# BASELINE MONITORING REPORT

# SAMPLE YEARS 2005, 2006 AND 2007

# BLACK CANYON OF THE BEAR RIVER, IDAHO

**Prepared for PacifiCorp**
**&**
**the Environmental Coordination Committee**

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AFDW | Ash-Free Dry Weight |
| AI | Autotrophic Index |
| ANOVA | Analysis of Variance |
| APHA | American Public Health Association |
| BF | Bankfull |
| BMI | Benthic macroinvertebrate |
| BWD ratio | Bankfull width / bankfull water depth |
| CFS | Cubic Feet per Second |
| CL | Confidence Level |
| $cm^2$ | square centimeters |
| CPUE | Catch per Unit Effort |
| ECC | Environmental Coordination Committee |
| FERC | Federal Energy Regulatory Commission |
| g | Grams |
| ID DEQ | Idaho Department of Environmental Quality |
| $m^2$ | square meters |
| mg | Milligrams |
| MSE | Mean square error |
| R | Reach |
| RBT | Rainbow Trout |
| ΔT | Temperature Difference |
| T | Transect |
| µG | Micrograms |
| WP | Wetted Perimeter |
| Wr | Relative Weight |
| WY | Water Year |

# EXECUTIVE SUMMARY

In December 2003 PacifiCorp received a new operating license for the Bear River Hydroelectric Project (FERC No. 20) located in southeast Idaho. The new license includes a condition requiring PacifiCorp to implement and study a variable flow regime at the Grace Hydropower Facility in the 6.2 mile reach known as the Black Canyon between Grace Dam and the Grace powerhouse. PacifiCorp, in collaboration with the Environmental Coordination Committee (ECC), developed the Bear River Black Canyon Monitoring Study to examine the effect of variable flow regime on the river channel shape, substrate and aquatic biota. Specifically the Black Canyon Monitoring Plan includes investigation of: 1) Channel Morphology—shape and substrate composition; 2) Periphyton—chlorophyll concentration and biomass; 3) Filamentous Algae—density; 4) Fisheries—population trends, community composition, fish condition; 5) Macroinvertebrates—population trends, diversity and community indices; and 6) Organic Matter Ash-Free Dry Weight (AFDW).

The monitoring effort comprises four study reaches. Reach 1, partially regulated by Bear Lake, serves as the reference reach. Reaches 2, 3 and 4, subject to the variable flow regime below Grace Dam, serve as the experimental reaches. The monitoring study spans six-years of data collection. The first three-years serve as a baseline period collecting data in all reaches prior to implementation of the variable flow regime. The second three-year term, years four through six, serve as the experimental phase when reaches 2, 3 and 4 will be subjected to flows ranging from 800 to 1500 cfs, approximately 700 to 1400 cfs greater than the minimum instream flow of 65 cfs below Grace Dam. Field sampling occurs once annually in October. Field sampling was initiated in October 2005 and will conclude October 2010. This narrative reports on the first three-years of baseline monitoring.

In 2005, distinct differences in biological and physical habitat characteristics were detected between respective study reaches. These differences between reaches were also observed in 2006 and 2007. Due to these distinct differences, comparative analysis between sample years (2005 through 2007) focused largely on changes over time within a respective reach rather than between reaches.

Channel morphology was monitored in reaches 2 and 3 only located downstream of Grace Dam. Channel shape and structure characteristics remained largely unchanged in these reaches over the three year baseline monitoring period. Discharge remained relatively stable for the three-year period below Grace Dam. In September 2006 a pulse release occurred to assist channel restoration efforts in the former Cove impoundment. The daily average flow did not exceed 150 cfs. The instantaneous maximum was reported to be approximately 500 cfs. This discharge event did not appear to be of sufficient magnitude to alter the channel shape or structure in reaches 2 and 3 in 2006. In 2007, flows tracked the minimum instream flow (MIF) for the most part with several instances nearly reaching 200 cfs.

The periphyton metrics exhibited considerable sample variability between means for respective sample years. The high degree of periphyton sample variance could be due to the heterogeneity inherent in stream habitats. Despite the high degree of variability between samples significant differences within individual reaches were observed over the three-year baseline monitoring period. Periphyton AFDW was significantly different between sample years in reaches 1 and 3 but similar in reaches 2 and 4 over the three-year sample period. Chlorophyll a was significantly different between years in reach 1 but similar in reaches 2, 3 and 4 over the three-years. Chlorophyll b and c was significantly different in reaches 1, 2 and 3 but similar in reach 4. The autotrophic index (AI) was significantly different between sample years for reaches 1, 2 and 3 over the three-year baseline monitoring period but similar in reach 4 for the same time frame. AI was substantially greater in reach 1 in all three sample years compared to reaches 2, 3 and 4.

Filamentous algae coverage was significantly different between sample years in reach 2 only. These differences were not attributed to changes in discharge between sample years in reach 2. Algal coverage in reaches 1, 3 and 4 respectively was similar over the three-year period.

Seven fish species were collected in the four reaches over the three-year baseline monitoring period. Reaches 1 and 4 contained 5 species each while reaches 2 and 3 had 4 species each. Reach 4 was the only reach where rainbow trout were collected with the exception of a single rainbow collected in reach 3 in the October 2006 sampling effort. Longnose dace and Utah sucker were the only species collected in all 4 reaches. Reaches 3 and 4 typically had the highest density of fish for each respective sample year while reach 2 was consistently the lowest density.

Multi-year comparisons indicate that there was a high degree of variability in total catch, catch rates, and biomass between years in reaches 1, 3, and 4 respectively. Differences in fish density between years for respective study reaches might be due to a number of factors including differences in discharge, stocking schedule, angling closures and lastly Cove Dam removal in September of 2006 downstream of reach 4. Fish species richness for respective study reaches varied over the three-year period but the dominant taxa in the fish community remained relatively consistent between years. The differences in fish species richness was likely due to collection of an uncommon taxa for a respective study reach that was missed in other sampling years.

The high degree of variability in the fish community for respective reaches during the baseline monitoring period will make it difficult to detect differences between the baseline monitoring and experimental phase when the whitewater releases occur. Reach 2 consistently had less variation than the other reaches over the three-year baseline period and, therefore, statistical tests will have more power to detect potential differences under the whitewater flow regime. For all four study reaches, relative species composition had relatively little variation between samples years within respective study reaches. The dominant 1 or 2 species in each reach were consistent between sample years. Consequently, the relative fish species composition data from 2005 through 2007 should be useful for comparisons with the data collected during the experimental phase.

The benthic macroinvertebrate (BMI) community density was similar over the three-year sampling period for respective reaches although densities and community composition differed significantly between reaches each year. Comparisons within respective study reaches across the three-year period indicated some significant differences for individual BMI metrics such as taxa richness and community composition. This inter-annual differences could be the result of spatial and temporal variability inherent in BMI distribution and not necessarily changes in the community between sample years. Reach 4 was dominated by the non-native New Zealand Mud Snail (NZMS). This invasive species comprised approximately 80% of the BMI community each sample year but was not observed in reaches 1, 2 or 3. Further investigation may be warranted to determine when this taxa was first introduced to the Bear River system and potential consequences on the rainbow trout population in reach 4 as well as bonneville cutthroat trout restoration efforts.

Statistical power analysis of BMI taxa richness in 2006 and 2007 indicated the single surber (SS) sample was more sensitive at detecting small changes in taxa numbers than the composite surber (CS) sample. Taxa richness in the SS samples was directly proportional to the CS samples in 2006 and 2007 indicating that although the SS samples capture fewer taxa than the CS samples the former sampling method tracked changes between years in a similar manner. Variability was greater in the composite samples likely due to the increased number of microhabitats sampled, particularly inclusion of stream margin habitats typically occupied by different taxa than those commonly found in the thalweg. Gradients of increasing taxa richness below impoundments should be expected, but this gradient was only apparent among the SS samples not the CS samples. For ecological monitoring studies, sampling design should be optimized to detect ecologically relevant changes in community structure. The sampling program should be adequate to statistically detect an ecologically relevant amount of change—otherwise, "no significant difference" may be reported simply because the data were too variable for the number of replicates used. Using the CS samples there is a greater likelihood of making Type I and II errors than using the SS samples.

# 1. INTRODUCTION

The effects of flow regulation on stream ecology and fish populations have been and will continue to be widely studied throughout the world (Petts 1984; Naiman and Bilby 1998). Many studies have been and will be conducted in conjunction with the relicensing of hydroelectric projects. These studies are designed in part to evaluate operational effects on downstream water quality and quantity, aquatic biota and habitats, channel structure and stability and on recreational activities such as rafting and fishing.

In December 2003 PacifiCorp received a new operating license for the Bear River Hydroelectric Project (FERC No. 20) located in southeast Idaho. The new license includes a condition requiring PacifiCorp to implement and study a variable flow regime at the Grace Hydropower Facility in the 6.2 mile reach known as the Black Canyon between Grace Dam and the Grace powerhouse. PacifiCorp, in collaboration with the Environmental Coordination Committee (ECC), developed a monitoring plan for the Black Canyon of the Bear River to characterize the aquatic biota and habitat responding to the new minimum instream flow regime and compare those results with the aquatic biota and habitat resulting from the variable flow regime associated with recreational whitewater boating flows.

This study plan focuses specifically on the effect of the variable flow regimes on aquatic biota and habitat in the Black Canyon of the Bear River in southeast Idaho. The study is designed to evaluate and quantify changes in the abundance, composition and distribution of aquatic biota and habitat longitudinally across sites and through time as well as compare post-disturbance conditions to a reference reach.

In years 2005-2007 Phase I monitoring studies were conducted to characterize the aquatic biota and habitat present under the new minimum instream flow conditions in the FERC license. In years 2008-2010, the FERC license requires PacifiCorp to provide periodic whitewater boating flows below Grace Dam. The objective in the 2008-2010 Phase II study is to characterize the aquatic biota and associated habitat exposed to variable flow regimes resulting from whitewater releases. Data from the 2005-2007 Phase I study will be compared to results from the 2008-2010 Phase II study to determine the effects of whitewater releases from Grace Dam on fisheries, macroinvertebrates, periphyton and aquatic habitat at three study reaches located in the 6.2 mile bypass reach.

Specifically the Black Canyon Monitoring Plan includes investigation of: 1) Macroinvertebrates—population trends, diversity and community indices; 2) Organic Matter Ash-Free Dry Weight (AFDW); 3) Periphyton—chlorophyll concentration and biomass; 4) Fisheries—population trends, community composition, fish condition; 5) Filamentous Algae—density; and 6) Channel Morphology—shape and substrate composition.

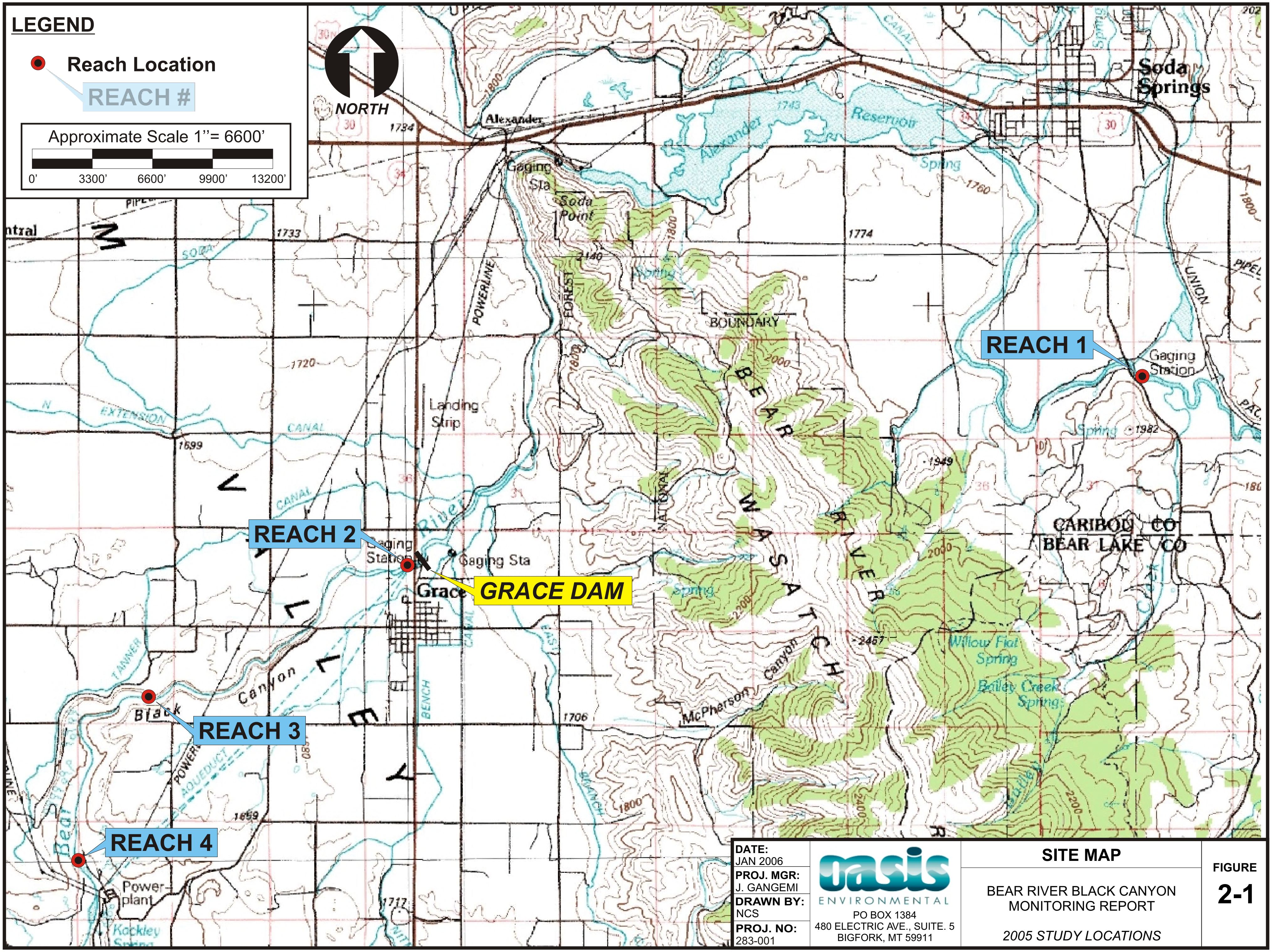
The Black Canyon Monitoring Plan includes a reference reach located upstream of Soda Reservoir and three experimental reaches within the Black Canyon. The reference reach is not subjected to the flow fluctuations associated with the whitewater releases but is partially regulated by Bear Lake. Field sampling will occur once annually in October. Field sampling was initiated in October 2005 and will conclude in October 2010.

# 2. STUDY AREA

The Bear River originates in Summit County, Utah in the northern Uinta Mountains in the Wasatch National Forest. From an aerial perspective, the Bear River is a giant three state loop originating in Utah, traversing north into Wyoming then curving west into southeast Idaho before bending in a southerly direction back into Utah and emptying into the Great Salt Lake. This circuitous route is dictated by the north-south orientation of mountain chains and corresponding valleys. In the higher elevation zones, snow is the dominant form of precipitation. Accordingly, the majority of the annual hydrograph occurs during spring snowmelt.

Since European settlement in the 1850's numerous water diversion dams and storage reservoirs have been constructed on the Bear River for irrigating agricultural lands. The most notable storage was the diversion of water into the formerly closed basin Bear Lake via Stewart Dam and an associated canal system. This canal system greatly increased the storage capacity in the Bear River basin and consequently altered the annual hydrograph significantly below this diversion point. In the 1900's, additional dams and diversions were constructed for hydropower generation and irrigation.

This study encompasses four study reaches (Figure 2-1). Reach 1 located upstream of Soda Reservoir serves as the reference reach for this study. Reaches 2, 3, and 4, located downstream of Grace Dam, serve as the experimental reaches. This 6.2 mile section of the Bear River below Grace Dam is known as the Black Canyon named after the basalt walls of the incised canyon. Approximately 0.5 miles downstream of Grace Dam, the Bear River cuts through a basalt bedrock layer into the Black Canyon. The river gradient in the Black Canyon is considerably steeper relative to upstream and downstream reaches. In the Black Canyon the character of the Bear River alternates between steep cascades, plunge pools, riffles and runs. Channel shape and structure is dominated by bedrock ledges and large boulders. In contrast, reach 1 upstream of Soda Reservoir has a flatter gradient and more closely resembles an alluvial channel with alternating erosion and deposition zones.

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SITE MAP

BEAR RIVER BLACK CANYON MONITORING REPORT

*2005 STUDY LOCATIONS*

FIGURE 2-1

## 2.1 REACH 1: UPSTREAM OF SODA RESERVOIR

Reach 1 was located approximately 1 mile upstream of Soda Reservoir. Five transects were sampled in a 0.25 mile reach directly upstream of Bailey Road. This section of the Bear River was located in a broad alluvial valley. The reach was a Rosgen C type channel. The predominant habitat type was alternating riffles and runs with clearly demarcated scour and deposition zones exhibited by the gravel/cobble point bars above the wetted perimeter. Bankfull zones were clearly delineated by grasses and woody vegetation. The substrate was highly embedded with fine silt and sand. In higher velocity riffle areas substrate was less embedded. In lower velocity runs a thick mat of periphytic algae blanketed cobbles and gravels further trapping fine sediments.

Reach 1 served as the reference reach for comparison with reaches 2, 3 and 4 which were scheduled for periodic spring flow fluctuations required in the new FERC license for the Grace hydropower project. Instream flows in reach 1 were partially regulated by a combination of upstream dams and reservoirs. The peaks in the spring snowmelt hydrograph were buffered by upstream reservoir storage. Instream flows remained above normal through August and early September to meet downstream irrigation needs. Discharge averaged 118 cfs during the October sampling effort in 2007.

## 2.2 REACH 2: DOWNSTREAM OF GRACE DAM

Reach 2 was located directly downstream of Grace Dam just west of the Highway 34 bridge and the power canal viaduct. Instream flows were relatively stable year-round regulated by releases from Grace Dam. Discharge averaged 82 cfs during the 2007 October sampling effort. Transects A through E spanned approximately 800 meters from upstream to downstream. Transects A through C were indicative of the scour and deposition found in alternating pool and riffle stream habitat types with the exception that the pool areas are largely filled in with sand and silt. This reach was a Rosgen Type C channel. Transects D and E were distinctly different than transects A, B and C. The gradient increased slightly and the substrate shifted to larger particle sizes including extensive bedrock shelves in transect D. Transects D and E were located at the nick point where the Bear River begins cutting through the basalt shelf into the Black Canyon.

## 2.3 REACH 3: BLACK CANYON

Reach 3 was located in the incised canyon of the Bear River known as the Black Canyon. Instream flows were relatively stable year-round regulated by releases from Grace Dam. Discharge averaged from 82 cfs during the 2007 October sampling effort. Mladenka and Van Every (2004) established five transects in an ascending order from downstream to upstream, starting with transect 6 and ending with transect 10. For the six-year Black Canyon monitoring study the transects in reach 3 were re-labeled to A, B, C, D and E in descending order from upstream to downstream for consistency with naming conventions in reaches 1, 2 and 4.

Reach 3 was approximately 400 meters long. The reach began 100 meters upstream of a sweeping left hand turn and continued through the turn, ending approximately 25 meters below it. This section of river channel was constrained and defined by the basalt bedrock of the Black Canyon. The outside of the bend (right bank) was defined by the edge of a talus slope stretching down from the top of the canyon walls, 180 ft in elevation above the stream. Much of reach 3 was run type habitat with the exception of Transect A which was riffle habitat. Transect E was located at the start of a 300 meter long pool. Scour around boulders on the right bank formed "pocket water" adjacent to the boulders. Deposition of gravel and sand material formed point bars on the river left bank heavily vegetated with perennials and in some cases woody shrubs. Reach 3 resembled a Rosgen Type C channel.

## 2.4 REACH 4: BEAR RIVER ABOVE GRACE POWER PLANT

Reach 4 was located at the downstream end of the Black Canyon, approximately 6.2 miles downstream of Grace Dam. This reach was just upstream of the Grace power plant. Discharge averaged 112 cfs during the 2007 October sampling period. Discharge in reach 4 was approximately 30 cfs greater than reaches 2 and 3 due to inflows from spring sources just upstream of reach 4. This reach resembled a Rosgen Type B channel. The channel consisted of high velocity laminar flow over basalt bedrock ledges with corresponding plunge pools. Basalt bedrock ledges were the dominant substrate type. Large mats of filamentous algae clung to a significant percentage of the bedrock substrate.

# 3. METHODS

Field and laboratory methods used for the six-year Black Canyon monitoring study are described for each discipline. Hydrology data for reach 1 and reach 2 was obtained from PacifiCorp. Temperature data for reaches 1, 2 and 4 was obtained from the Idaho Department of Environmental Quality (ID DEQ).

## *3.1 CHANNEL SURVEY*

Channel shape and substrate type were surveyed in October at two of the four study areas. The two reaches surveyed were reach 2 and reach 3, located below the Grace Dam and in the middle of Black Canyon respectively. Five transects were surveyed in each reach. The locations of the transects were pre-selected by staff from the Idaho Department of Environmental Quality (Mladenka and Van Every 2004). Each transect was marked with 18" rebar stakes located on both banks, perpendicular to stream flow. The stakes located on the river right bank were labeled with stamped metal tags describing the transect number and location.

In 2005, surveys were conducted with a CST/Berger precision autolevel and metric stadia rod. The 2006 and 2007 surveys were conducted with a Leica Total Station and rod mounted prism. Surveyed elevations for each cross section included right and left bank pins, bankfull, wetted perimeter and channel elevations. The latter elevations were taken at major elevation changes or in one meter increments, whichever occurred first. Substrate type was recorded with each elevation point.

Surveys of both reaches started with shooting benchmark elevations established in 2004 by Idaho DEQ. These elevations were re-set to 100 meters for calculation purposes.

Bankfull features were difficult to identify in reaches 2 and 3 due to the effects of flow regulation, grazing in reach 2 and vegetation encroachment in reach 3. Deposition zones and scour common in stream systems with fluctuating flow regimes were not evident in reaches 2 and 3. The field crew conducting channel surveys in 2005, 2006 and 2007 consisted of the same individuals each year for consistency identifying bankfull features in these reaches.

## *3.2 SUBSTRATE SURVEY*

Wolman pebble counts were conducted on reaches 2 and 3. The pebble count for reach 2 started at a randomly selected point in transect TD (ID DEQ T4). The pebble count for reach 3 started at a randomly selected point in transect TD (ID DEQ T7). Standard procedures for conducting Wolman pebble counts were followed (Wolman 1954). Particles were classified into six categories: Fines (0-0.062 mm), Sand (0.062-2.0 mm), Gravel (2.0-64 mm), Cobble (64-256 mm), Boulder (256-4096 mm), and Bed Rock. Pebble counts were conducted in an upstream direction due to the high amount of fine sediment mobilized in the water column.

## *3.3 PERIPHYTON*

Periphyton was sampled in all four study reaches using natural substrate material. Cobble substrate was randomly selected in each transect of the four study reaches. After removal from the stream, a 4 cm by 4 cm surface area was immediately scraped with a razor blade and the dislodged material rinsed with deionized water into a Nalgene filtering apparatus containing a 47 mm Gelman A/E glass-fibre filter. Two samples were scraped and filtered from each rock substrate for paired analysis of AFDW and chlorophyll concentrations. Filtered material was stored on dry ice in dark containers to prevent pigment degradation. Periphyton samples were analyzed for the concentration of chlorophyll a, b and c according to the methods described in the Standard Methods for Examination of Water & Wastewater (American Public Heath Association, 20th ed., 1999). Periphyton samples were homogenized and extracted with 90 percent acetone. Chlorophyll concentration was determined using a spectrophotometer correcting for degraded materials within the sample.

## 3.4 FILAMENTOUS ALGAE

Filamentous algae and macrophyte coverage was quantified along five transects in each of the four study reaches. Researchers deployed a 50 cm by 50 cm pvc square sampler further divided into quarter sections by an intersecting grid at 25 cm. The algal coverage for each quarter cell in the grid was recorded as a percentage per cell. The cumulative percent coverage per 0.25 $m^2$ was summed and expressed as filamentous algal coverage per $m^2$.

## 3.5 FISHERIES

Electrofishing was used to sample three designated study reaches and one upstream reference reach of the Bear River. All sampling was conducted from October 9, 2006 to October 11, 2006 under similar stream flow conditions. In October 2007, a Halltech model HT-2000 electrofishing unit was used to sample 100-meter long sections of each reach. For the October 2005 and 2006 sampling events, a Smith-root model 12-B backpack electrofishing unit was used. In each section, a three person crew conducted two consecutive upstream electrofishing passes, collecting all fish possible with dip nets. All captured fish were anesthetized, identified by species, weighed in grams, and total length was measured in millimeters. All rainbow trout captured were checked for freeze-brands and the location and orientation of the freeze-brand was recorded.

For each reach, relative species composition was determined by taking the total number of fish caught of each species, dividing by the total catch of all species, and multiplying by 100 (% of catch). In addition, relative biomass by species was determined for each reach by taking the total weight of each species, dividing by the total weight of all species, and multiplying by 100 (% of biomass). Catch per unit effort (CPUE) was calculated by dividing the total number of fish collected in two passes by the total electrofishing effort in minutes.

Relative weight (Wr) was used to assess the condition of rainbow trout and common carp according to the methods described by Anderson and Neumann (1996). The condition (relative weight) of the other species collected was not determined because the relative weight equations have not been developed for those species or they were not within the applicable length for the equations.

## 3.6 BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrates were sampled in October at all four study reaches. In each reach, five transects were sampled. In 2005, eight BMI samples were combined into a single composite sample for each transect. In total, forty BMI subsamples were collected for each study reach. Individual subsamples were randomly located laterally along each transect encompassing a variety of microhabitats.

In 2006 and 2007 BMI samples were divided into two jars per transect to test the variance in single surber samples verses composite samples. The first surber sample was collected in the thalweg of the transect and preserved in a separate reference jar referred to as the single surber (SS) sample. The remaining seven surber samples were collected laterally along the same transect in a random fashion and combined in the field to become a composite. These seven surber samples were referred to as the composite sample (CS).

Samples were collected using a 400 $cm^2$ surber sampler with 500 µm mesh. The substrate was disturbed to a depth of 10 cm. Individual substrate was scrubbed clean of attached material and organisms. The effort used per collection of each individual sample was consistent throughout all the study reaches. Samples were preserved in 90 percent isopropyl alcohol in the field then decanted in the laboratory and preserved in 95 percent ethanol for long-term storage.

Identification and enumeration was performed by EcoAnalysts in Moscow, Idaho. In 2005, macroinvertebrates were processed according to Idaho DEQ standards. These standards include the identification of 500 organisms to the genus/species-level (or the lowest possible level) for all groups of organisms.

In 2006 and 2007 the laboratory sorting procedure was modified to account for differences in the size of the samples and allow comparisons of the within-site variability between SS samples and CS samples. The SS sample (1/8 of the transect) was sub-sampled to 200 organisms. In the event that the sample contained fewer than 200 organisms, the entire sample was sorted. The CS (7/8 of the transect) was sub-sampled to 500 organisms.

## 3.7 ORGANIC MATTER ASH-FREE DRY WEIGHT

Organic Matter present in BMI samples was quantified using American Public Health Association (APHA) Standard Methods (1999) for Ash-Free Dry Weight (AFDW). A subsample of each composite BMI sample was homogenized, filtered, weighed after drying at 100 ºC and re-weighed again after being placed in the muffle furnace at 500 ºC to measure the amount of organic material expressed as AFDW. The data was standardized to represent the amount of organic material per square meter in grams.

## 3.8 STATISTICAL ANALYSIS

Statistical analysis was carried out using a single factor ANOVA ($\alpha = 0.1$) to compare differences among the four study reaches within a sample year. Statistical comparisons between the three sample years within an individual study reach were undertaken with the single factor ANOVA ($\alpha = 0.1$) and the non-parametric Kruskal-Wallis H-Test.

Taxa richness was used to test BMI sample variability by performing a statistical power analysis assuming the following error rates: $\alpha = \beta = 0.10$. The amount of change required to reject the null hypothesis ($\delta$) was then solved for different sample sizes. This was done for richness determinations from the 500-organism CS samples and the 200-organism SS samples. Thus, $\delta$ measures the amount of change in taxa richness necessary at an individual site to detect a change in community composition. Thus lower $\delta$-values were desired because they indicate methods that were less-likely to fail to detect ecological changes. This method of comparison was limited by the assumption that each site was compared to itself in the future, without the other sites (Cohen 1988). Thus it provided a conservative estimate of power.

To circumvent limitations in the analysis, the statistical power of the overall ANOVA design including all sites was examined. This study design assumed that there was a shift in community composition below Grace dam because this was a well established phenomenon

(Ward and Stanford 1983). The shift in taxa richness was assumed to be subtle (10%) and occurred in a downstream longitudinal fashion over the study area. Thus, the change between sites was 4 taxa and the overall change (from upstream to downstream) was a total of 16 taxa. We used the same error-rate ($\alpha = 0.10$) for this analysis as for the previous site-specific tests. The analysis tested the power ($1- \beta$) to reject the null hypothesis with this error-rate when a four or more taxa gradient actually occurred downstream between each site. This analysis was performed at several replication levels using both the CS 500-organism samples and SS 200-organsim samples with the results were compared graphically.

# 4. RESULTS

The October 2005, 2006 and 2007 monitoring results are organized into the seven resource parameters. Histograms were used to present descriptive statistics (averages and confidence levels, alpha = 0.1) organized by respective reaches and sample years. Statistical analysis using the parametric single factor ANOVA ($\alpha = 0.1$) and the non-parametric Kruskal-Wallis H-Test were used to compare results within an individual site over the three sample years. Non-parametric tests were used in cases where sample variance was significant (Bartlett-Test for homogeneity of variances) thereby violating use of the single factor ANOVA.

Temperature and discharge data were included in this report for individual study reaches where available. Discharge data measured at the USGS gage located upstream of Soda Reservoir and the USGS gage located in the bypass channel below Grace dam were included for comparison of hydrologic differences between the reference site and study reaches 2, 3, and 4 located below the dam as well as instream flow differences during sampling efforts in 2005, 2006 and 2007. The discharge data should be viewed as draft numbers since these were not published, verified discharge data from the USGS. Hourly temperature data for reaches 1, 2, 3 and 4 was obtained from the ID DEQ.

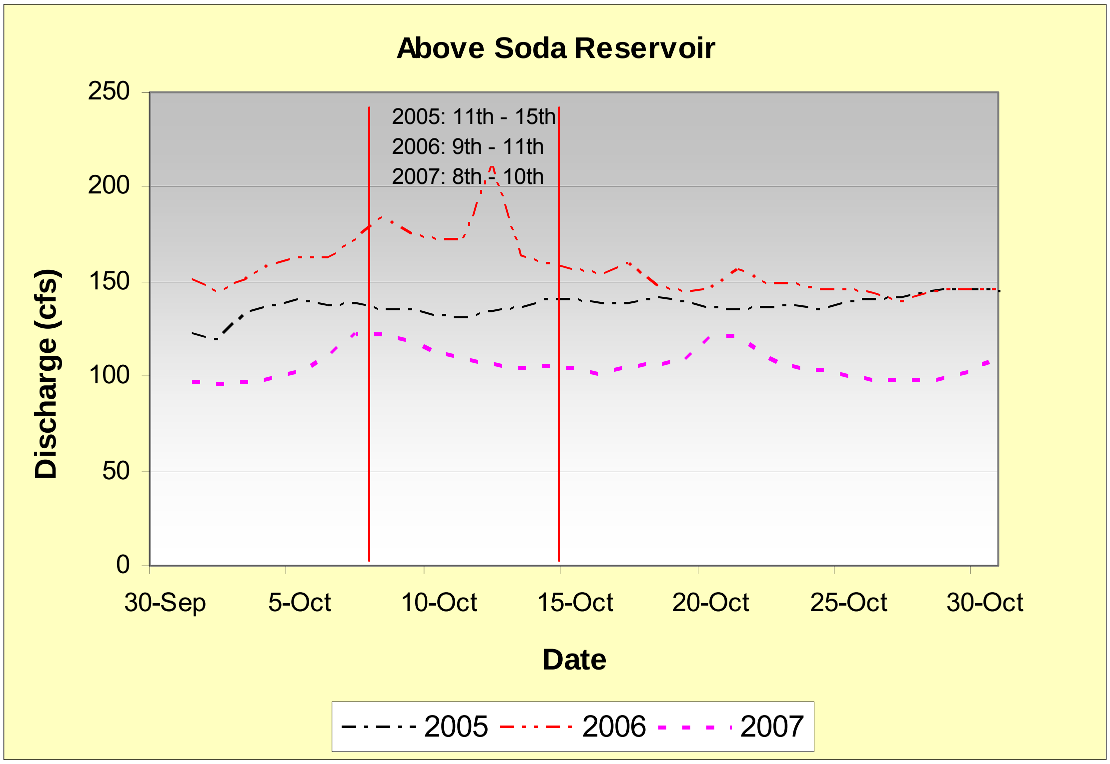
## *4.1 HYDROLOGY*

Discharge in reach 1, the reference reach, averaged 118 cfs during the October 8-10, 2007 sampling period (Figure 4.1-1). This was the lowest average sampling discharge for reach 1 during the three-year baseline monitoring period. In October 2005, average discharge was 138 cfs and in October 2006, average discharge was 182 cfs, considerably greater than the other sampling periods. The increase in discharge during the 2006 sampling effort was noticeable. Transect wetted perimeter width, water depths and current velocities were greater than observed in 2005 or 2007.

Discharge in reach 2 averaged 81 cfs during the October 8-10, 2007 sampling period (Figure 4.1-1). This was the lowest average sampling discharge for reach 2 during the three-year baseline monitoring period. In October 2005, average discharge was 94 cfs and in October 2006, average discharge was 108 cfs. These differences in average discharge between sample years were not noticeable in the field in reach 2 likely due to the flat and broad channel shape. In reach 3, the discharge differences between sample years were more noticeable in the field due to the more incised channel shape relative to reach 2.

The annual discharge for each respective water year in reach 1 varied slightly in timing, magnitude and duration of peak flows (Figure 4.1-2). The peak discharge in the 2006-2007 water year was 1610 cfs on July 8$^{th}$, 2007. This peak was considerably greater than 2005 and 2006 peak discharge. The peak discharge in water year 2004-2005 was 1336 cfs on July 25$^{th}$ and in water year 2005-2006 the peak was 1157 cfs on April 13$^{th}$. In all three water years flow regulation from Bear Lake upstream shaped the hydrograph. Discharge during the summer irrigation delivery period (generally July 1 to September 1) resulted in prolonged high flows later in the summer season. In 2005, daily average discharge was greater than 1000 cfs from July 1 to August 1. In 2006, daily average discharge remained less than 1000 cfs from July 1 through September 1. In 2007, daily average discharge in reach 1 exceeded 1000 cfs from June 19$^{th}$ through August 4$^{th}$ with additional peak discharges greater than 1000 cfs between August 1 and September 1 2007.

**Figure 4.1-1: Discharge, October sampling period, 2005, 2006 and 2007**



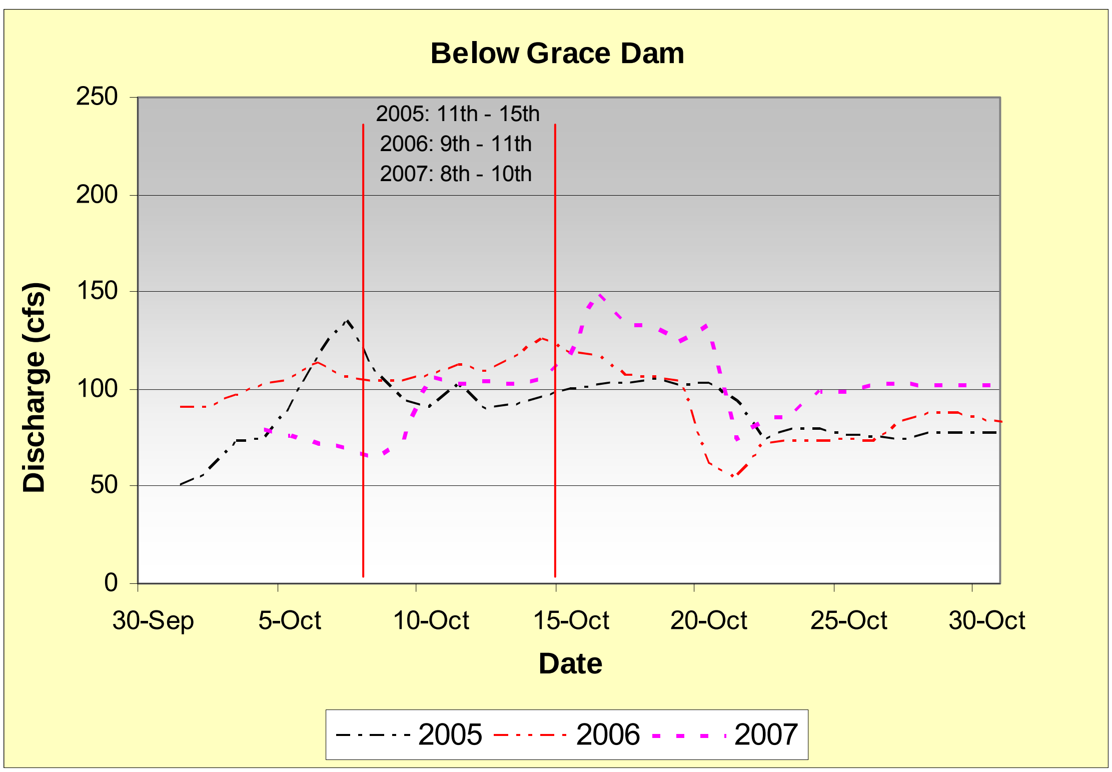
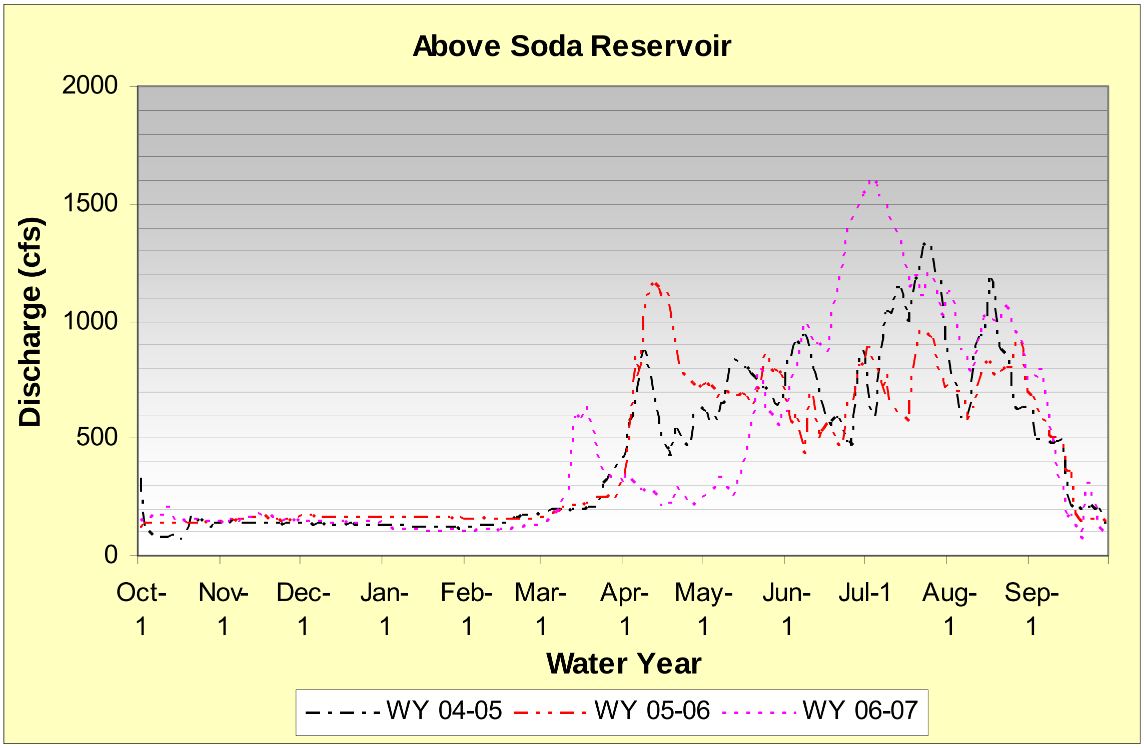
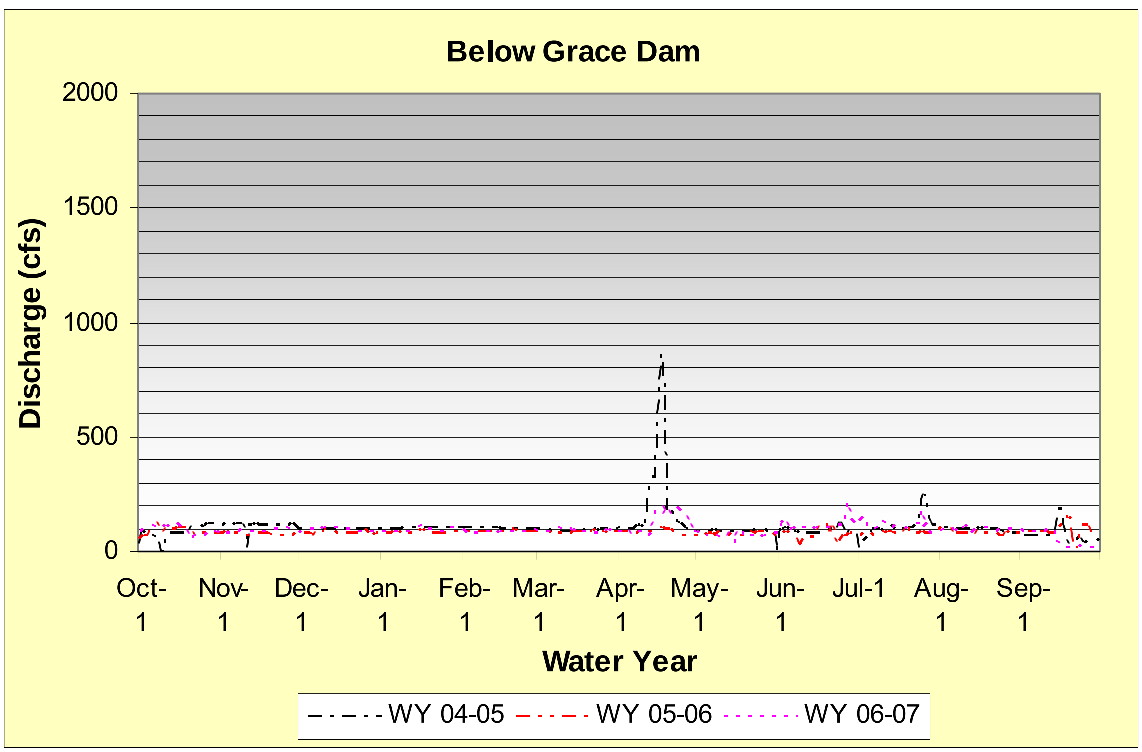



**Figure 4.1-2: Baseline discharge (2005-2007) for reaches 1 and 2 on the Bear River**



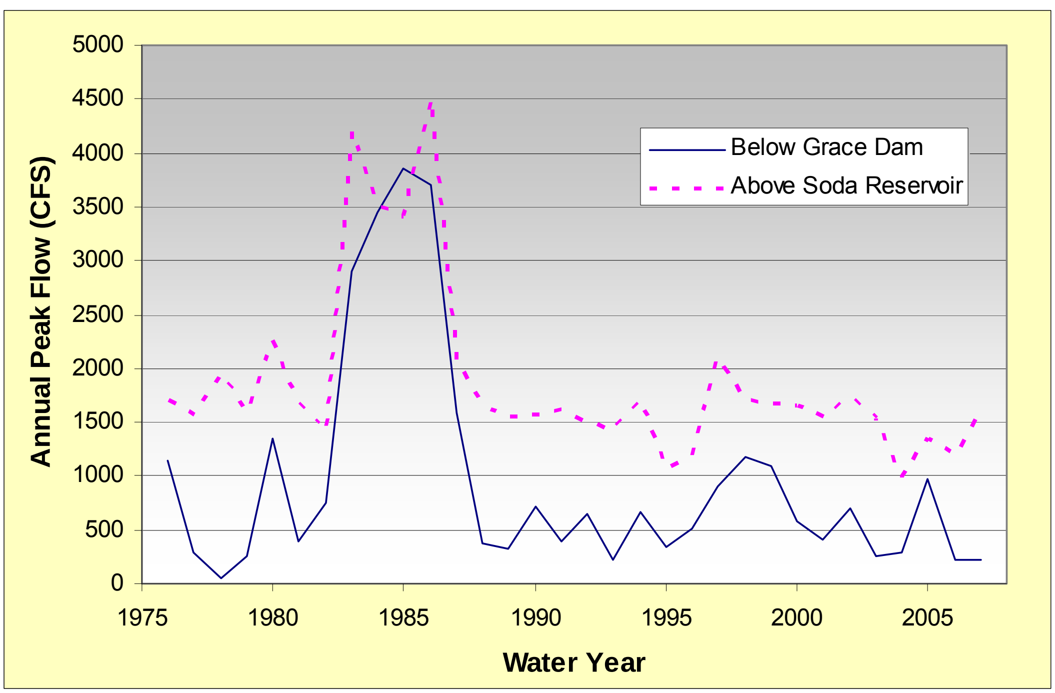
In reach 2 the average annual discharge for the 2006-2007 water year was 93 cfs compared to 102 cfs in 2004-2005 and 83 cfs in the 2005-2006 water year. Releases above the minimum instream flow (MIF) occurred during each of the three baseline study years. Only one of these releases was substantially greater than the MIF, a spring pulse flow of 863 cfs on April 17, 2005. No other releases of this magnitude occurred during the three-year baseline monitoring period.

Reach 3 did not have a staff gage and corresponding rating curve for measuring discharge. It was assumed that discharge in reach 3 was roughly equivalent to that measured in reach 2. Reach 4 also lacked a staff gage. Previous studies estimated that discharge in reach 4 was approximately 30 to 60 cfs greater than reach 2 flows (Connelly Baldwin, personal communication). The additional discharge is from groundwater inflows located at the bottom end of the Black Canyon. For this study we assumed flows in reach 4 were 30 cfs greater than discharge measured in reach 2.

The annual instantaneous peak discharge during the three-year baseline monitoring period for reaches 1 and 2 was lower than annual peaks recorded between 1976 and 2006 (Figure 4.1-3). For the period 1976 to 2007 the average annual peak flow in reach 1 was 1884 cfs. During the three-year baseline monitoring period annual instantaneous peak discharges were 1350 cfs, 1200 cfs and 1610 cfs in 2005, 2006 and 2007 respectively.

In reach 2 the annual peak discharge for the period 1976 to 2006 was 961 cfs compared to an annual instantaneous peak discharge of 965 cfs, 222 cfs, and 218 cfs in 2005, 2006 and 2007 respectively. The peak below Grace dam in 2005 was the result of spring run-off in the Bear River watershed. In 2006 and 2007 spring run-off did not result in spill from Grace Dam. In 2006, pulse flows over Grace dam less than 500 cfs instantaneously occurred in September to assist with channel restoration efforts associated with Cove Dam decommissioning.

**Figure 4.1-3: Annual peak discharge (1976-2007), Bear River, ID**



## 4.2 CHANNEL SHAPE AND SUBSTRATE

Reach 2 transects were surveyed on October 8, 2007 between 0830 and 1430 hours. Discharge was 65 cfs. Reach 3 transects were surveyed on October 10, 2007 between 1130 and 1630 hours. The flow recorded for the Bear River below Grace Dam during the reach 3 survey was 107 cfs. The flows recorded for the Bear River during the previous sampling events in reach 2 were 89 cfs in 2005 and 104 cfs in 2006. In reach 3 instream flows were 101 cfs in 2005 and 107 cfs in 2006.

In 2007 reach 2 had a mean bankfull width of 62.88 meters (Table 4.2-1). The bankfull widths were narrowest at transect TE, 48.95 meters, and widest at transect TD, 76.13 meters. The mean water depths associated with the bankfull elevation were between 0.29 meters at TC and 0.64 meters at TA. The mean water depth based on bankfull elevations was 0.43 meters. Reach 2 bankfull widths increased between 2005 and 2007 for TA and TB, 0.49 meters and 1.97 meters, respectively. Bankfull widths decreased between 2005 and 2007 for TC, TD and TE. The largest decrease in bankfull width was transect TE, bankfull width decreased 2.33 meters between 2005 and 2007. The mean bankfull widths for reach 2 were 63.04 meters in 2005, 62.71 meters in 2006, and 62.88 meters in 2007.

**Table 4.2-1: Channel survey data for reaches 2 and 3; October 2005, 2006 and 2007.**

| Reach | Transect | Bankfull Width (m) | | | Average Bankfull Depth (m) | | | Bankfull Width/Depth Ratio | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 |
| 2 | TA | 48.85 | 48.85 | 49.34 | 0.57 | 0.58 | 0.64 | 86.46 | 84.06 | 77.38 |
| 2 | TB | 67.22 | 67.22 | 69.19 | 0.48 | 0.45 | 0.48 | 140.97 | 150.74 | 145.12 |
| 2 | TC | 71.30 | 71.50 | 70.79 | 0.31 | 0.27 | 0.29 | 226.42 | 267.65 | 247.44 |
| 2 | TD | 76.57 | 76.57 | 76.13 | 0.16 | 0.25 | 0.30 | 483.48 | 312.19 | 252.06 |
| 2 | TE | 51.28 | 49.42 | 48.95 | 0.19 | 0.44 | 0.43 | 269.73 | 111.77 | 113.46 |
| **Reach 2 Mean** | | **63.04** | **62.71** | **62.88** | **0.34** | **0.40** | **0.43** | **241.41** | **185.28** | **167.09** |
| 3 | TA | 28.80 | 28.80 | 28.80 | 0.73 | 1.21 | 1.33 | 39.34 | 23.81 | 21.66 |
| 3 | TB | 20.70 | 20.70 | 20.70 | 0.63 | 0.65 | 0.67 | 33.09 | 31.95 | 30.86 |
| 3 | TC | 17.10 | 17.10 | 17.10 | 0.62 | 0.65 | 0.63 | 27.37 | 26.45 | 27.21 |
| 3 | TD | 24.80 | 24.80 | 24.80 | 0.86 | 0.41 | 0.41 | 28.77 | 60.12 | 59.81 |
| 3 | TE | 17.50 | 17.50 | 17.50 | 1.03 | 1.00 | 1.00 | 17.03 | 17.44 | 17.47 |
| **Reach 3 Mean** | | **21.78** | **21.78** | **21.78** | **0.77** | **0.78** | **0.81** | **29.12** | **31.95** | **31.40** |

In 2007, reach 3 had a mean bankfull width of 21.78 meters. The bankfull widths ranged from 17.10 meters at TC to 28.80 meters at TA. The mean water depths associated with the elevation of the bankfull indicators were between 0.41 meters at TD and 1.33 meters at TA, and the mean water depth was 0.81 meters.

The mean bankfull widths in 2005 and 2006 were 63.04 meters and 62.88 meters respectively. The greatest bankfull width was 76.57 meters for transect TD in both 2005 and 2006. The smallest bankfull width was 48.85 meters for transect TA in both 2005 and 2006. The greatest mean bankfull depth was 0.43 meters in 2007. The mean bankfull depths for the two previous years were 0.34 meters in 2005 and 0.40 meters in 2006.

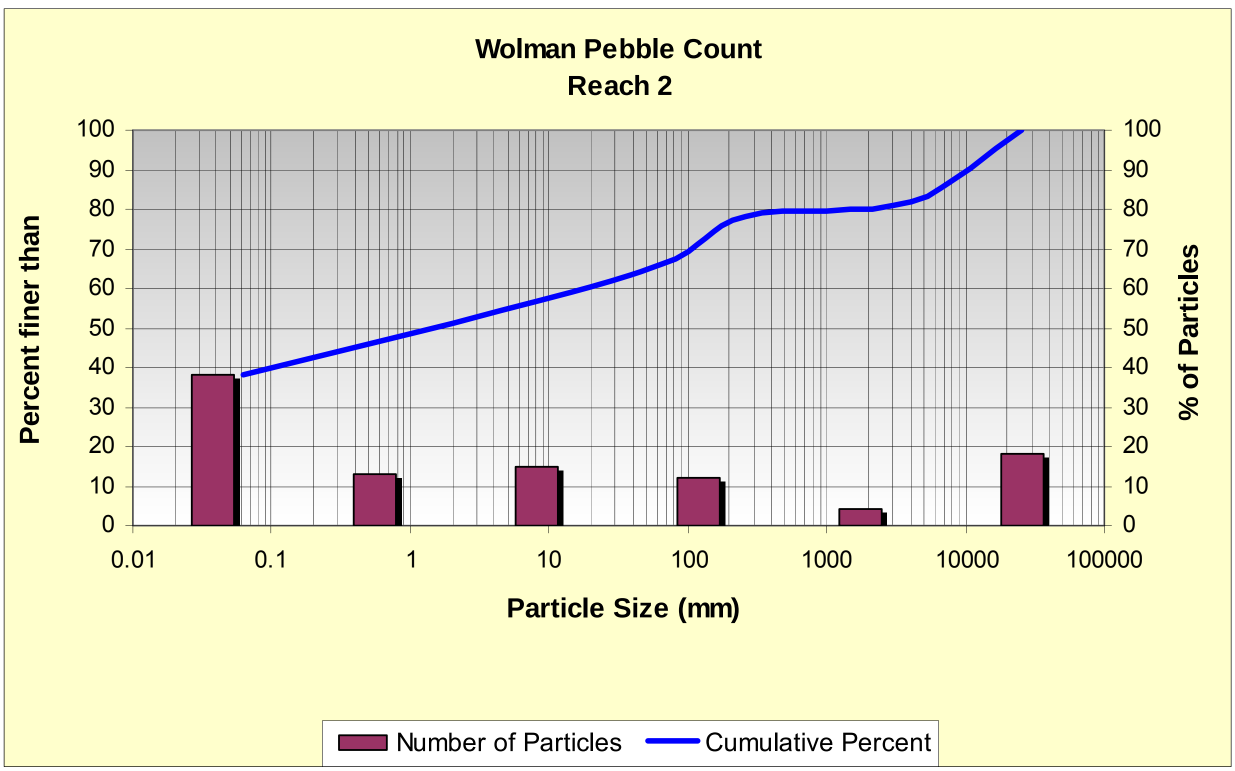
Rosgen (1994, 1996) uses the bankfull width to water depth ratio (BWD ratio) to characterize streams in his Level II stream classification system. The BWD ratio for reach 2 ranged from 77.38 at TA to 252.06 at TD. The mean BWD ratio for reach 2 in 2007 was 167.09. Rosgen's stream classification system ranks these BWD indices "very high". The BWD ratio for reach 2 was 241.41in 2005 and 185.28 in 2006. These BWD indices are also classified by Rosgen as "very high." The BWD ratio for reach 3 ranged from 17.47 at TE to 59.81 at TD, and the mean was 31.40. Rosgen ranks these BWD ratios in the "moderate to high" range. The mean BWD ratio for reach 3 was 29.12 in 2005 and 31.95 in 2006. The Rosgen BWD indices for these two years are also "moderate to high."

The Wolman Pebble count conducted in reach 2 indicates fines made up 38% of the stream channel, more than double the amount of any other class size (Figure 4.2-1). The Wolman Pebble counts from 2005 and 2006 were 42% and 40% respectively.

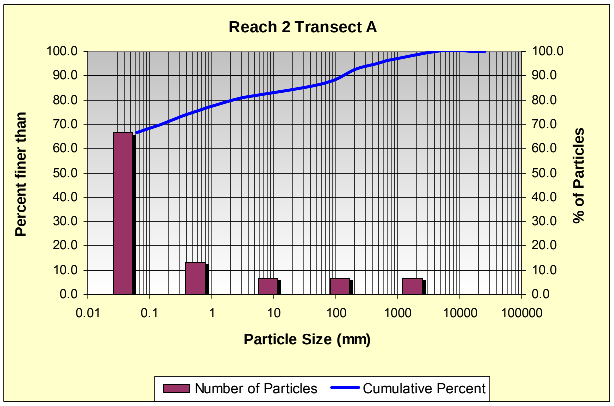
In reach 2, transects TA, TB, TC and TE contained a high percentage of fines embedding gravel, cobble and boulders (Figure 4.2-2). The percentage of fine material for these transects in 2007 was 66.7% fines at TA, 77.5% fines at TB, 46.7% fines at TC, and 58.6% fines at TE. Transect TD had a lower percentage of fine material, 28.8%, and a greater amount of boulders and bedrock. The gradient in reach 2 increases longitudinally downstream with a pronounced increase just upstream of transect TD. The percentage of fine material for these transects in the previous two years was: TA – 81% in both 2005 and 2006, TB – 59% in 2005 and 65.7% in 2006, TC – 29.5% in 2005 & 33.3% in 2006, TD – 10.5% in 2005 and 15.9% in 2006, TE – 37.5% macrophyte in 2005 & 21.7% fines in 2006.

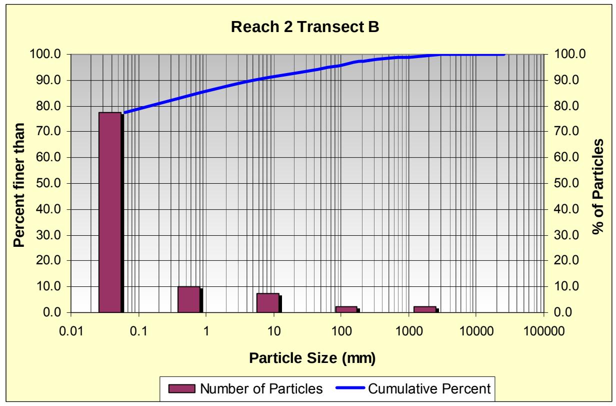
In reach 3 all transects except for TE were predominantly sand and gravel, with the gravel size class ranging from 42.1% to 18.8% of the total substrate composition (Figure 4.2-3). In transect TE the substrate was finer than other transects with 17.6% fines, 52.9% sand and 29.4% gravel. These results are similar to the previous two years. In 2005 and 2006 sand and gravel were the predominant class size in all transects except TE, ranging from 56.3% to 12.5% sand. The Wolman Pebble count for reach 3 indicates that gravel comprised 57% of the substrate material in 2007 (Figure 4.2-4). The Wolman Pebble counts for 2005 and 2006 both contained high percentages of gravel, 45% and 61% respectively.

