Susitna-Watana Hydroelectric Project
(FERC No. 14241)

River Productivity Study
(Study 9.8)

2013 Initial River Productivity Results
Technical Memorandum

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

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September 2014

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LIST OF ACRONYMS AND SCIENTIFIC LABELS

Abbreviation	Definition
$\delta^{13}C$	Carbon-13 isotopic signature, reported in parts per thousand (per mil, ‰)
‰	parts per thousand (per mil
ADF&G	Alaska Department of Fish and Game
AEA	Alaska Energy Authority
ANOVA	Analysis of Variance
BMI	benthic macroinvertebrates
EPT	Ephemeroptera, Plecoptera, and Trichoptera, insect orders of typically sensitive taxa
FA	Focus Areas
FERC	Federal Energy Regulatory Commission
FL	Fork length
ft^3	cubic foot (feet)
g	gram
H’	Shannon-Wiener diversity index, calculated to represent diversity
HCl	Hydrochloric acid
HD	Hester-Dendy, multiplate sampler
HSC	habitat suitability curve
ILP	Integrated Licensing Process
IP	Implementation Plan
ISR	Initial Study Report
J	joule
J’	Pielou’s J’, an index of community evenness
m^2	square meter(s)
MANCOVA	Multivariate analysis of covariance
MixSIAR	A Bayesian stable isotope mixing model
mm	millimeter(s)
NAWQA	National Water-Quality Assessment
OM	organic matter
P	P-value or calculated probability. The estimated probability of rejecting the null hypothesis (H0) of a study question when that hypothesis is true.
PIT-tag	Passive Integrated Transponder tags used to individually identify animals and monitor their movements.
QA/QC	quality assurance/quality control
RP	River Productivity
RSP	Revised Study Plan
SIA	stable isotope analysis
SPD	Study Plan Determination
TKA	Talkeetna River
UAF	University of Alaska Fairbanks

Abbreviation	Definition
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1. INTRODUCTION

Following the first study season in 2013, FERC's regulations for the Integrated Licensing Process (ILP) required AEA to "prepare and file with the Commission an initial study report describing its overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule." (18 CFR 5.15(c)(1)) The Initial Study Report (ISR) on River Productivity (RP) was prepared in accordance with FERC's ILP regulations and detailed AEA's status in implementing the study, as set forth in the FERC-approved Revised Study Plan (RSP), the Implementation Plan (IP), and as modified by FERC's April 1 SPD (collectively referred to herein as the "Study Plan").

At the time of submission of the ISR, laboratory results of the samples collected during the 2013 field collection efforts were still pending. Thus, the purpose of this technical memorandum is to provide a preliminary review and summary of 2013 results based on laboratory data received after the ISR submittal in June 2014. While data analyses and data collection are still ongoing, this technical memorandum provides preliminary results based on one year of study for five of the eight study objectives to be completed. Those objectives are:

- Characterize the pre-Project benthic macroinvertebrate and algal communities with regard to species composition and abundance in the Middle and Lower Susitna River.
- Estimate drift of benthic macroinvertebrates in selected habitats within the Middle and Lower Susitna River to assess food availability to juvenile and resident fishes.
- Conduct a trophic analysis to describe the food web relationships within the current riverine community within the Middle and Lower Susitna River.
- Characterize the invertebrate compositions in the diets of representative fish species in relationship to their source (benthic or drift component).
- Estimate benthic macroinvertebrate colonization rates in the Middle Susitna Segment under pre-Project baseline conditions to assist in evaluating future post-Project changes to productivity in the Middle Susitna River.

Data analyses on the remaining study objectives are still in progress. These include:

- Conduct a feasibility study in 2013 to evaluate the suitability of using reference sites on the Talkeetna River to monitor long-term Project-related change in benthic productivity.
- Develop habitat suitability criteria for Susitna benthic macroinvertebrate and algal habitats to predict potential change in these habitats downstream of the proposed dam site.
- Characterize organic matter resources (e.g., available for macroinvertebrate consumers) including coarse particulate organic matter, fine particulate organic matter, and suspended organic matter in the Middle and Lower Susitna River.

Preliminary results for the Talkeetna River sites are provided in this technical memorandum, but more analysis is necessary to evaluate their comparability with study sites sampled on the

Susitna River. This analysis, as well as results regarding the additional objectives above, will be included in the USR. Development of the habitat suitability criteria (HSC) is dependent on completion of metric calculations for benthic macroinvertebrates, algae, drift, and analyzing those metrics with the environmental data that was collected in the field. The HSC analysis is in progress and there are no results to report on at this time. Organic matter was analyzed by utilizing the sorted debris from processed invertebrate samples. The laboratory analyses of these fractions was conducted after the completion of the invertebrate sample processing. Final data sets were delivered in July 2014, therefore data QA/QC and analysis is currently in progress at this time.

2. METHODS

Field methods for all 2013 study activities were presented in the Initial Study Report (AEA 2014, Study 9.8) and are not repeated in this technical memo. The methods presented below are intended to supplement the methods presented in the ISR by describing the sample processing and analytical methods applied to 2013 data collections. These supplemental methods are presented below by study objective.

2.1. Characterization of benthic macroinvertebrate and algal communities

Benthic macroinvertebrate sampling was conducted at five stations located in the Middle Segment and upper portion of the Lower Segment on the Susitna River (Figures 2.1-1 and 2.1-2). Benthic macroinvertebrate replicate samples were stored in individual containers and immediately preserved in the field with 95 percent ethanol (non-denatured). Samples were shipped to and processed by Ecoanalysts, Inc. (Moscow, Idaho) using sample processing protocols established by the USEPA for the Rapid Bioassessment Protocols (Barbour et al. 1999) and modified for use in Alaska (Major and Barbour 2001). Organic matter (OM) content from processed subsampled material was retained and analyzed by size (coarse and fine particulate OM).

The taxonomic composition of each sample was used to generate a taxa-abundance matrix. The matrix was reviewed and adjusted for different levels of taxonomy. When identifying macroinvertebrates, some specimens were either too immature or too damaged for identification at the genus-level, and could only be assigned to a higher taxonomic level (e.g., family, subfamily, order). For instance, a sample may contain individuals identifiable only to the mayfly family Baetidae, yet also contain individuals clearly identified to one or more genera within this family (e.g., *Baetis tricaudatus*, *Diphetor hageni*). This situation can lead to inflated estimates of the number of taxa in a sample.

To prevent the inflation of metrics, the abundances of these “parent” taxa were distributed proportionately among their composite taxa. This apportioning is similar to the method used by the USGS NAWQA studies to correct for “ambiguous taxa” (Cuffney et al. 1997). The abundances of “parent” taxa (orders, families) were retained in analysis when there were no composite taxa identified in the sample.

After applying the corrective measures used in preparing the taxa-abundance matrix, the data were used to calculate a number of descriptive metrics commonly used in aquatic ecological studies. These metrics were classified as abundance measures, richness measures, composition measures, and functional feeding groups.

2.1.1. Abundance Measures

Macroinvertebrate abundance is represented by *density*, which is the total number of individuals collected in a unit area. Subsample enumerations were expanded to provide a density estimate (individuals/m^2) for each sample.

2.1.2. Richness Measures

Metrics used to describe macroinvertebrate species richness include: taxa richness, Ephemeroptera Plecoptera Trichoptera (EPT) richness, diversity, and evenness.

Taxa richness is the number of different types, or taxa, of invertebrates occurring in a given ecosystem or sample. It is important to discern the two different taxa richness values generated for this report:

> The *mean taxa richness* is the average number of taxa collected from the four samples collected at a site, not the site's total taxa richness. By averaging the taxa richness of the samples, the influence of rare taxa is minimized, thus reducing the taxa richness score.
>
> The *total taxa richness* for a site is simply a tally of all taxa collected at a site, utilizing all collected samples. Thus, the occurrence of rare taxa is given a weight equal to common taxa. As a result, total taxa richness indicates larger estimates of taxa richness than mean taxa richness. While total taxa richness may not lend itself to statistical analysis in the short-term study, it provides a measure of contrast between sites, and may become statistically useful in the long-term program.

EPT richness is the number of taxa from the insect orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). Following protocols from numerous state and federal agencies, taxa richness values were calculated separately for each order. Both mean and total EPT taxa richness values were determined.

Chironomid taxa richness is the number of taxa from the insect family Chironomidae (midges, Order = Diptera). Because Chironomidae are typically dominant in Alaskan streams (Oswood 1989), identifications were made to genus level to fully reflect the taxonomic richness in the Susitna River. This metric reflects the contribution of chironomids to the taxa richness measure.

Ecological diversity is a measure of community structure defined by the relationship between the number of distinct taxa and their relative abundance. The *Shannon-Wiener diversity index* (H') was calculated (log e) to represent diversity. This index usually lies between 1.5 and 3.5 for ecological data. Higher index numbers indicate greater diversity, and the presence of a complex ecological community. Diversity usually decreases with impaired habitat or water quality, or increased disturbance. *Pielou's J'*, an index of community evenness, was also calculated. Values range from 0 to 1.0. Higher values indicate a more even spread in the community.

2.1.3. Composition Measures

The relative abundance of major taxonomic groups provides information on a stream community's structure and the relative contribution of the populations to the total fauna (Barbour et al. 1999). Eight major taxonomic groups were used to describe the community structure in our analysis: Ephemeroptera, Plecoptera, Trichoptera, Coleoptera (beetles), Chironomidae (midges), Diptera (true flies other than midges), Other Insects, and Non-insects. Composition measures of certain taxonomic groups are often used as indicators of impairment in streams. For example, an increase in the relative abundance of Chironomidae or non-insect taxa, or a decrease in the relative abundance of Plecoptera or Trichoptera, may indicate environmental stress in a stream. For plankton tow samples (Section 3 of this report), zooplankton were broken out from Non-insects, due to their importance to those samples.

The *EPT:Chironomid ratio* is a ratio of the abundance of Ephemeroptera, Plecoptera, Trichoptera in relation to chironomids. The ratio ranges from 0 to 1, with scores below 0.5 indicating more Chironomidae in the community.

The *percent dominant taxa* metric is the relative abundance of the most abundant taxa in a sample: the most abundant taxon, and the top three most abundant taxa, were calculated. Disturbances usually cause the abundance of a few taxa to increase and an elevation of the percent dominance of the most abundant taxa.

2.1.4. Functional Feeding Groups

Benthic macroinvertebrate taxa abundances were allocated into functional-feeding group categories according to their preferred methods of gathering food, based on determinations of the primary feeding mechanism by Barbour et al. (1999). The major functional-feeding groups used in our analysis were: collector-gatherers, collector-filterers, scrapers, shredders, predators, and parasites as defined by Cummins et al. (2008). All other functional feeding groups, and any individuals with unclassified or unknown feeding mechanisms, were consolidated into a seventh group, "Others." Data are presented as a percent of the total sample abundance.

2.2. Benthic Macroinvertebrate Drift Estimation

Invertebrate drift and plankton tow samples were shipped to and processed by Ecoanalysts, Inc. (Moscow, Idaho) using methods similar to those used for benthic samples (Barbour et al. 1999; Major and Barbour 2001). Organic matter (OM) content was retained and analyzed by size (coarse and fine particulate OM). Data received was prepared for benthic macroinvertebrate samples as detailed in Section 2.1. Density was measured by volume, per cubic foot, and all metrics dependent upon density estimates reflect this as well.

2.3. Feasibility Study of the Talkeetna River as a reference

Benthic macroinvertebrate samples, invertebrate drift, and plankton tow samples were collected during the same seasonal events as samples on the Susitna River, using the same field collection methods. Samples were shipped to and processed by Ecoanalysts, Inc. (Moscow, Idaho) using the same methods used for benthic and seston samples from the Susitna River samples collected (Barbour et al. 1999; Major and Barbour 2001). Data received was prepared same as for benthic macroinvertebrate and drift samples, as detailed in Sections 2.1 and 2.2.

2.4. Trophic analysis, using trophic modeling and stable isotope analysis, to describe the food web relationships

2.4.1. Trophic model development

In 2013, bioenergetics models were developed for each study site where adequate growth, diet composition, and temperature data were collected. Growth inputs were compiled for two sampling stations (RP-104 and RP-141; Figure 2.1-1) for Chinook and coho salmon (see Section 3. Results). Diet composition data was considered adequate if four or more fish of a given species were sampled in at least two seasons, providing a starting and ending point for simulations. Diet and temperature data were available for all three seasons at two sites for Chinook salmon (RP-104 side slough and RP-141 tributary mouth) and one site for coho salmon (RP-141 tributary mouth). In addition, diet data were available for two seasons at five additional sites for coho salmon (RP-81 tributary mouth, spring and summer; RP-81 upland slough, spring and fall; RP-104 side channel, summer and fall; RP-104 side slough, summer and fall; and RP-104 upland slough, summer and fall). Adequate growth and temperature data were available for the RP-104 side slough and upland slough sites, and these were modeled. Growth inputs were not available for coho salmon at RP-81, and a full temperature time series was not available at the RP-104 side channel, where the temperature logger appeared to be above water for nine days of the 22-day interval when diet data was available. Therefore, these sites were excluded from modeling. Too few rainbow trout were sampled during 2013 to adequately characterize the size-at-age relationship from scales, so this species was not modeled.

Length distribution data were compiled from all fish captured in each study station by the River Productivity and Fish Distribution and Abundance in the Middle and Lower River Studies. Monthly length-frequency distributions were examined for Chinook salmon and coho salmon at stations RP-104 and RP-141. Distinct size modes were provisionally identified as age-0, age-1, or age-2 fish. All fish sampled in this study were aged, except for a small number for which all scales were regenerated or otherwise unreadable. Ages were assigned based on the presence of annuli and the number of circuli following the criteria of Moulton (1997). Scales were aged independently by two readers with prior aging experience, and a third experienced reader acted as a tie-breaker when necessary.

Modal fork lengths (FL, mm) were converted to wet weights (*W*, g) for input to the model using length-weight relationships developed for juvenile Chinook salmon:

$$W = 1.13 \times 10^{-5}\ FL^{2.98}\ (n = 2{,}014,\ r^2 = 0.93), \qquad (1)$$

and for juvenile coho salmon:

$$W = 1.61 \times 10^{-6}\ FL^{2.98}\ (n = 3{,}309,\ r^2 = 0.89), \qquad (2)$$

in the Middle and Lower Susitna River based on the combined length and weight data collected in 2013 by the River Productivity and Fish Distribution and Abundance in the Middle and Lower River Studies.

For modeling purposes, all diet items were grouped into five categories: fish eggs, fish, aquatic invertebrates, terrestrial invertebrates of aquatic origin (such as adult chironomid midges), and terrestrial invertebrates of terrestrial origin (such as beetles). We estimated the energy density (J/g wet weight) of prey items as 9,000 for salmon eggs, based on a review of measured values in the literature (Armstrong 2010), 5,200 for fish, based on the mean size of fish prey found in stomach contents (39 mm FL, 0.6 g) and a size-based energy density relationship for sockeye salmon (Beauchamp et al. 1989), and standard estimates for aquatic and terrestrial invertebrates (3,967 and 3,600 respectively; Cummins and Wuycheck 1971). The diet analysis showed that juvenile Chinook salmon and coho salmon ate large numbers of fish eggs after reaching 72 and 59 mm, respectively. Fish also comprised a large fraction of the diet of juvenile Chinook salmon larger than 63 mm during spring. To incorporate these ontogenetic shifts into the simulations, we excluded fish and fish eggs from the diet of salmon until they reached these threshold sizes, and specified the diet composition of smaller fish based on only the invertebrate components of the overall diet.

Using these input data, we estimated the consumption rate (g wet mass / day) of prey by juvenile Chinook salmon and coho salmon during the interval between sampling dates with Wisconsin bioenergetics models (Hanson et al. 1997). The models were implemented in the program R (R Core Team 2014), using physiological parameters for Chinook salmon (Stewart and Ibarra 1991; Madenjian et al. 2004) and coho salmon (Stewart and Ibarra 1991). The models iteratively adjusted the ration size of simulated fish, expressed as a proportion *P* of the theoretical maximum consumption rate (C_{max}), until the simulated growth equaled the observed growth. Lower values of *P* (near zero) indicated that growth was limited by low food intake, while higher values closer to 1 indicated that feeding rates were high and growth was mostly limited by thermal constraints on digestion and metabolism or by the quality of food. Growth efficiency (g total growth / g total consumption) was computed for each simulation to indicate the percent of energy intake that was allocated to growth as opposed to metabolism and waste. These metrics were then compared among sampling sites to determine whether growth was limited primarily by water temperature, food consumption, or food quality in the study area, and whether these limiting factors differed among habitats (McCarthy et al. 2009).

In 2013, low catch related to access limitations and target species distributions resulted in smaller than expected fish sample sizes. Consequetnly the data were not conducive for parameterizing preliminary growth rate potential models and evaluation with a sensitivity analysis as described in the Revised Study Plan. This study element will be completed after the 2014 field season when additional data samples will be collected. Access limitations have been address for 2014 and target species adjustments have been made for sites upstream and downstream of Devils Canyon to haelp ensure sufficient sample sizes will be collected in 2014.

2.4.2. Conduct stable isotope analysis of food web components to help determine energy sources and pathways in the riverine communities

For stable isotope sample processing, algae samples were treated with 1 M HCl solution to remove inorganic carbonates that may affect sample $\delta^{13}C$ values. All invertebrate samples, salmon carcass tissue, and salmon eggs were treated with a chloroform-methanol solution to remove lipids from fatty tissues that typically have more variable and depleted $\delta^{13}C$ signatures relative to other tissue types (Sotiropoulos et al. 2004), and that may ultimately affect the comparability of isotopic values of samples with varying lipid content.

For stable isotope data analysis, a combination of two- and three-way ANOVAs were performed to determine whether mean $\delta^{13}C$ values of benthic algae, benthic organic matter, and organic matter drift differed between macrohabitat types, along an upstream to downstream gradient, and across seasons.

Most aquatic invertebrates (e.g., Plecoptera, Ephemeroptera) do not feed beyond their aquatic juvenile life stages, so adult insects of aquatic origin were combined with aquatic larval invertebrates in their respective functional feeding group composite samples for stable isotope analysis. The mean $\delta^{13}C$ isotopic signatures of composite functional feeding group samples from each sampling site and event were compared using a three-way ANOVA to determine whether energy sources differed between invertebrate functional feeding groups.

A Bayesian stable isotope mixing model (MixSIAR; Stock and Semmens 2013) was used to determine the relative contributions of terrestrial, freshwater, and marine diet sources to target fish species and age class. Diet proportions were then compared between macrohabitat types, along an upstream to downstream gradient, and across seasons. Aquatic invertebrate samples from each functional feeding group were lumped into an overarching “freshwater” diet source for use in the mixing models since there were no significant differences between functional feeding group $\delta^{13}C$ values within each sampling site. Other diet source inputs for the mixing models were “terrestrial”, which included all invertebrates of terrestrial origin found at each site, and “marine”, which included spawning salmon carcass and egg tissue. Variability in the diet composition for each focal species and age class was also estimated based on the stable isotope mixing model results.

2.5. Characterize the invertebrate compositions in the diets of representative fish species in relationship to their source (benthic or drift component)

Diet composition data were summarized in terms of diet proportions by dry mass, the most relevant metric for energy flow and food web studies (Chipps and Garvey 2007) and were calculated for each fish and summarized under five broad categories: fish eggs, fish, aquatic invertebrates, terrestrial invertebrates of aquatic origin (e.g., adult chironomid midges with an aquatic larval stage), and terrestrial invertebrates of terrestrial origin (e.g., ants and caterpillars). The wet mass of fresh salmon eggs was estimated from a length-weight relationship from the literature (Fleming and Ng 1987). The wet mass of prey fish was estimated based on taxon-specific length-mass relationships calculated from fish measured and weighed by the Fish Distribution and Abundance in the Middle and Lower Susitna River Study (Study 9.6.). The dry mass of fish and fish eggs were estimated from wet masses using percent dry mass values of 24.9% for *Oncorhynchus* spp., 22.5% for sculpins, and 40% for fresh salmon eggs (Ashton et al. 1993; Brey et al. 2010). The resulting dry mass values estimated for fish and fish eggs were similar to dry mass values measured directly for similarly sized salmon fry, sculpins, and salmon eggs in other Alaskan rivers (M. Wipfli, unpublished data).

Diet composition data from Chinook salmon and coho salmon were analyzed using MANCOVA (multivariate analysis of covariance) to identify spatial, temporal, and ontogenetic patterns. Rainbow trout diet data were analyzed graphically, but not statistically due to the small sample size (n = 31 non-empty stomach content samples) and an unbalanced allocation of samples among sampling strata. Diet proportion data from Chinook salmon and coho salmon were arcsine-square root transformed to meet the assumption of normality (Chipps and Garvey 2007).

The transformed diet proportions of five prey categories were specified as response variables in separate MANCOVA models for each species. Each model tested for fixed effects of season, focus area, and habitat type, with fork length as a covariate, using a significance level (alpha) of 0.05.

