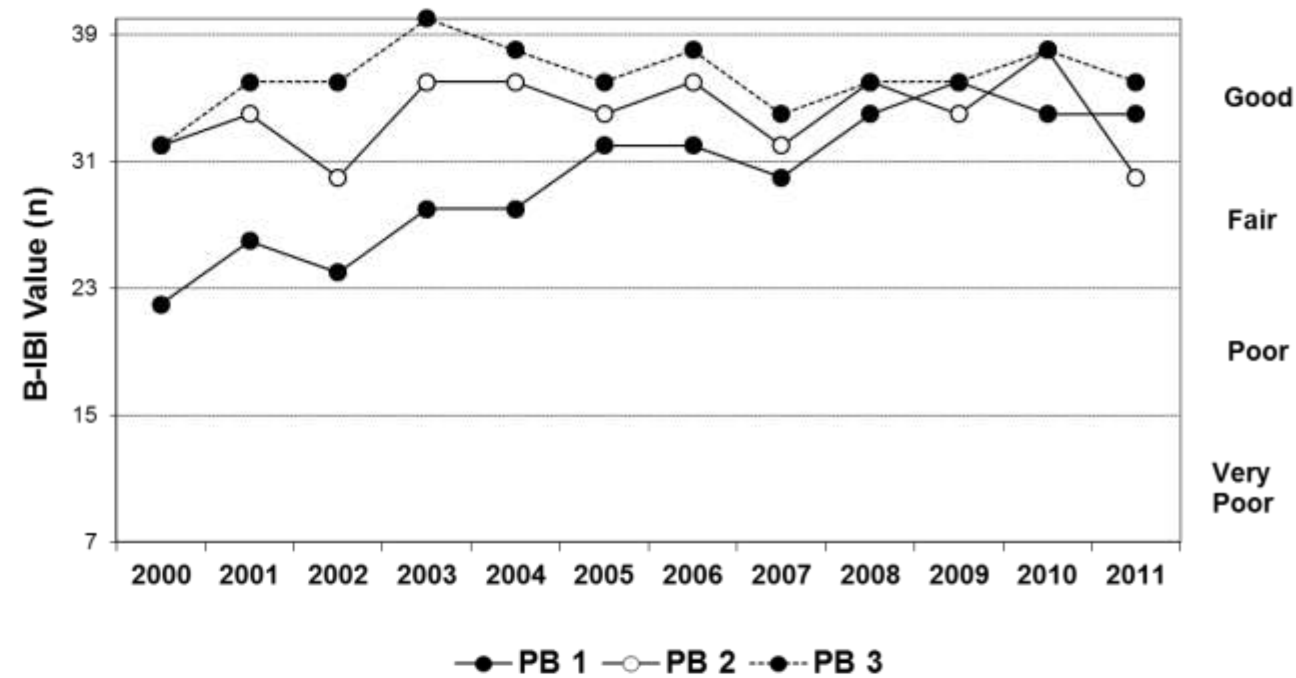
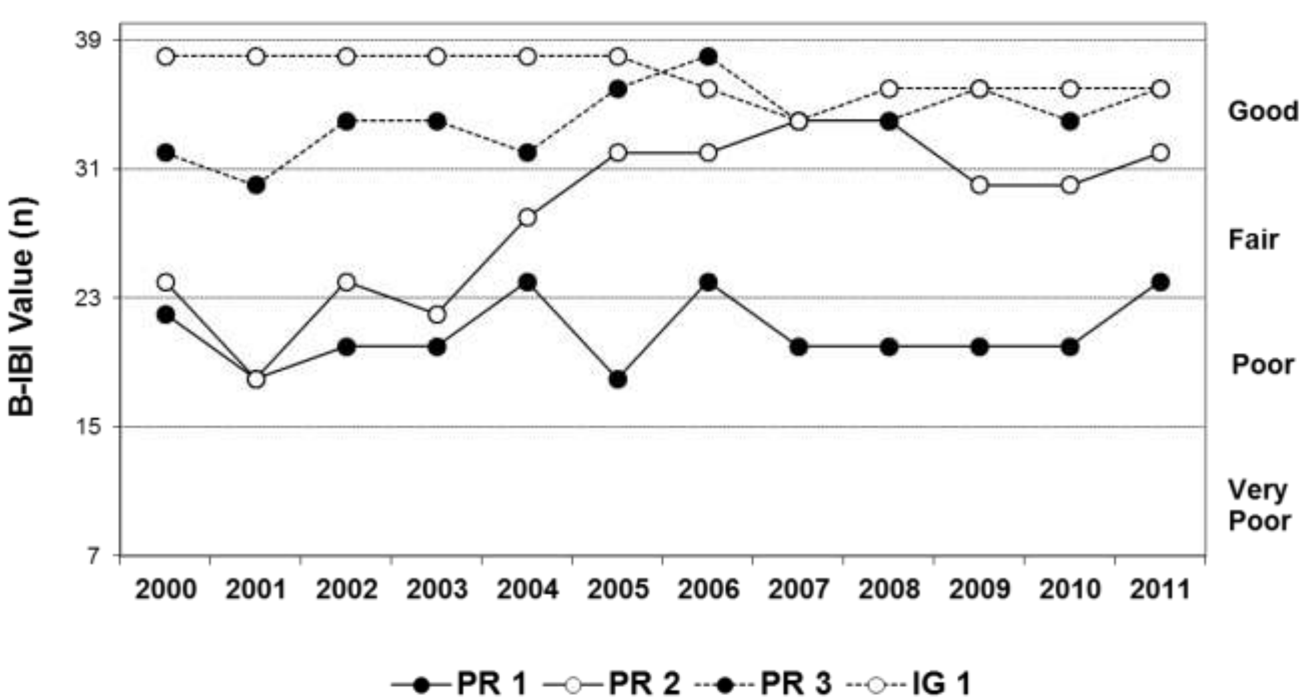