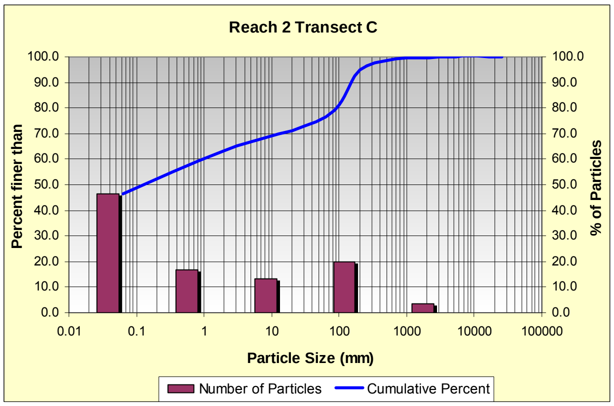
**Figure 4.2-1: Wolman pebble count in reach 2, October 2007.**

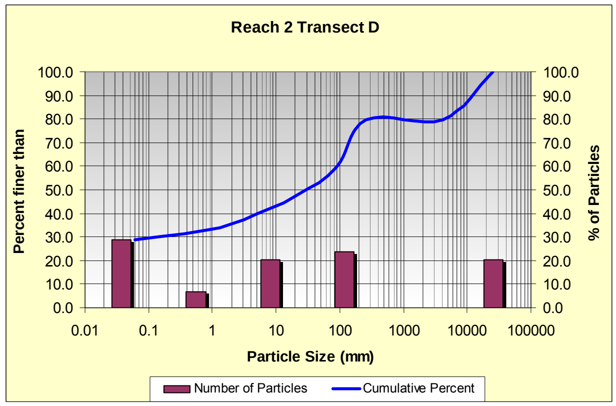


## Figure 4.2-2: Substrate composition for reach 2, 2007



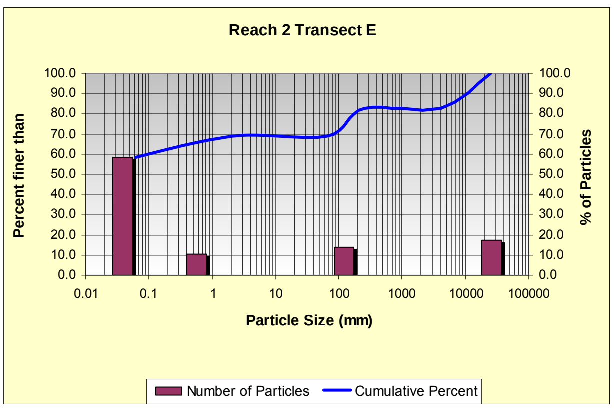



**Figure 4.2-3: Substrate composition for reach 3, 2007.**

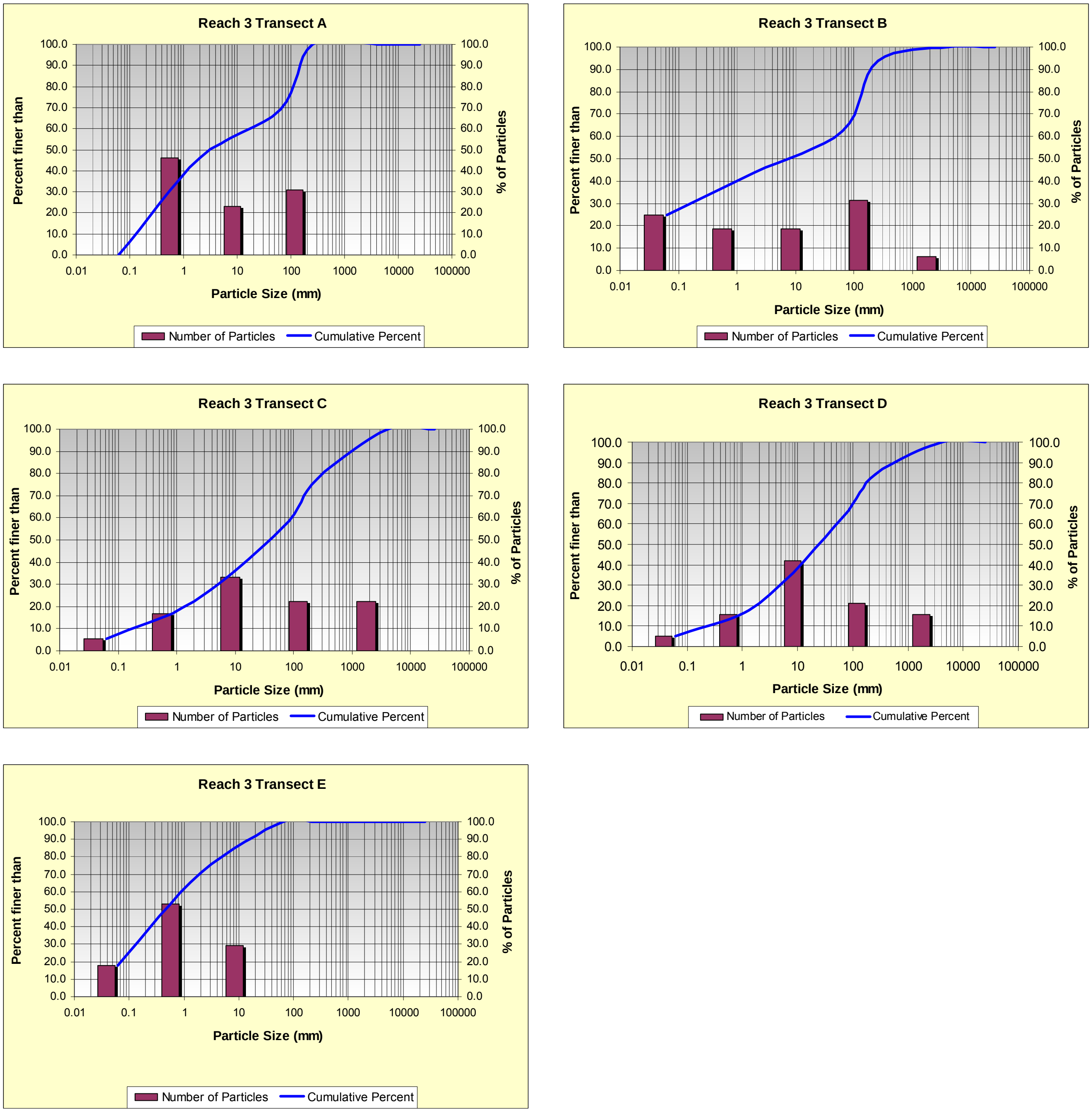
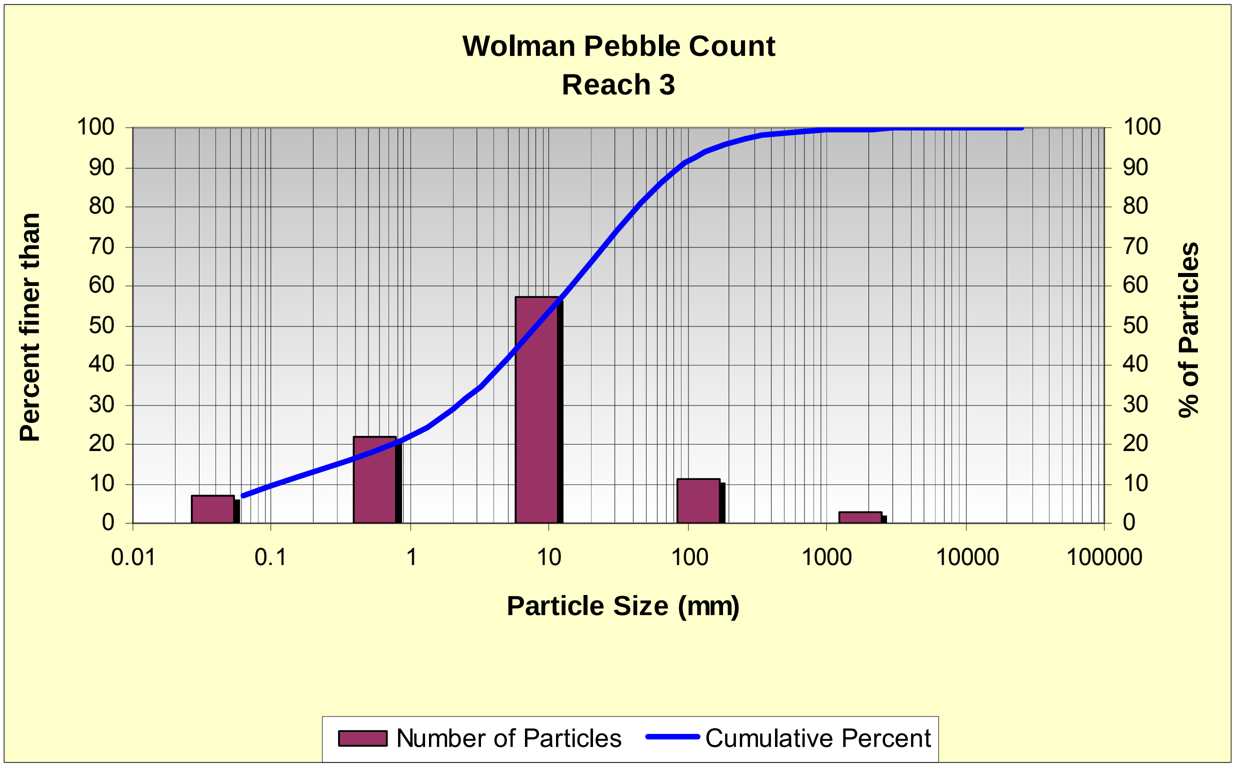


**Figure 4.2-4: Wolman pebble count in reach 3, October 2007.**




## 4.3 PERIPHYTON— ASH-FREE DRY WEIGHT AND CHLOROPHYLL

Periphyton AFDW in 2007 was greater in reference reach 1 than treatment reaches 2, 3 and 4 located below Grace Dam (Figure 4.3-1). This difference between the reference reach and the experimental reaches was statistically significant (0.03, H-test). The high sample variance particularly in reach 1 precluded the parametric single factor ANOVA. Periphyton AFDW steadily declined with each progressive study reach. The AFDW average for reach 1 was 208.9 g/m$^2$ compared to 110.4 g/m$^2$, 46.6 g/m$^2$ and 39.7 g/m$^2$ for reaches 2, 3, and 4 respectively.

AFDW comparisons between years within a single study reach indicate significant differences in reaches 1 and 3. In reach 1, periphyton AFDW was significantly lower in 2005 compared to sample years 2006 and 2007 (p=0.009, H-test). The high sample variance in 2006 and 2007 precluded the parametric single factor ANOVA. In reach 3, periphyton AFDW was significantly greater in 2006 compared to 2005 and 2007 (p=0.04, H-test). Periphyton AFDW in reaches 2 and 4 was similar over the three sample years but again high sample variance was evident.

Periphyton chlorophyll a in 2007 was lower in reference reach 1 than treatment reaches 2, 3 and 4 located below Grace Dam (Figure 4.3-2). This difference between the reference reach and the experimental reaches was statistically significant (0.03, H-test). Periphyton chlorophyll a was substantially higher in reaches 2, 3 and 4 compared to reach 1. The chlorophyll a average for reach 1 was 58.6 mg/m$^2$ compared to 152.6 mg/m$^2$, 125.8 mg/m$^2$ and 224.9 mg/m$^2$ for reaches 2, 3, and 4 respectively. These results were similar to patterns observed in 2005 for the respective reaches. In 2005, chlorophyll a concentration was also significantly lower in the reference reach compared to the treatment reaches (0.04, H-test). In contrast, chlorophyll a concentrations in 2006 did not exhibit any differences between the reference and experimental reaches.

**Figure 4.3-1: Periphyton mean AFDW, October 2005, 2006 and 2007.**

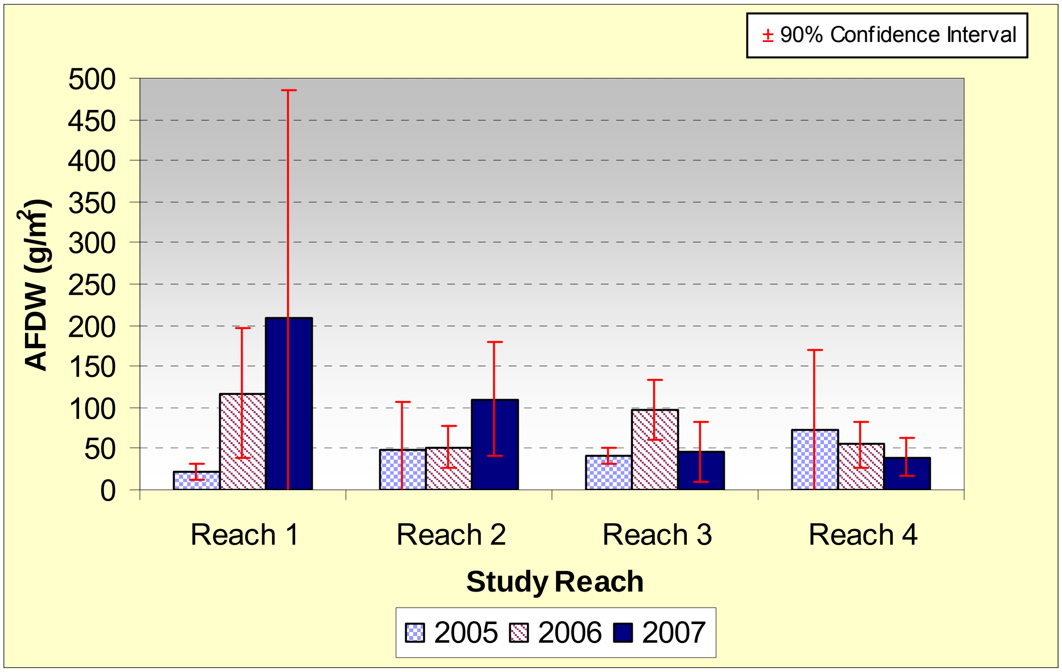
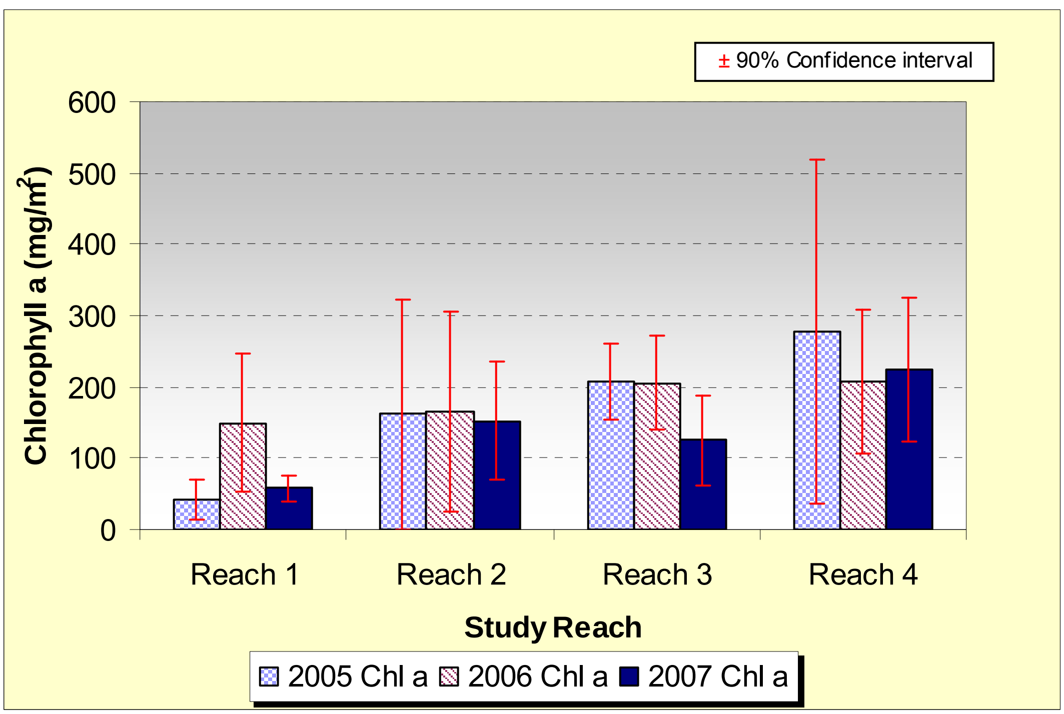



**Figure 4.3-2: Periphyton mean chlorophyll a concentration, October 2005, 2006 and 2007.**




Chlorophyll a comparisons across the three samples years within a single study reach indicate significant differences in reach 1 only. In reach 1, periphyton chlorophyll a was significantly greater in 2006 compared to sample years 2005 and 2007 (p=0.05, H-test). The high sample variance in 2006 precluded the parametric single factor ANOVA. In reaches 2, 3 and 4 periphyton chlorophyll a concentration was similar between sample years 2005, 2006 and 2007. Chlorophyll a concentrations, for the most part, progressively increased from upstream to downstream for individual sample years.

Periphyton chlorophyll b average concentrations in 2007 were similar between reference reach 1 and the three treatment reaches located below Grace Dam (Figure 4.3-3). The 2007 chlorophyll b average values were 3.9 mg/m$^2$, 6.1 mg/m$^2$, 0.2 mg/m$^2$and 9.1 mg/m$^2$ respectively for reaches 1 through 4. Periphyton chlorophyll b in 2006 also showed no statistically significant differences between the reference reach and the treatment reaches. In contrast, periphyton chlorophyll b concentrations in 2005 were significantly different between the reference reach and the three treatment reaches (0.04, H-test).

Chlorophyll b comparisons across the three samples years within a single study reach indicate significant differences in all four study reaches. In reach 1, periphyton chlorophyll b was significantly greater in 2005 compared to sample years 2006 and 2007 ($p=0.02$, H-test). In reach 2, periphyton chlorophyll b was significantly greater in 2006 compared to sample years 2005 and 2007 ($p=0.07$, H-test). In reach 3, periphyton chlorophyll b was significantly lower in 2007 compared to sample years 2005 and 2006 ($p=0.008$, H-test). In reach 4, periphyton chlorophyll b was significantly greater in 2005 compared to sample years 2006 and 2007 ($p=0.07$, H-test). These differences in periphyton chlorophyll b concentrations for all four study reaches do not exhibit any discernible patterns across sites in a given sample year or between sample years. High sample variance in each study reach precluded parametric statistical tests.

Periphyton chlorophyll c average concentrations in 2007 were similar between reference reach 1 and the three treatment reaches located below Grace Dam (Figure 4.3-4). The 2007 chlorophyll b average values were 5.4 mg/m$^2$, 12.4 mg/m$^2$, 9.1 mg/m$^2$ and 14.8 mg/m$^2$ respectively for reaches 1 through 4. Periphyton chlorophyll c concentrations were lower at the reference reach compared to the downstream treatment reaches in all three sample years but significantly lower in 2005 only (0.02, H-test).

Chlorophyll c comparisons across the three samples years within a single study reach indicate significant differences in study reaches 1, 2 and 3. In reach 1, periphyton chlorophyll c was significantly lower in 2005 compared to sample years 2006 and 2007 ($p=0.02$, H-test). In reach 2, periphyton chlorophyll c was significantly lower in 2006 compared to sample years 2005 and 2007 ($p=0.08$, H-test). In reach 3, periphyton chlorophyll c was significantly greater in 2005 compared to sample years 2006 and 2007 ($p=0.05$, H-test). In reach 4, periphyton chlorophyll c was not significantly different between sample years. The significant differences in periphyton chlorophyll c concentrations between sample years in reaches 1, 2 and 3 did not exhibit a consistent trend but instead vary across sites in a given sample year or between sample years. The only consistent pattern for periphyton chlorophyll c concentrations was the greater concentrations in 2005 in reaches 2, 3 and 4 compared to sample years 2006 and 2007.

In 2007, the Autotrophic Index (AI) was significantly different between the four reaches ($p=0.002$, H-test). Reach 1 had the highest autotrophic index in 2007 (2967.8) compared to reach 2-830.5; reach 3-353.6; and reach 4-182.9 (Figure 4.3-5). Reach 1 had the highest AI values in 2005 and 2006 as well although substantially lower than the 2007 values (591.4 and 825.4 respectively).

Periphyton AI comparisons across the three samples years within a single study reach indicate significant differences in study reaches 1, 2 and 3. In reach 1, periphyton AI was significantly greater in 2007 compared to sample years 2005 and 2006 ($p=0.006$, H-test). In reach 2, periphyton AI was significantly greater in 2007 compared to sample years 2005 and 2006 (p=0.09, H-test). In reach 3, periphyton AI was significantly greater in 2006 compared to sample years 2005 and 2007 (p=0.02, H-test). In reach 4, periphyton AI was not significantly different between sample years.

**Figure 4.3-3: Periphyton mean chlorophyll b concentration, October 2005, 2006 and 2007.**

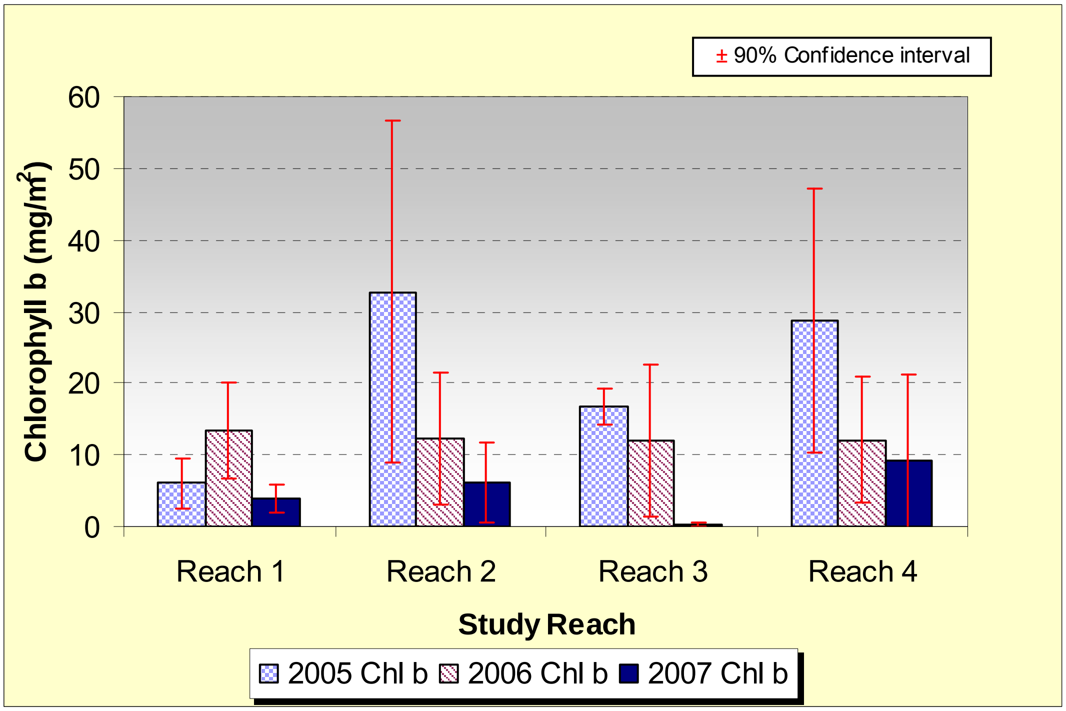



**Figure 4.3-4: Periphyton mean chlorophyll c concentration, October 2005, 2006 and 2007.**

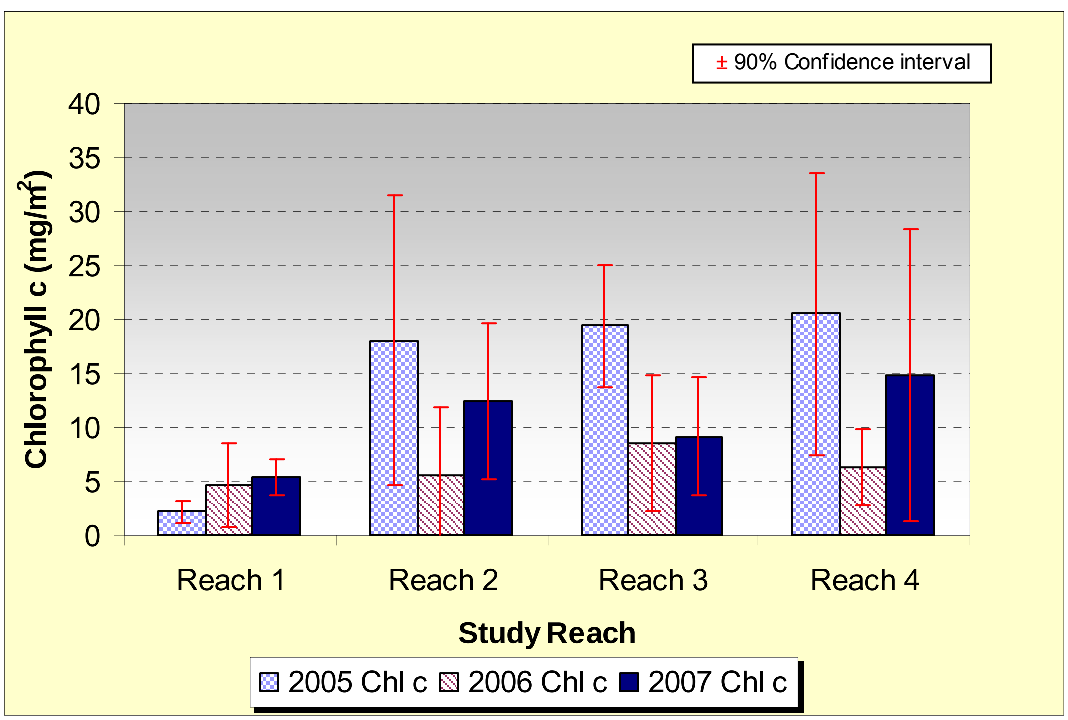
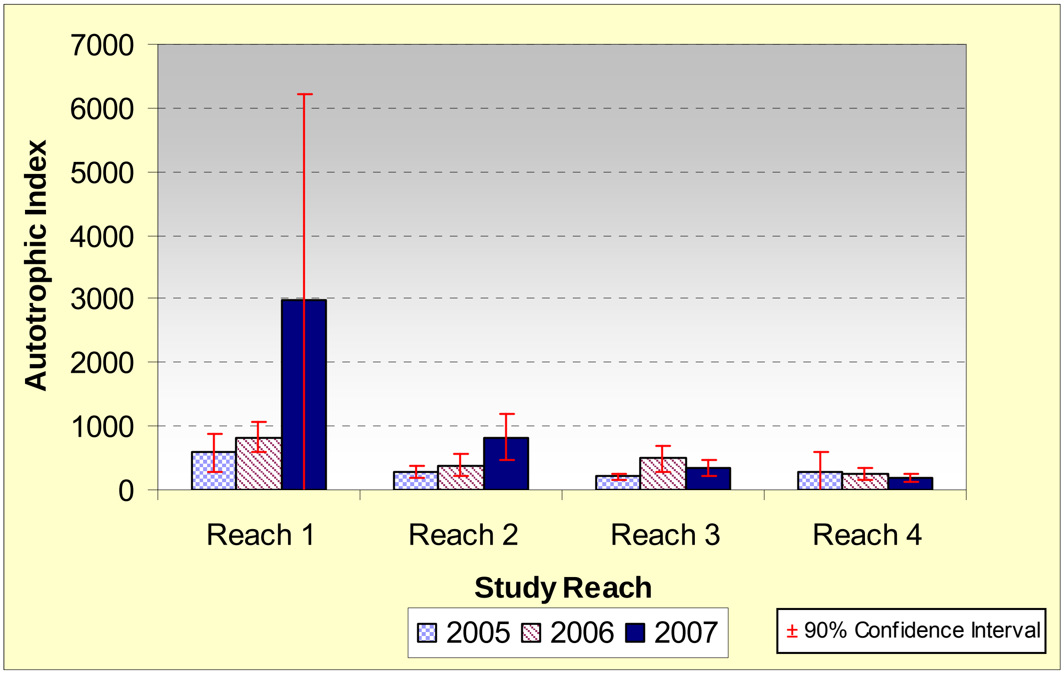


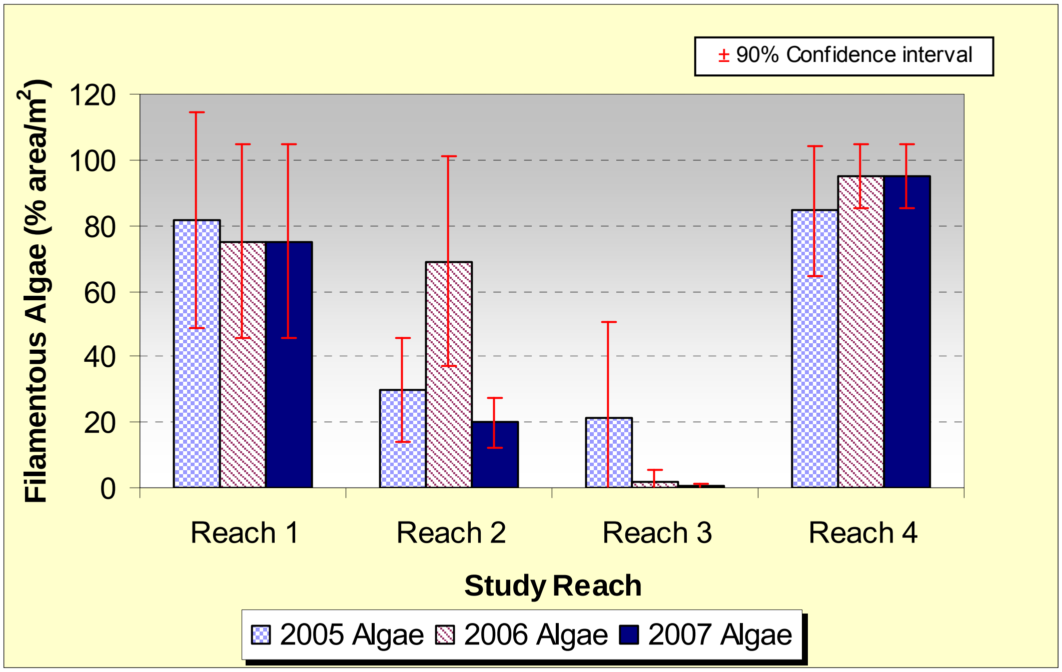
**Figure 4.3-5: Periphyton mean autotrophic index, October 2005, 2006 and 2007.**




## 4.4 FILAMENTOUS ALGAE

Filamentous algae cover was significantly different between sites in 2007 (p=0.0008, H-test). Differences in filamentous algae between study reaches was also evident in 2005 and 2006. Reach 4 had the highest coverage (95%) followed by reach 1 (75%), 2 (20%) and 3 (<1%) in descending order of coverage (Figure 4.4-1). Filamentous algae comparisons across the three sample years within a single study reach indicate similar algal coverage between years in reaches 1, 3 and 4 although reach 3 exhibited substantially less filamentous algae in years 2006 and 2007 compared to 2005 but was not significant due to high variability between transects during the 2005 sampling event. Algal coverage in reach 2 was significantly higher in 2006 compared to sample years 2005 and 2007 (p=0.06, H-test).

**Figure 4.4-1: Filamentous algae cover, October 2005, 2006 and 2007.**




## *4.5 FISHERIES*

Fisheries data was analyzed to determine species abundance, biomass and relative weight. Relative weight is a measure of fish condition. Catch per unit effort (CPUE) was calculated for each reach for comparison purposes within and between sample study years. Seven species total were collected in this sampling effort but not all species were present in each study reach. The analysis was divided into results for each respective study reach.

### 4.5.1 Reach 1—Above Soda Reservoir

Four species were collected in reach 1 for a total catch of 59 fish and biomass of 0.39 kg (Table 4.5-1). Longnose dace were the most abundant (35 fish; 59% of the catch) followed by mottled sculpin (20; 34%), common carp (3; 8%), and redside shiner (1; 2%) (Figure 4.5-1). Longnose dace comprised a majority of the biomass at 48% (186 g), followed by mottled sculpin (44%; 172 g), common carp (7%; 28 g), redside shiner (2%; 4 g) (Figure 4.5-2).

Catch per unit effort (CPUE) was highest for longnose dace at 1.97 fish/minute, followed by mottled sculpin (1.13 fish/minute), common carp (0.17 fish/minute), and redside shiner (0.06 fish/minute) (Figure 4.5-3).

**Table 4.5-1: Fish density and biomass per 100 meters in reach 1, October 2007**

| Species | N | Weight (g) | CPUE (fish / minute) |
|---|---|---|---|
| Longnose Dace (*Rhinichthys cataractae* ) | 35 (59%) | 186 (48%) | 1.97 |
| Small Mouth Bass (*Micropterus dolomieu* ) | 0 | 0 | 0 |
| Mottled Sculpin (*Cottus bairdi* ) | 20 (34%) | 172 (44%) | 1.13 |
| Common Carp (*Cyprinus carpio* ) | 3 (5%) | 28 (7%) | 0.17 |
| Redside Shiner (*Richardsonius balteatus* ) | 1 (2%) | 4 (2%) | 0.06 |
| Utah Sucker (*Catostomus ardens* ) | 0 | 0 | 0 |
| Rainbow Trout (*Oncorhynchus mykiss* ) | 0 | 0 | 0 |
| Total | 59 | 390 | 3.33 |

**Figure 4.5-1: Fish species composition, October 2007**

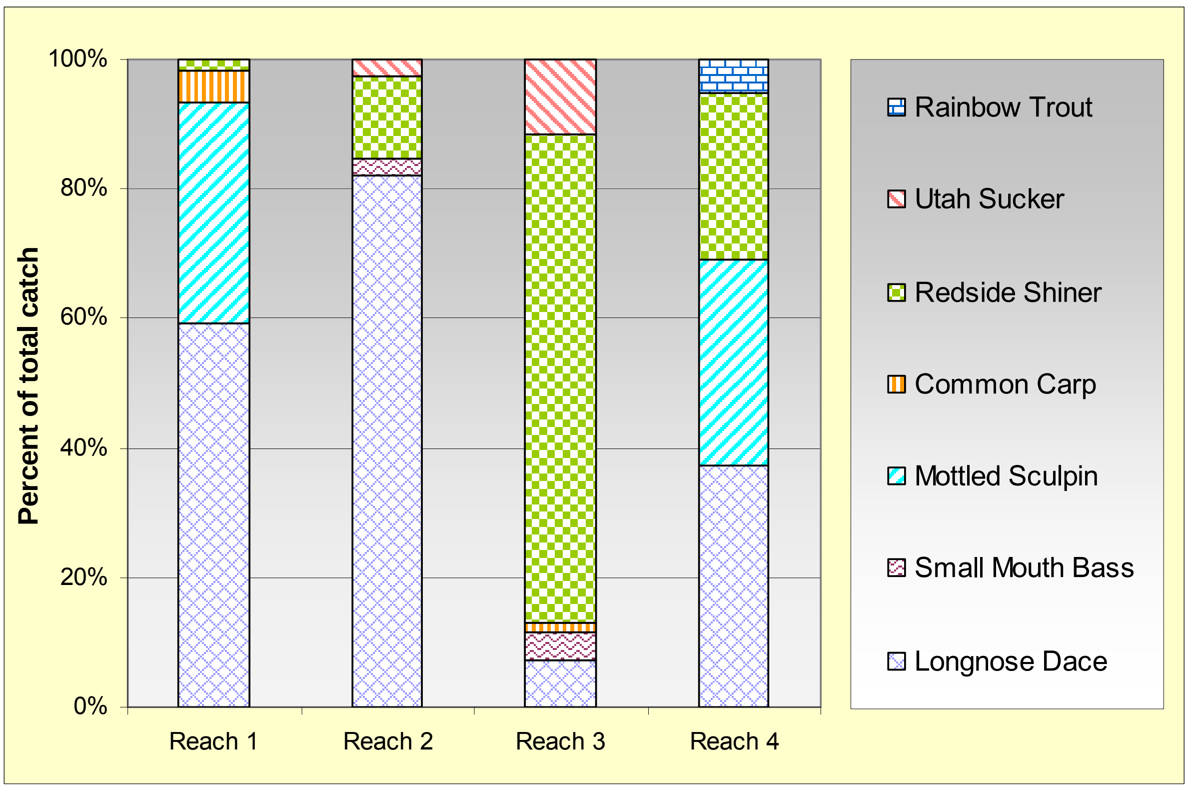


**Figure 4.5-2: Fish species biomass, October 2007**

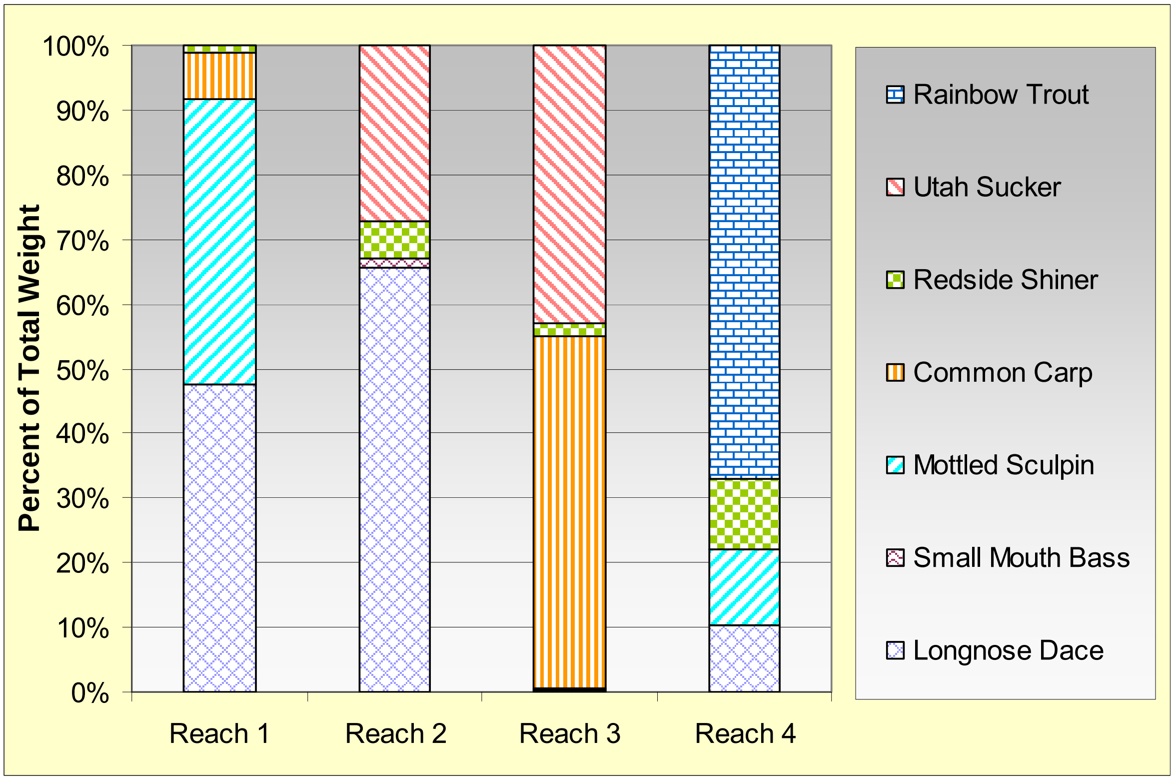



**Figure 4.5-3: Catch per unit effort for reaches 1, 2, 3 and 4, October 2007**

### 4.5.2 Reach 2— Below Grace Dam

Four species were collected in reach 2 for a total catch of 39 fish and biomass of 0.52 kg (Table 4.5-2). Longnose dace were the most abundant as they accounted for 32 of the 39 fish collected (82% of the catch) followed by redside shiner (5; 13%), small mouth bass (1; 3%), and Utah sucker (1; 3%) (Figure 4.5-1). Accordingly, longnose dace comprised a majority of the biomass at 66% (338g) followed by Utah sucker (27%, 140 g), redside shiner (6%; 30 g), and small mouth bass (2%; 8 g) (Figure 4.5-2).

**Table 4.5-2: Fish density and biomass per 100 meters in reach 2, October 2007**

| Species | N | Weight (g) | CPUE (fish / minute) |
|---|---|---|---|
| Longnose Dace (*Rhinichthys cataractae*) | 32 (82%) | 338 (66%) | 1.55 |
| Small Mouth Bass (*Micropterus dolomieu*) | 1 (3%) | 8 (2%) | 0.05 |
| Mottled Sculpin (*Cottus bairdi*) | 0 | 0 | 0 |
| Common Carp (*Cyprinus carpio*) | 0 | 0 | 0 |
| Redside Shiner (*Richardsonius balteatus*) | 5 (13%) | 30 (6%) | 0.24 |
| Utah Sucker (*Catostomus ardens*) | 1 (3%) | 140 (27%) | 0.05 |
| Rainbow Trout (*Oncorhynchus mykiss*) | 0 | 0 | 0 |
| Total | 39 | 516 | 1.89 |

Catch per unit effort was greatest for longnose dace at 1.55 fish / minute followed by redside shiner (0.24 fish/minute), small mouth bass (0.05 fish/minute), and Utah sucker (0.05 fish/minute) (Figure 4.5-3).

### 4.5.3 Reach 3— Black Canyon

Five species were collected in reach 3 for a total catch of 69 fish and a biomass of 9.13 kg (Table 4.5-3). Redside shiner dominated in abundance (52 fish; 75% of catch) followed by Utah sucker (8; 12%), longnose dace (5; 7%), small mouth bass (3; 4%) and common carp (1; 1%) (Figure 4.5-1). The one common carp collected accounted for 54% of the biomass (4960 g), followed by Utah sucker (43%; 3920 g), redside shiner (2%, 198 g), small mouth bass (<1%; 30 g) and longnose dace (<1%; 24 g) (Figure 4.5-2).

**Table 4.5-3: Fish density and biomass per 100 meters in reach 3, October 2007**

| Species | N | Weight (g) | CPUE (fish / minute) |
|---|---|---|---|
| Longnose Dace (*Rhinichthys cataractae*) | 5 (7%) | 24 (<1%) | 0.30 |
| Small Mouth Bass (*Micropterus dolomieu*) | 3 (4%) | 30 (<1%) | 0.18 |
| Mottled Sculpin (*Cottus bairdi*) | 0 | 0 | 0 |
| Common Carp (*Cyprinus carpio*) | 1 (1%) | 4960 (54%) | 0.06 |
| Redside Shiner (*Richardsonius balteatus*) | 52 (75%) | 198 (2%) | 3.13 |
| Utah Sucker (*Catostomus ardens*) | 8 (12%) | 3920 (43%) | 0.48 |
| Rainbow Trout (*Oncorhynchus mykiss*) | 0 | 0 | 0 |
| Total | 69 | 9132 | 4.15 |

Catch per unit effort was greatest for redside shiner at 3.13 fish/minute, followed by Utah sucker (0.48 fish/minute), longnose dace (0.30 fish / minute), small mouth bass (0.18 fish/minute), and common carp (0.06 fish/minute) (Figure 4.5-3).

### 4.5.4 Reach 4—Above Grace Power Plant

Four species were collected in reach 4 for a total catch of 94 fish with a biomass of 2.18 kg (Table 4.5-4). Longnose dace were the most abundant (35 fish; 37% of the catch) followed by mottled sculpin (30; 32%), redside shiner (24; 26%), and rainbow trout (5; 5%) (Figure 4.5-1). Rainbow trout accounted for a large majority of the biomass at 67% (1460g). The remaining 23% of the biomass was comprised of mottled sculpin (12%; 252 g), redside shiner (11%; 238g), and longnose dace (10%; 225 g) (Figure 4.5-2).

**Table 4.5-4: Fish density and biomass per 100 meters in reach 4, October 2007**

| Species | N | Weight (g) | CPUE (fish / minute) |
|---|---|---|---|
| Longnose Dace (*Rhinichthys cataractae*) | 35 (37%) | 225 (10%) | 1.77 |
| Small Mouth Bass (*Micropterus dolomieu*) | 0 | 0 | 0 |
| Mottled Sculpin (*Cottus bairdi*) | 30 (32%) | 252 (12%) | 1.52 |
| Common Carp (*Cyprinus carpio*) | 0 | 0 | 0 |
| Redside Shiner (*Richardsonius balteatus*) | 24 (26%) | 238 (11%) | 1.21 |
| Utah Sucker (*Catostomus ardens*) | 0 | 0 | 0 |
| Rainbow Trout (*Oncorhynchus mykiss*) | 5 (5%) | 1460 (67%) | 0.25 |
| Total | 94 | 2175 | 4.75 |

Catch per unit effort was greatest for longnose dace at 1.77 fish/minute followed by mottled sculpin (1.52 fish/minute), redside shiner (1.21 fish/minute), and rainbow trout (0.25 fish/minute) (Figure 4.5-3).

A total of 5 rainbow trout were collected in reach 4. One of the 5 fish was marked with a freeze-brand and 4 fish had no mark. The freeze-brand was on the right side behind the dorsal fin and had the orientation of an upright T. This particular location of the freeze-brand indicated that the fish was released in 2007 and the orientation indicated that it was released at the foot bridge below the Grace power plant.

The 5 rainbow trout collected in reach 4 ranged in length from 263 mm to 336 mm and had a mean length of 310 mm (Table 4.5-5). They ranged in weight from 174 g to 410 g with a mean weight of 292 g. The length-frequency distribution of the 5 rainbow trout collected in reach 4 is shown in figure 4.5-4.

**Table 4.5-5: Rainbow Trout lengths and weights in reach 4, October 2007**

| Number | Freeze brand | Length (mm) | Weight (g) | Relative Weight |
|---|---|---|---|---|
| 1 | Footbridge 2007 | 336 | 392 | 95 |
| 2 | None | 351 | 410 | 87 |
| 3 | None | 302 | 206 | 69 |
| 4 | None | 299 | 278 | 96 |
| 5 | None | 263 | 174 | 88 |
| | Average | 310 | 292 | 87 |

**Figure 4.5-4: Length frequency distribution for RBT in reach 4, October 2007**

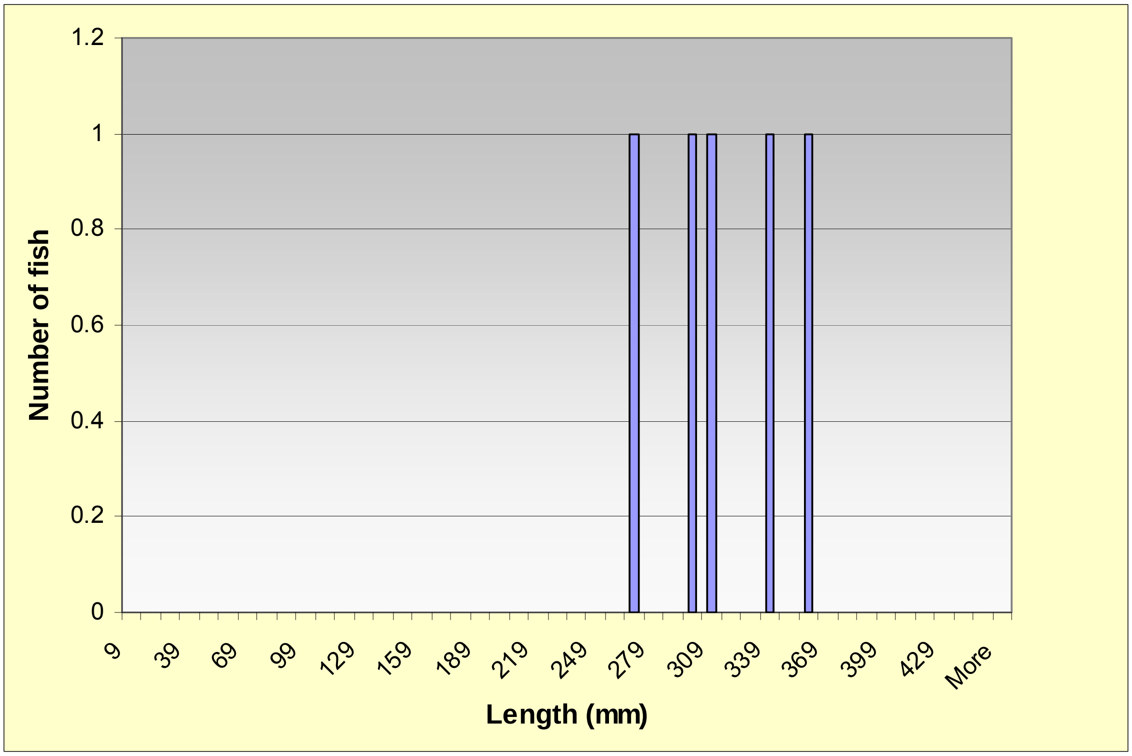
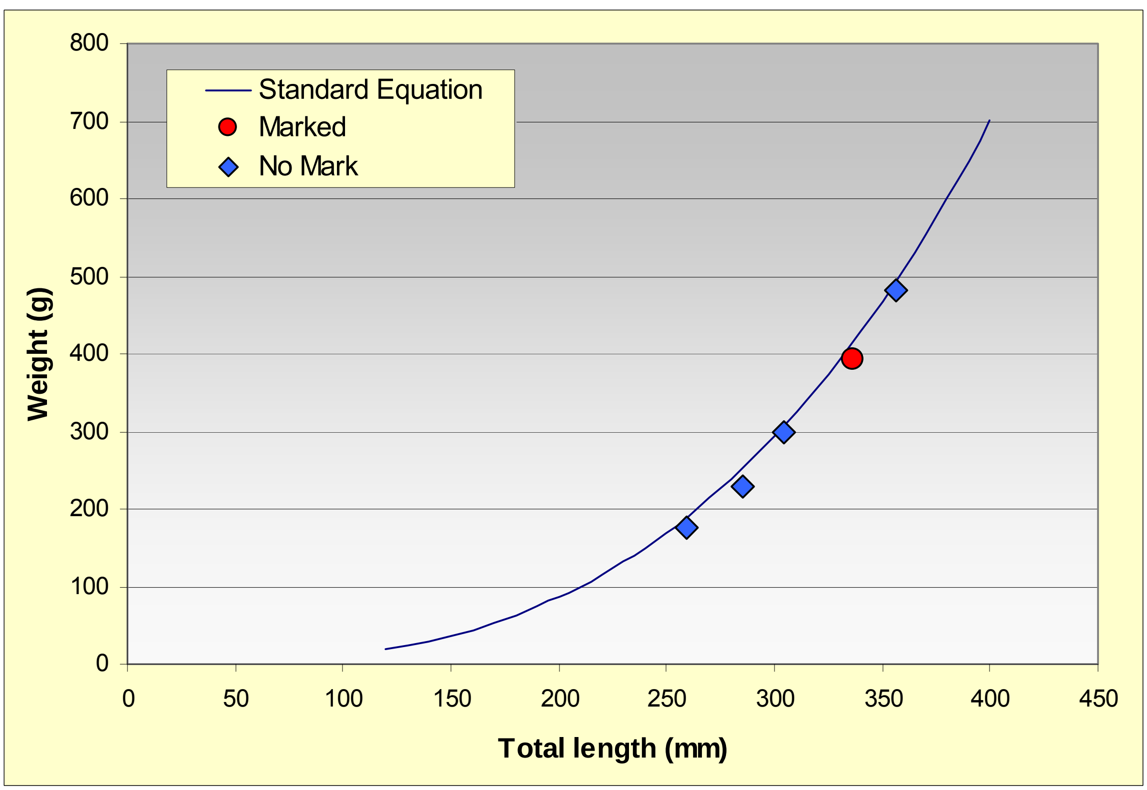



**Figure 4.5-5. Length-weight relationship for rainbow trout in reach 4, October 2007**



Overall, the relative weights of the 5 rainbow trout collected in reach 4 fell below the standard weight-length curve (Wr = 100) (Figure 4.5-5). The mean relative weight (Wr) for all 5 rainbows was 87 and ranged from 69 to 96 (Table 4.5-5). The freeze-branded fish had a relative weight of 95. For the 4 unmarked fish, the mean relative weight was 85 and ranged from 69 to 96.

### 4.5.5 Within Reach Comparisons—2005, 2006, and 2007

In reach 1, species richness was greatest in 2006. Five species were collected in reach 1 in 2006 compared to four species in 2005 and 2007 (Table 4.5-6). Longnose dace, mottled sculpin, and common carp were collected in all 3 years, while one juvenile Utah sucker was collected in 2006 and one redside shiner was collected in 2007.

**Table 4.5-6: Fish density and biomass for reach 1, October 2005, 2006, and 2007**

| Species | 2005 | | | 2006 | | | 2007 | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Weight (g) | CPUE | N | Weight (g) | CPUE | N | Weight (g) | CPUE |
| Longnose Dace | 55 (65%) | 362 (5%) | 3.29 | 14 (36%) | 78 (29%) | 0.83 | 35 (59%) | 186 (48%) | 1.97 |
| Small Mouth Bass | 1 (1%) | 30 (<1%) | 0.06 | 9 (23%) | 40 (15%) | 0.53 | 0 | 0 | 0 |
| Mottled Sculpin | 26 (31%) | 260 (4%) | 1.56 | 12 (31%) | 94 (35%) | 0.71 | 20 (34%) | 172 (44%) | 1.13 |
| Common Carp | 2 (2%) | 6654 (91%) | 0.12 | 3 (8%) | 48 (18%) | 0.18 | 3 (5%) | 28 (7%) | 0.17 |
| Redside Shiner | 0 | 0 | 0 | 0 | 0 | 0 | 1 (2%) | 4 (2%) | 0.06 |
| Utah Sucker | 0 | 0 | 0 | 1 (3%) | 10 (4%) | 0.06 | 0 | 0 | 0 |
| Rainbow Trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 84 | 7306 | 5.03 | 39 | 270 | 2.31 | 59 | 390 | 3.33 |

In reach 2, species richness was much greater in 2006 and 2007 than in 2005 (Table 4.5-7). Four species were collected in 2006 and 2007 while only 2 were collected in 2005. Longnose dace and small mouth bass were present all years, while redside shiner and Utah sucker were only collected in 2006 and 2007.

**Table 4.5-7: Fish density and biomass for reach 2, October 2005, 2006, and 2007**

| Species | 2005 | | | 2006 | | | 2007 | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Weight (g) | CPUE | N | Weight (g) | CPUE | N | Weight (g) | CPUE |
| Longnose Dace | 33 (97%) | 257 (97%) | 1.52 | 29 (88%) | 206 (84%) | 1.28 | 32 (82%) | 338 (66%) | 1.55 |
| Small Mouth Bass | 1 (3%) | 8 (3%) | 0.05 | 1 (3%) | 8 (3%) | 0.04 | 1 (3%) | 8 (2%) | 0.05 |
| Mottled Sculpin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Common Carp | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Redside Shiner | 0 | 0 | 0 | 2 (6%) | 20 (8%) | 0.09 | 5 (13%) | 30 (6%) | 0.24 |
| Utah Sucker | 0 | 0 | 0 | 1 (3%) | 12 (5%) | 0.04 | 1 (3%) | 140 (27%) | 0.05 |
| Rainbow Trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 34 | 265 | 1.57 | 33 | 246 | 1.45 | 39 | 516 | 1.89 |

In reach 3, species richness was greater in 2007 than in 2005 and 2006 (Table 4.5-8). Five species were collected in 2007 and four species were collected in 2005 and 2006. Longnose dace, redside shiner, and Utah sucker were collected all years while a small number of small mouth bass were collected in 2005 and 2007, and one rainbow trout was collected in reach 3 in 2006. In 2007, a single common carp was collected in reach 3. Carp were not collected at this site in 2005 or 2006.

**Table 4.5-8: Fish density and biomass for reach 3, October 2005, 2006, and 2007**

| Species | 2005 | | | 2006 | | | 2007 | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Weight (g) | CPUE | N | Weight (g) | CPUE | N | Weight (g) | CPUE |
| Longnose Dace | 5 (4%) | 22 (5%) | 0.43 | 3 (3%) | 12 (2%) | 0.23 | 5 (7%) | 24 (<1%) | 0.30 |
| Small Mouth Bass | 1 (1%) | 4 (<1%) | 0.09 | 0 | 0 | 0 | 3 (4%) | 30 (<1%) | 0.18 |
| Mottled Sculpin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Common Carp | 0 | 0 | 0 | 0 | 0 | 0 | 1 (1%) | 4960 (54%) | 0.06 |
| Redside Shiner | 101 (85% | 392 (83%) | 8.71 | 73 (82%) | 240 (31%) | 5.48 | 52 (75%) | 198 (2%) | 3.13 |
| Utah Sucker | 12 (10%) | 56 (12%) | 1.03 | 12 (13%) | 234 (30%) | 0.09 | 8 (12%) | 3920 (43%) | 0.48 |
| Rainbow Trout | 0 | 0 | 0 | 1 (1%) | 294 (38%) | 0.08 | 0 | 0 | 0 |
| Total | 119 | 474 | 10.26 | 89 | 780 | 5.88 | 69 | 9132 | 4.15 |

Reach 4 had 5 fish species in 2005 and 2006 but only four in 2007 (Table 4.5-9). Longnose dace, mottled sculpin, redside shiner, and rainbow trout were all collected in all years of the study, while Utah suckers were collected in small numbers in 2005 and 2006, but none were collected in 2007.

**Table 4.5-9: Fish density and biomass for reach 4, October 2005, 2006, and 2007**

| Species | 2005 | | | 2006 | | | 2007 | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Weight (g) | CPUE | N | Weight (g) | CPUE | N | Weight (g) | CPUE |
| Longnose Dace | 39 (39%) | 263 (4%) | 2.59 | 27 (57%) | 134 (7%) | 1.10 | 35 (37%) | 225 (10%) | 1.77 |
| Small Mouth Bass | 0 | 0 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mottled Sculpin | 27 (27%) | 180 (3%) | 1.80 | 7 (15%) | 66 (3%) | 0.29 | 30 (32%) | 252 (12%) | 1.52 |
| Common Carp | 0 | 0 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Redside Shiner | 10 (10%) | 92 (1%) | 0.67 | 6 (13%) | 58 (3%) | 0.25 | 24 (26%) | 238 (11%) | 1.21 |
| Utah Sucker | 2 (2%) | 58 (1%) | 0.13 | 1 (2%) | 52 (3%) | 0.04 | 0 | 0 | 0 |
| Rainbow Trout | 22 (22%) | 6308 (91%) | 1.46 | 6 (13%) | 1600 (84%) | 0.25 | 5 (5%) | 1460 (67%) | 0.25 |
| Total | 100 | 6901 | 6.65 | 47 | 1910 | 1.93 | 94 | 2175 | 4.75 |

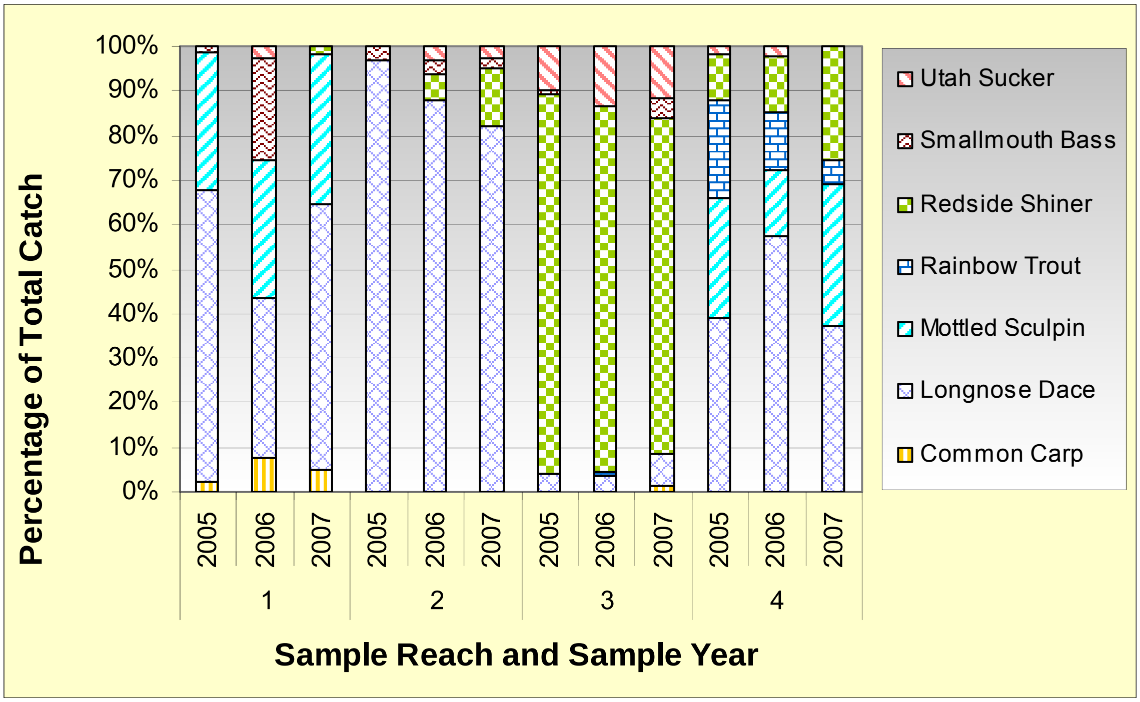
In reach 1, longnose dace accounted for the largest proportion of the relative species composition in all 3 years (65%, 36%, and 59% of catch) (Figure 4.5-6). Mottled sculpin were the next most abundant in all years at 31%, 31% and 34% of the catch. In all years, other species comprised less than 10% of the catch except in 2006, when small mouth bass accounted for 23%.