2.6. Estimate benthic macroinvertebrate colonization rates in the Middle Susitna River Segment under pre-Project baseline conditions to assist in evaluating future post-Project changes to productivity in the Middle Susitna River.

Colonization samples were collected with Hester-Dendy multiplate samplers during the August-September 2013 time period in Focus Area 104 (Whiskers Slough). Samples were shipped to and processed by Ecoanalysts, Inc. (Moscow, Idaho) using the same methods used for benthic samples from the Susitna River samples collected (Barbour et al. 1999; Major and Barbour 2001). Data received was prepared same as for benthic macroinvertebrate samples, as detailed in Section 2.1.

3. RESULTS

The following results were developed based on data collected in 2013 and processed by a taxonomic laboratory from late summer 2013 to spring 2014. Because this represents one year of a two-year study, we caution the reader in drawing rigid conclusions regarding trends evident in this data set. Additional data collection is ongoing for the trophic and fish diet objectives in 2014 and further data will be collected in 2015 to describe the benthic community. After two years of study data are available, the data will be analyzed together for completion of study objectives. The 2013 results for algal sampling are presented in the ISR 9.8.5.2 and 9.8.5.4 and are not repeated herein

3.1. Characterize the pre-Project benthic macroinvertebrate and algal communities with regard to species composition and abundance in the Middle and Lower Susitna River

A total of 271 Hess samples and 70 petite Ponar grab samples were collected from the 20 study sites and submitted to the taxonomy laboratory in 2013 (Table 3.1-1). Processed sample results were used to calculate an assortment of metrics for each site for each index event period. For simplicity, metric results are presented in the broader descriptive classes as discussed in the methods section for each study station. Summary results (range, average, and median metric scores) for each study site are presented in Tables 3.1-2 through 3.1-4.

Mean values for all metrics calculated for the River Productivity study sites in each seasonal event are presented in Appendix A (Tables A3.1-1 through A3.1-15.) Results for mean density, mean taxa richness, and mean EPT richness are graphically presented in Figures 3.1-1 through 3.1-15.

In 2013, benthic densities were higher overall in off-channel sites compared to main channel and side channel sites. Upland sloughs and side sloughs in the Middle Reach had among the highest averaged densities (7,024 – 10,542 individuals/m^2) (Tables 3.1-2 and 3.1-3). Overall densities were also higher at tributary mouths compared to those recorded for main channel habitats, ranging from an average 1,996 individuals/m^2 at a small unnamed tributary at RP-173-1 to 5,425 individuals/m^2 at the mouth of Whiskers Creek.

Overall benthic taxa richness during 2013 was highest in tributary mouths, followed by off-channel habitats (side sloughs and upland sloughs). The EPT and chironomid taxa richness were higher in tributaries and slough habitats, as well. Exceptions were at sites RP-173-3 and RP-141-2, two side channel habitats that experienced reduced flows from the main channel during the summer and fall months, making them in many ways more similar to side slough habitats (Tables 3.1-2 and 3.1-3).

The higher taxa richness measures in tributary mouths and off-channel habitats were also reflected in higher diversity scores, often exceeding an overall average score of 2.00. Chironomid taxa contributed 50-percent or more to the average taxa richness at all 2013 sites, with the exception of the Montana Creek main channel and side channel sites during the summer and fall event periods, which showed a greater contribution of EPT taxa to the mean taxa richness in summer and fall (Table 3.1-4).

Overall benthic community composition measures revealed that all sites were dominated by the three most abundant taxa present in samples, averaging around 60- to 75-percent of the relative abundance. The dominance of the top three taxa tended to be lower in tributary mouth habitats, but were still greater than 50-percent overall. Relative abundances of chironomids to the benthic communities were generally 50-percent or higher at most sites below Devils Canyon (Tables 3.1-3 and 3.1-4). Sites above Devils Canyon showed overall relative abundances around 32- to 46-percent, with the exceptions of sites RP-173-3 and RP-173-4, a side channel and side slough that both experienced reduced flows during the summer and fall event periods (Table 3.1-2).

The contribution of EPT taxa to community compositions appeared to be less determined by macrohabitat types. Sites within the three uppermost stations (FA-184, FA-173, and FA-141) had notable relative abundances of EPT taxa that averaged around 20- to 25-percent at both main channel and off-channel sites; however, upland slough sites averaged less than 1-percent overall (Tables 3.1-2 and 3.1-3). Also, the mouths of larger tributaries (Indian River, Tsusena Creek, Montana Creek) tended to have greater contributions of EPT to the overall community compositions than did the smaller tributaries (Whiskers Creek, unnamed creek in FA-173). Sites within FA-104 (Whiskers Slough) showed relative abundances of EPT of around 7-percent with the exception of the side channel site, RP-104-5, which was an extensive shallow riffle area throughout the 2013 study season (Table 3.1-3). In the Lower Reach, at RP-81 (Montana Creek), the relative abundances of EPT taxa were sizeable, reaching as high as 55-percent in the side channel site RP-81-4 (Table 3.1-4).

3.1.1. RP-184 (Watana Dam)

At the Watana Dam station, estimates of the mean macroinvertebrate density (individuals/m^2) were noticeably higher at the mouth of Tsusena Creek (RP-184-1), ranging from 3,284.5 individuals/m^2 in the spring to 2,114 individuals/m^2 in the summer (Figure 3.1-1). In contrast, mean density at the side channel and main channel sites (RP-184-2 and 184-3, respectively) ranged from 125.6 individuals/m^2 in the spring to 646.5 individuals/m^2 in the fall at RP-184-2.

Mean taxa richness measures show a similar trend, with the tributary mouth averaging approximately 25 taxa in the spring and summer, and 19 in the fall, the main channel and side channel sites showing mean taxa richness ranging from 5.8 to 9.4 taxa (Figure 3.1-2). Mean EPT taxa richness was nearly three times higher at the mouth of Tsusena Creek compared to the main and side channel sites in the spring and summer event periods, with equal contributions of mayfly and stonefly taxa (Figure 3.1-3).

3.1.2. RP-173 (Stephan Lake Complex)

Within the RP-173 station, mean density estimates typically increased over the open water period and did not exceed 6,000 individuals/m^2. One exception was the side slough macrohabitat site (RP-173-4), where densities ranged from a low of 7,391.5 individuals/m^2 during the fall to a high of 28,720 individuals/m^2 during the summer (Figure 3.1-4). In contrast, mean density estimated at the main channel (RP-184-2) ranged from 95.3 individuals/m^2 in the spring to 1,095.3 individuals/m^2 in the fall.

Mean taxa richness measures were similar among RP-173 sites, with the tributary mouth, side channel, and the side slough sites maintaining around 21.8 to 26.8 taxa (Figure 3.1-5). The main channel site had a mean taxa richness ranging from 5.2 and 5.8 taxa in the spring and summer, with an increase to 12.4 taxa in the fall (Figure 3.1-5). Mean EPT taxa richness was higher at the tributary mouth (RP-173-1) as compared to other sites during the summer, but were comparable to the side channel and side slough sites in the spring and fall event periods (Figure 3.1-6). Chironomid taxa contributed 50-percent or more to the average taxa richness at sites within RP-173.

3.1.3. RP-141 (Indian River)

Mean density estimates were highest at RP-141 (Indian River), with nearly 20,000 individuals/m^2 recorded in the spring and summer in the upper extent of the upland slough site (RP-141-4) (Figure 3.1-7). Mean density estimates at the main channel site (RP-141-3) did not exceed 135 individuals/m^2 (Figure 3.1-7). Mean densities at the mouth of Indian River (RP-141-1) were approximately 1,300 to 1,400 individuals/m^2 in the spring and fall event period, peaking to 4,705 individuals/m^2 during the summer event.

Mean taxa richness measures were similar among sites, with the tributary mouth, side channel, and the upland slough sites supporting 14 to 19 taxa. The mouth of Indian River was an exception with a summer mean taxa richness that well-exceeded other sites at 28.2 taxa (Figure 3.1-8). The main channel site was taxa-poor, with a mean taxa richness of approximately 4 taxa in the spring and fall, and 7.24 taxa during the summer (Figure 3.1-8). Mean EPT taxa richness was higher at the Indian River mouth (RP-141-1) than other sites during the summer and fall, but comparable to the side channel (RP-141-2) in the spring event period, with largely mayfly and stonefly taxa (Figure 3.1-9). Chironomid taxa contributed 50-percent or more to the average taxa richness at sites within RP-141.

3.1.4. RP-104 (Whiskers Slough)

At RP-104 (Whiskers Slough), mean densities in the main channel and side channel sites did not exceed 221 individuals/m^2 during 2013 and were much lower compared to off-channel sites, where estimates ranged from 1,420.8 individuals/m^2 in the upland slough site (RP-104-4) during the spring, to 21,695.3 individuals/m^2 in Whiskers Slough (RP-104-2) during the summer (Figure 3.1-10). Mean density estimates for the off-channel habitat sites were lower during the spring event, but increased noticeably in the summer and fall event periods (Figure 3.1-10).

Mean taxa richness measures also was higher within off-channel sites as compared to the main channel sites. The tributary mouth site (RP-104-1) maintained the highest mean taxa richness, ranging from 24 taxa in the spring to 27.2 taxa in the summer (Figure 3.1-11). Mean taxa richness in the side slough (RP-104-2) increased from a low of 12.4 taxa during the spring, to a high of 38 taxa during the fall. The main channel and side channel sites showed mean taxa richness ranging from 2.6 taxa in the summer to 7.8 taxa during the spring (Figure 3.1-11). Mean EPT taxa richness was higher in the tributary mouth (RP-104-1) and side slough (RP-104-2) sites than the other three sites (Figure 3.1-12).

3.1.5. RP-81 (Montana Creek)

A contrast between main channel and off-channel macrohabitat was also seen at Station RP-81 (Montana Creek). Mean density estimates in the upland slough site (RP-81-1) and the mouth of Montana Creek (RP-81-2) ranged from 1,074.4 to 7,579.1 individuals/m^2 over the study period. These densities were higher than mean density estimates at the main channel site (RP-81-3) and side channel sites (RP-81-4), which ranged from 7.0 to 616.3 individuals/m^2 (Figure 3.1-13).

Mean taxa richness measures also were higher within off-channel macrohabitats as compared to main channel macrohabitats in Montana Creek. The tributary mouth site (RP-81-2) maintained the highest mean taxa richness, ranging from 21.2 taxa in the spring to 31.6 taxa in the summer event (Figure 3.1-14). Mean taxa richness in the side slough (RP-81-1), sampled with Ponar grabs, ranged from a low of 9 taxa during the summer event, to a high of 26.8 taxa during the fall event. The lower estimates at main channel and side channel sites ranged from 0.6 taxa in the summer to 9.6 taxa during the fall (Figure 3.1-14). Mean EPT taxa richness was higher at the tributary mouth (RP-81-2) than the other three sites, with contributions from all three EPT orders (Figure 3.1-15).

3.2. Estimate drift of benthic macroinvertebrates in selected habitats within the Middle and Lower Susitna River to assess food availability to juvenile and resident fishes

A total of 92 drift net samples and 85 plankton tow samples were collected from the 20 study sites and submitted to the taxonomy laboratory in 2013 (Table 3.2-1). Processed sample results were used to calculate an assortment of metrics for each site for each index event period. Summary results (range, average, and median metric scores) for each study site for a selection of metrics are presented in Tables 3.2-2 through 3.2-4. For simplicity, metric results are presented in the broader descriptive classes as discussed in the methods section for each study station.

Mean values for all drift net and plankton tow metrics calculated for the River Productivity study sites are presented in Appendix A (Tables A3.2-1 through A3.2-10). Results for mean drift density and plankton tow density are graphically presented in Figures 3.2-1 through 3.2-5.

Overall estimates within the study sites in 2013 revealed higher densities per cubic foot (ft^3) of water in sites characterized as non-flowing habitats that were sampled with plankton tows compared to flowing water habitats that were sampled with the drift nets. Upland sloughs and side sloughs showed among the highest overall averaged densities via plankton tows (1.27 – 9.75 individuals/ft^3) in the study year (Tables 3.2-2 through 3.2-4). For flowing habitats, mouths of the larger tributaries (RP-184-1, RP-141-1, RP-81-2) showed higher overall drift densities as compared nearby main channel and side channel sites.

Overall drift taxa richness during 2013 was highest in tributary mouths, followed by main channel habitats; fewer taxa were captured in plankton tows taken in off-channel habitats (side sloughs and upland sloughs) (Tables 3.2-2 through 3.2-4). Both the EPT taxa richness and overall chironomid taxa richness were higher in tributaries and main channel habitats than in the slough habitats. The higher taxa richness in tributary mouths and main channel habitats were also reflected higher diversity scores for these habitats; diversity often exceeded an overall average score of 2.00 (Tables 3.2-2 through 3.2-4).

In 2013, drift community composition measures revealed the relative abundance by the three most abundant taxa present averaged between 45- to 78-percent for most sites. The dominance of the top three taxa tended to be higher in upland and side sloughs as compared to other habitats. Sites above Devils Canyon showed community compositions largely comprised of chironomids, with smaller relative abundances of EPT (averages ranging from 0.9- to 11-percent) and zooplankton (many sites averaging 11- to 12-percent) (Table 3.2-2). At sites below Devils Canyon, flowing water sites (tributary mouths, main channels, and side channels) displayed communities mostly composed of chironomids and a sizeable contribution of EPT, whereas slow-water habitat sites were comprised of chironomids and a larger relative abundance of zooplankton, especially at upland slough sites (Tables 3.2-3 and 3.2-4). One notable exception was the unusually high EPT relative abundance estimate at RP-141-5 (70.5 percent), a site established immediately upstream of the mouth of Indian River (Table 3.2-3). Due to a backwater effect at this site, little flow passed through the drift nets and very low drift densities were recorded. The relative abundance estimates were based upon an overall low numbers of invertebrates captured and thus produced the abnormally high percentage value.

3.2.1. RP-184 (Watana Dam)

Mean drift densities were higher at the mouth of Tsusena Creek (RP-184-1), where they increased tenfold from 0.125 individuals/ft^3 during the summer to 1.25 individuals/ft^3 in the fall (Figure 3.2-1). In contrast, both the side channel and main channel sites showed consistently low drift densities below 0.10 individuals/ft^3; the only exception was a main channel site that had a mean drift density of 0.268 individuals/ft^3 during fall. Mean taxa richness also was considerably higher in the drift at the tributary mouth, showing an average of 41.5 taxa in the summer and dropping to 12.5 taxa in the fall. Mean taxa richness for the main channel and side channel sites averaged around 24.4 taxa in the spring and fall, but averaged only 7 to 8 taxa in the summer. EPT taxa richness followed a similar trend, with higher numbers of EPT taxa collected at the tributary mouth until the fall event period. Community compositions for drift at RP-184 show that samples were largely comprised of chironomids in the spring and summer event periods. During the fall period, drift compositions shifted to higher contributions of simuliids (Other Diptera), zooplankton, and other non-insect taxa.

3.2.2. RP-173 (Stephan Lake Complex)

At RP-173, drift densities for the tributary mouth, main channel, and side channel sites ranged from 0.037 to 0.188 individuals/ft^3 (Figure 3.2-2). Plankton tow density measured at the side slough site and within the side channel site during fall ranged from 0.427 to 4.25 individuals/ft^3. Mean taxa richness was high in drift net samples, with the tributary mouth site showing the highest average of 51.5 taxa in the spring and dropping to 30.5 taxa in the fall. Mean taxa richness for the main channel site averaged around 24.8 taxa overall, whereas the side channel site showed a spring average of 30.5 taxa before dropping to an average of 3 taxa during the summer and fall. In contrast, plankton tows in the side slough site ranged from a low of 1.8 taxa in the fall, to 8.8 taxa during summer. Drift net samples also collected higher numbers of EPT taxa than plankton tows, ranging from an average of 3 to 9 taxa, in comparison to 0.0 to 0.4 taxa for plankton tows.

Community compositions for drift and plankton tows show that samples were largely comprised of chironomids. Plankton tows collected in the side slough site also showed a notable contribution of zooplankton, ranging from an average of 11.8-percent to 13.42-percent. Drift net samples consistently collected higher proportions of mayflies and stoneflies compared to plankton tows, with a higher contribution of simuliids (Other Diptera) showing up during the fall.

3.2.3. RP-141 (Indian River)

Drift densities in the RP-141 mouth, main channel, and side channel sites, and ranged from 0.011 individuals/ft^3 to 0.653 individuals/ft^3 (Figure 3.2-3). Plankton tow density was measured at the upland slough site in the slow-water habitat, revealing densities of 0.393 to 2.64 individuals/ft^3, and additionally within the side channel site during the fall event due to lower flow conditions, which collected 0.038 individuals/ft^3. Mean drift taxa richness was high overall, with the tributary mouth site showing an average of 41 taxa for the sampling seasons as well as the highest taxa richness within the side channel site with an average of 47 taxa. As flow levels receded over the course of the sampling season, mean taxa richness in the side channel dropped to 19.5 taxa in summer, and again to 0.6 taxa in the fall. Mean taxa richness for the main channel site averaged around 15 taxa overall, ranging from 10 taxa in the spring to 21.5 taxa during the fall event. In contrast to drift taxa richness, plankton tows resulted in generally lower taxa richness. For example, in the upland slough site, taxa richness ranged from a low of 3 taxa in the summer to 9.2 taxa during the spring. Drift net samples also collected higher numbers of EPT taxa (average of 3 to 11.5 taxa) than plankton tows (average of 0.0 to 0.6 taxa).

Community compositions for drift and plankton tows show that samples were largely comprised of chironomids. Plankton tows collected in the upland slough had a notable contribution of zooplankton, ranging from an average of 6.2-percent in the summer to 53.2-percent during the spring. Drift net samples consistently collected higher proportions of mayflies and stoneflies, and Other Diptera (generally simuliids) as compared to plankton tows.

3.2.4. RP-104 (Whiskers Slough)

Mean drift density estimates for the RP-104 station at Whiskers Slough were calculated for the mouth of Whiskers Creek, side slough, main channel, and side channel sites, and ranged from 0.02 individuals/ft^3 to 0.101 individuals/ft^3 (Figure 3.2-4). Plankton tows were utilized at the upland slough site in slow-water habitat, and additionally within the side slough site during the summer and fall events, and within the side channel site during the fall event, due to lower flow conditions at those locations. Plankton tow densities ranged from 1.125 to 18.48 individuals/ft^3 in the upland slough, from 0.189 to 5.420 individuals/ft^3 in the side slough in the summer and fall event periods, and showed a lower density of 0.035 individuals/ft^3 in the side channel in the fall event period (Figure 3.2-4). Mean taxa richness was higher in the drift net samples, with the tributary mouth site showing an overall average of 21.67 taxa for the sampling seasons, and the highest taxa richness within the station. Mean taxa richness for the main channel site averaged around 13.67 taxa overall, ranging from 7 taxa in the summer to 17.5 taxa during the fall event period. In contrast, plankton tows in the upland slough site ranged from a low of 3.6 taxa in the spring, to 15.6 taxa during the summer event period. Drift net samples also generally collected higher numbers of EPT taxa than plankton tows, ranging from an average of 1.5 to 7 EPT taxa, in comparison to 0.0 to 0.8 EPT taxa for plankton tows.

Community compositions for drift and plankton tows in RP-104 reveal a wide variety of taxa represented in the water column. Chironomids were often dominant in both drift and plankton samples, but no discernable trend or pattern is immediately apparent. Plankton tows collected in the upland slough site also showed a notable contributions of zooplankton, ranging from an average of 42.9-percent in the fall to 72.8-percent during the spring event period. Drift net samples collected higher proportions of mayflies and stoneflies, and Other Diptera (generally simuliids) throughout the three seasons, compared to plankton tows.

3.2.5. RP-81 (Montana Creek)

Drift densities were calculated for the mouth of Montana Creek, main channel, and side channel sites and ranged from 0.02 to 0.252 individuals/ft^3 (Figure 3.2-5). Drift samples collected during the summer period at the tributary mouth site (RP-81-2) were lost in transit from the field, so no results were available for that site/event period. Plankton tows were utilized at the upland slough site (RP-81-1) in slow-water habitat for the spring and summer event periods; however, lower flows created riffle habitat at that site in the fall so drift nets were used instead. Plankton tow densities averaged 4.98 individuals/ft^3 in spring event period at RP-81-1, and 7.96 individuals/ft^3 in the summer event period (Figure 3.2-5). Drift samples within RP-81-1 in the fall averaged 0.204 individuals/ft^3.

Mean drift taxa richness was high, with the tributary mouth site showing an average of 35 taxa in spring, and an average of 44.5 taxa in fall. Mean taxa richness for the main channel site averaged around 25.2 taxa overall, ranging from 18 taxa in spring to 29 taxa in fall. Taxa richness for the side channel site (RP-81-4) averaged 19.7 taxa overall, whereas the side channel site established just upstream from the tributary mouth averaged 25.5 taxa overall. In contrast, taxa richness in plankton tows was lower. For example, zooplankton taxa richness in the upland slough site averaged 9.2 taxa in spring and 5.6 taxa in summer. When the upland slough area was sampled for drift in the fall, taxa richness averaged 20.5 taxa. Similar to overall taxa richness, spring average EPT taxa was higher in the tributary mouth than other habitats, but increased to comparable levels within the main channel and side channel sites in the summer and fall.

