SWAMP
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Final Technical Report	2014

FINAL REPORT
WADEABLE STREAMS BIOASSESSMENT
REGION 8
Sites Sampled: June – July 2011

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California State University Long Beach
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Executive Summary

The Santa Ana Regional Water Quality Control Board contracted California State University Long Beach's Stream Ecology and Assessment Laboratory, through the Institute for Integrated Research in Materials Environments and Society, to conduct a six-year study (2006-2011) of the waterways within the Santa Ana River watershed. This study is designed to address the federal Environmental Protection Agency-mandated requirement (EPA requirement 305(b)) for an assessment of the integrity of surface waters in the watersheds of the Santa Ana and San Jacinto Rivers by sampling the biological (benthic macroinvertebrates), physical (in-stream habitat, surrounding riparian habitats), and chemical (water quality measurements and water samples for further laboratory analysis) attributes at each sampling location. At the conclusion of the six year period, the data collected will be used to estimate the number of wadeable stream kilometers (perinnial and ephemeral) that are in one of five categories of health (very good, good, fair, poor, and very poor). Annual reports during these six years will provide information on the quality of the individual sites sampled.

During the 2011 bioassessment sampling events, a total of 169 distinct benthic macroinvertebrate taxa were identified from the 45 sampled locations. Taxa were identified to Level II of the Standard Taxonomic Effort compiled by the Southwestern Association of Freshwater Invertebrate Taxonomists. Sample locations were divided into three categories: low-elevation (0 meters to 350 meters), mid-elevation (350 meters to 700 meters), and high-elevation (700 meters and higher). Using the Southern California Coastal Index of Biotic Integrity (SCC-IBI: Ode et al. 2005) as a measure of biotic condition, stream sites were classified (very poor, poor, fair, good, and very good). SCC-IBI scores (adjusted to a scale of 0 to 100) ranged from 1.0 to 45.8 (very poor to fair) for low-elevation sites, 0 to 34.3 (very poor to poor) for mid-elevation sites, and 22.9 to 74.4 (very poor to good) for high-elevation sites. The SCC-IBI scores were positively correlated with elevation (R-square = 0.39) (low-elevation mean score = 19.1 (SE = 3.1), mid-elevation mean score = 18.3 (SE = 5.6), and high-elevation mean score = 38.2 (SE = 2.9). IBI scores were also positively correlated with overall habitat scores ($R^2 = 0.44$) and were negatively correlated with temperature ($R^2 = 0.32$). The physical habitat condition of the sampled sites ranged from poor to optimal (0 to 15 "poor," 16 to 30 "marginal," 31 to 45 "suboptimal," and 46 to 60 "optimal"). Predominantly natural high-elevation channels had the highest values (averaging 48, SE = 1.8 and ranging from 28 to 58), followed by mid-elevation channels (averaging 40.6, SE = 5.1 and ranging from 22 to 50), and finally the low-elevation channels had the lowest values (averaging 28.7, SE = 2.7 and ranging from 14 to 49). The water quality characteristics were highly variable among sites with slightly acidic to alkaline with pH values ranging from 4.53 to 10.2, more than adequate levels of mean dissolved oxygen (5.68 to 28.47 mg/L), and highly variable specific conductance values (96 to 2603 µS/cm). Natural inland waters usually contain small amounts of dissolved mineral salts.

The data collected during the 2011 bioassessment sampling events concluded the subset of the proposed sites that were to be collected within the region over the six-year experimental period. The results obtained from 2006 to 2011 will provide information for a detailed analysis of the health of the waters within the region.

Introduction

Freshwater is an important natural resource. Understanding the health of rivers, streams, and other water resources is essential for the development of management plans that protect the nation's vital water resources. One approach that has been advocated for improving water quality is the development of biological objectives, which provide the narrative or numeric benchmarks that describe the conditions necessary to protect aquatic life beneficial uses. These bioassessment tools utilize direct measurements of biological assemblages occupying various trophic levels and can include plants, macroinvertebrates, vertebrates (fish) and periphyton (diatoms and algae), as direct methods for assessing the biological health of a waterway's ecosystem. Direct measurements of biological communities, when used in conjunction to other relevant measurements of watershed health (e.g. watershed characteristics, land-use practices, in-stream habitat and water chemistry), are effective ways to monitor long-term trends of a watershed's condition (Davis and Simon 1995). Biological assessments, which integrate the effects of water quality over time, are sensitive to many aspects of both habitat and water chemistry and provide a more familiar representation of ecological health to those who are unfamiliar with interpreting the results of chemical or toxicity tests (Gibson 1996). When integrated with physical habitat assessments and chemical test results, biological assessments describe the health of a waterway and provide an *in vivo* means of evaluating the anthropogenic effects (e.g. sediments, temperature and habitat alteration) on a waterway. As defined by the 2006 EPA Wadeable Streams Assessment (WSA) document, *"biological integrity represents the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to that of the natural habitat of the region."* Bioassessment is a proxy for determining stream water quality and habitat quality based on the types and numbers of organisms living there.

The monitoring of water quality using benthic macroinvertebrates (BMIs) is the most utilized bioassessment method when compared with similar assessments that use vertebrates or periphyton. BMIs are not only ubiquitous, but are relatively stationary and highly diverse. These traits can provide a variety of predictable responses to a number of environmental stresses (Rosenberg and Resh 1993). Depending on the length of time an individual BMI taxon resides in an aquatic environment (a few months to several years), the sensitivity to physical and chemical alterations to its environment will vary. BMIs are an excellent indicator group in assessing the health of a waterway (Resh and Jackson 1993) and function as a significant food resource for both aquatic and terrestrial organisms. In addition, herbivorous BMIs aid in the control of periphyton populations and many BMI taxa contribute to the breakdown of detritus. Furthermore, the diversity of BMI taxa also plays an important role in the overall ecology and biogeography of a region (Erman 1996).

Biological assessments are often based on multimetric techniques. These techniques use a number of biologic measurements (metrics), each representing a particular aspect of the biological community, to assign a water quality value to the location under study. Locations can then be ranked by these values and classified into qualitative categories of "very good," "good," "fair," "poor," and "very poor." This system of ranking and categorizing biological conditions is referred to as an Index of Biotic Integrity (IBI), and is currently the recommended method for the development of biocriteria by the United States Environmental Protection Agency (USEPA;

Davis and Simon 1995). This method may also be used in the development of Tiered Aquatic Life Uses (TALU). The current IBI used for southern California is the Southern Coastal California Index of Biological Integrity (SCC-IBI; Ode et al. 2005), developed by the California Department of Fish and Game's Aquatic Bioassessment Laboratory (Cal/DFG-ABL).

Water quality information for the streams in the Santa Ana and San Jacinto watersheds (Region 8) is currently based mostly on discharger data from NPDES permits, and volunteer monitoring efforts of selected streams. This information focuses on problem areas within the region or areas where permits have been issued. Consequently, there are a large number of streams in the region that lack water quality information. Due to lack of available funding to implement a fully comprehensive "multiple biological assemblage model" to assess the biotic integrity, a decision was made by the Santa Ana Regional Water Quality Control Board (SARWQCB) to initially focus on using a macroinvertebrate bioassessment tool to assess the biotic integrity of the wadeable streams (perennial and ephermeral) in Region 8 of California.

With funding provided by the Surface Water Ambient Monitoring Program (SWAMP)[1], the SARWQCB contracted California State University Long Beach (CSULB) Stream Ecology and Assessment Laboratory (SEAL), through the Institute for Integrated Research in Materials Environments and Society (IIRMES), to conduct a six-year study within Region 8 of California waterways utilizing a probabilistic sampling design. IIRMES, a multifaceted organization was designed to promote and enhance educational and research opportunities for faculty, graduate and undergraduate students, and the greater community at large by embracing and integrating all scientists who study historical and temporally changing phenomena from the solid earth to organisms, landscapes, and societies. By collaborating with interdisciplinary faculty, scientists within the organization are able to bring common research perspectives, techniques, and instrumentation to bear their research.

While IIRMES has the task of analyzing the water chemistry for sites from the probablisitic draw, E. S. Babcock & Sons Inc. is contracted by San Bernandino County Flood Control District to analyze the water chemistry for the sites that are under the Southern California Stormwater Monitoring Coalition (SMC) program. The SMC program is a regional watershed monitoring effort initiated by the Southern California Coastal Water Research Project (SCCWRP) with the purpose of standardizing in-stream monitoring for local programs and coordinating monitoring efforts to produce an estimation of the stream condition in the region.

Project Objective

The objective of the 2011 sampling event is to conclude the six-year bioassessment project described within this report in order to address the federal Environmental Protection Agency

[1] SWAMP is a program enacted by the California State Waterboard that unifies the water supply monitoring programs conducted throughout State. SWAMP was designed in response to Assembly Bill 982, which called for an evaluation and accountability of the water quality monitoring programs by the State Legislature.

(EPA) mandated requirement (EPA requirement 305(b)) for an assessment of the integrity of surface waters in Region 8 of California. Specifically, this project aims to meet this objective by collecting and subsequently analyzing macroinvertebrate data collected from random sites using the SCC-IBI. This method yields a single score of the biological integrity of a site. The SCC-IBI model provides a score based on the combination of seven biological metrics. This score can then be ranked, and compared to sites that are independently designated as high-quality "reference" sites.

The data collected using this analysis may be used to identify streams where water quality and /or habitat condition improvements are warranted. They also may be used to refine and compare several methods of analysis and interpretation of bioassessment data. Although not comprehensive by nature, the design of the ongoing project will also provide a basis to estimate the percentage of wadeable stream kilometers in the region that meet the aquatic life beneficial use. The region's Basin Plan related to beneficial use is as follows: *"Inland surface water communities and populations including vertebrate, invertebrate and plant species shall not be degraded as a result of the discharge of waste. Degradation is damage to an aquatic community or population with the result that a balanced community no longer exists. A balanced community is one that is diverse, has the ability to sustain itself through cyclic seasonal changes, includes necessary food chain species, and is not dominated by pollution tolerant species, unless that domination is caused by physical habitat limitations. A balanced community also may include historically introduced non-native species but does not include species present because best available technology has not been implemented or because site-specific objectives have been adopted or because of thermal discharges* (SARWQCB 1995)*."*

Methods

In order to comply with standard sampling protocols, initially established by the Cal/DFG-ABL during the development of the SCC-IBI, benthic macroinvertebrate samples were collected between an index period between June 6 and July 26.

Sampling Site Selection

The SARWQCB worked with statistician Tony Olsen from EPA at Corvallis to design a cost effective, randomized sampling design based upon the Environmental Monitoring and Assessment Program (EMAP; USEPA 2006) criteria that could be used to representatively sub-sample the various streams in the region. Dr. Olsen provided a list of coordinates for 750 potential locations to select for sampling. Under the original sampling design, 50 sites would be randomly selected from these locations annually for a period of five years to provide a total of 250 sites that would be considered statistically representative of the 1302 linear stream kilometers covering the Santa Ana regional stream network. This sampling density provided a level of statistical precision of +/- 12% with at a spatial coverage resolution of approximately 1.6 linear kilometers. The original sampling study also did not include any stratification elements, and was designed for perennial and non-perennial streams that were 3rd and higher Strahler

stream order[2]. Given the nature of the terrain and the xeric conditions in southern California, not all sites were found to be viable for the study. Consequently, prior to collecting any environmental measurements or infauna samples, the sites from within the list were prescreened first by undertaking reconnaissance of each of the sampling locations to determine accessibility and suitability for benthic macroinvertebrate sampling. Elements that were deemed essential for an accessible site to be considered suitable for sampling were based upon criteria that led to the development of the SCC-IBI. Subsequently, two approved modifications were made to the design in the sampling study outlined above:

First, due to the constraints in the available funds for the project, the number of sampling sites was set to 45 for the 2011 sampling year. Statistical analyses show that reduction in sampling effort increased the level of imprecision regarding the representation of the sub samples by 4% (Tony Olsen, personal communication). While not desirable, this difference was not considered to unduly compromise the objectives of the study. Furthermore it was concluded that additional sampling or an extension to the duration of the study could ultimately be undertaken to restore the original level of precision in the sampling design.

Second, the initial experimental design involved dividing Region 8 into three hydrological units (Santa Ana, San Gabriel, and the San Jacinto units). Because the portion of the San Gabriel hydrological unit included in Region 8 contained only seven sites, those sites were combined with those in the Santa Ana hydrological unit. The two hydrologic units (Santa Ana and San Jacinto, with the former including the San Gabriel) were subsequently divided into three elevation strata: 0 meters to 350 meters, 350 meters to 700 meters, and 700 meters and up. Randomly generated GPS coordinates were used to determine the location of sites (evenly distributed throughout defined categories). The purpose of dividing the region into three elevation categories was to ensure that sampling occurred throughout the entire region each year. It was determined that not dividing the region into these biologically relevant strata might have resulted in analytical bias due to intensive sampling in a small subset of the region one year and no sampling in this subset the following year.

Sampling took place between June 6 and July 26 in 2011, and the samples were transported to the laboratory within 36 hours of collection for water chemistry analyses, storage and subsequent processing. Table 1 provides site-specific information.

Sampling Reach Determination

The sampling procedures used during the 2011 bioassessment survey followed the FULL level of the *Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California* (Ode 2007), which is a modification of the California Stream Bioassessment Procedures (CSBP; DFG 2003) and Environmental Monitoring and Assessment Program (EMAP) procedures. At each sample location, a 150-meter reach was established (250-meters for streams with wetted-widths greater

[2] Strahler stream order is a hierarchical method of describing where in a watershed a particular stream lies with respect to the headwater streams. For example, all headwater streams are first-order streams; when two first-order streams meet they form a second-order stream. This naming convention follows until the waterway meets an ocean or lake.

than 10 meters). Each reach was broken into 11 equidistant transects, spaced every 15 meters (25 meters for streams with widths greater than 10 meters), with each transect designated with a number representing its location along the reach (0 meters through 150/250 meters, downstream to upstream). BMI sample locations for each transect followed the reach-wide benthos procedure (RWB) for streams with gradients greater than 1% that carry particle size classes larger than sand (> 2mm particle size class); the margin-center-margin (MCM) was used for streams with gradients less than 1% that carry sand (< 2mm particle size class). This was implemented using best professional judgement whereby sites with substrates dominated by sand were sampled using the MCM method.

Table 1. Sites sampled during the 2011 index period (June 6 – July 26, 2011). Sites indicated in bold italics were part of the SMC program. All other sites were from the original probablisitic draw. "DUP" denotes where a field replicate was taken.

			Field Recorded			
SWAMP Code	Stream name	County	Latitude	Longitude	Elevation (m)	Collection date
			NAD 83			
802SWC020	Strawberry Creek	Riverside	33.76705	-116.69019	1896	12-Jul-11
801NLC105	Lytle Creek	San Bernardino	34.25153	-117.49409	982	14-Jul-11
802SJR116	Temescal Wash	Riverside	33.66458	-117.27673	402	25-Jul-11
801RB8197	Chino Creek	San Bernardino	33.9827	-117.69921	179	11-Jul-11
801RB8254	Deer Creek (DUP)	San Bernardino	34.17388	-116.98386	1366	19-Jul-11
801RB8312	Santa Ana River	Riverside	33.95507	-117.5329	183	6-Jul-11
801RB8339	Temescal Wash	Riverside	33.76385	-117.46571	304	25-Jul-11
801RB8404	Day Creek	San Bernardino	34.05885	-117.54179	298	15-Jun-11
801RB8418	San Diego Creek	Orange	33.68088	-117.80756	21	13-Jul-11
801RB8439	Temescal Wash	Riverside	33.86946	-117.53536	193	8-Jun-11
802SJC453	San Jacinto River	Riverside	33.73663	-116.8252	620	12-Jul-11
801RB8467	Temescal Wash	Riverside	33.78296	-117.47984	278	9-Jul-11
801RB8483	Cajon Wash	San Bernardino	34.25191	-117.45967	745	6-Jun-11
801RB8494	Santa Ana River	Riverside	33.96319	-117.47569	208	20-Jun-11
801RB8501	Mill Creek	San Bernardino	34.09206	-116.94312	1449	14-Jun-11
801RB8511	Herkey Creek	Orange	33.73577	-117.65975	317	9-Jun-11
801RB8512	Bear Creek (DUP)	San Bernardino	34.17054	-117.01403	1111	19-Jul-11
801RB8521	Chino Creek	San Bernardino	33.98065	-117.69542	182	6-Jul-11
801SAR528	Santa Ana River	Orange	33.87267	-117.71284	114	11-Jul-11
801RB8533	Mill Creek	San Bernardino	34.08833	-117.04308	858	7-Jul-11
801RB8549	Delhi Channel	Orange	33.66026	-117.88094	7	13-Jun-11
801RB8558	Temescal Wash	Riverside	33.8715	-117.53907	190	8-Jun-11
801RB8566	Cucamonga Creek (DUP)	San Bernardino	33.99743	-117.59924	216	15-Jun-11
801RB8575	Mill Creek	San Bernardino	34.09854	-116.99293	1146	7-Jun-11
801RB8590	Santa Ana River	San Bernardino	34.17328	-116.83667	1886	20-Jul-11
801RB8593	Delhi Channel	Orange	33.69763	-117.87672	5	13-Jun-11
801RB8594	Santa Ana River	Riverside	33.94695	-117.55388	175	20-Jun-11
801RB8607	Santa Ana River	San Bernardino	34.18322	-116.86449	1768	19-Jul-11
801RB8618	Santa Ana River	San Bernardino	34.16035	-116.80533	2006	19-Jul-11
801RB8622	Stream near Hartford Spring	Riverside	33.80933	-117.35716	574	16-Jun-11

			Field Recorded			
SWAMP Code	Stream name	County	Latitude	Longitude	Elevation (m)	Collection date
			NAD 83			
801RB8629	San Timoteo	Riverside	33.95681	-117.0647	650	14-Jul-11
845RB8633	Coyote Creek	Orange	33.87168	-118.0235	8	26-Jul-11
801S00791	***Cleghorn Creek (DUP)***	***San Bernardino***	***34.27906***	***-117.4495***	***865***	***22-Jun-11***
801S00903	***Santa Ana River***	***San Bernardino***	***34.17732***	***-116.84428***	***1841***	***6-Jul-11***
801S01367	***Devil's Canyon***	***San Bernardino***	***34.2146***	***-117.32873***	***708***	***23-Jul-11***
801S01523	***Mill Creek***	***San Bernardino***	***34.09657***	***-116.9847***	***1198***	***7-Jul-11***
801S01559	***Lytle Creek***	***San Bernardino***	***34.21004***	***-117.45605***	***711***	***21-Jun-11***
801S01655	***Mill Creek***	***San Bernardino***	***34.07793***	***-117.06413***	***750***	***6-Jul-11***
801S02123	***City Creek***	***San Bernardino***	***34.10783***	***-117.20232***	***369***	***5-Jul-11***
801S02464	***San Antonio Creek Channel***	***San Bernardino***	***34.24498***	***-117.64409***	***1397***	***22-Jun-11***
801S02749	***Stream near Sphion Gage Canal***	***Riverside***	***33.93126***	***-117.37662***	***302***	***27-Jun-11***
802S03234	***Forbes Canyon***	***Riverside***	***33.66357***	***-116.62646***	***1470***	***28-Jun-11***
802S10146	***Robert Falls***	***Riverside***	***33.70541***	***-116.73363***	***1337***	***28-Jun-11***
802S11394	***Strawberry Creek***	***Riverside***	***33.7114***	***-116.76916***	***910***	***30-Jun-11***
802S25288	***Strawberry Creek***	***Riverside***	***33.71665***	***-116.76372***	***1013***	***30-Jun-11***

Sample Collection

BMI samples were collected starting with the downstream transect and then proceeding upstream. BMI samples were collected from streams meeting RWB parameters at 25% instream of the right bank (R), 50% instream of the right bank (C) or 75% instream of the right bank (L) at each transect following a R, C, L, C, R zig-zag pattern starting with the right bank. This alternating pattern was followed along each 150-meter sampling reach until a single sample was collected from each reach (0 meters to 150 meters). Streams meeting MCM parameters were sampled at the right bank margin (RM), center (C), or left bank margin (LM) following a RM, C, LM, C, RM zig-zag pattern where flow was adequate.