In reach 2, longnose dace were by far the most abundant in 2005, 2006 and 2007 (97%, 88%, 82%), and small mouth bass comprised 3% of the catch in all 3 years (Figure 4.5-6). Redside shiner and Utah sucker accounted for only a small proportion of the catch in 2006 and 2007, and neither of these species were collected in this reach in 2005.

In reach 3, redside shiner were the most abundant species in 2005, 2006, and 2007 (85%, 82%, and 75%) followed in all years by Utah sucker (10%, 13%, 12%) (Figure 4.5-6). Longnose dace, small mouth bass, common carp, and rainbow trout also accounted for small proportions of the catch in reach 3 during this study.

In reach 4, longnose dace accounted for the majority of the relative species composition in 2005 (39% of catch) and 2006 (57%), and 2007 (37%) (Figure 4.5-6). Mottled sculpin were the next most abundant in all 3 years (27%, 15%, and 32%). Rainbow trout accounted for 22% of the catch in 2005, 13% in 2006, and 5% in 2007. Redside shiner comprised a moderate amount of the catch all 3 years at 10% in 2005, 13% in 2006, and 26% in 2007.

**Figure 4.5-6: Species composition for reaches 1, 2, 3, and 4, 2005, 2006, and 2007**



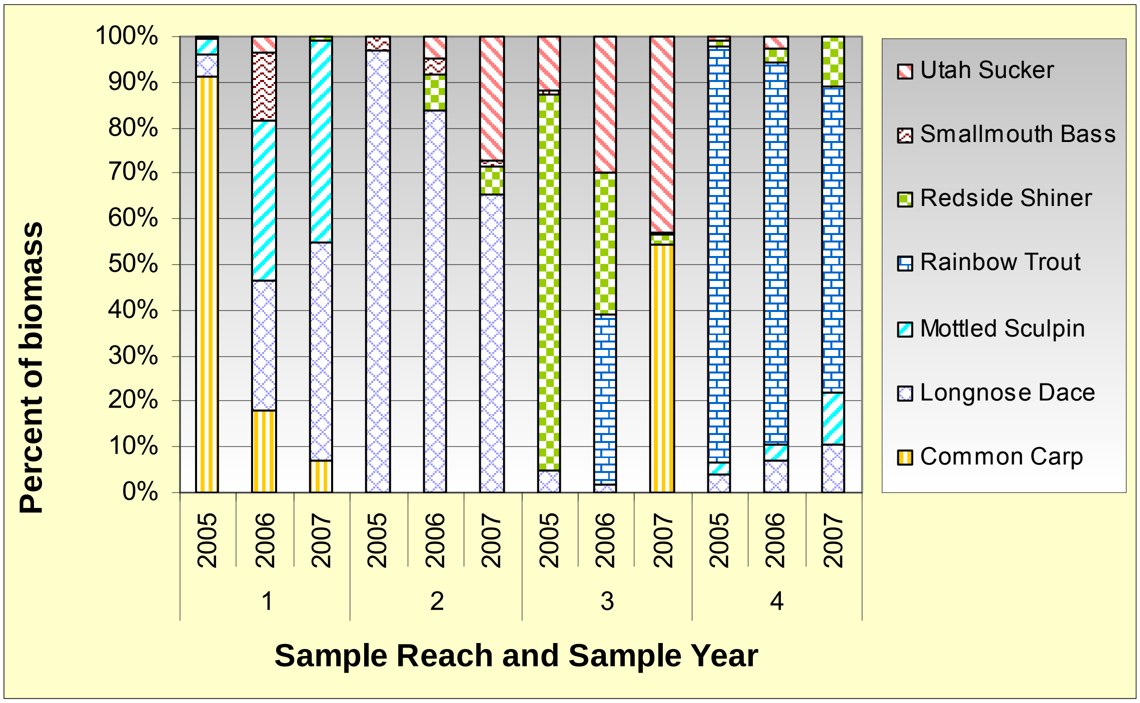

In reach 1, the total biomass was 7.31 kg in 2005, but was only 0.27 in 2006 and 0.39 in 2007 (Table 4.5-6). The large difference in total biomass was largely the result of collecting two large adult common carp in 2005 while only small juvenile carp were collected in 2006 and 2007. Accordingly, common carp accounted for 91% of the biomass in 2005 at 6.65 kg while in 2006 and 2007 they accounted for only 18% and 7%, respectively (Figure 4.5-7). In 2006, mottled sculpin accounted for the largest proportion of the biomass at 35% with just 0.09 kg followed by longnose dace at 29% (0.08 kg). In 2007 longnose dace accounted for the highest proportion of the biomass at 48% (0.19 kg) followed closely by mottled sculpin at 44% (0.17kg).

Total biomass in reach 2 was very similar in 2005 and 2006 at 0.27 and 0.25 kg, respectively, however in 2007 biomass increased to 0.52 kg (Table 4.5-7). This increase was due mainly to the capture of one 0.14 kg Utah sucker (27% of biomass). Longnose dace comprised a large majority of the biomass in all three years (97% in 2005; 84 % in 2006, and 66% in 2007). The remaining biomass was typically comprised of small proportions of small mouth bass and redside shiner (Figure 4.5-7).

In reach 3, total biomass was much greater in 2007 (9.13 kg) than in 2006 (0.78 kg) or 2005 (0.47 kg) (Table 4.5-8). The much greater total biomass can be attributed to the collection of one large adult common carp (4.96 kg) and several large adult Utah suckers. No carp were collected in reach 3 in 2005 or 2006 and only juvenile Utah suckers were collected during the same period. Redside shiner comprised a majority of the biomass in 2005 (83%, 0.39 kg). Rainbow trout made up a majority of the biomass in 2006 at 0.29 kg (38%) and common carp accounted for the highest proportion of the biomass in 2007 at 54% (4.96 kg) (Figure 4.5-7).

Total biomass in reach 4 was considerably greater in 2005 (6.90 kg) than in 2006 (1.91 kg) or 2007 (2.18 kg) (Table 4.5-9). This decrease in total biomass was consistent with a decrease in the number of rainbow trout collected in 2006 and 2007. However, rainbow trout still accounted for a large majority of the biomass in 2005, 2006, and 2007 at 91%, 84%, and 67%, respectively (Figure 4.5-7). The remainder of the biomass in reach 4 was typically comprised of small proportions of longnose dace, mottled sculpin, redside shiner, and Utah sucker.

**Figure 4.5-7: Biomass for reaches 1, 2, 3, and 4, 2005, 2006, and 2007**




In reach 1, total catch and CPUE varied considerably between the three study years. Total catch was highest in 2005 at 84 fish, followed by 59 fish in 2007, and 39 fish in 2006 (Table 4.5-6). Likewise, catch per unit effort (CPUE) was also highest in 2005 at 5.03 fish/minute, lesser at 3.33 fish/minute in 2007, and was lowest in 2006 at 2.31 fish/minute.

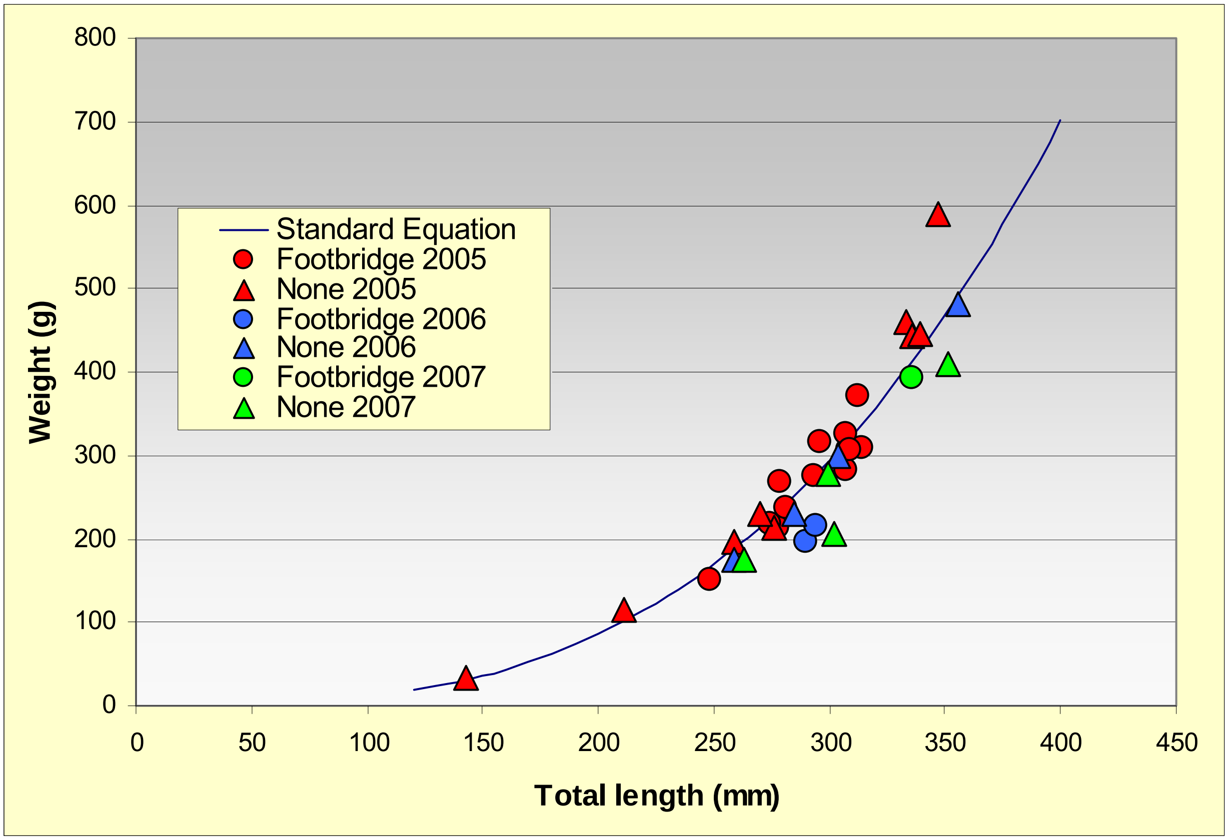
Total catch in reach 2 was similar between 2005, 2006, and 2007 with 34, 33, and 39 fish, respectively (Table 4.5-7). Correspondingly, CPUE was also similar with a rate of 1.57 fish/minute in 2005, 1.45 fish/minute in 2006, and 1.89 fish/minute in 2007.

Total catch in reach 3 decreased each year of the study. In 2005, total catch was highest at 119 fish, decreased to 89 fish in 2006, and decreased again in 2007 to 69 (Table 4.5-8). Following the same trend as total catch, CPUE was considerably higher in 2005 at 10.26 fish/minute than the 5.88 fish/minute in 2006 or the 4.15 fish/minute in 2007.

In reach 4, total catch was much higher in 2005 (100 fish) and 2007 (94 fish) than in 2006 when only 47 fish were collected (Table 4.5-9). Similarly, CPUE was also considerably greater in 2005 (6.65 fish/minute) and 2007 (4.75) than in 2006 (1.93 fish/minute).

Overall, the condition (relative weight) of rainbow trout in reach 4 was highest in 2005 with a mean of 104 (Figure 4.5-8). Mean relative weight of all rainbow trout collected was 89 in 2006, and in 2007 the mean was 87. The mean relative weight of freeze-branded hatchery released fish was lowest in 2006 at 76 compared to 95 in 2007 and 100 in 2005. The mean relative weight of fish without freeze-brands was 109 in 2005, 95 in 2006, and 85 in 2007.

**Figure 4.5-8: Length-weight relationship for rainbow trout, reach 4, 2005, 2006, and 2007**



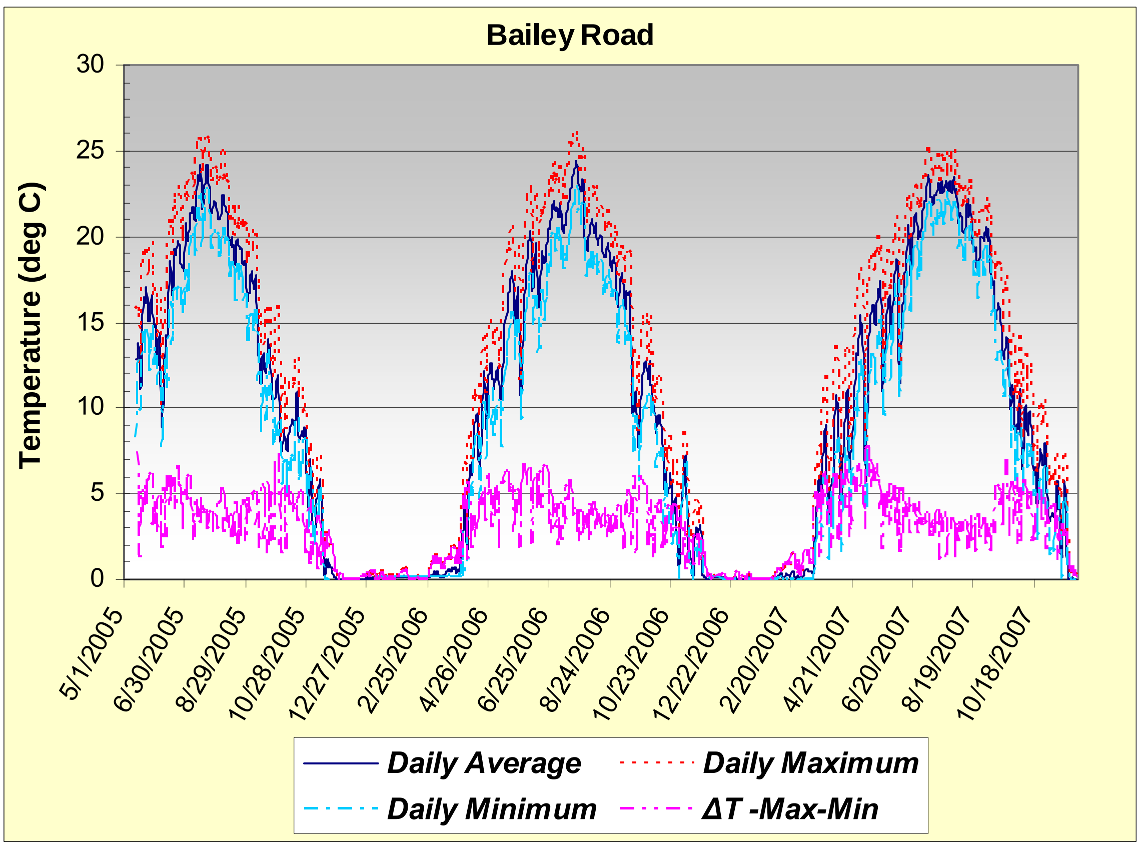

### 4.6 TEMPERATURE

Water temperature can be a critical factor limiting the distribution and abundance of aquatic species particularly coldwater fishes. For this reason analysis of water temperature at respective study sites was included in this report. Idaho DEQ staff deployed hobo temps in study reaches 1, 2, 3 and 4. Dates of deployment varied for respective sites depending on ease of access to the site. For example, in reach 3 the hobo temp was deployed on July 5, 2006 whereas the hobo temp in reach 2 adjacent to highway 34 has nearly continuous data since June 18, 2004. In this report data analysis spans the entire three-year period where water temperature data was available. The continuous data sets over the three year period convey seasonal fluctuations and influence of river regulation and natural springs on thermal regimes at respective study reaches. Analysis of temperature data focuses mainly on the summer period and shoulder seasons between April 1 and October 31. For salmonids temperature can be a limiting factor during the summer and accompanying shoulder seasons.

Daily average, minimum and maximum temperatures as well as the range of difference between the minimum and maximum were calculated from the hourly data for each study reach respectively (Figures 4.6-1, 4.6-2 4.6-3 and 4.6-4). Water temperatures in each respective study reach display varying degrees of response to meteorological conditions coupled with surface water heating in upstream impoundments. Daily maximum water temperature for each study reach was plotted alongside discharge below Grace Dam for comparison between reaches and to evaluate the influence of surface water spills from Grace Dam on water temperatures in the three reaches in the Black Canyon (Figure 4.6-5). The difference in maximum temperature, ΔT, relative to reach 2 was plotted for reaches 1, 3 and 4 respectively to analyze longitudinal maximum water temperature differences between reaches (Figure 4.6-6).

In reach 1 average stream temperatures began to exceed 20 ºC from June 16 through September 1, 2007 with occasional dips below 20 ºC in the latter part of August. In 2005 and 2006, daily average water temperatures did not reach 20 ºC until late June and typically were below 20 ºC by mid-August. Daily maximum temperatures were consistently above 20 ºC from June 12 through September 4, 2007. The maximum water temperature in reach 1 was 25.3 ºC on July 5, 2007 compared to 26.1 ºC in 2006 and 25.8 ºC in 2005, both of which occurred on July 22. Daily minimum temperatures were consistently greater than 20 ºC from July 2 through August 4, 2007. Daily minimum temperatures exceeded 20 ºC for 37 days in the summer of 2007, compared to 17 days in 2006 and 21 days in 2005. Temperatures greater than 20 ºC exceed thresholds for salmonids. Diel temperature fluctuations (maximum minus minimum daily temperature) during the summer months (June 21 through September 21) in reach 1 averaged 3.2 ºC in 2007, compared to 3.8 ºC in 2006 and 4.0 ºC in 2005.

**Figure 4.6-1: Daily minimum, average and maximum water temperatures in reach 1, 2005 through 2007**




Reach 2 daily average water temperatures were greater than 20 ºC from June 23 to August 21, 2007, compared to June 29 to August 12, 2006 and July 1 to August 15 in 2005 (Figure 4.6-2). Daily maximum temperatures were consistently above 20 ºC from June 21 to September 4, 2007 compared to June 22 through August 19, 2006 and June 27 to August 18, 2005. A maximum stream temperature of 24.3 ºC was recorded on July 8, 2007 in reach 2, compared to a maximum of 24.6 ºC on July 25, 2006 and 23.9 ºC on July 1, 2005. Diel temperature fluctuations during the summer months (June 21 through September 21) in reach 2 averaged 1.6 ºC in 2007 compared to 1.3 ºC in 2006 and 1.4 ºC in 2005. Diel temperature fluctuations during the summer months in reach 2 exhibited a substantially narrower range in daily temperature fluctuations relative to reach 1.

In reach 3, stream temperature was monitored in 2006 only. The hobo temp was deployed on July 5 and retrieved on October 10, 2006. In 2006, daily average stream temperatures exceeded 20 ºC from the time of deployment to July 31 (Figure 4.6-3). Daily maximum temperatures were consistently above 20 ºC from deployment through September 6, 2006. A maximum stream temperature of 27.1 ºC was recorded on July 21, 2006 in reach 3. This was the highest stream temperature recorded for all reaches for the period of study, 2005 through 2006. Diel temperature fluctuations during the summer months of 2006 in reach 3 averaged 6 ºC, the widest daily fluctuation of the four study reaches.

**Figure 4.6-1: Daily minimum, average and maximum water temperatures in reach 2, 2005 through 2007**

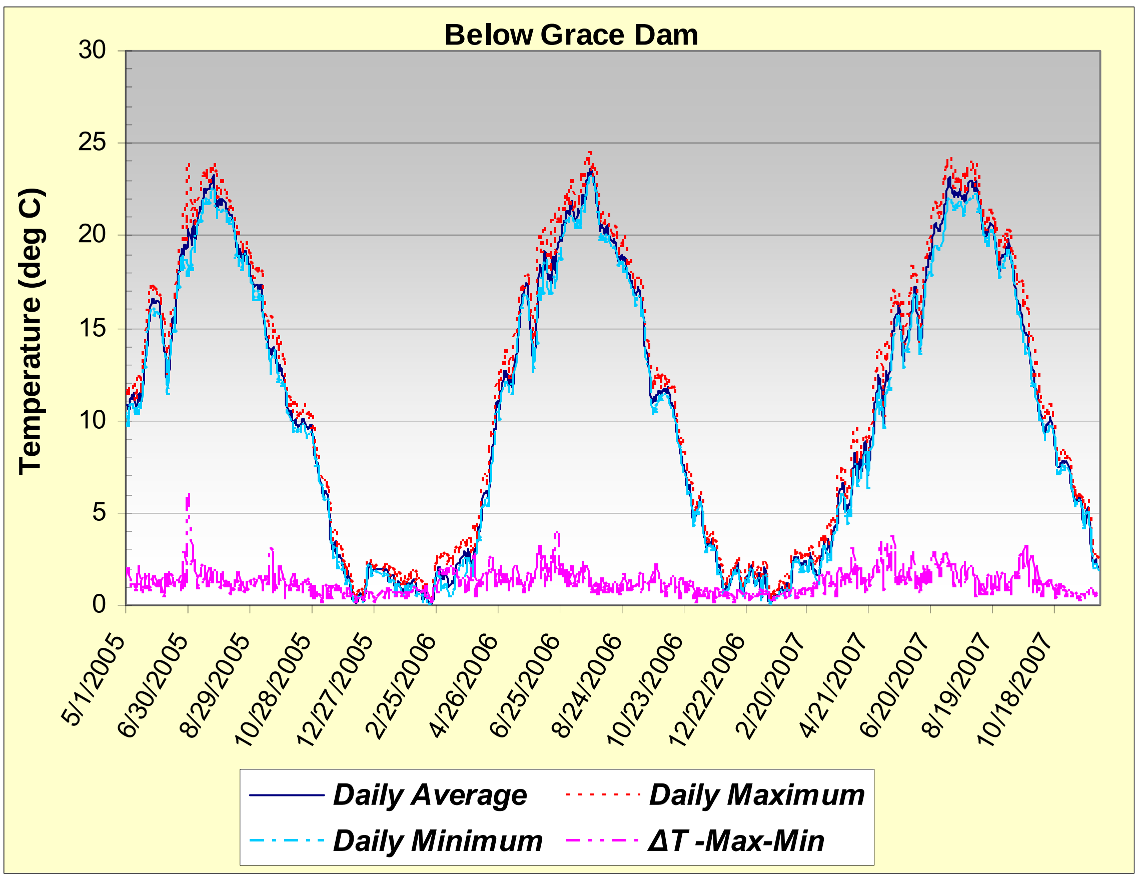
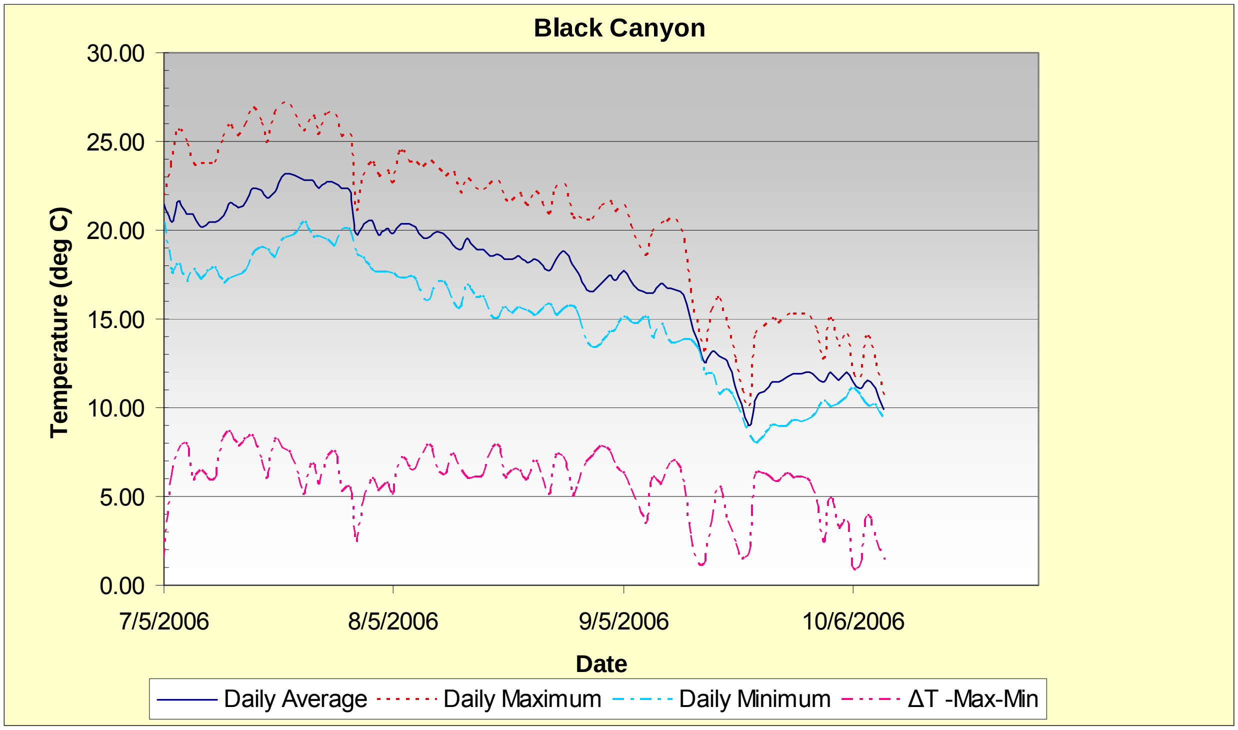
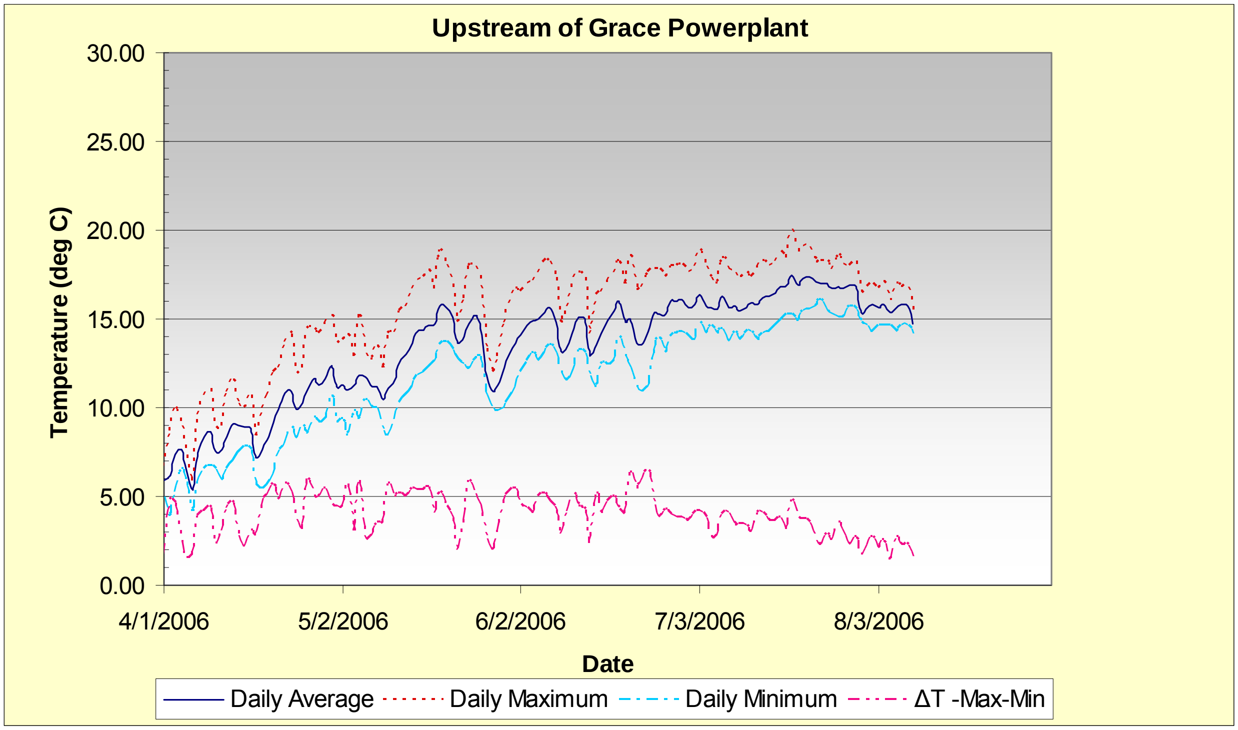


**Figure 4.6-1: Daily minimum, average and maximum water temperatures in reach 3, 2005 through 2007**




Reach 4 daily average water temperatures never exceeded 20 ºC in 2006 or 2007 (Figure 4.6-4). In 2005 the daily average exceeded 20 C on July 25, 2005 only. Daily maximum temperatures in reach 4 remained below 20 ºC throughout the summer period in each year except for a single day in each year respectively; July 25, 2005 (22.9 ºC), July 19, 2006 (20.1 ºC) and July 23, 2007 (21.0 ºC). Diel temperature fluctuations during the summer months in reach 4 averaged 4.1 ºC in 2007, 3.5 ºC in 2006 and 4.0 ºC in 2005.

**Figure 4.6-1: Daily minimum, average and maximum water temperatures in reach 4, 2005 through 2007**




In 2005, 2006 and 2007, daily maximum stream temperatures in reach 1 were 1 ºC warmer on average than those recorded in reach 2 below Grace Dam during the summer season, June 21 to September 21 (Figure 4-6.5). Daily maximum stream temperatures in reach 3 were 2.2 ºC warmer on average than those recorded in reach 2 below Grace Dam (Figure 4-6.5) indicating thermal warming between reach 2 and 3. Reach 4 daily maximum temperatures averaged 2.0 ºC, 3.5 ºC and 2.3 ºC cooler in 2005, 2006 and 2007 respectively than reach 2 below Grace Dam for the summer season.

Releases from Grace Dam have the potential to cause thermal loading to surface waters in reaches 2, 3 and 4. Over the three-year monitoring period discharge has remained relatively stable in the regulated reach below Grace Dam reflecting the MIF requirement in the FERC license. On several occasions, spills from Grace Dam have occurred to pass water downstream to meet irrigation demands. In 2005, the maximum summer flow below Grace Dam was 255 cfs on July 26, 2005. In 2006, several small discharge spikes occurred in the summer time frame; 128 cfs on June 21; 122 cfs on July 22, 115 cfs on August 4 and 152 cfs on September 18. In 2007, the maximum flow below Grace Dam was 218 cfs on June 27$^{th}$. During that release maximum temperatures in reach 4 reached 20.8 ºC, equivalent to the highest temperature recorded in reach 4 in 2007.

**Figure 4.6-5: Daily maximum water temperature differences between reaches, 2005-2007**

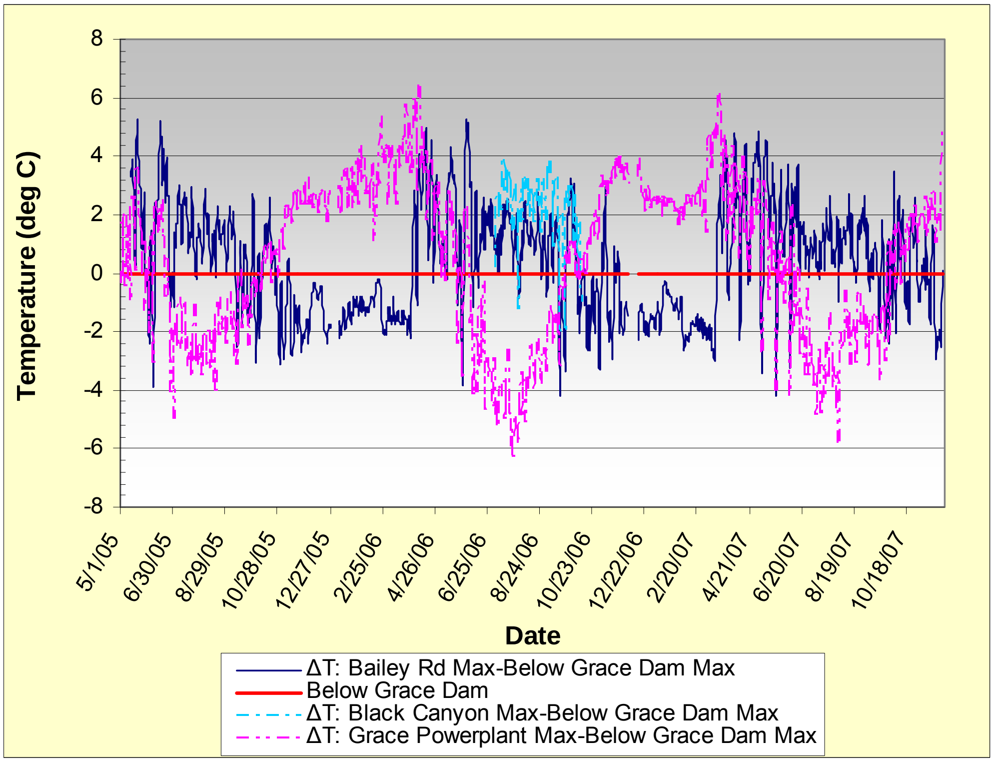
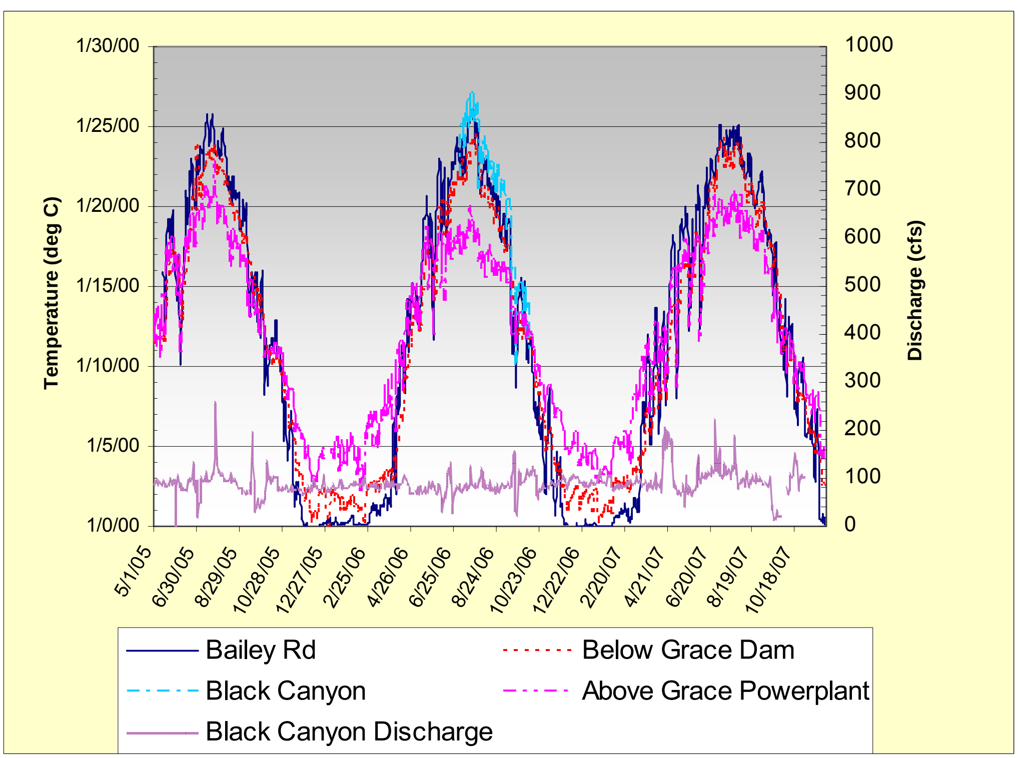



**Figure 4.6-6: Maximum water temperatures in reaches 1, 2, 3 and 4, 2005 through 2007**



The absence of substantial changes in discharge in the summer season during the three-year baseline monitoring period makes it difficult to detect if there was an interaction between changes in discharge at Grace Dam and stream temperatures in reaches 2, 3 and 4 (Figure 4.6-6). In 2006, daily maximum stream temperatures in reach 4 increased approximately 1 ºC from the previous day on June 21 and July 19 corresponding to discharge increases from Grace Dam. In 2007, daily maximum stream temperature on June 27 was approximately 2 ºC higher than the day prior or after the release. Meteorological data was not included in the analysis to factor in the influence of air temperatures. Temperature data was not available for reach 3 in years 2005 and 2007.

## *4.7 BENTHIC MACROINVERTEBRATES*

In 2007, BMI density (Figure 4.7-1) was significantly different between the four study reaches (p=0.001, H-test). Reach 4 contained the highest BMI density (80,589 organisms/m$^2$) of all four study reaches. Reach 4 BMI density was approximately six-times greater than reach 1 (14,367 organisms/m$^2$), five-times greater than reach 2 (16,151 organisms/m$^2$) and twenty-two-times greater than reach 3 (3,645 organisms/m$^2$). Reach 3 contained the lowest BMI density in 2007.

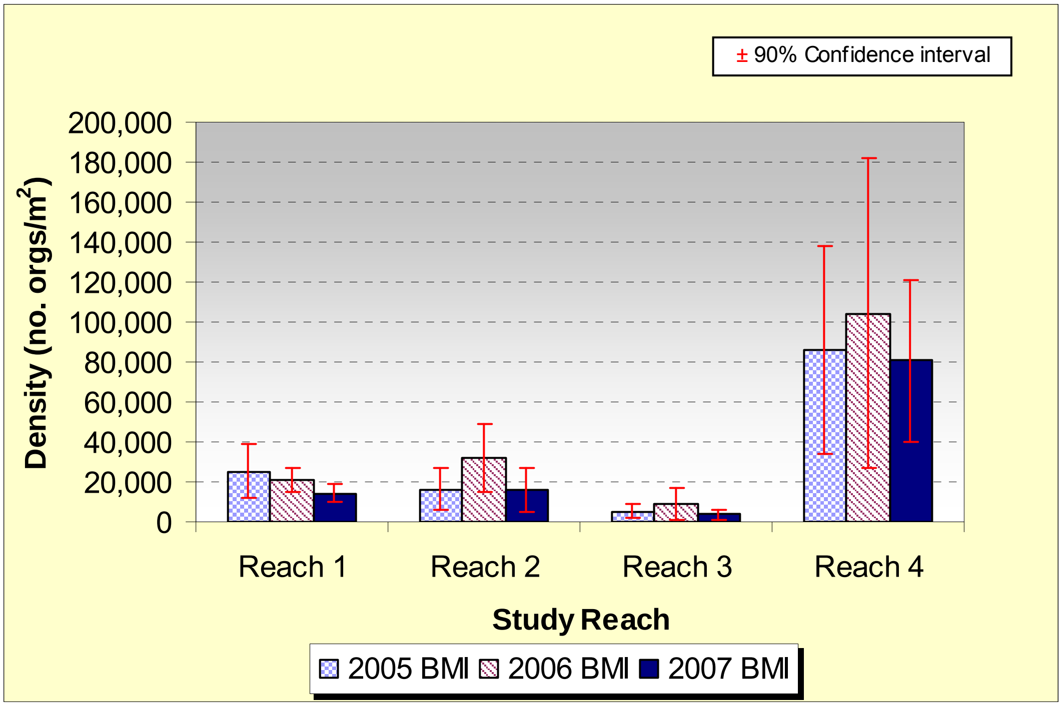
Multi-year comparisons within a single study reach indicate BMI densities were similar over time (single factor ANOVA and Kruskal-Wallis H-test). In reach 1, BMI density was highest in 2005 declining progressively with each successive sample year; 2005 (25,144 organisms/m$^2$), 2006 (21,190 organisms/m$^2$) and 2007 (14,367 organisms/m$^2$) (Table 4.7-1). In reach 2, BMI density in 2006 (31,929 organisms/m$^2$) was nearly double densities in 2005 (16,402 organisms/m$^2$) and 2007 (16,151 organisms/m$^2$). In reach 3, BMI density was highest in 2006 (8,620 organisms/m$^2$) followed by 2005 (5,390 organisms/m$^2$) and lastly 2007 (3,645 organisms/m$^2$). Reach 4 BMI density followed a similar pattern to reaches 2 and 3 with the 2006 samples containing the highest BMI density (104,430 organisms/m$^2$) followed by 2005 (86,048 organisms/m$^2$) and lastly by 2007 (80,589 organisms/m$^2$).

**Table 4.7-1: Average BMI density in October at four reaches; 2005, 2006 and 2007**

| | BMI | | | | | | EPT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2005 | | 2006 | | 2007 | | 2005 | | 2006 | | 2007 | |
| **Study Reach** | Density | No. taxa | Density | No. taxa | Density | No. taxa | Density | No. taxa | Density | No. taxa | Density | No. taxa |
| Reach 1 | 25,144 | 39 | 21,190 | 39 | 14,367 | 28 | 14,836 | 14 | 13,415 | 16 | 10,544 | 13 |
| Reach 2 | 16,402 | 37 | 31,929 | 39 | 16,151 | 25 | 595 | 5 | 1,244 | 5 | 124 | 3 |
| Reach 3 | 5,390 | 45 | 8,621 | 39 | 3,645 | 35 | 826 | 11 | 2,125 | 10 | 727 | 9 |
| Reach 4 | 86,048 | 25 | 104,430 | 34 | 80,589 | 20 | 412 | 2 | 2,310 | 5 | 238 | 2 |

EPT density (Figure 4.7-2) varied significantly between the four study reaches in 2007 (p=0.005, H-test). EPT density was substantially greater in reach 1 (10,544 organisms/m$^2$) than reaches 2, 3 and 4 (124 organisms/m$^2$, 727 organisms/m$^2$ and 238 organisms/m$^2$ respectively). In reach 1, EPT comprised 73 percent of the overall BMI density compared to 1 percent, 20 percent and less than 1 percent in reaches 2, 3 and 4 respectively.

**Figure 4.7-1: BMI Density, 2005, 2006 and 2007**




Multi-year comparisons within a single study reach indicate EPT densities were similar in reaches 1, 2 and 3 over time (single factor ANOVA and Kruskal-Wallis H-test). In reach 1, EPT density was highest in 2005 declining progressively with each successive sample year; 2005 (14,836 organisms/m$^2$), 2006 (13,415 organisms/m$^2$) and 2007 (10,544 organisms/m$^2$) (Table 4.7-1). In reach 2, EPT density in 2006 (1,244 organisms/m$^2$) was double densities in 2005 (595 organisms/m$^2$) and ten times greater than 2007 (124 organisms/m$^2$). In reach 3, EPT density was highest in 2006 (2,125 organisms/m$^2$) followed by 2005 (826 organisms/m$^2$) and lastly 2007 (727 organisms/m$^2$). In reach 4, EPT density was significantly greater in 2006 compared to EPT density in 2005 and 2006 (412 and 238 organisms/m$^2$ respectively) ($p= 0.005$, H-test).

BMI taxa richness was significantly different between study reaches in 2007 ($p=0.02$, single factor ANOVA) (Figure 4.7-3). Reach 3 contained the highest number of taxa (35) followed by reach 1 (28), reach 2 (25) and reach 4 (20). Significant differences in taxa richness also existed in 2005 between reaches ($p=0.006$, H-test). In 2005, reach 3 had the highest taxa richness (45), compared to reach 1 (39), reach 2 (37) and reach 4 (25) (Table 4.7-1). In 2006, taxa richness was similar between reaches. In that sample year, reaches 1, 2 and 3 each contained 39 taxa while reach 4 was again the lowest with 34 taxa.

Multi-year comparisons within each study reach indicates that taxa richness declined across all reaches in 2007 compared to the previous two sampling years. In reach 1, taxa richness was significantly lower in 2007 (28) compared to 2005 and 2006 (39 taxa respectively) ($p=0.002$, single factor ANOVA). In reach 2, taxa richness was significantly lower in 2007 (25) compared to 2005 and 2006 (37 and 39 taxa respectively) ($p=0.07$, single factor ANOVA). In reach 3, taxa richness was lower in 2007 compared to 2005 and 2006 but not significant. In reach 4, taxa richness was significantly lower in 2007 (20) compared to 2005 and 2006 (25 and 34 taxa respectively) (p=0.006, single factor ANOVA). Taxa richness was more similar in sample years 2005 and 2006 for individual reaches.

EPT taxa richness was significantly different between study reaches in 2007 (p=0.001, H-test) (Figure 4.7-4). Reach 1 contained the highest number of taxa (13) followed by reach 3 (9), reach 2 (3) and reach 4 (2). EPT taxa richness was also significantly different between reaches in 2005 (p=0.0005, H-test) and 2006 (p=0.000005, single factor ANOVA). EPT taxa richness was highest in reach 1 in both 2005 (14) and 2006 (16) followed by reach 3 with (11 and 10 respectively), reach 2 ( 5 EPT taxa each year) and reach 4 (2 and 5 EPT taxa respectively). In all three years reaches 1 and 3 had the highest number of EPT taxa, while reaches 2 and 4 had the lowest number of EPT taxa.

Multi-year comparisons within each study reach indicates that EPT taxa richness declined across three out of four reaches in 2007 compared to the previous two sampling years. EPT taxa richness was significantly different between years in two out of four reaches. In reach 1, EPT taxa richness was significantly higher in 2006 (16) compared to 2005 (14) and 2007 (13) (p=0.06, H-test). In reach 4, EPT taxa richness was significantly higher in 2006 (5) compared to 2005 and 2007 (2 EPT taxa respectively) (p=0.001, single factor ANOVA).

In reach 4, the EPT taxa community was more similar in 2007 and 2005 EPT compared to 2006. In 2006, three Ephemeroptera taxa were present not previously observed in 2005; *Baetis sp.*, *Ephemerella sp.* and *Fallceon quilleri.* The Ephemeroptera *Tricorythodes sp.* observed in 2005 in reach 4 was not found in 2006. In 2007, *Tricorythodes sp.* and *Baetis tricaudatus* were the only Ephemeroptera taxa present in reach 4. *Ephemerella sp.* and *Fallceon quilleri* were not observed in 2007 in reach 4. Trichoptera taxa in 2007 consisted of *Hydroptial sp.*, *Nectopsyche sp.* and *Oecetis sp.*. The three new Trichoptera taxa observed in 2006 in reach 4 were not observed in 2007; *Chimarra sp.*, *Glossosomatidae* and *Neotrichia* sp.. The Trichoptera taxa, *Amiocentrus aspilus*, previously found in reach 4 in 2005 was not observed in 2006 or 2007. Plecoptera taxa were not present in reach 4 in 2005, 2006 or 2007.

**Figure 4.7-2: EPT density, 2005, 2006 and 2007**

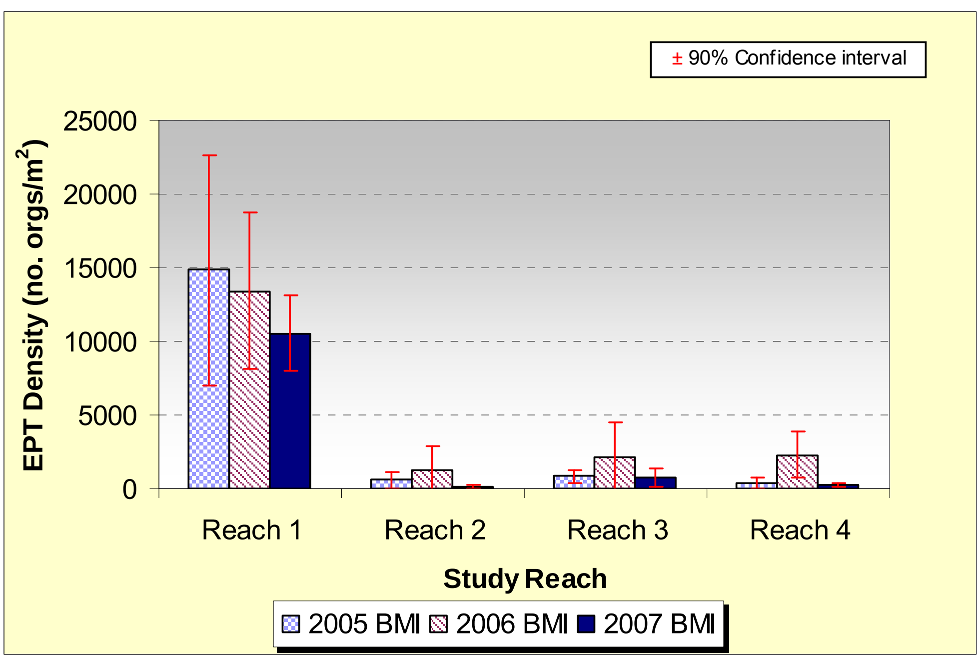


**Figure 4.7-3: BMI taxa richness, 2005, 2006 and 2007**

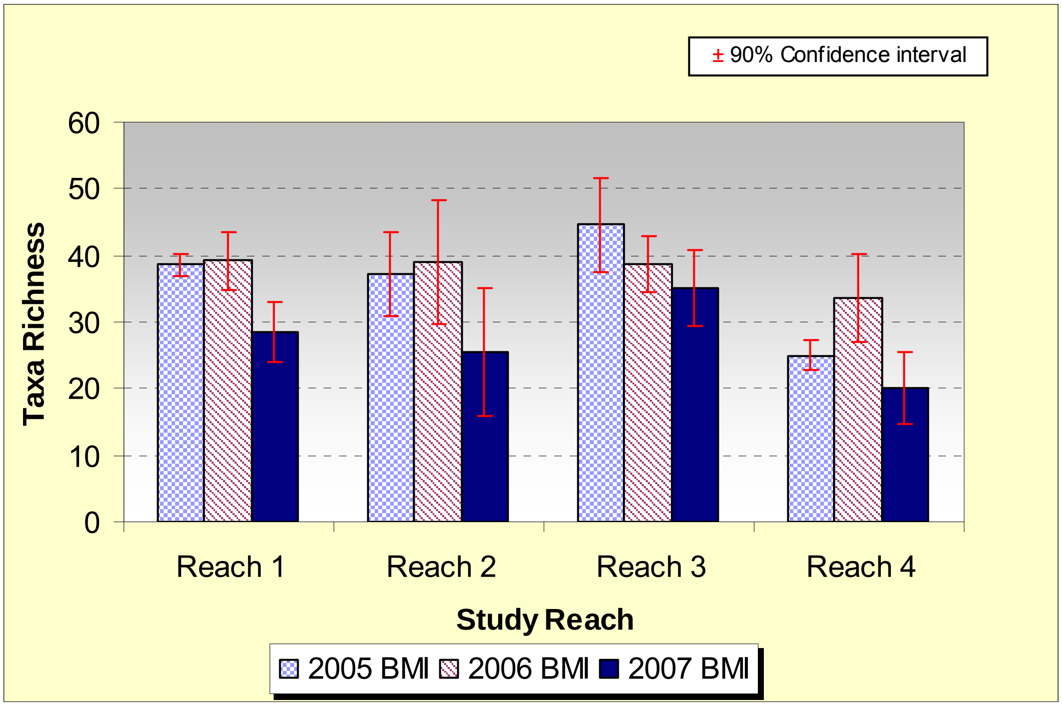
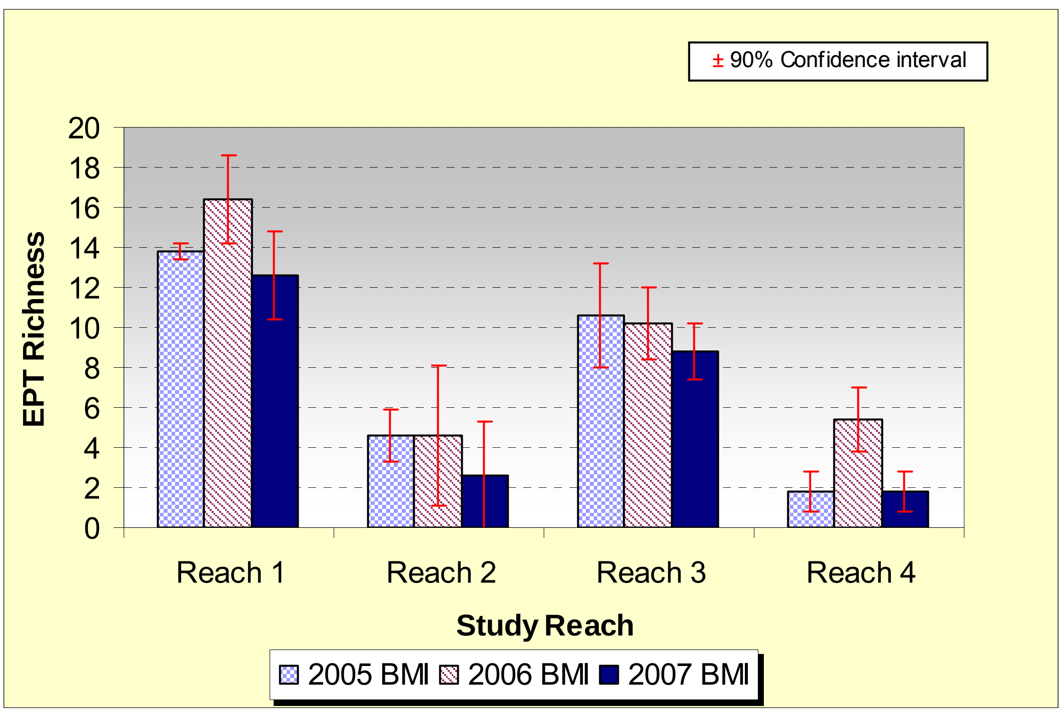



**Figure 4.7-4: EPT taxa richness, 2005, 2006 and 2007**




Dominant taxa measures reveal the proportion of the dominant taxa relative to the larger BMI community. In 2007, the top three dominant taxa in reach 1 comprised 47% of the BMI density; dominant taxa 1—19%, dominant taxa 2—15% and dominant taxa 3—12% (Table 4.7-2).

Percentages for the top three dominant taxa in 2005 and 2006 were lower than 2007 (42% and 41% respectively) (Figure 4.7-5). Dominant 1 and 2 taxa had similar percentages in all three years, but the third dominant taxa was significantly higher in 2007 compared to 2005 and 2006 (p=0.02, H-test).

**Table 4.7-2: Top three dominant taxa percentages, 2005, 2006 and 2007**

| Study Reach | Dominant Taxa 1 (%) | | | Dominant Taxa 2 (%) | | | Dominant Taxa 3 (%) | | | Totals (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 |
| R1 | 20.2 | 17.3 | 19.3 | 12.5 | 12.6 | 15.1 | 8.9 | 10.6 | 12.3*** | 41.6 | 40.5 | 46.7 |
| R2 | 31.6 | 25.2 | 38.4 | 12.4 | 12.3 | 16.4 | 9.9 | 9.5 | 11.4 | 53.9 | 47.0 | 66.2 |
| R3 | 21.7 | 13.4* | 23.0 | 9.8 | 10.4 | 14.0** | 8.4 | 9.7 | 9.4 | 40.0 | 33.5 | 46.4 |
| R4 | 79.6 | 70.3 | 82.6 | 5.3 | 5.3 | 3.6 | 3.1 | 3.9 | 2.4 | 88.0 | 79.4 | 88.6 |

*p=0.05 H-test **p=0.02 H-test ***p=0.02 H-test

The dominant taxa in reach 1 consisted of Ephemeroptera, Trichoptera and Diptera taxa. In 2005 three different dominant taxa were present in reach 1; *Simulium sp.* (TA), *Hydropsyche sp.* (TB) and *Ephemerella inermis/infrequens* (TC, TD and TE). The dominant taxa in 2006 was similar to that in 2005; *Simulium sp.* (TA and TD), *Hydropsyche sp.* (TB) and *Ephemerella infrequens* (TC and TE). In 2007, the dominant taxa included two new Trichoptera taxa in addition to *Hydropsyche sp.* and a chronomid; *Protoptila sp.* (TA), *Hydropsyche sp.* (TB), *Cricotopus trifascia gr.* (TC and TD) and *Culoptila sp.* (TE).

In reach 2 in 2007, the top three dominant taxa comprised 66% of the BMI density (dominant taxa 1—38%, dominant taxa 2—16% and dominant taxa 3—11%). In 2005 and 2006, the combined percentages for the top three dominant taxa in reach 2 were 54% and 47% respectively.

The dominant taxa in reach 2 consisted of a crustacean (*Ostracoda*), water mites and dipterans. In 2005, the dominant taxa in reach 2 was *Ostracoda* in transects TA, TB, TC and TE. Transect TD was dominated by the water mite *Hygrobates sp.* The dominant taxa in 2006 and 2007 in reach 2 was identical for four of the five transects, TB through TE; *Simulium sp.*(TB), *Ostracoda* (TC) and *Hygrobates sp*. (TD and TE). Transect TA contained *Microtendipes pedellus gr.* in 2006 and *Turbellaria* in 2007.

In Reach 3, the top three dominant taxa in 2007 comprised 46% of the BMI density (dominant taxa 1—23%, dominant taxa 2—14% and dominant taxa 3—9%). In 2005 and 2006, the combined percentages for the top three dominant taxa in reach 3 were 40% and 34% respectively. In 2006, the dominant 1 taxa percentage was significantly lower than 2005 and 2007 (p=0.05, H-test). In 2007, the dominant 2 taxa percentage was significantly higher than 2005 and 2006 (p=0.02, H-test). The dominant 3 taxa percentage was similar for all three sample years.

The dominant taxa in reach 3 consisted largely of dipterans, water mites and an aquatic Lepidoptera (*Petrophila sp.*) over the three year sample period. In 2005, the water mite *Hygrobates sp*. was the dominant taxa at four of the five transects and *Orthocladius sp.*, a chironomid, was the dominant taxa at the fifth transect. In 2006, five different taxa dominated each transect; *Pseudochironomus sp.* (TA), *Hygrobates sp.* (TB), *Petrophila sp.* (TC), *Turbellaria* (TD) and *Prostoma sp.* (TE). In 2007, *Orthocladius sp.* was the dominant taxa in two transects (TA and TC), *Hygrobates sp.* (TB), *Petrophila sp.* (TD) and *Ostracoda* (TE).

In Reach 4, the top three dominant taxa comprised 89% of the BMI community (dominant taxa 1—83%, dominant taxa 2—4% and dominant taxa 3—2%). In 2005 and 2006, the combined percentages for the top three dominant taxa in reach 4 were 88% and 79% respectively.

Reach 4 was dominated by the order Gastropoda. In 2005, transects TA through TE in reach 4 were dominated by *Potamopyrgus antipodarum*. In 2006, transects TA through TE in reach 4 were dominated by *Hydrobiidae*, the family level for the taxa *Potamopyrgus antipodarum.* In 2007, transects TA through TE in reach 4 were again dominated by *Potamopyrgus antipodarum*.

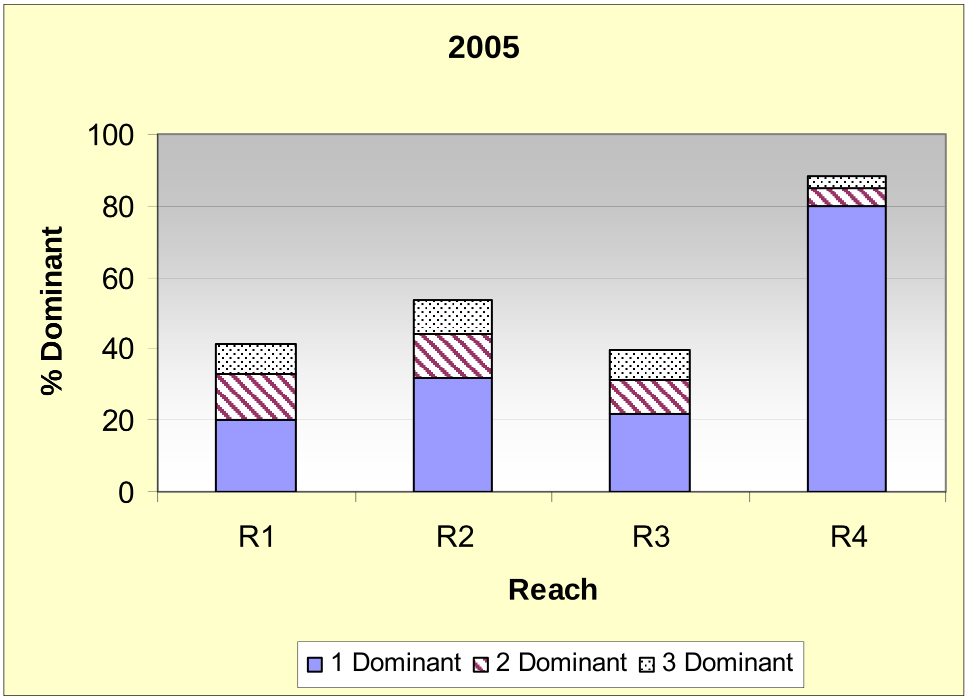
BMI community composition had distinct differences between reaches in 2007 (Figure 4.7-6). In reach 1, Trichoptera dominated the community (55%) followed by Chironomidae (19%), and Ephemeroptera (19%). In reach 2, BMI community composition was distributed between Acarina (27%), Crustacea(26%) and Chironomidae (22%). In reach 3, BMI community composition was dominated by Chironomidae (27%), Trichoptera (17%), Coleoptera (11%) and Lepidoptera (9%). In reach 4, BMI community composition was dominated by Gastropoda (89%), Chironomidae (5%) and Acarina (2%). Table 4.7-3 and 4.7-4 list the density per square meter and relative abundance for all taxonomic orders present at each respective study reach.