Community compositions for drift and plankton tows in RP-81 revealed a wide variety of taxa represented in the water column. As compared to plankton tows, drift samples often were dominated by chironomids and had higher proportions of mayflies and stoneflies, and Other

Diptera (generally simuliids) throughout the seasons. Plankton tows collected in the upland slough site also showed notable contributions of zooplankton and other non-insect taxa (typically ostracods, oligochaete worms, and water mites), although zooplankton and non-insect taxa were also prevalent in drift net samples during the fall.

3.3. Conduct a feasibility study in 2013 to evaluate the suitability of using reference sites on the Talkeetna River to monitor long-term Project-related change in benthic productivity.

A total of 30 Hess samples, 15 petite Ponar grab samples, 12 drift net samples, and 10 plankton tow samples were collected from three sites established on the Talkeetna River and submitted to the taxonomy laboratory in 2013 (Tables 3.3-1 and 3.3-2). Processed sample results were used to calculate an assortment of metrics for each site for each index event period. Summary results (range, average, and median metric scores) for a selection of metrics at the Talkeetna sites are presented in Tables 3.1-4 and 3.2-4. For simplicity, metric results are presented in the broader descriptive classes as discussed in the methods section for each study station. Mean values for all benthic, drift net, and plankton tow metrics calculated for the Talkeetna study sites are presented in Appendix A (Tables A3.3-1 through 3.3-5). Results for mean density, mean taxa richness, mean EPT richness, and mean drift and plankton tow densities are graphically presented in Figures 3.3-1 through 3.3-4.

For the Talkeetna River station (RP-TKA), mean density estimates were lower in the side channel site as compared to the two off-channel sites established. The side channel site (RP-TKA-1) showed estimates ranging from around 550 individuals/m^2 in the spring and fall event periods, to 821 individuals/m^2 in during the summer event (Figure 3.3-1). Mean density estimates for the upland slough site (RP-TKA-2), sampled by Ponar grab, ranged from a high of 6,699.5 individuals/m^2 in spring to a low of 1,145.3 in summer. The side slough site (RP-TKA-3) mean density estimates were highest in spring (13,040 individuals/m^2), and decreased noticeably in the summer and fall (Figure 3.3-1).

Mean taxa richness measures revealed higher numbers of taxa within the side slough site in comparison to the side channel and upland slough sites. The side slough site maintained the highest mean taxa richness, averaging 25.5 taxa overall, and ranging from an average of 20.4 to 28.4 taxa (Figure 3.3-2). Mean taxa richness in the side channel (RP-TKA-1) averaged 11.9 taxa over the course of the seasons, while at the upland slough site, taxa richness changed over the seasons, ranging from a low 8.6 taxa in summer to 17.4 taxa in fall event (Figure 3.3-2). Similar to taxa richness, EPT taxa richness also was higher at the side slough site (RP-TKA-3) with contributions from all three EPT orders and indicated an increased presence of caddisflies in the community, especially during the fall (Figure 3.3-3).

Community composition within RP-TKA was largely dominated by chironomids, resulting in high contributions of collector-gatherers. Both the side channel and side slough sites also had varying contributions of mayflies and stoneflies throughout the seasons, which was reflected in the functional feeding group compositions as increased scraper, shredder, and predator feeding strategies. Community composition at the upland slough site (RP-TKA-2) was primarily comprised of chironomids and non-insect taxa (oligochaete worms), with notably no EPT taxa contributions.

Drift densities were calculated for both the side channel and side slough sites, and ranged from 0.041 to 0.121 individuals/ft^3 (Figure 3.3-4). Plankton tow density was measured at the upland slough site in the slow-water habitat, revealing densities of 0.960 to 1.87 individuals/ft^3. Mean taxa richness was considerably higher in the drift net as compared to plankton tow samples. The side channel site showing an average of 21 to 27 taxa. The side slough site revealed an average of 31 taxa in spring, 40.5 taxa in summer, and declined to an average of 18.5 taxa in fall. In contrast, plankton tows in the upland slough site ranged from a low of 4.2 taxa in summer, to 5.4 taxa in the spring and fall. Drift net samples also collected higher numbers of EPT taxa than plankton tows, ranging from an average of 5 to 8.5 taxa, in comparison to 0.2 to 0.6 taxa for plankton tows.

Community compositions for drift and plankton tows show that samples were largely comprised of chironomids. Plankton tows collected in the upland slough site also showed a notable contribution of zooplankton, ranging from an average of 23-percent to 29.1-percent during the study seasons. Drift net samples collected higher proportions of mayflies and stoneflies throughout the three seasons, with a higher contribution of caddisflies during the summer and fall event periods, compared to plankton tows.

3.4. Conduct a trophic analysis, using trophic modeling and stable isotope analysis, to describe the food web relationships in the current riverine community within the Middle and Lower Susitna River

3.4.1. Develop a trophic model to estimate how environmental factors and food availability affect the growth rate potential of focal fish species under current and future conditions

3.4.1.1. Growth rates of salmon

Juvenile Chinook and coho salmon in the Middle and Lower River exhibited distinct size modes when fish captured at all sites were combined (Figures 3.4-1 and 3.4-2). Ninety-five Chinook salmon and 114 coho salmon were aged from scales to determine size-at-age relationships for both species (Figures 3.4-3 and 3.4-4). The samples of aged fish ranged from 50-165 mm FL for Chinook salmon and 48-119 mm for coho salmon. This size range only partially overlapped with the apparent age-0 size modes visible in the length-frequency histograms; therefore, we used the length-frequency data with corroborating information from previous studies on the Susitna River (Roth and Stratton 1985; Roth et al. 1986) to determine the size of age-0 fish. We interpreted the sizes of the age-0 fish aged from scales as indicating the upper limit of the age-0 size distribution.

The growth rates of Chinook salmon appeared to vary between the RP-104 (Whiskers Slough Complex) and RP-141 (Indian River) sampling stations (Figures 3.4-5 through 3.4-7). In June, the modal size of age-0 Chinook salmon was 50 mm FL at RP-104, while the modal size of fish captured at RP-141 (Indian River) was only 35 mm. However, the Chinook salmon at RP-104 appeared to grow slowly, reaching only 55 mm by September (Figure 3.4-7). In contrast, in September, the modal size of age-0 Chinook salmon at RP-141 was 80 mm (Figure 3.4-6). Age-1 Chinook salmon appeared to grow from 75-95 mm between June and September at RP-104, and from 75-105 mm during the same period at RP-141 (Figure 3.4-7). These patterns were corroborated by the scale data (Fig. 3.4-3). The size structure of Chinook salmon and coho salmon captured at RP-81 were also examined, but too few fish were captured to estimate seasonal growth.

In June, the Chinook salmon size distribution at RP-141 was trimodal, suggesting that significant numbers of age-2 fish were present. Scale samples confirmed that these large (105-140 mm) fish were age 2. The modal size of this age class grew from 120 mm in June to 135 mm in September (Figure 3.4-6). By September, few age-2 fish remained at RP-141. Conversely, large numbers of age-2 Chinook salmon were also captured at RP-104 during September, but not during the earlier periods (Figure 3.4-5).

Coho salmon grew at similar rates in both the RP-104 and RP-141 stations, based on their size distributions (Figs. 3.4-8 through 3.4-10). The modal sizes of age-0 coho grew from 35-40 mm FL in June to 55-60 mm in September at both stations. The modal sizes of age-1 coho were 60-65 mm in June and 100-105 mm in September at both stations. Few age-2 coho salmon were identified based on size structure or scale analyses.

Ten individual passive integrated transponder (PIT) tagged Chinook salmon and four coho salmon were measured multiple times between late July and late September 2013 at River Productivity sampling stations, providing individual growth trajectory data. These fish exhibited growth rates averaging 1.0-percent of their body mass per day (range: -0.09- to 2.25-percent). Based on their sizes, most of these fish were age 1. Nearly all of these marking and recapture events occurred in side sloughs and upland sloughs in RP-104 and RP-141.

3.4.1.2. Bioenergetics modeling

Juvenile salmon fed at markedly different rates among species, age classes, and sampling sites; however, food intake was a primary factor limiting growth in all cases (Table 3.4-1). Among sites with three seasons of input data, growth and consumption rates were consistently lower at the RP-104 side slough than at the RP-141 tributary mouth. At the RP-104 side slough, age-0 Chinook salmon fed at a relatively low proportion of their maximum possible consumption rate (P = 0.24), indicating that their growth was strongly limited by food intake. In contrast, the age-0 Chinook salmon at the RP-141 tributary mouth fed at a higher rate of P = 0.50, indicating that food intake was less limiting to growth. Age-0 coho salmon fed at an intermediate rate of P = 0.36 at the RP-141 tributary mouth.

The growth efficiency of juvenile salmon also varied widely, ranging from a low of 5.5-percent for age-0 Chinook salmon at the RP-104 side slough to a high of 55-percent for age-1 Chinook salmon at the RP-141 tributary mouth. Overall, age-1 salmon exhibited greater growth efficiency than age-0 salmon at the same site, indicating that they met their metabolic needs with a smaller fraction of their overall energy intake, leaving more surplus energy to allocate to growth.

The mean mass-specific growth rates (g growth / g body mass / day) of Chinook and coho salmon ranged from 0.29- to 2.2-percent (Table 3.4-1). This range of values was similar to the -0.09- to 2.25-percent range of growth rates measured for individual PIT tagged fish. To achieve these growth rates, age-0 salmon consumed 5.2- to 9.6-percent of their body weight per day on average. Age-1 salmon consumed 2.1-percent of their body weight per day, and age-2 salmon consumed 1.7-percent of their body weight per day, on average. Age-0 salmon at all sites and age-1 coho salmon at the RP-104 upland slough consumed primarily aquatic insects during the modeled periods, while age-1 and age-2 salmon at all other sites consumed primarily fish eggs and fish (Table 3.4-2).

3.4.2. Conduct stable isotope analysis of food web components to help determine energy sources and pathways in the riverine communities

In 2013, a total of 1,155 tissue samples were collected for stable isotope analysis (SIA) from multiple study components, including benthic macroinvertebrates, benthic algae, benthic organic matter, invertebrates and organic matter in drift samples, salmon carcasses, and fin clips from fish (Table 3.4-3).

The isotopic signatures of algae, organic matter, and spawning salmon carcasses and eggs were well separated overall, providing a baseline with sufficient contrast to test for differences between aquatic, terrestrial, and marine-derived energy flow to fish (Figures 3.4-11 through 3.4-14). Large- and fine-scale spatial patterns were also present within each of these basal endmember groups. Overall mean algal $\delta^{13}C$ values were significantly more depleted within study reaches below Devil's Canyon (FA-81, mean $\delta^{13}C$ = -28.45‰; FA-104, mean $\delta^{13}C$ = -28.53‰; FA-141, mean $\delta^{13}C$ = -29.34‰) compared to the study reach above the canyon (FA-184, mean $\delta^{13}C$ = -23.30‰). Algal values of $\delta^{13}C$ varied little from season to season within each reach (P-value range: 0.108 – 0.927), but $\delta^{13}C$ values generally varied significantly by macrohabitat type ($p < 0.001$) (Figure 3.4-12). Samples collected in main channel and side channel sites were the most similar in comparison to samples collected from other habitat types ($P = 0.848$), but differed from off-channel samples. Further stratified by habitat and season, mean algal $\delta^{13}C$ values from samples varied the most between macrohabitat types during the summer sampling event. Algae samples from main channel and side channel habitat types showed more enriched $\delta^{13}C$ values than those from upland slough, tributary mouth, and side slough habitat types (Figure 3.4-12).

Benthic organic matter samples (Figure 3.4-13) did not show any significant differences in $\delta^{13}C$ values among study reaches ($P = 0.710$) and seasons ($P = 0.360$). The only significant differences that occurred among habitat types were between samples that were collected in the summer sampling event, but there were no apparent patterns when examining pairwise comparisons of habitat types for this sampling event.

Organic matter drift samples (Figure 3.4-14) showed few differences in mean $\delta^{13}C$ values between study reaches when stratified by season. The only study reach that was consistently different from other reaches was FA-81. No significant differences in mean $\delta^{13}C$ values occurred across seasons. There were no apparent patterns in mean $\delta^{13}C$ values between habitat types. Nearly half of all pairwise comparisons of habitat types showed significant differences.

Averaged over all sites and seasons (see Appendix A Tables A3.4-1 through 3.4-12), significant differences existed between the mean $\delta^{13}C$ values of all aquatic invertebrate functional feeding groups and terrestrial invertebrates. When aquatic functional feeding groups were compared across macrohabitat types, significant differences in mean $\delta^{13}C$ values existed between main channel habitats (main channel, side channel, tributary mouth) and off-channel habitats (side slough, upland slough). Specifically, invertebrates from off-channel habitats showed more enriched $\delta^{13}C$ values (mean $\delta^{13}C$ range: -28.443‰ to -33.724‰) compared to $\delta^{13}C$ values of invertebrates from main channel habitats (mean $\delta^{13}C$ = -27.020‰, -27.167‰). Differences in mean $\delta^{13}C$ values of aquatic invertebrates within these macrohabitat groupings were often not significant. No significant differences existed for any invertebrate group when compared across seasons (P-value range: 0.054 – 0.755), with the exception of shredders, which showed a shift from summer to fall (P = 0.044).

In general, mean invertebrate $\delta^{13}C$ differed among focus areas (P < 0.001); sample $\delta^{13}C$ values were most similar between FAs 81 and 141 (P = 0.047). Overall, invertebrates from FA-104 showed the most depleted $\delta^{13}C$ values (mean $\delta^{13}C$ = -31.028‰) while those from FA-184 were the most enriched (mean $\delta^{13}C$ = -26.768‰). Grazers and terrestrial invertebrates varied the least among focus areas (no significant differences). Mean $\delta^{13}C$ values of collector and emergent insect samples, which consisted mostly of collectors (Chironomidae), differed the most among study reaches. Because aquatic invertebrate functional feeding groups did not differ within each macrohabitat type and mostly did not differ across seasons, functional feeding groups were combined into a single aquatic invertebrate diet category for fish when running stable isotope mixing models.

Contributions of freshwater, terrestrial, and marine diet sources to each target fish species and age class were estimated using a Bayesian stable isotope mixing model (MixSIAR; Stock and Semmens 2013) and compared across macrohabitat types, study reaches, and seasons. A total of 237 fish samples collected in 2013 were used in this analysis. Mixing model results suggest that for juvenile Chinook and coho salmon, freshwater, terrestrial, and marine sources all contributed substantially to consumer tissue. In general, marine sources were more important to both juvenile and adult rainbow trout compared to Chinook and coho salmon.

The contribution of marine diet sources increased seasonally (Figure 3.4-15) from June to October for Chinook, coho, and adult rainbow trout. For juvenile Chinook and coho, a peak in terrestrial contributions occurred in the spring, whereas freshwater source contributions peaked in the summer. Sample sizes for juvenile rainbow trout were low, however mixing model outputs show that for the fish sampled, terrestrial sources made up the majority of the diet in the spring, marine sources in the summer, and freshwater sources in the fall. When comparing source contributions across study reaches (Figure 3.4-16), mixing model outputs showed similar dietary patterns between juvenile Chinook and coho salmon. From downstream to upstream study reaches, the contribution of marine sources to juvenile Chinook and coho increased while that of terrestrial sources decreased. Freshwater sources were fairly similar in diets of these species across study reaches. For juvenile rainbow trout, terrestrial sources contributed the most to diet at FA-81 and marine contributions were greatest at FA-141. No juvenile rainbow trout were sampled at FA-104. Adult rainbow trout tissue sampled at FA-104 showed a heavy marine dietary influence. Contributions from terrestrial and marine sources to juvenile Chinook and coho varied between habitat types (Figure 3.4-17), but freshwater sources varied little. Specifically, terrestrial sources were relatively greater in both upland sloughs and side channels; and marine sources were relatively more important in side sloughs and tributary mouths. Juvenile rainbow trout differed greatly in source contributions between the upland slough and tributary mouth habitats where they were sampled, with upland slough trout being heavily influenced by a terrestrial signature and tributary mouth trout showing more influence from marine sources. Adult rainbow trout sampled in the FA-104 side slough were heavily influenced by marine sources.

Mixing model outputs included measures of variability with mean diet proportions by each covariate. These results show that seasonal effects primarily drove variation in the diets of all fish species and life stages analyzed (see Appendix A, Figures A3.4-1 through A3.4-4).

3.5. Characterize the invertebrate compositions in the diets of representative fish species in relationship to their source (benthic or drift component)

Non-empty stomach contents were analyzed from 196 fish, and a total of 4,375 diet items were identified and measured. Nearly all (> 95-percent) of the fish eggs in stomach contents were identified as salmon eggs based on their large size (5.5-10.5 mm diameter). The prey fish identified in stomach contents were coho salmon fry, unidentified salmonids, sculpins, and unidentified fish ranging from approximately 4-56 mm FL. The most common aquatic invertebrates in stomach samples (by mass) were caddisfly larvae, heptageniid mayfly larvae, and chironomid midge larvae. The most common terrestrial invertebrates in stomach samples were adult beetles, adult hymenopterans (ants, bees, and wasps), adult caddisflies, and adult true flies.

The diet composition of juvenile Chinook salmon shifted ontogenetically (effect of fork length) and differed significantly among seasons and habitat types, but not among focus areas (MANCOVA; Table 3.5-1). The diet composition of juvenile coho salmon shifted ontogenetically and differed significantly among seasons, focus areas, and habitat types (MANCOVA; Table 3.5-1). The smallest fish with salmon eggs in its stomach were 59 mm FL for coho salmon, 72 mm for Chinook salmon, and 74 mm for rainbow trout (Figure 3.5-1). The smallest fish with fish in its stomach were 50 mm for coho salmon, 63 mm for Chinook salmon, and 105 mm for rainbow trout (Figure 3.5-2). The smallest piscivorous fish (50-120 mm FL) ate only small (< 20 mm standard length) unidentifiable prey fish. Rainbow trout began to consume salmonid prey once they reached 121 mm FL, and Chinook salmon began to consume salmonids at 123 mm FL. No coho salmon had salmonid prey in their stomach contents. All piscivorous fish consumed only prey fish < 40-percent of their own fork length.

During spring, juvenile Chinook salmon and adult rainbow trout ate primarily fish, while juvenile coho salmon and juvenile rainbow trout ate primarily aquatic and terrestrial invertebrates (Figure 3.5-3). During summer and fall, juvenile Chinook salmon and juvenile coho salmon ate large proportions of salmon eggs, with the remainder of their diets composed of aquatic and terrestrial invertebrates. Adult rainbow trout ate primarily fish during summer and salmon eggs during fall. Diet composition of Chinook salmon appeared to differ substantially between focus areas RP-104 (Whiskers Creek / Slough), where salmon eggs dominated the diet, RP-81 (Montana Creek), where invertebrates and fish made up the diet, and RP-141 (Indian River), where fish and fish eggs made up the diet (Figure 3.5-4). However, these differences were not statistically significant, suggesting that they may have been driven largely by seasonal or habitat-based differences in sample size. The diet of coho salmon differed significantly among focus areas, with similar diets of roughly 70-percent salmon eggs and 30-percent invertebrates at RP-81 and RP-104 vs. a diet of 93-percent salmon eggs at RP-141 (Figure 3.5-4). Additional information on diet compositions is available in Appendix A (Tables A3.5-1 through 3.5-3).

Both Chinook salmon and coho salmon diets differed among habitat types (Figure 3.5-5). Chinook salmon ate mostly salmon eggs in side channels and side sloughs, mostly fish in tributary mouths, and mostly aquatic invertebrates or terrestrial invertebrates of aquatic origin in upland sloughs. Coho salmon diets showed a similar pattern, except that they included mostly salmon eggs, rather than fish, in tributary mouths. The rainbow trout diet data was interpreted with caution because the sample size was unbalanced, with particular habitats sampled in certain focus areas but not in others. Therefore, it was difficult to determine which factor drove the observed differences in diet composition.

3.6. Estimate benthic macroinvertebrate colonization rates in the Middle Susitna River Segment under pre-Project baseline conditions to assist in evaluating future post-Project changes to productivity in the Middle Susitna River.

A total of 105 Hester-Dendy samplers were collected during the 2013 test effort and submitted to the taxonomy laboratory in 2013. Processed sample results received from the laboratory were used to calculate an assortment of metrics for each set of samplers. Mean values for all metrics calculated for the colonization sampler sets at each colonization site are presented in Appendix A (Tables A3.6-1 through A3.6-4). Results for mean density and mean taxa richness are graphically presented in Figures 3.6-1 through 3.6-8.