The BMIs were collected using a one foot wide, 0.5-millimeter mesh D-frame kick-net. A one-foot by one-foot sampling plot, directly in front of the net, was sampled by first checking for heavy organisms such as clams and/or snails. These organisms were removed from the substrate by hand and placed into the net. Stones larger than a golf ball were carefully picked-up and rubbed in front of the net to collect all attached animals. The remaining underlying substrate was sampled by digging through the material to a depth of four inches (10-centimeters) and thoroughly manipulating the substrate in each quadrat with a consistent sampling effort (approximately one to three minutes). For streams with insufficient current to bring the suspended BMIs into the net, sites were sampled using the standard figure-eight collecting procedure. This procedure was repeated at each of the 11 transects.

The resulting 11 samples from a site were composited into 1-liter jars and preserved in the field using 95% isopropanol. Larger samples (e.g. samples that contained more than 50% sediment or 66% organic material) were split into additional jars as needed. A label containing the project, sample date, site designation, longitude and latitude, sampler's initials, and jar number was placed in each jar. A chain of custody form was completed for each sample location. As soon as the samples were returned to the lab, the isopropanol was replaced with fresh 70% ethanol.

Physical Habitat Quality Assessment and Water Quality Measurements

The physical habitat was surveyed along the entire reach of each sampling location following the Full Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California (Ode 2007). At every 15-meter interval along the 150-meter reach (25-meter intervals along a 250-meter reach), starting at transect 0-meters, physical habitat quality was determined by recording substrate complexity, consolidation, embeddedness, sediment depth, identifying human influences, and measuring canopy cover. At each transect, a depth profile was obtained at five equidistant points starting at banks edge and ending on the opposite banks edge. Additional substrate measurements and depth profiles were measured midway between main transects throughout the entire reach. Each sampling reach was scored using the General Habitat Characterization Form. The scores for the three parameters (epifaunal substrate/cover, sediment deposition and channel alteration) are obtained by selecting the most appropriate number within four categories ranging from poor (0-5), marginal (6-10), subobtimal (11-15) and optimal (16-20) as outlined on page 2 of the Full version of the SWAMP Stream Habitat Characterization Form. Stream velocity was measured using a 60% stream depth method at each transect using a Flowatch flow meter that measures velocities directly (buoyant object method was used when 60% depth method cannot be preformed due to obstructions or depth limitations).

Four water quality parameters were collected on site at each sample location using a YSI 556 environmental monitoring unit and these included pH, dissolved oxygen (mg/l), specific conductance (µS/cm), and water temperature (°C). In addition to these on site measurements, a 1000 mL water sample was collected at each site for laboratory analysis to test for other parameters used to describe the general chemical status of the streams. These measurements were performed by IIRMES and include the quantification of ammonia as nitrogen, dissolved orthophosphate as P, nitrate-nitrogen, nitrite-nitrogen, alkalinity, turbidity, and total suspended solids. Measurements done under E. S. Babcock & Sons Inc. include the quantification of all analytes mentioned for IIRMES excluding turbidity, as well as total nitrogen and phosphorus as P. Although this form of sampling only provides a snapshot of the potential water chemistry at the time of BMI collection, the water chemistry collected during BMI sampling can provide valuable insight as to potential exposure values at each site.

Taxonomic Identification of BMIs

The BMI samples were transported to and processed by CSULB-SEAL. At the laboratory, each sample was rinsed through a No. 35 standard testing sieve (0.5 mm brass mesh) and transferred into a tray marked with twenty, 25 cm^2 grids. All sample material was removed from one

randomly selected grid at a time and placed into a Petri dish for inspection under a stereomicroscope. All invertebrates from the grid were separated from the surrounding detritus and transferred to vials containing 70% ethanol. This process was continued until 600 organisms[3] were removed from each sample. The material left from the processed grids was transferred into a jar with 70% ethanol and labeled as "remnant" material. Any remaining unprocessed sample from the tray was transferred back to the original sample container with 70% ethanol and archived. BMIs were then identified to standard taxonomic levels established by the Southwestern Association of Freshwater Invertebrate Taxonomists (SAFIT) using standard taxonomic keys, typically genus level for insects and order or class for non-insects (Brown 1972, Edmunds et al. 1976, Kathman and Brinkhurst 1998, Klemm 1985, Merritt and Cummins 1995, Pennak 1989, Stewart and Stark 1993, Surdick 1985, Thorp and Covich 1991, Usinger 1963, Wiederholm 1983, 1986, Wiggins 1996, Wold 1974).

Data Analysis

A taxonomic list of all aquatic macroinvertebrates identified from the samples was entered into a Microsoft Excel® spreadsheet program. Excel® was used to generate a standalone taxonomic list, and to calculate and summarize the benthic macroinvertebrate community-based metric values.

To generate the seven biological metrics (Table 2) used to calculate the SCC-IBI, all samples were statistically subsampled to 500 BMIs. Each of the seven metrics is included in one of the following major categories:

Richness Measures – These metrics reflect the diversity of the aquatic assemblage where increasing diversity correlates with increasing health of the assemblage and suggests that niche space, habitat, and food sources are adequate to support survival and propagation of a variety of species.

Tolerance/Intolerance Measures – These metrics reflect the relative sensitivity of the community to aquatic perturbations. The taxa used are usually pollution tolerant or intolerant, but are generally nonspecific to the type of stressors. The metric values usually increase as the effects of pollution in the form of organics and sedimentation increase.

Functional Feeding Groups – These metrics provide information on the balance of feeding strategies in the aquatic assemblage. The functional feeding group composition is a surrogate for complex processes of trophic interactions, production, and food source availability. An imbalance of the functional feeding groups reflects unstable food dynamics and indicates a stressed condition.

Index of Biotic Integrity

An Index of Biotic Integrity (IBI) uses biological metrics to describe the biological condition of a watershed or ecoregion. These metrics vary by biogeographical area and are based on reference

[3] Current SWAMP protocols require a 600 count of BMI. The calculation of the SCC-IBI, however, uses a 500 count. Samples are statistically subsampled to 500 prior to calculating the SCC-IBI.

sites. These reference sites are locations within the biogeographical area thought to be relatively pristine and minimally impacted by anthropogenic activities. Many different metrics were measured, but only those that showed responsiveness to watershed-scale and reach-scale disturbance variables and lacked correlation with other responsive metrics were used (Ode et al. 2005). The IBI used to evaluate the 45 sampled sites was developed from 2000 to 2003 and was based on data from the Southern California Coastal region (Ode et al. 2005; Table 3). It should be noted that the reference sites assessed during the development of the SCC-IBI did not include sites with physical alterations (i.e., concrete-lined or modified channels), and low gradient reference sites were largely underrepresented.

Quality Assurance and Quality Control (QA/QC)

All QA/QC requirements were followed by sampling personnel (CSULB 2010) during the 2011 sampling events. An auditor from SCCWRP accompanied sampling personnel during the 2011 bioassessment to ensure that all sampling activities were completed using the approved methods. Only CSULB-SEAL personnel trained in the approved sampling methods participated in the collection of BMIs during the 2011 sampling events. All internal QA/QC procedures were followed and none of the limits described in the document were violated. Picking error also occurred in certain samples during sample processing leading to greater than 600 BMIs being picked. When this occurred, 600 BMIs were randomly subsampled from the overall data set from that specific location. Sites 801RB8594, 801RB8622, 801RB8629, 802SWC020, 801NLC105, 801RB8494, 801S01655, and 802S11394 had fewer than 450 BMIs in the benthic sample; although SCC-IBI scores were generated for these sites, scores generated using fewer than 450 BMIs have not been validated. All QA/QC documentation, including the chain of custody form for each site, is on file with the appropriate contract laboratory and CSULB-SEAL.

Table 2. Bioassessment metrics used to describe characteristics of the benthic macroinvertebrate (BMI) communities at assessed sites.

BMI Metric	Description	Response to Impairment
Richness Measures		
EPT Taxa	Number of taxa in the Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) insect orders	Decrease
Number of Coleoptera Taxa	Number of taxa from the insect order Coleoptera (beetles)	Decrease
Number of Predator Taxa	Number of taxa from the predator functional feeding group	Decrease
Tolerance/Intolerance Measures		
Percent Tolerant Taxa	Percent of taxa in sample that are highly tolerant to impairment as indicated by a tolerance value 8, 9, 10	Increase
Percent Non-insect Taxa	Percent of organisms in sample that are not in the Class Insecta	Increase
Functional Feeding Groups (FFG)		
Percent Collector-Gatherers (CG)	Percent of macrobenthos that collect or gather fine particulate matter	Increase
Percent Collector-Filterers (CF)	Percent of macrobenthos that filter fine particulate matter	Increase
Percent Collector Gathererers + Collector Filterers (CF)	Percent of macrobenthos that collect or gather fine particulate matter and/or percent of macrobenthos that filter fine particulate matter	Increase

Table 3. Southern Coastal California Benthic Macroinvertebrate Index of Biotic Integrity parameters and scoring ranges (to adjust IBI scores so that they range from 0 to 100, multiply the total IBI score by 10/7; from Ode et al. 2005).

	Metric Scoring Ranges for the Southern Coastal California B-IBI						
Metric Score	**# EPT Taxa**	**% Intolerant Individuals**	**# Predator Taxa**	**% Tolerant Taxa**	**% Non-Insect Taxa**	**% CF + CG**	**# Coleoptera Taxa**
10	> 17	25-100	> 12	0-4	0-8	0-59	> 5
9	16-17	23-24	12	5-8	9-12	60-63	
8	15	21-22	11	9-12	13-17	64-67	5
7	13-14	19-20	10	13-16	18-21	68-71	4
6	11-12	16-18	9	17-19	22-25	72-75	
5	9-10	13-15	8	20-22	26-29	76-80	3
4	7-8	10-12	7	23-25	30-34	81-84	2
3	5-6	7-9	6	26-29	35-38	85-88	
2	4	4-6	5	30-33	39-42	89-92	1
1	2-3	1-3	4	34-37	43-46	93-96	
0	0-1	0	0-3	38-100	47-100	97-100	0

Total IBI Scoring Range Adjusted Scale (0 - 100)	0-19 Very Poor	20-39 Poor	40-59 Fair	60-79 Good	80-100 Very Good

Results

BMI Community Structure

During the 2011 bioassessment sampling events, 169 distinct BMI taxa were identified from the 45 sampled locations (Appendix D).

Index of Biological Integrity – SCC-IBI scores were adjusted from a scale of 0 to 70 (seven summed metrics ranging from 0 to 10), to a scale of 0 to 100 for ease of interpretation. Adjusted SCC-IBI scores were obtained by multiplying the summed SCC-IBI score by 10 and dividing that score by 7. The adjusted SCC-IBI scores for the 2011 bioassessment sampling events ranged from 10 to 74 (Table 4, Figure 1). SCC-IBI scores were positively correlated with elevation (R^2 = 0.39, Figure 2) and overall habitat characterization scores (R^2 = 0.44, Figure 12), and negatively correlated with water temperature (R^2 = 0.32, Figure 3). SCC-IBI scores showed no correlation with dissolved oxygen (Figure 4), turbidity (Figure 5), specific conductance (Figure 6), alkalinity (Figure 7), dissolved orthophosphate (Figure 8), ammonia (Figure 9), nitrate (Figure 10), and nitrite (Figure 11).

Water Chemistry – Refer to Appendix C for water chemistry values.

Physical Habitat Quality

During the 2011 bioassessment sampling events, samples were collected from a wide array of landuse and channel types, which is presented in Table 5. Low elevation streams consisted of a mix of streams surrounded by urban/suburban landcover with concrete-lined and natural channel types; mid elevation streams were predominantly urban/suburban landcover with man-made embankments and natural stream bottoms; and high elevation streams were all surrounded by forest landcover with natural channel types (Table 5). Landuse/landcover categories follow those used on the SWAMP field data sheets. Overall habitat characterization scores for the 2011 sampling year ranged from 14 to 58 (poor to optimal; Table 5) with low elevation streams averaging 28.7 (SE = 2.7 (marginal)), mid elevation streams averaging 40.6 (SE = 5.1 (suboptimal)), and high elevation streams averaging 48 (SE = 1.8 (optimal)).

Resampling Efforts

Ten sites were chosen for sampling that had been previously sampled sometime over the six-year period. These are listed in Table 6. Figure 13 shows a scatterplot of the IBI scores of these sites from the original sampling year against the IBI score earned from 2011 sampling. The dark blue line represents perfect concordance of the pairs of IBI scores. The red lines are the best fit and 95% confidence intervals. Eight sites fall within these confidence intervals while two sites scored significantly different than their first sampling event. The IBI for 801RB8312 increased by 32 points while the IBI for 802SJR116 decreased by nine points. The slopes of the best fit and the perfect concordance lines are not significantly different from one another suggesting that IBI scores can be a stable index of biotic quality over time.

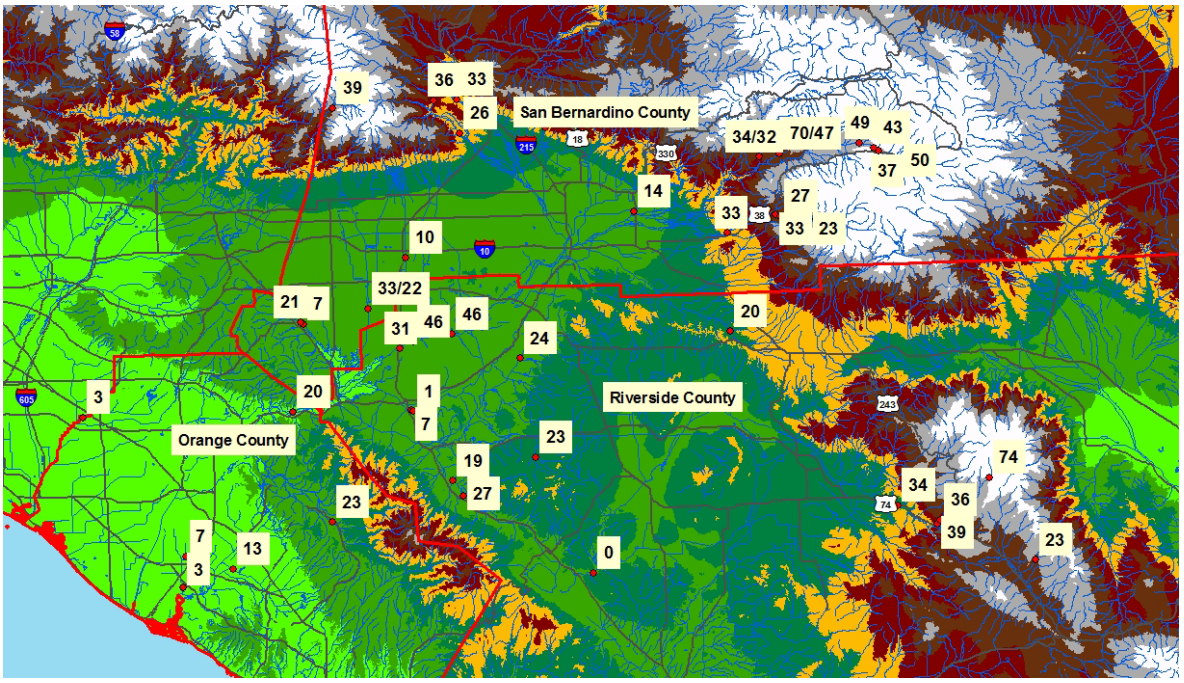


Figure 1. SCC-IBI scores for sites sampled during the 2011 bioassessment survey.

Table 4. SCC-IBI metrics and overall rating for each location sampled during the 2011 bioassessment survey. The eight sites shown in italics had fewer than 450 BMIs collected.

Site/Replicate	EPT Taxa	Predator Taxa	Coleoptera Taxa	Percent Non-Insect Taxa	Percent Intolerant Individuals	Percent Tolerant Taxa	Percent Collector Individuals	IBI	IBI (100)	IBI Rating
802SWC020 (rep 1)	7	9	4	8	8	9	7	**52**	**74**	**Good**
801NLC105 (rep 1)	1	0	0	10	4	8	2	**25**	**36**	**Poor**
802SJR116 (rep 1)	0	0	0	0	0	0	0	**0**	**0**	**Very Poor**
801RB8197(rep 1)	1	0	0	8	0	6	0	**15**	**21**	**Poor**
801RB8254 (rep 1)	7	6	5	8	10	8	5	**49**	**70**	**Good**
801RB8254 (rep 2)	4	2	0	7	7	8	5	**33**	**47**	**Fair**
801RB8312 (rep 1)	2	1	7	7	0	5	10	**32**	**46**	**Fair**
801RB8339 (rep 1)	3	1	0	4	0	6	5	**19**	**27**	**Poor**
801RB8404 (rep 1)	0	0	0	2	0	5	0	**7**	**10**	**Very Poor**
801RB8418 (rep 1)	0	3	2	2	0	0	2	**9**	**13**	**Very Poor**
801RB8439 (rep 1)	0	0	0	0	0	0	1	**1**	**1**	**Very Poor**
802SJC453 (rep 1)	0	2	8	8	1	4	1	**24**	**34**	**Poor**
801RB8467 (rep 1)	4	1	0	1	0	1	6	**13**	**19**	**Very Poor**
801RB8483 (rep 1)	0	6	4	8	0	5	0	**23**	**33**	**Poor**
801RB8494 (rep 1)	3	2	7	9	0	7	4	**32**	**46**	**Fair**
801RB8501 (rep 1)	0	0	0	8	1	7	0	**16**	**23**	**Poor**
801RB8511 (rep 1)	2	3	4	4	0	2	1	**16**	**23**	**Poor**
801RB8512 (rep 1)	3	3	4	7	0	7	0	**24**	**34**	**Poor**
801RB8512 (rep 2)	3	2	4	6	0	7	0	**22**	**31**	**Poor**
801RB8521 (rep 1)	1	0	0	2	0	2	0	**5**	**7**	**Very Poor**
801SAR528 (rep 1)	3	0	0	4	0	7	0	**14**	**20**	**Poor**
801RB8533 (rep 1)	1	0	0	8	1	9	0	**19**	**27**	**Poor**
801RB8549 (rep 1)	1	0	0	1	0	0	0	**2**	**3**	**Very Poor**
801RB8558 (rep 1)	1	0	0	1	0	2	1	**5**	**7**	**Very Poor**
801RB8566 (rep 1)	3	0	0	7	0	5	8	**23**	**33**	**Poor**
801RB8566 (rep 2)	1	0	0	4	0	5	5	**15**	**21**	**Poor**
801RB8575 (rep 1)	2	1	0	10	1	9	0	**23**	**33**	**Poor**
801RB8590 (rep 1)	5	1	0	9	2	9	0	**26**	**37**	**Poor**
801RB8593 (rep 1)	0	0	0	0	0	0	5	**5**	**7**	**Very Poor**
801RB8594 (rep 1)	3	0	2	8	0	7	2	**22**	**31**	**Poor**
801RB8607 (rep 1)	5	7	2	7	4	8	1	**34**	**49**	**Fair**
801RB8618 (rep 1)	5	5	2	5	5	7	6	**35**	**50**	**Fair**
801RB8622 (rep 1)	1	1	0	2	0	2	10	**16**	**23**	**Poor**
801RB8629 (rep 1)	1	0	2	6	0	4	1	**14**	**20**	**Poor**
845RB8633 (rep 1)	0	0	0	0	0	0	2	**2**	**3**	**Very Poor**
801S00791 (rep 1)	1	0	2	10	0	7	0	**20**	**29**	**Poor**
801S00791 (rep 2)	0	0	2	9	0	6	0	**17**	**24**	**Poor**
801S00903 (rep 1)	5	3	0	9	3	10	0	**30**	**43**	**Fair**
801S01367 (rep 1)	6	10	5	8	8	6	6	**49**	**70**	**Good**

Table 4 continued. SCC-IBI metrics and overall rating for each location sampled during the 2011 bioassessment survey. The eight sites shown in italics had fewer than 450 BMIs collected.