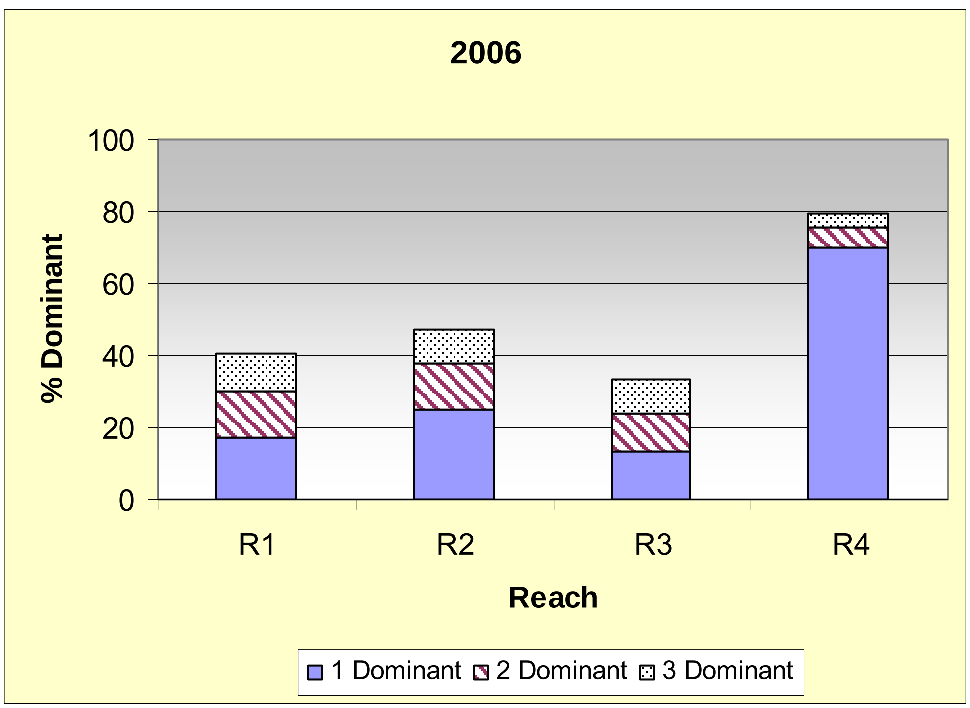
In reach 1, BMI community composition shifted over time from a community evenly distributed between Ephemeroptera, Diptera and Trichoptera in 2005 and 2006 to a community dominated by Trichoptera in 2007. In 2005, the BMI community composition consisted of Ephemeroptera (38%), Diptera (35%), Trichoptera (20%) and Annelida (4%). The remaining orders were less than 1% of the community composition. In 2006, the BMI community composition consisted of Diptera (35%), Trichoptera (32%) and Ephemeroptera (31%). In 2007, reach 1 community composition consisted of Trichoptera (55%), Ephemeroptera (19%), Chironomidae (19%) and Diptera (5%).

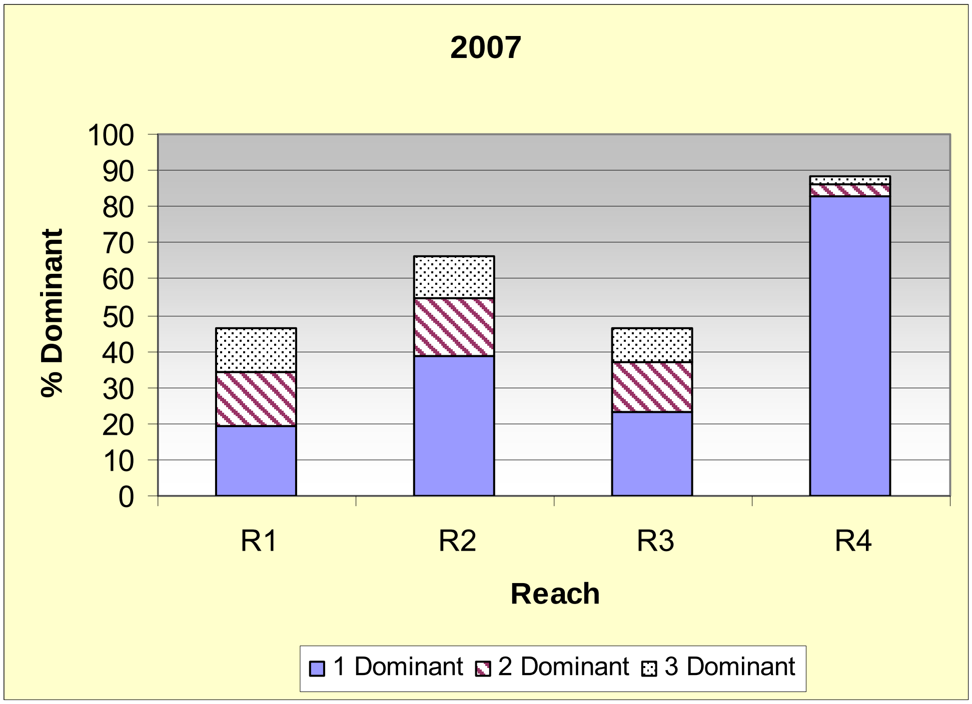
In reach 2, the BMI community composition remained similar for the most part over the three year sampling period with the exception of Acarina which doubled in percentage between 2005 and 2007. In 2005, BMI community composition was dominated by Chironomidae (39%) followed by Crustacea (26%), Acarina (12%), and other organisms (12%). In 2006, BMI community composition was again dominated by Chironomidae (36%), Acarina (20%), other organisms (13%) and Crustacea (11%). In 2007, BMI community composition was dominated by Acarina (27%), Crustacea (26%), Chironomidae (22%) and other organisms (14%). The order Trichoptera made up 4% of the BMI community composition in 2005 and 2006 respectively and 1% in 2007. The order Ephemeroptera was less than 1 percent of the BMI community all three years. The order Plecoptera was not present in reach 2 in any of the sample years.

BMI community composition in reach 3 had the most balanced distribution of taxonomic orders relative to reaches 1, 2 and 4. In 2005, BMI community composition consisted of Acarina (26%), Chironomidae (24%), Trichoptera (11%), Coleoptera (11%), Diptera (7%), Lepidoptera (5%) and Ephemeroptera (4%). In 2006, BMI community composition consisted of Chironomidae (28%), Trichoptera (21%), Acarina (17%), Colepotera (13%), Lepidoptera (9%), Diptera (4%) and Ephemeroptera (3%). In 2007, BMI community composition consisted of Chironomidae (27%), Acarina (21%), Trichoptera (17%), Colepotera (11%), Lepidoptera (9%), Crustacea (6%), Diptera (4%) and Ephemeroptera (3%). Lepidoptera were more common in reach 3 relative to reaches 1, 2 and 4. Plecoptera were not present in reach 3 in 2007 but comprised less than 1% in 2005 and 2006.

**Figure 4.7-5: Top three dominant taxa; 2005, 2006 and 2007**






Reach 4 was dominated by the order Gastropoda in all three sample years; 2005 (85%), 2006 (77%) and 2007 (89%). Chironomidae was the second most dominant taxa in the three sample years; 2005 (8%), 2006 (11%) and 2007 (5%). Ephemeroptera made up less than 1% of the BMI community in reach 4 in all three sample years. Plecoptera were not present in any sample year. Reach 4 was the only site where gastropods were dominated the BMI community composition. Gastropods made up less than 1% of the community composition in reaches 1, 2 and 3 in all three sample years.

**Table 4.7-3: BMI relative abundance by taxonomic order, reaches 1 and 2**

| Taxonomic Order | Reach 1 | | | | | | Reach 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2005 | | 2006 | | 2007 | | 2005 | | 2006 | | 2007 | |
| | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % |
| **Ephemeroptera** | 9508 | 38% | 6,544 | 31% | 2,680 | 19% | 11 | 0% | 116 | 0% | 26 | 0% |
| **Plecoptera** | 354 | 1% | 81 | 0% | 38 | 0% | 0 | 0% | 0 | 0% | 0 | 0% |
| **Trichoptera** | 4961 | 20% | 6,798 | 32% | 7,825 | 54% | 584 | 4% | 1,128 | 4% | 98 | 1% |
| **Odonata** | 3 | 0% | 6 | 0% | 0 | 0% | 95 | 1% | 83 | 0% | 77 | 0% |
| **Coleoptera** | 52 | 0% | 73 | 0% | 112 | 1% | 58 | 0% | 73 | 0% | 40 | 0% |
| **Chironomidae** | 6939 | 28% | 4,438 | 21% | 2,713 | 19% | 6425 | 39% | 11,444 | 36% | 3,518 | 22% |
| **Diptera** | 1770 | 7% | 2,838 | 13% | 761 | 5% | 671 | 4% | 2,171 | 7% | 401 | 2% |
| **Lepidoptera** | 266 | 1% | 83 | 0% | 179 | 1% | 9 | 0% | 24 | 0% | 0 | 0% |
| **Gastropoda** | 5 | 0% | 0 | 0% | 0 | 0% | 1 | 0% | 17 | 0% | 0 | 0% |
| **Bivalvia** | 145 | 1% | 90 | 0% | 15 | 0% | 108 | 1% | 1,096 | 3% | 105 | 1% |
| **Annelida** | 1042 | 4% | 158 | 1% | 4 | 0% | 300 | 2% | 1,683 | 5% | 1,095 | 7% |
| **Acarina** | 47 | 0% | 72 | 0% | 14 | 0% | 2029 | 12% | 6,502 | 20% | 4,326 | 27% |
| **Crustacea** | 31 | 0% | 14 | 0% | 17 | 0% | 4221 | 26% | 3,383 | 11% | 4,167 | 26% |
| **Other Organisms** | 0 | 0% | 8 | 0% | 7 | 0% | 1889 | 12% | 4,207 | 13% | 2,302 | 14% |
| **Total Organisms/m2** | 25123 | | 21202 | | 14366 | | 16400 | | 31927 | | 16156 | |

**Table 4.7-4: BMI relative abundance by taxonomic order, reaches 3 and 4**

| Taxonomic Order | Reach 3 | | | | | | Reach 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2005 | | 2006 | | 2007 | | 2005 | | 2006 | | 2007 | |
| | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % | No./m$^2$ | % |
| Ephemeroptera | 216 | 4% | 295 | 3% | 123 | 3% | 211 | 0% | 1,188 | 1% | 157 | 0% |
| Plecoptera | 3 | 0% | 2 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% |
| Trichoptera | 607 | 11% | 1,827 | 21% | 604 | 17% | 199 | 0% | 1,116 | 1% | 81 | 0% |
| Odonata | 31 | 1% | 2 | 0% | 4 | 0% | 19 | 0% | 59 | 0% | 0 | 0% |
| Coleoptera | 588 | 11% | 1,086 | 13% | 384 | 11% | 478 | 1% | 1,040 | 1% | 52 | 0% |
| Chironomidae | 1309 | 24% | 2,453 | 28% | 976 | 27% | 6829 | 8% | 11,744 | 11% | 4,042 | 5% |
| Diptera | 374 | 7% | 324 | 4% | 161 | 4% | 1027 | 1% | 3,484 | 3% | 1,013 | 1% |
| Lepidoptera | 267 | 5% | 767 | 9% | 325 | 9% | 0 | 0% | 0 | 0% | 0 | 0% |
| Gastropoda | 12 | 0% | 0 | 0% | 1 | 0% | 72841 | 85% | 79,890 | 77% | 71,841 | 89% |
| Bivalvia | 0 | 0% | 2 | 0% | 18 | 0% | 221 | 0% | 341 | 0% | 305 | 0% |
| Annelida | 122 | 2% | 41 | 0% | 9 | 0% | 491 | 1% | 227 | 0% | 63 | 0% |
| Acarina | 1427 | 26% | 1,431 | 17% | 748 | 21% | 2664 | 3% | 1,554 | 1% | 1,274 | 2% |
| Crustacea | 136 | 3% | 36 | 0% | 230 | 6% | 225 | 0% | 497 | 0% | 416 | 1% |
| Other Organisms | 298 | 6% | 351 | 4% | 62 | 2% | 994 | 1% | 2,991 | 3% | 1,220 | 2% |
| Total Organisms/m2 | 5391 | | 8618 | | 3644 | | 86201 | | 104131 | | 80465 | |

BMI functional feeding group composition differed between reaches in 2007 (Figure 4.7-7). Reach 1 consisted of scrapers (34%), filterers (32%), gatherers (20%), shredders (11%) and predators (3%). Reach 2 consisted of gatherers (45%), predators (39%), shredders (11%) and filterers (5%). Reach 3 consisted of gatherers (37%), predators (26%), scrapers (20%), filterers (14%) and shredders (2%). Reach 4 consisted of scrapers (84%), gatherers (6%), predators (4%), filterers (2%) and shredders (2%). The differences in functional feeding group composition were most pronounced for reach 4.

In reach 1, functional feeding group composition was relatively similar for the three sampling events with the exception of 2007 when scrapers increased from 8% and 7% respectively in 2005 and 2006 to 34% in 2007 (Table 4.7-5). Shredders decreased from 19% in 2005 to 11% in 2006 and 2007 in reach 1.

In reach 2, functional feeding group composition differed in 2006 compared to 2005 and 2007. Notable changes in composition include an increase in filterers (18%) in 2006 compared to 6% and 5% in 2005 and 2006 respectively. In 2005, gatherers comprised 54% of the functional feeding group community but decreased to 35% in 2006 and 45% in 2007. Scrapers were 1% or less of the community in all three sample years. Predators occupied 31%, 35% and 39% respectively in 2005, 2006 and 2007. The predator feeding group occupied similar percentages in reaches 2 and 3 but was less than 10% in reaches 1 and 4.

In reach 3, predators dominated the community in 2005 (44%) but decreased to 27% and 26% in 2006 and 2007 respectively. Gatherers increased from 30% in 2005 to 35% in 2006 and 38% in 2007. Filterers increased in 2006 and 2007 in reach 3 to 15% and 14% respectively compared to 6% in 2005. Scrapers comprised 15% in 2005 and 20% in 2006 and 2007. Shredders comprised 2% of the community each year.

In reach 4 scrapers comprised the largest percentage of the functional feeding group composition in all three sample years, 83%, 73% and 84% respectively. Gatherers comprised 8%, 13% and 6% in 2005, 2006 and 2007 respectively. Predators were the next most common group with 6% in years 2005 and 2006 and 4% in 2007. Filterers comprised 1% in 2005, 5% in 2006 and 2% in 2007.

**Table 4.7-5: Functional feeding group composition reaches 1, 2, 3 and 4.**

| Functional Feeding Group | Reach 1 | | | Reach 2 | | | Reach 3 | | | Reach 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 | 2005 | 2006 | 2007 |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| Filterers | 31 | 43 | 32 | 6 | 18 | 5 | 6 | 15 | 14 | 1 | 5 | 2 |
| Gatherers | 34 | 36 | 20 | 54 | 35 | 45 | 30 | 35 | 38 | 8 | 13 | 6 |
| Predators | 8 | 3 | 3 | 31 | 35 | 39 | 44 | 27 | 26 | 6 | 6 | 4 |
| Scrapers | 8 | 7 | 34 | 1 | 1 | 0 | 15 | 20 | 20 | 83 | 73 | 84 |
| Shredders | 19 | 11 | 11 | 7 | 10 | 11 | 2 | 2 | 2 | 1 | 2 | 2 |
| Piercer-Herbivores | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| Unclassified | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 |

**Figure 4.7-6: BMI community composition in reaches 1, 2, 3, 4; October 2007**

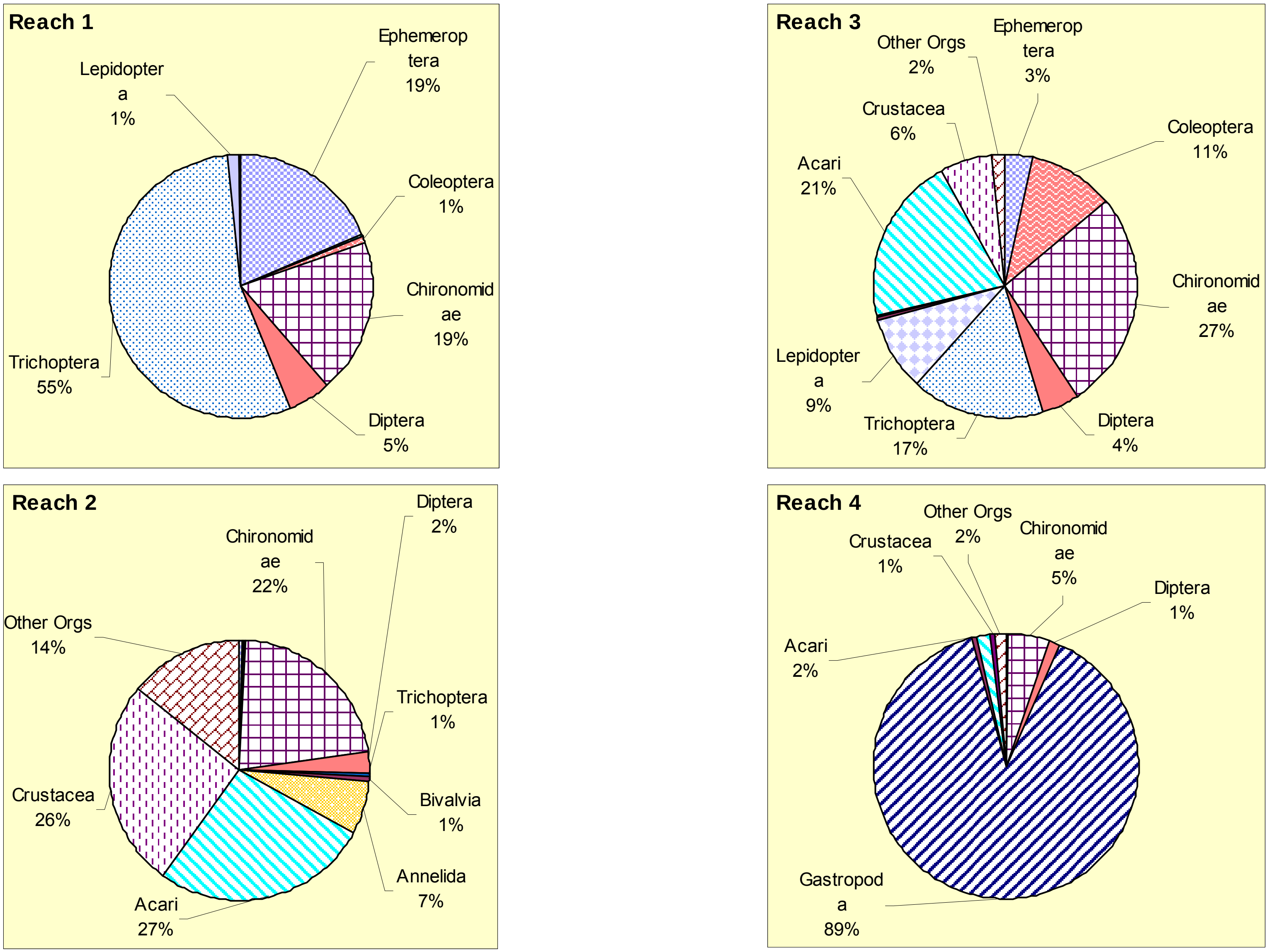
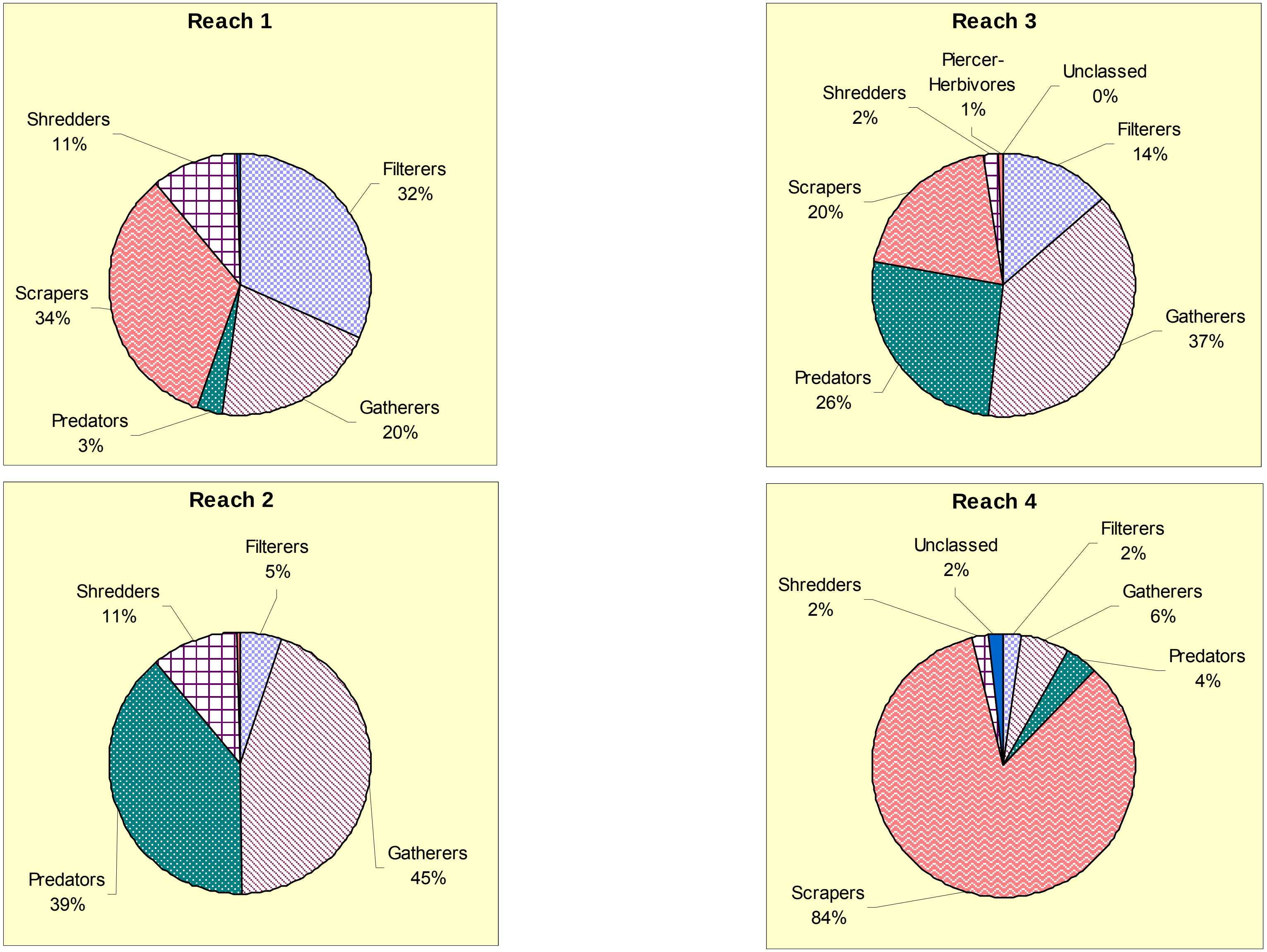


**Figure 4.7-7: BMI functional feeding group composition in reaches 1, 2, 3, 4; October 2007**



### 4.7.1 Statistical Power Analysis

In 2006 and 2007, a statistical power analysis was conducted to assess variability in single stratified (SS) samples verses composite samples (CS) using taxa richness for respective years. In 2006 and 2007, taxa richness in CS samples was greater in each reach than for the SS samples (Figure 4.7-8). The higher taxa richness in CS samples was likely due to the larger sample size coupled with the increased laboratory effort relative to SS samples (500 organism count compared to 200 organism count).

In 2006, mean taxa richness was relatively similar across the four study reaches with a decline in reach 4. The SS and CS taxa richness means tracked each other proportionally for each respective study reach. In 2007, taxa richness was distinctly different between study reaches. These differences in taxa richness means were evident in both SS and CS samples indicating that the SS and CS samples were both capable of reflecting changes in taxa richness between sample reaches despite distinctly different means between reaches.

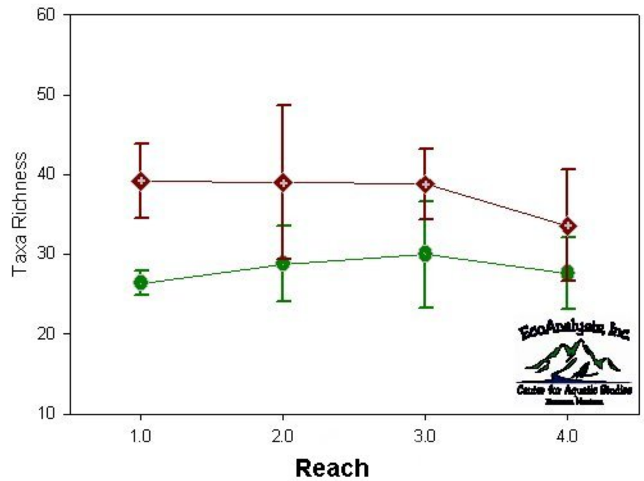
For each reach, the number of taxa required to detect a statistical difference was graphed as a function of the number of replicates for both the 2006 and 2007 samples (Figure 4.7-9 and 4.7-10 respectively). The number of taxa required to detect a change with five replicate samples (current Black Canyon study design) was identified for SS and CS samples. Based on the 2006 and 2007 BMI data, the sensitivity of five replicate SS and CS samples was different for each reach. In 2006, reach 1 SS samples required a minimum change of 2 taxa for statistical significance whereas CS samples required a change in 8 taxa to recognize a statistically significant change in the BMI community. In 2007, reach 1 SS samples required 7 taxa compared to 9 taxa for CS samples to detect a change in the BMI community. In reach 2, SS samples required 7 taxa in 2006 and 10 taxa in 2007 to detect a change in the BMI community compared to 16 in 2006 and 20 in 2007 for CS samples. In reach 3, SS samples required 8 taxa in 2006 and 5 taxa in 2007 to detect a statistical significant change in the BMI community compared to 10 taxa in 2006 and 12 taxa in 2007 for CS samples. In reach 4, SS samples required 10 taxa in 2006 and 5 taxa in 2007 to detect a statistical significant change in the BMI community compared to 11 taxa in 2006 and 2007 for CS samples.

A power analysis was conducted to detect a 10% (4 taxa) change in taxa richness among all four study reaches using the calculated mean square error rate (45.8) for the taxa richness data. This analysis estimated the statistical power to detect a 10% increase in taxa richness at each successive reach downstream (cumulatively, a 16 taxa difference longitudinally between reach 1 and reach 4). This was performed for the 200-organism, SS samples, and the 500-organism CS samples for the 2006 and the 2007 taxa richness data respectively.

For the CS samples in 2006, the five transect study design was 71.8% likely to detect a difference of 4 taxa between reaches (Figure 4.7-11). The probability of a type-II statistical error, failing to detect an actual 10% change in taxa richness between study reaches, was 28.2%. In 2007, CS samples were 45% likely to detect a difference of 4 taxa between reaches (Figure 4.7-12). The probability of a type-II statistical error in 2007 for CS samples was 55%. Increasing the number of transects, 8 in 2006 and 16 in 2007, would reduce these statistical errors to 10%.

In contrast, the SS samples at five transects in 2006 were 95% likely to detect a change of 4 taxa between reaches. In 2007, the SS samples were 90% likely to detect a change of 4 taxa between reaches. The SS analysis used the mean square error rate of 22.4 and the same number of taxa. Thus, the five transects in the SS samples allowed a balance of $\alpha = \beta = 0.10$, but this balance of error-rate could not be achieved by the CS samples until the study was expanded to 8 transects per reach in 2006 and 16 transects in 2007. In other words, the SS samples were more capable of detecting small changes in taxa (4) compared to the CS samples using five transects per reach.

**Figure 4.7-8: BMI taxa richness for SS and CS samples, 2006 and 2007**



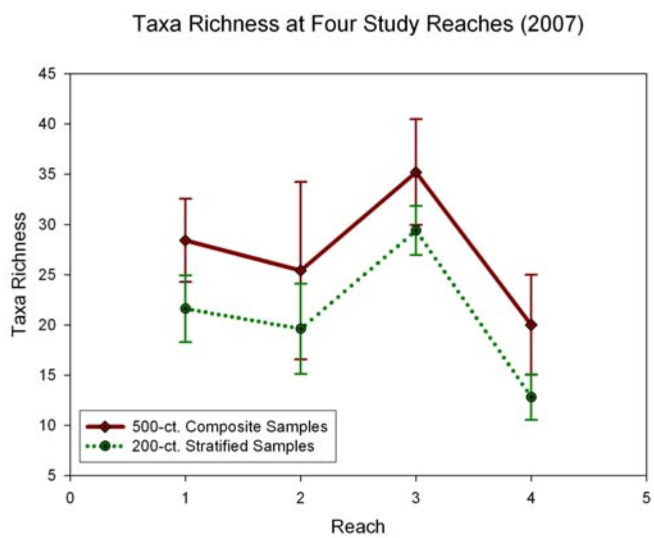



**Figure 4.7-9: 2006 BMI taxa richness power analysis; reach 1, 2, 3 and 4**

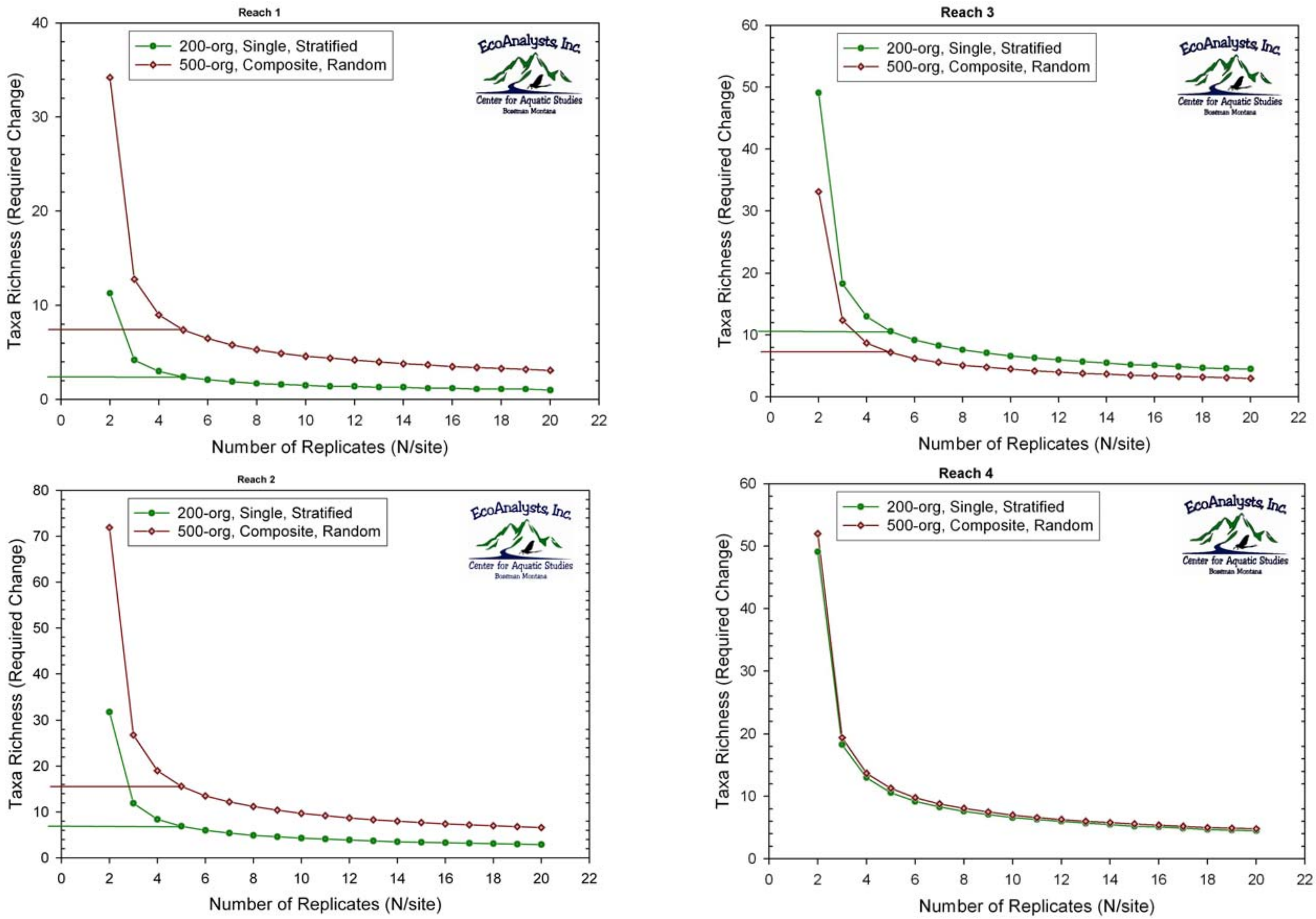


**Figure 4.7-10: 2007 BMI taxa richness power analysis; reach 1, 2, 3 and 4**

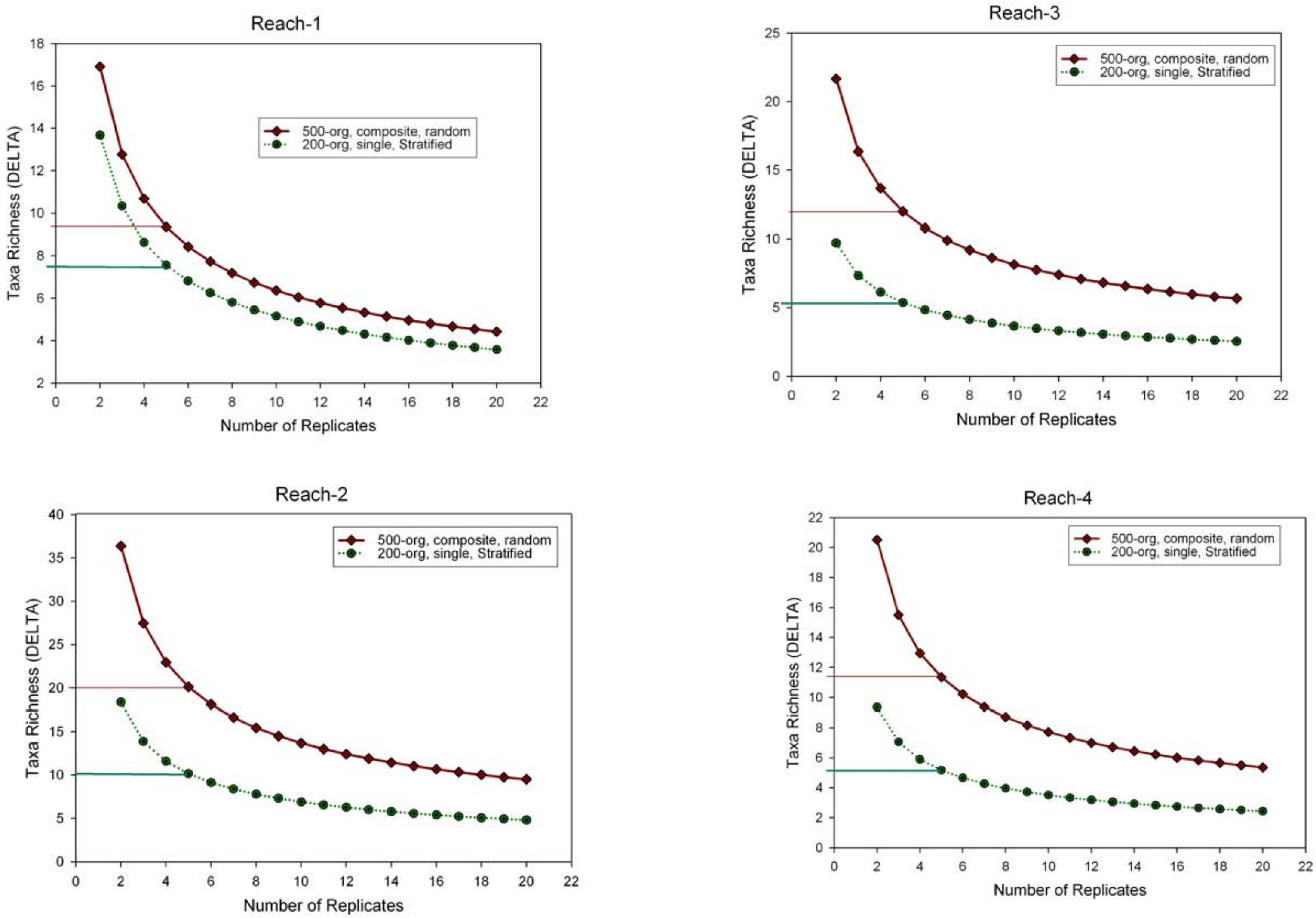


**Figure 4.7-11: 2006 SS sample and CS sample power analysis**

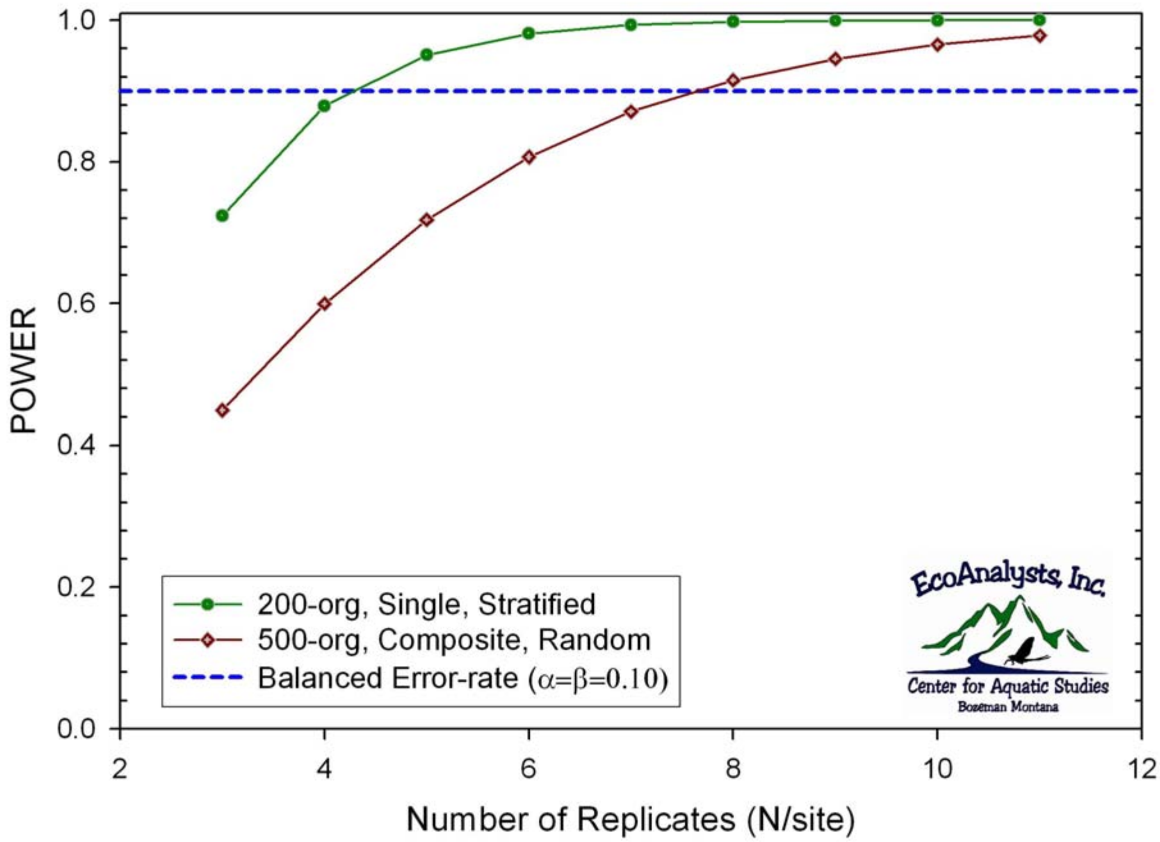
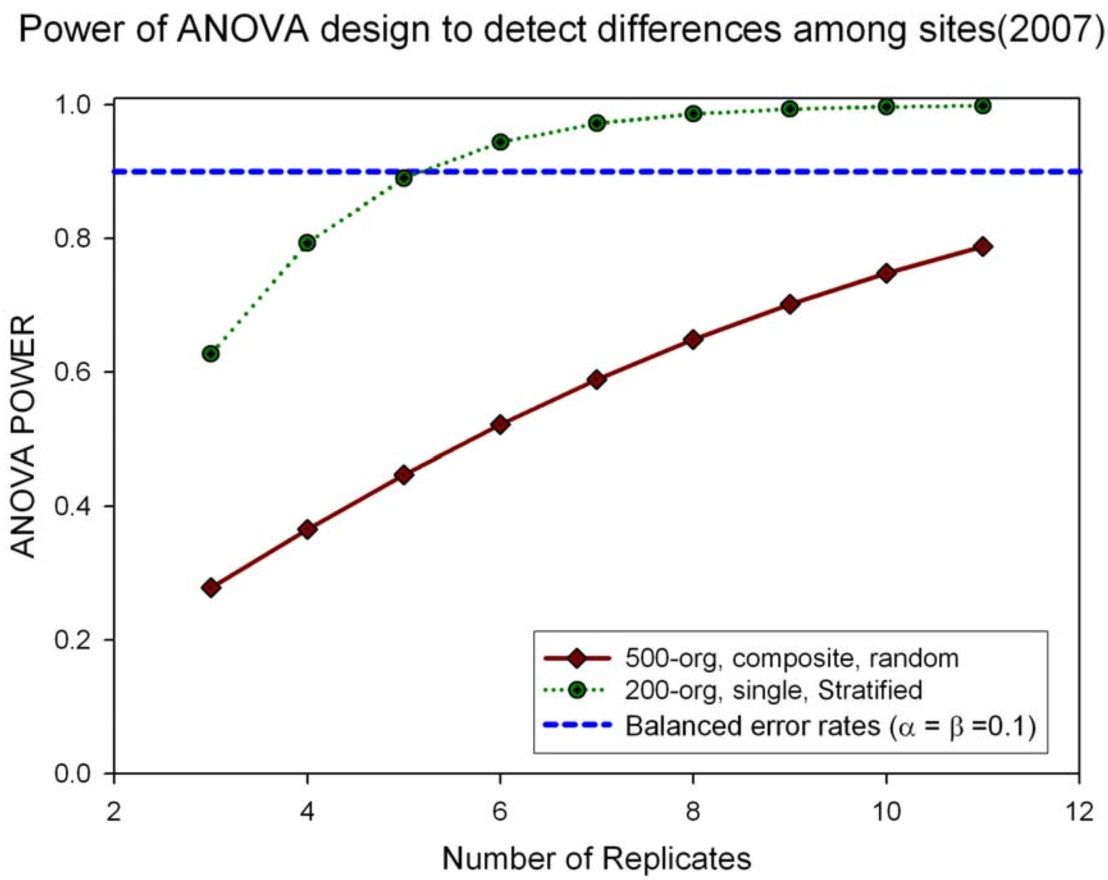


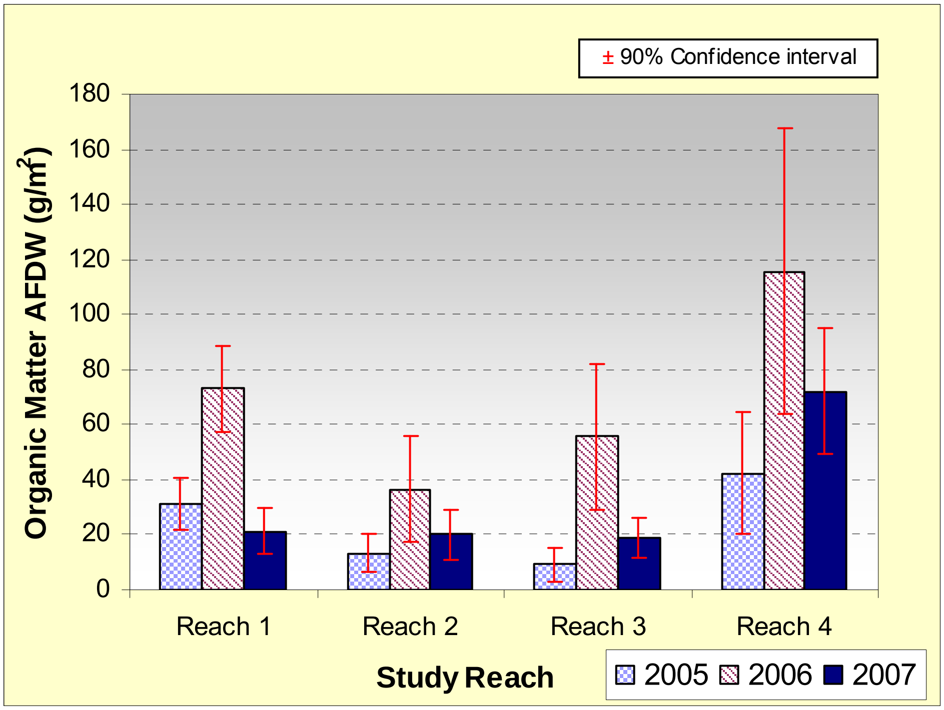
**Figure 4.7-12: 2007 SS sample and CS sample power analysis**




### *4.8 ORGANIC MATTER ASH-FREE DRY WEIGHT*

Organic matter AFDW (Figure 4.8-1) was significantly different between reaches (p=0.01, single Kruskal-Wallis H-test). Reach 4 had the highest organic matter biomass, 72.0 g/m$^2$. Organic matter AFDW in reaches 1, 2 and 3 was 21.4 g/m$^2$, 20.0 g/m$^2$ and 18.6 g/m$^2$ respectively. The 2007 organic matter AFDW values were more similar to 2005 values than 2006. The 2006 organic matter AFDW measures were significantly greater than values observed in 2005 or 2007 for reaches 1, 2, 3 and 4 (p=0.006, p=0.05, p=0.01 and p=0.05 respectively, Kruskal-Wallis H-test).

**Figure 4.8-1: Organic matter ash-free dry weight, 2005, 2006 and 2007**



# 5. DISCUSSION

## *5.1 CHANNEL SHAPE AND SUBSTRATE*

In 2007, discharge in reach 2 was lower than either of the previous two October sampling events. Reach 2 discharge was approximately 70 cfs in October 2007 compared to approximately 100 cfs in 2005 and 2006. In reach 3, discharge varied by about 10 cfs between the three October sampling events.

Because of these differences in discharge between sample years, survey metrics dependent on discharge vary between years. Consequently, between year comparisons are based on measures relative to bankfull.

The greatest mean bankfull width for reach 2 was observed in 2005 at 63.04 meters. The mean bankfull widths for reach 2 in 2006 and 2007 were 62.71 meters and 62.88 meters respectively. This difference of 0.33 meters between 2005 and 2006 represents less than 0.5% of the mean bankfull width for reach 2 over the three year period. These small differences in bankfull width can be attributed to the difficulty in definitively locating bankfull indicators along reach 2.

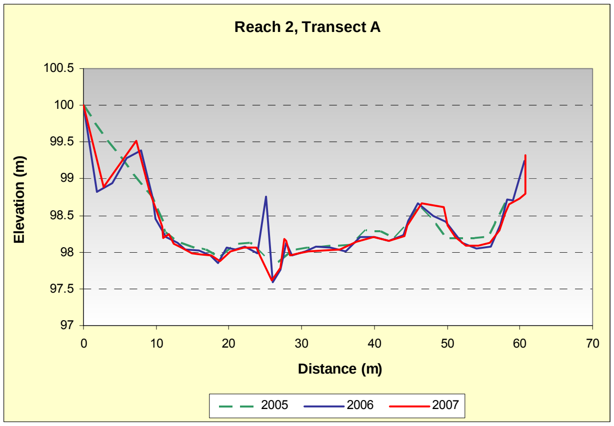
The greatest mean bankfull depth for the combined transects in reach 2 was observed in 2007 at 0.43 meters. The mean bankfull depths for reach 2 were 0.34 meters in 2005, 0.40 meters in 2006 and 0.43 meters in 2007. The difference of 0.09 meters between bankfull depths in reach 2 from 2005 to 2007 can be attributed to the difficulty in consistently locating bankfull indicators along reach 2. In 2005, 2006, and 2007 transect TA had the greatest average bankfull depth of 0.57, 0.58, and 0.64 meters respectively.

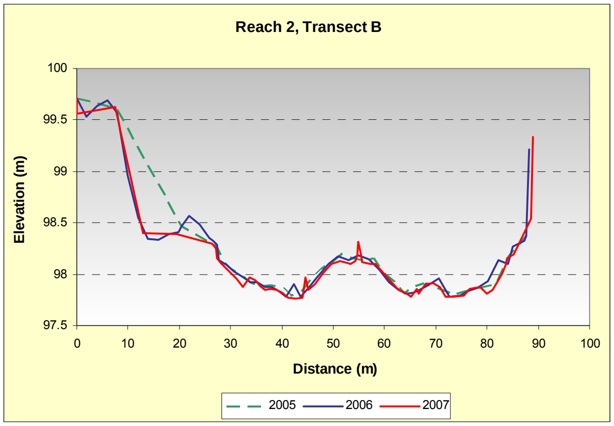
In reach 2, bankfull depths exhibited significant differences in transects TD and TE over the three year period. Bankfull depth in transect TD was significantly greater in 2007 than in 2005 ($p=2.2E-9$, H-test). Bankfull depth in transect TE was also significantly greater in 2007 than the two previous years ($p=1.5E-6$, H-test). Transect TD was located at the nick point for Black Canyon. The substrate was predominantly bed rock overlain with fines. The heavily carved out nature of the bedrock makes consistent surveying at identical points along the transect challenging. Moving the rod a couple inches in either direction can result in a large elevation change. Transect TE was located downstream of TD in a similar bedrock substrate. This transect has the same difficulties associated with channel surveys in transect TD. It is unlikely that the channel in these two reaches has moved due to the lack of change in the upstream channels that have more mobile substrates.

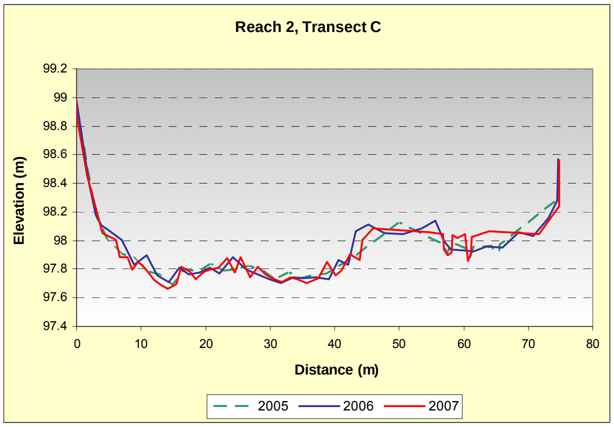
The mean bankfull depths for reach 2 varied by 0.09 meters. The majority of the river banks in this section were severely impacted by cattle grazing, making typical bankfull indicators such as changes in vegetation and changes in slope very difficult to accurately locate in a single year let alone use the same bankfull elevation between years. The survey crew consisted of the same individuals over the three year monitoring period thus minimizing variables associated with choosing bankfull locations. The channel in reach 2 has not changed shape or undergone a flow event of substantial magnitude to alter the bankfull locations during the three year monitoring period as is evident in the channel cross sections for reach 2 (Figure 5.1-1).

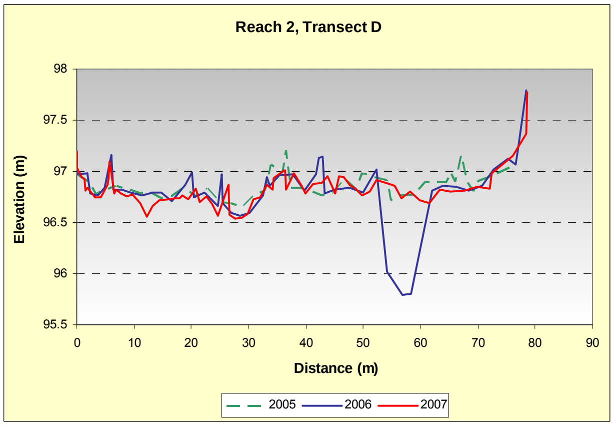
The substrate composition was similar over the three year sampling period (Figure 5.1-2). Wolman pebble counts remain consistent over all three years, with the percentage of fines being twice as high as the subdominant substrate, bedrock.

**Figure 5.1-1: Channel cross-sections reach 2, 2005, 2006 and 2007**



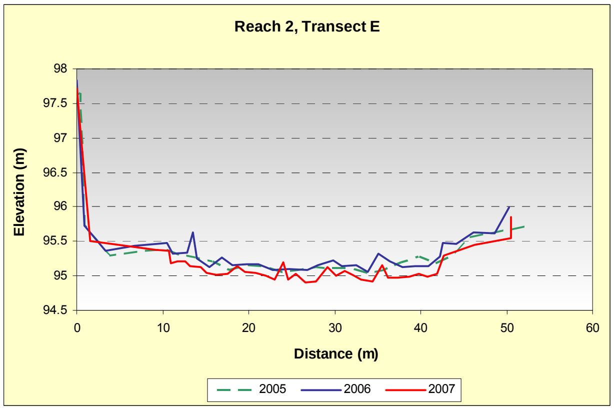
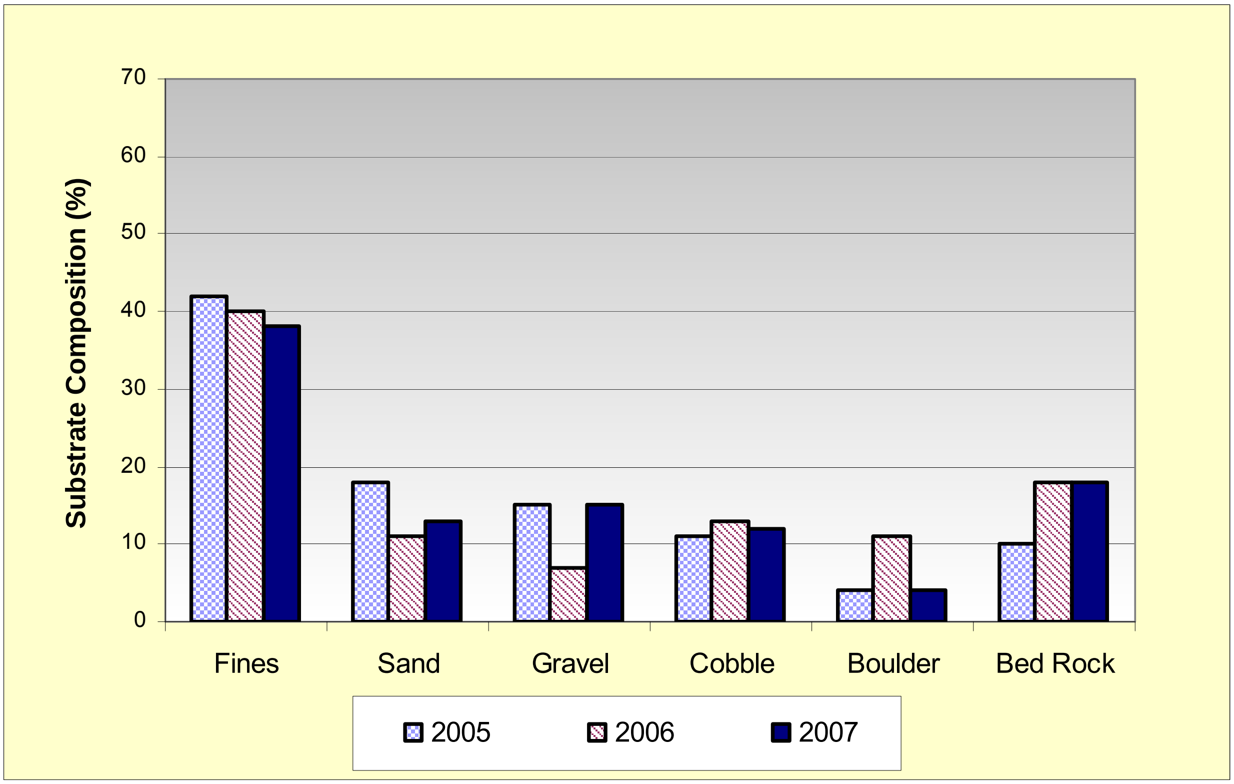



**Figure 5.1-2: Wolman pebble count comparison for reach 2, 2005, 2006 and 2007**




Bankfull widths in reach 3 remained constant over the three years of monitoring. The rebar pins placed on the river right side in 2004 were located at bankfull along each transect. Some rebar pins were unable to be located in 2005 along the left bank. In 2006, a new rebar pin was placed on the river left side at transect TC, due to the old ½ inch pin pulling out. A new pin was also placed at transect TD in 2007. This pin had not been located in the two previous years. The consistency of the pins placed at the bankfull indicators on the right bank makes identification of bankfull more uniform during the first three years along reach 3 than in reach 2. Bankfull locations were also easier to identify in reach 3. Dense vegetation makes identification difficult but topographic breaks were well defined in this reach compared to reach 2. Bankfull elevation may change after a large flow event.

Transect TA in reach 3 featured statistically significant changes in bankfull depths over the three year sampling period (p=3.3E-5, H-test). The mean bankfull depths for the three years were 0.69 meters in 2005, 1.25 meters in 2006, and 1.38 meters in 2007. Transect TA was located perpendicular to a point bar. The surveying crew was unable to locate the left bank pin during the 2005 sampling season. The pin has been located in subsequent years. This may explain the change in bankfull depths between 2005 and the following two years. It is unlikely that the channel shape has changed during the three year baseline monitoring period. The channel cross sections over 2005, 2006 and 2007 were nearly identical (Figure 5.1-3) and any event capable of changing the channel in transect TA would likely have altered the other transects as well.

The greatest mean bankfull depth for the combined transects in reach 3 was observed in 2007 at 0.81 meters. The mean bankfull depths were 0.77 meters in 2005, 0.78 meters in 2006 and 0.81 meters in 2007. In 2005, transect TE had the greatest bankfull depth of 1.03 meters. In

2006 and 2007 transect TA had the greatest bankfull depths of 1.21 and 1.33 meters respectively. The small changes in bankfull depths between 2005 and 2006-2007 were likely related to the replacement of left bank pins at transects TC and TD.

The substrate composition was similar over the three year sampling period (Figure 5.1-4). Wolman pebble counts were constant over all three years, with gravel being the predominant substrate class size.