During the 8-week colonization test periods, samplers located at sites in main channel macrohabitats (RP-HD-3 and RP-HD-4) were subjected to fluctuating water levels, and were exposed for short periods of time. Flows rapidly declined during the last two weeks of the test run, resulting in large amounts of sediment deposited at RP-HD-3, both burying and exposing all samplers at that site. All samplers at RP-HD-3 were retrieved on September 20, 2013; to prevent additional losses due to dewatering, all sampler sets were retrieved from RP-HD-4 the following day, cutting the exposure times short by one week, resulting in colonization test times of 1, 3, 5, and 7 weeks. The clear water colonization test sites located in Whiskers Slough did not experience water level reductions as severe, and the final 1-week sampler sets were successfully deployed and retrieved at those sites.

Results indicated that conditions were more favorable for colonization in the clear water sites. Mean densities in the clear and warm site (HD-1) reached over 6,000 individuals/m^2 by 57 days (8 weeks), and the clear and cold site (HD-2) reached an average of approximately 4,000 individuals/m^2 by the conclusion of the 8-week period (Figures 3.6-1 and 3.6-2) Average taxa richness in the clear and warm site reached an average of 31.3 taxa in Week-4 at a deep set and 35.33 taxa at a shallow set in Week-8 (Figure 3.6-3). For the clear and cold site, peak taxa richness reached an average of 12.67 taxa at a deep set in Week-4 and 14.33 taxa at a shallow set in Week-8 (Figure 3.6-4).

In contrast, densities at the turbid sites were lower, with the turbid and cold site showing a maximum average density of 171.8 individuals/m^2 in a deep set colonized for 8-weeks, and the turbid and warm site (HD-4) reaching a maximum average density of 759 individuals/m^2 in a deep set colonized for 8-weeks (Figures 3.6-5 and 3.6-6). Average taxa richness was also lower at turbid sites as compared to clear sites, with the turbid and cold site peaking at an average of

7.33 taxa at a deep set in Week 8 (Figure 3.6-7), and the turbid and warm site reaching a peak average of 12 taxa at a deep set in Week 8 as well (Figure 3.6-8).

4. DISCUSSION

4.1. Benthic Macroinvertebrate and Algal Communities

Results from the 2013 benthic macroinvertebrate sampling effort, as well as the algal sampling results given in the ISR, showed initial differences in several metrics between mainstem macrohabitats (main channel and side channel habitats) when compared to other macrohabitat types, especially tributary mouths and off-channel habitats (side sloughs, upland sloughs). Tributary mouths were generally highest in mean benthic density, taxa richness, and EPT richness, and often showed higher percentages of those EPT taxa in community compositions. Side sloughs and upland sloughs displayed higher densities and taxa richness measures later in the sampling season, during summer and fall. Main channel and side channel sites often displayed the lowest density and taxa richness measures in comparison to other macrohabitats, although exceptions were evident, especially within side channels that became more disconnected from main channel influence, such as RP-173-3 and RP-141-2. Data from the next year of study will be reviewed independently to see if these trends hold up over two years and/or if different trends are evident.

The metrics calculated from the taxonomic abundance data are the first step in the data analyses planned for the benthic macroinvertebrate data collected for this study. Benthic metrics can be used initially to describe the benthic community structure and function, but ultimately will serve as one of the data sets used to conduct the statistical analyses and modeling, together with the environmental data sets collected alongside the biological data. The data collected in 2013 and the future data collection efforts planned for 2015 will provide the information needed for the additional statistical analyses, the results of which will be provided in the Updated Study Report.

4.2. Drift of Benthic Macroinvertebrates

Results from the drift sampling effort generally showed noticeable differences in several metrics between mainstem macrohabitats (main channel and side channel habitats) when compared to other macrohabitat types, especially tributary mouths and off-channel habitats (side sloughs, upland sloughs). Tributary mouths were generally highest in mean drift density, taxa richness, and EPT richness, and often showed higher percentages of those EPT taxa in community compositions, especially during the spring and fall event periods. Plankton tows collected within side sloughs and upland sloughs displayed higher densities of zooplankton and non-insect taxa, as well as chironomids, but usually showed very low taxa richness results. Main channel and side channel sites often displayed the lowest drift density and taxa richness measures in comparison to tributary mouths, and those side sloughs that were able to be sampled via drift nets.

The marked difference between drift net densities and plankton tow densities is largely attributed to how each method samples the water volumes. Drift nets sample a significantly higher volume of water, as it is the water moving downstream through the net itself. Invertebrates and debris within the water column are more diluted within this large volume, and the drift net serves to filter a subsample of that volume. In contrast, the plankton tow net samples a much smaller volume of water by moving through it, capturing any invertebrates and debris that are suspended in water within its path. Invertebrates and debris within the water column are therefore more concentrated within that limited volume, thus the higher numbers collected. So, while invertebrate densities within an upland slough are much higher, the total volume that density can be applied to is limited to the volume of the slough, whereas the total volume that drift density estimate can be applied to is the volume of water in the main channel. Therefore, the presentation of drift density and plankton tow density reflect the concentration of prey items per cubic foot of water encountered within that macrohabitat, but does not factor in the total volumes available. As stated for benthic samples, the data from the next year of study will be reviewed independently from the 2013 data set to determine if the trends evident in 2013 are repeated, or if new trends are evident.

The metrics calculated from the taxonomic abundance data are the first step in the data analyses planned for the invertebrate drift data collected for this study. These metrics can be used initially to describe the benthic community structure and function, but ultimately will serve as one of the data sets used to conduct the statistical analyses and modeling, together with the environmental data sets collected alongside the biological data. Future analyses will also include calculating biomass estimates, and a comparison to the fish diet data also being collected for the River Productivity Study. The data collected in 2013 and the future data collection efforts planned for 2015 will provide the information needed for the additional statistical analyses, the results of which will be provided in the Updated Study Report.

4.3. Feasibility of Talkeetna as a Reference

Results from the benthic macroinvertebrate sampling effort on the Talkeetna River, as well as the algal sampling results given in the ISR, generally showed noticeable differences in several metrics between mainstem macrohabitats (the side channel habitat) when compared to the off-channel habitats (side sloughs, upland sloughs) sampled. Side sloughs and upland sloughs displayed higher densities and the side slough showed higher taxa richness measures during the sampling season than were seen at the side channel site.

The metrics calculated from the taxonomic abundance data are a first step in characterizing the structure and function of benthic communities in the Talkeetna River. These 2013 data will undergo additional analysis that will allow for comparisons of similar macrohabitat sites on the Susitna and Talkeetna rivers collected during the same event period. This analysis will support an assessment of the Talkeetna River as a future reference site for evaluating Project effects within a monitoring program, the results of which will be provided in the Updated Study Report.

4.4. Trophic Analysis of Food Web

4.4.1. Trophic Model

The growth patterns of age-0 Chinook salmon and age-0 and age-1 coho salmon in 2013 were similar to those reported in the middle Susitna River during the 1980s, but the growth and life history of older age classes appeared to differ from prior studies. For example, in 1984, the average size of age-0 coho salmon grew from approximately 40 mm FL in late May to 58 mm FL in early October. Age-1 coho salmon grew from 70 to 104 mm FL on average (Roth and

Stratton 1985). Similar growth rates were reported in 1985 (Roth et al. 1986). These growth rates were comparable to those reported here (Figure 3.4-10). However, the historical studies reported that the largest juvenile salmon (> 100 mm FL) captured in the Susitna River were mostly coho, rather than Chinook as indicated by the 2013 data. In 1984 and 1985, age-1 Chinook salmon had mostly completed their migration to saltwater by late July, and most Chinook salmon captured during August-October were age-0. During those years, many coho salmon reared in freshwater for two complete years and smolted at age 2. Correspondingly, the size distribution of coho salmon captured in the river contained far more large fish > 100 mm than did the distribution of Chinook salmon. These historical patterns were consistent with more recent studies in the Susitna Basin and northern Cook Inlet (e.g., Moulton 1997; Davis and Davis 2009; Sepulveda et al. 2013), as well as with broad geographical patterns in juvenile salmon life history (Taylor 1990; Quinn 2005).

In contrast, the 2013 data suggested that substantial numbers of age-1 and age-2 Chinook salmon were present in the river through September and October, while few coho salmon were captured after June of their age-1 year. Other data from 2013 and 2014 suggest that some Chinook salmon in this system may exhibit a two-year freshwater residence. Chinook salmon captured in the downstream migrant trap at the dam site, upstream of documented coho salmon habitat, were large enough (> 100 mm FL) to potentially be age 2. Some of these large Chinook salmon may have migrated downstream to rear in the middle river tributaries. Other possible explanations for the discrepancy with previous studies are potential misinterpretation of the size-frequency and scale pattern data or potential misidentification of larger coho as Chinook in the field. Expanded genetic sampling of larger juvenile salmon during 2014 is being conducted to test the accuracy of species identifications assigned in the field. A more robust sample size of aged fish collected in 2014 is also likely to improve the quantification of size-at-age patterns. We interpreted the data from larger Chinook salmon (age-2s as well as age-1s sampled during August-October) with caution until these preliminary results could be corroborated, and focused our interpretation on the younger age classes.

The initial bioenergetics model results indicated that feeding rate was the primary factor limiting the growth of juvenile Chinook and coho salmon, and temperature and food quality were of secondary importance. This is consistent with general bioenergetics theory: across the range of temperatures typically observed in Alaskan streams and rivers, the growth of juvenile Chinook and coho salmon is expected to be limited mostly by feeding rate (Beauchamp 2009). However, exceptions occur when temperatures are cool and food is abundant. For example, a bioenergetics analysis and field experiment in the Chena River demonstrated that juvenile Chinook salmon fed close to their theoretical maximum consumption rate (P near 1), and temperature was the primary limitation on growth (Perry 2012). Likewise, heterogeneous stream temperatures in Southwest Alaskan streams caused high variability in age-0 coho salmon growth, and these differences were amplified by the ability of faster-growing coho to consume salmon eggs during their first summer (Armstrong et al. 2010). A broader comparison of salmon growth and consumption patterns across a wider range of sampling sites will be possible after the second year of data is collected in 2014.

4.4.2. Stable isotope analysis of food web components

The 2013 isotopic analysis showed that of all endmembers analyzed, algal samples had the greatest variability within the entire system and among study reaches (Figure 3.4-11), with the range of algal $\delta^{13}C$ values overlapping that of all other subsidies (benthic and drift organic matter, spawning salmon). The high variability in algal $\delta^{13}C$ signatures has been documented in other studies (Rounick et al. 1982; Doucett et al. 1996), and has been shown to vary with flow rates and CO_2 concentrations among habitats (Finlay et al. 1999). Because clear isotopic separation of sources is required for diet studies, this variability and overlap of algal signatures relative to other organic matter sources has made interpretation of previous studies difficult, if not impossible (Michener and Lajtha 2007). Low sample sizes (n = 1 to 3) of algae components at each site may also contribute to wide isotopic variability of algal signatures. Despite wide isotopic variability of algal samples collected for this study, aquatic invertebrate $\delta^{13}C$ values (of all functional feeding groups) were similar to algal $\delta^{13}C$ values from within the same site. This consistency suggests that the algae collections in this study were successful in capturing the variability in algal signatures.

Stable isotope mixing models suggest that both spatial and an upriver-to-downriver trends exist in the relative contributions of freshwater, terrestrial, and marine sources. An increasing proportion of marine sources in the diets of the target fish species from June to October suggests that fish are foraging on energy-rich spawning salmon tissue and eggs as they become available as a food source. These data corroborate the findings from the stomach content analysis that juvenile Chinook and coho salmon consume substantial amounts of marine-derived food. This is in contrast to prior juvenile salmon diet studies in the Middle Susitna Basin, which found that these species relied almost exclusively on aquatic and terrestrial insects (ADF&G 1983; Hansen and Richards 1985). An upriver-downriver spatial trend exists in the proportion of marine subsidies consumed, where rearing salmon and resident trout are more heavily influenced by this diet source higher up in the system. The opposite trend was expected; however, more spawning salmon were observed in FA-104 and FA-141 at the time of sampling than at FA-81. The spatial trend may therefore be explained by the overlap of suitable spawning habitats with rearing habitats. Mixing models also suggest differences in dietary contributions between habitat types, where foraging target species in generally clear, oxygenated tributary mouths and side sloughs receive a greater marine subsidy compared to more turbid side channels and less-connected upland sloughs. Again, these differences may speak to the overlap of suitable spawning and rearing habitat.

Results from mixing models showed a consistent but partially overlapping isotopic relationship between aquatic and terrestrial invertebrate diet sources (see Appendix A, Figures A3.4-1 through A3.4-4). Despite overlap in source signatures, mixing models were able to converge on diet solutions for each target fish species; however, isotopic diet proportion results should be considered in conjunction with the stomach content analysis results to gain a clearer understanding of diet sources. Some diet items that were found in fish stomach samples, such as non-salmon eggs and salmon fry, were not available as source inputs for isotopic analysis. The second year of data collected in 2014 will be incorporated to increase sample sizes and develop a more roubust trophic model.

4.5. Invertebrate composition in the diets of representative fish species

All three study species relied heavily on salmon eggs and fish during the three sampling periods between June and September 2013. This pattern was relatively consistent across the three focus areas studied and in three out of four macrohabitat types, with the exception of upland sloughs. These diet data are interpreted with caution and focus on the broad trends in the data because of the relatively low sample sizes. Further, the diet proportions by mass metric tends to be highly variable when relatively unusual diet items are much larger than the average diet item in the dataset, such as fish in these data (Chipps and Garvey 2007). The expanded fish diet sampling program in 2014 should provide an increase in sample sizes and yield a more robust dataset for characterizing the diet composition beyond this preliminary analysis and despite intrinsic variability seen in 2013 data.

In contrast to these results, prior studies found that juvenile Chinook salmon and coho salmon consumed primarily aquatic invertebrates during 1982, with very little consumption of salmon eggs and no consumption of fish (ADF&G 1983; Hansen and Richards 1985). Direct comparisons with the historic data are challenging because those data were presented in terms of diet proportions by number, rather than diet proportions by mass, the metric used in this study, which is now preferred for food web and energy flow studies (Chipps and Garvey 2007). However, the historic data consistently show that salmon eggs were not consumed by juvenile Chinook or coho salmon, with the exception of the last sampling event of the season on September 23, 1982 at Indian River, when eggs comprised 6-percent of the Chinook salmon diet and 2-percent of the coho salmon diet (proportions by number; ADF&G 1983, Appendix Tables 3-C-12 and 3-C-19). These reported proportions would likely translate to substantial proportions by mass because the average mass of a salmon egg was 23-76 times greater than that of an average terrestrial or aquatic invertebrate food item in the 2013 dataset. These historical data indicate that juvenile Chinook and coho consumed salmon eggs at Indian River in late September. However, there is no evidence that they utilized salmon eggs during other spawning runs or at other sites within the Susitna Basin. This apparent difference may be due to increased availability of salmon eggs to juvenile salmon, which could potentially result from small, climate-driven changes in spawner run timing, juvenile growth to the size threshold for gape limitation, or other factors. Alternatively, it may simply be an artifact of spatial and temporal mismatches between the historical diet sampling events and salmon spawning runs.

4.6. Benthic Macroinvertebrate Colonization Rates

When considering the colonization test results, it is important to note that both turbid sites were subjected to early exposures during the final week of the test period, and these lower densities were very likely the result of that exposure. However, deep sets at HD-4 did remain inundated for the duration of the test period, so it is reasonable to assume that turbid conditions could result in lower densities during colonization. Water temperature appears to have an effect on the colonization levels, with warm conditions producing higher densities and taxa richness compared to cold conditions. The factor of water depth appeared to have little effect on the colonization of the Hester-Dendy samplers, aside from the increased risk of dewatering and exposure in habitats that experience frequent and significant water level fluctuations, as was seen at the turbid sites for shallow samplers.

In test runs that were not disturbed, colonization appears to be reached at approximately six weeks, based upon density estimates. Factoring in taxa richness measures, the clear sites indicated that mean taxa numbers were reached as early as four weeks. However, this could be the initial colonizing pioneer taxa, and additional time may be necessary until the community can be determined to be in equilibrium. For turbid conditions, the limited results suggest that a 6-8 week period may be sufficient, as well.

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6. TABLES

Table 3.1-1. Benthic macroinvertebrate sample totals for 2013 sampling during three index events (Spr= Spring, Sum=Summer, Fall) and Post-Storm sampling for sites in the Middle and Lower River Segments of the Susitna River for the River Productivity Study.

		Hess Samples					Ponar Grab Samples				
Site	Macrohabitat Type	Spr	Sum	Fall	Post-Storm	Total	Spr	Sum	Fall	Post-Storm	Total
RP-184-1	Tributary Mouth (TM)	5	5	5		15					
RP-184-2	Side Channel (SC)	5	5	5		15					
RP-184-3	Main Channel (MC)	5	5	5		15					
RP-173-1	Tributary Mouth	5	5	5		15					
RP-173-2	Main Channel	5	5	5		15					
RP-173-3	Side Channel	5	5	5		15					
RP-173-4	Side Slough	5	5	2	5	17	5	5	5	5	20
RP-141-1	Tributary Mouth	5	5	5		15					
RP-141-2	Side Channel	5	5			10			5		5
RP-141-3	Mult Split Main Channel	5	5	5		15					
RP-141-4	Upland Slough	5	4	3		12	5	5	5		15
RP-104-1	Side Slough	5	5	5		15					
RP-104-2	Side Slough	5	5	2	5	17			5		5
RP-104-3	Main Channel	5	5	5		15					
RP-104-4	Upland Slough						5	5	5		15
RP-104-5	Side Channel	5	5	5		15					
RP-81-1	Upland Slough			5		5	5	5			10
RP-81-2	Tributary Mouth	5	5	5		15					
RP-81-3	Split Main Channel	5	5	5		15					
RP-81-4	Side Channel	5	5	5		15					
	Totals	90	89	82	10	271	20	20	25	5	70

Table 3.1-2. Summary benthic metrics for sites at River Productivity stations in Middle Reach above Devils Canyon.

Station	FA-184 (Watana Dam)			FA-173 (Stephan Lake Complex)			
Site	RP-184-1	RP-184-2	RP-184-3	RP-173-1	RP-173-2	RP-173-3	RP-173-4
Habitat	TM	SC	MC	TM	MC	SC	SS
Density (Individuals/m^2)							
Range	1337 - 5178	23.3 - 1744	58.1 - 488	244 - 4930	11.6 - 3291	826 - 9037	0 - 65116
Average	2653.0	337.2	218.6	1995.7	439.5	3664.3	9068.8
Median	2372.1	209.3	174.4	1546.5	127.9	2941.9	4821.7
Taxa Richness							
Range	16 - 33	2 - 14	3 - 15	3 - 43	1 - 17	8 - 32	0 - 40
Average	22.9	7.5	7.9	23.9	7.8	23.5	16.0
Median	23	8	7	25	7	25	17
EPT Richness							
Range	4 - 11	0 - 6	0 - 6	0 - 12	0 - 10	0 - 8	0 - 9
Average	6.0	2.0	2.0	7.0	3.0	5.0	2.0
Median	6	2	2	7	2	5	1
Chironomid Taxa							
Range	4 - 17	0 - 6	0 - 9	1 - 20	0 - 5	5 - 20	0 - 22
Average	11.0	3.0	3.0	11.0	3.0	13.0	10.0
Median	10	4	4	12	3	13	11
Diversity (H')							
Range	1.31 - 2.53	0.69 - 2.04	0.95 - 2.3	0.84 - 3.08	0 - 2.03	1.4 - 2.73	0 - 2.8
Average	1.99	1.48	1.69	2.35	1.45	2.17	1.87
Median	1.96	1.67	1.69	2.48	1.61	2.32	1.91
Relative Abundance Top 3 Taxa (Percent)							
Range	50.1 - 87.3	57.5 - 100	51.3 - 100	33.7 - 100	60 - 100	46.2 - 83.3	0 - 100
Average	69.8	77.6	71.8	56.3	76.5	63.8	65.3
Median	73.7	75.1	72.9	51.6	74.1	62.9	65.9
Relative Abundance EPT (Percent)							
Range	11.1 - 68.4	0 - 70	0 - 58.3	0 - 55.9	0 - 60.4	0 - 65.3	0 - 20
Average	43.5	24.3	21.3	28.4	25.0	19.7	2.7
Median	43.3	22.2	16.0	27.8	24.1	7.7	0.3
Relative Abundance Chironomids (Percent)							
Range	6.2 - 88.3	0 - 100	0 - 88.9	8.4 - 74.2	0 - 100	16.7 - 90.3	0 - 100
Average	32.0	45.6	36.1	42.4	35.6	53.8	70.9
Median	26.3	50.0	40.0	53.3	27.3	52.2	77.1

Table 3.1-3. Summary benthic metrics for sites at River Productivity stations in Middle Reach below Devils Canyon.