Site/Replicate	EPT Taxa	Predator Taxa	Coleoptera Taxa	Percent Non-Insect Taxa	Percent Intolerant Individuals	Percent Tolerant Taxa	Percent Collector Individuals	IBI	IBI (100)	IBI Rating
801S01523 (rep 1)	3	2	0	7	1	6	0	**19**	**27**	**Poor**
801S01559 (rep 1)	1	0	0	8	0	9	0	**18**	**26**	**Poor**
801S01655 (rep 1)	3	1	5	7	1	6	0	**23**	**33**	**Poor**
801S02123 (rep 1)	3	0	0	4	0	2	1	**10**	**14**	**Very Poor**
801S02464 (rep 1)	3	2	0	10	2	9	1	**27**	**39**	**Poor**
801S02749 (rep 1)	1	0	2	8	0	6	0	**17**	**24**	**Poor**
802S03234 (rep 1)	0	4	2	6	0	4	0	**16**	**23**	**Poor**
802S10146 (rep 1)	0	3	2	4	1	6	1	**17**	**24**	**Poor**
802S11394 (rep 1)	5	1	0	8	3	9	1	**27**	**39**	**Poor**
802S25288 (rep 1)	4	2	0	9	1	8	1	**25**	**36**	**Poor**

Table 5. Physical habitat characterization and overall rating for each location sampled during the 2011 bioassessment survey.

Site	Epifaunal substrate	Sediment Deposition	Channel Alteration	Dominant landuse/landcover	Overall Habitat Characterization score (0 to 60)	Overall Habitat Characterization Score Rating	IBI (100)
802SWC020	19	19	20	Forest	**58**	**Optimal**	**74**
801NLC105	6	7	15	Suburban/Town	**28**	**Marginal**	**36**
802SJR116	13	18	14	Other	**45**	**Suboptimal**	**0**
801RB8197	2	19	1	Urban/Industrial	**22**	**Marginal**	**21**
801RB8254	18	16	20	Forest	**54**	**Optimal**	**70**
801RB8312	8	8	11	Suburban/Town	**27**	**Marginal**	**46**
801RB8339	16	15	18	Forest	**49**	**Optimal**	**27**
801RB8404	1	19	0	Urban/Industrial	**20**	**Marginal**	**10**
801RB8418	6	5	7	Suburban/Town	**18**	**Marginal**	**13**
801RB8439	5	19	0	Suburban/Town	**24**	**Marginal**	**1**
802SJC453	10	10	18	Forest	**38**	**Suboptimal**	**34**
801RB8467	12	11	15	Other	**38**	**Suboptimal**	**19**
801RB8483	17	12	20	Other	**49**	**Optimal**	**33**
801RB8494	14	15	12	Suburban/Town	**41**	**Suboptimal**	**46**
801RB8501	14	12	12	Forest	**38**	**Suboptimal**	**23**
801RB8511	11	16	16	Range	**43**	**Suboptimal**	**23**
801RB8512	16	18	20	Forest	**54**	**Optimal**	**34**
801RB8521	2	20	0	Urban/Industrial	**22**	**Marginal**	**7**
801SAR528	12	12	11	Suburban/Town	**35**	**Suboptimal**	**20**
801RB8533	9	15	16	Forest	**40**	**Suboptimal**	**27**
801RB8549	6	8	0	Suburban/Town	**14**	**Poor**	**3**
801RB8558	5	19	0	Suburban/Town	**24**	**Marginal**	**7**
801RB8566	1	20	0	Range	**21**	**Marginal**	**33**
801RB8575	12	16	20	Forest	**48**	**Optimal**	**33**
801RB8590	18	19	20	Forest	**57**	**Optimal**	**37**
801RB8593	9	5	0	Suburban/Town	**14**	**Poor**	**7**
801RB8594	14	16	11	Suburban/Town	**41**	**Suboptimal**	**31**
801RB8607	19	19	20	Forest	**58**	**Optimal**	**49**
801RB8618	11	19	20	Forest	**50**	**Optimal**	**50**
801RB8622	17	12	19	Suburban/Town	**48**	**Optimal**	**23**
801RB8629	18	13	19	Suburban/Town	**50**	**Optimal**	**20**
845RB8633	0	19	0	Urban/Industrial	**19**	**Marginal**	**3**
801S00791	8	10	16	Forest	**34**	**Suboptimal**	**29**
801S00903	19	9	19	Forest	**47**	**Optimal**	**43**
801S01367	19	17	20	Forest	**56**	**Optimal**	**70**
801S01523	11	14	20	Forest	**45**	**Suboptimal**	**27**
801S01559	9	15	13	Forest	**37**	**Suboptimal**	**26**
801S01655	12	15	15	Forest	**42**	**Suboptimal**	**33**
801S02123	8	6	8	Urban/Industrial	**22**	**Marginal**	**14**
801S02464	18	15	18	Forest	**51**	**Optimal**	**39**

Table 5 continued. Physical habitat characterization and overall rating for each location sampled during the 2011 bioassessment survey.

Site	Epifaunal substrate	Sediment Deposition	Channel Alteration	Dominant landuse/landcover	Overall Habitat Characterization score (0 to 60)	Overall Habitat Characterization Score Rating	IBI (100)
801S02749	14	16	15	Suburban/Town	**45**	**Suboptimal**	**24**
802S03234	18	14	20	Forest	**52**	**Optimal**	**23**
802S10146	18	14	12	Forest	**44**	**Suboptimal**	**24**
802S11394	18	19	20	Forest	**57**	**Optimal**	**39**
802S25288	19	18	20	Forest	**57**	**Optimal**	**36**

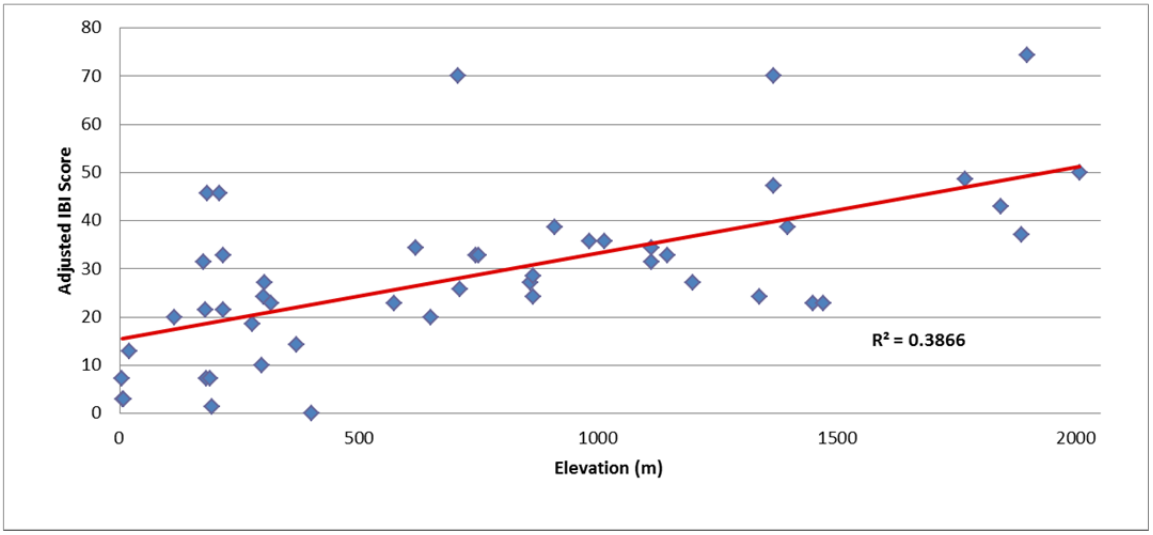


Figure 2. IBI scores as a function of elevation (IBI scores adjusted on a scale of 0 to 100) ($p < 0.0001$).

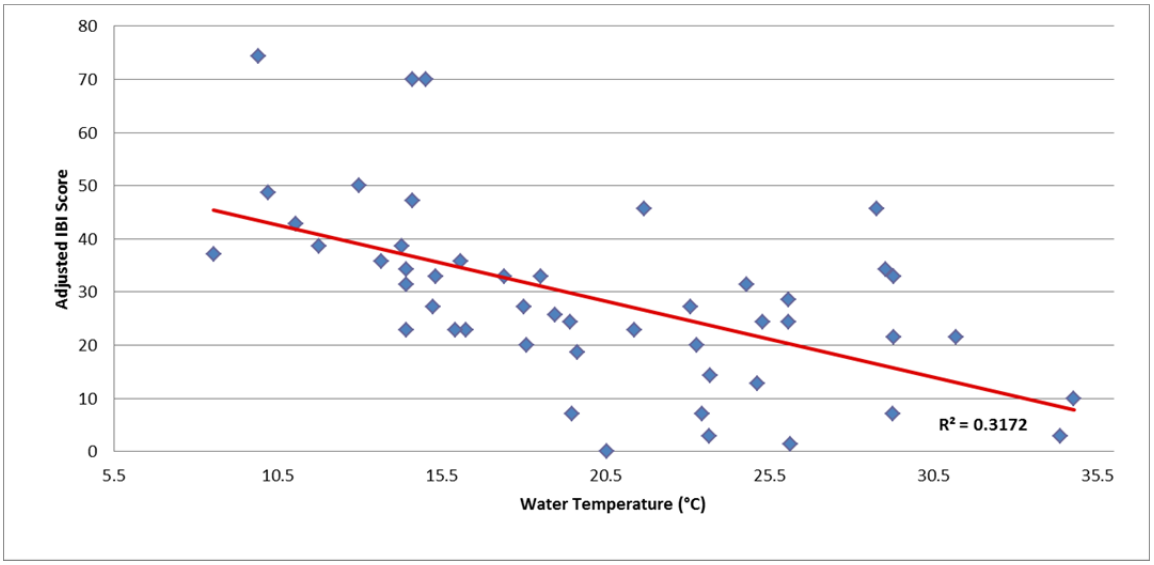


Figure 3. IBI scores as a function of water temperature (IBI scores adjusted on a scale of 0 to 100) ($p= 0.001$).

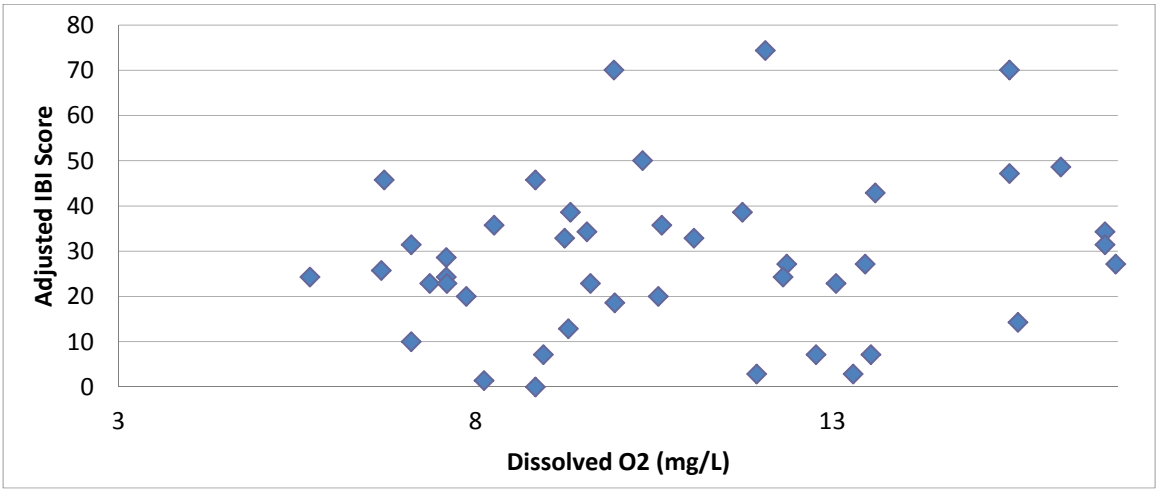


Figure 4. IBI scores as a function of dissolved oxygen (IBI scores adjusted on a scale of 0 to 100).

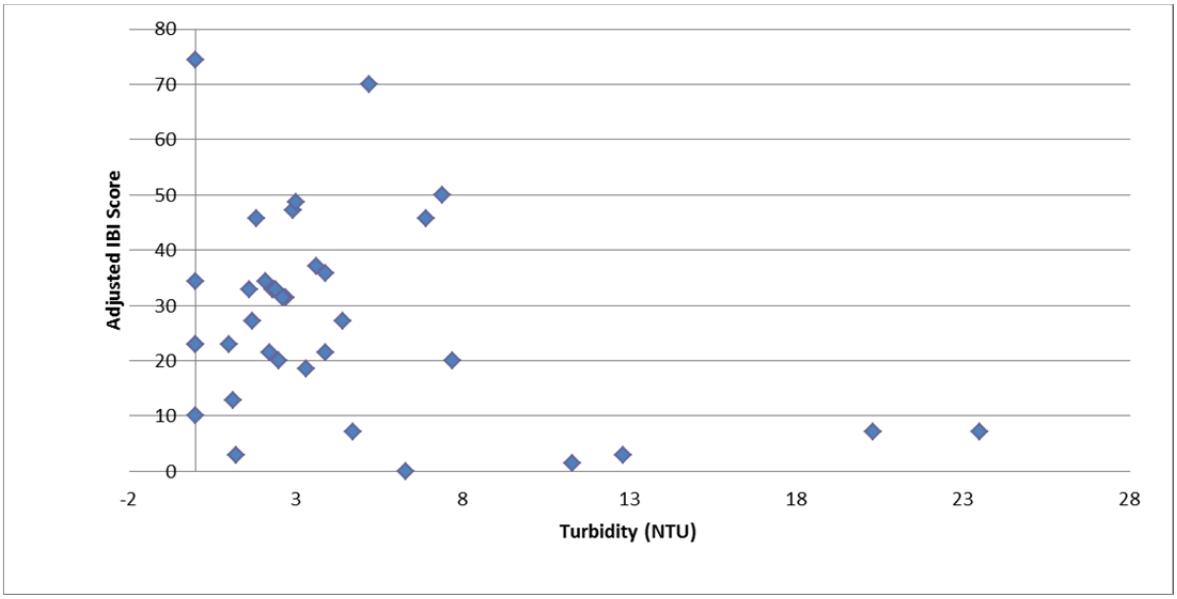


Figure 5. IBI scores as a function of turbidity (IBI scores adjusted on a scale of 0 to 100).

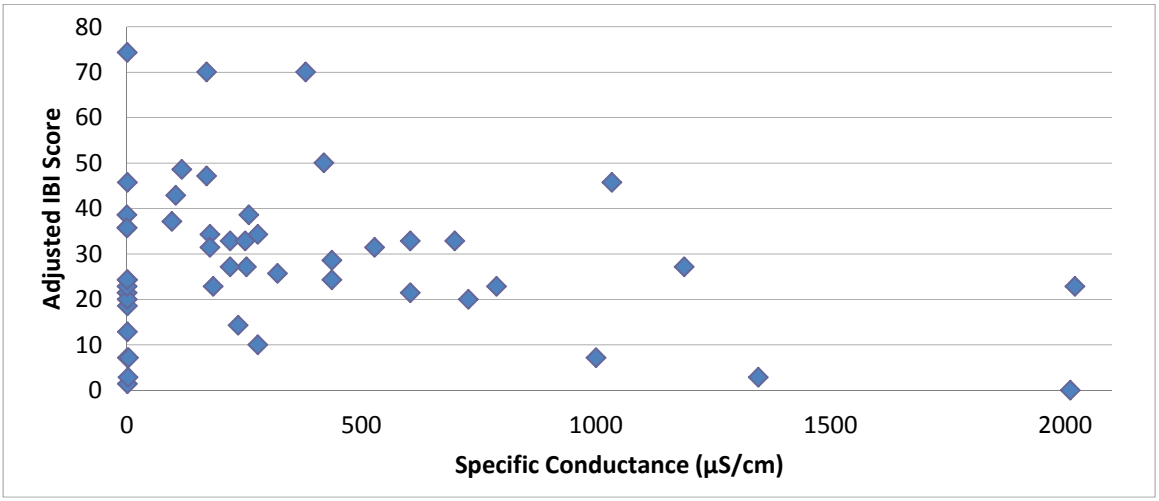


Figure 6. IBI scores as a function of specific conductance (IBI scores adjusted on a scale of 0 to 100).