**Figure 5.1-3: Channel cross sections in reach 3, 2005, 2006 and 2007**

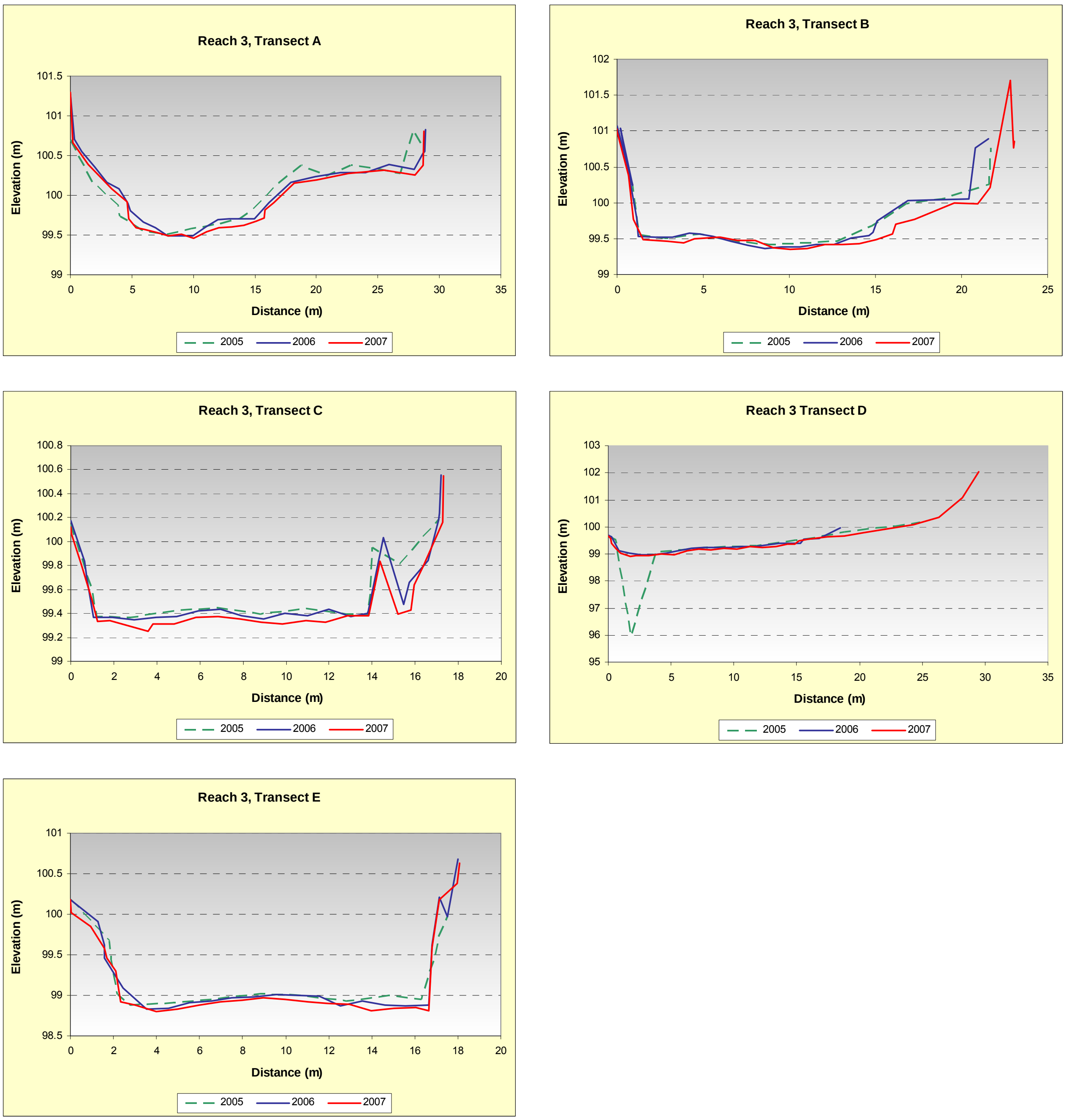
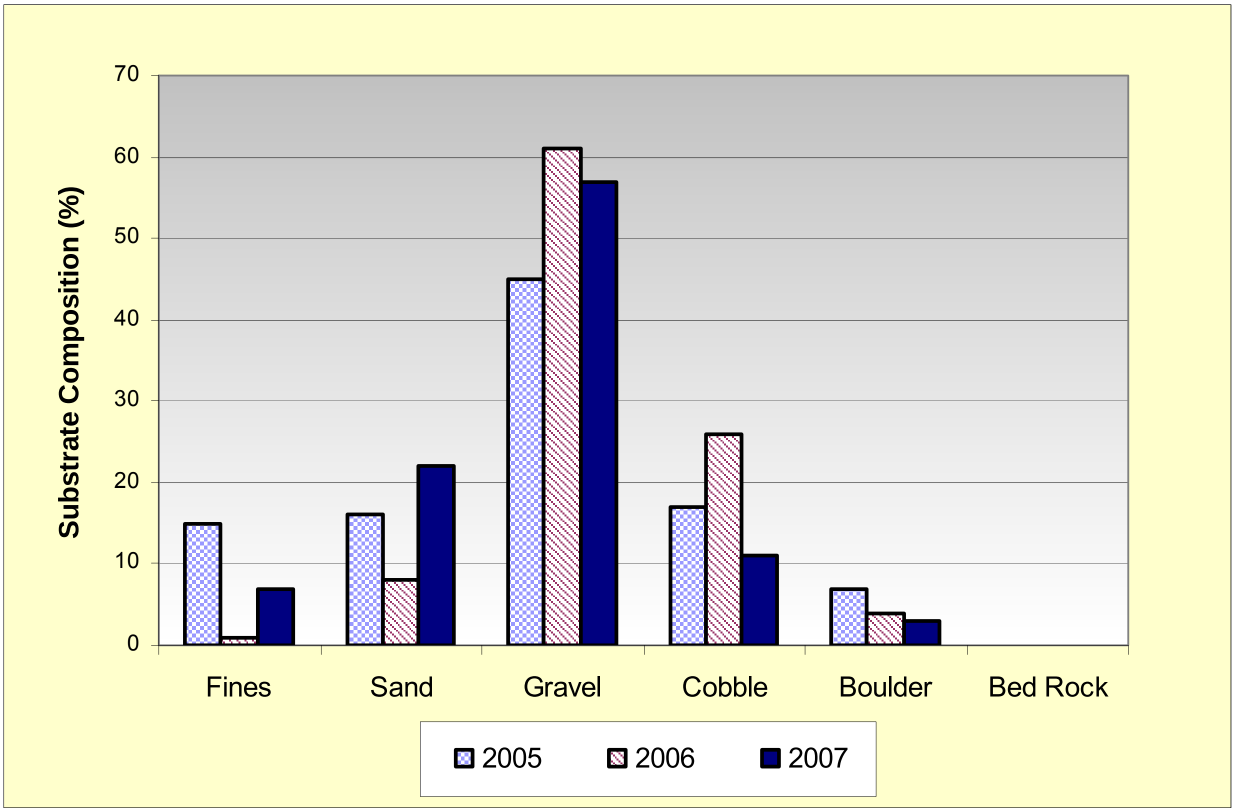


**Figure 5.1-4: Wolman pebble count comparison; reach 3, 2005, 2006 and 2007**




## *5.2 PERIPHYTON*

Periphyton, sometimes referred to as benthic algae, is the algal growth found on substrates in aquatic environments. In addition to algae this benthic layer on rock substrates typically hosts a wide assemblage of micro and macroscopic organisms as well as detritus and fine sediments. Accordingly, AFDW values represent the weight of the algal material contained in the periphyton community as well as bacteria, benthic macroinvertebrates and detritus trapped in the longer algal filaments. Chlorophyll analysis on the other hand measures the ability of pigments to absorb light and as such serves as a measure of algal community productivity.

The autotrophic index (AI), the ratio AFDW/Chlorophyll a, provides information on the relative viability of the periphyton community. If large amounts of non-photosynthesizing organic material are present, the numerator becomes inflated, and the ratio exceeds the normal range of 50-200 (APHA 1999). In all three October sampling events, the four study reaches exceed the normal AI range. The inflated numerators indicate that the periphyton matrix contains a large amount of non-algal organic material. This organic material likely includes bacteria, BMI and detritus trapped in the algal filaments. In 2007, reaches 1 and 2 were significantly greater than previous two October sampling events respectively indicating these reaches contain even more non-photosynthesizing organic matter than previous years.

AI values in reach 1 were substantially greater than the other three study reaches and significantly greater than previous years for that site. In 2005, 2006 and 2007, reach 1 had the highest AI values of the four reaches potentially indicating higher productivity in the bacterial community residing in the periphyton assemblage. Chlorophyll a concentrations in reach 1 were similar to values in reaches 2, 3 and 4 in 2006. The elevated AI values in reach 1 relative to reaches 2, 3 and 4 were likely the result of nutrient enrichment from upstream and adjacent land-use practices increasing bacterial productivity in the periphyton assemblage. Land-use practices, specifically cattle grazing and tilled soils, upstream and adjacent to reach 1 and the associated nutrient enrichment may stimulate higher bacterial productivity relative to reaches 2, 3 and 4. The reaches below Grace Dam, particularly reaches 3 and 4, have considerable buffers from agricultural practices due to the canyon topography coupled with riparian and upland vegetation. Furthermore, much of the nutrient enrichment from upstream land-use practices settles out in Soda and Grace reservoir. The elevated AI values in reach 1 relative to reaches 2, 3 and 4 were likely the result of nutrient enrichment from upstream and adjacent land-use practices increasing bacterial productivity in the periphyton assemblage.

The substantial increase in AI values in reach 1 in 2007 suggests a change in land-use practices or discharge of organic material into the Bear River upstream. Considerable work occurred in 2007 dredging areas of Mud Lake upstream (Eve Davies, personal communication). Dredging Mud Lake may have resulted in a mobilization of organic carbon and other nutrients stimulating bacterial growth in reach 1.

The periphyton community exhibited significant differences between years in reaches 1 and 3. The periphyton community in reaches 2 and 4, on the other hand, appeared to be similar between sample years. In reach 1, AFDW and Chlorophyll a means were significantly different. Chlorophyll a was significantly greater in 2006 while AFDW was significantly greater in 2007. In reach 3, Chlorophyll a was similar between the three sample years but AFDW was significantly greater in 2006 compared to 2005 and 2007. Because of these differences between years within reaches 1 and 3, detecting changes in the periphyton community from whitewater releases in the treatment phase of the study will be difficult particularly given the fact that the most significant differences between years occurred in the reference reach.

The next three years mark the experimental phase of the study design when whitewater flows will be released into the Black Canyon below Grace Dam serving as the treatment to study reaches 2, 3 and 4. Ongoing monitoring of the periphyton community will help document potential changes resulting from changes in instream flows. Discharge, in particular, has been determined to be an important environmental factor influencing site specific algal growth (Biggs and Kilroy 2000). In reaches 2, 3 and 4 discharge remained virtually the same for all three reaches during the annual October sampling events with the exception that reach 4 has 30 to 60 cfs more discharge than reaches 2 and 3. Nonetheless, all three reaches lack the hydrologic fluctuations more common in unregulated systems.

Periphyton AFDW and chlorophyll concentrations typically change rapidly in streams due to disturbance events such as discharge fluctuations (Steinman and McIntire 1990) or rapid growth responses to changing environmental conditions such as turbidity (Sheath et al. 1986). Consequently, identifying environmental factors responsible for differences in the periphyton community between sample years based on a single annual sampling event of periphyton AFDW and chlorophyll can be problematic. The fall sampling event associated with the Black Canyon Monitoring Study provides a snapshot of the periphyton community in the respective reaches in the same time frame. Because of the single sampling event researchers were not able to identify the factors contributing to differences in the periphyton community between reaches or explain causes in inter-annual variation when it occurs. Understanding the environmental factors influencing the periphyton community in a given reach is best achieved through systematic sampling where periphyton is sampled on a weekly or biweekly basis. This latter study approach enables researchers to track periphyton growth rates while simultaneously monitoring biotic and abiotic factors (Biggs 1990; Biggs 1996; Biggs and Kilroy 2000).

Nonetheless, the present study design allows managers to document the periphyton community annually and identify statistically significant differences where they exist.

## 5.3 FILAMENTOUS ALGAE

Filamentous algae coverage was significantly different between the four study reaches in 2005, 2006 and 2007. Algal coverage was highest in reach 4 in all three October sample events followed by reach 1, reach 2 and lastly reach 3. Multi-year comparisons indicate algal coverage was similar between years in reaches 1, 3 and 4. In reach 2, algal coverage was significantly higher in 2006 compared to 2005 and 2007. In reach 3, algal coverage was substantially lower in 2006 and 2007 compared to 2005 but not significant.

Increases in discharge can potentially scour filamentous algae from substrate. As part of the Cove Dam decommissioning higher flows (approximately 500 cfs) were released from Grace Dam to reconstruct the Bear River channel in the former Cove impoundment in September 2006. In reach 2, macrophytes were the dominant plant material covering the substrate as opposed to filamentous algae. Distinguishing macrophyte coverage from the filamentous algae impossible, therefore, reach 2 values reflect the combined cover of macrophytes and filamentous algae on the stream substrate. In reaches 1, 3 and 4 macrophytes were also included in the filamentous algae coverage for consistency between reaches. However, reaches 1 and 3 had less macrophytes and more filamentous algae relative to reach 2. Furthermore, substrate in reaches 1, 2 and 4 was typically larger than reach 3. The larger substrate provides more stability and less susceptibility to scour. The macrophytes coupled with the larger substrate in reach 2 might have been capable of withstanding the September 2006 discharge pulse. In contrast, the lack of macrophytes coupled with the smaller substrate in reach 3 may not have been sufficient to prevent sloughing of material downstream during that discharge event thereby reducing coverage for the October 2006 sampling event. In July 2007, MIFs in reaches 2, 3 and 4 were increased (approximately 200 cfs for short durations). These increases were likely due to delivery of irrigation water exceeding the capacity of the Grace flowline. These increases in discharge might have been sufficient to scour filamentous algae from the substrate in reach 3, although this seems unlikely.

In reach 2, macrophyte/filamentous algae coverage did not appear to be effected by scour from flow events less than 1000 cfs. On April 17$^{th}$, 2005 a release of 863 cfs occurred from Grace Dam. In the subsequent October 2005 sampling period mean coverage was 30%. In October 2006 mean coverage was 69%, shortly after an instantaneous peak discharge of approximately 500 cfs. In October 2007, mean coverage declined back to levels similar to that found in 2005, 20% but unlike 2005, no substantial increases in discharge occurred below Grace Dam in the 2007 water year to account for this decrease in coverage.

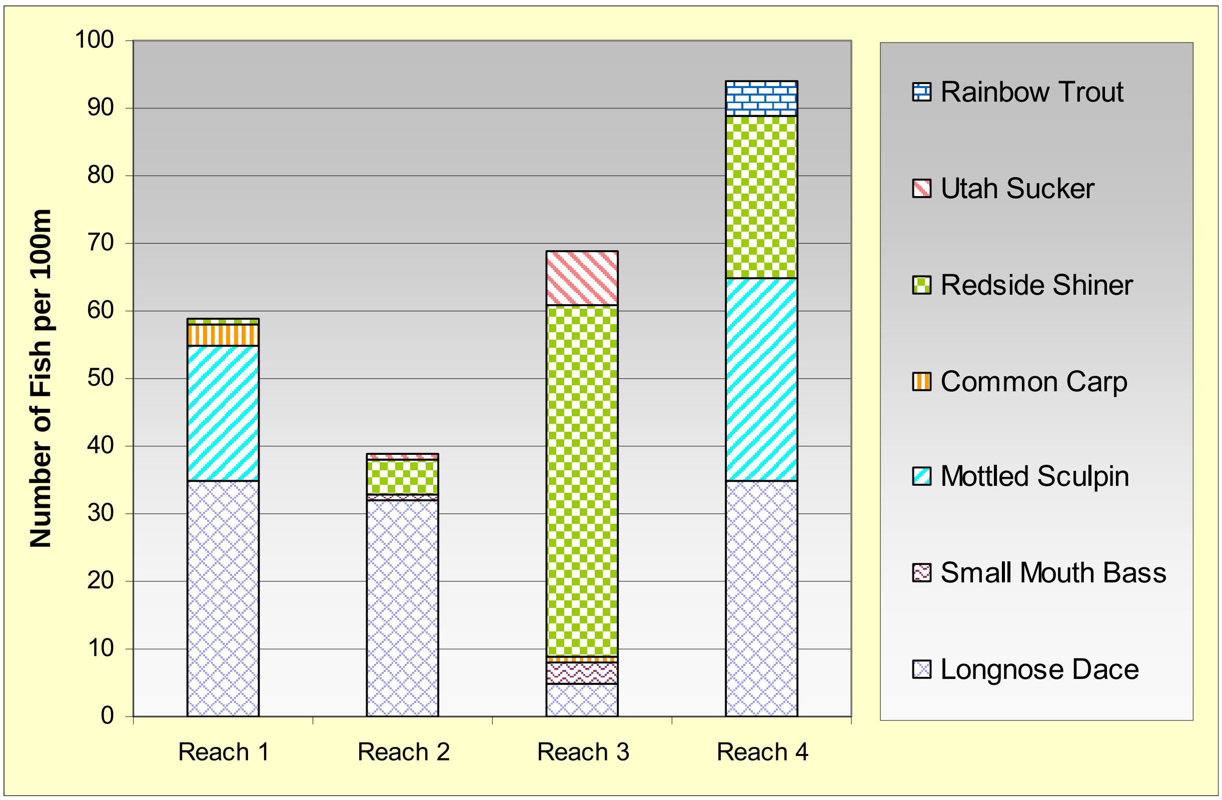
## 5.4 FISHERIES

In 2007, reach 3 contained the highest fish species richness of the four study reaches with 5 species collected, while reaches 1, 2, and 4 each had 4 species collected. Longnose dace and redside shiner were the only species collected in all 4 reaches in 2007.

Multi-year comparisons within each study reach indicate that species richness increased in 3 of the 4 reaches between 2005 and 2006. Between sample years 2006 and 2007 species richness increased in only 2 reaches (from 4 species to 5) and decreased in the other 2 reaches (from 5 species to 4). In nearly all cases, when an additional species was detected in a sample, they were only collected in small numbers (1 or 2 fish per 100 meters), and therefore had low relative abundances. The opposite was also true; when a species went undetected in a sample, they had only been collected in small numbers during past sampling years. Thus, while it is possible that these apparent changes in species richness were a result of a species not being present in a reach during the sampling period, it is also possible that some species were present in small numbers but were not detected during sampling.

In 2007, reach 4 had the highest total catch of fish per 100 meters (94) compared to the other three reaches (Figure 5.4-1). The majority of these were longnose dace (37%), mottled sculpin (32%), and redside shiner (26%). Five rainbow trout were also collected in reach 4. Total catch in reach 3 was the next highest at 69 per 100 meters. Reach 1 had a total catch of 59 fish per 100 meters, and reach 2 had the lowest total catch at 39 per 100 meters.

**Figure 5.4-1: Total catch per 100 meters for reaches 1, 2, 3, and 4, October 2007**




Multi-year comparisons within each reach indicate that total catch varied considerably between years in reaches 1, 3, and 4, while total catch in reach 2 showed very little variation between years. However, reach 2 also had the lowest total catch in all 3 years and therefore less variation would be expected between years.

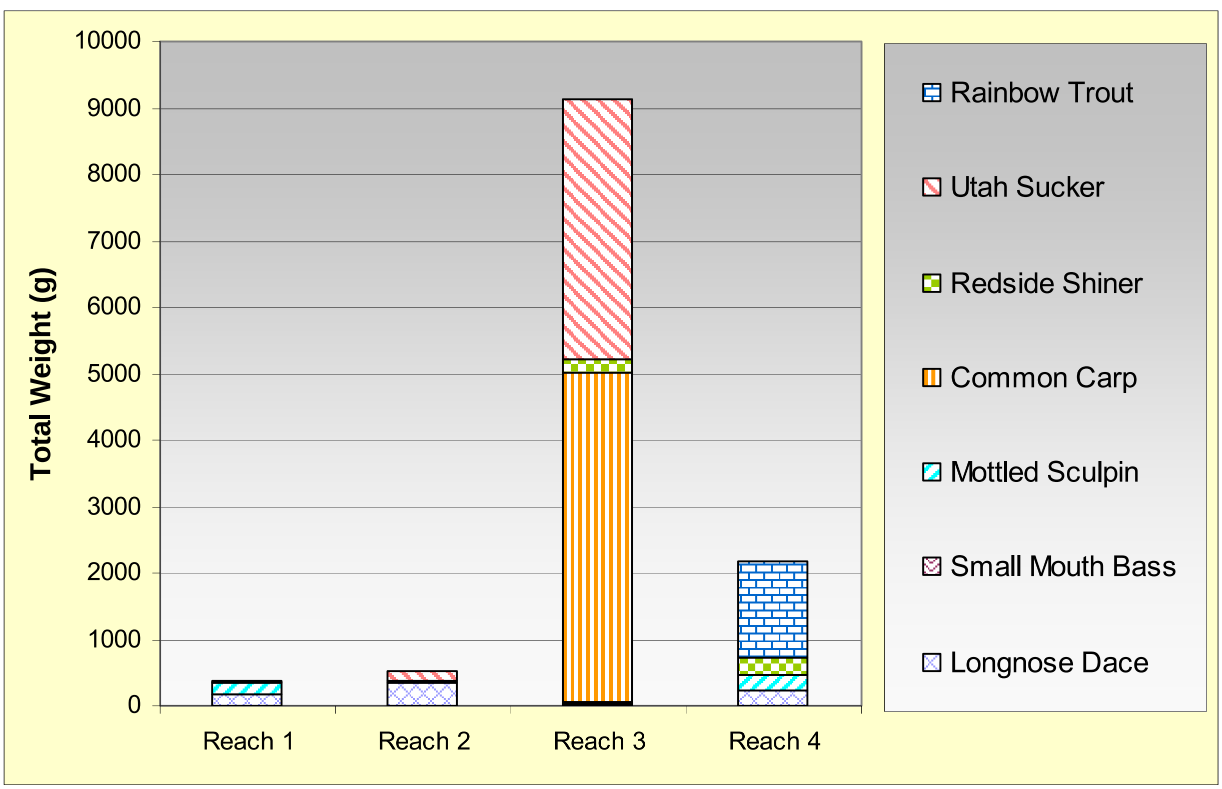
In 2007, the highest overall catch rate was 4.75 fish / minute in reach 4, followed by 4.15 fish/minute in reach 3, 3.33 fish/minute e in reach 1, and the lowest catch rate was 1.89 fish/minute in reach 2 (Figure 4.5-3). Longnose dace had the highest catch rate in 3 of the 4 reaches (reaches 1, 2, and 4), and redside shiner had the highest catch rate in reach 3. Accordingly, the relative species composition was dominated by longnose dace in 3 of the 4 reaches (reaches 1, 2, and 4) whereas redside shiner represented the largest percentage of the sample in reach 3 (Figure 4.5-2).

Multi-year comparisons also indicate that catch rates follow similar trends between years as total catch, and thus show a similar degree of variation. The similarities between total catch and catch rates are expected due to the direct correlation of these two metrics. Accordingly, catch rates varied considerably between years in reaches 1, 3, and 4, while catch rates in reach 2 showed very little variation between years. However, reach 2 also had the lowest catch rate in all 3 years and therefore less variation would again be expected between years.

In 2007, the highest total biomass was in reach 3 (9.13 kg), and was followed by reach 4 (2.18 kg) (Figure 5.4-2). Reach 1 and reach 2 had far less total biomass at 0.39 kg and 0.52 kg, respectively. Longnose dace accounted for nearly half of the biomass in reach 1 (48%). In reach 2, longnose dace were the most abundant and they accounted for a large majority (66%) of the biomass. In reach 3, redside shiner were by far the most abundant (75% of the catch), however common carp and Utah sucker comprised a large majority of the biomass (54% and 43% respectively) despite the fact that only 1 carp and 8 suckers were collected. In reach 4, rainbow trout accounted for 67% of the biomass, but they only accounted for 5% of the catch in terms of abundance.

Multi-year comparisons within each reach show that there is a large amount of variation in total biomass between years in reaches 1, 3, and 4 while reach 2 shows considerably less variation than the other reaches. A large amount of the variation between years in total biomass is likely the result of collecting just a few large bodied adult carp, suckers, or rainbows in some year(s) while none were collected in other years. Data from reach 2 further supports this idea since no large bodied adults were collected in any of the sample years and accordingly, there was little variation between years. However, reach 2 also had very little variation in total catch and catch rates between sample years 2005-2007.

**Figure 5.4-2: Fish biomass per 100 meters, reaches 1, 2, 3 and 4, October 2007**



Reach 4 was the only reach where rainbow trout were collected in all three sample years. Rainbow trout were not present in the other study reaches with the exception of a single rainbow trout collected in reach 3 in 2006. In reach 4, rainbow trout total catch and CPUE was considerably higher in 2005 than in a 2006 or 2007 (Table 4.5-9). It should be noted that these differences are likely a result of the rainbow trout stocking schedule. In 2005, Idaho Fish and Game released 250 freeze-branded rainbow trout below the foot bridge near the Grace power plant on October 14. This release was approximately 1 hour prior to and 75 meters downstream of the fish sampling for reach 4. As a result, some of the fish collected that day may have just been released from the nearby hatchery truck. In 2006, the last stocking occurred on September 12, and in 2007 the last stocking occurred on August 29$^{th}$. Accordingly, in 2006 and 2007 the rainbow trout had more time to disperse throughout the river or be caught by anglers. Either scenario could have contributed to the decreased total catch and decreased CPUE.

## 5.5 TEMPERATURE

Temperature data for the three-year baseline monitoring period at the four study reaches revealed distinct seasonal patterns. Comparisons between reaches 1, 2, 3 and 4 also revealed distinct differences in water temperature. These differences were particularly notable during the summer months. Reach 3 exhibited the highest maximum temperatures (27.1 ºC) of all four reaches over the three-year period. Reach 4 exhibited the coolest water temperatures with daily averages consistently below 20 ºC throughout the summer months and a single day each year when a maximum water temperature exceeded 20 ºC. Daily averages in reaches 1, 2 and 3 exceeded 20 ºC for a substantial number of days each summer season. In all three-years, daily minimums in reaches 1 and 2 exceeded the 20 ºC threshold for a continuous 20 days or more with the maximum 40 days in 2007 in reach 2.

The temperature data exhibited similar seasonal patterns over the three-year period. Annual differences over the summer period in daily minimum, average and maximum temperatures in reaches 1, 2 and 4 were attributed to changes in meteorological conditions in respective sample years rather than induced by changes in reservoir operations between years. Temperature data was not available for reach 3 in 2005 or 2007.

Surface water releases from Grace Reservoir have the potential to increase stream water temperatures in reaches 2, 3 and 4 during the summer season. Under minimum instream flow conditions between June 21 and September 21 daily minimum instream flows exceed the 20 ºC salmonid threshold in both reaches 2 and 3, but not in reach 4. Minimum temperatures over 20 ºC for a consecutive 24-hour period over multiple days would make the reach unsuitable for salmonids. In reach 2, minimum instream flows exceeded the 20 ºC salmonid threshold in all three years; 37, 37 and 40 days respectively. In reach 3, water temperatures were monitored from July 5 2006 to October 10, 2006. Daily minimum water temperatures exceeded the 20 ºC salmonid threshold on 32 days starting on July 5. Increased discharges from Grace Dam are not likely to cause large increases in stream temperatures in reaches 2 and 3 since those temperatures are already greatly influenced by meteorological conditions similar to those influencing surface water temperatures in the Grace impoundment. In reach 1, daily minimum water temperatures also exceed the 20 ºC salmonid threshold over the summer season; 2005 (21 days), 2006 (17 days) and 2007 (34 days).

In reach 4, daily average stream temperatures and daily maximums remain consistently below 20 ºC for the much of the summer season except for three dates annually; July 25, 2005, July 19, 2006 and July 23, 2007. The July 19, 2006 rise in daily maximum temperatures above 20 ºC corresponded to an increase in discharge from Grace Dam of 122 cfs. In 2005, discharge spikes below Grace Dam on July 26 (255 cfs) and September 16, 2005 (194 cfs) did not appear to alter daily maximum stream temperatures. Outside the summer season (June 21 to September 21), daily average water temperatures in reaches 1, 2 and 3 were below the 20 ºC threshold. Deployment of an additional hobo temp in the epilimnion of the Grace impoundment would yield additional data on surface water temperature discharged into the Black Canyon.

## 5.6 HYDROLOGY

Reach 1 differs from reaches 2, 3 and 4 hydrologically. Water storage in Bear Lake partially regulates flows in reach 1 by decreasing the magnitude of peak flow events during spring snowmelt and shifting the snowmelt hydrograph into July, August and early September to fulfill downstream water rights. Discharge timing and magnitude differed slightly between the three water years encompassing the baseline monitoring period. In 2007, releases from Bear Lake started in June due to the increased air temperatures and below normal run-off relative to the 2005 and 2006 water years. Regulated releases from Bear Lake peaked at 1610 cfs in 2007 compared to 933 cfs in 2006 and 1336 cfs in 2005. These hydrologic differences between sample years were small and not likely to cause changes in the biological community between sample years in reach 1.

Reaches 2, 3 and 4 in the Black Canyon of the Bear are fully regulated by upstream irrigation and power generation diversions. Instream flows below Grace Dam remain relatively stable year round. Groundwater upwellings and springs just upstream of reach 4 contribute an additional 30-60 cfs on top of the existing base flow. During the three-year baseline monitoring period, no scheduled whitewater releases occurred in the reaches below Grace Dam. In April 2005, a spill flow of 863 cfs occurred from spring run-off. In mid-September of 2006, pulse flows were released from Grace Dam to assist channel restoration efforts in the former Cove impoundment. Daily average flows reported for those releases were 152 cfs on September 18, 2006. Instantaneous peak flow data for these pulse flows were not available but were assumed not to exceed 500 cfs from Grace Dam. In the spring of 2008, scheduled whitewater flows will be released from Grace Dam ranging in magnitude from 800 to 1200 cfs on three weekends starting in April and concluding in early July.

## 5.7 BENTHIC MACROINVERTEBRATES

Overall, the 2007 BMI data was consistent with results obtained in 2005 and 2006 for respective reaches. Multi-year comparisons within respective reaches indicate no significant differences in BMI density between sample years. In reach 4, EPT density was significantly higher in 2006 compared to 2005 and 2007 but comprises less than 2% of the overall BMI density for that reach. BMI taxa richness was significantly lower in reach 1 in 2007 compared to 2005 and 2006. In reach 4, BMI taxa richness in 2007 was similar to 2005 but both were significantly lower than 2006 results for reach 4. EPT richness was significantly lower in 2007 in reach 1. In reach 4, EPT richness was similar to 2005 results but both years were lower than 2006. The differences between years in these individual metrics might be due to spatial and temporal variability inherent in the BMI community. Researchers did not observe habitat differences between years in reach 1 or 4 that would account for these metric increases.

Distinct reach differences in the BMI community were well documented in all three sample years. In all three sample years the BMI community composition in reach 1 was distinctly different from reaches 2, 3 and 4 located downstream of Grace Dam. In reach 1, EPT density made up 59%, 63% and 73% of the BMI community in sample years 2005, 2006 and 2007 respectively. In contrast, reaches 2, 3 and 4 contained very few EPT taxa let alone high densities of these species. In reach 2, EPT density comprised 4% of the community in 2005 and 2006 then declined to 1% in 2007. In reach 3, EPT comprised 15%, 24% and 20 % in sample years 2005, 2006 and 2007 respectively. In reach 4, EPT taxa made up less than 1% of the BMI community in 2005 and 2007 and 2% in 2006. These differences in BMI community composition signify distinct differences in aquatic habitats in the respective reaches. EPT taxa are typically found in water bodies with cold, well oxygenated water and favor good quality habitat. As such, these orders are used as an index for assessing water quality and habitat conditions. The lack of EPT taxa in reaches 2, 3 and 4 indicates poor water quality and/or habitat conditions. Reach 2 was dominated by dipterans (chironomids in particular) and crustaceans each sample year. Dipterans are typically indicative of poor water quality and habitat condition. Reach 3 was also dominated by dipterans (chironomids) as well as Acarina (water mites). Reach 4 was dominated by an invasive species.

Reach 4 had the highest BMI density but the lowest diversity of the four reaches. Reach 4 was dominated almost exclusively by gastropods. In 2005, the dominant gastropod was *Potamopyrgus antipodarum* (81%) in the family Hydrobiidae. In 2006, Hydrobiidae was the most abundant BMI taxa identified in reach 4 (74%). On average, 4% of the Hydrobiidae Identified in 2006 were labeled as *Potamopyrgus antipodarum* by taxonomists. This family level identification rather than genus and species reflects a more conservative taxonomic level identification. In 2007, taxonomists returned to the higher resolution genus and species level identification evident in 2005 finding *Potamopyrgus antipodarum* the most abundant BMI taxa (83%). In all likelihood, *Potamopyrgus antipodarum* was the Hydrobiid identified in the 2006 samples but taxonomists elected to use the more conservative level of identification that year.

As noted in 2006, the presence of *Potamopyrgus antipodarum* in reach 4 raises concerns. *Potamopyrgus antipodarum,* also known as the New Zealand mud snail (NZMS), is an invasive species. Transport mechanisms into reach 4 could possibly be through fish stocking or the private hatchery with return stream flows to the Bear in the Black Canyon. Alternatively, the snail may have been transported into the reach by anglers or boaters. It is uncertain how long the snail has been present in reach 4 since this was the dominant taxa in all three years of baseline sampling. The taxa was not observed in reaches 1, 2 or 3 during the three-year baseline monitoring effort. The potential ecological impacts of this exotic snail are not yet fully understood. The Department of Ecology at Montana State University-Bozeman maintains a website dedicated to disseminating information on NZMS distribution and ecological research (http://www.esg.montana.edu/aim/mollusca/nzms/). The snail is present in a number of other western rivers.

Analysis of BMI functional feeding group composition further demonstrates the differences between reach 1 and the three treatment reaches below Grace Dam. Reach 1 was dominated by scrapers (34%), filterers (32%), gatherers (20%), and shredders (11%). Given the October sampling date coupled with leaf fall from the adjacent riparian community these functional groups were expected for this time period (Vannote et al. 1980). The scrapers were substantially higher in 2007 compared to 2005 and 2006. The filter feeders likely take advantage of the high nutrient concentrations resulting from agricultural land-use practices adjacent to and upstream from reach 1.

In Reach 2, the BMI community was dominated by gatherers and predators in all three sample years. The gatherer feeding group in reach 2 consists largely of chironomids. The general lack of riparian vegetation in reach 2 due to grazing practices coupled with the upstream reservoir trapping leaf litter input likely accounts in part for the lack of shredder taxa in this reach. Poor habitat quality likely also plays a significant role in the lack of diversity in the functional feeding groups.

Reach 3 in the Black Canyon was dominated by predators and gatherers and to a lesser degree by scrapers in all three sample years. Although limited to the immediate riparian area the Black Canyon does contain sufficient deciduous shrubs to support shredders on par with Reach 1. The fact that shredders make up only 2 percent of the community suggests other factors limit this group. Shredders tend to be in the EPT group of taxonomic orders. The lack of suitable cobble substrate could be the limiting factor.

Reach 4 was dominated by scrapers likely capitalizing on the abundant filamentous algae. The open canopy coupled with the stable bedrock substrate, stable flow regime and nutrient inputs from groundwater upwellings make this site conducive to algal growth. Other researchers have found increases in scraper densities corresponding to reaches with open canopies (Hawkins et al. 1982; Noel et al. 1986; Fuller et al. 1986; Behmer and Hawkins 1986). The NZMS is classified as a scraper. The lack of disturbance might further enable the NZMS scraper specialist to outcompete generalist species. Resh et al (1988) attributed increased BMI species richness to the increased habitat complexity that results in streams with intermediate levels of disturbance. Reach 4 receives little disturbance annually and as expected the species diversity was low dominated by the invasive NZMS capitalizing on the abundant filamentous algae.

Reach 4 supported a significantly higher BMI density than the other three study reaches in all three study years. Autochthonous food sources such as filamentous algae are considered to be of higher nutritional value than allochthonous inputs (Anderson and Cummins 1979; Minshall 1978). The quality of the food resources in Reach 4 combined with the low species diversity and lack of disturbance may have attributed to the significantly higher BMI densities.

Taxa richness in the SS samples was directly proportional to the CS samples in 2006 and 2007 indicating that although the SS samples capture fewer taxa than the CS samples the former sampling method tracked changes between years in a similar manner. In 2006, the SS samples were more able to detect change in taxa richness than the CS samples particularly in reaches 1, 2 and 3. The SS samples in 2006 had a 92% chance of detecting a change in 4 taxa between reaches using 5 transects. In contrast, the CS samples had a 65% chance of detecting a change in 4 taxa between reaches using 5 transects. In order to get a 90% chance of detecting change in 4 taxa (alpha = beta = 0.1) would require 8 transects in 2006.

In 2007, SS samples were also better able to detect changes in taxa richness than the CS samples. The SS samples in 2007 had a 90% chance of detecting a change in 4 taxa between reaches using 5 transects. In contrast, the CS samples had a 45% chance of detecting a change in 4 taxa between reaches using 5 transects. In order to get a 90% chance of detecting change in 4 taxa (alpha = beta = 0.1) would require 16 transects in 2007.

Gradients of increasing taxa richness below impoundments are expected, but this gradient was only apparent among the SS samples not the CS samples. For ecological monitoring studies, sampling design should be optimized to detect ecologically relevant changes in community structure. The sampling program should be adequate to statistically detect an ecologically relevant amount of change—otherwise, “no significant difference” may be reported simply because the data were too variable for the number of replicates used. Using the CS samples there is a greater likelihood of making Type I and II errors than using the SS samples.

## *5.8 ORGANIC MATTER ASH-FREE DRY WEIGHT*

Organic matter AFDW was significantly greater in 2006 compared to 2005 and 2007 for each sample reach. The reason for these differences between sample years within individual reaches remains uncertain. The fact that the 2006 AFDW values were greater in all reaches suggests external basin-wide factors were responsible for the increase rather than site specific factors.

Reach 4 had the highest organic matter AFDW per square meter for each respective sample year. The relatively stable flow regime coupled with the bedrock ledges allows the mats of macrophytes and filamentous algae to maximize growth with little scour or disturbance from bedload movement on an annual basis. In contrast, substrate in reaches 1, 2 and 3 was smaller and less stable making it more susceptible to movement at lower discharge volumes compared to reach 4. Furthermore, organic matter growth in reach 4 might be greater than the other three reaches due to nutrient inputs associated with the groundwater upwellings. Travertine deposits indicative of calcium carbonate precipitates were observed in reach 4. The nutrient inputs associated with the upwelling likely stimulates macrophyte and filamentous algal growth. Calcium carbonate deposits were not observed in reaches 1, 2 or 3.

Reaches 1, 2 and 3 contained virtually identical organic matter AFDW means in 2007. In contrast, reach 1 was substantially greater than reaches 2 and 3 in October 2005 and 2006. The brown mats of filamentous algae observed in previous October sampling events in reach 1 were still present. As reported in previous years, the algal material in reach 1 was shorter and darker in comparison to the long bright green filaments found in reach 4. In addition, reach 1 consisted primarily of filamentous algae lacking the macrophytes common to reaches 2 and 4. As noted from observations during the 2005 sampling event, the filamentous algae in reach 1 was likely entering seasonal decline in October as evidenced by the decaying stalks.

# 6. CONCLUSIONS

The new license for the Bear River Hydroelectric Project (FERC No. 20) includes a condition requiring PacifiCorp to implement and study a variable flow regime at the Grace Hydropower Facility in the 6.2 mile reach known as the Black Canyon between Grace Dam and the Grace powerhouse. PacifiCorp, in collaboration with the ECC, developed the Bear River Black Canyon Monitoring Study to examine the effect of the variable flow regime on the river channel shape, substrate and aquatic biota. Specifically, the Black Canyon Monitoring Plan includes investigation of: 1) Macroinvertebrates—population trends, diversity and community indices; 2) Organic Matter Ash-Free Dry Weight (AFDW); 3) Periphyton—chlorophyll concentration and biomass; 4) Fisheries—population trends, community composition, fish condition; 5) Filamentous Algae—density; and 6) Channel Morphology—shape and substrate composition.

The monitoring effort comprises four study reaches. Reach 1, partially regulated by Bear Lake, serves as the reference reach. Reaches 2, 3 and 4, subject to the variable flow regime below Grace Dam, serve as the experimental reaches. The monitoring study spans six-years of data collection. The first three-years serve as a baseline period collecting data in all reaches prior to implementation of the variable flow regime. The second three-year term, years four through six, serve as the experimental phase when reaches 2, 3 and 4 will be subjected to flows ranging from 800 to 1500 cfs, approximately 700 to 1400 cfs greater than the minimum instream flow of 65 cfs below Grace Dam. Field sampling occurs once annually in October. Field sampling was initiated in October 2005 and will conclude October 2010.

This report describes study results from the baseline monitoring effort, years 2005 through 2007. The year 1 report, the 2005 data, served as a baseline characterization of the four study reaches. Based on year 1 data analysis it was determined that reaches 1, 2, 3 and 4 were distinctly different from each other. Because of these distinct differences, the analysis in 2006 and 2007 focused largely on changes over time within respective reaches rather than comparisons between reaches.

Channel morphological characteristics remained largely unchanged in reaches 2 and 3 in 2007 compared to 2005 and 2006. Discharge remained relatively stable for the three year baseline monitoring period from 2005 through 2007 below Grace Dam. In September 2006, a pulse release occurred below Grace Dam to assist channel restoration efforts in the former Cove impoundment. The daily average flow did not exceed 150 cfs. The instantaneous maximum was reported to be approximately 500 cfs. This discharge event did not appear to alter the channel shape or structure in reaches 2 and 3.

The periphyton community was significantly different between sample years in reaches 1 and 3 but similar across the baseline monitoring period in reaches 2 and 4. Differences were detected in reach 1 for AFDW and Chlorophyll a. The AI was significantly different between sample years in reaches 1, 2 and 3 but similar in reach 4. These inconsistent trends in periphyton metrics between samples years for respective reaches could simply be due to habitat heterogeneity inherent in stream habitats. Alternatively, the differences could be a manifestation of the interaction between substrate and discharge unique to each reach. Reaches 1 and 3 contain the smallest average substrate particle sizes on average for the four reaches with the exception of transects TA, TB and TC in reach 2. Consequently, reaches 1 and 3 would be more vulnerable to scour at lower discharges compared to reaches 2 and 4. This scour could cause disturbance in the periphyton community.

Filamentous algae coverage differed between years in reach 2 only where 2006 coverage was significantly greater than in 2005 and 2007. The cause for the increase in 2006 remains uncertain but could be due to differences in spring and summer discharge between years. Coverage in reaches 1, 3 and 4 was similar across the three-year baseline monitoring period for respective reaches.

In 2007, seven fish species were collected for the combined four reaches. Reach 3 contained 5 species while reaches 1, 2, and 4 had 4 species each. Longnose dace and redside shiner were the only species collected in all 4 reaches. Reach 4 had the highest density of fish. Reach 2 had the lowest fish density as was evident in sample years 2005 and 2006. Reach 4 was the only reach where rainbow trout were collected. The last rainbow trout stocking in reach 4 occurred nearly 6 weeks prior to sampling. Low rainbow trout abundance and catch rates observed in 2007 compared to 2005 suggests a strong relationship between catch rates and the rainbow trout stocking schedule.

Multi-year comparisons indicate that there was a high degree of variability in total catch, catch rates, and biomass between years in reaches 1, 3, and 4 suggesting statistically significant differences in these variables may be more difficult to detect between the baseline monitoring and experimental phase when the whitewater releases occur. Reach 2 consistently had less variation than the other reaches and therefore statistical tests will have more power to detect any differences. Relative species composition also had relatively little variation as the dominant 1 or 2 species in each reach was quite consistent between years. Accordingly, the relative species composition data from 2005 through 2007 should be useful for comparisons with the data collected during the experimental phase.

BMI density was similar throughout the three-year study period for the respective study reaches with some exceptions for individual metrics which were most likely the result of spatial and temporal variability inherent in BMI sampling efforts. The invasive species, NZMS, continues to be the dominant taxa in reach 4. The potential ecological effects of this invasive species on other trophic levels in reach 4 remains uncertain. As of the October 2007 sampling, NZMS were not present in reaches 1, 2 or 3. Continued educational signage at the footbridge in reach 4 will help to warn anglers and boaters of the potential to inadvertently transport these aquatic hitchhikers to upstream reaches and adjacent water bodies.

Statistical power analysis of BMI taxa richness indicated the single surber sample was more sensitive at detecting small changes in taxa numbers than the composite surber sample in both 2006 and 2007. Variability was greater in the composite samples likely due to the increased number of microhabitats sampled, particularly inclusion of stream margin habitats typically occupied by different taxa than those commonly found in the thalweg. Gradients of increasing taxa richness below impoundments are expected, but this gradient was only apparent among the SS samples, not the CS samples. Field sampling should continue to separate SS and CS samples in the experimental phase of the study for comparison with the baseline monitoring effort.

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# APPENDIX A

## CHANNEL SURVEY DATA

Bear River
Reach 2 Channel Survey Data 2005

**Project Name: Bear River, Id**
**Project Code: 283-001**
**Date: 2005_10_12 Time: 7:45 am**
**Reach 2 Transects 1-5**
**staff: Instrument - Brian Anderson, Rod - John Gangemi**
**Conditions: Partly cloudy, warming to upper 60's by mid day.**
**Tape was tied at 20 cm, adjusted distance column is true distance**

| Station | Back Site | Height of Instrument | Fore Site | Elevation (m) | Distance (m) | Adjusted Distance (m) | Comments | Depth (m) | Bankfull Depth (m) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 | | | BM | | |
| | 1.3 | 101.3 | | | | | | | |
| | | | 1.292 | 100.008 | 0.2 | 0 | RBP | | |
| | | | 1.716 | 99.584 | 3 | 2.8 | | | |
| | | | 2.559 | 98.741 | 9.65 | 9.45 | BF | | 0 |
| | | | 2.88 | 98.42 | 11.12 | 10.92 | WP | 0 | 0.321 |
| | | | 3.025 | 98.275 | 11.46 | 11.26 | SA | 0.145 | 0.466 |
| | | | 3.154 | 98.146 | 13 | 12.8 | FI | 0.274 | 0.595 |
| | | | 3.221 | 98.079 | 15 | 14.8 | FI | 0.341 | 0.662 |
| | | | 3.27 | 98.03 | 17 | 16.8 | CO | 0.39 | 0.711 |
| | | | 3.374 | 97.926 | 19 | 18.8 | CO | 0.494 | 0.815 |
| | | | 3.205 | 98.095 | 21 | 20.8 | GR | 0.325 | 0.646 |
| | | | 3.175 | 98.125 | 23 | 22.8 | FI | 0.295 | 0.616 |
| | | | 3.352 | 97.948 | 25 | 24.8 | FI | 0.472 | 0.793 |
| | | | | | | | | | |
| | | | 3.435 | 97.865 | 27 | 26.8 | FI | 0.555 | 0.876 |
| Transect 1 | | | 3.283 | 98.017 | 29 | 28.8 | FI | 0.403 | 0.724 |
| | | | 3.233 | 98.067 | 31 | 30.8 | FI | 0.353 | 0.674 |
| | | | 3.219 | 98.081 | 33 | 32.8 | FI | 0.339 | 0.66 |
| | | | 3.218 | 98.082 | 35 | 34.8 | FI | 0.338 | 0.659 |
| | | | 3.204 | 98.096 | 37 | 36.8 | FI | 0.324 | 0.645 |
| | | | 3.005 | 98.295 | 39 | 38.8 | FI | 0.125 | 0.446 |
| | | | 3.018 | 98.282 | 41 | 40.8 | FI | 0.138 | 0.459 |
| | | | 3.105 | 98.195 | 43 | 42.8 | FI | 0.225 | 0.546 |
| | | | 2.908 | 98.392 | 44.67 | 44.47 | WP | 0.028 | 0.349 |
| | | | 2.662 | 98.638 | 46.2 | 46 | | | 0.103 |
| | | | 2.93 | 98.37 | 48.7 | 48.5 | WP | 0.05 | 0.371 |
| | | | 3.112 | 98.188 | 50 | 49.8 | FI | 0.232 | 0.553 |
| | | | 3.109 | 98.191 | 52 | 51.8 | FI | 0.229 | 0.55 |
| | | | 3.109 | 98.191 | 54 | 53.8 | FI | 0.229 | 0.55 |
| | | | 3.098 | 98.202 | 56 | 55.8 | FI | 0.218 | 0.539 |
| | | | 2.92 | 98.38 | 56.7 | 56.5 | WP | 0.04 | 0.361 |
| | | | 2.58 | 98.72 | 58.5 | 58.3 | BF | | 0.021 |
| TP 1 | | | 2.69 | 98.61 | | | | | |
| | 2.32 | 100.93 | | | | | | | |
| | | | 1.22 | 99.71 | 0.2 | 0 | RBP | | |
| | | | 1.318 | 99.612 | 7.9 | 7.7 | | | |
| | | | 2.468 | 98.462 | 20.58 | 20.38 | BF | | 0 |
| | | | 2.656 | 98.274 | 27.4 | 27.2 | WP | 0 | 0.188 |
| | | | 2.803 | 98.127 | 28.8 | 28.6 | GR | 0.147 | 0.335 |

Bear River
Reach 2 Channel Survey Data 2005

| Station | Back Site | Height of Instrument | Fore Site | Elevation (m) | Distance (m) | Adjusted Distance (m) | Comments | Depth (m) | Bankfull Depth (m) |
|---|---|---|---|---|---|---|---|---|---|
| Transect 2 | | | 2.874 | 98.056 | 30.15 | 29.95 | GR | 0.218 | 0.406 |
| | | | 2.93 | 98 | 32 | 31.8 | MC | 0.274 | 0.462 |
| | | | 3.013 | 97.917 | 34 | 33.8 | GR | 0.357 | 0.545 |
| | | | 3.042 | 97.888 | 36 | 35.8 | MC | 0.386 | 0.574 |
| | | | 3.039 | 97.891 | 38 | 37.8 | FI | 0.383 | 0.571 |
| | | | 3.053 | 97.877 | 40 | 39.8 | SA | 0.397 | 0.585 |
| | | | 3.142 | 97.788 | 42 | 41.8 | FI | 0.486 | 0.674 |
| | | | 3.1 | 97.83 | 44 | 43.8 | CO | 0.444 | 0.632 |
| | | | 2.972 | 97.958 | 46 | 45.8 | CO | 0.316 | 0.504 |
| | | | 2.875 | 98.055 | 48 | 47.8 | CO | 0.219 | 0.407 |
| | | | 2.808 | 98.122 | 50 | 49.8 | FI | 0.152 | 0.34 |
| | | | 2.725 | 98.205 | 52 | 51.8 | FI | 0.069 | 0.257 |
| | | | 2.778 | 98.152 | 54 | 53.8 | FI | 0.122 | 0.31 |
| | | | 2.79 | 98.14 | 56 | 55.8 | SA | 0.134 | 0.322 |
| | | | 2.774 | 98.156 | 58 | 57.8 | SA | 0.118 | 0.306 |
| | | | 2.912 | 98.018 | 60 | 59.8 | SA | 0.256 | 0.444 |
| | | | 2.995 | 97.935 | 62 | 61.8 | SA | 0.339 | 0.527 |
| | | | 3.121 | 97.809 | 64 | 63.8 | CO | 0.465 | 0.653 |
| | | | 3.06 | 97.87 | 66 | 65.8 | SA | 0.404 | 0.592 |
| | | | 3.016 | 97.914 | 68 | 67.8 | FI | 0.36 | 0.548 |
| | | | 3.052 | 97.878 | 70 | 69.8 | FI | 0.396 | 0.584 |
| | | | 3.128 | 97.802 | 74 | 73.8 | FI | 0.472 | 0.66 |
| | | | 3.07 | 97.86 | 78 | 77.8 | FI | 0.414 | 0.602 |
| | | | 3.03 | 97.9 | 82 | 81.8 | FI | 0.374 | 0.562 |
| | | | 2.753 | 98.177 | 84.4 | 84.2 | WP | 0.097 | 0.285 |
| | | | 2.56 | 98.37 | 87.8 | 87.6 | BF | | 0.092 |
| TP 2 | | | 2.605 | 98.325 | | | | | |
| | 1.09 | 99.415 | | | | | | | |
| Trans. 3 | | | 0.461 | 98.954 | 0.2 | 0 | RBP | | |
| | | | 1.239 | 98.176 | 3.2 | 3 | BF | | 0 |
| | | | 1.412 | 98.003 | 5 | 4.8 | WP | 0 | 0.173 |
| | | | 1.502 | 97.913 | 7 | 6.8 | FI | 0.09 | 0.263 |
| | | | 1.533 | 97.882 | 9 | 8.8 | CO | 0.121 | 0.294 |
| | | | 1.632 | 97.783 | 11 | 10.8 | CO | 0.22 | 0.393 |
| | | | 1.649 | 97.766 | 13 | 12.8 | CO | 0.237 | 0.41 |
| | | | 1.724 | 97.691 | 15 | 14.8 | CO | 0.312 | 0.485 |
| | | | 1.612 | 97.803 | 17 | 16.8 | CO | 0.2 | 0.373 |
| | | | 1.632 | 97.783 | 19 | 18.8 | CO | 0.22 | 0.393 |
| | | | 1.58 | 97.835 | 21 | 20.8 | CO | 0.168 | 0.341 |
| | | | 1.625 | 97.79 | 23 | 22.8 | CO | 0.213 | 0.386 |
| | | | 1.612 | 97.803 | 25 | 24.8 | CO | 0.2 | 0.373 |
| | | | 1.591 | 97.824 | 27 | 26.8 | MC | 0.179 | 0.352 |
| | | | 1.623 | 97.792 | 29 | 28.8 | MC | 0.211 | 0.384 |
| | | | 1.69 | 97.725 | 31 | 30.8 | GR | 0.278 | 0.451 |
| | | | 1.639 | 97.776 | 33 | 32.8 | MC | 0.227 | 0.4 |
| | | | 1.678 | 97.737 | 35 | 34.8 | MC | 0.266 | 0.439 |
| | | | 1.656 | 97.759 | 37 | 36.8 | GR | 0.244 | 0.417 |
| | | | 1.645 | 97.77 | 39 | 38.8 | MC | 0.233 | 0.406 |

Bear River
Reach 2 Channel Survey Data 2005

| Station | Back Site | Height of Instrument | Fore Site | Elevation (m) | Distance (m) | Adjusted Distance (m) | Comments | Depth (m) | Bankfull Depth (m) |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1.592 | 97.823 | 41 | 40.8 | FI | 0.18 | 0.353 |
| | | | 1.531 | 97.884 | 43.39 | 43.19 | WP | 0.119 | 0.292 |
| | | | 1.288 | 98.127 | 50.2 | 50 | | | 0.049 |
| | | | 1.439 | 97.976 | 56.94 | 56.74 | WP | 0.027 | 0.2 |
| | | | 1.508 | 97.907 | 57.65 | 57.45 | CO | 0.096 | 0.269 |
| | | | 1.432 | 97.983 | 58.3 | 58.1 | WP | 0.02 | 0.193 |
| | | | 1.472 | 97.943 | 60.51 | 60.31 | WP | 0.06 | 0.233 |
| | | | 1.538 | 97.877 | 61.15 | 60.95 | FI | 0.126 | 0.299 |
| | | | 1.458 | 97.957 | 61.8 | 61.6 | WP | 0.046 | 0.219 |
| | | | 1.453 | 97.962 | 64.52 | 64.32 | WP | 0.041 | 0.214 |
| | | | 1.498 | 97.917 | 64.91 | 64.71 | FI | 0.086 | 0.259 |
| | | | 1.482 | 97.933 | 65.74 | 65.54 | FI | 0.07 | 0.243 |
| | | | 1.445 | 97.97 | 65.81 | 65.61 | WP | 0.033 | 0.206 |
| | | | 1.135 | 98.28 | 74.5 | 74.3 | BF | | -0.104 |
| TP 3 | | | 1.9 | 97.515 | | | | | |
| | 1.6 | 99.115 | | | | | | | |
| | | | 1.93 | 97.185 | 0.2 | 0 | RBP | | |
| | | | 2.142 | 96.973 | 0.23 | 0.03 | BF | | 0 |
| | | | 2.227 | 96.888 | 2.5 | 2.3 | WP | 0 | 0.085 |
| | | | 2.345 | 96.77 | 3.6 | 3.4 | CO | 0.118 | 0.203 |
| | | | 2.293 | 96.822 | 5 | 4.8 | CO | 0.066 | 0.151 |
| | | | 2.258 | 96.857 | 7 | 6.8 | CO | 0.031 | 0.116 |
| | | | 2.282 | 96.833 | 9 | 8.8 | CO | 0.055 | 0.14 |
| | | | 2.322 | 96.793 | 11 | 10.8 | GR | 0.095 | 0.18 |
| | | | 2.316 | 96.799 | 13 | 12.8 | GR | 0.089 | 0.174 |
| | | | 2.38 | 96.735 | 15 | 14.8 | CO | 0.153 | 0.238 |
| | | | 2.35 | 96.765 | 17 | 16.8 | CO | 0.123 | 0.208 |
| | | | 2.272 | 96.843 | 19 | 18.8 | SA | 0.045 | 0.13 |
| | | | 2.358 | 96.757 | 21 | 20.8 | BO | 0.131 | 0.216 |
| | | | 2.282 | 96.833 | 23 | 22.8 | GR | 0.055 | 0.14 |
| | | | 2.408 | 96.707 | 25 | 24.8 | CO | 0.181 | 0.266 |
| | | | 2.422 | 96.693 | 27 | 26.8 | CO | 0.195 | 0.28 |
| | | | 2.468 | 96.647 | 29 | 28.8 | CO | 0.241 | 0.326 |
| | | | 2.357 | 96.758 | 31 | 30.8 | CO | 0.13 | 0.215 |
| | | | 2.306 | 96.809 | 33 | 32.8 | BO | 0.079 | 0.164 |
| | | | 2.05 | 97.065 | 34 | 33.8 | BO | | |
| | | | 2.13 | 96.985 | 36 | 35.8 | BO | | |
| Trans. 4 | | | 1.91 | 97.205 | 36.8 | 36.6 | BO | | |
| | | | 2.274 | 96.841 | 37.5 | 37.3 | GR | 0.047 | 0.132 |
| | | | 2.278 | 96.837 | 39 | 38.8 | MC | 0.051 | 0.136 |
| | | | 2.308 | 96.807 | 41 | 40.8 | GR | 0.081 | 0.166 |
| | | | 2.353 | 96.762 | 43 | 42.8 | GR | 0.126 | 0.211 |
| | | | 2.32 | 96.795 | 45 | 44.8 | BO | 0.093 | 0.178 |
| | | | 2.191 | 96.924 | 47 | 46.8 | BO | | 0.049 |
| | | | 2.29 | 96.825 | 49 | 48.8 | GR | 0.063 | 0.148 |
| | | | 2.13 | 96.985 | 50 | 49.8 | BR | | |
| | | | 2.203 | 96.912 | 54.4 | 54.2 | BR | | 0.061 |
| | | | 2.395 | 96.72 | 55.04 | 54.84 | GR | 0.168 | 0.253 |