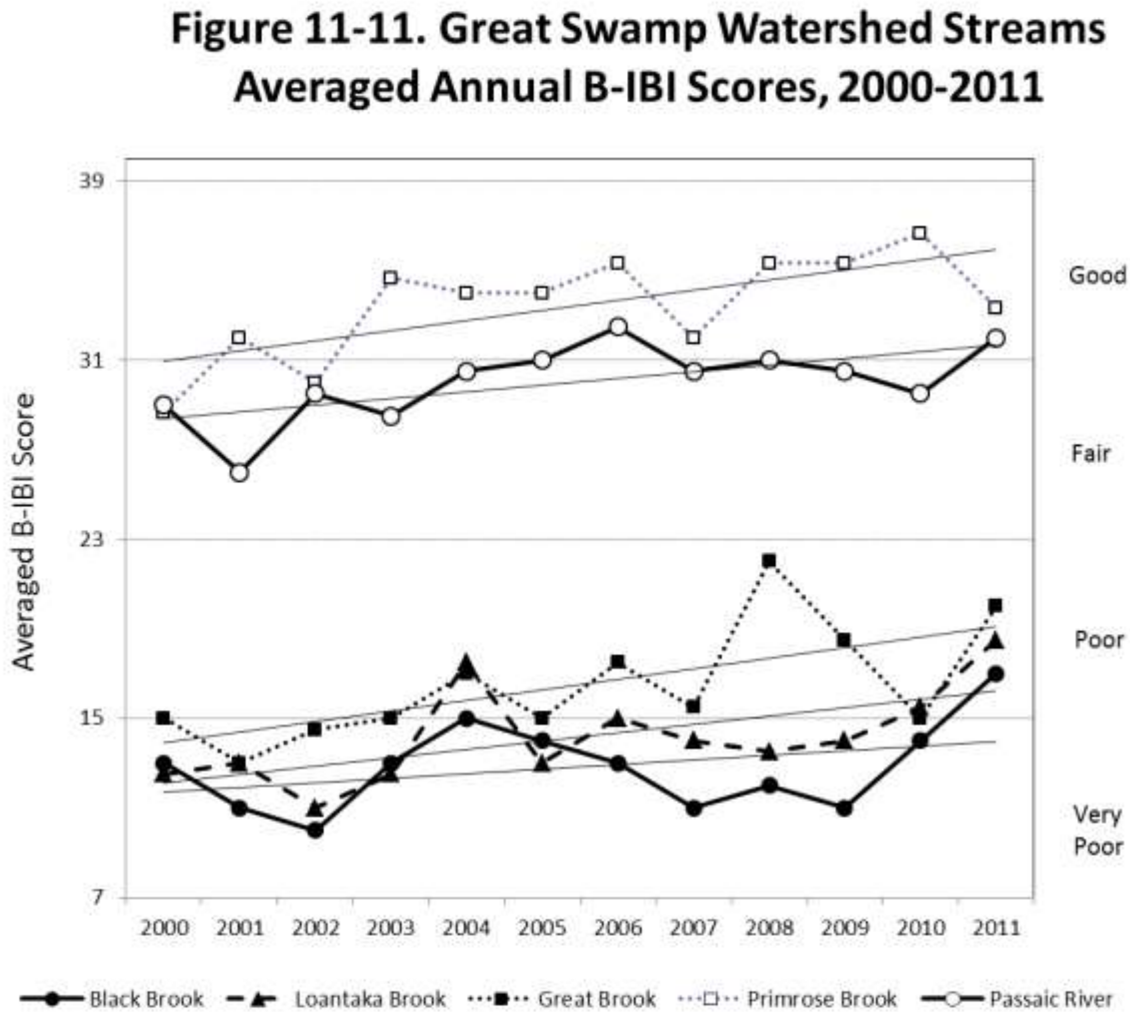