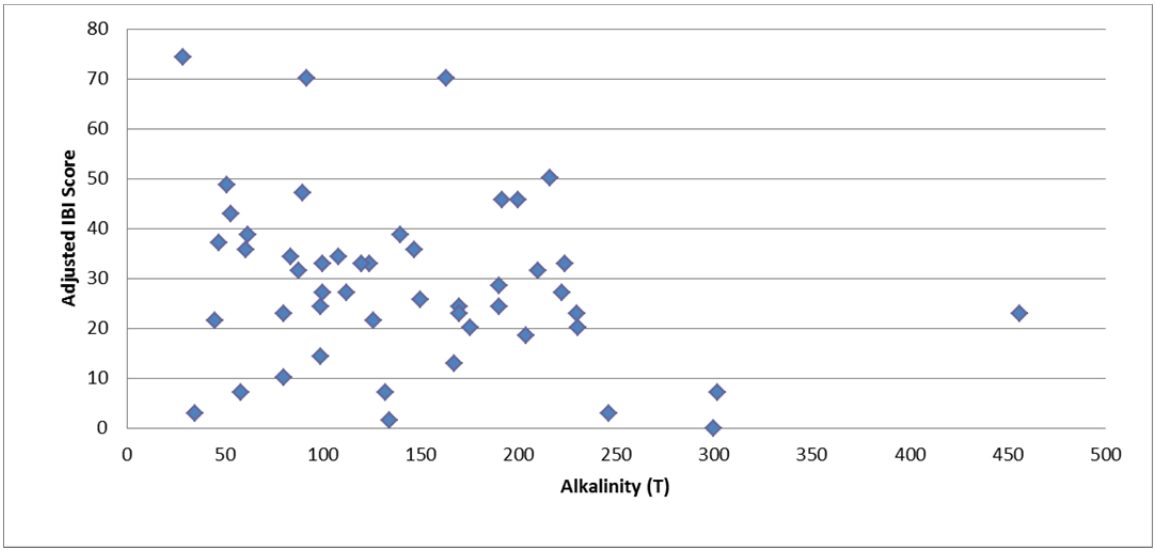


Figure 7. IBI scores as a function of alkalinity (IBI scores adjusted on a scale of 0 to 100).

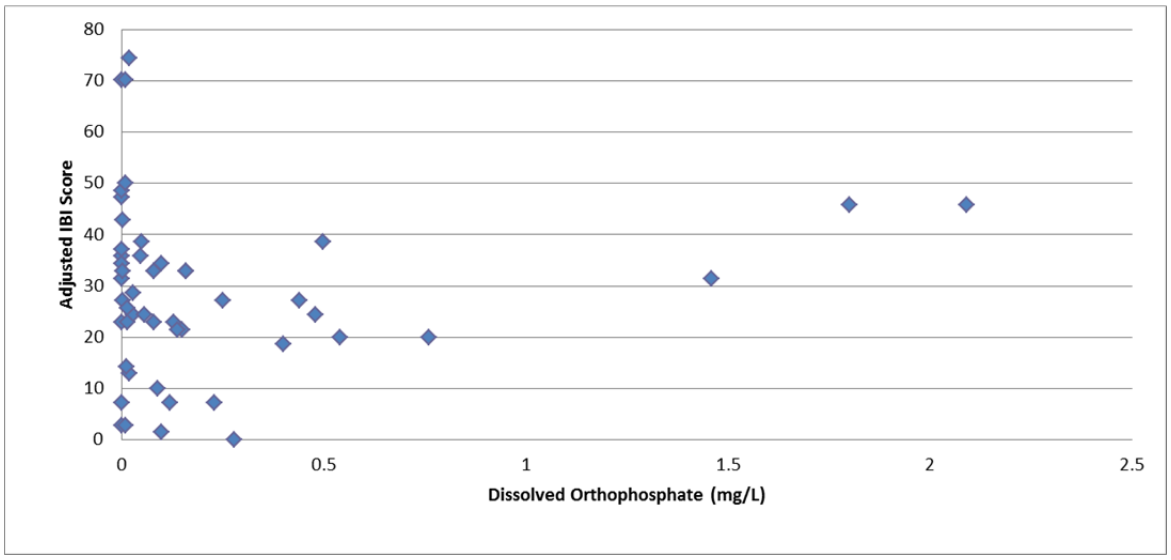


Figure 8. IBI scores as a function of dissolved orthophosphate (IBI scores adjusted on a scale of 0 to 100).

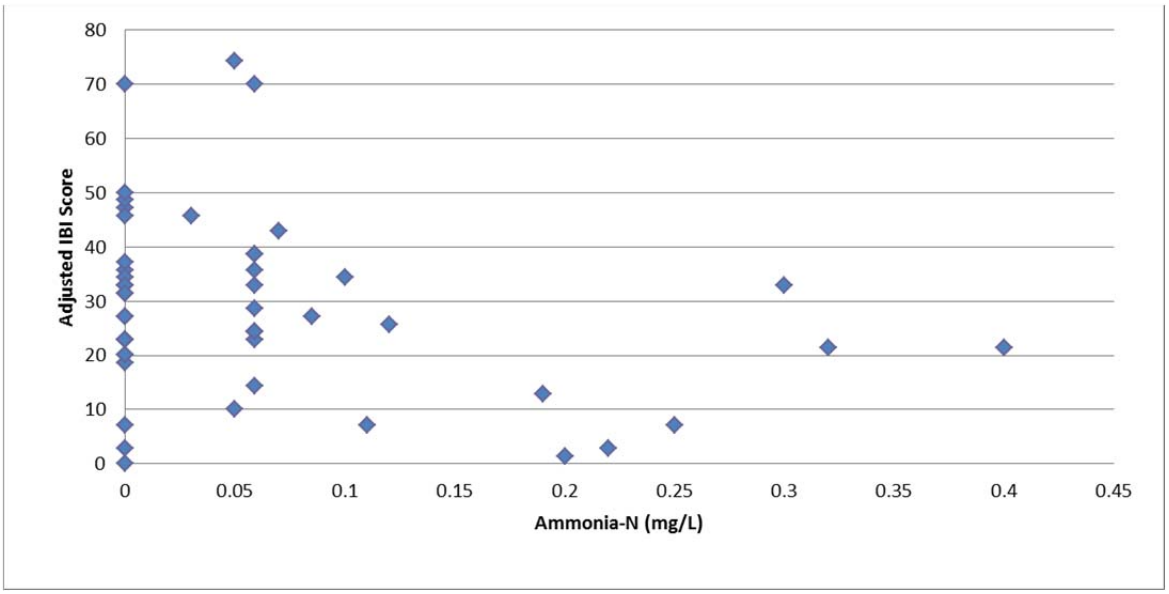


Figure 9. IBI scores as a function of ammonia (IBI scores adjusted on a scale of 0 to 100).

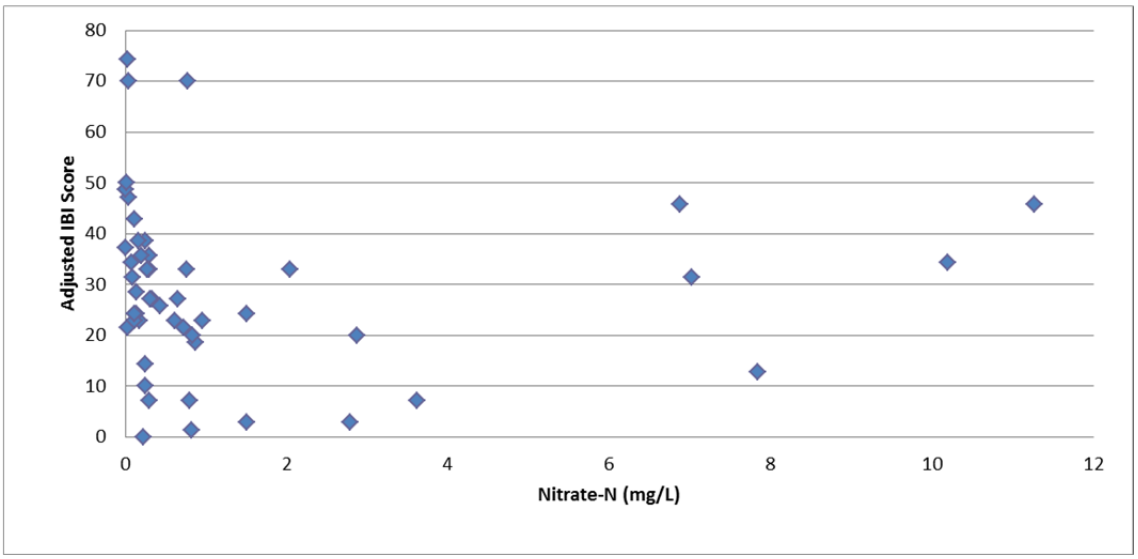


Figure 10. IBI scores as a function of nitrate (IBI scores adjusted on a scale of 0 to 100).

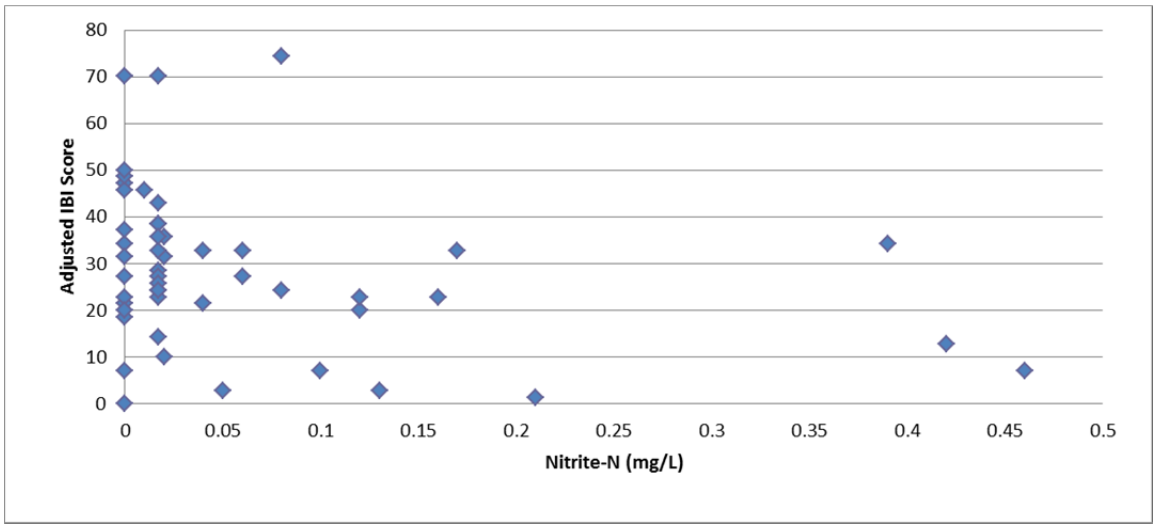


Figure 11. IBI scores as a function of nitrite (IBI scores adjusted on a scale of 0 to 100).

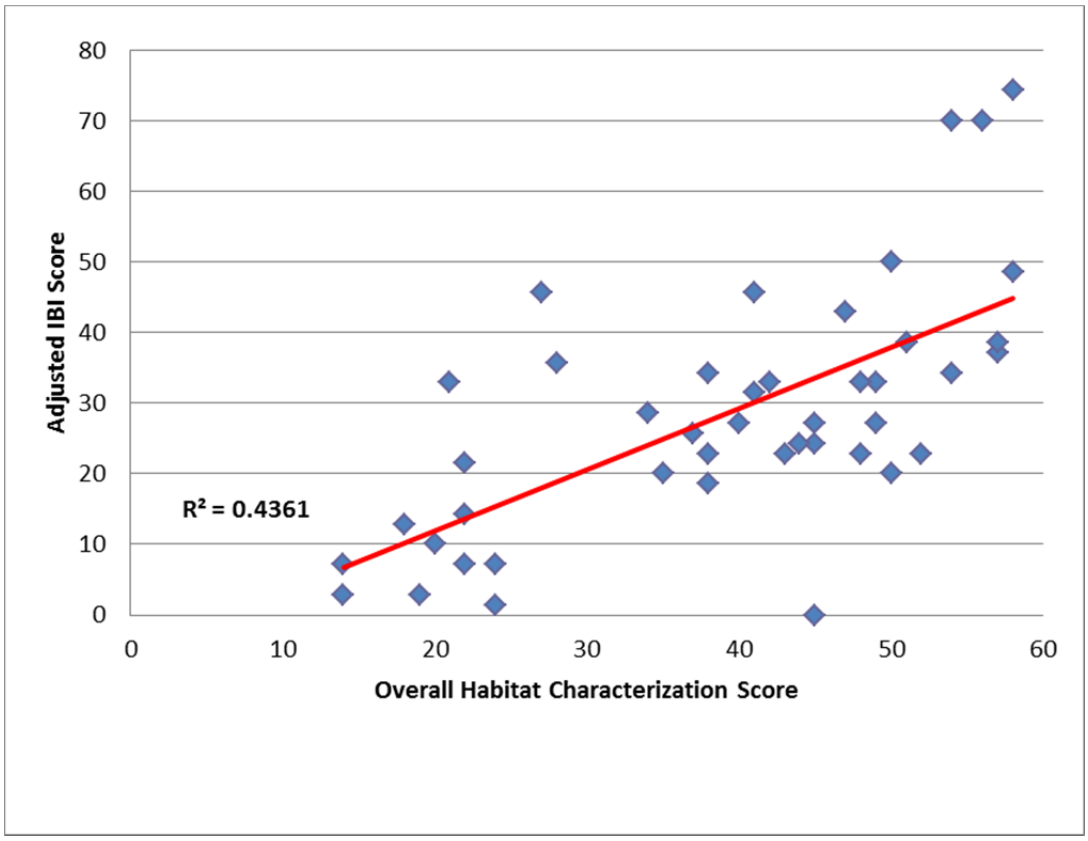


Figure 12. IBI scores as a function of overall habitat characterization (IBI scores adjusted on a scale of 0 to 100) ($p < 0.0001$).

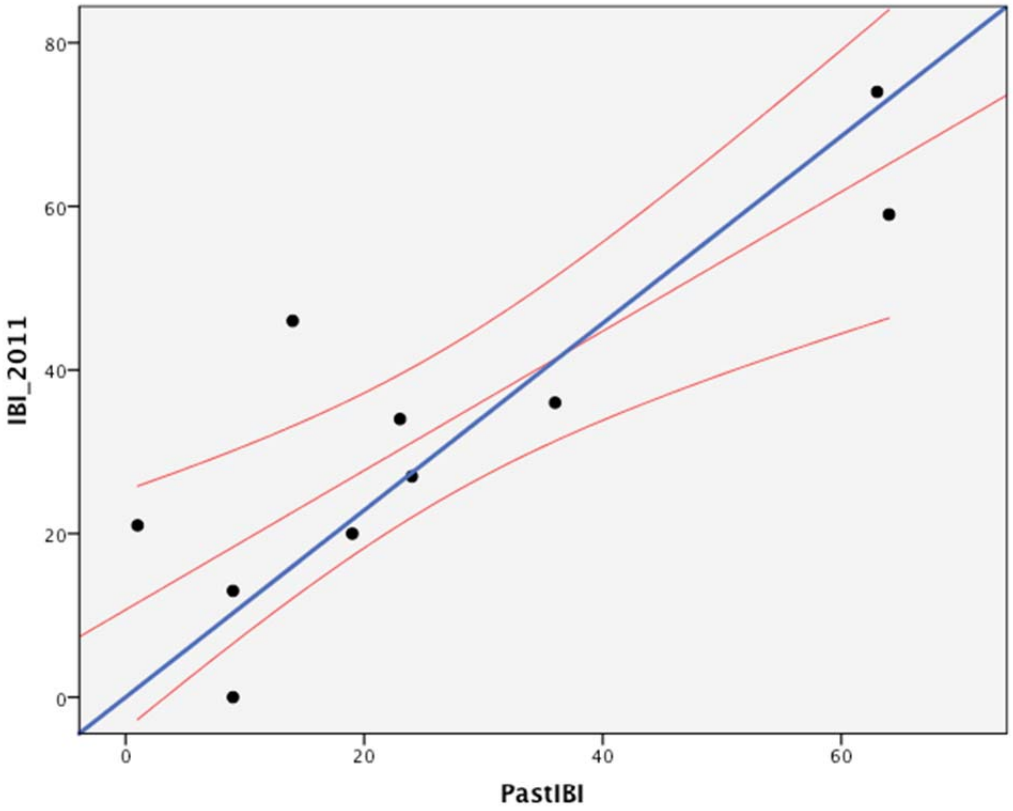


Figure 13. Scatterplot of past IBI scores and scores obtained from 2011 sampling. The regression line with 95% confidence intervals is shown in red. The blue line is a reference line representing perfect concordance between the past IBI score and the IBI score from 2011 sampling.

Table 6. Summary of IBI scores for ten sites previously sampled then resampled in 2011. The two sites shown in italics had fewer than 450 BMIs collected.

Site	Sampling Year of Past IBI	2011 IBI	Past IBI	Change in IBI Score
802SWC020	2006	74	63	11
801NLC105	2007	36	36	0
802SJR116	2006	0	9	-9
801RB8197	2009	21	1	20
801RB8254	2009	59	64	-5
801RB8312	2009	46	14	32
801RB8339	2009	27	24	3
801RB8418	2009	13	9	4
802SJC453	2007	34	23	11
801SAR528	2008	20	19	1

Conclusion

This report gives the results from the sixth year of the six-year monitoring project to assess the quality of the waterways within Region 8.

BMI Community Structure - The low and mid elevation sites were dominated by the facultative and tolerant insects and non-insects. These included midge larvae Chironomidae, crustaceans *Hyalella* sp. and Ostracoda, worms Oligochaeta, as well as mayflies *Baetis* sp. High-elevations sites were not only dominated by the aforementioned organisms (with the exception of Oligochaeta and *Hyalella* sp.), but were also dominated by semi-intolerant blackfly larvae *Simulium* sp., intolerant blackfly larvae *Prosimulium* sp., and intolerant stoneflies *Malenka* sp., *Yoraperla* sp., and *Zapada* sp.

Chironomidae larvae are highly tolerant of impaired conditions and are a documented signature of urbanization (Wang and Lyons 2002). Although Chironomidae larvae were present at all sites, their presence was not entirely determined by urbanization. Sites that were isolated from the influence of urbanization still exhibited similar levels of Chironomidae larvae when compared to sites surrounded by urbanization. Most Baetidae mayfly genera are moderately tolerant members of the EPT group of BMIs and have a preference for sediment-dominated streambeds, having no need for complex habitat with high volume of interstitial areas. They are, however, sensitive to contamination and low dissolved oxygen levels. The presence of stoneflies *Malenka* sp., *Yoraperla* sp., and *Zapada* sp. within high-elevation sites indicates relatively pristine habitat conditions for these sensitive organisms.

Physical/Habitat Quality and Chemical Characteristics – "Poor" scores for physical habitat condition of low elevation streams were primarily driven by the lack of epifaunal substrate cover coupled with channel alterations for flood control purposes; concrete-lined channels' physical habitat conditions scored higher than expected due to the lack of sediment within these systems, which is considered beneficial for inhabiting BMIs; on the contrary, concrete-lined channels lack micro-topography that many sensitive BMIs require to survive. "Marginal" scores for physical habitat condition of mid elevation streams were due to an increase in epifaunal substrate cover, when compared to low gradient streams. "Optimal" scores for physical habitat condition of high elevation streams were due to pristine habitat conditions, although a few locations were lacking in epifaunal substrate cover and had increased sedimentation.

The water quality characteristics were not consistent among sites with acidic to alkaline mean pH field values (4.53 to 10.2; Appendix C), more than adequate levels of mean dissolved oxygen (5.68 to 97.1 mg/L; Appendix C), and highly variable conductivity values (0.158 to 2021 µS/cm; Appendix C). Natural inland waters usually contain small amounts of dissolved mineral salts; low and high levels of dissolved salts can be harmful to living organisms not able to osmoregulate causing the uptake of water into the organism's cells which can be lethal. Surveys of inland fresh waters indicate that a good mix of fish fauna is found where conductivity values range between 150 and 500 uS/cm and that the upper tolerance limit for freshwater organisms is 2000 uS/cm (McKee and Wolf 1971). Within this study, the highest levels of conductivity were found within our urban low elevation streams and are typical of systems with flows fed by urban influence.