Station	FA-141 (Indian River)				FA-104 (Whiskers Slough)				
Site	RP-141-1	RP-141-2	RP-141-3	RP-141-4	RP-104-1	RP-104-2	RP-104-3	RP-104-4	RP-104-5
Habitat	TM	SC	MC	US	TM	SS	MC	US	SC
Density (Individuals/m^2)									
Range	547 - 7380	116 - 2971	0 - 256	517 - 64744	326 - 12062	81 - 47132	0 - 407	258 - 21493	11.6 - 279
Average	2468.5	827.0	96.1	10541.7	5424.9	7667.1	147.3	7024.4	130.2
Median	1755.8	602.8	81.4	7220.9	4081.4	3057.0	116.3	6544.5	116.3
Taxa Richness									
Range	11 - 38	3 - 29	0 - 11	4 - 22	13 - 33	6 - 41	0 - 13	3 - 32	1 - 14
Average	20.1	11.3	5.0	13.6	25.9	21.3	5.9	16.4	5.7
Median	18	10	5	14	28	20	6	17	5
EPT Richness									
Range	3 - 12	0 - 10	0 - 8	0 - 5	0 - 6	0 - 6	0 - 2	0 - 1	0 - 4
Average	7.0	3.0	2.0	1.0	3.0	3.0	1.0	0.0	2.0
Median	7	2	1	0	4	2.5	0	0	2
Chironomid Taxa									
Range	2 - 17	2 - 15	0 - 5	0 - 15	8 - 22	3 - 26	0 - 9	1 - 22	0 - 9
Average	8.0	6.0	2.0	9.0	16.0	14.0	4.0	12.0	3.0
Median	7	5	2	9	17	13	4	11	3
Diversity (H')									
Range	1.26 - 2.42	0.51 - 3.06	0 - 2.06	0.84 - 2.57	1.77 - 2.77	1.33 - 2.7	0 - 1.91	1.04 - 2.73	0 - 2.5
Average	1.90	1.74	1.35	1.71	2.26	2.15	1.43	1.82	1.35
Median	1.97	1.84	1.45	1.73	2.27	2.1	1.63	1.79	1.39
Relative Abundance Top 3 Taxa (Percent)									
Range	50.4 - 83.1	30 - 100	0 - 100	47.8 - 95.5	41.5 - 74.4	39 - 85.3	0 - 100	34.5 - 100	41.7 - 100
Average	68.9	68.6	73.2	74.8	59.2	60.5	68.7	70.1	77.4
Median	70.0	68.8	75.0	74.3	58.1	59.1	72.7	72.0	80.0
Relative Abundance EPT (Percent)									
Range	13.9 - 91.1	0 - 50	0 - 66.7	0 - 6.6	0 - 32.1	0 - 42.1	0 - 28.6	0 - 6.9	0 - 75
Average	61.5	16.9	26.6	0.8	7.1	7.1	7.2	0.5	33.9
Median	73.0	10.2	28.6	0.0	4.6	4.6	0.0	0.0	33.3
Relative Abundance Chironomids (Percent)									
Range	3.4 - 81.8	29.5 - 100	0 - 100	0 - 96.2	26.8 - 92	34.3 - 84.3	0 - 100	16.7 - 100	0 - 100
Average	30.5	66.5	55.2	57.6	74.4	59.2	65.2	55.7	42.2
Median	20.0	63.3	44.4	55.9	85.5	56.3	70.0	55.5	33.3

Table 3.1-4. Summary benthic metrics for sites at River Productivity stations in Lower Reach downstream of the confluence with Chulitna River.

Station	RP-81 (Montana Creek)				RP-TKA (Talkeetna River)		
Site	RP-81-1	RP-81-2	RP-81-3	RP-81-4	RP-TKA-1	RP-TKA-2	RP-TKA-3
Habitat	US	TM	MC	SC	SC	US	SS
Density (Individuals/m^2)							
Range	628 - 19576	698 - 16233	0 - 244	58.1 - 884	279.1 - 1698	129 - 13476	1895 - 18870
Average	3864.8	3996.9	111.6	284.5	637.2	4609.8	7690.0
Median	1872.1	2534.9	139.5	162.8	558.1	2669.4	5782.9
Taxa Richness							
Range	6 - 26	9 - 40	0 - 10	4 - 15	9 - 17	2 - 29	14 - 32
Average	13.2	26.5	3.7	7.9	11.9	13.1	25.5
Median	10	27	3	9	11	12	26
EPT Richness							
Range	0 - 2	2 - 15	0 - 5	1 - 9	3 - 9	0 - 1	5 - 13
Average	0.0	8.0	1.0	4.0	5.0	0.0	9.0
Median	0	8	0	3	5	0	10
Chironomid Taxa							
Range	4 - 20	6 - 21	0 - 5	0 - 7	2 - 8	2 - 23	6 - 17
Average	9.0	13.0	2.0	2.0	5.0	10.0	11.0
Median	6	13	1	2	5	9	11
Diversity (H')							
Range	1.15 - 2.6	1.13 - 3.2	0 - 1.96	1.33 - 2.25	1.45 - 2.42	0.64 - 2.59	1.58 - 2.91
Average	1.85	2.32	0.84	1.78	1.89	1.61	2.26
Median	1.65	2.44	0.72	1.67	1.80	1.61	2.31
Relative Abundance Top 3 Taxa (Percent)							
Range	44.3 - 89.5	32.6 - 93.1	0 - 100	45.5 - 84.2	48.7 - 81.6	53.1 - 100	32.4 - 85.6
Average	70.6	59.4	67.9	65.0	67.3	77.0	60.8
Median	76.5	59.4	81.0	62.5	70.7	80.2	63.1
Relative Abundance EPT (Percent)							
Range	0 - 2.5	4.6 - 55	0 - 68.4	9.1 - 100	11 - 70.4	0 - 0.6	10.5 - 73.9
Average	0.5	22.0	13.8	54.6	35.6	0.0	34.6
Median	0.0	20.6	0.0	60.0	29.2	0.0	23.4
Relative Abundance Chironomids (Percent)							
Range	18.5 - 73.7	28.3 - 94.7	0 - 100	0 - 66.7	14.3 - 88.4	10.1 - 100	15.5 - 84.9
Average	46.2	68.0	33.1	28.3	56.1	59.4	55.9
Median	46.6	74.3	23.8	26.7	62.3	68.9	61.4

Table 3.2-1. Benthic drift and plankton tow sample totals for 2013 sampling during three index events (Spr= Spring, Sum=Summer, Fall) and Post-Storm for sampling sites in the Middle and Lower River Segments of the Susitna River for the River Productivity Study.

		Drift Samples				Plankton Tow Samples				
Site	Macrohabitat Type	Spr	Sum	Fall	Total	Spr	Sum	Fall	Post-Storm	Total
RP-184-1	Tributary Mouth	2	2	2	6					
RP-184-2	Side Channel	2	2	2	6					
RP-184-3	Main Channel	2	2	2	6					
RP-173-1	Tributary Mouth	2	2	2	6					
RP-173-2	Main Channel	2	2	2	6					
RP-173-3	Side Channel	2	2		2			5		5
RP-173-4	Side Slough					5	5	5		15
RP-141-1	Tributary Mouth	2	2	2	6					
RP-141-2	Side Channel	2	2	2	6					
RP-141-3	Mult Split Main Channel	2	2		2			5		5
RP-141-4	Upland Slough					5	5	5		15
RP-141-5*	Main Channel		2		2					
RP-104-1	Trib Mouth/Side Slough	2	2	2	6					
RP-104-2	Side Slough	2			2		5	5	5	15
RP-104-3	Main Channel	2	2	2	6					
RP-104-4	Upland Slough	2			2	5	5	5		15
RP-104-5	Side Channel	2	2		2			5		5
RP-81-1	Upland Slough			2	2	5	5			10
RP-81-2	Tributary Mouth	2	2	2	6					
RP-81-3	Split Main Channel	2	2	2	6					
RP-81-4	Side Channel	2	2	2	6					
RP-81-5*	Side Channel	2	2	2	6					
	Totals	36	34	28	92	20	25	35	5	85

Note:
* = Additional site established immediately upstream of tributary mouth to address tributary mouth drift contributions.

Table 3.2-2. Summary drift and plankton metrics for sites at River Productivity stations in Middle Reach above Devils Canyon.

Station	FA-184 (Watana Dam)			FA-173 (Stephan Lake Complex)			
Site	RP-184-1	RP-184-2	RP-184-3	RP-173-1	RP-173-2	RP-173-3	RP-173-4
Habitat	TM	SC	MC	TM	MC	SC	SS
Density (Individuals/ft^3)							
Range	0.076 - 2.18	0.003 - 0.11	0.01 - 0.45	0.023 - 0.27	0.034 - 0.34	0 - 2.64	0 - 10.75
Average	0.53	0.05	0.12	0.14	0.17	0.54	1.72
Median	0.22	0.06	0.07	0.11	0.15	0.09	0.56
Taxa Richness							
Range	10 - 54	7 - 28	6 - 29	26 - 55	17 - 34	0 - 32	0 - 15
Average	30.3	19.7	17.8	40.0	24.8	9.2	4.3
Median	32.50	23.50	20.00	40.50	24.50	4.00	3.00
EPT Richness							
Range	2 - 9	1 - 5	0 - 5	5 - 13	2 - 9	0 - 4	0 - 1
Average	5.0	2.5	2.7	7.3	4.3	1.0	0.1
Median	5.00	2.00	2.50	6.50	4.00	0.00	0.00
Chironomid Taxa							
Range	3 - 27	2 - 16	5 - 13	6 - 25	5 - 14	0 - 12	0 - 8
Average	14.2	9.7	8.2	15.7	9.7	4.0	2.5
Median	15.50	10.50	7.00	16.50	9.50	2.00	2.00
Diversity (H')							
Range	0.3 - 3.12	1.88 - 2.45	1.53 - 2.14	1.92 - 3.31	1.99 - 2.87	0 - 2.76	0 - 2.29
Average	1.87	2.13	1.90	2.78	2.50	1.32	0.82
Median	1.99	2.09	1.96	3.07	2.55	1.22	0.80
Relative Abundance Top 3 Taxa (Percent)							
Range	41.7 - 97.7	54.2 - 78.4	53.8 - 80.2	31.2 - 73.6	37 - 70.1	0 - 100	0 - 100
Average	69.4	63.3	69.2	47.6	53.1	69.3	78.7
Median	67.3	62.2	69.4	38.5	52.5	76.9	96.0
Relative Abundance EPT (Percent)							
Range	1.5 - 10.3	1.7 - 11.1	0 - 7.7	4.5 - 22.9	4.2 - 13.5	0 - 20	0 - 8.3
Average	5.9	5.5	3.3	11.0	6.8	5.4	0.9
Median	6.1	4.8	2.8	10.0	5.0	0.0	0.0
Relative Abundance Chironomids (Percent)							
Range	2.7 - 82.6	8.4 - 66.4	4.5 - 90	23.6 - 55.9	3.5 - 57.8	0 - 100	0 - 100
Average	56.6	38.9	42.4	37.8	35.9	66	69.3
Median	71.46	42.64	47.54	34.29	47.23	66.67	75.00
Relative Abundance Zooplankton (Percent)							
Range	0 - 0.5	0 - 43.3	0 - 54.2	0 - 0.9	0 - 48.6	0 - 33.3	0 - 50
Average	0.1	11.7	11.6	0.3	11.8	6.1	11.3
Median	0.0	0.0	0.3	0.2	4.9	0.0	0.0

Table 3.2-3. Summary drift and plankton metrics for sites at River Productivity stations in Middle Reach below Devils Canyon.

	Station	FA-141 (Indian River)					FA-104 (Whiskers Slough)				
	Site	RP-141-1	RP-141-2	RP-141-3	RP-141-4	RP-141-5	RP-104-1	RP-104-2	RP-104-3	RP-104-4	RP-104-5
Metric	Habitat	TM	SC	MC	US	MC	TM	SS	MC	US	SC
Density (Individuals/ft^3)	Range	0.18 - 0.75	0 - 0.22	0.002 - 0.08	0 - 5.36	0.009 - 0.02	0.02 - 0.06	0 - 17.07	0 - 0.15	0 - 75.23	0 - 0.17
	Average	0.48	0.07	0.03	1.27	0.01	0.04	1.82	0.05	9.75	0.05
	Median	0.49	0.01	0.03	0.34	0.01	0.04	0.17	0.05	4.68	0.01
Taxa Richness	Range	37 - 45	0 - 54	2 - 24	0 - 15	5 - 18	17 - 33	0 - 13	0 - 22	0 - 20	0 - 35
	Average	41.0	15.1	15.0	5.4	11.5	21.7	4.7	13.7	10.5	11.0
	Median	41.00	2.00	18.50	4.00	11.50	19.50	3.00	14.50	12.00	2.00
EPT Richness	Range	6 - 12	0 - 6	0 - 6	0 - 2	2 - 3	2 - 3	0 - 3	0 - 4	0 - 1	0 - 8
	Average	9.5	2.1	2.2	0.3	2.5	2.8	0.6	2.3	0.2	2.2
	Median	9.50	1.00	1.50	0.00	2.50	3.00	0.00	2.50	0.00	0.00
Chironomid Taxa	Range	15 - 19	0 - 24	1 - 13	0 - 7	1 - 6	9 - 16	0 - 6	0 - 11	0 - 6	0 - 19
	Average	16.3	6.0	6.7	1.6	3.5	11.7	2.0	5.0	2.5	4.8
	Median	15.50	1.00	7.00	1.00	3.50	11.00	1.00	5.00	2.00	0.00
Diversity (H')	Range	1.96 - 3.08	0 - 2.97	0.64 - 2.85	0 - 2.34	0.84 - 2.07	2.17 - 2.97	0 - 1.74	0 - 2.86	0 - 2.4	0 - 2.77
	Average	2.57	1.28	1.98	1.21	1.46	2.51	0.88	1.93	1.67	1.22
	Median	2.60	0.69	2.08	1.33	1.46	2.54	1.10	2.10	1.97	0.64
Relative Abundance Top 3 Taxa (Percent)	Range	34 - 73.4	0 - 100	38.1 - 100	0 - 100	62.7 - 93.3	39.5 - 67.8	0 - 100	0 - 71.4	0 - 100	0 - 100
	Average	54.1	43.3	62.0	78.0	78.0	50.2	71.8	45.5	56.2	33.9
	Median	55.8	46.1	60.4	83.3	78.0	46.8	80.3	51.2	62.1	41.4
Relative Abundance EPT (Percent)	Range	10.6 - 38.5	0 - 50	0 - 22	0 - 7.7	51 - 90	3.3 - 26.3	0 - 66.7	0 - 24	0 - 50	0 - 62.5
	Average	23.4	11.3	8.4	1.0	70.5	11.5	11.0	7.9	3.5	13.2
	Median	21.0	5.7	4.3	0.0	70.5	9.8	0.0	5.9	0.0	0.0
Relative Abundance Chironomids (Percent)	Range	24.8 - 64.1	0 - 50	12.7 - 75.6	0 - 88	3.3 - 15.7	19.3 - 84.6	0 - 100	0 - 53.1	0 - 25	0 - 60.7
	Average	44.4	23.5	41.1	28.9	9.5	54.3	43.2	25.4	11.1	18.6
	Median	43.52	33.33	37.85	33.33	9.51	57.37	33.33	21.20	12.20	0.00
Relative Abundance Zooplankton (Percent)	Range	0 - 0.6	0 - 9	0 - 11.8	0 - 96.7	0 - 0	0 - 11.4	0 - 66.7	0 - 36.6	0 - 85.4	0 - 66.7
	Average	0.2	1.7	2.9	31.9	0.0	3.9	15.5	10.0	52.6	8.0
	Median	0.0	0.0	1.2	23.8	0.0	1.8	3.7	1.0	61.2	0.0

Table 3.2-4. Summary drift and plankton metrics for sites at River Productivity stations in Lower Reach downstream of confluence with Chulitna River.

Station	RP-81 (Montana Creek)					RP-TKA (Talkeetna River)		
Site	RP-81-1	RP-81-2	RP-81-3	RP-81-4	RP-81-5	RP-TKA-1	RP-TKA-2	RP-TKA-3
Habitat	US	TM	MC	SC	SC	SC	US	SS
Density (Individuals/ft^3)								
Range	0 - 38.06	0.071 - 0.23	0.01 - 0.13	0.02 - 0.11	0.04 - 0.27	0.022 - 0.17	0 - 5.43	0.035 - 0.2
Average	5.43	0.14	0.06	0.05	0.14	0.10	1.44	0.08
Median	0.94	0.14	0.04	0.04	0.12	0.11	0.87	0.05
Taxa Richness								
Range	0 - 22	35 - 51	17 - 35	8 - 27	19 - 34	20 - 28	0 - 10	17 - 47
Average	9.6	39.8	25.2	19.7	25.5	23.5	5.0	30.0
Median	8.50	36.50	23.50	19.50	23.50	22.50	5.00	31.00
EPT Richness								
Range	0 - 2	5 - 9	1 - 8	1 - 9	3 - 7	5 - 7	0 - 2	4 - 9
Average	0.3	7.3	4.5	5.0	4.8	5.5	0.4	7.3
Median	0.00	7.50	4.50	5.00	4.50	5.00	0.00	8.00
Chironomid Taxa								
Range	0 - 8	14 - 25	5 - 14	2 - 9	2 - 13	6 - 12	0 - 5	4 - 21
Average	2.8	17.5	9.5	5.7	7.3	9.0	2.3	12.3
Median	2.00	15.50	9.50	6.50	8.00	9.00	2.00	14.00
Diversity (H')								
Range	0 - 2.04	2.48 - 3.26	2.33 - 3.32	1.77 - 3.07	1.78 - 3.14	2.47 - 2.73	0 - 2.15	2.06 - 3.06
Average	1.29	2.83	2.80	2.39	2.66	2.59	1.30	2.52
Median	1.36	2.79	2.85	2.31	2.74	2.58	1.49	2.46
Relative Abundance Top 3 Taxa (Percent)								
Range	0 - 100	33.6 - 59.3	24.5 - 54.2	29.4 - 73.2	32.3 - 73.4	37.3 - 59.9	0 - 100	37.2 - 69.2
Average	76.2	47.6	40.9	49.9	46.8	50.3	72.6	54.1
Median	81.5	48.8	41.3	49.0	45.0	53.1	75.0	53.5
Relative Abundance EPT (Percent)								
Range	0 - 0.9	9.3 - 18.3	2.4 - 24.7	8.1 - 79	12.9 - 44.3	16.5 - 32.5	0 - 27.3	13.6 - 64.8
Average	0.1	14.3	11.0	36.5	25.3	23.7	4.6	33.2
Median	0.0	14.9	7.1	24.3	21.9	22.9	0.0	26.2
Relative Abundance Chironomids (Percent)								
Range	0 - 100	27.2 - 63	8.7 - 53.2	2.9 - 66.7	1.3 - 42.5	32.5 - 66	0 - 100	9.3 - 75.6
Average	18.1	44.9	35.1	29.2	23	47.6	48.2	49.8
Median	5.24	44.72	35.47	32.33	26.37	49.16	43.75	53.03
Relative Abundance Zooplankton (Percent)								
Range	0 - 100	0 - 21	0 - 44.3	0 - 1	0 - 61.3	0 - 1.6	0 - 60	0 - 1.1
Average	46.5	8.7	8.6	0.3	17.1	0.3	27.6	0.3
Median	43.6	6.8	1.2	0.0	4.0	0.0	28.6	0.0

Table 3.3-1. Benthic macroinvertebrate sample totals for 2013 sampling during three index events (Spring, Summer, Fall) for sites in the Talkeetna River (TKA) for the River Productivity Study.

Site	Macro-habitat Type	Hess Samples				Ponar Grab Samples			
		Spring	Summer	Fall	Total	Spring	Summer	Fall	Total
RP-TKA-1	Side Channel	5	5	5	15				
RP-TKA-2	Upland Slough					5	5	5	15
RP-TKA-3	Side Slough	5	5	5	15				
	Totals:	10	10	10	30	5	5	5	15

Table 3.3-2. Benthic drift and plankton tow sample totals for 2013 sampling during three index events (Spring, Summer, Fall) for sites in the Talkeetna (TKA) River for the River Productivity Study.

Site	Macro-habitat Type	Drift Samples				Plankton Tow Samples			
		Spring	Summer	Fall	Total	Spring	Summer	Fall	Total
RP-TKA-1	Side Channel	2	2	2	6				
RP-TKA-2	Upland Slough						5	5	10
RP-TKA-3	Side Slough	2	2	2	6				
	Totals:	4	4	4	12	0	5	5	10

Table 3.4-1. Bioenergetics model results showing the growth, consumption rate, and growth efficiency of juvenile Chinook and coho salmon. Growth and consumption were simulated for 91-day intervals between the spring and fall sampling events (Spr-Fall) or for 31-day intervals between the summer and fall events (Sum-Fall), depending on the availability of input data.