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Bear River
Reach 2 Channel Survey Data 2005

| Station | Back Site | Height of Instrument | Fore Site | Elevation (m) | Distance (m) | Adjusted Distance (m) | Comments | Depth (m) | Bankfull Depth (m) |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2.345 | 96.77 | 57 | 56.8 | CO | 0.118 | 0.203 |
| | | | 2.341 | 96.774 | 59 | 58.8 | FI | 0.114 | 0.199 |
| | | | 2.223 | 96.892 | 61 | 60.8 | BR | | 0.081 |
| | | | 2.215 | 96.9 | 64.8 | 64.6 | BR | | 0.073 |
| | | | 2.12 | 96.995 | 65.4 | 65.2 | BR | | |
| | | | 2.22 | 96.895 | 66.19 | 65.99 | BR | | 0.078 |
| | | | 1.954 | 97.161 | 67.18 | 66.98 | BO | | |
| | | | 2.221 | 96.894 | 68.2 | 68 | FI | | 0.079 |
| | | | 2.31 | 96.805 | 69.44 | 69.24 | FI | 0.083 | 0.168 |
| | | | 2.21 | 96.905 | 70.18 | 69.98 | FI | | 0.068 |
| | | | 2.17 | 96.945 | 72.1 | 71.9 | WP | | 0.028 |
| | | | 2.05 | 97.065 | 76.8 | 76.6 | BF | | -0.092 |
| TP 4 | | | 3.255 | 95.86 | | | | | |
| | 3.97 | 99.83 | | | | | | | |
| Trans. 5 | | | 2.235 | 97.595 | 0.2 | 0 | RBP | | |
| | | | 2.181 | 97.649 | 0.7 | 0.5 | | | |
| | | | 4.097 | 95.733 | 1.1 | 0.9 | BF | | 0 |
| | | | 4.541 | 95.289 | 4 | 3.8 | | 0.1 | 0.085 |
| | | | 4.441 | 95.389 | 10.37 | 10.17 | WP | 0 | 0.203 |
| | | | 4.52 | 95.31 | 12 | 11.8 | CO | 0.079 | 0.151 |
| | | | 4.558 | 95.272 | 14 | 13.8 | CO | 0.117 | 0.116 |
| | | | 4.615 | 95.215 | 16 | 15.8 | BO | 0.174 | 0.14 |
| | | | 4.741 | 95.089 | 18 | 17.8 | BO | 0.3 | 0.18 |
| | | | 4.681 | 95.149 | 20 | 19.8 | MC | 0.24 | 0.174 |
| | | | 4.695 | 95.135 | 22 | 21.8 | MC | 0.254 | 0.238 |
| | | | 4.768 | 95.062 | 24 | 23.8 | MC | 0.327 | 0.208 |
| | | | 4.74 | 95.09 | 26 | 25.8 | MC | 0.299 | 0.13 |
| | | | 4.708 | 95.122 | 28 | 27.8 | BO | 0.267 | 0.216 |
| | | | 4.72 | 95.11 | 30 | 29.8 | BO | 0.279 | 0.14 |
| | | | 4.715 | 95.115 | 32 | 31.8 | MC | 0.274 | 0.266 |
| | | | 4.78 | 95.05 | 34 | 33.8 | BO | 0.339 | 0.28 |
| | | | 4.75 | 95.08 | 36 | 35.8 | MC | 0.309 | 0.326 |
| | | | 4.638 | 95.192 | 38 | 37.8 | BO | 0.197 | 0.215 |
| | | | 4.548 | 95.282 | 40 | 39.8 | BO | 0.107 | 0.164 |
| | | | 4.64 | 95.19 | 42 | 41.8 | BO | 0.199 | |
| | | | 4.53 | 95.3 | 44.06 | 43.86 | WP | 0.089 | |
| | | | 4.27 | 95.56 | 45.9 | 45.7 | | | |
| | | | 4.123 | 95.707 | 52.38 | 52.18 | BF | | 0.132 |
| TP 5 | | | 1.77 | 98.06 | | | | | |
| | 3.49 | 101.55 | | | | | | | |
| | | | 2.135 | 99.415 | | | | | |
| | 0.42 | 99.835 | | | | | | | |
| | | | 1.63 | 98.205 | | | | | |
| | 4.815 | 103.02 | | | | | Closure: .007*(total distance/100)1/2 | | |

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Bear River
Reach 2 Channel Survey Data 2006

| | |
|---|---|
| **Project Name: Bear River, Id** | |
| **Project Code: 283-001** | |
| **Date: 2006_10_09** | **Time: 8:00 am** |
| **Reach 2** | **Transects TA-TE** |
| **Staff: Instrument - Drake Burford , Rod - Brian Anderson** | |
| **Conditions: Overcase, warming to 50's by mid day.** | |

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| TA | 0.000 | 100.000 | | | RBP |
| | 1.896 | 98.821 | | | |
| | 3.927 | 98.945 | | | |
| | 5.895 | 99.284 | | | |
| | 7.895 | 99.385 | | | |
| | 9.450 | 98.741 | | 0.000 | BF |
| | 9.941 | 98.460 | | 0.281 | |
| | 11.325 | 98.200 | 0.000 | 0.541 | WP |
| | 12.887 | 98.126 | 0.074 | 0.615 | FI |
| | 14.003 | 98.042 | 0.158 | 0.699 | FI |
| | 15.801 | 98.018 | 0.182 | 0.723 | FI |
| | 17.387 | 97.954 | 0.247 | 0.787 | FI |
| | 18.522 | 97.850 | 0.351 | 0.891 | SA |
| | 19.701 | 98.066 | 0.135 | 0.675 | CO |
| | 20.893 | 98.037 | 0.164 | 0.704 | CO |
| | 22.212 | 98.076 | 0.124 | 0.665 | CO |
| | 23.874 | 97.984 | 0.216 | 0.757 | SA |
| | 25.154 | 98.754 | | | BO |
| | 26.001 | 97.593 | 0.607 | 1.148 | GR |
| | 27.054 | 97.759 | 0.441 | 0.982 | GR |
| | 27.803 | 98.127 | 0.073 | 0.614 | BO |
| | 28.667 | 97.954 | 0.246 | 0.787 | FI |
| | 30.452 | 98.010 | 0.191 | 0.731 | FI |
| | 31.975 | 98.072 | 0.128 | 0.669 | FI |
| | 34.005 | 98.062 | 0.138 | 0.679 | FI |
| | 35.999 | 98.013 | 0.187 | 0.728 | FI |
| | 38.017 | 98.202 | | 0.539 | FI |
| | 39.955 | 98.204 | | 0.537 | FI |
| | 42.021 | 98.154 | 0.046 | 0.587 | FI |
| | 44.014 | 98.227 | | 0.514 | FI |
| | 44.584 | 98.430 | | 0.311 | WP |
| | 45.942 | 98.664 | | 0.077 | |
| | 48.114 | 98.495 | | 0.246 | |
| | 49.806 | 98.412 | | 0.329 | WP |
| | 52.022 | 98.126 | 0.074 | 0.615 | FI |
| | 53.996 | 98.049 | 0.151 | 0.692 | FI |
| | 55.977 | 98.070 | 0.130 | 0.671 | FI |
| | 57.272 | 98.380 | | 0.361 | WP |
| | 58.300 | 98.720 | | 0.021 | BF |
| | 59.027 | 98.700 | | | |
| | 60.636 | 99.246 | | | LBP |

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Bear River
Reach 2 Channel Survey Data 2006

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| | | | | | |
| | 0.000 | 99.713 | | | RBP |
| | 1.908 | 99.532 | | | |
| | 3.895 | 99.633 | | | |
| | 5.918 | 99.688 | | | |
| | 7.913 | 99.574 | | | |
| | 9.877 | 98.961 | | | |
| | 11.896 | 98.552 | | | |
| | 13.884 | 98.346 | | | |
| | 15.899 | 98.337 | | | |
| | 17.914 | 98.386 | | | |
| | 19.912 | 98.410 | | | |
| | 20.380 | 98.462 | | 0.000 | BF |
| | 21.918 | 98.571 | | | |
| | 23.911 | 98.486 | | | |
| | 25.904 | 98.350 | | 0.112 | |
| | 26.613 | 98.328 | 0.000 | 0.134 | WP |
| | 27.314 | 98.284 | 0.044 | 0.178 | FI |
| | 27.678 | 98.140 | 0.188 | 0.322 | GR |
| | 29.121 | 98.088 | 0.239 | 0.374 | GR |
| | 30.711 | 98.024 | 0.304 | 0.438 | GR |
| | 32.287 | 97.978 | 0.350 | 0.484 | GR |
| | 33.887 | 97.920 | 0.407 | 0.542 | GR |
| | 35.159 | 97.921 | 0.407 | 0.541 | GR |
| | 36.753 | 97.874 | 0.453 | 0.588 | GR |
| | 38.016 | 97.878 | 0.450 | 0.584 | GR |
| | 39.304 | 97.839 | 0.489 | 0.623 | GR |
| | 40.884 | 97.785 | 0.543 | 0.677 | FI |
| TB | 42.382 | 97.904 | 0.424 | 0.558 | BO |
| | 43.714 | 97.779 | 0.548 | 0.683 | FI |
| | 45.394 | 97.872 | 0.455 | 0.590 | FI |
| | 46.863 | 97.968 | 0.360 | 0.494 | FI |
| | 49.011 | 98.096 | 0.231 | 0.366 | FI |
| | 50.993 | 98.175 | 0.153 | 0.287 | FI |
| | 52.929 | 98.139 | 0.188 | 0.323 | FI |
| | 54.952 | 98.182 | 0.146 | 0.280 | FI |
| | 56.979 | 98.148 | 0.180 | 0.314 | FI |
| | 58.955 | 98.040 | 0.288 | 0.422 | FI |
| | 60.889 | 97.922 | 0.406 | 0.540 | FI |
| | 62.788 | 97.843 | 0.484 | 0.619 | FI |
| | 64.306 | 97.809 | 0.518 | 0.653 | FI |
| | 65.482 | 97.815 | 0.512 | 0.647 | SA |
| | 66.436 | 97.834 | 0.494 | 0.628 | FI |
| | 68.586 | 97.892 | 0.436 | 0.570 | FI |
| | 70.626 | 97.962 | 0.365 | 0.500 | FI |
| | 72.744 | 97.784 | 0.543 | 0.678 | FI |
| | 74.650 | 97.787 | 0.541 | 0.675 | FI |
| | 76.311 | 97.839 | 0.489 | 0.623 | FI |
| | 78.148 | 97.866 | 0.461 | 0.596 | FI |

Bear River
Reach 2 Channel Survey Data 2006

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| | 80.158 | 97.930 | 0.397 | 0.532 | FI |
| | 82.166 | 98.139 | 0.189 | 0.323 | BO |
| | 84.096 | 98.099 | 0.228 | 0.363 | FI |
| | 84.951 | 98.265 | 0.062 | 0.197 | WP |
| | 87.313 | 98.328 | | 0.134 | |
| | 87.600 | 98.370 | | 0.092 | BF |
| | 88.278 | 99.210 | | | LBP |
| | | | | | |
| TC | 0.000 | 98.972 | | | RBP |
| | 1.901 | 98.403 | | | |
| | 3.000 | 98.176 | | 0.000 | BF |
| | 3.928 | 98.106 | | 0.070 | |
| | 4.817 | 98.078 | 0.000 | 0.098 | WP |
| | 6.952 | 98.003 | 0.076 | 0.173 | FI |
| | 8.906 | 97.830 | 0.249 | 0.346 | FI |
| | 10.903 | 97.895 | 0.183 | 0.281 | CO |
| | 12.510 | 97.755 | 0.323 | 0.421 | GR |
| | 14.319 | 97.709 | 0.369 | 0.467 | CO |
| | 15.901 | 97.812 | 0.266 | 0.364 | CO |
| | 17.367 | 97.761 | 0.318 | 0.415 | CO |
| | 19.011 | 97.775 | 0.304 | 0.401 | CO |
| | 20.609 | 97.810 | 0.268 | 0.366 | GR |
| | 22.195 | 97.767 | 0.311 | 0.409 | GR |
| | 24.177 | 97.886 | 0.193 | 0.290 | CO |
| | 26.357 | 97.794 | 0.284 | 0.382 | CO |
| | 28.152 | 97.765 | 0.313 | 0.411 | GR |
| | 29.955 | 97.730 | 0.349 | 0.446 | CO |
| | 31.620 | 97.701 | 0.377 | 0.475 | CO |
| | 33.596 | 97.741 | 0.337 | 0.435 | CO |
| | 35.137 | 97.735 | 0.343 | 0.441 | GR |
| | 37.071 | 97.741 | 0.337 | 0.435 | GR |
| | 39.068 | 97.731 | 0.347 | 0.445 | GR |
| | 40.627 | 97.862 | 0.217 | 0.314 | CO |
| | 42.032 | 97.831 | 0.247 | 0.345 | FI |
| | 43.327 | 98.065 | 0.014 | 0.111 | WP |
| | 45.169 | 98.110 | | 0.066 | |
| | 47.776 | 98.050 | 0.028 | 0.126 | |
| | 50.593 | 98.043 | 0.036 | 0.133 | |
| | 53.573 | 98.087 | | 0.089 | |
| | 55.645 | 98.142 | | 0.034 | WP |
| | 56.890 | 97.995 | 0.084 | 0.181 | FI |
| | 58.021 | 97.939 | 0.140 | 0.237 | FI |
| | 60.079 | 97.931 | 0.147 | 0.245 | FI |
| | 61.526 | 97.925 | 0.153 | 0.251 | FI |
| | 63.486 | 97.960 | 0.119 | 0.216 | FI |
| | 66.046 | 97.952 | 0.126 | 0.224 | FI |
| | 68.538 | 98.060 | 0.019 | 0.116 | WP |
| | 70.716 | 98.031 | | 0.145 | |
| | 73.144 | 98.162 | | 0.014 | |

Bear River
Reach 2 Channel Survey Data 2006

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| | 74.500 | 98.280 | | | BF |
| | 74.705 | 98.568 | | | LBP |
| | | | | | |
| TD | 0.000 | 97.198 | | | RBP |
| | 0.030 | 96.973 | | 0.000 | BF |
| | 1.877 | 96.984 | 0.000 | | WP |
| | 2.418 | 96.780 | 0.204 | 0.193 | CO |
| | 3.650 | 96.763 | 0.221 | 0.210 | CO |
| | 4.895 | 96.835 | 0.148 | 0.138 | FI |
| | 6.106 | 97.162 | | | BO |
| | 6.416 | 96.823 | 0.161 | 0.150 | CO |
| | 7.925 | 96.817 | 0.167 | 0.156 | CO |
| | 9.444 | 96.792 | 0.191 | 0.181 | CO |
| | 11.362 | 96.760 | 0.224 | 0.213 | CO |
| | 13.172 | 96.794 | 0.190 | 0.179 | CO |
| | 14.738 | 96.797 | 0.187 | 0.176 | BO |
| | 16.536 | 96.712 | 0.272 | 0.261 | GR |
| | 18.860 | 96.870 | 0.113 | 0.103 | BR |
| | 20.126 | 96.991 | | | BR |
| | 20.464 | 96.744 | 0.240 | 0.229 | CO |
| | 22.219 | 96.791 | 0.193 | 0.182 | GR |
| | 23.736 | 96.705 | 0.279 | 0.268 | CO |
| | 24.554 | 96.661 | 0.323 | 0.312 | CO |
| | 25.262 | 96.976 | 0.008 | | BO |
| | 25.540 | 96.684 | 0.300 | 0.289 | CO |
| | 27.042 | 96.598 | 0.386 | 0.375 | FI |
| | 28.475 | 96.566 | 0.418 | 0.407 | CO |
| | 30.187 | 96.597 | 0.387 | 0.376 | FI |
| | 32.543 | 96.769 | 0.215 | 0.204 | BR |
| | 33.230 | 96.939 | 0.045 | 0.034 | BR |
| | 33.615 | 96.856 | 0.128 | 0.117 | CO |
| | 35.393 | 96.967 | 0.017 | 0.006 | BR |
| | 37.723 | 96.971 | 0.013 | 0.002 | BR |
| | 39.727 | 96.809 | 0.175 | 0.164 | CO |
| | 41.712 | 96.973 | 0.011 | 0.000 | BR |
| | 42.302 | 97.128 | | | BO |
| | 42.888 | 97.141 | | | BO |
| | 43.274 | 96.786 | 0.198 | 0.187 | BR |
| | 44.993 | 96.820 | 0.164 | 0.153 | BR |
| | 47.528 | 96.839 | 0.145 | 0.134 | GR |
| | 49.872 | 96.789 | 0.195 | 0.184 | GR |
| | 52.356 | 97.014 | | | BR |
| | 54.152 | 96.021 | 0.963 | 0.952 | BR |
| | 56.874 | 95.794 | 1.190 | 1.179 | GR |
| | 58.392 | 95.801 | 1.183 | 1.172 | BR |
| | 61.946 | 96.808 | 0.176 | 0.165 | BR |
| | 63.802 | 96.855 | 0.129 | 0.118 | FI |
| | 66.147 | 96.853 | 0.131 | 0.120 | FI |
| | 68.398 | 96.809 | 0.175 | 0.164 | FI |

Bear River
Reach 2 Channel Survey Data 2006

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| | 70.750 | 96.863 | 0.121 | 0.110 | FI |
| | 72.711 | 97.022 | | | WP |
| | 75.257 | 97.123 | | | |
| | 76.600 | 97.065 | | | BF |
| | 76.966 | 97.192 | | | |
| | 78.416 | 97.793 | | | LBP |
| | | | | | |
| TE | 0.000 | 97.836 | | | RBP |
| | 0.900 | 95.733 | | 0.000 | BF |
| | 3.394 | 95.365 | | 0.368 | |
| | 6.750 | 95.432 | | 0.301 | |
| | 9.233 | 95.461 | | 0.272 | |
| | 10.471 | 95.474 | 0.000 | 0.259 | WP |
| | 11.147 | 95.328 | 0.146 | 0.405 | BR |
| | 12.860 | 95.342 | 0.132 | 0.391 | CO |
| | 13.556 | 95.624 | | 0.109 | BO |
| | 13.982 | 95.255 | 0.219 | 0.478 | CO |
| | 15.460 | 95.133 | 0.342 | 0.600 | CO |
| | 16.824 | 95.270 | 0.204 | 0.463 | BO |
| | 18.062 | 95.155 | 0.319 | 0.578 | CO |
| | 19.755 | 95.174 | 0.301 | 0.559 | GR |
| | 21.137 | 95.166 | 0.308 | 0.567 | FI |
| | 22.830 | 95.081 | 0.393 | 0.652 | FI |
| | 24.740 | 95.097 | 0.377 | 0.636 | GR |
| | 26.816 | 95.092 | 0.382 | 0.641 | GR |
| | 28.014 | 95.159 | 0.315 | 0.574 | GR |
| | 29.780 | 95.222 | 0.252 | 0.511 | GR |
| | 30.890 | 95.136 | 0.338 | 0.597 | FI |
| | 32.476 | 95.152 | 0.322 | 0.581 | FI |
| | 33.887 | 95.062 | 0.412 | 0.671 | FI |
| | 35.112 | 95.328 | 0.147 | 0.405 | BO |
| | 36.425 | 95.208 | 0.266 | 0.525 | BO |
| | 37.890 | 95.129 | 0.345 | 0.604 | BO |
| | 39.322 | 95.136 | 0.339 | 0.597 | BO |
| | 40.907 | 95.142 | 0.332 | 0.591 | BO |
| | 42.203 | 95.274 | 0.200 | 0.459 | BO |
| | 42.589 | 95.475 | | 0.258 | WP |
| | 44.176 | 95.466 | | 0.267 | |
| | 46.148 | 95.626 | | 0.107 | |
| | 48.644 | 95.610 | | 0.123 | |
| | 50.318 | 95.998 | | | LBP/BF |

**Project Name: Bear River, Id**
**Project Code: 283-001**
**Date: 2007_10_08 Time: 8:30 am**
**Reach 2 Transects TA-TE**
**Staff: Instrument - Drake Burford , Rod - Brian Anderson**
**Conditions: Overcase, warming to 50's by mid day.**

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| | | | | | |
| TA | 0.000 | 100.000 | | | RBP |
| | 2.827 | 98.894 | | | |
| | 7.207 | 99.518 | | | |
| | 9.156 | 98.823 | | | |
| | 10.811 | 98.348 | 0.147 | 0.464 | |
| | 10.977 | 98.191 | 0.304 | 0.621 | F |
| | 11.714 | 98.241 | 0.255 | 0.571 | C |
| | 12.462 | 98.109 | 0.387 | 0.703 | S |
| | 13.458 | 98.055 | 0.440 | 0.757 | F |
| | 14.883 | 97.987 | 0.509 | 0.825 | F |
| | 16.063 | 97.965 | 0.530 | 0.847 | G |
| | 17.592 | 97.954 | 0.542 | 0.858 | F |
| | 18.731 | 97.872 | 0.623 | 0.939 | S |
| | 20.271 | 98.004 | 0.491 | 0.807 | F |
| | 22.019 | 98.056 | 0.440 | 0.756 | G |
| | 23.747 | 98.067 | 0.429 | 0.745 | M |
| | 24.318 | 97.944 | 0.551 | 0.868 | S |
| | 25.951 | 97.617 | 0.878 | 1.195 | S |
| | 27.067 | 97.787 | 0.708 | 1.025 | F |
| | 27.551 | 98.174 | 0.321 | 0.638 | B |
| | 27.831 | 98.147 | 0.348 | 0.665 | B |
| | 28.394 | 97.956 | 0.539 | 0.856 | F |
| | 29.614 | 97.989 | 0.506 | 0.823 | F |
| | 30.926 | 98.014 | 0.481 | 0.798 | F |
| | 33.007 | 98.023 | 0.472 | 0.789 | F |
| | 35.300 | 98.039 | 0.456 | 0.773 | F |
| | 37.502 | 98.136 | 0.360 | 0.676 | F |
| | 39.940 | 98.211 | 0.284 | 0.601 | F |
| | 41.950 | 98.155 | 0.340 | 0.657 | F |
| | 44.054 | 98.213 | 0.282 | 0.599 | F |
| | 44.475 | 98.364 | 0.131 | 0.448 | |
| | 46.492 | 98.671 | | 0.141 | |
| | 49.570 | 98.613 | | 0.199 | |
| | 50.034 | 98.361 | 0.134 | 0.451 | F |
| | 51.124 | 98.211 | 0.285 | 0.601 | F |
| | 52.619 | 98.084 | 0.412 | 0.728 | F |
| | 54.292 | 98.095 | 0.401 | 0.717 | F |
| | 55.904 | 98.124 | 0.371 | 0.688 | C |
| | 57.230 | 98.303 | 0.192 | 0.509 | F |
| | 58.028 | 98.532 | | 0.280 | M |
| | 58.495 | 98.656 | | 0.156 | |
| | 60.009 | 98.727 | | 0.085 | |

Bear River
Reach 2 Channel Survey Data 2007

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| | 60.713 | 98.801 | | 0.011 | |
| | 60.733 | 99.316 | | | LBP |
| | | | | | |
| TB | 0.000 | 99.712 | | | RBP |
| | 0.034 | 99.559 | | | |
| | 7.554 | 99.623 | | | |
| | 12.869 | 98.400 | | 0.064 | |
| | 19.423 | 98.394 | | 0.070 | |
| | 26.391 | 98.291 | | 0.173 | |
| | 27.113 | 98.245 | | 0.219 | |
| | 27.257 | 98.160 | 0.033 | 0.304 | S |
| | 28.080 | 98.106 | 0.087 | 0.359 | G |
| | 29.035 | 98.065 | 0.128 | 0.399 | G |
| | 30.266 | 97.999 | 0.194 | 0.465 | M |
| | 31.313 | 97.952 | 0.241 | 0.512 | M |
| | 32.483 | 97.875 | 0.318 | 0.589 | S |
| | 33.699 | 97.969 | 0.224 | 0.495 | C |
| | 34.846 | 97.944 | 0.248 | 0.520 | G |
| | 35.700 | 97.885 | 0.308 | 0.579 | S |
| | 36.640 | 97.846 | 0.347 | 0.618 | M |
| | 37.750 | 97.852 | 0.341 | 0.612 | F |
| | 38.906 | 97.842 | 0.351 | 0.622 | F |
| | 40.093 | 97.815 | 0.378 | 0.649 | M |
| | 41.248 | 97.772 | 0.421 | 0.693 | M |
| | 42.642 | 97.766 | 0.427 | 0.698 | M |
| | 44.046 | 97.768 | 0.425 | 0.696 | F |
| | 44.632 | 97.971 | 0.221 | 0.493 | B |
| | 45.086 | 97.846 | 0.347 | 0.619 | F |
| | 46.432 | 97.900 | 0.293 | 0.565 | F |
| | 47.883 | 98.008 | 0.185 | 0.457 | F |
| | 49.611 | 98.104 | 0.089 | 0.361 | F |
| | 51.335 | 98.123 | 0.070 | 0.342 | F |
| | 52.772 | 98.109 | 0.084 | 0.355 | F |
| | 53.434 | 98.098 | 0.095 | 0.367 | F |
| | 54.385 | 98.128 | 0.065 | 0.336 | F |
| | 54.647 | 98.182 | 0.011 | 0.283 | |
| | 54.788 | 98.314 | | 0.150 | |
| | 55.357 | 98.187 | 0.006 | 0.278 | |
| | 55.622 | 98.116 | 0.077 | 0.349 | S |
| | 56.400 | 98.110 | 0.083 | 0.354 | F |
| | 57.331 | 98.103 | 0.090 | 0.362 | F |
| | 58.247 | 98.095 | 0.098 | 0.369 | F |
| | 59.462 | 98.024 | 0.169 | 0.440 | F |
| | 61.043 | 97.938 | 0.255 | 0.527 | F |
| | 62.655 | 97.842 | 0.351 | 0.622 | F |
| | 64.061 | 97.820 | 0.373 | 0.644 | M |
| | 65.189 | 97.784 | 0.409 | 0.681 | M |
| | 66.239 | 97.858 | 0.335 | 0.607 | F |
| | 66.658 | 97.811 | 0.382 | 0.654 | F |
| | 68.025 | 97.903 | 0.290 | 0.561 | F |
| | 69.382 | 97.912 | 0.280 | 0.552 | F |
| | 70.742 | 97.875 | 0.318 | 0.590 | F |

Bear River
Reach 2 Channel Survey Data 2007

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| | 71.921 | 97.782 | 0.410 | 0.682 | F |
| | 73.351 | 97.783 | 0.410 | 0.681 | F |
| | 75.526 | 97.791 | 0.402 | 0.674 | F |
| | 76.627 | 97.858 | 0.335 | 0.607 | F |
| | 78.564 | 97.878 | 0.314 | 0.586 | F |
| | 79.939 | 97.807 | 0.386 | 0.658 | F |
| | 81.168 | 97.843 | 0.350 | 0.621 | F |
| | 82.963 | 98.002 | 0.191 | 0.462 | F |
| | 83.676 | 98.097 | 0.096 | 0.367 | F |
| | 83.857 | 98.157 | 0.036 | 0.307 | |
| | 85.150 | 98.191 | 0.002 | 0.274 | |
| | 88.613 | 98.535 | | | |
| | 89.040 | 99.339 | | | LBP |
| | | | | | |
| TC | 0.000 | 98.963 | | | RBP |
| | 0.006 | 98.880 | | | |
| | 1.651 | 98.452 | | | |
| | 4.038 | 98.051 | | 0.093 | |
| | 6.155 | 98.003 | 0.024 | 0.141 | |
| | 6.677 | 97.883 | 0.144 | 0.261 | F |
| | 7.849 | 97.883 | 0.144 | 0.261 | F |
| | 8.654 | 97.798 | 0.229 | 0.346 | F |
| | 9.474 | 97.849 | 0.178 | 0.295 | C |
| | 10.129 | 97.829 | 0.198 | 0.315 | M |
| | 10.937 | 97.783 | 0.244 | 0.361 | C |
| | 12.006 | 97.719 | 0.308 | 0.425 | F |
| | 13.034 | 97.686 | 0.341 | 0.458 | S |
| | 14.128 | 97.662 | 0.365 | 0.482 | F |
| | 15.414 | 97.697 | 0.331 | 0.448 | S |
| | 16.271 | 97.819 | 0.208 | 0.325 | B |
| | 17.532 | 97.784 | 0.243 | 0.360 | G |
| | 18.486 | 97.729 | 0.298 | 0.415 | M |
| | 19.742 | 97.784 | 0.244 | 0.361 | S |
| | 20.719 | 97.797 | 0.230 | 0.347 | S |
| | 22.038 | 97.812 | 0.215 | 0.332 | M |
| | 23.360 | 97.875 | 0.153 | 0.270 | C |
| | 24.574 | 97.779 | 0.248 | 0.365 | G |
| | 25.466 | 97.881 | 0.146 | 0.263 | C |
| | 26.875 | 97.742 | 0.285 | 0.402 | G |
| | 28.128 | 97.814 | 0.213 | 0.330 | M |
| | 29.239 | 97.765 | 0.262 | 0.379 | F |
| | 30.398 | 97.738 | 0.289 | 0.406 | F |
| | 31.761 | 97.707 | 0.320 | 0.437 | M |
| | 33.094 | 97.744 | 0.283 | 0.400 | G |
| | 34.265 | 97.729 | 0.298 | 0.415 | M |
| | 35.715 | 97.701 | 0.326 | 0.443 | M |
| | 37.403 | 97.739 | 0.288 | 0.405 | C |
| | 38.755 | 97.848 | 0.179 | 0.296 | C |
| | 40.129 | 97.757 | 0.270 | 0.387 | S |
| | 41.084 | 97.790 | 0.237 | 0.354 | F |
| | 42.310 | 97.902 | 0.125 | 0.242 | F |
| | 43.798 | 97.866 | 0.161 | 0.278 | F |

Bear River
Reach 2 Channel Survey Data 2007

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| | 44.369 | 98.007 | 0.020 | 0.137 | |
| | 45.888 | 98.084 | | 0.060 | |
| | 54.678 | 98.060 | | 0.085 | |
| | 56.766 | 98.045 | | 0.099 | |
| | 56.910 | 97.939 | 0.088 | 0.205 | F |
| | 57.607 | 97.899 | 0.128 | 0.245 | F |
| | 58.085 | 97.920 | 0.107 | 0.224 | |
| | 58.217 | 98.035 | | 0.109 | |
| | 58.980 | 98.020 | 0.007 | 0.124 | |
| | 60.261 | 98.046 | | 0.099 | |
| | 60.719 | 97.854 | 0.173 | 0.290 | F |
| | 61.073 | 97.913 | 0.114 | 0.231 | F |
| | 61.200 | 98.025 | 0.002 | 0.119 | |
| | 63.901 | 98.068 | | 0.076 | |
| | 71.639 | 98.043 | | 0.101 | |
| | 74.830 | 98.237 | | | |
| | 74.865 | 98.560 | | | LBP |
| | | | | | |
| | 0.000 | 97.192 | | | RBP |
| | 0.034 | 97.039 | | | |
| | 0.775 | 96.945 | 0.013 | 0.149 | |
| | 1.268 | 96.925 | 0.033 | 0.169 | |
| | 1.479 | 96.812 | 0.146 | 0.282 | F |
| | 1.922 | 96.841 | 0.117 | 0.252 | G |
| | 3.121 | 96.744 | 0.214 | 0.349 | C |
| | 4.271 | 96.745 | 0.213 | 0.348 | C |
| | 5.422 | 96.867 | 0.091 | 0.227 | C |
| | 5.544 | 96.923 | 0.035 | 0.170 | |
| | 5.736 | 97.090 | | 0.004 | |
| | 6.081 | 96.980 | | 0.113 | |
| | 6.492 | 96.786 | 0.172 | 0.308 | G |
| | 6.949 | 96.817 | 0.141 | 0.277 | C |
| | 7.740 | 96.786 | 0.172 | 0.308 | S |
| | 8.768 | 96.754 | 0.204 | 0.339 | C |
| | 9.675 | 96.772 | 0.186 | 0.322 | G |
| | 11.123 | 96.692 | 0.265 | 0.401 | C |
| | 12.251 | 96.561 | 0.397 | 0.532 | G |
| | 13.256 | 96.656 | 0.302 | 0.438 | G |
| | 14.434 | 96.719 | 0.239 | 0.375 | F |
| | 16.011 | 96.725 | 0.233 | 0.369 | C |
| | 17.064 | 96.732 | 0.226 | 0.362 | S |
| | 17.853 | 96.733 | 0.225 | 0.361 | BR |
| | 18.405 | 96.766 | 0.191 | 0.327 | S |
| | 19.523 | 96.729 | 0.229 | 0.365 | G |
| | 20.776 | 96.833 | 0.125 | 0.260 | BR |
| | 21.486 | 96.694 | 0.263 | 0.399 | S |
| | 22.609 | 96.754 | 0.204 | 0.340 | G |
| | 23.699 | 96.677 | 0.281 | 0.416 | G |
| | 24.689 | 96.566 | 0.392 | 0.528 | F |
| | 26.416 | 96.869 | 0.089 | 0.224 | BR |
| | 26.634 | 96.576 | 0.382 | 0.517 | F |
| | 27.691 | 96.542 | 0.416 | 0.552 | F |

Bear River
Reach 2 Channel Survey Data 2007

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| | 28.750 | 96.549 | 0.409 | 0.545 | C |
| | 29.821 | 96.584 | 0.374 | 0.509 | F |
| TD | 30.873 | 96.725 | 0.233 | 0.369 | C |
| | 32.077 | 96.744 | 0.213 | 0.349 | G |
| | 33.168 | 96.868 | 0.090 | 0.226 | BR |
| | 34.180 | 96.820 | 0.138 | 0.273 | C |
| | 34.345 | 96.930 | 0.028 | 0.164 | |
| | 36.150 | 97.008 | | | |
| | 36.381 | 97.005 | | | |
| | 36.529 | 96.822 | 0.135 | 0.271 | F |
| | 37.897 | 96.977 | | | BR |
| | 39.209 | 96.860 | 0.098 | 0.233 | F |
| | 39.902 | 96.788 | 0.170 | 0.306 | C |
| | 41.213 | 96.876 | 0.082 | 0.217 | F |
| | 42.663 | 96.888 | 0.070 | 0.206 | G |
| | 43.749 | 96.950 | 0.008 | 0.143 | BR |
| | 45.031 | 96.785 | 0.173 | 0.308 | G |
| | 45.744 | 96.956 | 0.002 | 0.138 | BR |
| | 46.654 | 96.945 | 0.013 | 0.149 | BR |
| | 47.614 | 96.865 | 0.093 | 0.229 | G |
| | 48.671 | 96.826 | 0.132 | 0.268 | F |
| | 49.832 | 96.762 | 0.196 | 0.332 | F |
| | 51.177 | 96.797 | 0.161 | 0.296 | BR |
| | 52.230 | 96.912 | 0.045 | 0.181 | BR |
| | 53.984 | 96.884 | 0.074 | 0.210 | BR |
| | 55.423 | 96.861 | 0.097 | 0.232 | BR |
| | 56.602 | 96.733 | 0.225 | 0.360 | C |
| | 58.076 | 96.798 | 0.160 | 0.296 | C |
| | 59.767 | 96.715 | 0.243 | 0.379 | C |
| | 61.468 | 96.693 | 0.265 | 0.400 | F |
| | 63.273 | 96.820 | 0.137 | 0.273 | F |
| | 65.230 | 96.800 | 0.158 | 0.293 | F |
| | 67.656 | 96.813 | 0.144 | 0.280 | F |
| | 69.827 | 96.849 | 0.109 | 0.245 | F |
| | 72.102 | 96.827 | 0.130 | 0.266 | F |
| | 72.444 | 96.983 | | | |
| | 76.161 | 97.148 | | | |
| | 78.507 | 97.369 | | | |
| | 78.603 | 97.772 | | | LBP |
| | | | | | |
| | 0.000 | 97.716 | | | RBP |
| | 1.546 | 95.507 | | 0.018 | |
| | 9.153 | 95.372 | | 0.153 | |
| | 10.777 | 95.359 | | 0.166 | F |
| | 10.946 | 95.186 | 0.142 | 0.339 | F |
| | 11.746 | 95.206 | 0.122 | 0.319 | C |
| | 12.618 | 95.213 | 0.115 | 0.312 | F |
| | 13.166 | 95.148 | 0.180 | 0.377 | C |
| | 14.380 | 95.126 | 0.202 | 0.399 | S |
| | 15.132 | 95.043 | 0.285 | 0.482 | C |
| | 16.201 | 95.014 | 0.314 | 0.511 | S |
| | 17.544 | 95.026 | 0.302 | 0.499 | C |

Bear River
Reach 2 Channel Survey Data 2007

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| TE | 18.664 | 95.141 | 0.187 | 0.384 | F |
| | 19.574 | 95.057 | 0.271 | 0.468 | F |
| | 20.837 | 95.042 | 0.286 | 0.483 | M |
| | 21.966 | 95.002 | 0.326 | 0.523 | F |
| | 23.071 | 94.950 | 0.378 | 0.575 | BR |
| | 23.995 | 95.192 | 0.136 | 0.333 | S |
| | 24.569 | 94.952 | 0.376 | 0.573 | M |
| | 25.462 | 95.035 | 0.293 | 0.490 | F |
| | 26.597 | 94.902 | 0.426 | 0.623 | F |
| | 27.774 | 94.921 | 0.407 | 0.604 | BR |
| | 29.155 | 95.126 | 0.202 | 0.399 | F |
| | 30.167 | 94.998 | 0.330 | 0.527 | F |
| | 31.167 | 95.066 | 0.262 | 0.459 | F |
| | 32.104 | 95.016 | 0.312 | 0.509 | F |
| | 33.107 | 94.944 | 0.384 | 0.581 | BR |
| | 34.417 | 94.925 | 0.403 | 0.600 | BR |
| | 35.555 | 95.152 | 0.176 | 0.373 | F |
| | 36.159 | 94.980 | 0.348 | 0.545 | F |
| | 37.373 | 94.972 | 0.356 | 0.553 | F |
| | 38.643 | 94.994 | 0.333 | 0.531 | BR |
| | 39.751 | 95.031 | 0.297 | 0.494 | F |
| | 40.794 | 94.992 | 0.336 | 0.533 | F |
| | 41.865 | 95.026 | 0.301 | 0.499 | |
| | 42.672 | 95.296 | 0.031 | 0.228 | |
| | 46.254 | 95.451 | | 0.074 | |
| | 50.493 | 95.543 | | -0.018 | |
| | 50.526 | 95.857 | | | LBP |

Bear River
Reach 3 Channel Survey Data 2005

**Project Name: Bear River, Id**
**Project Code: 283-001**
**Date: 2005_10_15 Time: 8:40 am**
**Reach 3 Transects 1-5**
**Staff: Instrument - Brian Anderson, Rod - Drake**
**Conditions: Sunny, warming to 70's by mid day. Tape was tied at 20 cm, adjusted distance is true distance**

| Station | Back Site | Instr. Height | Fore Site | Elevation (m) | Distance (m) | Adjusted Distance (m) | Comments | Depth (m) | Bankfull Depth (m) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 | | | | | |
| BM | 2.714 | 102.714 | | | | | BM @ top of triangle rock | | |
| Trans 7 | | | 3.038 | 99.676 | 0.200 | 0.000 | RBP, BF | | 0.000 |
| | | | 3.206 | 99.508 | 0.800 | 0.600 | WP | 0.000 | 0.168 |
| | | | 3.620 | 99.094 | 0.900 | 0.700 | CO | 0.414 | 0.582 |
| | | | 6.756 | 95.958 | 2.000 | 1.800 | CO | 3.550 | 3.718 |
| | | | 3.632 | 99.082 | 4.000 | 3.800 | GR | 0.426 | 0.594 |
| | | | 3.571 | 99.143 | 6.000 | 5.800 | GR | 0.365 | 0.533 |
| | | | 3.473 | 99.241 | 8.000 | 7.800 | GR | 0.267 | 0.435 |
| | | | 3.444 | 99.270 | 10.000 | 9.800 | GR | 0.238 | 0.406 |
| TD | | | 3.405 | 99.309 | 12.000 | 11.800 | GR | 0.199 | 0.367 |
| | | | 3.300 | 99.414 | 14.000 | 13.800 | FI | 0.094 | 0.262 |
| | | | 3.217 | 99.497 | 15.100 | 14.900 | WP | 0.011 | 0.179 |
| | | | 3.070 | 99.644 | 17.000 | 16.800 | | | 0.032 |
| | | | 2.903 | 99.811 | 19.000 | 18.800 | | | |
| | | | 2.782 | 99.932 | 21.000 | 20.800 | | | |
| | | | 2.680 | 100.034 | 23.000 | 22.800 | | | |
| | | | 2.540 | 100.174 | 25.000 | 24.800 | BF | | -0.498 |
| Trans 6 | | | 2.535 | 100.179 | 0.200 | 0.000 | RBP, BF | | 0.000 |
| | | | 3.048 | 99.666 | 2.000 | 1.800 | | | 0.513 |
| | | | 3.261 | 99.453 | 2.100 | 1.900 | WP | 0.000 | 0.726 |
| | | | 3.705 | 99.009 | 2.400 | 2.200 | BO | 0.444 | 1.170 |
| | | | 3.832 | 98.882 | 3.000 | 2.800 | BO | 0.571 | 1.297 |
| | | | 3.800 | 98.914 | 5.000 | 4.800 | CO | 0.539 | 1.265 |
| | | | 3.758 | 98.956 | 7.000 | 6.800 | GR | 0.497 | 1.223 |
| | | | 3.694 | 99.020 | 9.000 | 8.800 | GR | 0.433 | 1.159 |
| TE | | | 3.710 | 99.004 | 11.000 | 10.800 | GR | 0.449 | 1.175 |
| | | | 3.782 | 98.932 | 13.000 | 12.800 | GR | 0.521 | 1.247 |
| | | | 3.715 | 98.999 | 15.000 | 14.800 | BO | 0.454 | 1.180 |
| | | | 3.760 | 98.954 | 16.500 | 16.300 | BO | 0.499 | 1.225 |
| | | | 3.245 | 99.469 | 17.100 | 16.900 | WP | | 0.710 |
| | | | 3.005 | 99.709 | 17.300 | 17.100 | LBP | | 0.470 |
| | | | 2.745 | 99.969 | 17.700 | 17.500 | LBF | | 0.210 |
| Trans 8 | | | 2.574 | 100.140 | 0.200 | 0.000 | RBP, BF | | 0.000 |
| | | | 3.118 | 99.596 | 1.200 | 1.000 | WP | 0.000 | 0.544 |
| | | | 3.340 | 99.374 | 1.400 | 1.200 | GR | 0.222 | 0.766 |
| | | | 3.345 | 99.369 | 3.000 | 2.800 | GR | 0.227 | 0.771 |
| | | | 3.295 | 99.419 | 5.000 | 4.800 | CO | 0.177 | 0.721 |
| | | | 3.263 | 99.451 | 7.000 | 6.800 | GR | 0.145 | 0.689 |
| | | | 3.318 | 99.396 | 9.000 | 8.800 | GR | 0.200 | 0.744 |
| TC | | | 3.270 | 99.444 | 11.000 | 10.800 | GR | 0.152 | 0.696 |

Bear River
Reach 3 Channel Survey Data 2005

| Station | Back Site | Instr. Height | Fore Site | Elevation (m) | Distance (m) | Adjusted Distance (m) | Comments | Depth (m) | Bankfull Depth (m) |
|---|---|---|---|---|---|---|---|---|---|
| | | | 3.318 | 99.396 | 13.000 | 12.800 | GR | 0.200 | 0.744 |
| | | | 3.328 | 99.386 | 14.000 | 13.800 | GR | 0.210 | 0.754 |
| | | | 3.133 | 99.581 | 14.100 | 13.900 | WP | 0.015 | 0.559 |
| | | | 2.760 | 99.954 | 14.200 | 14.000 | | | 0.186 |
| | | | 2.898 | 99.816 | 15.500 | 15.300 | | | 0.324 |
| | | | 2.533 | 100.181 | 17.300 | 17.100 | BF | | |
| Trans 9 | | | 1.675 | 101.039 | 0.200 | 0.000 | RBP | | |
| | | | 2.465 | 100.249 | 1.100 | 0.900 | BF | | 0.000 |
| | | | 2.990 | 99.724 | 1.400 | 1.200 | WP | 0.000 | 0.525 |
| | | | 3.160 | 99.554 | 1.500 | 1.300 | CO | 0.170 | 0.695 |
| | | | 3.210 | 99.504 | 3.000 | 2.800 | GR | 0.220 | 0.745 |
| | | | 3.153 | 99.561 | 5.000 | 4.800 | GR | 0.163 | 0.688 |
| | | | 3.250 | 99.464 | 7.000 | 6.800 | GR | 0.260 | 0.785 |
| TB | | | 3.290 | 99.424 | 9.000 | 8.800 | GR | 0.300 | 0.825 |
| | | | 3.270 | 99.444 | 11.000 | 10.800 | GR | 0.280 | 0.805 |
| | | | 3.250 | 99.464 | 13.000 | 12.800 | GR | 0.260 | 0.785 |
| | | | 3.030 | 99.684 | 15.000 | 14.800 | WP | 0.040 | 0.565 |
| | | | 2.734 | 99.980 | 17.000 | 16.800 | | | 0.269 |
| | | | 2.660 | 100.054 | 19.000 | 18.800 | | | 0.195 |
| | | | 2.460 | 100.254 | 21.800 | 21.600 | BF | | |
| | | | 1.945 | 100.769 | 21.900 | 21.700 | LBP | | |
| Trans 10 | | | 2.025 | 100.689 | 0.200 | 0.000 | RBP, BF | | 0.000 |
| | | | 2.546 | 100.168 | 2.000 | 1.800 | | | 0.521 |
| | | | 2.851 | 99.863 | 4.100 | 3.900 | WP | 0.000 | 0.826 |
| | | | 2.980 | 99.734 | 4.200 | 4.000 | GR | 0.129 | 0.955 |
| | | | 3.148 | 99.566 | 6.000 | 5.800 | GR | 0.297 | 1.123 |
| | | | 3.200 | 99.514 | 8.000 | 7.800 | GR | 0.349 | 1.175 |
| | | | 3.133 | 99.581 | 10.000 | 9.800 | GR | 0.282 | 1.108 |
| | | | 3.085 | 99.629 | 12.000 | 11.800 | GR | 0.234 | 1.060 |
| | | | 3.005 | 99.709 | 14.000 | 13.800 | CO | 0.154 | 0.980 |
| TA | | | 2.870 | 99.844 | 15.200 | 15.000 | WP | 0.019 | 0.845 |
| | | | 2.582 | 100.132 | 17.000 | 16.800 | | | 0.557 |
| | | | 2.340 | 100.374 | 19.000 | 18.800 | | | 0.315 |
| | | | 2.468 | 100.246 | 21.000 | 20.800 | | | 0.443 |
| | | | 2.335 | 100.379 | 23.000 | 22.800 | | | 0.310 |
| | | | 2.380 | 100.334 | 25.000 | 24.800 | | | 0.355 |
| | | | 2.434 | 100.280 | 27.000 | 26.800 | | | 0.409 |
| | | | 1.893 | 100.821 | 28.100 | 27.900 | LBP | | |
| | | | 2.162 | 100.552 | 29.000 | 28.800 | BF | | 0.137 |
| TP 1 | | | 3.060 | 99.654 | | | | | |
| | 1.473 | 101.127 | | | | Closure: .007*(total distance/100)1/2 | | | |
| | | | 1.118 | 100.009 | | | 0.009 | | |

Bear River
Reach 3 Channel Survey Data 2006

**Project Name: Bear River, Id**
**Project Code: 283-001**
**Date: 2005_10_10 Time: 15:45 pm**
**Reach 3 Transects TA-TE**
**Staff: Instrument - Brian Anderson, Rod - Drake**
**Conditions: Sunny, warming to 70's by mid day.**

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| TA | 0.00 | 101.270 | | 0.000 | RBP/BF |
| | 0.31 | 100.704 | | 0.566 | |
| | 0.96 | 100.553 | | 0.717 | |
| | 1.98 | 100.353 | | 0.917 | |
| | 2.96 | 100.163 | | 1.108 | |
| | 3.92 | 100.080 | | 1.190 | |
| | 4.71 | 99.903 | 0.000 | 1.367 | WP |
| | 4.90 | 99.803 | 0.100 | 1.467 | GR |
| | 5.93 | 99.666 | 0.237 | 1.604 | GR |
| | 6.94 | 99.589 | 0.313 | 1.681 | GR |
| | 7.91 | 99.493 | 0.410 | 1.778 | GR |
| | 8.95 | 99.495 | 0.408 | 1.776 | GR |
| | 9.95 | 99.495 | 0.408 | 1.776 | GR |
| | 11.00 | 99.600 | 0.303 | 1.670 | GR |
| | 12.00 | 99.698 | 0.205 | 1.573 | CO |
| | 12.94 | 99.699 | 0.204 | 1.571 | GR |
| | 13.98 | 99.701 | 0.202 | 1.570 | GR |
| | 14.95 | 99.703 | 0.200 | 1.568 | CO |
| | 16.17 | 99.907 | | 1.363 | WP |
| | 17.95 | 100.162 | | 1.108 | |
| | 19.91 | 100.240 | | 1.031 | |
| | 21.92 | 100.286 | | 0.984 | |
| | 24.02 | 100.286 | | 0.985 | |
| | 25.92 | 100.384 | | 0.887 | |
| | 27.95 | 100.328 | | 0.942 | |
| | 28.69 | 100.533 | | 0.737 | |
| | 28.80 | 100.552 | | 0.718 | BF |
| | 28.88 | 100.823 | | | LBP |
| | | | | | |
| | 0.00 | 101.072 | | | RBP |
| | 0.90 | 100.249 | | 0.000 | BF |
| | 0.18 | 101.039 | | | |
| | 1.12 | 99.795 | 0.000 | 0.454 | WP |
| | 1.24 | 99.534 | 0.261 | 0.715 | GR |
| | 2.21 | 99.519 | 0.276 | 0.730 | CO |
| | 3.21 | 99.520 | 0.275 | 0.729 | FI |
| | 4.18 | 99.574 | 0.221 | 0.675 | FI |
| | 4.76 | 99.568 | 0.227 | 0.681 | CO |

Bear River
Reach 3 Channel Survey Data 2006

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| TB | 5.56 | 99.534 | 0.261 | 0.715 | CO |
| | 6.61 | 99.465 | 0.329 | 0.784 | GR |
| | 7.60 | 99.407 | 0.387 | 0.842 | GR |
| | 8.60 | 99.363 | 0.432 | 0.886 | GR |
| | 9.57 | 99.390 | 0.404 | 0.859 | CO |
| | 10.61 | 99.389 | 0.406 | 0.860 | CO |
| | 11.58 | 99.422 | 0.373 | 0.827 | GR |
| | 12.57 | 99.420 | 0.374 | 0.829 | GR |
| | 13.59 | 99.508 | 0.287 | 0.741 | GR |
| | 14.60 | 99.540 | 0.255 | 0.709 | SA |
| | 14.86 | 99.591 | 0.204 | 0.658 | SA |
| | 15.09 | 99.748 | 0.047 | 0.501 | WP |
| | 16.89 | 100.032 | | 0.217 | |
| | 20.44 | 100.055 | | 0.194 | |
| | 20.80 | 100.768 | | | |
| | 21.56 | 100.892 | | | LBP |
| | 21.60 | 100.254 | | | BF |
| | | | | | |
| TC | 0.00 | 100.176 | | 0.000 | RBP/BF |
| | 0.65 | 99.837 | | 0.339 | |
| | 0.76 | 99.688 | 0.000 | 0.487 | WP |
| | 1.07 | 99.370 | 0.319 | 0.806 | GR |
| | 1.95 | 99.368 | 0.320 | 0.808 | GR |
| | 2.94 | 99.343 | 0.345 | 0.832 | GR |
| | 3.97 | 99.368 | 0.320 | 0.808 | GR |
| | 4.93 | 99.370 | 0.318 | 0.805 | GR |
| | 5.95 | 99.424 | 0.264 | 0.751 | CO |
| | 6.94 | 99.438 | 0.251 | 0.738 | GR |
| | 7.95 | 99.380 | 0.308 | 0.796 | GR |
| | 8.96 | 99.350 | 0.338 | 0.825 | CO |
| | 9.95 | 99.404 | 0.284 | 0.772 | CO |
| | 10.98 | 99.379 | 0.309 | 0.796 | GR |
| | 11.99 | 99.432 | 0.256 | 0.743 | CO |
| | 12.99 | 99.372 | 0.316 | 0.804 | CO |
| | 13.81 | 99.402 | 0.287 | 0.774 | CO |
| | 14.53 | 100.035 | | 0.141 | BO |
| | 15.45 | 99.473 | 0.216 | 0.703 | FI |
| | 15.73 | 99.660 | 0.028 | 0.515 | WP |
| | 16.59 | 99.842 | | 0.334 | |
| | 17.10 | 100.181 | | | BF |
| | 17.12 | 100.234 | | | |
| | 17.19 | 100.558 | | | LBP |
| | | | | | |
| | 0.00 | 99.698 | | 0.000 | RBP/BF |
| | 0.24 | 99.633 | 0.000 | 0.065 | WP |
| | 0.86 | 99.129 | 0.504 | 0.569 | BO |
| | 1.66 | 99.035 | 0.597 | 0.662 | CO |

oasis ENVIRONMENTAL

Bear River
Reach 3 Channel Survey Data 2006

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Comments |
|---|---|---|---|---|---|
| TD | 2.59 | 98.963 | 0.670 | 0.735 | CO |
| | 3.59 | 98.981 | 0.652 | 0.717 | GR |
| | 4.60 | 99.037 | 0.596 | 0.661 | GR |
| | 5.59 | 99.108 | 0.525 | 0.590 | GR |
| | 6.60 | 99.213 | 0.420 | 0.485 | CO |
| | 7.60 | 99.244 | 0.389 | 0.454 | CO |
| | 8.59 | 99.232 | 0.401 | 0.466 | CO |
| | 9.56 | 99.254 | 0.379 | 0.443 | GR |
| | 10.58 | 99.260 | 0.373 | 0.438 | GR |
| | 11.64 | 99.275 | 0.358 | 0.422 | GR |
| | 12.62 | 99.335 | 0.298 | 0.363 | SA |
| | 13.62 | 99.396 | 0.237 | 0.301 | SA |
| | 14.64 | 99.403 | 0.230 | 0.295 | SA |
| | 15.27 | 99.381 | 0.252 | 0.317 | SA |
| | 15.54 | 99.548 | 0.085 | 0.150 | FI |
| | 16.78 | 99.578 | 0.055 | 0.119 | WP |
| | 18.45 | 99.967 | | | LBP |
| | 24.80 | 100.174 | | | BF |
| | | | | | |
| TE | 0.00 | 100.181 | | 0.000 | RBP/BF |
| | 1.30 | 99.914 | | 0.267 | |
| | 1.58 | 99.616 | 0.000 | 0.564 | WP |
| | 1.58 | 99.463 | 0.153 | 0.718 | FI |
| | 2.44 | 99.086 | 0.530 | 1.095 | BO |
| | 3.52 | 98.832 | 0.784 | 1.349 | FI |
| | 4.56 | 98.842 | 0.775 | 1.339 | SA |
| | 5.54 | 98.911 | 0.705 | 1.270 | SA |
| | 6.54 | 98.929 | 0.688 | 1.252 | SA |
| | 7.51 | 98.966 | 0.651 | 1.215 | GR |
| | 8.50 | 98.978 | 0.638 | 1.203 | GR |
| | 9.55 | 99.007 | 0.610 | 1.174 | GR |
| | 10.53 | 98.995 | 0.621 | 1.186 | SA |
| | 11.55 | 98.986 | 0.630 | 1.195 | SA |
| | 12.56 | 98.867 | 0.749 | 1.314 | SA |
| | 13.56 | 98.928 | 0.688 | 1.252 | SA |
| | 14.61 | 98.884 | 0.732 | 1.297 | SA |
| | 15.56 | 98.873 | 0.743 | 1.308 | GR |
| | 16.66 | 98.881 | 0.736 | 1.300 | SA |
| | 16.81 | 99.618 | | 0.563 | WP |
| | 17.13 | 100.208 | | | |
| | 17.50 | 99.969 | | 0.212 | BF |
| | 18.00 | 100.682 | | | LBP |

**Project Name: Bear River, Id**
**Project Code: 283-001**
**Date: 2007_10_10 Time: 11:30 am**
**Reach 3 Transects TA-TE**
**Staff: Instrument - Brian Anderson , Rod - Drake Buford**
**Conditions: Overcase, warming to 50's by mid day.**

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| | | | | | |
| TA | 0.000 | 101.294 | | 0.000 | |
| | 0.229 | 100.662 | | 0.631 | |
| | 1.455 | 100.388 | | 0.906 | |
| | 3.351 | 100.080 | | 1.213 | |
| | 4.621 | 99.918 | | 1.376 | |
| | 4.739 | 99.703 | 0.162 | 1.591 | S |
| | 5.357 | 99.597 | 0.269 | 1.697 | G |
| | 6.019 | 99.572 | 0.294 | 1.722 | S |
| | 7.033 | 99.530 | 0.335 | 1.764 | S |
| | 8.006 | 99.491 | 0.374 | 1.803 | G |
| | 9.040 | 99.509 | 0.356 | 1.785 | C |
| | 10.037 | 99.459 | 0.406 | 1.835 | C |
| | 11.042 | 99.539 | 0.327 | 1.755 | C |
| | 12.077 | 99.587 | 0.278 | 1.707 | C |
| | 13.105 | 99.607 | 0.258 | 1.687 | S |
| | 14.092 | 99.619 | 0.246 | 1.675 | S |
| | 15.098 | 99.678 | 0.187 | 1.615 | G |
| | 15.720 | 99.711 | 0.155 | 1.583 | S |
| | 15.812 | 99.812 | 0.053 | 1.481 | |
| | 16.557 | 99.909 | | 1.385 | |
| | 18.181 | 100.155 | | 1.138 | |
| | 20.049 | 100.198 | | 1.096 | |
| | 22.632 | 100.271 | | 1.023 | |
| | 25.498 | 100.318 | | 0.975 | |
| | 28.005 | 100.252 | | 1.042 | |
| | 28.692 | 100.373 | | 0.921 | |
| | 28.727 | 100.804 | | 0.490 | |
| | | | | | |
| | 0.000 | 101.032 | | | |
| | 0.020 | 100.994 | | | |
| | 0.664 | 100.378 | | | |
| | 0.963 | 99.768 | | 0.481 | |
| | 1.507 | 99.488 | 0.246 | 0.761 | S |
| | 2.933 | 99.468 | 0.266 | 0.781 | C |
| | 3.866 | 99.440 | 0.293 | 0.809 | G |
| | 4.499 | 99.502 | 0.231 | 0.747 | F |
| | 5.908 | 99.519 | 0.214 | 0.730 | F |
| | 5.978 | 99.517 | 0.217 | 0.732 | S |
| | 7.001 | 99.475 | 0.258 | 0.774 | F |
| | 8.005 | 99.470 | 0.263 | 0.779 | S |
| | 9.045 | 99.371 | 0.363 | 0.878 | C |

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| TB | 10.035 | 99.352 | 0.382 | 0.897 | C |
| | 11.052 | 99.361 | 0.373 | 0.888 | C |
| | 12.081 | 99.417 | 0.317 | 0.832 | C |
| | 13.063 | 99.413 | 0.320 | 0.836 | G |
| | 14.055 | 99.431 | 0.303 | 0.818 | G |
| | 15.033 | 99.490 | 0.243 | 0.759 | F |
| | 16.011 | 99.571 | 0.162 | 0.678 | B |
| | 16.163 | 99.699 | 0.034 | 0.550 | |
| | 17.262 | 99.767 | | 0.482 | |
| | 19.571 | 100.000 | | 0.249 | |
| | 20.958 | 99.985 | | 0.264 | |
| | 21.672 | 100.217 | | 0.032 | |
| | 22.849 | 101.704 | | | |
| | 22.999 | 100.764 | | | |
| | 23.064 | 100.859 | | | |
| | | | | | |
| TC | 0.000 | 100.124 | | 0.000 | |
| | 0.049 | 100.063 | | 0.061 | |
| | 0.510 | 99.811 | | 0.313 | |
| | 0.885 | 99.583 | 0.142 | 0.541 | |
| | 0.979 | 99.519 | 0.207 | 0.605 | B |
| | 1.246 | 99.335 | 0.391 | 0.789 | S |
| | 1.829 | 99.338 | 0.388 | 0.787 | G |
| | 3.602 | 99.254 | 0.471 | 0.870 | G |
| | 3.804 | 99.310 | 0.416 | 0.814 | C |
| | 4.798 | 99.311 | 0.415 | 0.814 | S |
| | 5.824 | 99.365 | 0.361 | 0.759 | G |
| | 6.854 | 99.374 | 0.352 | 0.750 | C |
| | 7.859 | 99.352 | 0.374 | 0.772 | C |
| | 8.840 | 99.328 | 0.398 | 0.796 | C |
| | 9.832 | 99.311 | 0.415 | 0.813 | G |
| | 10.910 | 99.340 | 0.385 | 0.784 | G |
| | 11.850 | 99.326 | 0.400 | 0.798 | G |
| | 12.859 | 99.379 | 0.347 | 0.746 | B |
| | 13.821 | 99.380 | 0.345 | 0.744 | B |
| | 14.349 | 99.836 | | 0.288 | B |
| | 15.201 | 99.394 | 0.332 | 0.730 | S |
| | 15.821 | 99.427 | 0.299 | 0.697 | F |
| | 15.968 | 99.640 | 0.086 | 0.484 | |
| | 16.372 | 99.795 | | 0.329 | |
| | 17.270 | 100.158 | | | |
| | 17.319 | 100.552 | | | |
| | | | | | |
| | 0.000 | 99.657 | | 0.000 | |
| | 0.184 | 99.573 | | 0.085 | |
| | 0.240 | 99.388 | 0.163 | 0.269 | S |
| | 0.613 | 99.203 | 0.348 | 0.454 | B |
| | 0.990 | 99.019 | 0.531 | 0.638 | B |
| | 1.738 | 98.903 | 0.647 | 0.754 | B |
| | 2.234 | 98.951 | 0.600 | 0.706 | C |