SCC-IBI and Region 8 – While an IBI is an informative tool for assessing waterway condition, this multimetric technique is not without its limitations. When an IBI is developed, the individual metrics that comprise an IBI are generated for a specific region based on reference condition sites for that area. While Region 8 falls within the boundaries of the SCC-IBI, there were few sites from this area reflected in the developed SCC-IBI and this may partially explain the variability in IBI scores observed among the low gradient sites within Region 8. Moreover, the resultant IBI scores may not adequately reflect waterway condition or health. Many sites included in the developed SCC-IBI were located at high elevations and were also characterized as high gradient streams. However, many sites in Region 8 were located at low elevation, and characterized as low gradient streams in channelized environments. Currently there is no developed IBI for low gradient, low elevation streams in this region, nor are channelized waterways included in the developed SCC-IBI.

Additionally, the SCC-IBI was developed by adjusting total counts of BMIs to 500 by means of the Monte Carlo method. This was necessary as the current SWAMP protocols require a sample of 600 BMIs, but the SCC-IBI was built using a 500 count. Several streams sampled during the 2011 bioassessment survey were whole-sorted and obtained fewer than 450 organisms; although IBI scores were generated for these locations, caution should be used when interpreting these scores being that they do not adhere to the statistical tools used to generate the SCC-IBI.

Resampling Efforts – In 2011, ten sites were resampled. The primary objective of resampling was to ascertain how consistent SCC-IBI scores may be from year to year at the same site. This was in preparation for future sampling events (2012 and 2013) where resampling was a key component. The data from the ten sites resampled in 2011 suggested that there was a high degree of congruence, but that some sites may have experienced significant changes (either positive or negative) and that they warrant further study. The two sites identified here (801RB8312 and 802SJR116) as showing notable divergence in SCC-IBI scores in 2011 as compared to their scores when they were originally sampled were targeted for resampling in 2012.

Literature Cited

Brown, H.P. 1972. Aquatic Dryopoid Beetles (Coleoptera) of the United States. U.S. Environmental Protection Agency Project, # 18050 ELD. Washington D.C.

CSULB, 2006. Quality Assurance Project Plan for Bioassessment Monitoring of Region 8 v.1.0. Santa Ana Regional Water Quality Control Board (Region 8). (updated 5/15/2010).

Davis, W.S. and T.P. Simon, eds. 1995. Biological assessment and criteria. Tools for water resource planning and decision making. CRC Press, Boca Raton, FL.

DFG. 2003. California Stream Bioassessment Procedure. California Department of Fish and Game, Water Pollution Control Laboratory. Rancho Cordova, CA.

Edmunds, G.G., S.L. Jensen and B. Lewis. 1976. The Mayflies of North and Central America. University of Minnesota Press, Minneapolis, MN.

Erman, N.A. 1996. Status of Aquatic Invertebrates. In: Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options. University of California Davis, Centers for Water and Wildland Resources.

Gibson, G.R. 1996. Biological Criteria: Technical Guidance for Streams and Small Rivers. EPA 822-B-96-001. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

Kathman, R.D., and R.O. Brinkhurst. 1998. Guide to the Freshwater Oligochaetes of North America. Aquatic Resources Center, College Grove, TN.

Klemm, D.J. 1985. A guide to the freshwater Annelida (Polychaeta, Naidid and Tubificid Oligochaeta, and Hirudinea of North America. Kendall/Hunt Publishing Co., Dubuque, IA.

McKee, J. E. and H.W. Wolf (eds.) 1971. Water quality criteria, 2nd ed., California, The Resources Agency of California, State Water Resources Control Board, 584 pp. (Publ. No. 3-A).

Merritt, R.W. and K.W. Cummins. 1995. An introduction to the aquatic insects of North America. Second Edition. Kendall/Hunt Publishing Co., Dubuque, IA.

Ode, P.R. 2007. Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California. SWAMP Bioassessment Field Procedures.

Ode, P.R., A.C. Rehn and J.T. May. 2005. A Quantitative Tool for Assessing the Integrity of Southern Coastal California Streams. Environmental Management 35:493-504.

Pennak, R.W. 1989. Freshwater invertebrates of the United States, 3rd Ed. John Wiley and Sons, Inc., New York, NY.

Resh, V.H. and J.K. Jackson. 1993. Rapid Assessment approaches to biomonitoring using benthic macroinvertebrates. In: D.M. Rosenberg and V.H. Resh, eds., Chapman and Hall, NY.

Rosenberg, D.M. and V.H. Resh, eds. 1993. Freshwater Biomonitoring and Benthic Macroinvertebrates, Chapman Hall, New York, NY.

SARWQCB 1995. The Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin. California Environmental Protection Agency, Santa Ana Regional Water Quality Control Board. Riverside, California.

Stewart, K.W. and B.P.Stark. 1993. Nymphs of North American Stonefly Genera (Plecoptera). University of North Texas Press, Denton, TX.

Surdick, R.F. 1985. Nearctic Genera of Chloroperlinae (Plecoptera: Chloroperlidae). University of Illinois Press. Chicago, IL.

Thorp, J.H. and A.P. Covich (eds.) 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic Press, San Diego.

USEPA (Dec 2006). United States Environmental Protection Agency (USEPA). Biological Indicators of Watershed Health. Retrieved January 19, 2007, from. http://www.epa.gov/bioindicators/html/worms.html.

Usinger, R.L. 1963. Aquatic Insects of California. University of California Press. Berkeley, CA.

Wang, L. and J. Lyons. 2002. Fish and Benthic Macroinvertebrate assemblages as indicators of stream degradation in urbanizing watersheds. In T.P. Simon (ed). Biological Response Signatures: Indicator Patterns Using Aquatic Communities. CRC Press, Washington D.C.

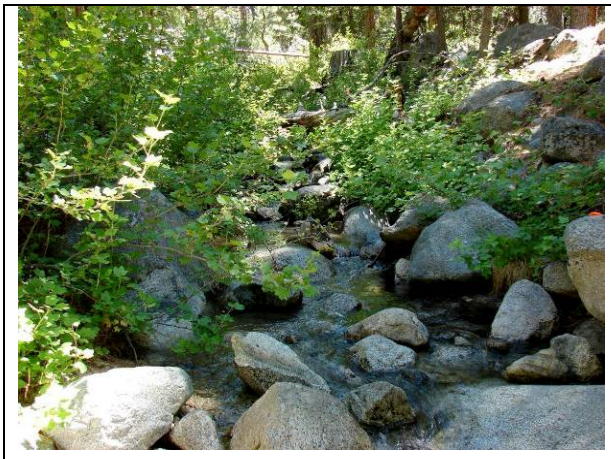
Wiederholm, T. 1983. Chironomidae of the Holarctic region - Part 1. Larvae. Entomologica Scandinavica, Supplement No. 19. Sandby, Sweden.

Wiederholm, T. 1986. Chironomidae of the Holarctic region - Part 2. Pupae. Entomologica Scandinavica, Supplement No.28. Sandby, Sweden.

Wiggins, G.B. 1996. Larvae of the North American Caddisfly Genera (Trichoptera), 2nd Edition. University of Toronto Press, Toronto, Canada.

Wold, J.L. 1974. Systematics of the genus Rhyacophila (Trichoptera: Rhyacophilidae) in western North America with special reference to the immature stages. Masters of Science Thesis. Oregon State University, Corvallis, OR.

Appendix A: Location Photos for Transect A



Site 020: Transect A

Site 105: Transect A

Site 116: Transect A

N/A

Site 197: Transect A

Site 254: Transect A

Site 312: Transect A

Site 339: Transect A

Site 404: Transect A

Site 418: Transect A

Site 439: Transect A

Site 453: Transect A

Site 467: Transect A

Site 483: Transect A

Site 494: Transect A

Site 501: Transect A

Site 511: Transect A

Site 512: Transect A

Site 521: Transect A

N/A Site 528: Transect A	 Site 533: Transect A
 Site 549: Transect A	 Site 558: Transect A
 Site 566: Transect A	 Site 575: Transect A

Site 590: Transect A

Site 593: Transect A

Site 594: Transect A

Site 607: Transect A

Site 618: Transect A

Site 622: Transect A

Site 629: Transect A

Site 633: Transect A

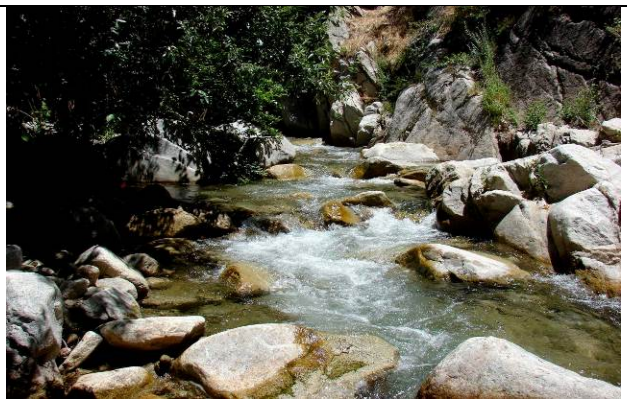
Site SMC-00791: Transect A

Site SMC-00903: Transect A

Site SMC-01367: Transect A

Site SMC-01523: Transect A

Site SMC-01559: Transect A



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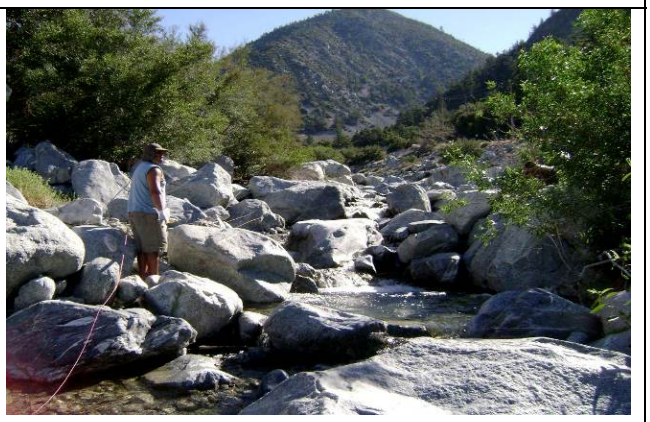
Site SMC-02123: Transect A



Site SMC-02464: Transect A

Site SMC-02749: Transect A

Site SMC-03234: Transect A

 Site SMC-10146: Transect A	N/A Site SMC-11394: Transect A
N/A Site SMC-25288: Transect A	

Appendix B: Standard Operating Procedures

STANDARD OPERATING PROCEDURES FOR COLLECTING BENTHIC MACROINVERTEBRATE SAMPLES AND ASSOCIATED PHYSICAL AND CHEMICAL DATA FOR AMBIENT BIOASSESSMENTS IN CALIFORNIA (UPDATED 02/01/07) CAN BE DOWNLOADED FROM:

http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_bioassessment_collection_020107.pdf

Appendix C: Water Chemistry Data

Appendix C1. Water chemistry data from IIRMES (including field and lab analyses). "DUP" denotes a field replicate; red values indicate a "Not Detectable" reading, and blue values indicate a"Detectable, but Not Quantifiable" reading. Dissolved oxygen, pH, water temperature, and specific conductance were measured in the field while the rest of the analytes were measured in the lab.

Site	Lab Replicate	Field Replicate	Dissolved O2 (mg/L)	Field pH	Water Temp. (°C)	Conductivity (µS/cm)	Alkalinity (T)	Ammonia-N (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Dissolved Orthophosphate (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)
Reporting Limits						1	5	0.03	0.05	0.05	0.01	5	2
802SWC020	1	1	12.06	6.93	9.9	700	28.6	0.05	0.03	0.08	0.02	4.8	-88
801NLC105	1	1	10.61	7.93	13.66	393	146.9	-88	0.3	0.02	-88	13.8	3.9
802SJR116	1	1	8.84	7.62	20.53	2011	299.9	-88	0.23	-88	0.28	10	6.3
801RB8197	1	1	20.65	9.45	31.18	453	44.9	0.4	0.03	-88	0.15	30	3.9
801RB8254	1	1	15.48	6.55	14.61	170	91.8	-88	0.04	-88	-88	7.5	5.2
801RB8254 DUP	1	2	15.48	6.55	14.61	170	89.8	-88	0.04	-88	-88	2.6	2.9
801RB8312	1	1	8.84	8.06	21.68	1034	191.8	-88	11.26	-88	2.09	58.4	6.9
801RB8339	1	1	16.97	7.28	23.1	1188	222.4	-88	0.33	-88	0.44	5.3	4.4
801RB8404	1	1	7.1	9.83	34.78	279	80	0.05	0.25	0.02	0.09	9	-88
801RB8418	1	1	9.3	8.43	25.12	978	167.3	0.19	7.84	0.42	0.02	6.5	1.1
801RB8439	1	1	8.12	8.07	26.14	1171	134	0.2	0.82	0.21	0.1	11.2	11.3
802SJC453	1	1	9.56	7.57	29.05	279	108.1	0.1	10.19	0.39	0.1	-88	-88
801RB8467	1	1	9.95	6.89	19.65	117	204	-88	0.87	-88	0.4	2	3.3
801RB8483	1	1	9.25	6.92	15.33	699	224	-88	2.04	0.17	0.08	2.8	1.6
801RB8494	1	1	6.72	7.59	28.76	1012	200	0.03	6.87	0.01	1.8	62	1.8
801RB8501	1	1	13.05	5.1	16.24	184	80	-88	0.18	-88	-88	1.4	-88
801RB8511	1	1	7.36	7.07	21.38	788	230	-88	0.62	0.16	0.13	1.6	1
801RB8512	1	1	16.82	5.34	14.41	177	83.6	-88	0.08	-88	-88	-88	2.1
801RB8512 DUP	1	2	16.82	5.34	14.41	177	87.7	-88	0.09	-88	-88	2	2.7
801RB8521	1	1	8.95	10.2	29.26	1000	58	0.25	0.3	0.1	0.23	15.2	23.5
801SAR528	1	1	7.87	7.39	23.28	864	175.4	-88	2.87	0.12	0.54	162.8	2.5
801RB8533	1	1	13.46	6.34	15.23	255	112	-88	0.31	0.06	0.25	2.2	1.7
801RB8549	1	1	11.94	7.61	23.65	2603	246	-88	2.79	0.13	-88	4	1.2
801RB8558	1	1	13.54	8.34	23.45	1175	132	0.11	0.8	-88	0.12	20.4	20.3
801RB8566	1	1	22.2	10.13	29.28	604	124	0.3	0.76	0.04	0.16	13.1	2.3
801RB8566 DUP	1	2	22.2	10.13	29.28	604	126	0.32	0.73	0.04	0.14	12.4	2.2
801RB8575	1	1	97.1	5.07	17.4	220	100	-88	0.3	0.06	0.16	1.8	2.4
801RB8590	1	1	28.47	6.24	8.54	96	46.9	-88	-88	-88	-88	6.7	3.6
801RB8593	1	1	12.77	6.67	19.49	342	302	-88	3.62	0.46	-88	29.8	4.7
801RB8594	1	1	7.1	7.14	24.8	528	210	-88	7.02	0.02	1.46	209.4	2.6
801RB8607	1	1	16.2	7.8	10.21	117	51	-88	-88	-88	-88	9.5	3
801RB8618	1	1	10.34	5.69	12.99	420	216.2	-88	0.02	-88	0.01	14.4	7.4
801RB8622	1	1	9.61	6.97	14.41	2021	456	-88	0.96	0.12	0.08	3.6	-88
801RB8629	1	1	10.56	7.62	18.09	728	230.5	-88	0.84	-88	0.76	12.8	7.7
845RB8633	1	1	13.29	9.97	34.37	1346	34.7	0.22	1.51	0.05	0.01	38.2	12.8

Appendix C2. Water chemistry data from E. S. Babcock & Sons, Inc. (including field and lab analyses). "DUP" denotes a field replicate; red values indicate a "Not Detectable" reading, and blue values indicate a "Detectable, but Not Quantifiable" reading. Dissolved oxygen, pH, water temperature, and specific conductance were measured in the field while the rest of the analytes were measured in the lab.

Site	Lab Replicate	Field Replicate	Dissolved O2 (mg/L)	Field pH	Water Temp. (°C)	Conductivity (µS/cm)	Alkalinity (T)	Total Nitrogen (mg/L)	Ammonia-N (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Dissolved Orthophosphate (mg/L)	Total Suspended Solids (mg/L)	Phosphorus as P (mg/L)
Reporting Limits						1	3	0.4	0.1	0.2	0.1	0.05	1	0.05
801S00791	1	1	7.59	7.05	26.08	437	190	0.45	0.059	0.14	0.017	0.029	22	0.02
801S00791 DUP	1	2	7.59	7.05	26.08	437	190	0.45	0.059	0.14	0.017	0.029	22	0.02
801S00903	1	1	13.6	4.53	11.05	104	53	0	0.07	0.11	0.017	0.0028	7	0.01
801S01367	1	1	9.94	7.25	15.02	381	163	0.97	0.059	0.77	0.017	0.011	0.7	0.01
801S01523	1	1	12.36	5.21	18.02	220	100	1	0.085	0.65	0.017	0.003	4	0.02
801S01559	1	1	6.68	7.49	18.95	321	150	0.72	0.12	0.43	0.017	0.015	5	0.01
801S01655	1	1	11.06	6.4	18.53	252	120	0.54	0.059	0.27	0.017	0.003	6	0.02
801S02123	1	1	15.6	7.66	23.69	237	99	0.61	0.059	0.25	0.017	0.012	4	0.02
801S02464	1	1	9.33	7.03	11.76	260	140	0.62	0.059	0.25	0.017	0.499	1	0.01
801S02749	1	1	12.31	7.83	25.3	1344	170	2	0.059	1.5	0.08	0.48	2	0.56
802S03234	1	1	7.6	7.08	15.91	465	170	0	0.059	0.11	0.017	0.015	0.9	0.03
802S10146	1	1	5.68	7.08	19.42	305	99	0	0.059	0.11	0.017	0.057	2	0.09
802S11394	1	1	11.74	7.23	14.3	159	62	0.46	0.059	0.16	0.017	0.05	0.6	0.05
802S25288	1	1	8.26	7.29	16.09	158	61	0.42	0.059	0.2	0.017	0.047	0.6	0.05

Appendix D: Benthic Macroinvertebrates Used for Calculating IBI Metrics

Table D1. BMI's collected, adjusted to counts of 500 via Monte Carlo method. Taxonomy follows the Standard Taxonomic Effort (SAFIT, 2011). Tolerance values and functional feeding groups based on CAMLnet (2007).