Fig. 11-10g. Passaic River B-IBI Score, 2000-2011





Stream Summaries

See Appendix 11-2 for Stream Summaries and suggestions for further action.

The June 2011 Great Swamp Watershed Study: Recommendations

1. With 20 years of unbroken annual data on Great Swamp Watershed streams, continuing to monitor these 17 sampling sites carries significant regional value.
2. A series of stream-site specific recommendations have been made below in the Stream Summaries section of this report (Appendix 11-2).

3. We have highlighted issues to be alert to in 2012 sampling. They include:
   -- Building TDS levels at GB5, BB2, and LB4.
   -- Locating the source of turbidity between PR3 and PR2.
   -- Keeping an eye on the decline in B-IBI score at PB2 – is it a consequence of minor changes in threshold community members or does it signify something more important?
   -- Continuing concern regarding poor environmental conditions at GB5.
   -- Detecting the possible influence of a year with heavy participation (2011), followed by several months of very low precipitation (2012).
   --Exploring the impact of simulid/Cardiocladius predator/prey relations on B-IBI scores for Great Brook.

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Table 11-1. Great Swamp Watershed, May 27,2011. Habitat Assessment

* Average, 2000-2008 ** Determined once

	Beck	B-IBI	width*	X depth*	X velocity*	discharge*	Gradient**	order**	%riffle	temp	TDS	DO	pH	Turbidity	
BB1	5	16	8.4	0.45	0.18	0.294	0.000	1	30	21.2	381.7	5.43	7.04	9.99	BB1
BB2	10	16	13.2	0.51	0.43	1.927	0.000	1	0	16.8	592	8.8	6.87	4.42	BB2
LB1	26	18	19.7	0.54	0.62	6.258	0.002	3	20	19.2	517	7.73	7.22	4.87	LB1
LB2	13	16	14.1	0.47	0.79	4.438	0.002	2	10	20.0	680	7.67	7.31	3.21	LB2
LB3	15	20	9.5	0.43	1.17	3.318	0.000	2	2	17.5	756	7.4	7.30	1.19	LB3
LB4	5	20	6.3	0.27	0.25	0.306	0.000	1	2	18.0	906	8.13	7.44	5.01	LB4
GB2	23	22	27.1	0.31	0.90	6.613	0.002	2	15	18.4	246.1	8.43	7.32	5.79	GB2
GB3	13	20	27.0	0.71	0.90	13.311	0.002	2	30	19.0	254.8	8.6	7.40	8.13	GB3
GB4	20	22	10.1	0.45	0.58	2.102	0.000	1	5	19.7	304	6.94	7.57	4.24	GB4
GB5	17	16	9.0	0.61	0.46	2.475	0.003	1	30	21.0	498	7.96	7.58	4.64	GB5
PB1	44	34	19.5	0.41	0.87	6.715	0.002	2	60	18.0	148.7	9.31	7.35	1.76	PB1
PB2	44	30	18.4	0.39	1.00	7.203	0.006	2	60	18.0	145.5	9.35	7.42	1.92	PB2
PB3	53	36	10.8	0.54	0.77	4.260	0.013	2	40	17.0	90	9.88	7.84	2.09	PB3
PR1	27	24	22.4	0.57	1.12	12.001	0.000	3	50	21.0	170.6	9.6	7.58	3.79	PR1
PR2	43	32	21.2	0.61	1.33	14.047	0.006	3	10	20.5	157	8.98	7.38	8.14	PR2
PR3	43	36	23.0	0.54	1.70	18.742	0.006	3	75	18.9	144.4	9.15	7.50	1.85	PR3
IG1	63	36	15.3	0.42	1.06	6.205	0.017	2	35	18.3	157.9	9.23	7.51	1.68	IG1
Mean	27.29	24.35	16.17	0.48	0.83	6.48	0.004	1.94	27.88	18.97	361.75	8.39	7.39	4.28	
Max	63	36	27.11	0.71	1.70	18.74	0.017	3	75	21.2	906	9.88	7.84	9.99	
Min	5	16	6.33	0.27	0.18	0.29	0.000	1	0	16.8	90	5.43	6.87	1.19	