Bear River
Reach 3 Channel Survey Data 2007

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| TD | 3.225 | 98.936 | 0.615 | 0.721 | G |
| | 4.205 | 98.993 | 0.558 | 0.664 | S |
| | 5.222 | 98.968 | 0.583 | 0.689 | G |
| | 6.294 | 99.109 | 0.442 | 0.548 | G |
| | 7.220 | 99.168 | 0.383 | 0.489 | G |
| | 8.187 | 99.153 | 0.398 | 0.504 | G |
| | 9.204 | 99.225 | 0.326 | 0.433 | C |
| | 10.248 | 99.195 | 0.356 | 0.462 | G |
| | 11.265 | 99.267 | 0.284 | 0.390 | C |
| | 12.273 | 99.251 | 0.300 | 0.406 | G |
| | 13.323 | 99.266 | 0.285 | 0.392 | G |
| | 14.229 | 99.356 | 0.195 | 0.301 | C |
| | 14.861 | 99.362 | 0.189 | 0.295 | S |
| | 15.150 | 99.472 | 0.079 | 0.185 | F |
| | 15.899 | 99.529 | 0.022 | 0.128 | |
| | 17.413 | 99.636 | | 0.021 | |
| | 18.817 | 99.659 | | | |
| | 20.297 | 99.792 | | | |
| | 22.283 | 99.935 | | | |
| | 24.320 | 100.082 | | | |
| | 26.334 | 100.354 | | | |
| | 28.200 | 101.082 | | | |
| | 29.486 | 102.031 | | | |
| | | | | | |
| TE | 0.000 | 100.179 | | 0.000 | |
| | 0.034 | 100.023 | | 0.157 | |
| | 0.958 | 99.847 | | 0.332 | |
| | 1.585 | 99.578 | 0.263 | 0.601 | |
| | 1.697 | 99.457 | 0.384 | 0.722 | F |
| | 2.096 | 99.300 | 0.541 | 0.880 | BO |
| | 2.332 | 98.922 | 0.920 | 1.258 | F |
| | 3.023 | 98.882 | 0.960 | 1.298 | F |
| | 3.987 | 98.797 | 1.044 | 1.382 | S |
| | 4.973 | 98.829 | 1.012 | 1.350 | S |
| | 5.987 | 98.877 | 0.964 | 1.302 | S |
| | 6.971 | 98.917 | 0.924 | 1.262 | G |
| | 7.987 | 98.935 | 0.906 | 1.244 | G |
| | 8.959 | 98.973 | 0.869 | 1.207 | G |
| | 9.979 | 98.948 | 0.893 | 1.231 | G |
| | 11.022 | 98.922 | 0.919 | 1.257 | G |
| | 11.965 | 98.903 | 0.938 | 1.276 | S |
| | 12.968 | 98.888 | 0.953 | 1.291 | S |
| | 13.985 | 98.814 | 1.027 | 1.365 | S |
| | 15.029 | 98.838 | 1.003 | 1.341 | S |
| | 16.041 | 98.850 | 0.991 | 1.329 | S |
| | 16.666 | 98.815 | 1.027 | 1.365 | S |
| | 16.799 | 99.588 | 0.254 | 0.592 | |
| | 17.121 | 100.176 | | 0.004 | |
| | 17.965 | 100.383 | | | |

| Transect | STN (m) | Elevation adjusted for BM 100 (m) | WP Depth (m) | BF Depth (m) | Substrate |
|---|---|---|---|---|---|
| | 18.079 | 100.628 | | | |

# APPENDIX B

## PERIPHYTON DATA

Bear River, Idaho
Periphyton AFDW
2005-2007

| Sample ID No. | Reach | Transect | 2005 AFDW (g/m2) | 2006 AFDW (g/m2) | 2007 AFDW (g/m2) |
|---|---|---|---|---|---|
| BEAR-R1TA-AFDW | Reach 1 | TA | 25.00 | 68.75 | 58.75 |
| BEAR-R1TB-AFDW | Reach 1 | TB | 35.00 | 51.88 | 52.50 |
| BEAR-R1TC-AFDW | Reach 1 | TC | 17.50 | 123.13 | 725.00 |
| BEAR-R1TD-AFDW | Reach 1 | TD | 21.25 | 257.50 | 145.63 |
| BEAR-R1TE-AFDW | Reach 1 | TE | 6.88 | 85.00 | 62.50 |
| BEAR-R2TA-AFDW | Reach 2 | TA | 40.00 | 88.75 | 220.63 |
| BEAR-R2TB-AFDW | Reach 2 | TB | 35.00 | 65.63 | 144.38 |
| BEAR-R2TC-AFDW | Reach 2 | TC | 10.00 | 21.88 | 83.13 |
| BEAR-R2TD-AFDW | Reach 2 | TD | 153.13 | 31.25 | 47.50 |
| BEAR-R2TE-AFDW | Reach 2 | TE | 8.75 | 50.00 | 56.25 |
| BEAR-R3TA-AFDW | Reach 3 | TA | 51.88 | 72.50 | 13.13 |
| BEAR-R3TB-AFDW | Reach 3 | TB | 34.38 | 150.00 | 111.25 |
| BEAR-R3TC-AFDW | Reach 3 | TC | 48.13 | 111.88 | 33.75 |
| BEAR-R3TD-AFDW | Reach 3 | TD | 29.38 | 103.75 | 31.25 |
| BEAR-R3TE-AFDW | Reach 3 | TE | 44.38 | 48.13 | 43.75 |
| BEAR-R4TA-AFDW | Reach 4 | TA | 28.75 | 58.75 | 46.25 |
| BEAR-R4TB-AFDW | Reach 4 | TB | 22.50 | 83.75 | 17.50 |
| BEAR-R4TC-AFDW | Reach 4 | TC | 66.25 | 54.38 | 29.38 |
| BEAR-R4TD-AFDW | Reach 4 | TD | 248.13 | 5.00 | 80.00 |
| BEAR-R4TE-AFDW | Reach 4 | TE | 4.38 | 71.25 | 25.63 |

Bear River, Idaho
Periphyton Chlorophyll a
2005-2007

| Study Reach | Transect | Analyte | 2005 Chl (mg/m$^2$) | 2006 Chl (mg/m2) | 2007 Chl (mg/m$^2$) |
|---|---|---|---|---|---|
| Reach 1 | TA | Chla | 84.38 | 110.63 | 38.56 |
| Reach 1 | TB | Chla | 61.38 | 44.94 | 45.06 |
| Reach 1 | TC | Chla | 16.56 | 127.50 | 80.00 |
| Reach 1 | TD | Chla | 29.56 | 318.13 | 78.13 |
| Reach 1 | TE | Chla | 21.81 | 147.50 | 51.06 |
| Reach 2 | TA | Chla | 119.38 | 423.13 | 234.38 |
| Reach 2 | TB | Chla | 105.63 | 123.75 | 151.25 |
| Reach 2 | TC | Chla | 104.38 | 117.50 | 70.00 |
| Reach 2 | TD | Chla | 457.50 | 63.75 | 243.13 |
| Reach 2 | TE | Chla | 25.63 | 97.50 | 64.38 |
| Reach 3 | TA | Chla | 285.00 | 175.00 | 49.06 |
| Reach 3 | TB | Chla | 245.00 | 225.63 | 205.63 |
| Reach 3 | TC | Chla | 181.25 | 318.13 | 181.88 |
| Reach 3 | TD | Chla | 155.00 | 138.75 | 86.88 |
| Reach 3 | TE | Chla | 170.63 | 172.50 | 105.63 |
| Reach 4 | TA | Chla | 226.88 | 207.50 | 356.25 |
| Reach 4 | TB | Chla | 163.75 | 253.75 | 80.00 |
| Reach 4 | TC | Chla | 693.75 | 181.25 | 171.25 |
| Reach 4 | TD | Chla | 282.50 | 52.81 | 279.38 |
| Reach 4 | TE | Chla | 19.44 | 339.38 | 237.50 |

Bear River, Idaho
Periphyton Chlorophyll b
2005-2007

| Study Reach | Transect | Analyte | 2005 Chl (mg/m$^2$) | 2006 Chl (mg/m2) | 2007 Chl (mg/m$^2$) |
|---|---|---|---|---|---|
| Reach 1 | TA | Chlb | 11.50 | 10.19 | 3.38 |
| Reach 1 | TB | Chlb | 7.88 | 3.63 | 0.81 |
| Reach 1 | TC | Chlb | 2.88 | 14.94 | 4.06 |
| Reach 1 | TD | Chlb | 4.56 | 22.50 | 6.81 |
| Reach 1 | TE | Chlb | 3.38 | 15.63 | 4.31 |
| Reach 2 | TA | Chlb | 23.69 | 17.00 | 10.81 |
| Reach 2 | TB | Chlb | 27.69 | 25.38 | 12.69 |
| Reach 2 | TC | Chlb | 35.88 | 2.69 | 0.06 |
| Reach 2 | TD | Chlb | 72.50 | 3.25 | 0.06 |
| Reach 2 | TE | Chlb | 4.19 | 13.06 | 6.63 |
| Reach 3 | TA | Chlb | 20.13 | 7.44 | 0.75 |
| Reach 3 | TB | Chlb | 18.38 | 21.44 | 0.06 |
| Reach 3 | TC | Chlb | 13.31 | 26.06 | 0.06 |
| Reach 3 | TD | Chlb | 15.69 | 2.63 | 0.06 |
| Reach 3 | TE | Chlb | 16.25 | 2.56 | 0.06 |
| Reach 4 | TA | Chlb | 21.06 | 12.38 | 17.00 |
| Reach 4 | TB | Chlb | 34.44 | 25.00 | 0.94 |
| Reach 4 | TC | Chlb | 55.88 | 16.44 | 0.06 |
| Reach 4 | TD | Chlb | 29.06 | 5.44 | 27.63 |
| Reach 4 | TE | Chlb | 3.19 | 1.25 | 0.06 |

Bear River, Idaho
Periphyton Chlorophyll c
2005-2007

| Study Reach | Transect | Analyte | 2005 Chl (mg/m$^2$) | 2006 Chl (mg/m2) | 2007 Chl (mg/m$^2$) |
|---|---|---|---|---|---|
| Reach 1 | TA | Chlc | 4.06 | 2.50 | 3.81 |
| Reach 1 | TB | Chlc | 2.13 | 2.19 | 4.44 |
| Reach 1 | TC | Chlc | 1.88 | 3.44 | 6.00 |
| Reach 1 | TD | Chlc | 1.19 | 11.81 | 8.31 |
| Reach 1 | TE | Chlc | 1.44 | 3.25 | 4.31 |
| Reach 2 | TA | Chlc | 7.19 | 16.75 | 18.75 |
| Reach 2 | TB | Chlc | 20.63 | 6.31 | 13.50 |
| Reach 2 | TC | Chlc | 21.81 | 1.94 | 6.31 |
| Reach 2 | TD | Chlc | 38.31 | 0.38 | 20.44 |
| Reach 2 | TE | Chlc | 2.31 | 2.25 | 3.00 |
| Reach 3 | TA | Chlc | 23.38 | 3.63 | 0.69 |
| Reach 3 | TB | Chlc | 26.19 | 8.69 | 15.31 |
| Reach 3 | TC | Chlc | 14.94 | 19.75 | 13.31 |
| Reach 3 | TD | Chlc | 11.63 | 4.38 | 8.63 |
| Reach 3 | TE | Chlc | 20.69 | 5.75 | 7.63 |
| Reach 4 | TA | Chlc | 13.31 | 5.44 | 39.38 |
| Reach 4 | TB | Chlc | 29.88 | 7.50 | 6.44 |
| Reach 4 | TC | Chlc | 37.63 | 5.50 | 10.81 |
| Reach 4 | TD | Chlc | 18.94 | 1.63 | 4.31 |
| Reach 4 | TE | Chlc | 2.63 | 11.63 | 13.13 |

# APPENDIX C

## FILAMENTOUS ALGAE DATA

Filamentous Algae:  Bear River, October 2005

| Transect | Reach 1 | | | | | Reach 2 | | | | | Reach 3 | | | | | Reach 4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** |
| TA | 12 | 6 | 1 | 1 | 20 | 5 | 1 | 1 | 25 | 32 | 20 | 18 | 18 | 18 | 74 | 25 | 25 | 25 | 25 | 100 |
| TB | 25 | 25 | 21 | 25 | 96 | 10 | 8 | 5 | 2 | 25 | 4 | 6 | 2 | 3 | 15 | 25 | 25 | 25 | 25 | 100 |
| TC | 25 | 25 | 25 | 25 | 100 | 1 | 1 | 1 | 25 | 28 | 14 | 1 | 0 | 4 | 19 | 15 | 6 | 23 | 12 | 56 |
| TD | 25 | 25 | 25 | 25 | 100 | 1 | 5 | 2 | 1 | 9 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 22 | 25 | 97 |
| TE | 20 | 25 | 25 | 21 | 91 | 5 | 25 | 10 | 15 | 55 | 0 | 0 | 0 | 0 | 0 | 25 | 18 | 11 | 15 | 69 |
| | | | | **Average** | 81 | | | | **Average** | 30 | | | | **Average** | 22 | | | | **Average** | 84 |
| | | | | **Stdev** | 35 | | | | **Stdev** | 17 | | | | **Stdev** | 31 | | | | **Stdev** | 21 |
| | | | | **CI** | 25 | | | | **Average** | 12 | | | | **Average** | 22 | | | | **Average** | 15 |

Filamentous Algae:  Bear River, October 2006

| Transect | Reach 1 | | | | | Reach 2 | | | | | Reach 3 | | | | | Reach 4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** |
| TA | 20 | 25 | 25 | 25 | 95 | 25 | 25 | 25 | 25 | 100 | 2 | 2 | 2 | 2 | 8 | 23 | 25 | 25 | 25 | 98 |
| TB | 6 | 6 | 6 | 6 | 24 | 25 | 25 | 23 | 23 | 96 | 0 | 2 | 0 | 0 | 2 | 25 | 25 | 25 | 25 | 100 |
| TC | 15 | 22 | 15 | 15 | 67 | 18 | 23 | 9 | 25 | 75 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 | 25 | 100 |
| TD | 25 | 25 | 22 | 22 | 94 | 13 | 3 | 20 | 20 | 56 | 0 | 0 | 0 | 0 | 0 | 15 | 15 | 25 | 22 | 77 |
| TE | 25 | 25 | 20 | 25 | 95 | 0 | 9 | 3 | 6 | 18 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 | 25 | 100 |
| | | | | **Average** | 75 | | | | **Average** | 69 | | | | **Average** | 2 | | | | **Average** | 95 |
| | | | | **Stdev** | 31 | | | | **Stdev** | 34 | | | | **Stdev** | 3 | | | | **Stdev** | 10 |
| | | | | **CI** | 23 | | | | **Average** | 25 | | | | **Average** | 3 | | | | **Average** | 7 |

Filamentous Algae:  Bear River, October 2007

| Transect | Reach 1 | | | | | Reach 2 | | | | | Reach 3 | | | | | Reach 4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** | **Q1** | **Q2** | **Q3** | **Q4** | **Total** |
| TA | 2 | 2 | 2 | 0 | 6 | 22 | 25 | 25 | 22 | 94 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 | 25 | 100 |
| TB | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 | 20 | 95 | 0 | 0 | 0 | 2 | 2 | 25 | 25 | 25 | 25 | 100 |
| TC | 8 | 10 | 4 | 10 | 32 | 23 | 23 | 24 | 16 | 86 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 | 25 | 100 |
| TD | 5 | 3 | 12 | 8 | 28 | 24 | 20 | 18 | 18 | 80 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 | 25 | 100 |
| TE | 5 | 5 | 0 | 5 | 15 | 16 | 16 | 16 | 18 | 66 | 0 | 0 | 0 | 0 | 0 | 23 | 25 | 25 | 25 | 98 |
| | | | | **Average** | 16 | | | | **Average** | 84 | | | | **Average** | 0 | | | | **Average** | 100 |
| | | | | **Stdev** | 14 | | | | **Stdev** | 12 | | | | **Stdev** | 1 | | | | **Stdev** | 1 |
| | | | | **CI** | 10 | | | | **Average** | 9 | | | | **Average** | 1 | | | | **Average** | 1 |

# APPENDIX D

## FISHERIES DATA

Fish Survey Data
Reach 1,
Sample Years 2005-2007

| | Reach 1 2005 | Reach 1 2006 | Reach 1 2007 |
|---|---|---|---|
| **Date:** | 10/13/2005 | 10/10/2006 | 10/9/2007 |
| **Field Staff** | Drake Burford | Drake Burford | Drake Burford |
| | John Gangemi | Brian Anderson | Sean Newman |
| | Brian Anderson | Matt Umberger | Brian Anderson |
| **H2O Temp:** | 7 ºC | 6.9 ºC | 6.9 ºC |
| **Air Temp:** | 12.5 ºC | 3.5 ºC | 7.3 ºC |
| **Start Time:** | 11:30:00 AM | 1/0/1900 | 1/0/1900 |
| **End Time:** | 2:30:00 PM | 1/0/1900 | 1/0/1900 |
| **Electrofisher Unit:** | Smith Root 12-B | Smith Root 12-B | Halltech HT-2000 |
| **E-Fishing Method:** | 2 consecutive upstream passess | 2 consecutive upstream passess | 2 consecutive upstream passess |
| **Settings:** | G4 @ 400 | G4 @ 400 | 80/250 |
| **Effort (time in seconds):** | 9/28/1902 | 10/13/1902 | 11/30/1902 |

| Reach 1 2005 | | | Reach 1 2006 | | | Reach 1 2007 | | |
|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) |
| Carp | 516 | 2550 | Carp | 95 | 18 | Carp | 92 | 14 |
| Carp | 609 | 4104 | Carp | 104 | 20 | Carp | 55 | 4 |
| LN DC | 65 | 8 | Carp | 84 | 10 | Carp | 66 | 10 |
| LN DC | 46 | 4 | LN DC | 88 | 14 | LN DC | 53 | 6 |
| LN DC | 41 | 6 | LN DC | 96 | 12 | LN DC | 46 | 6 |
| LN DC | 40 | 4 | LN DC | 101 | 8 | LN DC | 48 | 6 |
| LN DC | 43 | 4 | LN DC | 79 | 6 | LN DC | 50 | 6 |
| LN DC | 49 | 6 | LN DC | 65 | 2 | LN DC | 45 | 4 |
| LN DC | 45 | 6 | LN DC | 72 | 6 | LN DC | 43 | 4 |
| LN DC | 63 | 10 | LN DC | 79 | 8 | LN DC | 89 | 8 |
| LN DC | 54 | 8 | LN DC | 77 | 6 | LN DC | 69 | 8 |
| LN DC | 48 | 6 | LN DC | 66 | 4 | LN DC | 53 | 4 |
| LN DC | 64 | 6 | LN DC | 67 | 4 | LN DC | 47 | 4 |
| LN DC | 46 | 6 | LN DC | 46 | 2 | LN DC | 43 | 4 |
| LN DC | 54 | 8 | LN DC | 50 | 2 | LN DC | 48 | 4 |
| LN DC | 57 | 10 | LN DC | 54 | 2 | LN DC | 46 | 4 |
| LN DC | 75 | 12 | LN DC | 48 | 2 | LN DC | 41 | 4 |

Fish Survey Data
Reach 1,
Sample Years 2005-2007

| Reach 1 2005 | | | Reach 1 2006 | | | Reach 1 2007 | | |
|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) |
| LN DC | 53 | 8 | MOT SC | 97 | 16 | LN DC | 77 | 8 |
| LN DC | 44 | 6 | MOT SC | 83 | 12 | LN DC | 47 | 4 |
| LN DC | 44 | 8 | MOT SC | 62 | 4 | LN DC | 45 | 4 |
| LN DC | 75 | 10 | MOT SC | 61 | 4 | LN DC | 53 | 4 |
| LN DC | 76 | 12 | MOT SC | 81 | 10 | LN DC | 45 | 4 |
| LN DC | 59 | 6 | MOT SC | 64 | 4 | LN DC | 47 | 4 |
| LN DC | 71 | 6 | MOT SC | 53 | 4 | LN DC | 72 | 6 |
| LN DC | 76 | 6 | MOT SC | 59 | 6 | LN DC | 54 | 4 |
| LN DC | 48 | 4 | MOT SC | 78 | 6 | LN DC | 87 | 10 |
| LN DC | 66 | 6 | MOT SC | 57 | 2 | LN DC | 68 | 6 |
| LN DC | 52 | 4 | MOT SC | 93 | 12 | LN DC | 51 | 4 |
| LN DC | 71 | 6 | MOT SC | 93 | 14 | LN DC | 47 | 4 |
| LN DC | 67 | 6 | SMB | 67 | 8 | LN DC | 48 | 4 |
| LN DC | 80 | 10 | SMB | 72 | 8 | LN DC | 56 | 6 |
| LN DC | 69 | 8 | SMB | 62 | 4 | LN DC | 54 | 4 |
| LN DC | 57 | 8 | SMB | 64 | 4 | LN DC | 49 | 4 |
| LN DC | 43 | 4 | SMB | 51 | 2 | LN DC | 86 | 10 |
| LN DC | 84 | 12 | SMB | 54 | 2 | LN DC | 77 | 6 |
| LN DC | 67 | 6 | SMB | 64 | 6 | LN DC | 94 | 8 |
| LN DC | 47 | 4 | SMB | 65 | 2 | LN DC | 72 | 6 |
| LN DC | 63 | 6 | SMB | 54 | 4 | LN DC | 45 | 4 |
| LN DC | 68 | 6 | UT SU | 99 | 10 | MOT SC | 100 | 12 |
| LN DC | 102 | 14 | | | | MOT SC | 92 | 10 |
| LN DC | 77 | 8 | | | | MOT SC | 104 | 14 |
| LN DC | 83 | 10 | | | | MOT SC | 80 | 8 |
| LN DC | 44 | 6 | | | | MOT SC | 64 | 6 |
| LN DC | 51 | 4 | | | | MOT SC | 84 | 8 |
| LN DC | 49 | 4 | | | | MOT SC | 79 | 8 |
| LN DC | 51 | 4 | | | | MOT SC | 79 | 4 |
| LN DC | 90 | 8 | | | | MOT SC | 84 | 10 |
| LN DC | 47 | 4 | | | | MOT SC | 109 | 20 |
| LN DC | 46 | 4 | | | | MOT SC | 105 | 10 |
| LN DC | 55 | 4 | | | | MOT SC | 85 | 8 |
| LN DC | 46 | 4 | | | | MOT SC | 61 | 6 |

Fish Survey Data
Reach 1,
Sample Years 2005-2007

| Reach 1 2005 | | | Reach 1 2006 | | | Reach 1 2007 | | |
|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) |
| LN DC | 90 | 8 | | | | MOT SC | 44 | 4 |
| LN DC | 67 | 4 | | | | MOT SC | 56 | 4 |
| LN DC | 56 | 4 | | | | MOT SC | 81 | 8 |
| LN DC | 67 | 6 | | | | MOT SC | 62 | 6 |
| LN DC | 67 | 6 | | | | MOT SC | 88 | 12 |
| LN DC | 43 | 4 | | | | MOT SC | 80 | 6 |
| MOT SC | 89 | 16 | | | | MOT SC | 84 | 8 |
| MOT SC | 94 | 14 | | | | RD SH | 46 | 4 |
| MOT SC | 92 | 14 | | | | | | |
| MOT SC | 98 | 14 | | | | | | |
| MOT SC | 66 | 6 | | | | | | |
| MOT SC | 63 | 8 | | | | | | |
| MOT SC | 98 | 16 | | | | | | |
| MOT SC | 62 | 6 | | | | | | |
| MOT SC | 57 | 4 | | | | | | |
| MOT SC | 97 | 12 | | | | | | |
| MOT SC | 90 | 8 | | | | | | |
| MOT SC | 101 | 16 | | | | | | |
| MOT SC | 102 | 16 | | | | | | |
| MOT SC | 88 | 12 | | | | | | |
| MOT SC | 75 | 6 | | | | | | |
| MOT SC | 110 | 20 | | | | | | |
| MOT SC | 92 | 10 | | | | | | |
| MOT SC | 66 | 4 | | | | | | |
| MOT SC | 65 | 6 | | | | | | |
| MOT SC | 65 | 6 | | | | | | |
| MOT SC | 69 | 6 | | | | | | |
| MOT SC | 84 | 8 | | | | | | |
| MOT SC | 67 | 6 | | | | | | |
| MOT SC | 90 | 12 | | | | | | |
| MOT SC | 61 | 6 | | | | | | |
| MOT SC | 74 | 8 | | | | | | |
| SMB | 116 | 30 | | | | | | |

Fish Survey Data
Reach 1,
Sample Years 2005-2007

| Reach 1 2005 | | | Reach 1 2006 | | | Reach 1 2007 | | |
|---|---|---|---|---|---|---|---|---|
| **Species** | **Length (mm)** | **Weight (g)** | **Species** | **Length (mm)** | **Weight (g)** | **Species** | **Length (mm)** | **Weight (g)** |

| **Fish Species Abbreviations** | |
|---|---|
| Carp: | Common Carp |
| LN DC: | Longnose Dace |
| MOT SC: | Mottled Sculpin |
| SMB: | Smallmouth Bass |
| RD SH: | Redside Shiner |
| RBT: | Rainbow Trout |
| UT SU: | Utah Sucker |

Fish Survey Data
Reach 2,
Sample Years 2005-2007

| | Reach 2 2005 | Reach 2 2006 | Reach 2 2007 |
|---|---|---|---|
| **Date:** | 10/13/2005 | 10/11/2006 | 10/9/2007 |
| **Field Staff** | Drake Burford | Drake Burford | Drake Burford |
| | John Gangemi | Brian Anderson | Sean Newman |
| | Brian Anderson | Matt Umberger | Brian Anderson |
| **H2O Temp:** | n/a | 10.6 ºC | 11.7 ºC |
| **Air Temp:** | n/a | 3.8 ºC | 18.2 ºC |
| **Start Time:** | 3:00:00 PM | 8:45:00 AM | 11:30:00 AM |
| **End Time:** | 5:20:00 PM | 10:00:00 AM | 1:30:00 PM |
| **Electrofisher Unit:** | Smith Root 12-B | Smith Root 12-B | Halltech HT-2000 |
| **E-Fishing Method:** | 2 consecutive upstream passes | 2 consecutive upstream passes | 2 consecutive upstream passes |
| **Settings:** | G4 @ 400 | G4 @ 400 | 80/250 |
| **Effort (time in seconds):** | 1305 | 1358 | 1240 |

| Reach 2 2005 | | | Reach 2 2006 | | | Reach 2 2007 | | |
|---|---|---|---|---|---|---|---|---|
| **Species** | **Length (mm)** | **Weight (g)** | **Species** | **Length (mm)** | **Weight (g)** | **Species** | **Length (mm)** | **Weight (g)** |
| LN DC | 84 | 6 | LN DC | 91 | 12 | LN DC | 90 | 10 |
| LN DC | 70 | 8 | LN DC | 90 | 10 | LN DC | 96 | 12 |
| LN DC | 71 | 10 | LN DC | 94 | 10 | LN DC | 85 | 12 |
| LN DC | 78 | 8 | LN DC | 88 | 8 | LN DC | 96 | 16 |
| LN DC | 72 | 10 | LN DC | 82 | 6 | LN DC | 106 | 16 |
| LN DC | 60 | 8 | LN DC | 91 | 12 | LN DC | 105 | 18 |
| LN DC | 65 | 8 | LN DC | 85 | 6 | LN DC | 97 | 14 |
| LN DC | 70 | 8 | LN DC | 87 | 10 | LN DC | 58 | 6 |
| LN DC | 65 | 8 | LN DC | 92 | 8 | LN DC | 59 | 6 |
| LN DC | 67 | 8 | LN DC | 93 | 6 | LN DC | 77 | 6 |
| LN DC | 58 | 8 | LN DC | 88 | 8 | LN DC | 95 | 12 |
| LN DC | 66 | 8 | LN DC | 73 | 6 | LN DC | 94 | 14 |
| LN DC | 58 | 4 | LN DC | 69 | 4 | LN DC | 62 | 4 |
| LN DC | 80 | 8 | LN DC | 79 | 10 | LN DC | 58 | 4 |
| LN DC | 49 | 1 | LN DC | 93 | 10 | LN DC | 100 | 16 |
| LN DC | 73 | 8 | LN DC | 63 | 6 | LN DC | 99 | 18 |
| LN DC | 58 | 6 | LN DC | 80 | 10 | LN DC | 93 | 10 |

Fish Survey Data
Reach 2,
Sample Years 2005-2007

| Reach 2 2005 | | | Reach 2 2006 | | | Reach 2 2007 | | |
|---|---|---|---|---|---|---|---|---|
| **Species** | **Length (mm)** | **Weight (g)** | **Species** | **Length (mm)** | **Weight (g)** | **Species** | **Length (mm)** | **Weight (g)** |
| LN DC | 85 | 14 | LN DC | 65 | 2 | LN DC | 92 | 12 |
| LN DC | 67 | 6 | LN DC | 71 | 4 | LN DC | 60 | 6 |
| LN DC | 83 | 14 | LN DC | 81 | 6 | LN DC | 97 | 12 |
| LN DC | 73 | 8 | LN DC | 81 | 4 | LN DC | 55 | 4 |
| LN DC | 82 | 12 | LN DC | 97 | 10 | LN DC | 100 | 14 |
| LN DC | 50 | 4 | LN DC | 100 | 12 | LN DC | 53 | 4 |
| LN DC | 66 | 8 | LN DC | 78 | 4 | LN DC | 101 | 16 |
| LN DC | 54 | 4 | LN DC | 75 | 4 | LN DC | 88 | 12 |
| LN DC | 75 | 8 | LN DC | 59 | 4 | LN DC | 85 | 8 |
| LN DC | 86 | 14 | LN DC | 55 | 4 | LN DC | 64 | 6 |
| LN DC | 83 | 12 | LN DC | 80 | 6 | LN DC | 102 | 12 |
| LN DC | 55 | 4 | LN DC | 57 | 4 | LN DC | 86 | 8 |
| LN DC | 66 | 8 | RD SH | 93 | 14 | LN DC | 100 | 12 |
| LN DC | 63 | 6 | RD SH | 84 | 6 | LN DC | 66 | 8 |
| LN DC | 59 | 6 | SMB | 72 | 8 | LN DC | 83 | 10 |
| LN DC | 53 | 4 | UT SU | 101 | 12 | RD SH | 84 | 10 |
| SMB | 66 | 8 | | | | RD SH | 57 | 4 |
| | | | | | | RD SH | 60 | 4 |
| | | | | | | RD SH | 63 | 6 |
| | | | | | | RD SH | 57 | 6 |
| | | | | | | SMB | 64 | 8 |
| | | | | | | UT SU | 224 | 140 |

| Fish Species Abbreviations | |
|---|---|
| Carp: | Common Carp |
| LN DC: | Longnose Dace |
| MOT SC: | Mottled Sculpin |
| SMB: | Smallmouth Bass |
| RD SH: | Redside Shiner |
| RBT: | Rainbow Trout |
| UT SU: | Utah Sucker |

Fish Survey Data
Reach 3,
Sample Years 2005-2007

| | Reach 3 2005 | Reach 3 2006 | Reach 3 2007 |
|---|---|---|---|
| **Date:** | 10/15/2005 | 10/10/2006 | 10/10/2007 |
| **Field Staff** | Drake Burford | Drake Burford | Drake Burford |
| | John Gangemi | Brian Anderson | Sean Newman |
| | Brian Anderson | Matt Umberger | Brian Anderson |
| **H2O Temp:** | 9.8 ºC | 12.1 ºC | 12.7 ºC |
| **Air Temp:** | 18.4 ºC | 16.6 ºC | 17.7 ºC |
| **Start Time:** | 1:30:00 PM | 2:25:00 PM | 1:30:00 PM |
| **End Time:** | 4:00:00 PM | 4:45:00 PM | 4:45:00 PM |
| **Electrofisher Unit:** | Smith Root 12-B | Smith Root 12-B | Halltech HT-2000 |
| **E-Fishing Method:** | 2 consecutive upstream passes | 2 consecutive upstream passes | 2 consecutive upstream passes |
| **Settings:** | G4 @ 400 | G4 @ 400 | 80/450 |
| **Effort (time in seconds):** | 696 | 799 | 996 |

| Reach 3 2005 | | | Reach 3 2006 | | | | Reach 3 2007 | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) | Freeze Brand | Species | Length (mm) | Weight (g) |
| RD SH | 36 | 4 | LN DC | 47 | 4 | | Carp | 709 | 4960 |
| RD SH | 39 | 4 | LN DC | 51 | 4 | | LN DC | 58 | 4 |
| RD SH | 35 | 4 | LN DC | 58 | 4 | | LN DC | 62 | 6 |
| RD SH | 41 | 4 | RBT | 281 | 294 | Ftbridge 2006 | LN DC | 82 | 10 |
| RD SH | 50 | 4 | RD SH | 78 | 6 | | LN DC | 38 | 2 |
| RD SH | 42 | 4 | RD SH | 65 | 4 | | LN DC | 41 | 2 |
| RD SH | 43 | 4 | RD SH | 79 | 8 | | RD SH | 50 | 4 |
| RD SH | 38 | 4 | RD SH | 75 | 6 | | RD SH | 57 | 4 |
| RD SH | 39 | 4 | RD SH | 51 | 4 | | RD SH | 53 | 4 |
| RD SH | 32 | 4 | RD SH | 58 | 2 | | RD SH | 49 | 2 |
| RD SH | 53 | 4 | RD SH | 71 | 4 | | RD SH | 46 | 2 |
| RD SH | 36 | 4 | RD SH | 45 | 2 | | RD SH | 50 | 4 |
| RD SH | 42 | 4 | RD SH | 53 | 2 | | RD SH | 51 | 4 |
| RD SH | 43 | 4 | RD SH | 52 | 2 | | RD SH | 49 | 4 |
| RD SH | 32 | 4 | RD SH | 44 | 2 | | RD SH | 52 | 4 |
| RD SH | 49 | 4 | RD SH | 47 | 2 | | RD SH | 42 | 2 |

Fish Survey Data
Reach 3,
Sample Years 2005-2007

| Reach 3 2005 | | |
|---|---|---|
| Species | Length (mm) | Weight (g) |
| RD SH | 40 | 4 |
| RD SH | 32 | 4 |
| RD SH | 45 | 4 |
| RD SH | 57 | 4 |
| SMB | 57 | 4 |
| UT SU | 63 | 6 |
| UT SU | 71 | 4 |
| UT SU | 71 | 6 |
| UT SU | 59 | 4 |
| UT SU | 58 | 4 |
| UT SU | 62 | 4 |
| UT SU | 68 | 4 |
| UT SU | 50 | 2 |
| UT SU | 66 | 6 |
| UT SU | 56 | 4 |
| UT SU | 49 | 4 |
| UT SU | 83 | 8 |

| Fish Species Abbreviations | |
|---|---|
| Carp: | Common Carp |
| LN DC: | Longnose Dace |
| MOT SC: | Mottled Sculpin |
| SMB: | Smallmouth Bass |
| RD SH: | Redside Shiner |
| RBT: | Rainbow Trout |
| UT SU: | Utah Sucker |

| Reach 3 2006 | | | |
|---|---|---|---|
| Species | Length (mm) | Weight (g) | Freeze Brand |
| RD SH | 44 | 2 | |
| RD SH | 48 | 2 | |
| RD SH | 44 | 2 | |
| RD SH | 45 | 2 | |
| RD SH | 48 | 2 | |
| RD SH | 46 | 2 | |
| RD SH | 50 | 2 | |
| RD SH | 41 | 2 | |
| RD SH | 35 | 2 | |
| RD SH | 41 | 2 | |
| RD SH | 39 | 2 | |
| RD SH | 40 | 2 | |
| RD SH | 40 | 2 | |
| RD SH | 79 | 4 | |
| RD SH | 102 | 12 | |
| RD SH | 86 | 8 | |
| RD SH | 76 | 6 | |
| RD SH | 83 | 8 | |
| RD SH | 53 | 2 | |
| RD SH | 52 | 4 | |
| RD SH | 45 | 2 | |
| RD SH | 52 | 4 | |
| RD SH | 47 | 2 | |
| RD SH | 45 | 2 | |
| RD SH | 45 | 2 | |
| RD SH | 39 | 2 | |
| RD SH | 48 | 2 | |
| RD SH | 51 | 2 | |
| RD SH | 45 | 2 | |
| RD SH | 54 | 2 | |
| RD SH | 46 | 2 | |
| RD SH | 48 | 2 | |
| RD SH | 45 | 2 | |
| RD SH | 42 | 2 | |

| Reach 3 2007 | | |
|---|---|---|
| Species | Length (mm) | Weight (g) |
| RD SH | 45 | 4 |
| RD SH | 53 | 4 |
| RD SH | 46 | 2 |
| RD SH | 48 | 4 |
| RD SH | 53 | 4 |
| RD SH | 47 | 4 |
| RD SH | 41 | 4 |
| RD SH | 46 | 4 |
| RD SH | 42 | 4 |
| RD SH | 43 | 2 |
| RD SH | 50 | 4 |
| RD SH | 51 | 4 |
| RD SH | 59 | 4 |
| RD SH | 49 | 4 |
| RD SH | 39 | 2 |
| RD SH | 65 | 4 |
| RD SH | 54 | 4 |
| RD SH | 52 | 4 |
| RD SH | 49 | 4 |
| RD SH | 83 | 8 |
| RD SH | 46 | 4 |
| RD SH | 44 | 4 |
| RD SH | 40 | 4 |
| RD SH | 44 | 4 |
| RD SH | 52 | 4 |
| RD SH | 46 | 4 |
| RD SH | 57 | 4 |
| RD SH | 52 | 4 |
| RD SH | 41 | 4 |
| RD SH | 46 | 4 |
| RD SH | 45 | 2 |
| RD SH | 50 | 4 |
| RD SH | 79 | 8 |
| RD SH | 49 | 4 |

Fish Survey Data
Reach 3,
Sample Years 2005-2007

| Reach 3 2005 | | | Reach 3 2006 | | | | Reach 3 2007 | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) | Freeze Brand | Species | Length (mm) | Weight (g) |
| | | | RD SH | 54 | 2 | | RD SH | 48 | 4 |
| | | | RD SH | 33 | 2 | | RD SH | 54 | 4 |
| | | | RD SH | 40 | 2 | | RD SH | 57 | 4 |
| | | | RD SH | 47 | 2 | | RD SH | 40 | 2 |
| | | | RD SH | 47 | 2 | | RD SH | 50 | 4 |
| | | | RD SH | 45 | 2 | | RD SH | 41 | 2 |
| | | | RD SH | 38 | 2 | | RD SH | 57 | 4 |
| | | | RD SH | 50 | 2 | | RD SH | 55 | 4 |
| | | | RD SH | 49 | 2 | | SMB | 82 | 10 |
| | | | RD SH | 87 | 8 | | SMB | 77 | 12 |
| | | | RD SH | 46 | 2 | | SMB | 66 | 8 |
| | | | RD SH | 60 | 2 | | UT SU | 486 | 1410 |
| | | | RD SH | 70 | 4 | | UT SU | 466 | 1256 |
| | | | RD SH | 86 | 8 | | UT SU | 352 | 496 |
| | | | RD SH | 47 | 2 | | UT SU | 259 | 162 |
| | | | RD SH | 45 | 2 | | UT SU | 68 | 6 |
| | | | RD SH | 42 | 2 | | UT SU | 242 | 170 |
| | | | RD SH | 49 | 2 | | UT SU | 267 | 242 |
| | | | RD SH | 71 | 4 | | UT SU | 241 | 178 |
| | | | RD SH | 97 | 10 | | | | |
| | | | RD SH | 45 | 2 | | | | |
| | | | RD SH | 76 | 4 | | | | |
| | | | RD SH | 74 | 4 | | | | |
| | | | RD SH | 90 | 8 | | | | |
| | | | RD SH | 82 | 6 | | | | |
| | | | RD SH | 72 | 6 | | | | |
| | | | RD SH | 57 | 2 | | | | |
| | | | UT SU | 65 | 6 | | | | |
| | | | UT SU | 78 | 6 | | | | |
| | | | UT SU | 61 | 4 | | | | |
| | | | UT SU | 65 | 4 | | | | |
| | | | UT SU | 77 | 6 | | | | |
| | | | UT SU | 159 | 46 | | | | |
| | | | UT SU | 174 | 58 | | | | |

Fish Survey Data
Reach 3,
Sample Years 2005-2007

| Reach 3 2005 | | | Reach 3 2006 | | | | Reach 3 2007 | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Species | Length (mm) | Weight (g) | Freeze Brand | Species | Length (mm) | Weight (g) |
| | | | UT SU | 166 | 52 | | | | |
| | | | UT SU | 61 | 4 | | | | |
| | | | UT SU | 63 | 4 | | | | |
| | | | UT SU | 62 | 4 | | | | |
| | | | UT SU | 145 | 40 | | | | |

Fish Survey Data
Reach 4,
Sample Years 2005-2007

| | Reach 4 2005 | Reach 4 2006 | Reach 4 2007 |
|---|---|---|---|
| **Date:** | 10/14/2005 | 10/11/2006 | 10/9/2007 |
| **Field Staff** | Drake Burford | Drake Burford | Drake Burford |
| | John Gangemi | Brian Anderson | Sean Newman |
| | Brian Anderson | Matt Umberger | Brian Anderson |
| **H2O Temp:** | n/a | 10.1 ºC | 12.3 ºC |
| **Air Temp:** | n/a | 10 ºC | 16.6 ºC |
| **Start Time:** | 1/0/1900 | 10:30:00 AM | 2:00:00 PM |
| **End Time:** | 1/0/1900 | 1:30:00 PM | 5:45:00 PM |
| **Electrofisher Unit:** | Smith Root 12-B | Smith Root 12-B | Halltech HT-2000 |
| **E-Fishing Method:** | 2 consecutive upstream passes | 2 consecutive upstream passes | 2 consecutive upstream passes |
| **Settings:** | G4 @ 400 | G4 @ 400 | 80/350 |
| **Effort (time in seconds):** | 902 | 1469 | 1188 |

| Reach 4 2005 | | | | Reach 4 2006 | | | | Reach 4 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **Length (mm)** | **Weight (g)** | **Freeze Brand** | **Species** | **Length (mm)** | **Weight (g)** | **Freeze Brand** | **Species** | **Length (mm)** | **Weight (g)** | **Freeze Brand** |
| LN DC | 41 | 4 | | LN DC | 75 | 8 | | LN DC | 95 | 13 | |
| LN DC | 38 | 4 | | LN DC | 80 | 8 | | LN DC | 47 | 2 | |
| LN DC | 35 | 4 | | LN DC | 91 | 14 | | LN DC | 37 | 2 | |
| LN DC | 36 | 4 | | LN DC | 83 | 10 | | LN DC | 46 | 2 | |
| LN DC | 37 | 4 | | LN DC | 71 | 6 | | LN DC | 80 | 6 | |
| LN DC | 38 | 4 | | LN DC | 54 | 2 | | LN DC | 93 | 10 | |
| LN DC | 87 | 8 | | LN DC | 82 | 6 | | LN DC | 40 | 2 | |
| LN DC | 87 | 12 | | LN DC | 76 | 4 | | LN DC | 46 | 2 | |
| LN DC | 66 | 6 | | LN DC | 71 | 4 | | LN DC | 72 | 6 | |
| LN DC | 94 | 14 | | LN DC | 66 | 4 | | LN DC | 85 | 6 | |
| LN DC | 63 | 4 | | LN DC | 58 | 2 | | LN DC | 84 | 8 | |
| LN DC | 45 | 4 | | LN DC | 46 | 2 | | LN DC | 81 | 8 | |
| LN DC | 38 | 4 | | LN DC | 81 | 6 | | LN DC | 87 | 8 | |
| LN DC | 49 | 4 | | LN DC | 85 | 6 | | LN DC | 45 | 2 | |
| LN DC | 37 | 2 | | LN DC | 67 | 4 | | LN DC | 49 | 2 | |
| LN DC | 33 | 2 | | LN DC | 65 | 4 | | LN DC | 67 | 4 | |
| LN DC | 85 | 6 | | LN DC | 37 | 2 | | LN DC | 58 | 6 | |

Fish Survey Data
Reach 4,
Sample Years 2005-2007

| Reach 4 2005 | | | | Reach 4 2006 | | | | Reach 4 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Freeze Brand | Species | Length (mm) | Weight (g) | Freeze Brand | Species | Length (mm) | Weight (g) | Freeze Brand |
| LN DC | 71 | 12 | | LN DC | 85 | 12 | | LN DC | 70 | 6 | |
| LN DC | 59 | 6 | | LN DC | 67 | 4 | | LN DC | 95 | 12 | |
| LN DC | 46 | 4 | | LN DC | 72 | 4 | | LN DC | 49 | 4 | |
| LN DC | 45 | 4 | | LN DC | 66 | 4 | | LN DC | 101 | 14 | |
| LN DC | 35 | 2 | | LN DC | 67 | 4 | | LN DC | 102 | 14 | |
| LN DC | 34 | 2 | | LN DC | 60 | 4 | | LN DC | 84 | 10 | |
| LN DC | 46 | 4 | | LN DC | 37 | 2 | | LN DC | 66 | 4 | |
| LN DC | 88 | 18 | | LN DC | 51 | 4 | | LN DC | 66 | 6 | |
| LN DC | 69 | 6 | | LN DC | 39 | 2 | | LN DC | 83 | 10 | |
| LN DC | 79 | 6 | | LN DC | 35 | 2 | | LN DC | 70 | 6 | |
| LN DC | 73 | 6 | | MT SC | 75 | 6 | | LN DC | 48 | 4 | |
| LN DC | 74 | 65 | | MT SC | 73 | 8 | | LN DC | 77 | 6 | |
| LN DC | 51 | 4 | | MT SC | 90 | 12 | | LN DC | 86 | 8 | |
| LN DC | 51 | 4 | | MT SC | 89 | 14 | | LN DC | 80 | 8 | |
| LN DC | 66 | 6 | | MT SC | 87 | 12 | | LN DC | 66 | 8 | |
| LN DC | 48 | 4 | | MT SC | 80 | 8 | | LN DC | 74 | 6 | |
| LN DC | 48 | 4 | | MT SC | 71 | 6 | | LN DC | 71 | 6 | |
| LN DC | 49 | 4 | | RBT | 290 | 196 | Footbridge 2006 | LN DC | 49 | 4 | |
| LN DC | 36 | 2 | | RBT | 285 | 230 | none | MT SC | 83 | 8 | |
| LN DC | 65 | 6 | | RBT | 259 | 176 | none | MT SC | 88 | 10 | |
| LN DC | 48 | 2 | | RBT | 304 | 300 | none | MT SC | 61 | 4 | |
| LN DC | 40 | 2 | | RBT | 356 | 482 | none | MT SC | 62 | 4 | |
| MT SC | 77 | 12 | | RBT | 294 | 216 | Footbridge 2006 | MT SC | 102 | 14 | |
| MT SC | 57 | 4 | | RD SH | 97 | 16 | | MT SC | 89 | 8 | |
| MT SC | 64 | 8 | | RD SH | 90 | 12 | | MT SC | 56 | 4 | |
| MT SC | 63 | 6 | | RD SH | 65 | 6 | | MT SC | 94 | 10 | |
| MT SC | 53 | 6 | | RD SH | 101 | 16 | | MT SC | 103 | 14 | |
| MT SC | 47 | 4 | | RD SH | 60 | 6 | | MT SC | 83 | 10 | |
| MT SC | 59 | 4 | | RD SH | 65 | 2 | | MT SC | 76 | 6 | |
| MT SC | 53 | 4 | | UT SU | 165 | 52 | | MT SC | 71 | 6 | |
| MT SC | 55 | 4 | | | | | | MT SC | 75 | 6 | |
| MT SC | 62 | 4 | | | | | | MT SC | 53 | 4 | |
| MT SC | 60 | 4 | | | | | | MT SC | 89 | 12 | |

Fish Survey Data
Reach 4,
Sample Years 2005-2007

| Reach 4 2005 | | | | Reach 4 2006 | | | | Reach 4 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **Length (mm)** | **Weight (g)** | **Freeze Brand** | **Species** | **Length (mm)** | **Weight (g)** | **Freeze Brand** | **Species** | **Length (mm)** | **Weight (g)** | **Freeze Brand** |
| MT SC | 90 | 18 | | | | | | MT SC | 84 | 8 | |
| MT SC | 86 | 10 | | | | | | MT SC | 87 | 8 | |
| MT SC | 50 | 6 | | | | | | MT SC | 87 | 10 | |
| MT SC | 53 | 4 | | | | | | MT SC | 77 | 8 | |
| MT SC | 60 | 4 | | | | | | MT SC | 66 | 6 | |
| MT SC | 62 | 4 | | | | | | MT SC | 79 | 8 | |
| MT SC | 63 | 4 | | | | | | MT SC | 79 | 8 | |
| MT SC | 93 | 14 | | | | | | MT SC | 78 | 8 | |
| MT SC | 62 | 4 | | | | | | MT SC | 75 | 8 | |
| MT SC | 95 | 12 | | | | | | MT SC | 90 | 12 | |
| MT SC | 101 | 18 | | | | | | MT SC | 77 | 10 | |
| MT SC | 64 | 4 | | | | | | MT SC | 76 | 6 | |
| MT SC | 54 | 4 | | | | | | MT SC | 77 | 8 | |
| MT SC | 58 | 6 | | | | | | MT SC | 100 | 16 | |
| MT SC | 60 | 4 | | | | | | MT SC | 81 | 8 | |
| MT SC | 54 | 4 | | | | | | RBT | 351 | 410 | none |
| RBT | 268 | 214 | Footbridge 2005 | | | | | RBT | 302 | 206 | none |
| RBT | 238 | 152 | Footbridge 2005 | | | | | RBT | 299 | 278 | none |
| RBT | 304 | 310 | Footbridge 2005 | | | | | RBT | 336 | 392 | Footbridge 2007 |
| RBT | 323 | 460 | none | | | | | RBT | 263 | 174 | none |
| RBT | 283 | 276 | Footbridge 2005 | | | | | RD SH | 97 | 6 | |
| RBT | 133 | 34 | none | | | | | RD SH | 100 | 12 | |
| RBT | 201 | 114 | none | | | | | RD SH | 96 | 10 | |
| RBT | 269 | 268 | Footbridge 2005 | | | | | RD SH | 95 | 12 | |
| RBT | 326 | 442 | none | | | | | RD SH | 94 | 12 | |
| RBT | 297 | 282 | Footbridge 2005 | | | | | RD SH | 93 | 10 | |
| RBT | 264 | 218 | Footbridge 2005 | | | | | RD SH | 102 | 14 | |
| RBT | 329 | 446 | none | | | | | RD SH | 77 | 6 | |
| RBT | 249 | 196 | none | | | | | RD SH | 86 | 8 | |

Fish Survey Data
Reach 4,
Sample Years 2005-2007

| Reach 4 2005 | | | | Reach 4 2006 | | | | Reach 4 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Length (mm) | Weight (g) | Freeze Brand | Species | Length (mm) | Weight (g) | Freeze Brand | Species | Length (mm) | Weight (g) | Freeze Brand |
| RBT | 266 | 214 | none | | | | | RD SH | 91 | 10 | |
| RBT | 302 | 372 | Footbridge 2005 | | | | | RD SH | 86 | 8 | |
| RBT | 298 | 306 | Footbridge 2005 | | | | | RD SH | 86 | 8 | |
| RBT | 260 | 230 | none | | | | | RD SH | 96 | 12 | |
| RBT | 297 | 326 | Footbridge 2005 | | | | | RD SH | 94 | 10 | |
| RBT | 286 | 316 | Footbridge 2005 | | | | | RD SH | 100 | 14 | |
| RBT | 337 | 590 | none | | | | | RD SH | 70 | 6 | |
| RBT | 299 | 306 | Footbridge 2005 | | | | | RD SH | 97 | 14 | |
| RBT | 271 | 236 | Footbridge 2005 | | | | | RD SH | 62 | 6 | |
| RD SH | 80 | 6 | | | | | | RD SH | 89 | 10 | |
| RD SH | 70 | 10 | | | | | | RD SH | 92 | 12 | |
| RD SH | 88 | 16 | | | | | | RD SH | 96 | 12 | |
| RD SH | 65 | 10 | | | | | | RD SH | 70 | 6 | |
| RD SH | 81 | 12 | | | | | | RD SH | 97 | 12 | |
| RD SH | 79 | 10 | | | | | | RD SH | 83 | 8 | |
| RD SH | 63 | 10 | | | | | | | | | |
| RD SH | 70 | 6 | | | | | | | | | |
| RD SH | 83 | 8 | | | | | | | | | |
| RD SH | 67 | 4 | | | | | | | | | |
| UT SU | 129 | 32 | | | | | | | | | |
| UT SU | 125 | 26 | | | | | | | | | |

| Fish Species Abbreviations | |
|---|---|
| Carp: | Common Carp |
| LN DC: | Longnose Dace |
| MOT SC: | Mottled Sculpin |
| SMB: | Smallmouth Bass |
| RD SH: | Redside Shiner |
| RBT: | Rainbow Trout |
| UT SU: | Utah Sucker |

# APPENDIX E

## BENTHIC ORGANIC MATTER AFDW DATA

| Benthic Organic Matter AFDW (g/m$^2$) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Transect | 2005 | | | | 2006 | | | | 2007 | | | |
| | R1 | R2 | R3 | R4 | R1 | R2 | R3 | R4 | R1 | R2 | R3 | R4 |
| TA | 17.65 | 12.34 | 18.18 | 67.77 | 54.31 | 45.52 | 35.81 | 198.31 | 20.67 | 29.23 | 26.85 | 67.66 |
| TB | 31.57 | 10.84 | 13.77 | 30.25 | 93.43 | 65.41 | 83.09 | 61.25 | 15.50 | 14.03 | 20.76 | 62.50 |
| TC | 42.64 | 7.52 | 5.69 | 25.31 | 80.68 | 22.30 | 76.90 | 85.09 | 27.96 | 8.26 | 17.26 | 43.60 |
| TD | 38.67 | 9.52 | 7.37 | 67.23 | 58.89 | 14.61 | 64.29 | 93.87 | 32.39 | 17.72 | 21.78 | 77.52 |
| TE | 26.78 | 25.77 | 1.93 | 21.42 | 78.38 | 34.81 | 17.99 | 139.62 | 10.40 | 30.84 | 6.54 | 108.84 |

# APPENDIX F

## BENTHIC MACROINVERTEBRATE DATA

Taxa Density (orgs/$m^2$)
Reach 1, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 1 Composite Above Soda Reservoir | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| **Ephemeroptera** | Asioplax sp. | - | - | - | 6 | 14 | 10 | 13 | 26 | 19 |
| | Baetis sp. | - | - | - | 1,576 | 966 | 711 | - | - | - |
| | Baetis tricaudatus | 1,967 | 1,013 | 745 | 431 | 568 | 418 | 1,414 | 985 | 725 |
| | Ephemerella inermis/infrequens | 3,885 | 3,310 | 2,435 | 861 | 1,506 | 1,108 | - | - | - |
| | Ephemerella sp. | 270 | 604 | 444 | 1,897 | 858 | 631 | 293 | 130 | 96 |
| | Fallceon quilleri | - | - | - | - | - | - | - | - | - |
| | Heptageniidae | 41 | 39 | 29 | 119 | 46 | 34 | - | - | - |
| | Heptagenia sp. | - | - | - | - | - | - | 37 | 31 | 23 |
| | Heterocloeon sp. | - | - | - | - | - | - | - | - | - |
| | Leptohyphidae | - | - | - | 913 | 480 | 353 | - | - | - |
| | Maccaffertium terminatum | - | - | - | - | - | - | 213 | 198 | 146 |
| | Plauditus sp. | - | - | - | - | - | - | 6 | 13 | 10 |
| | Stenonema terminatum | 568 | 348 | 256 | 63 | 141 | 104 | - | - | - |
| | Tricorythodes sp. | 2,776 | 2,216 | 1,630 | 677 | 285 | 210 | 805 | 295 | 217 |
| **Odonata** | Argia sp. | - | - | - | - | - | - | - | - | - |
| | Coenagrion/Enallagma sp. | - | - | - | - | - | - | - | - | - |
| | Coenagrionidae | - | - | - | - | - | - | - | - | - |
| | Gomphidae | - | - | - | 6 | 13 | 10 | - | - | - |
| | Ophiogomphus sp. | 3 | 6 | 4 | - | - | - | - | - | - |
| **Plecoptera** | Perlidae | - | - | - | 54 | 61 | 45 | - | - | - |
| | Perlodidae | 354 | 175 | 129 | 27 | 60 | 44 | 47 | 56 | 41 |
| | Zapada cinctipes | - | - | - | - | - | - | - | - | - |
| **Hemiptera** | Sigara sp. | - | - | - | - | - | - | - | - | - |
| **Coleoptera** | Agabus sp. | - | - | - | - | - | - | - | - | - |
| | Cleptelmis addenda | - | - | - | 9 | 20 | 15 | - | - | - |
| | Dubiraphia sp. | - | - | - | - | - | - | - | - | - |
| | Heterlimnius sp. | - | - | - | - | - | - | - | - | - |
| | Microcylloepus sp. | 31 | 33 | 24 | 29 | 17 | 13 | 88 | 47 | 34 |
| | Optioservus sp. | 21 | 29 | 21 | 35 | 35 | 26 | 26 | 22 | 16 |
| | Stictotarsus sp. | - | - | - | - | - | - | - | - | - |
| **Diptera-** | Cardiocladius sp. | - | - | - | 39 | 59 | 44 | 9 | 18 | 14 |
| | Chironomini | - | - | - | - | - | - | - | - | - |
| | Cladopelma sp. | - | - | - | - | - | - | - | - | - |
| | Cladotanytarsus sp. | 190 | 195 | 143 | 8 | 18 | 13 | 43 | 8 | 6 |
| | Chironomidae | - | - | - | - | - | - | - | - | - |
| | Cricotopus bicinctus gr. | 10 | 23 | 17 | - | - | - | - | - | - |
| | Cricotopus sp. | - | - | - | 43 | 30 | 22 | - | - | - |
| | Cricotopus trifascia gr. | 1,032 | 576 | 424 | 1,828 | 197 | 145 | 2,044 | 1,479 | 1,088 |
| | Cryptochironomus sp. | 20 | 45 | 33 | - | - | - | - | - | - |
| | Derotanypus sp. | - | - | - | - | - | - | - | - | - |
| | Diamesa sp. | 32 | 72 | 53 | 50 | 35 | 25 | - | - | - |
| | Dicrotendipes sp. | - | - | - | - | - | - | - | - | - |
| | Eukiefferiella brehmi gr. | - | - | - | 6 | 14 | 10 | - | - | - |
| | Eukiefferiella coerulescens gr. | - | - | - | - | - | - | - | - | - |
| | Eukiefferiella devonica gr. | 15 | 34 | 25 | 23 | 22 | 16 | 42 | 39 | 29 |
| | Eukiefferiella gracei gr. | - | - | - | - | - | - | - | - | - |
| | Lopescladius (Cordiella) sp. | 13 | 23 | 17 | - | - | - | 12 | 23 | 17 |
| | Micropsectra sp. | - | - | - | - | - | - | - | - | - |
| | Micropsectra/Tanytarsus sp. | - | - | - | - | - | - | - | - | - |