Identified Taxa				Tol Val (TV)	Func Feed Grp	801RB8512 1	801RB8512 2	801RB8521	801SAR528	801RB8533	801RB8549
Insecta Taxa											
	Ephemeroptera										
			Ameletus	0	cg						
			Baetidae	4	cg						
			Baetis	5	cg		7	1	41	84	
			Baetis adonis	5	cg						
			Baetis tricaudatus	6	cg	21	22		22	141	
			Caudatella heterocaudata	1	cg	1					
			Caudatella hystrix	1	cg						
			Cinygmula	4	sc						
			Diphetor hageni	5	cg						
			Drunella	0	cg						
			Drunella coloradensis	0	p						
			Drunella flavilinea	0	cg					16	
			Drunella spinifera	0	p						
			Epeorus	0	sc						
			Ephemerella maculata	1	cg						
			Ephemerellidae	1	cg						
			Fallceon	4	cg	1		7	5		1
			Ironodes	3	sc						
			Leptohyphidae	4	cg						
			Leptophlebiidae	2	cg						
			Matriella teresa	2	cg		1				
			Paraleptophlebia	4	cg						
			Rhithrogena	0	sc						
			Tricorythodes explicatus	4	cg				10		3
		Odonata									
			Anax	8	p						
			Argia	7	p						
			Coenagrionidae	9	p						
			Libellulidae	9	p						
		Plecoptera									
			Calineuria californica	2	p	1					
			Chloroperlidae	1	p						
			Isoperla	2	p						
			Malenka	2	sh						
			Nemouridae	2	sh						
			Osobenus	1	p						
			Perlodidae	2	p						
			Skwala	2	p						
			Suwallia	1	p						
			Sweltsa	1	p						
			Zapada	2	sh	1					
			Zapada cinctipes	2	sh						
		Hemiptera									
			Ambrysus	5	p						
			Corisella decolor	8	p						
			Corixidae	8	p						4

Table D1 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

		Identified Taxa	Tol Val (TV)	Func Feed Grp	801RB8512 1	801RB8512 2	801RB8521	801SAR528	801RB8533	801RB8549
	Trichoptera									
		Agapetus	0	sc	2				1	
		Arctopsyche	4	cf						
		Cheumatopsyche	5	cf						
		Farula	0	cg						
		Glossosoma	1	sc						
		Glossosomatidae	0	sc						
		Gumaga	3	sh						
		Helicopsyche	3	sc						
		Hydropsyche	4	cf		1		317	4	
		Hydropsychidae	4	cf				4		
		Hydroptila	6	ph	3	5	6			1
		Hydroptilidae	4	ph						
		Lepidostoma	1	sh	1	1				
		Micrasema	1	mh	1	1				
		Nectopsyche	3	om						
		Neophylax	3	cg						
		Neotrichia	4	sc						
		Ochrotrichia	4	ph		2				
		Oxyethira	3	ph						
		Parapsyche	0	p						
		Psychoglypha	2	sh						
		Rhyacophila	0	p		2			2	
		Sericostomatidae	3	sh						
		Tinodes	2	sc						
		Trichoptera								
		Wormaldia	3	cf						
	Coleoptera									
		Berosus	5	p						
		Elmidae	4	cg	1					
		Enochrus	5	cg						
		Helichus	5	sh						
		Heterlimnius	4	cg	3					
		Hydraena	5	p						
		Hydrobius	8	p						
		Hydrobius fuscipes	5	p						
		Hydrophilus	5	p						
		Hydroporus	5	p						
		Hydroporus occidentalis	5	p						
		Hygrotus	5	p						
		Laccobius	5	cg						
		Lara	4	sh						
		Narpus	4	cg						
		Optioservus	4	sc		2				
		Postelichus	5							
		Sanfilippodytes	5	p						
		Staphylinidae								
		Stictotarsus	5	p						
		Tropisternus	5	p						
		Zaitzevia	4	sc		1				

Table D1 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801RB8512 1	801RB8512 2	801RB8521	801SAR528	801RB8533	801RB8549
		Diptera									
			Bezzia/Palpomyia	6	p						
			Blepharicera	0	sc					4	
			Caloparyphus	7	cg						
			Caloparyphus/Euparyphus	8	cg						
			Caudatella	1	cg						
			Ceratopogonidae	6	p					8	
			Chironomidae	6	cg	401	400	362	66	150	172
			Chrysops	8	p						
			Clinocera	6	p		1				
			Culicoides								
			Dasyhelea	6	cg						
			Dicranota	3	p						
			Diptera								
			Dixa	2	cg		1				
			Dixidae	2	cg						
			Dolichopodidae	4	p			1			
			Empididae	6	p				3		
			Ephydridae	6							
			Euparyphus	8	cg						
			Glutops	3	p						
			Hemerodromia	6	p				2		
			Hexatoma	2	p						
			Limonia	6	sh						
			Limoniinae	3							
			Maruina lanceolata	2	sc						
			Metachela/ Chelifera	6	p						
			Muscidae	6	p	4	9				
			Neoplasta	6	p	1				1	
			Pedicia	1	sh						
			Pericoma/Telmatoscopus	4	cg	1					
			Phoridae		cg						
			Probezzia	6	p						
			Psychodidae		cg						
			Sciomyzidae	6	p						
			Simulium	6	cf	2	3	3	3	7	
			Simulium arcticum	6	cf						
			Simulium argus	6	cf	1	4				
			Simulium canadense	6	cf						
			Simulium clarum/ venator	6	cf						
			Simulium defoliarti	6	cf	21	15			79	
			Simulium donovani	6	cf	2					
			Simulium hippovorum	6	cg	5	4				
			Simulium hunteri	6	cf						
			Simulium jacumbae	6	cf						
			Simulium piperi	6	cf						
			Simulium tescorum	6	cf						
			Simulium vittatum	6	cf				10		3
			Stratiomyidae	8	cg						
			Tabanidae	8	p						
			Tipula	4	om						
			Tipulidae	3							

Table D1 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	801RB8512 1	801RB8512 2	801RB8521	801SAR528	801RB8533	801RB8549
		Lepidoptera									
			Petrophila	5	sc						
		Megaloptera									
			Neohermes	0	p						
			Orohermes	0	p						
	Non-Insecta Taxa										
		Oligochaeta		5	cg	17	12	38	7	2	10
		Ostracoda		8	cg	6	3	80			179
		Turbellaria		4	p				7		
		Amphipoda									
			Crangonyctidae	4	cg						
			Gammarus	6	cg						
			Hyalella	8	cg			1		1	125
		Arhynchobdellida									
			Erpobdellidae	8	p						
		Basommatophora									
			Ferrissia	6	sc						
			Lymnaea	6	sc						
			Menetus opercularis								
			Physa	8	sc				1		1
		Hypsogastropoda									
			Hydrobiidae	8	sc						
			Pyrgulopsis		sc						
		Neotaenioglossa									
			Melanoides tuberculatus		sc						1
		Trombidiformes									
			Atractides	8	p	1					
			Frontipoda		p						
			Lebertia	8	p	1	1				
			Protzia	8	p						
			Sperchon	8	p			1			
			Sperchonopsis	8	p						
			Torrenticola	5	p	1	1				
			Wandesia	5	p						
		Veneroida									
			Corbicula	8	cf				2		
			Pisidium	8	cf		1				
			TOTAL			**500**	**500**	**500**	**500**	**500**	**500**

Table D2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	801RB8558	801RB8566 1	801RB8566 2	801RB8575	801RB8590	801RB8593
	Insecta Taxa										
		Ephemeroptera									
			Ameletus	0	cg						
			Baetidae	4	cg		2				
			Baetis	5	cg		2	8	143	44	
			Baetis adonis	5	cg		12	21			
			Baetis tricaudatus	6	cg				128	176	
			Caudatella heterocaudata	1	cg				1	11	
			Caudatella hystrix	1	cg						
			Cinygmula	4	sc					2	
			Diphetor hageni	5	cg						
			Drunella	0	cg						
			Drunella coloradensis	0	p						
			Drunella flavilinea	0	cg				13		
			Drunella spinifera	0	p					2	
			Epeorus	0	sc					5	
			Ephemerella maculata	1	cg						
			Ephemerellidae	1	cg				1	2	
			Fallceon	4	cg	1	2	10			
			Ironodes	3	sc						
			Leptohyphidae	4	cg						
			Leptophlebiidae	2	cg						
			Matriella teresa	2	cg					1	
			Paraleptophlebia	4	cg						
			Rhithrogena	0	sc					1	
			Tricorythodes explicatus	4	cg						
		Odonata									
			Anax	8	p						
			Argia	7	p						
			Coenagrionidae	9	p						
			Libellulidae	9	p						
		Plecoptera									
			Calineuria californica	2	p						
			Chloroperlidae	1	p						
			Isoperla	2	p						
			Malenka	2	sh						
			Nemouridae	2	sh						
			Osobenus	1	p						
			Perlodidae	2	p						
			Skwala	2	p						
			Suwallia	1	p				1	7	
			Sweltsa	1	p						
			Zapada	2	sh				1		
			Zapada cinctipes	2	sh						
		Hemiptera									
			Ambrysus	5	p						
			Corisella decolor	8	p						
			Corixidae	8	p						

Table D2 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801RB8558	801RB8566 1	801RB8566 2	801RB8575	801RB8590	801RB8593
		Trichoptera									
			Agapetus	0	sc						
			Arctopsyche	4	cf					2	
			Cheumatopsyche	5	cf						
			Farula	0	cg						
			Glossosoma	1	sc						
			Glossosomatidae	0	sc						
			Gumaga	3	sh						
			Helicopsyche	3	sc						
			Hydropsyche	4	cf				6	2	
			Hydropsychidae	4	cf						
			Hydroptila	6	ph						
			Hydroptilidae	4	ph	1	1				
			Lepidostoma	1	sh						
			Micrasema	1	mh					1	
			Nectopsyche	3	om						
			Neophylax	3	cg						
			Neotrichia	4	sc						
			Ochrotrichia	4	ph						
			Oxyethira	3	ph						
			Parapsyche	0	p						
			Psychoglypha	2	sh						
			Rhyacophila	0	p				2	2	
			Sericostomatidae	3	sh						
			Tinodes	2	sc						
			Trichoptera				1				
			Wormaldia	3	cf						
		Coleoptera									
			Berosus	5	p						
			Elmidae	4	cg						
			Enochrus	5	cg						
			Helichus	5	sh						
			Heterlimnius	4	cg						
			Hydraena	5	p						
			Hydrobius	8	p						
			Hydrobius fuscipes	5	p						
			Hydrophilus	5	p						
			Hydroporus	5	p						
			Hydroporus occidentalis	5	p						
			Hygrotus	5	p						
			Laccobius	5	cg						
			Lara	4	sh						
			Narpus	4	cg						
			Optioservus	4	sc						
			Postelichus	5							
			Sanfilippodytes	5	p						
			Staphylinidae								
			Stictotarsus	5	p						
			Tropisternus	5	p						
			Zaitzevia	4	sc						

Table D2 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801RB8558	801RB8566		801RB8575	801RB8590	801RB8593
							1	2			
		Diptera									
			Bezzia/Palpomyia	6	p				8	6	
			Blepharicera	0	sc						
			Caloparyphus	7	cg						
			Caloparyphus/Euparyphus	8	cg						
			Caudatella	1	cg						
			Ceratopogonidae	6	p						
			Chironomidae	6	cg	39	213	210	85	26	136
			Chrysops	8	p						
			Clinocera	6	p				1		
			Culicoides							1	
			Dasyhelea	6	cg						
			Dicranota	3	p						
			Diptera								
			Dixa	2	cg				1		
			Dixidae	2	cg						
			Dolichopodidae	4	p						
			Empididae	6	p						
			Ephydridae	6							
			Euparyphus	8	cg						
			Glutops	3	p						
			Hemerodromia	6	p						
			Hexatoma	2	p						
			Limonia	6	sh						
			Limoniinae	3							
			Maruina lanceolata	2	sc						
			Metachela/ Chelifera	6	p						
			Muscidae	6	p						
			Neoplasta	6	p						
			Pedicia	1	sh						
			Pericoma/Telmatoscopus	4	cg				1		
			Phoridae		cg						
			Probezzia	6	p						
			Psychodidae		cg		1				
			Sciomyzidae	6	p						
			Simulium	6	cf	3	2	2	25	3	
			Simulium arcticum	6	cf						
			Simulium argus	6	cf						
			Simulium canadense	6	cf					15	
			Simulium clarum/ venator	6	cf						
			Simulium defoliarti	6	cf					160	
			Simulium donovani	6	cf						
			Simulium hippovorum	6	cg			2	81		
			Simulium hunteri	6	cf						
			Simulium jacumbae	6	cf						
			Simulium piperi	6	cf						
			Simulium tescorum	6	cf					4	
			Simulium vittatum	6	cf	1	40	68			
			Stratiomyidae	8	cg						
			Tabanidae	8	p						
			Tipula	4	om						
			Tipulidae	3							

Table D2 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	801RB8558	801RB8566 1	801RB8566 2	801RB8575	801RB8590	801RB8593
		Lepidoptera									
			Petrophila	5	sc		178	114			
		Megaloptera									
			Neohermes	0	p						
			Orohermes	0	p						
	Non-Insecta Taxa										
		Oligochaeta		5	cg			63		8	1
		Ostracoda		8	cg	419	45	1	2		12
		Turbellaria		4	p						
		Amphipoda									
			Crangonyctidae	4	cg						
			Gammarus	6	cg						
			Hyalella	8	cg						231
		Arhynchobdellida									
			Erpobdellidae	8	p						
		Basommatophora									
			Ferrissia	6	sc						
			Lymnaea	6	sc						
			Menetus opercularis			3					
			Physa	8	sc	33					6
		Hypsogastropoda									
			Hydrobiidae	8	sc						
			Pyrgulopsis		sc						
		Neotaenioglossa									
			Melanoides tuberculatus		sc						114
		Trombidiformes									
			Atractides	8	p						
			Frontipoda		p						
			Lebertia	8	p						
			Protzia	8	p						
			Sperchon	8	p		1	1			
			Sperchonopsis	8	p						
			Torrenticola	5	p						
			Wandesia	5	p						
		Veneroida									
			Corbicula	8	cf						
			Pisidium	8	cf					19	
			TOTAL			**500**	**500**	**500**	**500**	**500**	**500**

Table D3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801RB8594	801RB8607	801RB8618	801RB8622	801RB8629	845RB8633
Insecta Taxa											
	Ephemeroptera										
			Ameletus	0	cg						
			Baetidae	4	cg						
			Baetis	5	cg	3	66	112	8	25	
			Baetis adonis	5	cg				1		
			Baetis tricaudatus	6	cg		15	17		4	
			Caudatella heterocaudata	1	cg		21				
			Caudatella hystrix	1	cg						
			Cinygmula	4	sc						
			Diphetor hageni	5	cg			1			
			Drunella	0	cg						
			Drunella coloradensis	0	p						
			Drunella flavilinea	0	cg		1	3			
			Drunella spinifera	0	p		8				
			Epeorus	0	sc		5				
			Ephemerella maculata	1	cg						
			Ephemerellidae	1	cg		2				
			Fallceon	4	cg	100				5	7
			Ironodes	3	sc			111			
			Leptohyphidae	4	cg						
			Leptophlebiidae	2	cg			3			
			Matriella teresa	2	cg		6	13			
			Paraleptophlebia	4	cg						
			Rhithrogena	0	sc						
			Tricorythodes explicatus	4	cg	2					
		Odonata									
			Anax	8	p						
			Argia	7	p					1	
			Coenagrionidae	9	p					1	
			Libellulidae	9	p						
		Plecoptera									
			Calineuria californica	2	p						
			Chloroperlidae	1	p						
			Isoperla	2	p			9			
			Malenka	2	sh						
			Nemouridae	2	sh						
			Osobenus	1	p						
			Perlodidae	2	p		1				
			Skwala	2	p		2				
			Suwallia	1	p						
			Sweltsa	1	p						
			Zapada	2	sh			3			
			Zapada cinctipes	2	sh			58			
		Hemiptera									
			Ambrysus	5	p	1					
			Corisella decolor	8	p						
			Corixidae	8	p						

Table D3 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801RB8594	801RB8607	801RB8618	801RB8622	801RB8629	845RB8633
		Trichoptera									
			Agapetus	0	sc						
			Arctopsyche	4	cf		1				
			Cheumatopsyche	5	cf						
			Farula	0	cg						
			Glossosoma	1	sc						
			Glossosomatidae	0	sc						
			Gumaga	3	sh						
			Helicopsyche	3	sc						
			Hydropsyche	4	cf	8	5	1	6		
			Hydropsychidae	4	cf	1					
			Hydroptila	6	ph	14				3	
			Hydroptilidae	4	ph	3					
			Lepidostoma	1	sh						
			Micrasema	1	mh		1	2			
			Nectopsyche	3	om						
			Neophylax	3	cg						
			Neotrichia	4	sc						
			Ochrotrichia	4	ph						
			Oxyethira	3	ph						
			Parapsyche	0	p						
			Psychoglypha	2	sh			2			
			Rhyacophila	0	p		13	1			
			Sericostomatidae	3	sh						
			Tinodes	2	sc						
			Trichoptera								
			Wormaldia	3	cf						
		Coleoptera									
			Berosus	5	p						
			Elmidae	4	cg		2				
			Enochrus	5	cg						
			Helichus	5	sh						
			Heterlimnius	4	cg						
			Hydraena	5	p						
			Hydrobius	8	p						
			Hydrobius fuscipes	5	p						
			Hydrophilus	5	p						
			Hydroporus	5	p						
			Hydroporus occidentalis	5	p						
			Hygrotus	5	p	1					
			Laccobius	5	cg						
			Lara	4	sh						
			Narpus	4	cg					1	
			Optioservus	4	sc						
			Postelichus	5							
			Sanfilippodytes	5	p						
			Staphylinidae								
			Stictotarsus	5	p						
			Tropisternus	5	p			1			
			Zaitzevia	4	sc						

Table D3 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801RB8594	801RB8607	801RB8618	801RB8622	801RB8629	845RB8633
		Diptera									
			Bezzia/Palpomyia	6	p		4		14		
			Blepharicera	0	sc						
			Caloparyphus	7	cg						
			Caloparyphus/Euparyphus	8	cg					1	33
			Caudatella	1	cg		9				
			Ceratopogonidae	6	p						
			Chironomidae	6	cg	14	288	49	59	12	59
			Chrysops	8	p						
			Clinocera	6	p						
			Culicoides								
			Dasyhelea	6	cg	1					
			Dicranota	3	p			1			
			Diptera								
			Dixa	2	cg				1		
			Dixidae	2	cg						
			Dolichopodidae	4	p						
			Empididae	6	p		2				
			Ephydridae	6		5			2		
			Euparyphus	8	cg						21
			Glutops	3	p						
			Hemerodromia	6	p						
			Hexatoma	2	p						
			Limonia	6	sh						
			Limoniinae	3							
			Maruina lanceolata	2	sc						
			Metachela/ Chelifera	6	p		2				
			Muscidae	6	p						
			Neoplasta	6	p		1				
			Pedicia	1	sh						
			Pericoma/Telmatoscopus	4	cg	1	6				
			Phoridae		cg						
			Probezzia	6	p						
			Psychodidae		cg						
			Sciomyzidae	6	p				1		
			Simulium	6	cf	3			6		
			Simulium arcticum	6	cf		28				
			Simulium argus	6	cf	4				8	
			Simulium canadense	6	cf						
			Simulium clarum/ venator	6	cf	30					
			Simulium defoliarti	6	cf			5			
			Simulium donovani	6	cf					61	
			Simulium hippovorum	6	cg						
			Simulium hunteri	6	cf						
			Simulium jacumbae	6	cf						
			Simulium piperi	6	cf		1	73	5		
			Simulium tescorum	6	cf					16	
			Simulium vittatum	6	cf						
			Stratiomyidae	8	cg						
			Tabanidae	8	p						
			Tipula	4	om			1			
			Tipulidae	3							