	Beck	B-IBI	cover	embed	regim	sedim	flow	chann	riffle	bank	veget	ripar	total	HabValue2	
BB1	5	16	9	5	3	6	12	8	3	6	7	2	61	27	BB1
BB2	10	16	7	3	4	3	12	6	2	7	7	20	71	22	BB2
LB1	26	18	8	4	13	2	12	5	9	2	2	9	66	19	LB1
LB2	13	16	12	6	11	2	12	6	9	3	4	13	78	24	LB2
LB3	15	20	2	1	5	0	12	10	2	2	2	13	49	7	LB3
LB4	5	20	4	7	4	2	12	3	1	3	2	2	40	15	LB4
GB2	23	22	5	8	10	3	12	9	8	8	7	4	74	34	GB2
GB3	13	20	17	14	18	15	12	10	13	9	7	4	119	58	GB3
GB4	20	22	4	2	9	1	12	4	3	6	8	6	55	20	GB4
GB5	17	16	11	6	14	3	12	5	14	6	9	11	91	38	GB5
PB1	44	34	16	13	12	11	12	10	18	14	12	11	129	68	PB1
PB2	44	30	14	10	16	14	12	18	20	9	10	14	137	63	PB2
PB3	53	36	19	17	20	16	12	13	18	11	13	20	159	75	PB3
PR1	27	24	7	8	7	8	12	13	14	7	9	20	105	46	PR1
PR2	43	32	14	10	15	8	12	7	10	5	7	20	108	40	PR2
PR3	43	36	19	17	20	16	12	11	18	13	13	11	150	77	PR3
IG1	63	36	17	16	17	18	12	11	13	16	16	18	154	79	IG1
Mean	27.29	24.35	10.88	8.65	11.65	7.53	12.00	8.76	10.29	7.47	7.94	11.65	96.82	41.88	
Max	63	36	19	17	20	18	12	18	20	16	16	20	159	79	
Min	5	16	2	1	3	0	12	3	1	2	2	2	40	7	

Table 11-2. Great Swamp Watershed, Summary of Environmental Data 2009-2011 | stressful conditions*

	Beck			B-IBI			Temperature			TDS			
	2011	2010	2009	2011	2010	2009	2011	2010	2009	2011	2010	2009	
BB1	**5**	**9**	**7**	**16**	14	**12**	**21.2**	22.4	15.7	381.7	308	266	BB1
BB2	**10**	**5**	**5**	16	14	**10**	16.8	18.4	16	592	534	488	BB2
LB1	26	20	19	18	18	14	19.2	22.0	19.6	517	564	330	LB1
LB2	13	16	15	**16**	16	16	20.0	**23.4**	**22.2**	**680**	**658**	468	LB2
LB3	15	**7**	11	20	**12**	16	17.5	20.2	19.1	**756**	**698**	**582**	LB3
LB4	**5**	11	**2**	20	16	**10**	18.0	20.7	19	**906**	**875**	**770**	LB4
GB2	23	22	21	22	16	20	18.4	21.5	19.9	246.1	256	497	GB2
GB3	13	13	21	20	14	16	19.0	22.7	**24**	254.8	267	**533**	GB3
GB4	20	15	16	22	16	22	19.7	21.3	18	304	354	384	GB4
GB5	17	17	15	**16**	14	16	**21.0**	**24.4**	**22.4**	498	357	233	GB5
PB1	44	50	49	34	34	36	18.0	20.1	18.6	148.7	122	249	PB1
PB2	44	52	42	30	38	34	18.0	19.7	18.6	145.5	121	248	PB2
PB3	53	57	51	36	38	36	17.0	20.9	18.9	90	76	148	PB3
PR1	27	22	36	24	20	20	**21.0**	22.5	18.75	170.6	130	136	PR1
PR2	43	32	37	32	30	30	**20.5**	21.0	15.5	157	126	120	PR2
PR3	43	32	37	36	32	36	18.9	20.6	20.4	144.4	112	253	PR3
IG1	63	60	70	36	36	36	18.3	20.6	17.5	157.9	118	229	IG1
mean	27.29	25.88	26.71	24.35	22.24	22.35	18.97	21.32	19.07	361.75	333.88	349	mean
max	63	60	70	36	38	36.00	21.2	24.4	24.00	906	875	770	max
min	5	5	2	16	12	10.00	16.8	18.4	15.50	90	76	120	min

	DO			pH			Turbidity			Habitat Value			
	2011	2010	2009	2011	2010	2009	2011	2010	2009	2011	2010	2009	
BB1	**5.43**	**4.6**	7.59	7.04	6.81	7.67	**9.99**	1.81	6.95	27	40	31	BB1
BB2	8.8	8.7	**5.6**	6.87	**6.29**	7.13	4.42	2.06	1.48	22	31	26	BB2
LB1	7.73	**6.44**	7.02	7.22	7.11	7.62	4.87	4.07	6.37	19	30	**10**	LB1
LB2	7.67	7.74	6.85	7.31	7.70	7.42	3.21	4.18	3.82	24	42	41	LB2
LB3	7.4	6.66	6.7	7.30	7.34	7.01	1.19	1.57	1.93	**7**	**26**	**7**	LB3
LB4	8.13	7.5	7.29	7.44	7.54	7.45	5.01	4.37	5.55	**15**	18	**17**	LB4
GB2	8.43	7.13	7.58	7.32	7.29	7.68	5.79	3.78	6.20	34	40	38	GB2
GB3	8.6	8.02	6.92	7.40	7.58	8.07	**8.13**	2.87	4.09	58	78	69	GB3
GB4	6.94	7.12	**5.9**	7.57	7.64	7.41	4.24	2.77	3.73	20	**21**	20	GB4
GB5	7.96	6.95	7.07	7.58	7.65	7.3	4.64	**8.72**	5.12	38	42	37	GB5
PB1	9.31	8.78	8.67	7.35	7.79	7.69	1.76	1.97	5.38	68	63	57	PB1
PB2	9.35	9	8.55	7.42	7.78	7.7	1.92	2.07	7.17	63	65	67	PB2
PB3	9.88	9.25	8.67	7.84	8.01	7.73	2.09	2.47	2.79	75	65	71	PB3
PR1	9.6	9.73	10.27	7.58	7.95	6.89	3.79	3.57	**8.70**	46	52	49	PR1
PR2	8.98	9.14	9.87	7.38	7.78	6.81	**8.14**	2.52	**8.77**	40	34	42	PR2
PR3	9.15	9.35	8.55	7.50	7.81	7.68	1.85	1.03	3.53	77	84	81	PR3
IG1	9.23	9.3	9	7.51	7.68	7.66	1.68	1.01	1.26	79	84	82	IG1
mean	8.39	7.97	7.77	7.39	7.51	7.47	4.28	2.99	4.87	41.88	48.47	43.82	mean
max	9.88	9.73	10.27	7.84	8.01	8.07	9.99	8.72	8.77	79	84	82.00	max
min	5.43	4.6	5.6	6.87	6.29	6.81	1.19	1.01	1.26	7	21	7.00	min