Taxa Density (orgs/$m^2$)
Reach 1, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 1 Composite Above Soda Reservoir | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| | Microtendipes pedellus gr. | 1,075 | 766 | 563 | 773 | 233 | 172 | 398 | 132 | 97 |
| | Nanocladius sp. | 10 | 23 | 17 | - | - | - | - | - | - |
| | Orthocladiinae | - | - | - | 16 | 35 | 26 | - | - | - |
| | Orthocladius (Euortho.) rivicola gr. | 462 | 325 | 239 | 27 | 41 | 30 | - | - | - |
| | Orthocladius (Euortho.) rivulorum | - | - | - | - | - | - | - | - | - |
| | Orthocladius (Euortho.) rivulorum gr. | - | - | - | - | - | - | - | - | - |
| | Orthocladius (Euorthocladius) sp. | - | - | - | 458 | 240 | 176 | 79 | 66 | 49 |
| | Orthocladius Complex | 404 | 358 | 263 | 157 | 225 | 165 | - | - | - |
| | Orthocladius sp. | 521 | 398 | 293 | 203 | 73 | 53 | 130 | 70 | 51 |
| | Parakiefferiella sp. | - | - | - | - | - | - | - | - | - |
| | Parametriocnemus sp. | - | - | - | - | - | - | 9 | 18 | 14 |
| | Paratanytarsus sp. | - | - | - | - | - | - | - | - | - |
| | Paratendipes sp. | - | - | - | - | - | - | - | - | - |
| | Pentaneura sp. | 30 | 68 | 50 | - | - | - | - | - | - |
| | Pentaneurini | - | - | - | - | - | - | - | - | - |
| | Phaenopsectra sp. | - | - | - | - | - | - | - | - | - |
| | Polypedilum sp. | 339 | 305 | 225 | 79 | 123 | 90 | 29 | 37 | 27 |
| | Potthastia longimana gr. | - | - | - | - | - | - | - | - | - |
| | Pseudochironomus sp. | - | - | - | - | - | - | - | - | - |
| | Rheocricotopus sp. | 15 | 34 | 25 | 8 | 18 | 13 | 13 | 26 | 19 |
| | Rheotanytarsus sp. | 381 | 296 | 218 | 83 | 68 | 50 | - | - | - |
| | Sublettea sp. | - | - | - | - | - | - | - | - | - |
| | Tanytarsini | - | - | - | - | - | - | - | - | - |
| | Tanytarsus sp. | - | - | - | - | - | - | - | - | - |
| | Thienemanniella sp. | 71 | 56 | 41 | 100 | 107 | 78 | 28 | 55 | 41 |
| | Thienemannimyia gr. sp. | 1,338 | 1,407 | 1,035 | 265 | 60 | 44 | 88 | 73 | 54 |
| | Tvetenia bavarica gr. | - | - | - | - | - | - | - | - | - |
| | Tvetenia discoloripes gr. | 980 | 827 | 608 | 272 | 169 | 124 | 136 | 109 | 80 |
| **Chironomidae** | Xenochironomus xenolabis | - | - | - | - | - | - | - | - | - |
| | Bezzia/Palpomyia sp. | - | - | - | - | - | - | - | - | - |
| | Caloparyphus sp. | - | - | - | - | - | - | - | - | - |
| | Ceratopogoninae | - | - | - | - | - | - | - | - | - |
| | Diptera | - | - | - | - | - | - | - | - | - |
| | Empididae | 11 | 24 | 18 | - | - | - | - | - | - |
| | Ephydridae | - | - | - | - | - | - | - | - | - |
| | Hemerodromia sp. | 134 | 187 | 138 | 35 | 35 | 26 | 283 | 108 | 79 |
| **Diptera** | Muscidae | - | - | - | - | - | - | - | - | - |
| | Neoplasta sp. | - | - | - | - | - | - | - | - | - |
| | Probezzia sp. | - | - | - | - | - | - | - | - | - |
| | Simuliidae | - | - | - | 392 | 565 | 415 | - | - | - |
| | Simulium sp. | 1,619 | 1,883 | 1,385 | 2,411 | 1,571 | 1,155 | 399 | 162 | 119 |
| | Stratiomyidae | - | - | - | - | - | - | - | - | - |
| | Tipula sp. | - | - | - | - | - | - | - | - | - |
| | Tipulidae | 5 | 12 | 9 | - | - | - | - | - | - |
| | Amiocentrus aspilus | - | - | - | - | - | - | - | - | - |
| | Brachycentrus occidentalis | 677 | 360 | 265 | 968 | 655 | 481 | 513 | 125 | 92 |
| | Cheumatopsyche sp. | 811 | 494 | 364 | 1,309 | 1,115 | 820 | 1,500 | 330 | 243 |
| | Chimarra sp. | - | - | - | - | - | - | - | - | - |
| | Culoptila sp. | 170 | 108 | 79 | 228 | 137 | 101 | 2,624 | 1,249 | 919 |

Taxa Density (orgs/$m^2$)
Reach 1, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 1 Composite Above Soda Reservoir | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| **Trichoptera** | Glossosomatidae | - | - | - | - | - | - | - | - | - |
| | Helicopsyche sp. | 244 | 217 | 159 | 93 | 75 | 55 | 154 | 140 | 103 |
| | Hydropsyche sp. | 2,061 | 1,172 | 862 | 2,952 | 2,897 | 2,131 | 1,388 | 465 | 342 |
| | Hydropsychidae | - | - | - | 32 | 37 | 27 | - | - | - |
| | Hydroptila sp. | 101 | 74 | 54 | 24 | 36 | 26 | 37 | 74 | 54 |
| | Hydroptilidae | - | - | - | 16 | 22 | 16 | - | - | - |
| | Leptoceridae | - | - | - | 16 | 22 | 16 | - | - | - |
| | Limnephilidae | 11 | 24 | 18 | - | - | - | - | - | - |
| | Mayatrichia sp. | - | - | - | - | - | - | - | - | - |
| | Nectopsyche sp. | - | - | - | 15 | 21 | 15 | 4 | 9 | 7 |
| | Neotrichia sp. | - | - | - | 12 | 26 | 19 | - | - | - |
| | Oecetis avara | 326 | 160 | 118 | 218 | 39 | 29 | 29 | 31 | 23 |
| | Oecetis sp. | - | - | - | - | - | - | - | - | - |
| | Oxyethira sp. | - | - | - | - | - | - | - | - | - |
| | Polycentropus sp. | - | - | - | - | - | - | - | - | - |
| | Protoptila sp. | 561 | 733 | 539 | 916 | 612 | 450 | 2,034 | 938 | 690 |
| **Lepidoptera** | Petrophila sp. | 266 | 155 | 114 | 83 | 79 | 58 | 182 | 100 | 74 |
| **Gastropoda** | Fluminicola sp. | - | - | - | - | - | - | - | - | - |
| | Gyraulus sp. | - | - | - | - | - | - | - | - | - |
| | Hydrobiidae | - | - | - | - | - | - | - | - | - |
| | Lymnaeidae | - | - | - | - | - | - | - | - | - |
| | Physa sp. | 5 | 12 | 9 | - | - | - | - | - | - |
| | Planorbidae | - | - | - | - | - | - | - | - | - |
| | Potamopyrgus antipodarum | - | - | - | - | - | - | - | - | - |
| | Pyrgulopsis sp. | - | - | - | - | - | - | - | - | - |
| | Valvata sp. | - | - | - | - | - | - | - | - | - |
| **Bivalvia** | Anodonta sp. | - | - | - | - | - | - | - | - | - |
| | Pisidium sp. | 145 | 106 | 78 | 77 | 59 | 43 | - | - | - |
| | Sphaeriidae | - | - | - | 14 | 19 | 14 | 9 | 18 | 14 |
| | Sphaerium sp. | - | - | - | - | - | - | 9 | 18 | 13 |
| **Annelida** | Aulodrilus pigueti | - | - | - | - | - | - | - | - | - |
| | Eclipidrilus sp. | - | - | - | - | - | - | - | - | - |
| | Enchytraeidae | 3 | 6 | 4 | - | - | - | - | - | - |
| | Erpobdellidae | 13 | 23 | 17 | - | - | - | - | - | - |
| | Helobdella sp. | - | - | - | - | - | - | - | - | - |
| | Limnodrilus hoffmeisteri | - | - | - | - | - | - | - | - | - |
| | Lumbricina | 11 | 24 | 18 | - | - | - | - | - | - |
| | Lumbriculidae | - | - | - | - | - | - | - | - | - |
| | Nais behningi | 289 | 348 | 256 | 8 | 18 | 13 | - | - | - |
| | Nais bretscheri | - | - | - | - | - | - | - | - | - |
| | Nais communis | - | - | - | - | - | - | - | - | - |
| | Nais elinguis | - | - | - | - | - | - | - | - | - |
| | Nais variabilis | 521 | 499 | 367 | 61 | 68 | 50 | - | - | - |
| | Ophidonais serpentina | 68 | 89 | 65 | 6 | 13 | 10 | - | - | - |
| | Rhynchelmis rostrata | - | - | - | - | - | - | - | - | - |
| | Quistradrilus multisetosus | - | - | - | - | - | - | - | - | - |
| | Spirosperma ferox | - | - | - | - | - | - | - | - | - |
| | Spirosperma sp. | - | - | - | - | - | - | - | - | - |
| | Tubificidae w/ cap setae | 76 | 60 | 44 | 52 | 47 | 35 | - | - | - |

Taxa Density (orgs/$m^2$)
Reach 1, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 1 Composite Above Soda Reservoir | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| | Tubificidae w/o cap setae | 62 | 51 | 38 | 32 | 30 | 22 | - | - | - |
| **Acari** | Acari | - | - | - | 6 | 14 | 10 | - | - | - |
| | Atractides sp. | 11 | 24 | 18 | 18 | 41 | 30 | - | - | - |
| | Aturus sp. | - | - | - | - | - | - | - | - | - |
| | Corticacarus | - | - | - | - | - | - | - | - | - |
| | Hygrobates sp. | - | - | - | - | - | - | - | - | - |
| | Lebertia sp. | 11 | 24 | 18 | - | - | - | - | - | - |
| | Limnesiidae | - | - | - | - | - | - | - | - | - |
| | Oribatei | - | - | - | - | - | - | - | - | - |
| | Sperchon sp. | 26 | 31 | 23 | 47 | 56 | 41 | 6 | 13 | 10 |
| | Testudacarus sp. | - | - | - | - | - | - | - | - | - |
| | Torrenticola sp. | - | - | - | - | - | - | - | - | - |
| **Crustacea** | Hyalella sp. | 20 | 33 | 24 | 14 | 19 | 14 | 16 | 19 | 14 |
| | Ostracoda | 11 | 24 | 18 | - | - | - | - | - | - |
| **Other Organisms** | Hydra sp. | - | - | - | - | - | - | - | - | - |
| | Nematoda | - | - | - | 8 | 18 | 13 | 9 | 18 | 14 |
| | Prostoma sp. | - | - | - | - | - | - | - | - | - |
| | Turbellaria | - | - | - | - | - | - | - | - | - |
| | **TOTAL** | **25,123** | **14,081** | **10,358** | **21,202** | **6,628** | **4,876** | **15,199** | **4,386** | **3,226** |

Taxa Density (orgs/m$^2$)
Reach 2, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 2 Composite Below Grace Dam | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| **Ephemeroptera** | Asioplax sp. | - | - | - | - | - | - | - | - | - |
| | Baetis sp. | - | - | - | 29 | 51 | 38 | - | - | - |
| | Baetis tricaudatus | - | - | - | - | - | - | 9 | 19 | 14 |
| | Ephemerella inermis/infrequens | - | - | - | - | - | - | - | - | - |
| | Ephemerella sp. | - | - | - | - | - | - | - | - | - |
| | Fallceon quilleri | - | - | - | 64 | 74 | 55 | 7 | 13 | 10 |
| | Heptageniidae | - | - | - | - | - | - | - | - | - |
| | Heptagenia sp. | - | - | - | - | - | - | - | - | - |
| | Heterocloeon sp. | - | - | - | - | - | - | - | - | - |
| | Leptohyphidae | - | - | - | 12 | 26 | 19 | - | - | - |
| | Maccaffertium terminatum | - | - | - | - | - | - | - | - | - |
| | Plauditus sp. | - | - | - | - | - | - | - | - | - |
| | Stenonema terminatum | - | - | - | - | - | - | - | - | - |
| | Tricorythodes sp. | 11 | 24 | 18 | 10 | 23 | 17 | - | - | - |
| **Odonata** | Argia sp. | - | - | - | - | - | - | 3 | 6 | 5 |
| | Coenagrion/Enallagma sp. | 68 | 77 | 57 | 12 | 26 | 19 | - | - | - |
| | Coenagrionidae | 27 | 47 | 34 | 71 | 97 | 72 | 77 | 129 | 95 |
| | Gomphidae | - | - | - | - | - | - | - | - | - |
| | Ophiogomphus sp. | - | - | - | - | - | - | - | - | - |
| **Plecoptera** | Perlidae | - | - | - | - | - | - | - | - | - |
| | Perlodidae | - | - | - | - | - | - | - | - | - |
| | Zapada cinctipes | - | - | - | - | - | - | - | - | - |
| **Hemiptera** | Sigara sp. | - | - | - | - | - | - | - | - | - |
| **Coleoptera** | Agabus sp. | - | - | - | - | - | - | - | - | - |
| | Cleptelmis addenda | - | - | - | - | - | - | 5 | 9 | 7 |
| | Dubiraphia sp. | - | - | - | - | - | - | - | - | - |
| | Heterlimnius sp. | - | - | - | - | - | - | - | - | - |
| | Microcylloepus sp. | 58 | 63 | 46 | 68 | 88 | 64 | 46 | 83 | 61 |
| | Optioservus sp. | - | - | - | 5 | 12 | 9 | - | - | - |
| | Stictotarsus sp. | - | - | - | - | - | - | - | - | - |
| **Diptera-** | Cardiocladius sp. | - | - | - | 63 | 74 | 54 | 9 | 19 | 14 |
| | Chironomini | - | - | - | - | - | - | - | - | - |
| | Cladopelma sp. | 1 | 3 | 2 | - | - | - | - | - | - |
| | Cladotanytarsus sp. | 5 | 12 | 9 | - | - | - | 5 | 9 | 7 |
| | Chironomidae | - | - | - | - | - | - | - | - | - |
| | Cricotopus bicinctus gr. | 200 | 206 | 152 | 474 | 558 | 411 | 68 | 79 | 58 |
| | Cricotopus sp. | 331 | 198 | 146 | 242 | 192 | 141 | 51 | 54 | 39 |
| | Cricotopus trifascia gr. | 364 | 298 | 219 | 3,283 | 2,923 | 2,150 | 870 | 749 | 551 |
| | Cryptochironomus sp. | 45 | 48 | 35 | - | - | - | - | - | - |
| | Derotanypus sp. | - | - | - | - | - | - | - | - | - |
| | Diamesa sp. | 12 | 24 | 17 | - | - | - | - | - | - |
| | Dicrotendipes sp. | 631 | 750 | 552 | 203 | 196 | 144 | 53 | 65 | 48 |
| | Eukiefferiella brehmi gr. | - | - | - | - | - | - | - | - | - |
| | Eukiefferiella coerulescens gr. | 3 | 6 | 4 | 29 | 37 | 27 | - | - | - |
| | Eukiefferiella devonica gr. | 40 | 45 | 33 | 326 | 371 | 273 | 49 | 63 | 47 |
| | Eukiefferiella gracei gr. | - | - | - | - | - | - | - | - | - |
| | Lopescladius (Cordiella) sp. | - | - | - | - | - | - | - | - | - |
| | Micropsectra sp. | 5 | 12 | 9 | 42 | 44 | 32 | 5 | 9 | 7 |
| | Micropsectra/Tanytarsus sp. | 32 | 72 | 53 | - | - | - | - | - | - |

Taxa Density (orgs/m$^2$)
Reach 2, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 2 Composite Below Grace Dam | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| Chironomidae | Microtendipes pedellus gr. | 267 | 546 | 402 | 990 | 1,435 | 1,055 | - | - | - |
| | Nanocladius sp. | - | - | - | - | - | - | - | - | - |
| | Orthocladiinae | - | - | - | 22 | 48 | 35 | - | - | - |
| | Orthocladius (Euortho.) rivicola gr. | - | - | - | 55 | 73 | 54 | - | - | - |
| | Orthocladius (Euortho.) rivulorum | - | - | - | - | - | - | - | - | - |
| | Orthocladius (Euortho.) rivulorum gr. | - | - | - | - | - | - | - | - | - |
| | Orthocladius (Euorthocladius) sp. | 122 | 70 | 52 | 516 | 707 | 520 | 14 | 28 | 21 |
| | Orthocladius Complex | 1,187 | 1,166 | 858 | 1,763 | 1,562 | 1,149 | - | - | - |
| | Orthocladius sp. | 299 | 193 | 142 | 1,477 | 2,254 | 1,658 | 460 | 342 | 252 |
| | Parakiefferiella sp. | 899 | 928 | 682 | 804 | 808 | 594 | 58 | 39 | 29 |
| | Parametriocnemus sp. | - | - | - | - | - | - | - | - | - |
| | Paratanytarsus sp. | - | - | - | 21 | 29 | 22 | - | - | - |
| | Paratendipes sp. | - | - | - | - | - | - | - | - | - |
| | Pentaneura sp. | 12 | 24 | 17 | 20 | 27 | 20 | - | - | - |
| | Pentaneurini | - | - | - | - | - | - | - | - | - |
| | Phaenopsectra sp. | 9 | 13 | 9 | - | - | - | - | - | - |
| | Polypedilum sp. | 69 | 143 | 105 | 87 | 126 | 93 | - | - | - |
| | Potthastia longimana gr. | 66 | 75 | 55 | - | - | - | - | - | - |
| | Pseudochironomus sp. | 1,650 | 2,020 | 1,486 | 374 | 257 | 189 | 48 | 72 | 53 |
| | Rheocricotopus sp. | 7 | 16 | 12 | 64 | 70 | 52 | - | - | - |
| | Rheotanytarsus sp. | 23 | 23 | 17 | 422 | 648 | 476 | 9 | 19 | 14 |
| | Sublettea sp. | - | - | - | - | - | - | - | - | - |
| | Tanytarsini | - | - | - | - | - | - | - | - | - |
| | Tanytarsus sp. | - | - | - | 9 | 21 | 15 | - | - | - |
| | Thienemanniella sp. | - | - | - | 24 | 53 | 39 | - | - | - |
| | Thienemannimyia gr. sp. | 78 | 168 | 123 | 21 | 46 | 34 | - | - | - |
| | Tvetenia bavarica gr. | - | - | - | - | - | - | - | - | - |
| | Tvetenia discoloripes gr. | 67 | 74 | 55 | 114 | 202 | 149 | - | - | - |
| | Xenochironomus xenolabis | - | - | - | - | - | - | - | - | - |
| Diptera | Bezzia/Palpomyia sp. | 149 | 192 | 141 | 63 | 74 | 54 | 9 | 19 | 14 |
| | Caloparyphus sp. | - | - | - | - | - | - | - | - | - |
| | Ceratopogoninae | - | - | - | - | - | - | 3 | 7 | 5 |
| | Diptera | - | - | - | - | - | - | - | - | - |
| | Empididae | - | - | - | - | - | - | - | - | - |
| | Ephydridae | - | - | - | - | - | - | - | - | - |
| | Hemerodromia sp. | 110 | 83 | 61 | 120 | 146 | 108 | 7 | 13 | 10 |
| | Muscidae | - | - | - | 12 | 26 | 19 | - | - | - |
| | Neoplasta sp. | - | - | - | - | - | - | - | - | - |
| | Probezzia sp. | - | - | - | - | - | - | 6 | 13 | 9 |
| | Simuliidae | - | - | - | 36 | 79 | 58 | - | - | - |
| | Simulium sp. | 408 | 366 | 269 | 1,930 | 2,344 | 1,724 | 427 | 732 | 538 |
| | Stratiomyidae | 3 | 6 | 4 | 10 | 23 | 17 | - | - | - |
| | Tipula sp. | 1 | 3 | 2 | - | - | - | - | - | - |
| | Tipulidae | - | - | - | - | - | - | - | - | - |
| | Amiocentrus aspilus | - | - | - | - | - | - | - | - | - |
| | Brachycentrus occidentalis | - | - | - | - | - | - | - | - | - |
| | Cheumatopsyche sp. | 38 | 27 | 20 | 169 | 244 | 179 | 8 | 10 | 7 |
| | Chimarra sp. | - | - | - | - | - | - | 9 | 19 | 14 |
| | Culoptila sp. | - | - | - | - | - | - | - | - | - |

Taxa Density (orgs/m$^2$)
Reach 2, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 2 Composite Below Grace Dam | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| **Trichoptera** | Glossosomatidae | - | - | - | - | - | - | - | - | - |
| | Helicopsyche sp. | 29 | 41 | 30 | 93 | 208 | 153 | 5 | 9 | 7 |
| | Hydropsyche sp. | 84 | 61 | 45 | 167 | 189 | 139 | 33 | 66 | 49 |
| | Hydropsychidae | - | - | - | 31 | 69 | 51 | - | - | - |
| | Hydroptila sp. | 111 | 70 | 52 | 72 | 162 | 119 | 14 | 28 | 21 |
| | Hydroptilidae | - | - | - | 33 | 37 | 27 | 5 | 9 | 7 |
| | Leptoceridae | 12 | 24 | 17 | 34 | 52 | 38 | - | - | - |
| | Limnephilidae | - | - | - | - | - | - | - | - | - |
| | Mayatrichia sp. | - | - | - | - | - | - | - | - | - |
| | Nectopsyche sp. | 8 | 17 | 13 | - | - | - | - | - | - |
| | Neotrichia sp. | - | - | - | - | - | - | - | - | - |
| | Oecetis avara | 295 | 507 | 373 | 529 | 940 | 692 | - | - | - |
| | Oecetis sp. | - | - | - | - | - | - | - | - | - |
| | Oxyethira sp. | 7 | 16 | 12 | - | - | - | - | - | - |
| | Polycentropus sp. | - | - | - | - | - | - | - | - | - |
| | Protoptila sp. | - | - | - | - | - | - | - | - | - |
| **Lepidoptera** | Petrophila sp. | 9 | 13 | 9 | 24 | 53 | 39 | - | - | - |
| **Gastropoda** | Fluminicola sp. | - | - | - | - | - | - | - | - | - |
| | Gyraulus sp. | - | - | - | - | - | - | - | - | - |
| | Hydrobiidae | - | - | - | - | - | - | - | - | - |
| | Lymnaeidae | 1 | 3 | 2 | 17 | 38 | 28 | - | - | - |
| | Physa sp. | - | - | - | - | - | - | - | - | - |
| | Planorbidae | - | - | - | - | - | - | - | - | - |
| | Potamopyrgus antipodarum | - | - | - | - | - | - | - | - | - |
| | Pyrgulopsis sp. | - | - | - | - | - | - | - | - | - |
| | Valvata sp. | - | - | - | - | - | - | - | - | - |
| **Bivalvia** | Anodonta sp. | - | - | - | - | - | - | - | - | - |
| | Pisidium sp. | 86 | 193 | 142 | 710 | 582 | 428 | - | - | - |
| | Sphaeriidae | 21 | 29 | 21 | 385 | 314 | 231 | 99 | 58 | 43 |
| | Sphaerium sp. | - | - | - | - | - | - | - | - | - |
| **Annelida** | Aulodrilus pigueti | - | - | - | - | - | - | - | - | - |
| | Eclipidrilus sp. | - | - | - | 49 | 44 | 32 | - | - | - |
| | Enchytraeidae | 1 | 3 | 2 | 88 | 145 | 107 | 5 | 9 | 7 |
| | Erpobdellidae | - | - | - | 21 | 29 | 22 | - | - | - |
| | Helobdella sp. | - | - | - | - | - | - | - | - | - |
| | Limnodrilus hoffmeisteri | - | - | - | - | - | - | - | - | - |
| | Lumbricina | 8 | 12 | 9 | 12 | 26 | 19 | - | - | - |
| | Lumbriculidae | - | - | - | - | - | - | 28 | 38 | 28 |
| | Nais behningi | - | - | - | - | - | - | - | - | - |
| | Nais bretscheri | - | - | - | 34 | 77 | 57 | - | - | - |
| | Nais communis | - | - | - | - | - | - | - | - | - |
| | Nais elinguis | - | - | - | - | - | - | - | - | - |
| | Nais variabilis | - | - | - | - | - | - | - | - | - |
| | Ophidonais serpentina | - | - | - | - | - | - | - | - | - |
| | Rhynchelmis rostrata | - | - | - | 170 | 180 | 133 | - | - | - |
| | Quistradrilus multisetosus | - | - | - | - | - | - | 344 | 545 | 401 |
| | Spirosperma ferox | - | - | - | 452 | 963 | 708 | - | - | - |
| | Spirosperma sp. | 128 | 123 | 91 | - | - | - | - | - | - |
| | Tubificidae w/ cap setae | 18 | 25 | 19 | 95 | 181 | 133 | 57 | 114 | 84 |

Taxa Density (orgs/m$^2$)
Reach 2, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 2 Composite Below Grace Dam | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| | Tubificidae w/o cap setae | 146 | 156 | 114 | 762 | 1,319 | 970 | 257 | 425 | 312 |
| **Acari** | Acari | 11 | 24 | 18 | 3 | 6 | 4 | - | - | - |
| | Atractides sp. | - | - | - | - | - | - | - | - | - |
| | Aturus sp. | - | - | - | - | - | - | - | - | - |
| | Corticacarus | 62 | 60 | 44 | - | - | - | - | - | - |
| | Hygrobates sp. | 1,593 | 1,699 | 1,250 | 5,470 | 5,989 | 4,406 | 3,418 | 4,627 | 3,404 |
| | Lebertia sp. | 1 | 3 | 2 | 63 | 67 | 49 | 111 | 77 | 56 |
| | Limnesiidae | - | - | - | 23 | 37 | 27 | - | - | - |
| | Oribatei | 3 | 6 | 4 | - | - | - | - | - | - |
| | Sperchon sp. | 202 | 178 | 131 | 207 | 180 | 132 | 54 | 50 | 37 |
| | Testudacarus sp. | - | - | - | - | - | - | - | - | - |
| | Torrenticola sp. | 156 | 158 | 116 | 737 | 859 | 632 | 1,324 | 1,940 | 1,427 |
| **Crustacea** | Hyalella sp. | 29 | 35 | 26 | 34 | 52 | 38 | - | - | - |
| | Ostracoda | 4,192 | 3,481 | 2,560 | 3,349 | 3,272 | 2,407 | 3,303 | 2,617 | 1,925 |
| **Other Organisms** | Hydra sp. | - | - | - | - | - | - | - | - | - |
| | Nematoda | 181 | 156 | 114 | 488 | 499 | 367 | 298 | 410 | 301 |
| | Prostoma sp. | 29 | 64 | 47 | 361 | 808 | 594 | 16 | 16 | 12 |
| | Turbellaria | 1,679 | 1,721 | 1,266 | 3,358 | 2,027 | 1,491 | 221 | 270 | 199 |
| **TOTAL** | | **16,400** | **11,197** | **8,236** | **31,927** | **17,585** | **12,935** | **11,909** | **11,587** | **8,524** |

Taxa Density (orgs/m$^2$)
Reach 3, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 3 Composite Black Canyon | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| **Ephemeroptera** | Asioplax sp. | - | - | - | - | - | - | - | - | - |
| | Baetis sp. | 29 | 29 | 22 | 7 | 16 | 12 | - | - | - |
| | Baetis tricaudatus | - | - | - | 175 | 239 | 176 | 43 | 80 | 59 |
| | Ephemerella inermis/infrequens | - | - | - | - | - | - | - | - | - |
| | Ephemerella sp. | - | - | - | - | 1 | 1 | - | - | - |
| | Fallceon quilleri | 53 | 70 | 52 | 90 | 104 | 76 | 57 | 100 | 73 |
| | Heptageniidae | - | - | - | - | - | - | - | - | - |
| | Heptagenia sp. | - | - | - | - | - | - | - | - | - |
| | Heterocloeon sp. | - | - | - | - | - | - | - | - | - |
| | Leptohyphidae | - | - | - | 14 | 14 | 10 | - | - | - |
| | Maccaffertium terminatum | - | - | - | - | - | - | - | - | - |
| | Plauditus sp. | - | - | - | - | - | - | - | - | - |
| | Stenonema terminatum | - | - | - | - | - | - | - | - | - |
| | Tricorythodes sp. | 134 | 193 | 142 | 9 | 19 | 14 | 6 | 7 | 5 |
| **Odonata** | Argia sp. | 28 | 17 | 12 | 1 | 3 | 2 | 1 | 2 | 1 |
| | Coenagrion/Enallagma sp. | - | - | - | - | - | - | - | - | - |
| | Coenagrionidae | 3 | 7 | 5 | - | 1 | 1 | 4 | 7 | 5 |
| | Gomphidae | - | - | - | - | - | - | - | - | - |
| | Ophiogomphus sp. | - | - | - | - | - | - | - | - | - |
| **Plecoptera** | Perlidae | - | - | - | - | - | - | - | - | - |
| | Perlodidae | - | - | - | - | - | - | - | - | - |
| | Zapada cinctipes | 3 | 6 | 4 | 2 | 5 | 4 | - | - | - |
| **Hemiptera** | Sigara sp. | 2 | 5 | 4 | - | - | - | 1 | 1 | 1 |
| **Coleoptera** | Agabus sp. | - | - | - | - | - | - | 1 | 1 | 1 |
| | Cleptelmis addenda | - | - | - | - | - | - | - | - | - |
| | Dubiraphia sp. | 4 | 7 | 5 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Heterlimnius sp. | - | - | - | - | - | - | 1 | 2 | 2 |
| | Microcylloepus sp. | 149 | 136 | 100 | 464 | 597 | 439 | 121 | 109 | 80 |
| | Optioservus sp. | 435 | 306 | 225 | 621 | 496 | 365 | 151 | 100 | 74 |
| | Stictotarsus sp. | - | - | - | - | - | - | - | - | - |
| **Diptera-** | Cardiocladius sp. | 1 | 2 | 2 | 38 | 49 | 36 | 8 | 14 | 11 |
| | Chironomini | 0 | 1 | 1 | - | - | - | - | - | - |
| | Cladopelma sp. | - | - | - | - | - | - | - | - | - |
| | Cladotanytarsus sp. | 17 | 19 | 14 | - | - | - | 1 | 2 | 2 |
| | Chironomidae | - | - | - | - | - | - | - | - | - |
| | Cricotopus bicinctus gr. | 2 | 5 | 4 | 7 | 15 | 11 | - | - | - |
| | Cricotopus sp. | 10 | 19 | 14 | 56 | 53 | 39 | 34 | 20 | 15 |
| | Cricotopus trifascia gr. | 46 | 43 | 32 | 60 | 58 | 43 | 13 | 21 | 16 |
| | Cryptochironomus sp. | 11 | 15 | 11 | - | - | - | - | - | - |
| | Derotanypus sp. | - | - | - | - | - | - | - | - | - |
| | Diamesa sp. | 4 | 6 | 4 | 8 | 18 | 13 | 1 | 2 | 1 |
| | Dicrotendipes sp. | 6 | 8 | 6 | 1 | 2 | 2 | 1 | 1 | 1 |
| | Eukiefferiella brehmi gr. | - | - | - | - | - | - | - | - | - |
| | Eukiefferiella coerulescens gr. | 3 | 7 | 5 | 30 | 33 | 24 | 5 | 7 | 5 |
| | Eukiefferiella devonica gr. | 9 | 8 | 6 | 97 | 118 | 87 | 26 | 42 | 31 |
| | Eukiefferiella gracei gr. | - | - | - | - | - | - | - | - | - |
| | Lopescladius (Cordiella) sp. | - | - | - | - | - | - | - | - | - |
| | Micropsectra sp. | 16 | 35 | 26 | - | 1 | 1 | - | - | - |
| | Micropsectra/Tanytarsus sp. | 5 | 6 | 5 | - | 1 | 1 | - | - | - |

Taxa Density (orgs/$m^2$)
Reach 3, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 3 Composite Black Canyon | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| Chironomidae | Microtendipes pedellus gr. | 24 | 23 | 17 | 1 | 2 | 2 | 1 | 1 | 1 |
| | Nanocladius sp. | - | - | - | - | - | - | - | - | - |
| | Orthocladiinae | - | - | - | 17 | 19 | 14 | - | - | - |
| | Orthocladius (Euortho.) rivicola gr. | 9 | 21 | 15 | 1 | 2 | 2 | - | - | - |
| | Orthocladius (Euortho.) rivulorum | 196 | 151 | 111 | 564 | 644 | 474 | 174 | 270 | 198 |
| | Orthocladius (Euortho.) rivulorum gr. | - | - | - | 10 | 14 | 10 | - | - | - |
| | Orthocladius (Euorthocladius) sp. | 2 | 5 | 4 | 15 | 20 | 15 | - | - | - |
| | Orthocladius Complex | 83 | 63 | 46 | 156 | 158 | 116 | - | - | - |
| | Orthocladius sp. | 574 | 504 | 371 | 567 | 584 | 429 | 441 | 444 | 327 |
| | Parakiefferiella sp. | 35 | 30 | 22 | 7 | 6 | 5 | 13 | 12 | 9 |
| | Parametriocnemus sp. | - | - | - | - | - | - | - | - | - |
| | Paratanytarsus sp. | - | - | - | - | - | - | - | - | - |
| | Paratendipes sp. | 3 | 7 | 5 | - | - | - | - | - | - |
| | Pentaneura sp. | - | - | - | - | - | - | - | - | - |
| | Pentaneurini | - | - | - | - | - | - | - | - | - |
| | Phaenopsectra sp. | - | - | - | - | - | - | - | - | - |
| | Polypedilum sp. | 3 | 7 | 5 | 7 | 15 | 11 | 4 | 7 | 5 |
| | Potthastia longimana gr. | - | - | - | - | - | - | - | - | - |
| | Pseudochironomus sp. | 226 | 196 | 144 | 775 | 699 | 514 | 61 | 60 | 44 |
| | Rheocricotopus sp. | - | - | - | 8 | 18 | 13 | - | - | - |
| | Rheotanytarsus sp. | 8 | 7 | 6 | 28 | 50 | 37 | 24 | 34 | 25 |
| | Sublettea sp. | - | - | - | - | - | - | - | - | - |
| | Tanytarsini | - | - | - | - | - | - | - | - | - |
| | Tanytarsus sp. | 3 | 7 | 5 | 0 | 1 | 1 | - | - | - |
| | Thienemanniella sp. | 2 | 5 | 4 | - | - | - | 1 | 1 | 1 |
| | Thienemannimyia gr. sp. | 10 | 13 | 10 | 1 | 1 | 1 | 11 | 13 | 9 |
| | Tvetenia bavarica gr. | - | - | - | - | - | - | - | - | - |
| | Tvetenia discoloripes gr. | - | - | - | - | - | - | 4 | 7 | 5 |
| | Xenochironomus xenolabis | - | - | - | - | - | - | - | - | - |
| Diptera | Bezzia/Palpomyia sp. | 150 | 138 | 102 | 14 | 17 | 12 | 25 | 42 | 31 |
| | Caloparyphus sp. | - | - | - | - | - | - | - | - | - |
| | Ceratopogoninae | - | - | - | - | - | - | - | - | - |
| | Diptera | - | - | - | - | - | - | - | - | - |
| | Empididae | - | - | - | - | - | - | - | - | - |
| | Ephydridae | - | - | - | - | - | - | - | - | - |
| | Hemerodromia sp. | 97 | 67 | 49 | 89 | 67 | 49 | 40 | 38 | 28 |
| | Muscidae | - | - | - | - | - | - | 1 | 2 | 1 |
| | Neoplasta sp. | - | - | - | - | - | - | - | - | - |
| | Probezzia sp. | - | - | - | - | - | - | 2 | 4 | 3 |
| | Simuliidae | - | - | - | - | - | - | - | - | - |
| | Simulium sp. | 125 | 154 | 113 | 221 | 288 | 212 | 76 | 127 | 93 |
| | Stratiomyidae | - | - | - | - | - | - | - | - | - |
| | Tipula sp. | 2 | 5 | 4 | - | - | - | 4 | 7 | 5 |
| | Tipulidae | - | - | - | - | - | - | - | - | - |
| | Amiocentrus aspilus | - | - | - | - | - | - | - | - | - |
| | Brachycentrus occidentalis | - | - | - | - | - | - | - | - | - |
| | Cheumatopsyche sp. | 88 | 87 | 64 | 272 | 307 | 226 | 147 | 165 | 121 |
| | Chimarra sp. | 59 | 65 | 48 | 327 | 464 | 341 | 85 | 117 | 86 |
| | Culoptila sp. | - | - | - | - | - | - | - | - | - |

Taxa Density (orgs/m$^2$)
Reach 3, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 3 Composite Black Canyon | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| Trichoptera | Glossosomatidae | - | - | - | - | - | - | - | - | - |
| | Helicopsyche sp. | 67 | 69 | 51 | 156 | 169 | 125 | 36 | 11 | 8 |
| | Hydropsyche sp. | 21 | 20 | 15 | 740 | 936 | 689 | 118 | 152 | 112 |
| | Hydropsychidae | - | - | - | 19 | 34 | 25 | - | - | - |
| | Hydroptila sp. | 52 | 43 | 32 | 12 | 16 | 12 | 22 | 25 | 18 |
| | Hydroptilidae | - | - | - | 4 | 7 | 5 | - | - | - |
| | Leptoceridae | - | - | - | 1 | 2 | 2 | - | - | - |
| | Limnephilidae | - | - | - | - | - | - | - | - | - |
| | Mayatrichia sp. | 10 | 19 | 14 | - | - | - | - | - | - |
| | Nectopsyche sp. | 41 | 44 | 32 | 2 | 4 | 3 | 4 | 7 | 5 |
| | Neotrichia sp. | 13 | 17 | 12 | 7 | 15 | 11 | - | - | - |
| | Oecetis avara | 230 | 184 | 135 | 192 | 179 | 131 | 38 | 20 | 14 |
| | Oecetis sp. | - | - | - | - | - | - | - | - | - |
| | Oxyethira sp. | - | - | - | - | - | - | - | - | - |
| | Polycentropus sp. | - | - | - | - | - | - | 1 | 1 | 1 |
| | Protoptila sp. | 26 | 38 | 28 | 94 | 153 | 113 | 7 | 6 | 5 |
| Lepidoptera | Petrophila sp. | 267 | 188 | 138 | 767 | 722 | 531 | 340 | 246 | 181 |
| Gastropoda | Fluminicola sp. | 4 | 10 | 7 | - | - | - | - | - | - |
| | Gyraulus sp. | - | - | - | - | - | - | - | - | - |
| | Hydrobiidae | - | - | - | - | - | - | - | - | - |
| | Lymnaeidae | 7 | 8 | 6 | - | 1 | 1 | - | - | - |
| | Physa sp. | - | - | - | - | - | - | - | - | - |
| | Planorbidae | - | - | - | - | - | - | - | - | - |
| | Potamopyrgus antipodarum | - | - | - | - | - | - | 1 | 2 | 2 |
| | Pyrgulopsis sp. | - | - | - | - | - | - | - | - | - |
| | Valvata sp. | - | - | - | - | - | - | - | - | - |
| Bivalvia | Anodonta sp. | - | - | - | - | - | - | - | - | - |
| | Pisidium sp. | 0 | 1 | 1 | 2 | 5 | 4 | - | - | - |
| | Sphaeriidae | - | - | - | - | - | - | 1 | 2 | 2 |
| | Sphaerium sp. | - | - | - | - | - | - | 18 | 37 | 27 |
| Annelida | Aulodrilus pigueti | - | - | - | - | - | - | - | - | - |
| | Eclipidrilus sp. | 30 | 56 | 41 | 3 | 5 | 4 | - | - | - |
| | Enchytraeidae | 3 | 6 | 4 | 24 | 53 | 39 | - | - | - |
| | Erpobdellidae | 30 | 27 | 20 | - | - | - | - | - | - |
| | Helobdella sp. | 12 | 22 | 16 | - | - | - | - | - | - |
| | Limnodrilus hoffmeisteri | - | - | - | - | - | - | - | - | - |
| | Lumbricina | 4 | 6 | 4 | 1 | 2 | 2 | - | - | - |
| | Lumbriculidae | - | - | - | - | - | - | - | - | - |
| | Nais behningi | 2 | 5 | 4 | - | - | - | - | - | - |
| | Nais bretscheri | 4 | 10 | 7 | 9 | 15 | 11 | - | - | - |
| | Nais communis | - | - | - | - | - | - | - | - | - |
| | Nais elinguis | - | - | - | - | - | - | - | - | - |
| | Nais variabilis | - | - | - | - | - | - | - | - | - |
| | Ophidonais serpentina | - | - | - | - | - | - | - | - | - |
| | Rhynchelmis rostrata | - | - | - | - | - | - | - | - | - |
| | Quistradrilus multisetosus | - | - | - | - | - | - | 7 | 15 | 11 |
| | Spirosperma ferox | - | - | - | 3 | 7 | 5 | - | - | - |
| | Spirosperma sp. | 19 | 26 | 19 | - | - | - | - | - | - |
| | Tubificidae w/ cap setae | 12 | 20 | 15 | - | - | - | 2 | 4 | 3 |

Taxa Density (orgs/$m^2$)
Reach 3, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 3 Composite Black Canyon | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| | Tubificidae w/o cap setae | 6 | 14 | 10 | 1 | 2 | 2 | 2 | 4 | 3 |
| **Acari** | Acari | - | - | - | - | - | - | - | - | - |
| | Atractides sp. | - | - | - | - | - | - | - | - | - |
| | Aturus sp. | - | - | - | - | - | - | - | - | - |
| | Corticacarus | 25 | 14 | 10 | - | - | - | - | - | - |
| | Hygrobates sp. | 1,026 | 715 | 526 | 867 | 1,002 | 737 | 401 | 369 | 271 |
| | Lebertia sp. | 11 | 9 | 6 | 1 | 3 | 2 | 2 | 4 | 3 |
| | Limnesiidae | - | - | - | 25 | 24 | 17 | - | - | - |
| | Oribatei | - | - | - | - | - | - | - | - | - |
| | Sperchon sp. | 162 | 125 | 92 | 296 | 352 | 259 | 142 | 156 | 115 |
| | Testudacarus sp. | - | - | - | - | - | - | - | - | - |
| | Torrenticola sp. | 202 | 107 | 78 | 242 | 238 | 175 | 131 | 129 | 95 |
| **Crustacea** | Hyalella sp. | - | - | - | - | - | - | - | - | - |
| | Ostracoda | 136 | 159 | 117 | 36 | 39 | 28 | 234 | 220 | 162 |
| **Other Organisms** | Hydra sp. | - | - | - | 8 | 18 | 13 | - | - | - |
| | Nematoda | 45 | 33 | 24 | 28 | 32 | 23 | 51 | 66 | 48 |
| | Prostoma sp. | 58 | 65 | 47 | 123 | 132 | 97 | 10 | 17 | 12 |
| | Turbellaria | 196 | 124 | 92 | 192 | 196 | 144 | 5 | 7 | 5 |
| | **TOTAL** | **5,391** | **3,391** | **2,494** | **8,618** | **8,306** | **6,110** | **3,644** | **2,698** | **1,985** |

Taxa Density (orgs/m$^2$)
Reach 4, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 4 Composite Above Grace Power Plant | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| **Ephemeroptera** | Asioplax sp. | - | - | - | - | - | - | - | - | - |
| | Baetis sp. | - | - | - | 490 | 595 | 438 | - | - | - |
| | Baetis tricaudatus | 132 | 181 | 133 | 631 | 764 | 562 | 129 | 86 | 63 |
| | Ephemerella inermis/infrequens | - | - | - | - | - | - | - | - | - |
| | Ephemerella sp. | - | - | - | 30 | 41 | 30 | - | - | - |
| | Fallceon quilleri | - | - | - | 37 | 51 | 37 | - | - | - |
| | Heptageniidae | - | - | - | - | - | - | - | - | - |
| | Heptagenia sp. | - | - | - | - | - | - | - | - | - |
| | Heterocloeon sp. | - | - | - | - | - | - | - | - | - |
| | Leptohyphidae | - | - | - | - | - | - | - | - | - |
| | Maccaffertium terminatum | - | - | - | - | - | - | - | - | - |
| | Plauditus sp. | - | - | - | - | - | - | - | - | - |
| | Stenonema terminatum | - | - | - | - | - | - | - | - | - |
| | Tricorythodes sp. | 79 | 139 | 102 | - | - | - | 21 | 43 | 32 |
| **Odonata** | Argia sp. | - | - | - | - | - | - | - | - | - |
| | Coenagrion/Enallagma sp. | 19 | 43 | 32 | - | - | - | - | - | - |
| | Coenagrionidae | - | - | - | 59 | 132 | 97 | - | - | - |
| | Gomphidae | - | - | - | - | - | - | - | - | - |
| | Ophiogomphus sp. | - | - | - | - | - | - | - | - | - |
| **Plecoptera** | Perlidae | - | - | - | - | - | - | - | - | - |
| | Perlodidae | - | - | - | - | - | - | - | - | - |
| | Zapada cinctipes | - | - | - | - | - | - | - | - | - |
| **Hemiptera** | Sigara sp. | - | - | - | - | - | - | - | - | - |
| **Coleoptera** | Agabus sp. | - | - | - | - | - | - | - | - | - |
| | Cleptelmis addenda | - | - | - | - | - | - | - | - | - |
| | Dubiraphia sp. | - | - | - | - | - | - | - | - | - |
| | Heterlimnius sp. | - | - | - | - | - | - | - | - | - |
| | Microcylloepus sp. | 317 | 425 | 313 | 936 | 1,159 | 852 | 65 | 83 | 61 |
| | Optioservus sp. | 162 | 191 | 140 | 104 | 121 | 89 | - | - | - |
| | Stictotarsus sp. | - | - | - | - | - | - | - | - | - |
| **Diptera-** | Cardiocladius sp. | 462 | 430 | 316 | 292 | 314 | 231 | 86 | 99 | 73 |
| | Chironomini | - | - | - | - | - | - | - | - | - |
| | Cladopelma sp. | - | - | - | - | - | - | - | - | - |
| | Cladotanytarsus sp. | 35 | 77 | 57 | - | - | - | - | - | - |
| | Chironomidae | - | - | - | - | - | - | - | - | - |
| | Cricotopus bicinctus gr. | - | - | - | 93 | 150 | 110 | - | - | - |
| | Cricotopus sp. | - | - | - | 160 | 151 | 111 | 107 | 215 | 158 |
| | Cricotopus trifascia gr. | 621 | 241 | 177 | 880 | 593 | 436 | 1,013 | 1,042 | 767 |
| | Cryptochironomus sp. | - | - | - | - | - | - | - | - | - |
| | Derotanypus sp. | - | - | - | 17 | 38 | 28 | - | - | - |
| | Diamesa sp. | 15 | 33 | 24 | - | - | - | - | - | - |
| | Dicrotendipes sp. | - | - | - | - | - | - | - | - | - |
| | Eukiefferiella brehmi gr. | 23 | 51 | 37 | 206 | 335 | 246 | - | - | - |
| | Eukiefferiella coerulescens gr. | 64 | 144 | 106 | 261 | 501 | 369 | - | - | - |
| | Eukiefferiella devonica gr. | 99 | 102 | 75 | 2,069 | 2,724 | 2,004 | 194 | 177 | 130 |
| | Eukiefferiella gracei gr. | - | - | - | 34 | 77 | 57 | - | - | - |
| | Lopescladius (Cordiella) sp. | - | - | - | - | - | - | - | - | - |
| | Micropsectra sp. | - | - | - | 17 | 38 | 28 | - | - | - |
| | Micropsectra/Tanytarsus sp. | - | - | - | 17 | 38 | 28 | - | - | - |

Taxa Density (orgs/$m^2$)
Reach 4, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 4 Composite Above Grace Power Plant | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| Chironomidae | Microtendipes pedellus gr. | 54 | 79 | 58 | 12 | 28 | 20 | - | - | - |
| | Nanocladius sp. | - | - | - | - | - | - | - | - | - |
| | Orthocladiinae | - | - | - | - | - | - | - | - | - |
| | Orthocladius (Euortho.) rivicola gr. | 30 | 66 | 49 | 12 | 28 | 20 | - | - | - |
| | Orthocladius (Euortho.) rivulorum | 380 | 369 | 272 | 935 | 905 | 666 | 906 | 1,371 | 1,008 |
| | Orthocladius (Euortho.) rivulorum gr. | - | - | - | - | - | - | - | - | - |
| | Orthocladius (Euorthocladius) sp. | 354 | 446 | 328 | 621 | 599 | 440 | 43 | 86 | 64 |
| | Orthocladius Complex | 746 | 465 | 342 | 1,012 | 1,214 | 893 | - | - | - |
| | Orthocladius sp. | 3,327 | 2,870 | 2,111 | 910 | 801 | 589 | 604 | 698 | 514 |
| | Parakiefferiella sp. | 129 | 287 | 211 | 107 | 160 | 118 | 43 | 86 | 64 |
| | Parametriocnemus sp. | - | - | - | - | - | - | - | - | - |
| | Paratanytarsus sp. | - | - | - | - | - | - | - | - | - |
| | Paratendipes sp. | - | - | - | - | - | - | - | - | - |
| | Pentaneura sp. | - | - | - | - | - | - | - | - | - |
| | Pentaneurini | - | - | - | 12 | 28 | 20 | - | - | - |
| | Phaenopsectra sp. | - | - | - | - | - | - | - | - | - |
| | Polypedilum sp. | - | - | - | 94 | 167 | 123 | - | - | - |
| | Potthastia longimana gr. | - | - | - | - | - | - | - | - | - |
| | Pseudochironomus sp. | 420 | 256 | 188 | 3,280 | 4,723 | 3,474 | 280 | 341 | 251 |
| | Rheocricotopus sp. | - | - | - | 195 | 278 | 204 | - | - | - |
| | Rheotanytarsus sp. | 23 | 51 | 37 | 394 | 431 | 317 | 258 | 187 | 137 |
| | Sublettea sp. | - | - | - | - | - | - | - | - | - |
| | Tanytarsini | - | - | - | 20 | 44 | 32 | - | - | - |
| | Tanytarsus sp. | - | - | - | - | - | - | - | - | - |
| | Thienemanniella sp. | - | - | - | 17 | 38 | 28 | - | - | - |
| | Thienemannimyia gr. sp. | 35 | 77 | 57 | - | - | - | - | - | - |
| | Tvetenia bavarica gr. | - | - | - | - | - | - | - | - | - |
| | Tvetenia discoloripes gr. | - | - | - | 76 | 128 | 94 | 43 | 86 | 64 |
| | Xenochironomus xenolabis | 15 | 33 | 24 | - | - | - | - | - | - |
| Diptera | Bezzia/Palpomyia sp. | 64 | 88 | 65 | 52 | 115 | 85 | 43 | 86 | 64 |
| | Caloparyphus sp. | 271 | 289 | 212 | - | - | - | - | - | - |
| | Ceratopogoninae | - | - | - | - | - | - | - | - | - |
| | Diptera | - | - | - | 34 | 77 | 57 | - | - | - |
| | Empididae | - | - | - | - | - | - | - | - | - |
| | Ephydridae | - | - | - | - | - | - | - | - | - |
| | Hemerodromia sp. | 178 | 268 | 197 | 365 | 283 | 208 | 21 | 43 | 32 |
| | Muscidae | - | - | - | 59 | 132 | 97 | - | - | - |
| | Neoplasta sp. | - | - | - | - | - | - | - | - | - |
| | Probezzia sp. | - | - | - | - | - | - | - | - | - |
| | Simuliidae | - | - | - | 17 | 38 | 28 | - | - | - |
| | Simulium sp. | 514 | 518 | 381 | 2,791 | 1,956 | 1,439 | 820 | 652 | 480 |
| | Stratiomyidae | - | - | - | 165 | 249 | 183 | 215 | 111 | 82 |
| | Tipula sp. | - | - | - | - | - | - | - | - | - |
| | Tipulidae | - | - | - | - | - | - | - | - | - |
| | Amiocentrus aspilus | 34 | 48 | 35 | 20 | 44 | 32 | - | - | - |
| | Brachycentrus occidentalis | - | - | - | - | - | - | - | - | - |
| | Cheumatopsyche sp. | - | - | - | - | - | - | - | - | - |
| | Chimarra sp. | - | - | - | 400 | 772 | 568 | - | - | - |
| | Culoptila sp. | - | - | - | - | - | - | - | - | - |

Taxa Density (orgs/$m^2$)
Reach 4, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 4 Composite Above Grace Power Plant | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) | Ave./($m^2$) | STDEV | CI (0.10) |
| Trichoptera | Glossosomatidae | - | - | - | 17 | 38 | 28 | - | - | - |
| | Helicopsyche sp. | - | - | - | - | - | - | - | - | - |
| | Hydropsyche sp. | - | - | - | - | - | - | - | - | - |
| | Hydropsychidae | - | - | - | - | - | - | - | - | - |
| | Hydroptila sp. | - | - | - | 148 | 251 | 185 | - | - | - |
| | Hydroptilidae | 142 | 196 | 144 | 437 | 467 | 344 | - | - | - |
| | Leptoceridae | - | - | - | - | - | - | - | - | - |
| | Limnephilidae | - | - | - | - | - | - | - | - | - |
| | Mayatrichia sp. | - | - | - | - | - | - | - | - | - |
| | Nectopsyche sp. | 23 | 51 | 37 | - | - | - | 43 | 86 | 64 |
| | Neotrichia sp. | - | - | - | 94 | 167 | 123 | - | - | - |
| | Oecetis avara | - | - | - | - | - | - | 43 | 86 | 64 |
| | Oecetis sp. | - | - | - | - | - | - | - | - | - |
| | Oxyethira sp. | - | - | - | - | - | - | - | - | - |
| | Polycentropus sp. | - | - | - | - | - | - | - | - | - |
| | Protoptila sp. | - | - | - | - | - | - | - | - | - |
| Lepidoptera | Petrophila sp. | - | - | - | - | - | - | - | - | - |
| Gastropoda | Fluminicola sp. | 2,253 | 1,349 | 992 | 57 | 83 | 61 | 1,010 | 552 | 406 |
| | Gyraulus sp. | 361 | 533 | 392 | - | - | - | - | - | - |
| | Hydrobiidae | - | - | - | 75,322 | 62,314 | 45,838 | - | - | - |
| | Lymnaeidae | - | - | - | - | - | - | - | - | - |
| | Physa sp. | 424 | 676 | 497 | - | - | - | - | - | - |
| | Planorbidae | - | - | - | - | - | - | - | - | - |
| | Potamopyrgus antipodarum | 69,803 | 47,665 | 35,063 | 4,511 | 5,183 | 3,813 | 80,929 | 37,310 | 27,445 |
| | Pyrgulopsis sp. | - | - | - | - | - | - | 1,846 | 1,704 | 1,253 |
| | Valvata sp. | - | - | - | - | - | - | - | - | - |
| Bivalvia | Anodonta sp. | - | - | - | - | - | - | - | - | - |
| | Pisidium sp. | 206 | 296 | 218 | 269 | 420 | 309 | - | - | - |
| | Sphaeriidae | 15 | 33 | 24 | 72 | 128 | 94 | 366 | 203 | 149 |
| | Sphaerium sp. | - | - | - | - | - | - | - | - | - |
| Annelida | Aulodrilus pigueti | - | - | - | - | - | - | - | - | - |
| | Eclipidrilus sp. | 414 | 420 | 309 | 210 | 382 | 281 | - | - | - |
| | Enchytraeidae | - | - | - | 17 | 38 | 28 | - | - | - |
| | Erpobdellidae | 39 | 87 | 64 | - | - | - | - | - | - |
| | Helobdella sp. | - | - | - | - | - | - | - | - | - |
| | Limnodrilus hoffmeisteri | - | - | - | - | - | - | - | - | - |
| | Lumbricina | - | - | - | - | - | - | - | - | - |
| | Lumbriculidae | - | - | - | - | - | - | 64 | 128 | 94 |
| | Nais behningi | - | - | - | - | - | - | - | - | - |
| | Nais bretscheri | - | - | - | - | - | - | - | - | - |
| | Nais communis | - | - | - | - | - | - | - | - | - |
| | Nais elinguis | - | - | - | - | - | - | - | - | - |
| | Nais variabilis | 19 | 43 | 32 | - | - | - | - | - | - |
| | Ophidonais serpentina | - | - | - | - | - | - | - | - | - |
| | Rhynchelmis rostrata | - | - | - | - | - | - | - | - | - |
| | Quistradrilus multisetosus | - | - | - | - | - | - | - | - | - |
| | Spirosperma ferox | - | - | - | - | - | - | - | - | - |
| | Spirosperma sp. | 19 | 43 | 32 | - | - | - | - | - | - |
| | Tubificidae w/ cap setae | - | - | - | - | - | - | - | - | - |

Taxa Density (orgs/m$^2$)
Reach 4, Bear River, ID

| 2005-2007 Master Taxa List | | Reach 4 Composite Above Grace Power Plant | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | | | 2006 | | | 2007 | | |
| | | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) | Ave./(m$^2$) | STDEV | CI (0.10) |
| | Tubificidae w/o cap setae | - | - | - | - | - | - | - | - | - |
| Acari | Acari | 23 | 51 | 37 | - | - | - | - | - | - |
| | Atractides sp. | 35 | 77 | 57 | 76 | 128 | 94 | - | - | - |
| | Aturus sp. | - | - | - | - | - | - | - | - | - |
| | Corticacarus | 65 | 100 | 73 | - | - | - | - | - | - |
| | Hygrobates sp. | 2,350 | 1,274 | 937 | 368 | 245 | 180 | 388 | 207 | 152 |
| | Lebertia sp. | - | - | - | - | - | - | - | - | - |
| | Limnesiidae | - | - | - | 20 | 44 | 32 | - | - | - |
| | Oribatei | - | - | - | - | - | - | - | - | - |
| | Sperchon sp. | 157 | 206 | 151 | 1,035 | 1,279 | 941 | 775 | 413 | 304 |
| | Testudacarus sp. | 35 | 77 | 57 | - | - | - | - | - | - |
| | Torrenticola sp. | - | - | - | 54 | 79 | 58 | 65 | 83 | 61 |
| Crustacea | Hyalella sp. | - | - | - | - | - | - | - | - | - |
| | Ostracoda | 225 | 246 | 181 | 497 | 365 | 268 | 474 | 502 | 369 |
| Other Organisms | Hydra sp. | - | - | - | - | - | - | - | - | - |
| | Nematoda | 171 | 215 | 159 | - | - | - | - | - | - |
| | Prostoma sp. | 79 | 139 | 102 | 20 | 44 | 32 | - | - | - |
| | Turbellaria | 744 | 816 | 601 | 2,971 | 3,111 | 2,288 | 1,358 | 1,131 | 832 |
| **TOTAL** | | **86,201** | **54,547** | **40,125** | **104,131** | **80,545** | **59,249** | **92,254** | **41,822** | **30,764** |