Table D3 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	801RB8594	801RB8607	801RB8618	801RB8622	801RB8629	845RB8633
		Lepidoptera									
			Petrophila	5	sc						
		Megaloptera									
			Neohermes	0	p						
			Orohermes	0	p						
	Non-Insecta Taxa										
		Oligochaeta		5	cg		4	21	37		4
		Ostracoda		8	cg	5		2	59		118
		Turbellaria		4	p					1	47
		Amphipoda									
			Crangonyctidae	4	cg						
			Gammarus	6	cg						
			Hyalella	8	cg						211
		Arhynchobdellida									
			Erpobdellidae	8	p						
		Basommatophora									
			Ferrissia	6	sc						
			Lymnaea	6	sc						
			Menetus opercularis								
			Physa	8	sc	1			125	1	
		Hypsogastropoda									
			Hydrobiidae	8	sc						
			Pyrgulopsis		sc						
		Neotaenioglossa									
			Melanoides tuberculatus		sc						
		Trombidiformes									
			Atractides	8	p				1		
			Frontipoda		p						
			Lebertia	8	p		2	2			
			Protzia	8	p		1				
			Sperchon	8	p				5	1	
			Sperchonopsis	8	p			1			
			Torrenticola	5	p		2	1			
			Wandesia	5	p			1			
		Veneroida									
			Corbicula	8	cf						
			Pisidium	8	cf		1	6			
			TOTAL			**197**	**500**	**500**	**330**	**141**	**500**

Table D4. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	802SWC020	802SWC105	802SWC116	802SWC197	802SWC254	
										1	2
Insecta Taxa											
	Ephemeroptera										
			Ameletus	0	cg	10					
			Baetidae	4	cg			1			
			Baetis	5	cg	79	17			42	9
			Baetis adonis	5	cg						
			Baetis tricaudatus	6	cg	11	44			59	72
			Caudatella heterocaudata	1	cg						
			Caudatella hystrix	1	cg	1					
			Cinygmula	4	sc						
			Diphetor hageni	5	cg						
			Drunella	0	cg						
			Drunella coloradensis	0	p						
			Drunella flavilinea	0	cg	2	1				
			Drunella spinifera	0	p					6	3
			Epeorus	0	sc						
			Ephemerella maculata	1	cg						
			Ephemerellidae	1	cg	2					
			Fallceon	4	cg			6	3		
			Ironodes	3	sc	25				2	
			Leptohyphidae	4	cg						
			Leptophlebiidae	2	cg						
			Matriella teresa	2	cg	6					
			Paraleptophlebia	4	cg						
			Rhithrogena	0	sc						
			Tricorythodes explicatus	4	cg						
		Odonata									
			Anax	8	p						
			Argia	7	p			2		1	
			Coenagrionidae	9	p			3			
			Libellulidae	9	p						
		Plecoptera									
			Calineuria californica	2	p						
			Chloroperlidae	1	p	4					
			Isoperla	2	p						
			Malenka	2	sh		9			4	
			Nemouridae	2	sh					7	
			Osobenus	1	p						
			Perlodidae	2	p						
			Skwala	2	p						
			Suwallia	1	p						
			Sweltsa	1	p	25					
			Zapada	2	sh	31					1
			Zapada cinctipes	2	sh						27
		Hemiptera									
			Ambrysus	5	p						
			Corisella decolor	8	p						
			Corixidae	8	p						

Table D4 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

		Identified Taxa		Tol Val (TV)	Func Feed Grp	802SWC020	802SWC105	802SWC116	802SWC197	802SWC254	
										1	2
		Trichoptera									
			Agapetus	0	sc		2			1	35
			Arctopsyche	4	cf					2	1
			Cheumatopsyche	5	cf						
			Farula	0	cg					87	
			Glossosoma	1	sc					4	
			Glossosomatidae	0	sc						
			Gumaga	3	sh						
			Helicopsyche	3	sc						
			Hydropsyche	4	cf					10	7
			Hydropsychidae	4	cf		1				17
			Hydroptila	6	ph				2		
			Hydroptilidae	4	ph						
			Lepidostoma	1	sh	4				1	
			Micrasema	1	mh	7				119	79
			Nectopsyche	3	om						
			Neophylax	3	cg	4	1			16	
			Neotrichia	4	sc						
			Ochrotrichia	4	ph						
			Oxyethira	3	ph						
			Parapsyche	0	p	14	1			4	1
			Psychoglypha	2	sh	4					
			Rhyacophila	0	p	1				3	5
			Sericostomatidae	3	sh						
			Tinodes	2	sc						
			Trichoptera			1					
			Wormaldia	3	cf						
		Coleoptera									
			Berosus	5	p						
			Elmidae	4	cg						
			Enochrus	5	cg						
			Helichus	5	sh						
			Heterlimnius	4	cg						
			Hydraena	5	p					1	
			Hydrobius	8	p						
			Hydrobius fuscipes	5	p						
			Hydrophilus	5	p						
			Hydroporus	5	p						
			Hydroporus occidentalis	5	p						
			Hygrotus	5	p						
			Laccobius	5	cg						
			Lara	4	sh					1	
			Narpus	4	cg						
			Optioservus	4	sc						
			Postelichus	5							
			Sanfilippodytes	5	p	1					
			Staphylinidae								
			Stictotarsus	5	p	2					
			Tropisternus	5	p						
			Zaitzevia	4	sc					1	

Table D4 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa		Tol Val (TV)	Func Feed Grp	802SWC020	802SWC105	802SWC116	802SWC197	802SWC254 1	802SWC254 2
Diptera									
	Bezzia/Palpomyia	6	p			1			
	Blepharicera	0	sc						
	Caloparyphus	7	cg				5		
	Caloparyphus/Euparyphus	8	cg		1	2	4		
	Caudatella	1	cg						
	Ceratopogonidae	6	p						
	Chironomidae	6	cg	57	12	28	154	98	205
	Chrysops	8	p						
	Clinocera	6	p					1	
	Culicoides								
	Dasyhelea	6	cg						
	Dicranota	3	p	9				1	
	Diptera								
	Dixa	2	cg					12	1
	Dixidae	2	cg						
	Dolichopodidae	4	p	1			1		
	Empididae	6	p						
	Ephydridae	6							
	Euparyphus	8	cg				3		
	Glutops	3	p	1					
	Hemerodromia	6	p						
	Hexatoma	2	p	1					
	Limonia	6	sh						
	Limoniinae	3		1					
	Maruina lanceolata	2	sc						
	Metachela/ Chelifera	6	p						
	Muscidae	6	p	1					
	Neoplasta	6	p						2
	Pedicia	1	sh						
	Pericoma/Telmatoscopus	4	cg	6			1		
	Phoridae		cg	6					
	Probezzia	6	p						
	Psychodidae		cg				2		
	Sciomyzidae	6	p						
	Simulium	6	cf	1		2	2		
	Simulium arcticum	6	cf						
	Simulium argus	6	cf				3		
	Simulium canadense	6	cf		2				
	Simulium clarum/ venator	6	cf						
	Simulium defoliarti	6	cf		2				
	Simulium donovani	6	cf					1	
	Simulium hippovorum	6	cg						1
	Simulium hunteri	6	cf						
	Simulium jacumbae	6	cf					1	
	Simulium piperi	6	cf						4
	Simulium tescorum	6	cf				1		10
	Simulium vittatum	6	cf	1					
	Stratiomyidae	8	cg						
	Tabanidae	8	p						
	Tipula	4	om						
	Tipulidae	3		1					

Table D4 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC020	802SWC105	802SWC116	802SWC197	802SWC254 1	802SWC254 2
		Lepidoptera									
			Petrophila	5	sc						
		Megaloptera									
			Neohermes	0	p						
			Orohermes	0	p						
	Non-Insecta Taxa										
		Oligochaeta		5	cg	2		52	58		3
		Ostracoda		8	cg	3		363	261	5	8
		Turbellaria		4	p						
		Amphipoda									
			Crangonyctidae	4	cg						
			Gammarus	6	cg						
			Hyalella	8	cg			32			
		Arhynchobdellida									
			Erpobdellidae	8	p			4			
		Basommatophora									
			Ferrissia	6	sc			1			
			Lymnaea	6	sc						
			Menetus opercularis							1	
			Physa	8	sc						
		Hypsogastropoda									
			Hydrobiidae	8	sc			1			
			Pyrgulopsis		sc						
		Neotaenioglossa									
			Melanoides tuberculatus		sc						
		Trombidiformes									
			Atractides	8	p						
			Frontipoda		p	1					
			Lebertia	8	p	4				1	
			Protzia	8	p						
			Sperchon	8	p						
			Sperchonopsis	8	p						
			Torrenticola	5	p					1	
			Wandesia	5	p						1
		Veneroida									
			Corbicula	8	cf			2			
			Pisidium	8	cf					7	8
			TOTAL			**330**	**93**	**500**	**500**	**500**	**500**

Table D5. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC312	802SWC339	802SWC404	802SWC418	802SWC439	802SWC453
	Insecta Taxa										
		Ephemeroptera									
			Ameletus	0	cg						
			Baetidae	4	cg						
			Baetis	5	cg						
			Baetis adonis	5	cg		5				
			Baetis tricaudatus	6	cg		18				
			Caudatella heterocaudata	1	cg						
			Caudatella hystrix	1	cg						
			Cinygmula	4	sc						
			Diphetor hageni	5	cg		2				
			Drunella	0	cg						
			Drunella coloradensis	0	p						
			Drunella flavilinea	0	cg						
			Drunella spinifera	0	p						
			Epeorus	0	sc						
			Ephemerella maculata	1	cg						
			Ephemerellidae	1	cg						
			Fallceon	4	cg	73			287		
			Ironodes	3	sc						
			Leptohyphidae	4	cg						
			Leptophlebiidae	2	cg						
			Matriella teresa	2	cg						
			Paraleptophlebia	4	cg						
			Rhithrogena	0	sc						
			Tricorythodes explicatus	4	cg	3					
		Odonata									
			Anax	8	p						
			Argia	7	p		20				
			Coenagrionidae	9	p		1				
			Libellulidae	9	p						
		Plecoptera									
			Calineuria californica	2	p						
			Chloroperlidae	1	p						
			Isoperla	2	p						
			Malenka	2	sh						
			Nemouridae	2	sh						
			Osobenus	1	p						
			Perlodidae	2	p						
			Skwala	2	p						
			Suwallia	1	p						
			Sweltsa	1	p						
			Zapada	2	sh						
			Zapada cinctipes	2	sh						
		Hemiptera									
			Ambrysus	5	p						
			Corisella decolor	8	p				6		
			Corixidae	8	p				2		

Table D5 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa			Tol Val (TV)	Func Feed Grp	802SWC312	802SWC339	802SWC404	802SWC418	802SWC439	802SWC453
		Trichoptera								
		Agapetus	0	sc						
		Arctopsyche	4	cf						
		Cheumatopsyche	5	cf						
		Farula	0	cg						
		Glossosoma	1	sc						
		Glossosomatidae	0	sc						
		Gumaga	3	sh						
		Helicopsyche	3	sc						
		Hydropsyche	4	cf	1	218			1	
		Hydropsychidae	4	cf						
		Hydroptila	6	ph	2	11				2
		Hydroptilidae	4	ph		1				
		Lepidostoma	1	sh						
		Micrasema	1	mh						8
		Nectopsyche	3	om						8
		Neophylax	3	cg						
		Neotrichia	4	sc						
		Ochrotrichia	4	ph		2				
		Oxyethira	3	ph						
		Parapsyche	0	p						
		Psychoglypha	2	sh						
		Rhyacophila	0	p						
		Sericostomatidae	3	sh						
		Tinodes	2	sc						1
		Trichoptera				1				
		Wormaldia	3	cf						
		Coleoptera								
		Berosus	5	p						1
		Elmidae	4	cg						
		Enochrus	5	cg						
		Helichus	5	sh						
		Heterlimnius	4	cg						
		Hydraena	5	p						
		Hydrobius	8	p						18
		Hydrobius fuscipes	5	p						
		Hydrophilus	5	p	1			1		
		Hydroporus	5	p	2					
		Hydroporus occidentalis	5	p						
		Hygrotus	5	p						
		Laccobius	5	cg	1					1
		Lara	4	sh						
		Narpus	4	cg						
		Optioservus	4	sc						
		Postelichus	5							
		Sanfilippodytes	5	p						1
		Staphylinidae								6
		Stictotarsus	5	p						
		Tropisternus	5	p	2					
		Zaitzevia	4	sc						

Table D5 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	802SWC312	802SWC339	802SWC404	802SWC418	802SWC439	802SWC453
		Diptera									
			Bezzia/Palpomyia	6	p	4			3		4
			Blepharicera	0	sc						
			Caloparyphus	7	cg						
			Caloparyphus/Euparyphus	8	cg				2		4
			Caudatella	1	cg						
			Ceratopogonidae	6	p						
			Chironomidae	6	cg	35	108	495	133	43	430
			Chrysops	8	p						
			Clinocera	6	p						
			Culicoides			1					1
			Dasyhelea	6	cg						
			Dicranota	3	p				1		
			Diptera								
			Dixa	2	cg						
			Dixidae	2	cg						
			Dolichopodidae	4	p				15		3
			Empididae	6	p						
			Ephydridae	6		1			8		1
			Euparyphus	8	cg				2		1
			Glutops	3	p						
			Hemerodromia	6	p						
			Hexatoma	2	p						
			Limonia	6	sh						
			Limoniinae	3							
			Maruina lanceolata	2	sc						
			Metachela/ Chelifera	6	p						
			Muscidae	6	p						
			Neoplasta	6	p		1				
			Pedicia	1	sh						
			Pericoma/Telmatoscopus	4	cg						
			Phoridae		cg						
			Probezzia	6	p						
			Psychodidae		cg				4		
			Sciomyzidae	6	p						
			Simulium	6	cf					2	
			Simulium arcticum	6	cf						
			Simulium argus	6	cf			1	1		
			Simulium canadense	6	cf						
			Simulium clarum/ venator	6	cf						
			Simulium defoliarti	6	cf						
			Simulium donovani	6	cf		4				
			Simulium hippovorum	6	cg						
			Simulium hunteri	6	cf						
			Simulium jacumbae	6	cf						
			Simulium piperi	6	cf						
			Simulium tescorum	6	cf		21				
			Simulium vittatum	6	cf	30		2		3	
			Stratiomyidae	8	cg						
			Tabanidae	8	p						
			Tipula	4	om						
			Tipulidae	3							

Table D5 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC312	802SWC339	802SWC404	802SWC418	802SWC439	802SWC453
		Lepidoptera									
			Petrophila	5	sc						
		Megaloptera									
			Neohermes	0	p						
			Orohermes	0	p						
	Non-Insecta Taxa										
		Oligochaeta		5	cg		3	1	12		5
		Ostracoda		8	cg	19	6	1	9	420	3
		Turbellaria		4	p		6				
		Amphipoda									
			Crangonyctidae	4	cg						
			Gammarus	6	cg						
			Hyalella	8	cg	73			2	1	
		Arhynchobdellida									
			Erpobdellidae	8	p						
		Basommatophora									
			Ferrissia	6	sc						
			Lymnaea	6	sc						
			Menetus opercularis								
			Physa	8	sc	252			7	30	2
		Hypsogastropoda									
			Hydrobiidae	8	sc				3		
			Pyrgulopsis		sc						
		Neotaenioglossa									
			Melanoides tuberculatus		sc						
		Trombidiformes									
			Atractides	8	p						
			Frontipoda		p						
			Lebertia	8	p						
			Protzia	8	p						
			Sperchon	8	p		71		1		
			Sperchonopsis	8	p						
			Torrenticola	5	p						
			Wandesia	5	p						
		Veneroida									
			Corbicula	8	cf		1		1		
			Pisidium	8	cf						
			TOTAL			**500**	**500**	**500**	**500**	**500**	**500**

Table D6. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	802SWC467	802SWC483	802SWC494	802SWC501	801S00791	
										1	2
Insecta Taxa											
	Ephemeroptera										
			Ameletus	0	cg						
			Baetidae	4	cg						
			Baetis	5	cg	84	21		58	54	155
			Baetis adonis	5	cg	20	16	4		13	36
			Baetis tricaudatus	6	cg				17	38	
			Caudatella heterocaudata	1	cg				6		
			Caudatella hystrix	1	cg						
			Cinygmula	4	sc						
			Diphetor hageni	5	cg						
			Drunella	0	cg						
			Drunella coloradensis	0	p						
			Drunella flavilinea	0	cg				9		
			Drunella spinifera	0	p						
			Epeorus	0	sc						
			Ephemerella maculata	1	cg						
			Ephemerellidae	1	cg						
			Fallceon	4	cg	50		48			
			Ironodes	3	sc						
			Leptohyphidae	4	cg	1					
			Leptophlebiidae	2	cg						
			Matriella teresa	2	cg						
			Paraleptophlebia	4	cg						
			Rhithrogena	0	sc						
			Tricorythodes explicatus	4	cg			2			
		Odonata									
			Anax	8	p						
			Argia	7	p						
			Coenagrionidae	9	p						
			Libellulidae	9	p						
		Plecoptera									
			Calineuria californica	2	p						
			Chloroperlidae	1	p						
			Isoperla	2	p						
			Malenka	2	sh					4	
			Nemouridae	2	sh						
			Osobenus	1	p						
			Perlodidae	2	p						
			Skwala	2	p						
			Suwallia	1	p				5		
			Sweltsa	1	p						
			Zapada	2	sh						3
			Zapada cinctipes	2	sh						
		Hemiptera									
			Ambrysus	5	p						
			Corisella decolor	8	p						
			Corixidae	8	p						