*> 1 STD above or below the mean

Table 11-3. Great Swamp Streams - Beck Index, June 1992 - June 2011

	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007*	2008*	2009*	2010*	2011*
Black Brook												
BB1-off Southern Blvd	4	2	4	4	4	5	3	4	5	4	8	3
BB2-North of Long Hill	3	8	7	3	6	3	7	4	5	0	4	6
Loantaka Brook												
LB1-Below Green Village Rd	5	7	6	10	11	11	12	7	7	4	8	15
LB2-Below Kitchell Rd	12	7	1	11	8	10	11	10	8	6	6	7
LB3-Below STP&SH Stables	3	5	3	3	6	5	4	6	3	6	2	8
LB4-Above STP&SH Stables	2	2	2	1	3	6	4	2	6	0	6	3
Great Brook												
GB2-Above Woodland Rd	14	9	10	11	13	7	15	9	18	10	6	13
GB3-Below Silver Lake	14	8	11	12	11	13	9	8	13	6	4	7
GB4-Off James St, Below I-287	8	9	7	12	10	8	10	11	9	12	6	11
GB5-Below Footes Pond	12	7	10	8	10	11	10	14	11	6	4	10
Primrose Brook												
PB1-Below Lee's Hill Rd	15	20	16	21	23	22	25	24	27	26	24	25
PB2-Below Mt Kemble Lake	22	31	24	25	30	22	29	26	33	24	28	25
PB3-Below Tempe Wick Rd	25	22	26	29	32	36	34	31	27	26	28	30
Passaic River												
PR1-Below Osborn Pond	11	16	10	15	18	14	18	16	16	10	10	15
PR2-Below I-287	18	16	17	22	20	24	30	24	28	20	20	24
PR3-Below confl w/ Indian Grave Bk	23	26	17	22	20	24	30	24	28	26	24	24
Indian Grave Brook												
IG1-Above confl w/ Passaic R	nd	30	31	34	34	33	30	26	32	26	26	35

*Beck Index Value for 2000 and after estimated from average "equivalency" factor calculated from June, 1999 LWP/NRCS parallel collections (i.e., x = 0.56 y)

Water Quality	Index Value
grossly polluted	0
moderately polluted	1-5
Clean, but poor habitat	6-9
Clean	>9

Source: NRCS Report

Table 11-4. Comparison between B-IBI components, 2010 and 2011

declined — declined
improved — improved

	BB1		BB2		LB1		LB2		LB3		LB4	
Data	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010
DOM	0.64	0.423077	0.422111	0.542289	0.55814	0.583333	0.386719	0.62439	0.616505	0.76555	0.433498	0.366197
TAXA	14	15	15	7	24	20	18	15	15	10	12	18
P Pred	0.336735	0.151899	0.011538	0.035088	0.011538	0.035088	0.080645	0.014706	0.039604	0.047847	0.059091	0.081731
IndIntol	0	1	1	0	1	0	0	1	0	1	0	0
#Eph	0	0	0	0	3	0	0	0	0	0	0	0
#Trich	1	1	1	0	1	2	1	2	0	1	1	1
#Plec	0	0	0	0	0	0	0	0	0	0	0	0
IndTol	7	6	3	4	4	4	7	3	3	4	2	6
B-IBI Scores	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010		2010
DOM	3	5	5	3	3	3	5	3	3	1	5	5
TAXA	3	3	3	1	5	3	3	3	3	1	3	3
P Pred	5	5	1	3	1	3	3	1	3	3	3	3
IndIntol	1	1	1	1	1	1	1	1	1	1	1	1
#Eph	1	1	1	1	3	1	1	1	1	1	1	1
#Trich	1	1	1	1	1	3	1	3	1	1	1	1
#Plec	1	1	1	1	1	1	1	1	1	1	1	1
IndTol	1	1	3	3	3	3	1	3	3	3	3	1
B-IBI Total	16	18	16	14	18	18	16	16	16	12	18	16