Species	Age	Station	Habitat	Seasons modeled	Growth (g wet)	Total consumption (g wet)	*P*, Proportion of max. consumption	Growth efficiency (%)	Mean mass-specific consumption rate (g/g/d)	Mean mass-specific growth rate (g/g/d)
Chinook	0	RP-104	SS	Spr-Fall	0.40	7.21	0.24	5.5%	5.2%	0.29%
Chinook	1	RP-104	SS	Spr-Fall	4.42	14.30	0.19	31%	2.9%	0.77%
Chinook	0	RP-141	TM	Spr-Fall	4.48	20.44	0.50	22%	9.6%	2.2%
Chinook	1	RP-141	TM	Spr-Fall	17.84	32.62	0.28	55%	3.6%	1.8%
Chinook	2	RP-141	TM	Spr-Fall	7.40	30.86	0.16	24%	1.7%	0.39%
Coho	0	RP-141	TM	Spr-Fall	1.79	9.91	0.36	18%	8.1%	1.5%
Coho	1	RP-141	TM	Spr-Fall	9.47	18.09	0.24	52%	3.7%	1.7%
Coho	0	RP-104	SS	Sum-Fall	0.58	4.01	0.35	14%	6.2%	0.92%
Coho	1	RP-104	SS	Sum-Fall	1.49	6.05	0.18	25%	2.1%	0.50%
Coho	0	RP-104	US	Sum-Fall	0.57	3.60	0.39	16%	5.5%	0.92%
Coho	1	RP-104	US	Sum-Fall	1.42	11.14	0.40	13%	3.7%	0.50%

Table 3.4-2. Total consumption by juvenile Chinook and coho salmon broken down by individual prey categories, as estimated by bioenergetics models. Prey categories included fish eggs, fish, aquatic invertebrates, terrestrial insects (aquatic origin), and terrestrial insects (terrestrial origin).

					Consumption by prey category (g wet)				
Species	Age	Station	Habitat	Seasons modeled	Fish Eggs	Fish	Aq. Inverts	TI (aq. origin)	TI (te. origin)
Chinook	0	RP-104	SS	Spr-Fall	-	-	5.54	1.46	0.21
Chinook	1	RP-104	SS	Spr-Fall	8.89	-	4.57	0.74	0.11
Chinook	0	RP-141	TM	Spr-Fall	-	-	18.7	0.4	1.4
Chinook	1	RP-141	TM	Spr-Fall	21.79	7.77	2.13	0.64	0.29
Chinook	2	RP-141	TM	Spr-Fall	18.22	9.80	1.88	0.59	0.37
Coho	0	RP-141	TM	Spr-Fall	-	-	9.1	0.2	0.6
Coho	1	RP-141	TM	Spr-Fall	12.04	4.35	1.18	0.35	0.16
Coho	0	RP-104	SS	Sum-Fall	-	-	1.40	1.03	1.58
Coho	1	RP-104	SS	Sum-Fall	3.06	0.98	0.81	0.57	0.63
Coho	0	RP-104	US	Sum-Fall	-	-	3.18	0.41	-
Coho	1	RP-104	US	Sum-Fall	-	-	9.86	1.27	-

Table 3.4-3. Total stable isotope samples analyzed in 2013.

Category	Component	Sites	Seasons	Samples	Maximum Potential Number of Samples	Spring	Summer	Fall	Total Number Analyzed (2013)
Endmembers	Benthic Algae	16	3	3	144	44	41	49	*134*
	Organic Matter - benthic	16	3	3	144	44	48	48	*140*
	Organic Matter - drift	16	3	2	96	30	32	32	*94*
	Salmon carcass	-	-	40	40	0	12	9	*21*
Invertebrates	Benthic- grazers	16	3	3	144	25	24	28	*77*
	Benthic- collectors	16	3	3	144	37	44	46	*127*
	Benthic- shredders	16	3	3	144	19	16	36	*71*
	Benthic- predators	16	3	3	144	36	37	32	*105*
	Terrestrial Drift	16	3	2	96	23	30	27	*80*
	Emergents	16	3	1	48	*32*	*33*	*10*	*75*
Fish	Chinook salmon - juveniles	16	3	8	384	30	38	20	*88*
	Coho salmon - juveniles	16	3	8	384	24	41	43	*108*
	Rainbow trout - juveniles	16	3	8	384	8	8	2	*18*
	Rainbow trout - adults	16	3	8	384	1	9	7	*17*
Total					2,680	353	413	389	1,155

Table 3.5-1. MANCOVA models testing for temporal, spatial, and ontogenetic differences in diet composition of juvenile Chinook salmon and juvenile coho salmon. Degrees of freedom (df) are listed for both hypothesis and error terms.

Factor	Levels	Hyp df	Error df	Wilk's lambda	*F*	*P*
Chinook salmon						
Fork length (covariate)	50-165 mm	5	66	-	3.79	0.0045
Season	Spring, Summer, Fall	10	132	0.506	5.36	<0.0001
Focus Area	RP-81, RP-104, RP-141	10	132	0.784	1.71	0.0846
Habitat	SC, SS, TM, US	15	183	0.542	3.02	0.0002
Coho salmon						
Fork length (covariate)	48-119 mm	5	76	-	0.242	0.0049
Season	Spring, Summer, Fall	10	152	0.785	1.96	0.0415
Focus Area	RP-81, RP-104, RP-141	10	152	0.761	2.23	0.0191
Habitat	SC, SS, TM, US	15	210	0.532	3.6	<0.0001

7. FIGURES

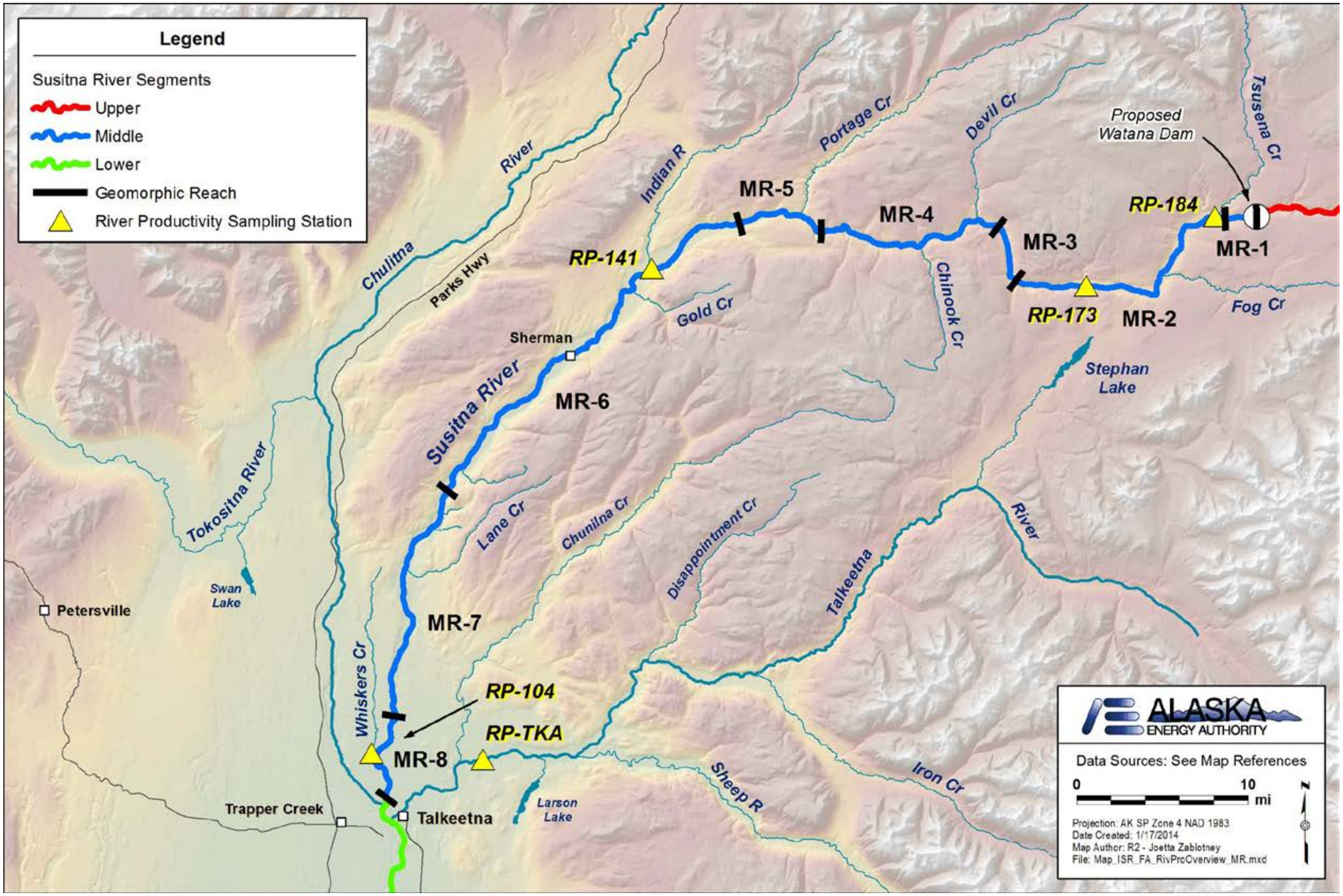

Figure 2.1-1. Middle Susitna River Segment, with the four River Productivity sampling stations /Instream Flow Focus Areas selected for the River Productivity Study, plus the sampling station for reference sites on the Talkeetna River.

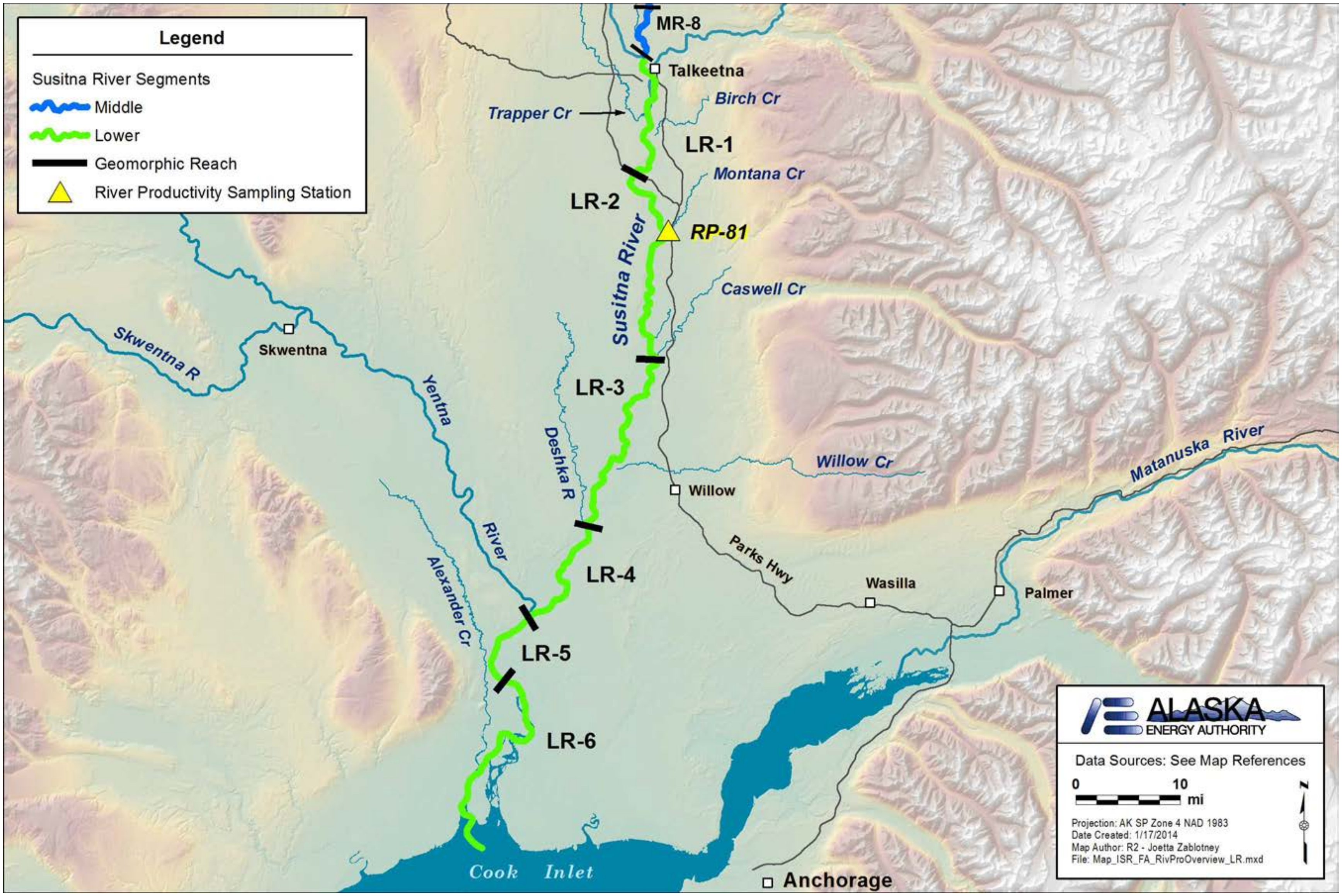

Figure 2.1-2. Lower Susitna River Segment, with Montana Creek area River Productivity sampling station selected for the River Productivity Study.

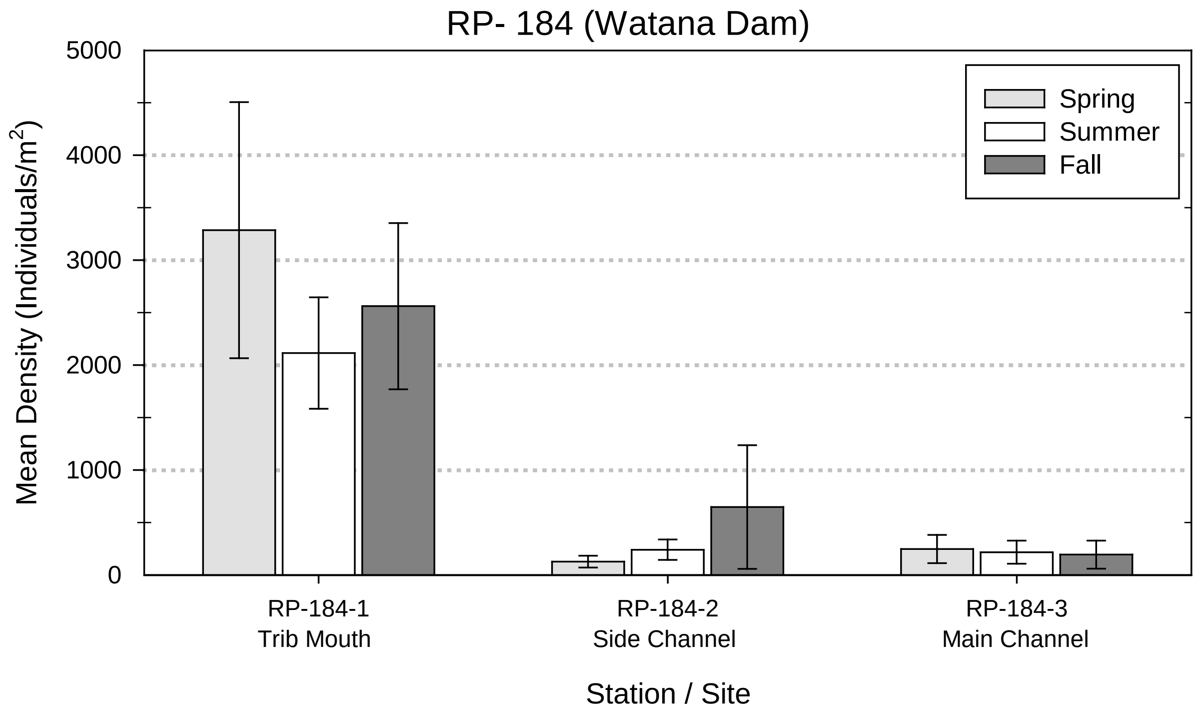

Figure 3.1-1. Mean density estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Watana Dam Focus Area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

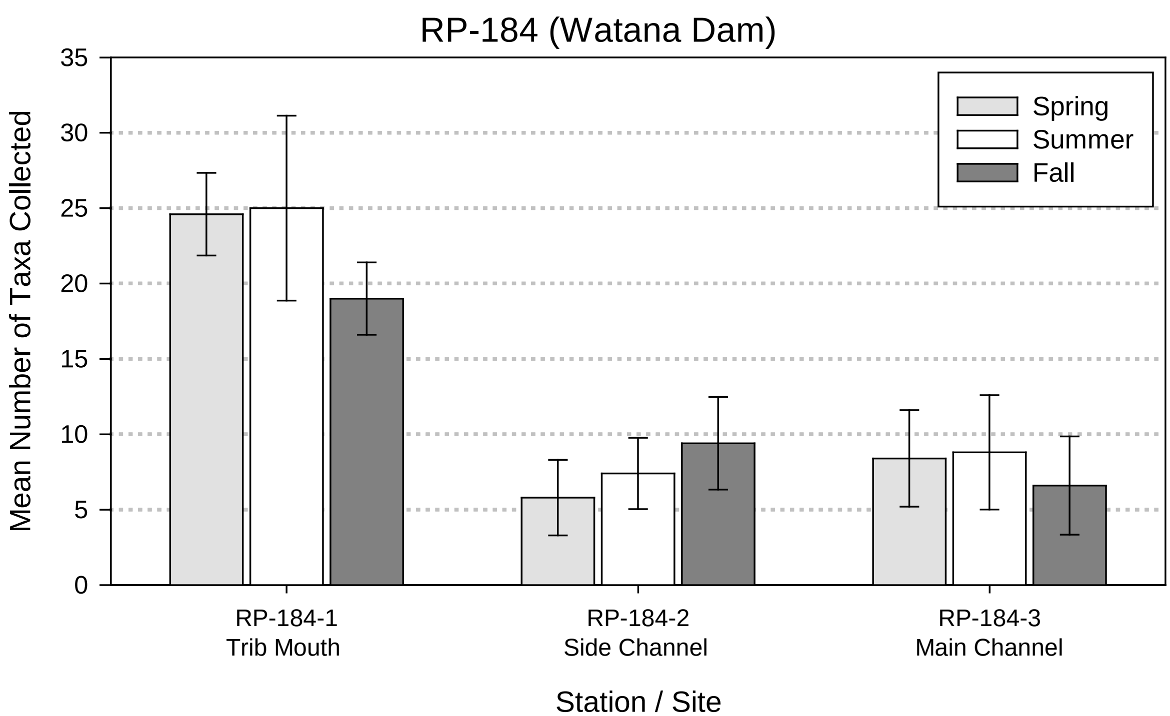

Figure 3.1-2. Mean taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Watana Dam Focus Area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

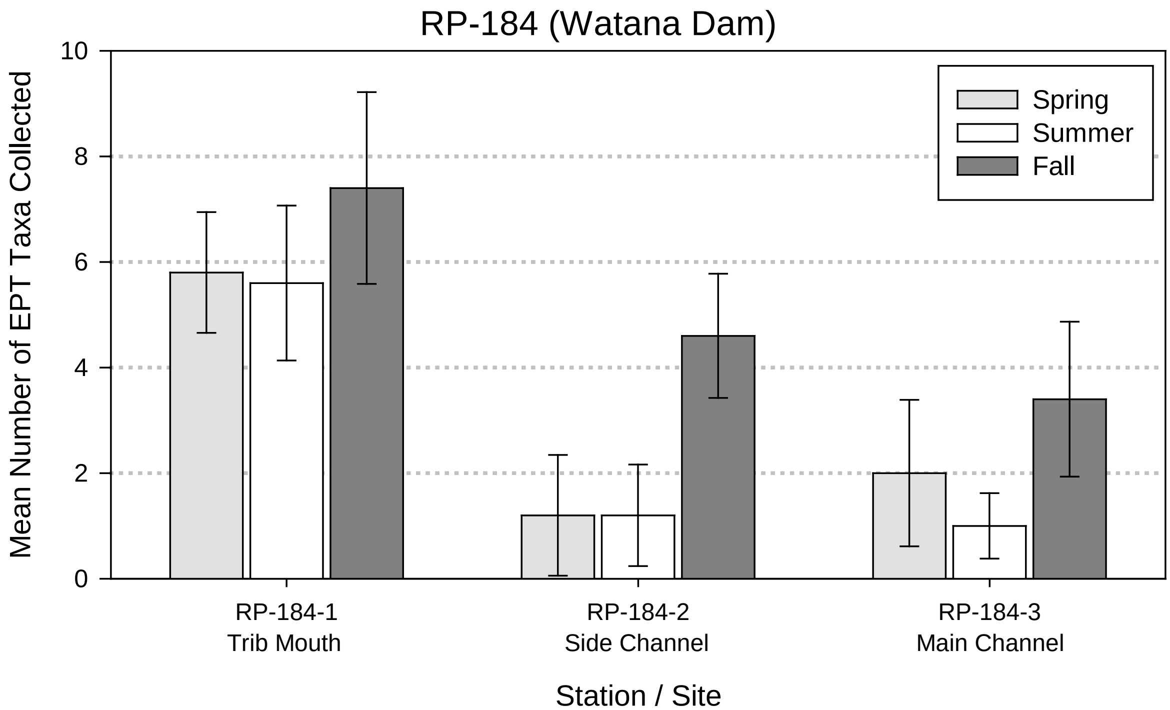

Figure 3.1-3. Mean EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Watana Dam Focus Area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study.Error bars represent 95-percent confidence intervals.