Table D6 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC467	802SWC483	802SWC494	802SWC501	801S00791	
										1	2
		Trichoptera									
			Agapetus	0	sc						
			Arctopsyche	4	cf						
			Cheumatopsyche	5	cf	1					
			Farula	0	cg						
			Glossosoma	1	sc						
			Glossosomatidae	0	sc		1				
			Gumaga	3	sh						
			Helicopsyche	3	sc						
			Hydropsyche	4	cf	1	8	23		5	12
			Hydropsychidae	4	cf	3					
			Hydroptila	6	ph	15		19			
			Hydroptilidae	4	ph	2		10			
			Lepidostoma	1	sh						
			Micrasema	1	mh						
			Nectopsyche	3	om						
			Neophylax	3	cg						
			Neotrichia	4	sc					1	
			Ochrotrichia	4	ph		1				
			Oxyethira	3	ph	1					
			Parapsyche	0	p						
			Psychoglypha	2	sh						
			Rhyacophila	0	p						
			Sericostomatidae	3	sh						
			Tinodes	2	sc						
			Trichoptera			1		1			
			Wormaldia	3	cf						
		Coleoptera									
			Berosus	5	p						
			Elmidae	4	cg						
			Enochrus	5	cg			1			
			Helichus	5	sh			1			
			Heterlimnius	4	cg						
			Hydraena	5	p						
			Hydrobius	8	p		1			1	1
			Hydrobius fuscipes	5	p			1			
			Hydrophilus	5	p						
			Hydroporus	5	p						
			Hydroporus occidentalis	5	p						
			Hygrotus	5	p						
			Laccobius	5	cg						
			Lara	4	sh		1				
			Narpus	4	cg						
			Optioservus	4	sc						
			Postelichus	5				1			
			Sanfilippodytes	5	p						
			Staphylinidae								
			Stictotarsus	5	p						
			Tropisternus	5	p						
			Zaitzevia	4	sc						

Table D6 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC467	802SWC483	802SWC494	802SWC501	801S00791 1	801S00791 2
		Diptera									
			Bezzia/Palpomyia	6	p						
			Blepharicera	0	sc						
			Caloparyphus	7	cg						
			Caloparyphus/Euparyphus	8	cg	4		3			
			Caudatella	1	cg						
			Ceratopogonidae	6	p						
			Chironomidae	6	cg	80	386	43	52	28	78
			Chrysops	8	p						
			Clinocera	6	p		4				
			Culicoides								
			Dasyhelea	6	cg						
			Dicranota	3	p						
			Diptera								
			Dixa	2	cg						
			Dixidae	2	cg						
			Dolichopodidae	4	p			1		2	
			Empididae	6	p						
			Ephydridae	6				34			
			Euparyphus	8	cg	1				2	6
			Glutops	3	p						
			Hemerodromia	6	p		2	1		1	
			Hexatoma	2	p						
			Limonia	6	sh						
			Limoniinae	3							
			Maruina lanceolata	2	sc						
			Metachela/ Chelifera	6	p						
			Muscidae	6	p	1	2	4			
			Neoplasta	6	p		1				
			Pedicia	1	sh						
			Pericoma/Telmatoscopus	4	cg						
			Phoridae		cg						
			Probezzia	6	p		1				
			Psychodidae		cg			18			
			Sciomyzidae	6	p						
			Simulium	6	cf	4	8	27	30	28	58
			Simulium arcticum	6	cf					1	
			Simulium argus	6	cf		23	21		108	86
			Simulium canadense	6	cf				95	75	29
			Simulium clarum/ venator	6	cf						
			Simulium defoliarti	6	cf				227		
			Simulium donovani	6	cf	1					3
			Simulium hippovorum	6	cg		5			138	31
			Simulium hunteri	6	cf						
			Simulium jacumbae	6	cf						
			Simulium piperi	6	cf						
			Simulium tescorum	6	cf			9			
			Simulium vittatum	6	cf						
			Stratiomyidae	8	cg						
			Tabanidae	8	p		2				
			Tipula	4	om					1	
			Tipulidae	3							

Table D6 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC467	802SWC483	802SWC494	802SWC501	801S00791 1	801S00791 2
		Lepidoptera									
			Petrophila	5	sc						
		Megaloptera									
			Neohermes	0	p						
			Orohermes	0	p						
	Non-Insecta Taxa										
		Oligochaeta		5	cg	3	7				2
		Ostracoda		8	cg	113		2	1		
		Turbellaria		4	p						
		Amphipoda									
			Crangonyctidae	4	cg	1					
			Gammarus	6	cg	3					
			Hyalella	8	cg	4					
		Arhynchobdellida									
			Erpobdellidae	8	p						
		Basommatophora									
			Ferrissia	6	sc						
			Lymnaea	6	sc						
			Menetus opercularis								
			Physa	8	sc	99					
		Hypsogastropoda									
			Hydrobiidae	8	sc						
			Pyrgulopsis		sc						
		Neotaenioglossa									
			Melanoides tuberculatus		sc						
		Trombidiformes									
			Atractides	8	p	1	2				
			Frontipoda		p						
			Lebertia	8	p	1					
			Protzia	8	p						
			Sperchon	8	p	5	8	3			
			Sperchonopsis	8	p						
			Torrenticola	5	p						
			Wandesia	5	p						
		Veneroida									
			Corbicula	8	cf						
			Pisidium	8	cf						
			TOTAL			**500**	**500**	**277**	**500**	**500**	**500**

Table D7. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC511	801S00903	801S01367	801S01523	801S01559	801S01655
Insecta Taxa											
	Ephemeroptera										
			Ameletus	0	cg						
			Baetidae	4	cg						
			Baetis	5	cg	4	20	102	195	11	48
			Baetis adonis	5	cg	28		2			9
			Baetis tricaudatus	6	cg		3	5	219	103	169
			Caudatella heterocaudata	1	cg		27		2		
			Caudatella hystrix	1	cg						
			Cinygmula	4	sc						
			Diphetor hageni	5	cg						
			Drunella	0	cg				9		1
			Drunella coloradensis	0	p			1	5		
			Drunella flavilinea	0	cg					1	1
			Drunella spinifera	0	p		2				
			Epeorus	0	sc		2	9	1		
			Ephemerella maculata	1	cg		3				
			Ephemerellidae	1	cg		7	1			
			Fallceon	4	cg	4					5
			Ironodes	3	sc						
			Leptohyphidae	4	cg						
			Leptophlebiidae	2	cg						
			Matriella teresa	2	cg		13				
			Paraleptophlebia	4	cg						
			Rhithrogena	0	sc		1		2		
			Tricorythodes explicatus	4	cg						
	Odonata										
			Anax	8	p						
			Argia	7	p						
			Coenagrionidae	9	p						
			Libellulidae	9	p			1			
	Plecoptera										
			Calineuria californica	2	p						
			Chloroperlidae	1	p						
			Isoperla	2	p			1			
			Malenka	2	sh			49		1	1
			Nemouridae	2	sh			2			
			Osobenus	1	p		1				
			Perlodidae	2	p						
			Skwala	2	p						
			Suwallia	1	p						
			Sweltsa	1	p						
			Zapada	2	sh						
			Zapada cinctipes	2	sh						
	Hemiptera										
			Ambrysus	5	p						
			Corisella decolor	8	p						
			Corixidae	8	p						

Table D7 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	802SWC511	801S00903	801S01367	801S01523	801S01559	801S01655
		Trichoptera									
			Agapetus	0	sc			21	1	1	2
			Arctopsyche	4	cf						
			Cheumatopsyche	5	cf						
			Farula	0	cg						
			Glossosoma	1	sc						
			Glossosomatidae	0	sc			14			
			Gumaga	3	sh						
			Helicopsyche	3	sc						
			Hydropsyche	4	cf	10	1	90	31	10	17
			Hydropsychidae	4	cf				2		
			Hydroptila	6	ph						1
			Hydroptilidae	4	ph	1			1		1
			Lepidostoma	1	sh			27		1	
			Micrasema	1	mh		2	9			
			Nectopsyche	3	om						
			Neophylax	3	cg						
			Neotrichia	4	sc						
			Ochrotrichia	4	ph	3			1		
			Oxyethira	3	ph						
			Parapsyche	0	p			2			
			Psychoglypha	2	sh						
			Rhyacophila	0	p		5	19	6		
			Sericostomatidae	3	sh						
			Tinodes	2	sc						
			Trichoptera					1			
			Wormaldia	3	cf						
		Coleoptera									
			Berosus	5	p						
			Elmidae	4	cg						
			Enochrus	5	cg						
			Helichus	5	sh						1
			Heterlimnius	4	cg						
			Hydraena	5	p						
			Hydrobius	8	p	2					
			Hydrobius fuscipes	5	p						
			Hydrophilus	5	p						
			Hydroporus	5	p						
			Hydroporus occidentalis	5	p						1
			Hygrotus	5	p						
			Laccobius	5	cg						
			Lara	4	sh						
			Narpus	4	cg			1			
			Optioservus	4	sc			1			
			Postelichus	5							
			Sanfilippodytes	5	p	2					
			Staphylinidae								
			Stictotarsus	5	p			19			
			Tropisternus	5	p						
			Zaitzevia	4	sc						1

Table D7 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	802SWC511	801S00903	801S01367	801S01523	801S01559	801S01655
		Diptera									
			Bezzia/Palpomyia	6	p	2	1				
			Blepharicera	0	sc						
			Caloparyphus	7	cg						
			Caloparyphus/Euparyphus	8	cg				1		1
			Caudatella	1	cg						
			Ceratopogonidae	6	p		1				
			Chironomidae	6	cg	339	159	74	13	44	54
			Chrysops	8	p						
			Clinocera	6	p			1	1		
			Culicoides								
			Dasyhelea	6	cg						
			Dicranota	3	p			2			
			Diptera								
			Dixa	2	cg			3			
			Dixidae	2	cg			2			
			Dolichopodidae	4	p				1		
			Empididae	6	p					3	
			Ephydridae	6							
			Euparyphus	8	cg						
			Glutops	3	p						
			Hemerodromia	6	p						
			Hexatoma	2	p						
			Limonia	6	sh						
			Limoniinae	3							
			Maruina lanceolata	2	sc						
			Metachela/ Chelifera	6	p						
			Muscidae	6	p	1					
			Neoplasta	6	p			1			2
			Pedicia	1	sh		1				
			Pericoma/Telmatoscopus	4	cg						
			Phoridae		cg						
			Probezzia	6	p						
			Psychodidae		cg						
			Sciomyzidae	6	p						
			Simulium	6	cf	1	2	3		8	1
			Simulium arcticum	6	cf						
			Simulium argus	6	cf	61				7	9
			Simulium canadense	6	cf						
			Simulium clarum/ venator	6	cf						
			Simulium defoliarti	6	cf						
			Simulium donovani	6	cf	5					
			Simulium hippovorum	6	cg		237		2	308	
			Simulium hunteri	6	cf						
			Simulium jacumbae	6	cf						
			Simulium piperi	6	cf						
			Simulium tescorum	6	cf						
			Simulium vittatum	6	cf						5
			Stratiomyidae	8	cg						
			Tabanidae	8	p						
			Tipula	4	om			1			
			Tipulidae	3							

Table D7 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	802SWC511	801S00903	801S01367	801S01523	801S01559	801S01655
		Lepidoptera									
			Petrophila	5	sc						
		Megaloptera									
			Neohermes	0	p			2			
			Orohermes	0	p						
	Non-Insecta Taxa										
		Oligochaeta		5	cg	4	2		2	1	1
		Ostracoda		8	cg	19		15	3	1	1
		Turbellaria		4	p						
		Amphipoda									
			Crangonyctidae	4	cg						
			Gammarus	6	cg						
			Hyalella	8	cg						
		Arhynchobdellida									
			Erpobdellidae	8	p						
		Basommatophora									
			Ferrissia	6	sc						
			Lymnaea	6	sc						
			Menetus opercularis								
			Physa	8	sc	2					
		Hypsogastropoda									
			Hydrobiidae	8	sc						
			Pyrgulopsis		sc			6			
		Neotaenioglossa									
			Melanoides tuberculatus		sc						
		Trombidiformes									
			Atractides	8	p	9		5			1
			Frontipoda		p						
			Lebertia	8	p			7			
			Protzia	8	p						
			Sperchon	8	p	3			2		4
			Sperchonopsis	8	p			1			
			Torrenticola	5	p						
			Wandesia	5	p		10				
		Veneroida									
			Corbicula	8	cf						
			Pisidium	8	cf						
			TOTAL			**500**	**500**	**500**	**500**	**500**	**337**

Table D8. BMI's collected, adjusted to counts via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801S02123	801S02464	801S02749	802S03234	802S10146	802S11394	802S25288
Insecta Taxa												
	Ephemeroptera											
		Ameletus		0	cg							1
		Baetidae		4	cg							
		Baetis		5	cg	90	36	36	7	57	178	46
		Baetis adonis		5	cg	38				33	4	
		Baetis tricaudatus		6	cg		99	48			94	21
		Caudatella heterocaudata		1	cg							
		Caudatella hystrix		1	cg							
		Cinygmula		4	sc							
		Diphetor hageni		5	cg		1					
		Drunella		0	cg							
		Drunella coloradensis		0	p							6
		Drunella flavilinea		0	cg		13				3	
		Drunella spinifera		0	p							
		Epeorus		0	sc		4					
		Ephemerella maculata		1	cg							
		Ephemerellidae		1	cg							
		Fallceon		4	cg	30		47	1			
		Ironodes		3	sc		1					
		Leptohyphidae		4	cg							
		Leptophlebiidae		2	cg		1			11		
		Matriella teresa		2	cg							
		Paraleptophlebia		4	cg					6	1	
		Rhithrogena		0	sc							
		Tricorythodes explicatus		4	cg	1						
	Odonata											
		Anax		8	p							1
		Argia		7	p							
		Coenagrionidae		9	p							
		Libellulidae		9	p							
	Plecoptera											
		Calineuria californica		2	p							
		Chloroperlidae		1	p							
		Isoperla		2	p						1	1
		Malenka		2	sh							
		Nemouridae		2	sh							
		Osobenus		1	p							
		Perlodidae		2	p							
		Skwala		2	p							
		Suwallia		1	p							
		Sweltsa		1	p							
		Zapada		2	sh		9					
		Zapada cinctipes		2	sh							
	Hemiptera											
		Ambrysus		5	p							
		Corisella decolor		8	p							
		Corixidae		8	p							

Table D8 continued part 1. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801S02123	801S02464	801S02749	802S03234	802S10146	802S11394	802S25288
		Trichoptera										
			Agapetus	0	sc							2
			Arctopsyche	4	cf							
			Cheumatopsyche	5	cf							
			Farula	0	cg							
			Glossosoma	1	sc							
			Glossosomatidae	0	sc						18	8
			Gumaga	3	sh						4	1
			Helicopsyche	3	sc	1						
			Hydropsyche	4	cf						3	
			Hydropsychidae	4	cf							
			Hydroptila	6	ph	11			1	1		
			Hydroptilidae	4	ph	3			2			
			Lepidostoma	1	sh						4	2
			Micrasema	1	mh					8	7	4
			Nectopsyche	3	om							
			Neophylax	3	cg							
			Neotrichia	4	sc							
			Ochrotrichia	4	ph							
			Oxyethira	3	ph							
			Parapsyche	0	p		6					
			Psychoglypha	2	sh				1			
			Rhyacophila	0	p		8					
			Sericostomatidae	3	sh						1	1
			Tinodes	2	sc							
			Trichoptera							2		
			Wormaldia	3	cf						1	
		Coleoptera										
			Berosus	5	p							
			Elmidae	4	cg							
			Enochrus	5	cg							
			Helichus	5	sh							
			Heterlimnius	4	cg							
			Hydraena	5	p							
			Hydrobius	8	p							
			Hydrobius fuscipes	5	p							
			Hydrophilus	5	p							
			Hydroporus	5	p							
			Hydroporus occidentalis	5	p							
			Hygrotus	5	p							
			Laccobius	5	cg			1				
			Lara	4	sh							
			Narpus	4	cg							
			Optioservus	4	sc							
			Postelichus	5								
			Sanfilippodytes	5	p				2	1		
			Staphylinidae									
			Stictotarsus	5	p							
			Tropisternus	5	p							
			Zaitzevia	4	sc							

Table D8 continued part 2. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

Identified Taxa				Tol Val (TV)	Func Feed Grp	801S02123	801S02464	801S02749	802S03234	802S10146	802S11394	802S25288
		Diptera										
			Bezzia/Palpomyia	6	p				5	1		
			Blepharicera	0	sc							
			Caloparyphus	7	cg							
			Caloparyphus/Euparyphus	8	cg	5		112				
			Caudatella	1	cg							
			Ceratopogonidae	6	p							
			Chironomidae	6	cg	130	56	41	324	99	87	84
			Chrysops	8	p				1			
			Clinocera	6	p				3	2		
			Culicoides									
			Dasyhelea	6	cg							
			Dicranota	3	p						1	
			Diptera							1		
			Dixa	2	cg		1					
			Dixidae	2	cg							
			Dolichopodidae	4	p	2		3			1	
			Empididae	6	p		1					
			Ephydridae	6								
			Euparyphus	8	cg			8				
			Glutops	3	p							
			Hemerodromia	6	p							
			Hexatoma	2	p							
			Limonia	6	sh						1	
			Limoniinae	3								
			Maruina lanceolata	2	sc						10	3
			Metachela/ Chelifera	6	p							
			Muscidae	6	p			5	2	4		
			Neoplasta	6	p					1		2
			Pedicia	1	sh							
			Pericoma/Telmatoscopus	4	cg			6				
			Phoridae		cg							
			Probezzia	6	p							
			Psychodidae		cg			1				
			Sciomyzidae	6	p							
			Simulium	6	cf	32	13		15	38	2	34
			Simulium arcticum	6	cf							
			Simulium argus	6	cf	129		150				
			Simulium canadense	6	cf		247				2	130
			Simulium clarum/ venator	6	cf							
			Simulium defoliarti	6	cf							
			Simulium donovani	6	cf			2	8			
			Simulium hippovorum	6	cg	20					5	147
			Simulium hunteri	6	cf				1			
			Simulium jacumbae	6	cf							
			Simulium piperi	6	cf				21		3	1
			Simulium tescorum	6	cf						1	
			Simulium vittatum	6	cf							
			Stratiomyidae	8	cg			1				
			Tabanidae	8	p							
			Tipula	4	om							
			Tipulidae	3								

Table D8 continued part 3. BMI's collected, adjusted to counts of 500 via Monte Carlo method.

			Identified Taxa	Tol Val (TV)	Func Feed Grp	801S02123	801S02464	801S02749	802S03234	802S10146	802S11394	802S25288
		Lepidoptera										
			Petrophila	5	sc							
		Megaloptera										
			Neohermes	0	p							
			Orohermes	0	p		1					
	Non-Insecta Taxa											
		Oligochaeta		5	cg	1		1	96	218	13	4
		Ostracoda		8	cg	1		38				
		Turbellaria		4	p							
		Amphipoda										
			Crangonyctidae	4	cg							
			Gammarus	6	cg							
			Hyalella	8	cg					3		
		Arhynchobdellida										
			Erpobdellidae	8	p							
		Basommatophora										
			Ferrissia	6	sc							
			Lymnaea	6	sc					9		
			Menetus opercularis									
			Physa	8	sc	2			8	3	1	
		Hypsogastropoda										
			Hydrobiidae	8	sc							
			Pyrgulopsis		sc							
		Neotaenioglossa										
			Melanoides tuberculatus		sc							
		Trombidiformes										
			Atractides	8	p	1			1	2	1	1
			Frontipoda		p							
			Lebertia	8	p							
			Protzia	8	p							
			Sperchon	8	p	3	3		1			
			Sperchonopsis	8	p							
			Torrenticola	5	p							
			Wandesia	5	p							
		Veneroida										
			Corbicula	8	cf							
			Pisidium	8	cf							
			TOTAL			**500**	**500**	**500**	**500**	**500**	**447**	**500**