	GB2		GB3		GB4		GB5		PB1		PB2	
Data	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010
DOM	0.417778	0.531401	0.46798	0.671429	0.397059	0.741445	0.579832	0.884444	0.295775	0.30038	0.548872	0.432099
TAXA	20	18	15	18	26	21	20	13	34	32	30	34
P Pred	0.035714	0.029126	0.167488	0.05314	0.108911	0.007722	0.100478	0.048689	0.100478	0.048689	0.086466	0.102881
IndIntol	1	1	0	1	2	2	0	0	7	5	9	11
#Eph	2	1	1	0	0	0	1	1	5	5	5	6
#Trich	2	2	2	1	0	1	1	1	6	7	7	6
#Plec	0	1	0	0	0	0	0	0	4	6	4	6
IndTol	3	5	6	8	5	7	6	2	3	4	2	3
B-IBI Scores	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010
DOM	5	3	5	3	5	3	3	1	5	5	3	5
TAXA	3	3	3	3	5	5	3	3	5	5	5	5
P Pred	3	3	5	3	5	1	5	3	5	3	3	5
IndIntol	1	1	1	1	3	3	1	1	5	5	5	5
#Eph	3	1	1	1	1	1	1	1	3	3	3	5
#Trich	3	3	3	1	1	1	1	1	5	5	5	5
#Plec	1	1	1	1	1	1	1	1	3	5	3	5
IndTol	3	1	1	1	1	1	1	3	3	3	3	3
B-IBI Total	22	16	20	14	22	16	16	14	34	34	30	38

	PB3		PR1		PR2		PR3		IG1	
Data	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010
DOM	0.385	0.387234	0.461187	0.700422	0.244541	0.435644	0.429864	0.512195	0.316456	0.301325
TAXA	36	39	19	19	30	23	38	30	39	38
P Pred	0.075	0.154472	0.03653	0.004274	0.085586	0.015789	0.134259	0.104418	0.090476	0.126984
IndIntol	9	8	2	2	6	7	10	4	8	8
#Eph	6	7	2	3	7	6	8	6	6	5
#Trich	6	7	3	3	7	5	7	6	9	8
#Plec	8	7	1	0	1	1	4	2	6	9
IndTol	3	4	4	4	4	1	3	3	3	2
B-IBI Scores	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010
DOM	5	5	5	3	5	5	5	3	5	5
TAXA	5	5	3	3	5	5	5	5	5	5
P Pred	3	5	3	1	3	1	5	5	3	5
IndIntol	5	5	3	3	5	5	5	5	5	5
#Eph	5	5	3	3	5	5	5	5	5	3
#Trich	5	5	3	3	5	3	5	5	5	5
#Plec	5	5	1	1	1	1	3	3	5	5
IndTol	3	3	3	3	3	5	3	3	3	3
B-IBI Total	36	38	24	20	32	30	36	34	36	36

Table 11-5. Comparison between B-IBI components at sites of significant change, 2011 vs 2010

declined

improved

	LB3		GB2		GB3		GB4		PB2		PR1	
Data	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**
DOM	0.616505	0.76555	0.417778	0.531401	0.46798	0.671429	0.397059	0.741445	0.548872	0.432099	0.461187	0.700422
TAXA	15	10	20	18	15	18	26	21	30	34	19	19
PPred	0.039604	0.047847	0.035714	0.029126	0.167488	0.05314	0.108911	0.007722	0.086466	0.102881	0.03653	0.004274
IndIntol	0	1	1	1	0	1	2	2	9	11	2	2
#Eph	0	0	2	1	1	0	0	0	5	6	2	3
#Trich	0	1	2	2	2	1	0	1	7	6	3	3
#Plec	0	0	0	1	0	0	0	0	4	6	1	0
IndTol	3	4	3	5	6	8	5	7	2	3	4	4
B-IBI Scores	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**
DOM	*3*	1	*5*	3	*5*	3	*5*	3	3	5	*5*	3
TAXA	*3*	1	3	3	3	3	5	5	5	5	3	3
PPred	3	3	3	3	*5*	3	*5*	1	3	5	*3*	1
IndIntol	1	1	1	1	1	1	3	3	5	5	3	3
#Eph	1	1	*3*	1	1	1	1	1	3	5	3	3
#Trich	1	1	3	3	*3*	1	1	1	5	5	3	3
#Plec	1	1	1	1	1	1	1	1	3	5	1	1
IndTol	3	3	*3*	1	1	1	1	1	3	3	3	3
B-IBI Total	**16**	**12**	**22**	**16**	**20**	**14**	**22**	**16**	**30**	**38**	**24**	**20**
2011 B-IBI Change	+4		+6		+6		+6		-8		+4	