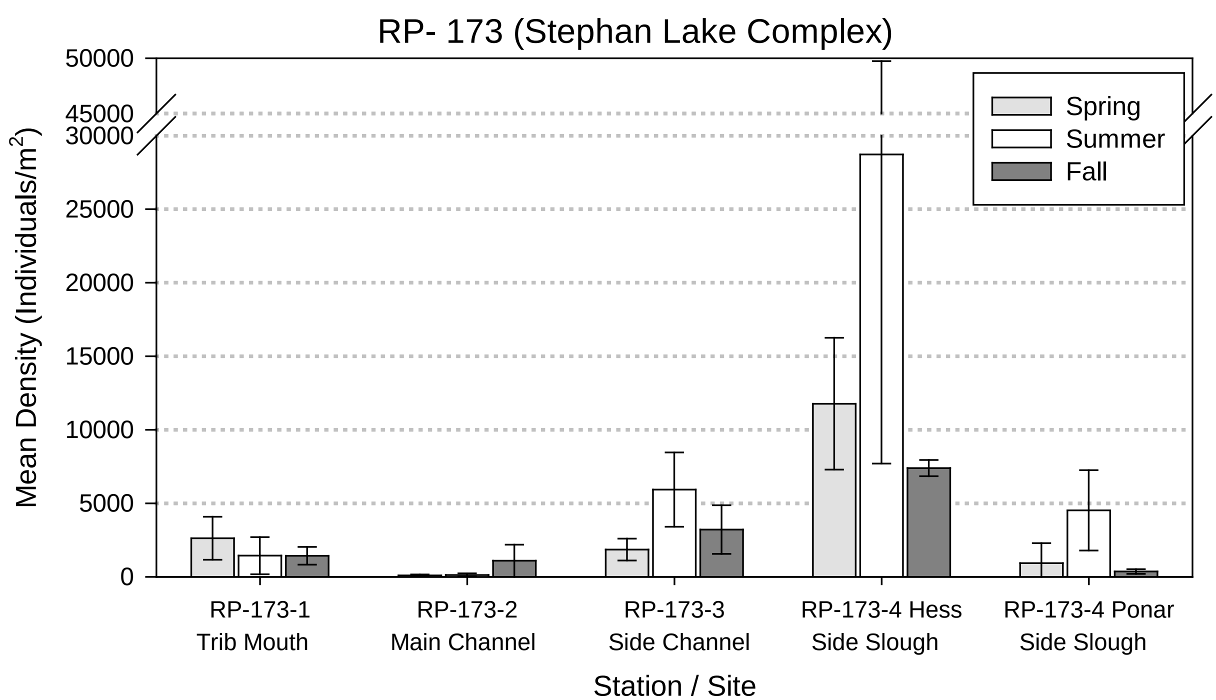

Figure 3.1-4. Mean density estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Stephan Lake Complex Focus Area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

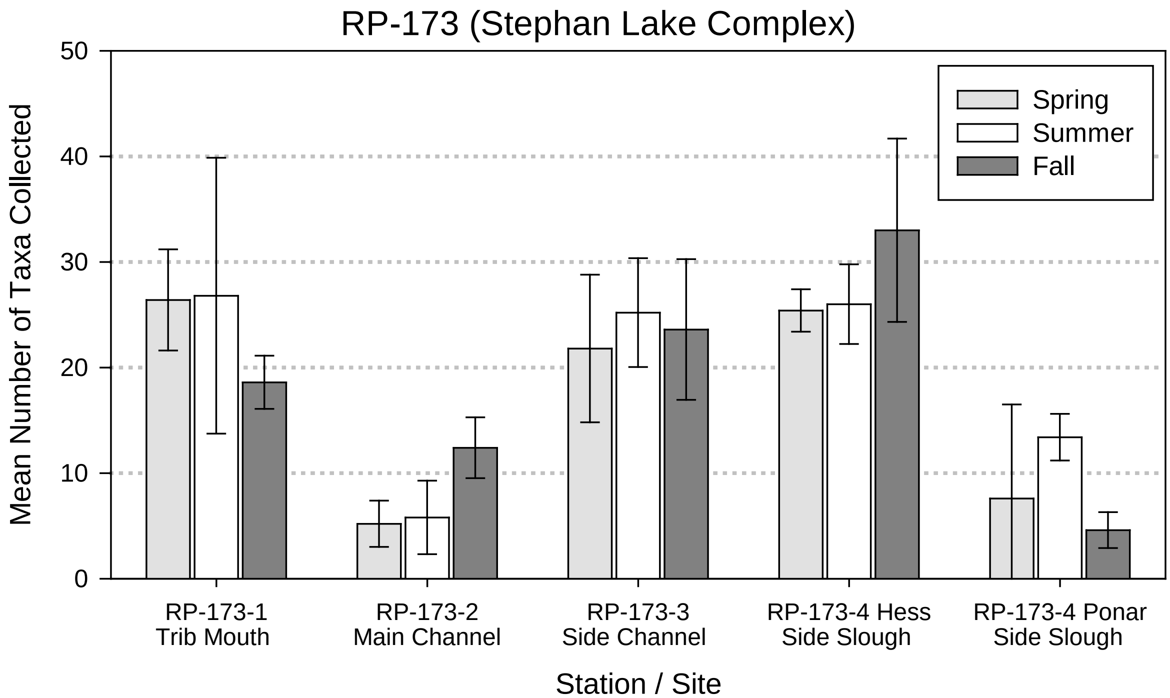

Figure 3.1-5. Mean taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Stephan Lake Complex Focus Area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

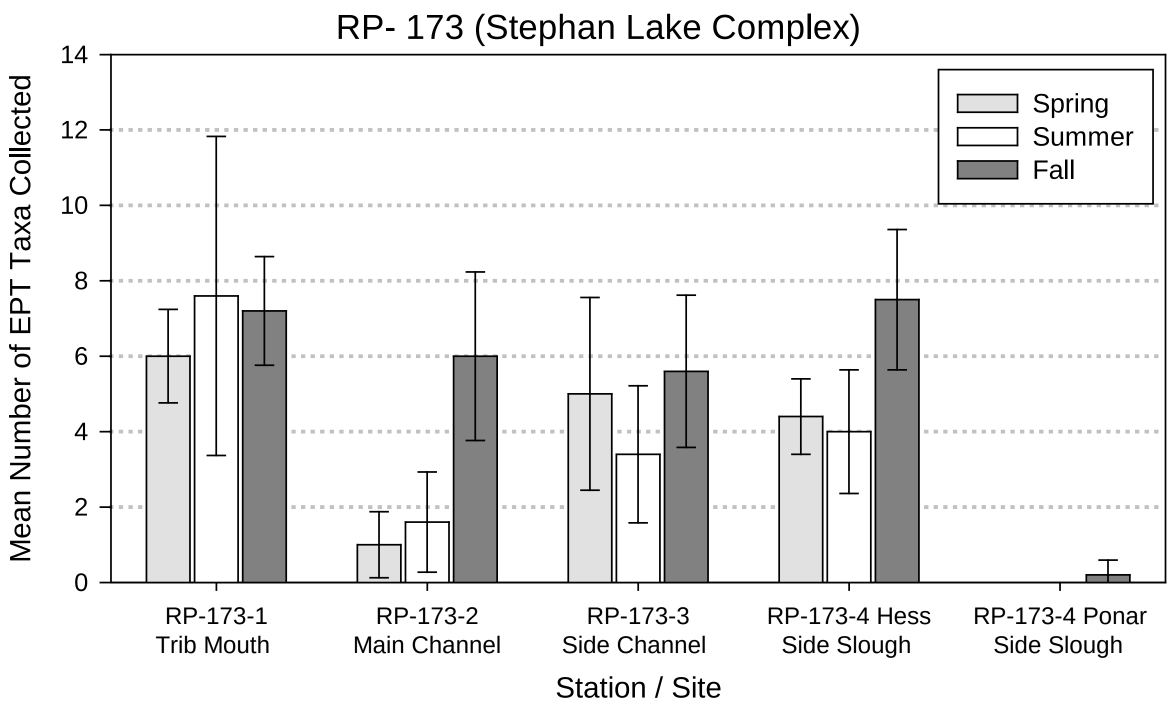

Figure 3.1-6. Mean EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Stephan Lake Complex Focus Area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

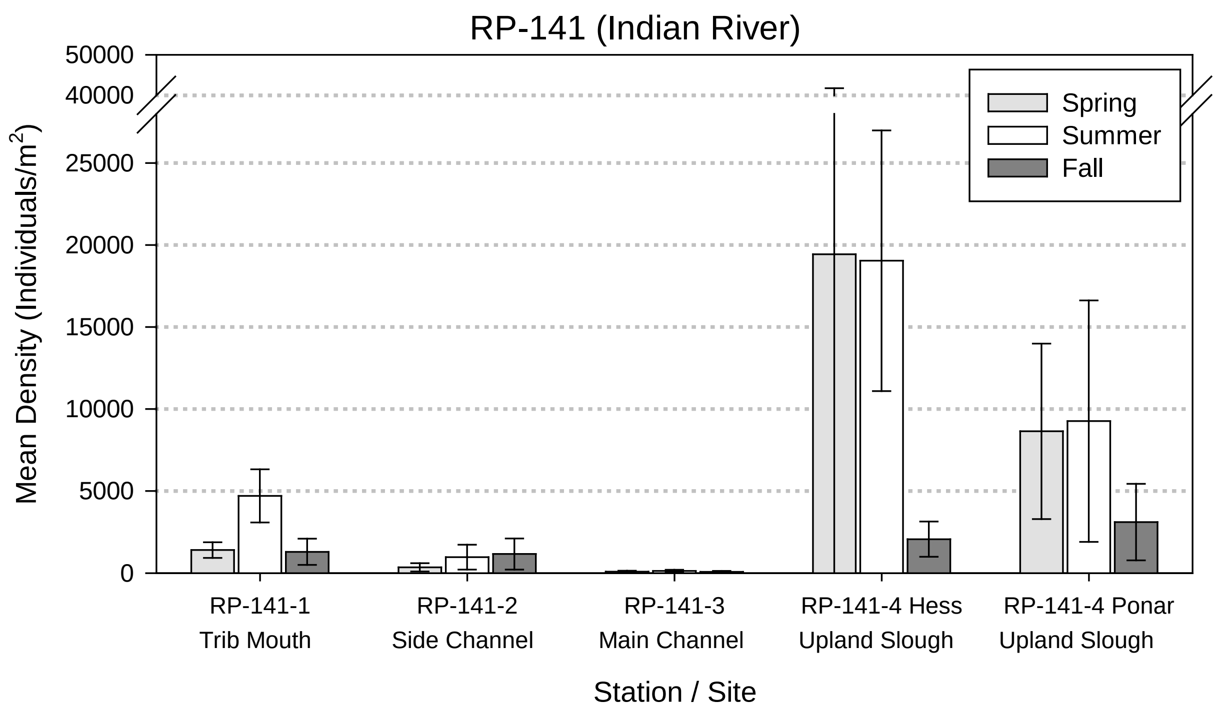

Figure 3.1-7. Mean density estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Indian River Focus Area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

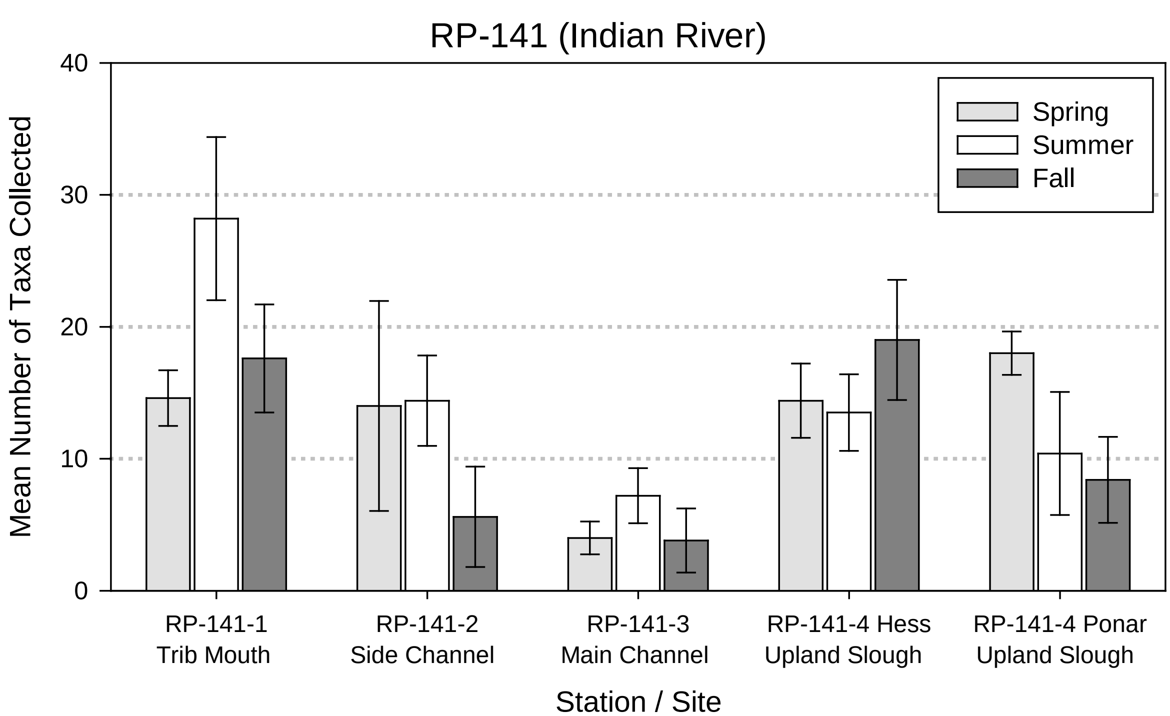

Figure 3.1-8. Mean taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Indian River Focus Area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

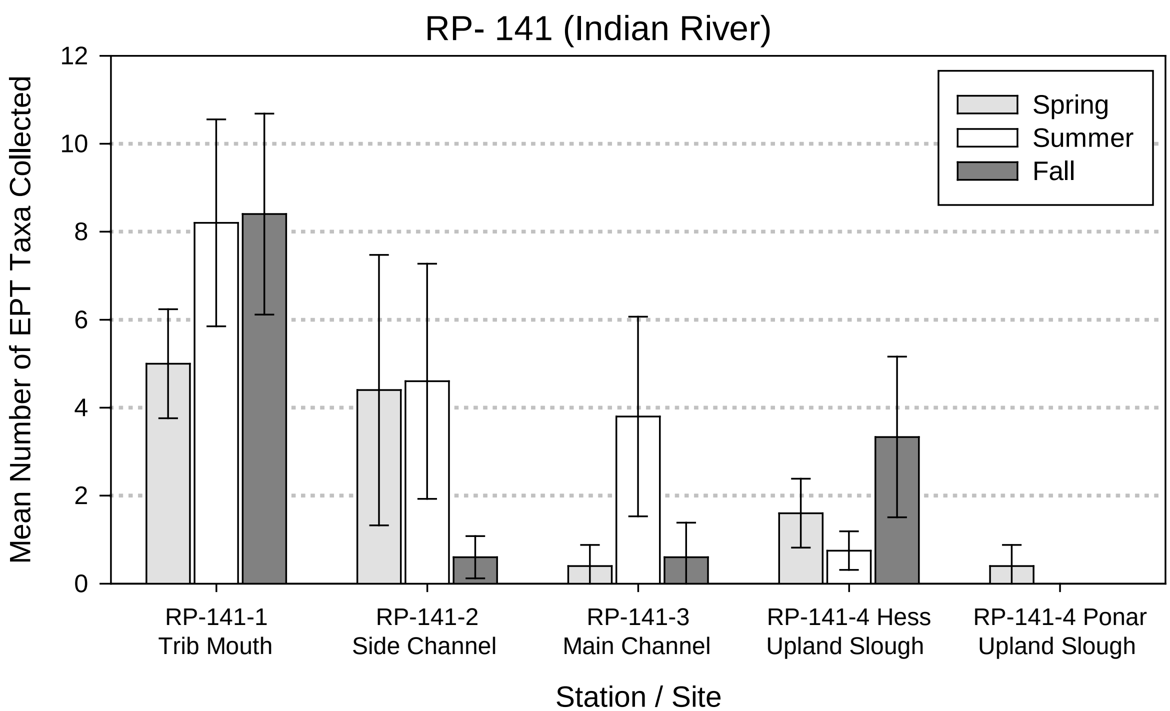

Figure 3.1-9. Mean EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Indian River Focus Area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

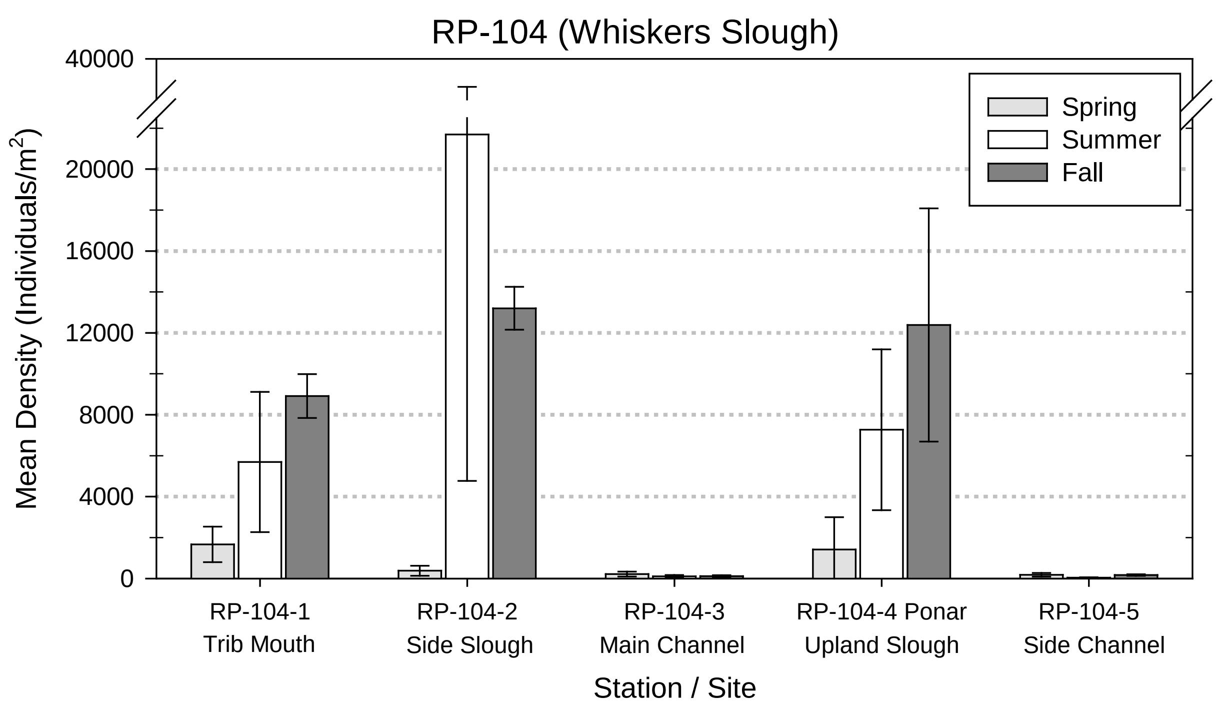

Figure 3.1-10. Mean density estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Whiskers Slough Focus Area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

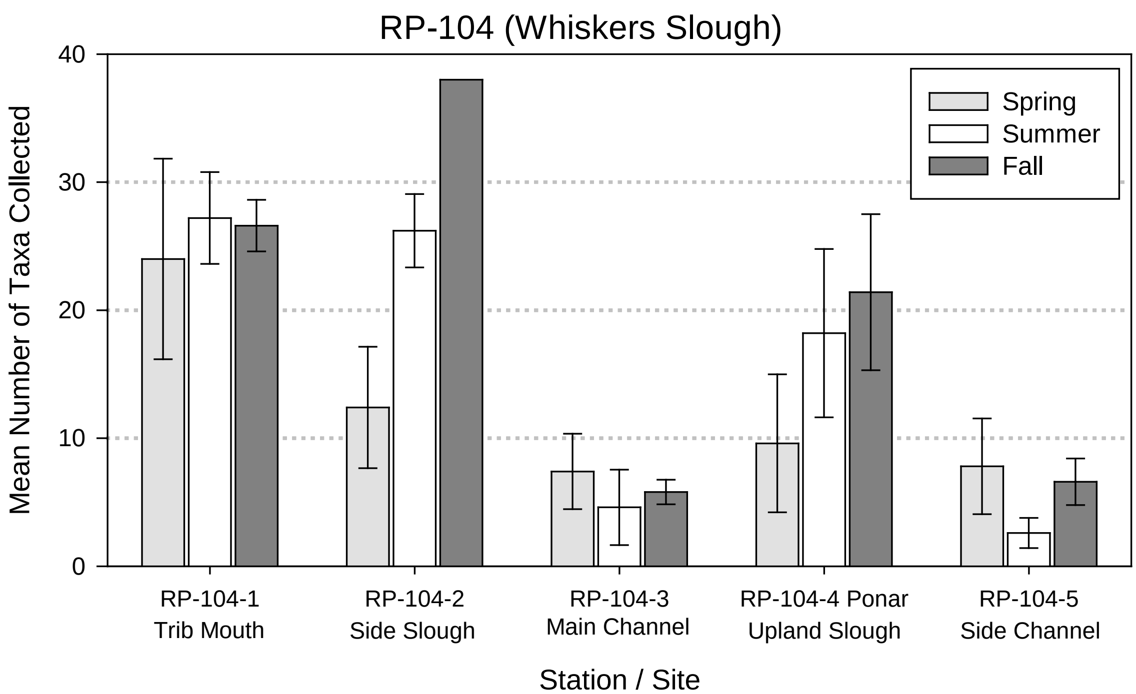

Figure 3.1-11. Mean taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Whiskers Slough Focus Area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