Appendix 11-1. Great Swamp, 2011	BB1	BB2	LB1	LB2	LB3	LB4	GB2	GB3	GB4	GB5	PB1	PB2	PB3	PR1	PR2	PR3	IG1	total
Ann:Hirudinea:Glossiphoniidae: Helobdella stagnalis	1			3														4
Ann:Hirudinea:Glossiphoniidae: Helobdella triserialis				2														2
Ann:Hirudinea:Erpobdellidae: Erpobdella punctata	1							2										3
Ann:Hirudinea:Erpobdellidae: Mooreobdella fervida								4										4
Ann:Hirudinea:Erpobdellidae: Mooreobdella sp.	4			3					1	17								25
Ann:Oligochaeta:Enchytraidae	18	36	2	15	101	21	4	2	2	18	7	19		4	6	2		257
Ann:Oligochaeta: Naiadae									1									1
Ann:Oligochaeta:Lumbricidae	2	26	2	6	26	9	1		3	2	2	1	1			3		84
Art:Chelicerata:Arachnida:Halacharidae		2											1					3
Col:Elmidae: Neoelmis			10				2		2								1	15
Col:Elmidae, Optioservus							12				8	6	2	3				31
Col:Elmidae: Stenelmis - adult			13	6			9		3		6	4	2	12	12	1	5	73
Col:Elmidae: Stenelmis A - larva			36	38	7	4	41	8	7	4	12	4	6	45	6	1	7	226
Col:Elmidae: Oulimnius														4				4
Col:Elmidae: Promoresia			1										2				8	11
Col:Elmidae: Stenelmis			5													1		6
Col:Elmidae: Neoelmis			1		3		10							7	1		7	29
Col:Elmidae: Stenelmis B - larva			5				6										2	13
Col:Hydrophilidae: Anacaena																1		1
Col:Elmidae:Macronyches																1		1
Col:Elmidae: adult unknown		2							1									3
Col:Dytiscidae: Dytiscid larva											1							1
Col:Psephenidae: Ectopria nervosa - larva																	2	2
Col:Psephenidae: Psephenus (herricki?)							13		1		21	48	1	1	9	16	29	139
Cru:Ostracoda										1								1
Cru:Amphipoda:Gammaridae: Gammarus faciatus		27	104	45	7	42	24	42	31	4	6	4	3	39	15	2	1	396
Cru:Cladocera - water flea		22			.													22
Cru:Isopoda: Caecidotea racovitzai			8					20						3	1		1	33
Dip:Athericidae: Atherix													1					1
Dip:Chironomidae:Orthocladini: Eukiefferiella discoloripes															1			1
Dip:Chironomidae:Orthocladini: Parametriocnemus					3													3
Dip:Chironomidae:Orthocladini: Cricotopus trifasciata															3			3
Dip:Chironomidae:Orthocladini: Synorthocladius				1														1
Dip:Chironomidae:Orthocladini: Eukiefferiella claripennis						17												17
Dip:Chironomidae:Orthocladini: Eukiefferiella bavarica group												3				1		4
Dip:Chironomidae:Orthocladini: Cricotopus tremulus	2					13			5	9						1		30
Dip:Chironomidae:Orthocladini: Orthocladius type III			2															2
Dip:Chironomidae:Orthocladini: Cardiocladius obscurus?			3		3		3	22	18	5	3	4		7	18	7	4	97
Dip:Chironomidae:Orthocladini: Cricotopus bicinctus									1		2							3
Dip:Chironomidae:Chironomini: Polypedilum convictum			1	54	3	46	5	30	31	92	8	2	3	3	7	3	4	292
Dip:Chironomidae:Chironomini: Endochironomus nigricans			1															1
Dip:Chironomidae:Chironomini: Cryptochironomus		48			.					2								50
Dip:Chironomidae:Orthocladini: Cricotopus intersectus		11			.	21		4					1					37
Dip:Chironomidae:Chironomini: Chironomus decorus group			7		14													21
Dip:Chironomidae:Chironomini: Chironomus riparius					5													5
Dip:Chironomidae:Tanypodini:Thienemannimyia group	56			12			4			4	1		2					79
Dip:Chironomidae:Orthocladini: Rheocricotopus robacki						4												4
Dip:Chironomidae:Tanypodini: Tanytarsus guerlus group	26												2					28
Dip:Chironomidae:Tanypodini: Tanytarsus coffmani	1		4	13						2								20
Dip:Chironomidae:Tanypodini: Pentaneura	4				3	13												20
Dip:Chironomidae,Tanypodini: Rheotanytarsus									16		6							22
Dip:Chironomidae: pupa	8	2		8	7		3		3	1	4				8	4	6	54
Dip:Simuliidae: Simulium venustum	3		40	38	19		53	6	50	2	6		17	9	13	6	6	268
Dip:Ephydridae									1									1
Dip:Simuliidae: pupa																1		1
Dip:Tipulidae: Dicranota																	5	5
Dip:Tipulidae: Tipula C									1									1
Dip:Tipulidae: Antocha - larva											2	1				1		4
Dip:Tipulidae: Tipula A			3						5			1	1				1	11

Eph:Baetidae: Baetis			1														1	2
Eph:Baetidae: Acentrella											2				17	57	10	86
Eph:Baetidae: Acentrella C																		0
Eph:Baetidae: Acentrella A			2								20	1	1		7	3		34
Eph:Baetidae: Baetis B																		0
Eph:Baetidae: Baetis C			1				6	2		1	6	11		1	38	5	22	93
Eph:Caenidae, Caenis robusta							2											2
Eph:Ephemerellidae: Timpanoga B																1		1
Eph:Ephemerellidae: Timpanoga (Dannella) A																6		6
Eph:Ephemerellidae: Ephemerella simplex															1			1
Eph:Ephemerellidae: Ephemerella subvaria												3	12				3	18
Eph:Ephemerellidae: Timpanoga															1			1
Eph:Ephemerellidae: Serratella B											42	98	53			2	8	203
Eph:Ephemerellidae:Serratella A													2					2
Eph:Ephemerellidae: Attenella B															2			2
Eph:Heptageniidae:Heptagenia																	1	1
Eph:Heptageniidae: Stenonena A											3	14	9	4	2	7		39
Eph:Isonychiidae: Isonychia A																1		1
Eph:Leptophelbiidae: Paraleptophlebia													3					3
Collembola											1		1			1		3
Lepidoptera		2			2				1		3	1		1				10
Millipedes		3			.	4												7
Meg: Nigronia serricornis										21	2	6			1			30
Mol:Bivalvia:Sphaeriidae: Sphaerium striatinum?			5	1	3			4	14						1			28
Mol:Gastropoda:Pulmonata:Physidae: Physella gyrina	2	14		1	.				2	1								20
Mol:Gastropoda:Pulmonata:Pleuroceridae: Goniobasis livescens									2									2
Mol:Gastropoda:Prosobranchia:Ancylidae: Ferrissia rivularis																2		2
Mol:Gastropoda:Prosobranchia:Limacidae: Amnicola limosa									1									1
Mol:Gastropoda:Pulmonata:Planorbidae: Gyraulus parvus				1						1								2
Mol:Gastropoda:Pulmonata:Planorbidae: Planorbula armigera		2			.													2
Nematomorpha																	1	1
Odo:Anisoptera:Gomphidae: Lanthus																	1	1
Odo:Anisoptera:Cordulegastridae: Cordulegaster									1									1
Odo:Zygoptera:Coenagrionidae: Amphiagrion							1	2										3
Pla:Planariidae: Dugesia										46								46
Ple:Capniidae:Allocapnia													5				1	6
Ple:Taeniopterygidae: Taeniopteryx A												1	5			1		7
Ple:Leuctridae: Leuctra											1		24	1	1		5	32
Ple:Nemouridae: Amphinemura													1				2	3
Ple:Perlidae: Isoperla													2					2
Ple:Perlidae: Acroneuria arenosa											2	1				2	3	8
Ple:Perlidae: Agnetina												3	1			2		6
Ple:Perlidae: Paragnetina											2							2
Ple:Perlidae: Acroneuria A											5	1	2			2	4	14
Ple:Pteronarcyidae: Pteronarcys													1				1	2
Tri:Brachycentridae: Micrasema											1						7	8
Tri:Glossosomatidae: Glossosoma A												2			1	5	6	14
Tri:Glossosomatidae: Agapetus											1	1	2				6	10
Tri:Hydropsychidae: Chaeumatopsyche	72	5	1	9	.		24	53		6	14	2	2	56	10	2	5	261
Tri:Hydropsychidae: Hydropsyche A							2	2		4	6	9	5	9	18	15	10	80
Tri:Hydroptilidae: Hydroptila						13									1			14
Tri:Philopotamidae: Chimarra					.									10	14	38		62
Tri:Philopotamidae: Dolophilodes											5	1	21		13		46	86
Tri:Polycentropodidae: Polycentropus																7	1	8
Tri:Psychomyiidae: Psychomyia													2					2
Tri:Uenoidae: Neophylax												7	1		1	2	3	14
Tri:Rhyacophilidae: Rhyacophila B											2	7				8	1	18
Number of Individuals	**200**	**202**	**258**	**256**	**206**	**207**	**225**	**203**	**204**	**243**	**213**	**266**	**200**	**219**	**229**	**221**	**237**	**3789**
Number of Species	**14**	**14**	**24**	**18**	**15**	**12**	**20**	**15**	**26**	**21**	**34**	**30**	**36**	**19**	**30**	**38**	**39**	**116**
B-IBI	**16**	**16**	**18**	**16**	**16**	**18**	**22**	**20**	**22**	**16**	**34**	**30**	**36**	**24**	**32**	**36**	**36**	