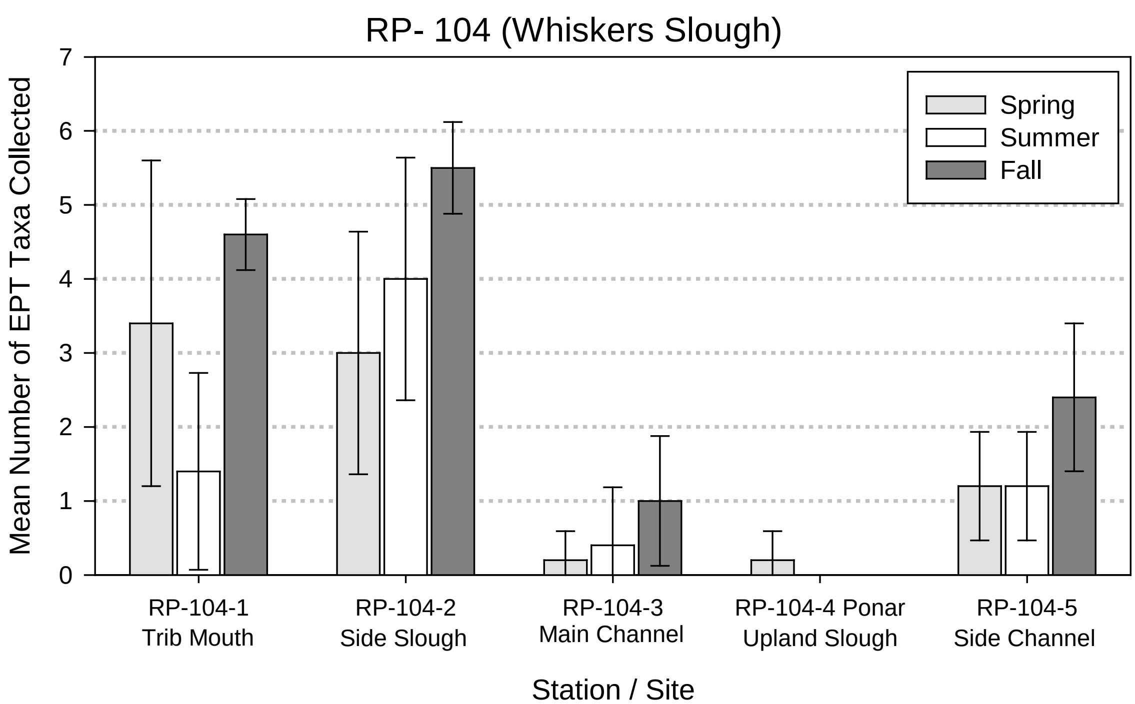

Figure 3.1-12. Mean EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Whiskers Slough Focus Area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

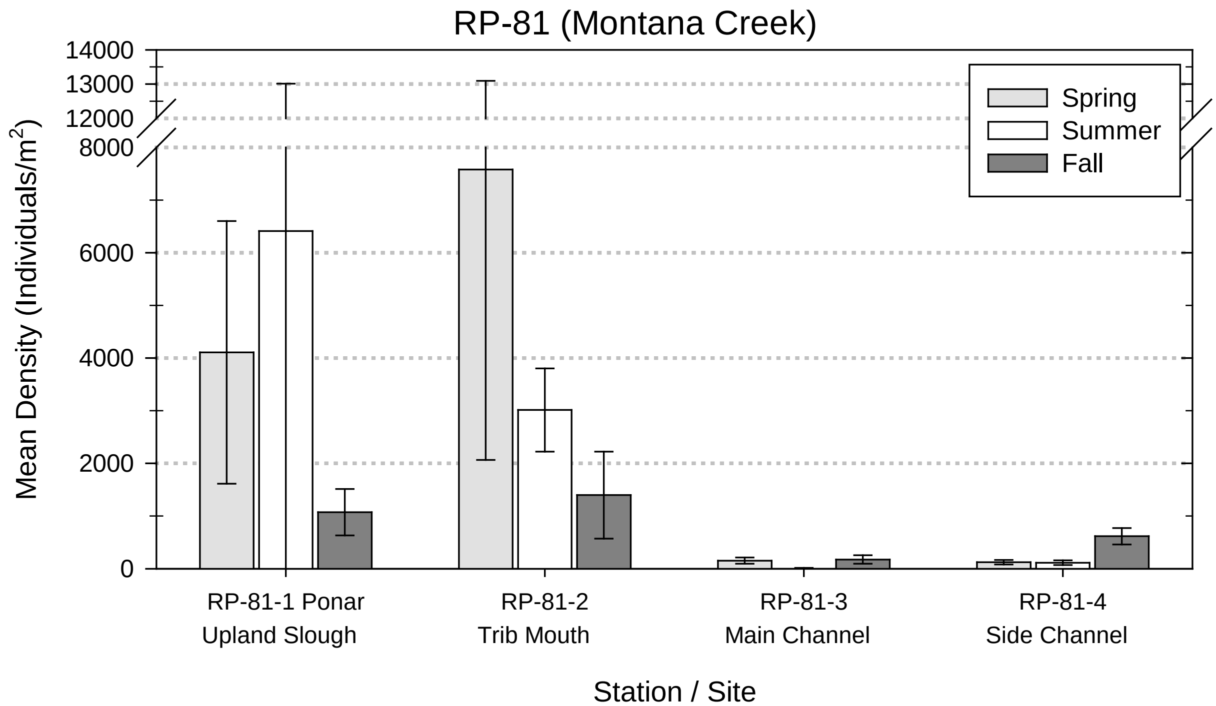

Figure 3.1-13. Mean density estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

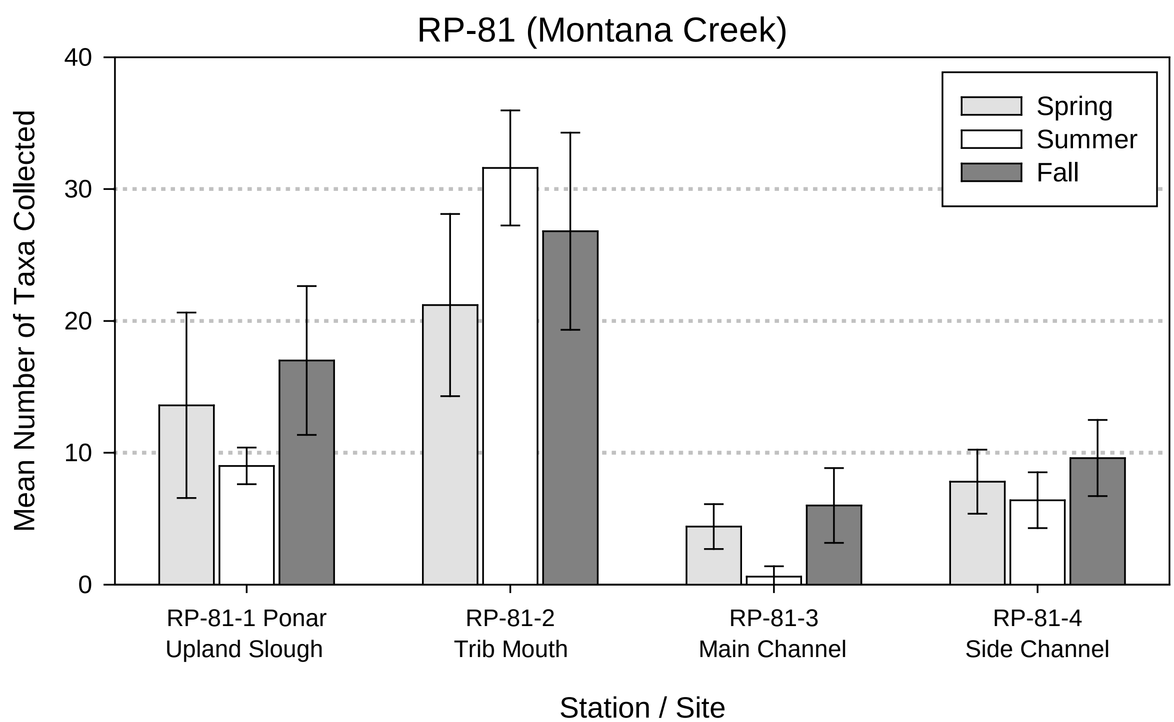

Figure 3.1-14. Mean taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

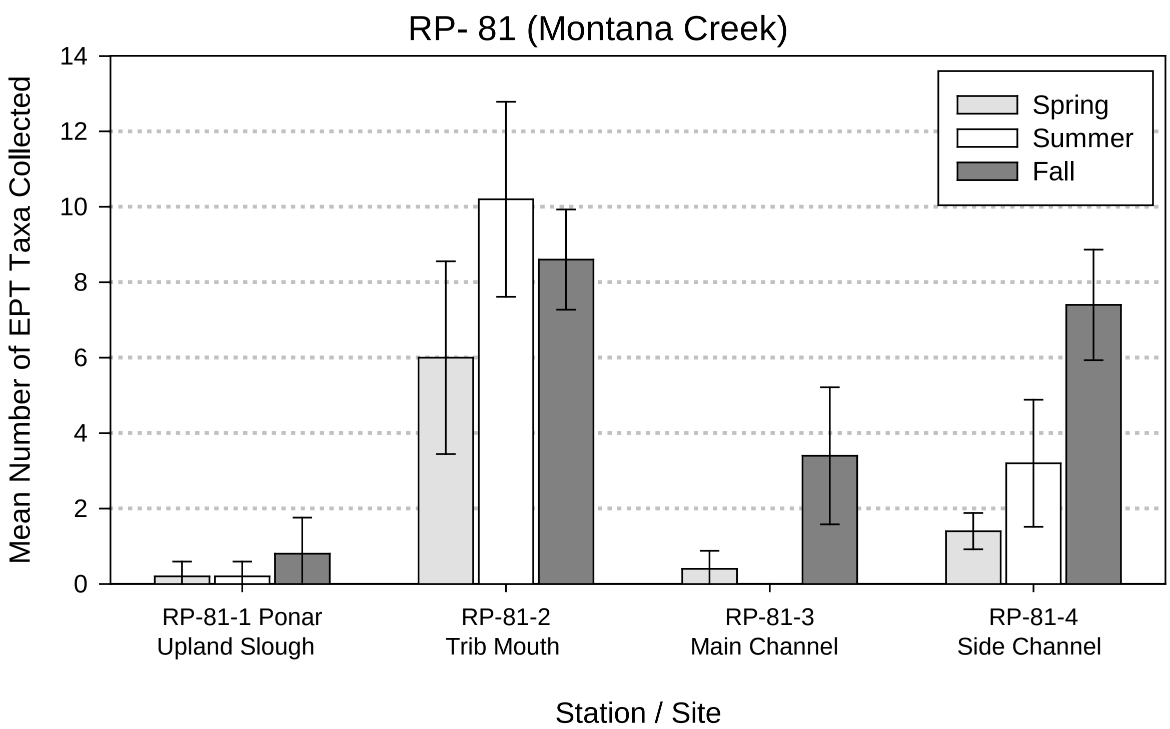

Figure 3.1-15. Mean EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

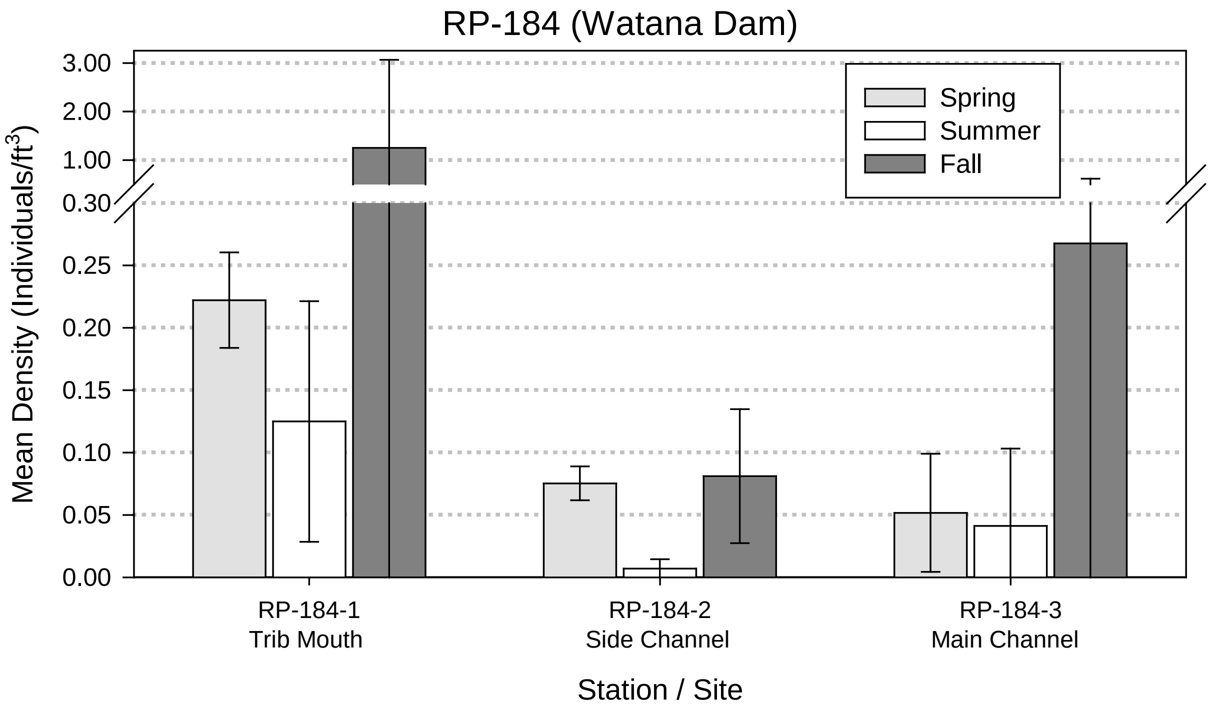

Figure 3.2-1. Mean drift density estimates from drift samples (n=2) collected in 2013 during three index events for sites within the Watana Dam Focus Area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals.

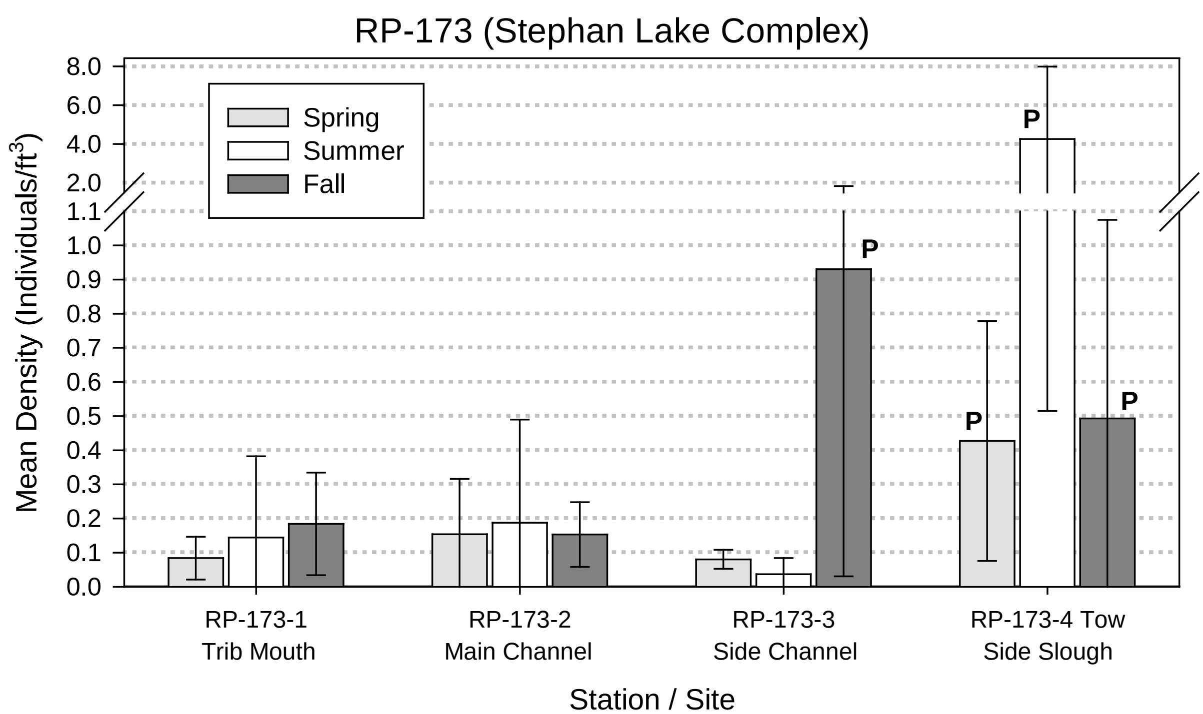

Figure 3.2-2. Mean drift density estimates from drift samples (n=2) and plankton tows (n=5) collected in 2013 during three index events for sites within the Stephan Lake Complex Focus Area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals. Bars marked with a “P” are plankton tows.

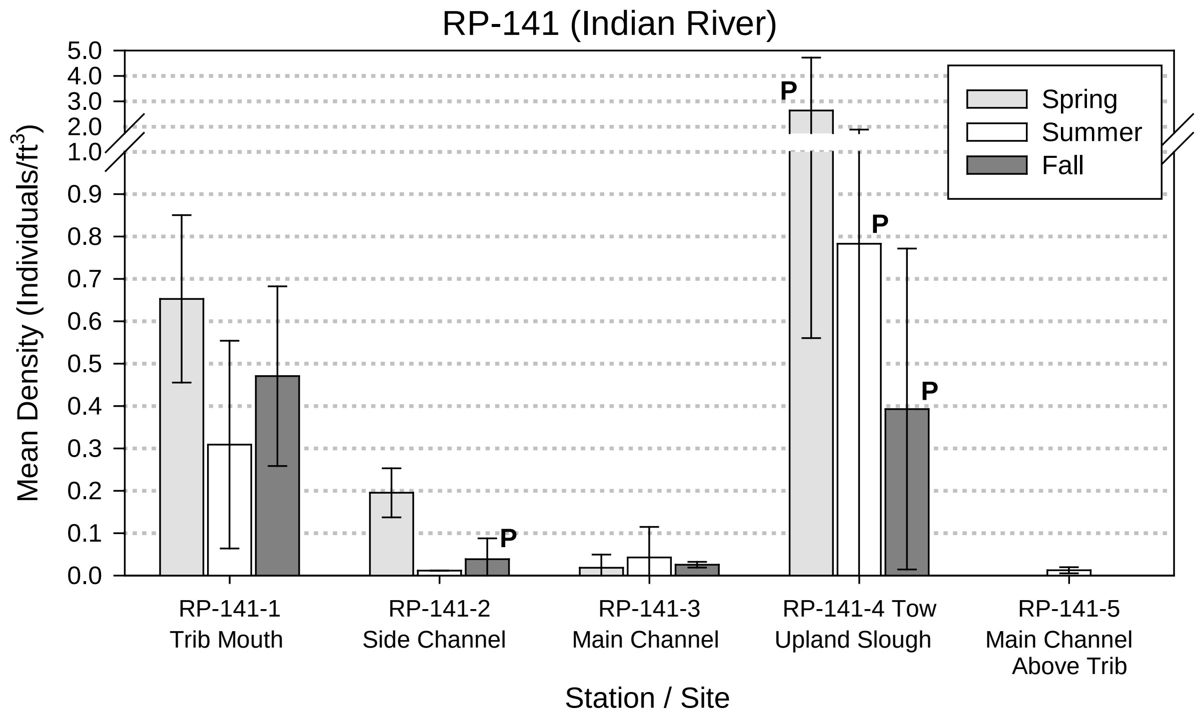

Figure 3.2-3. Mean drift density estimates from drift samples (n=2) and plankton tows (n=5) collected in 2013 during three index events for sites within the Indian River Focus Area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals. Bars marked with a “P” are plankton tows.

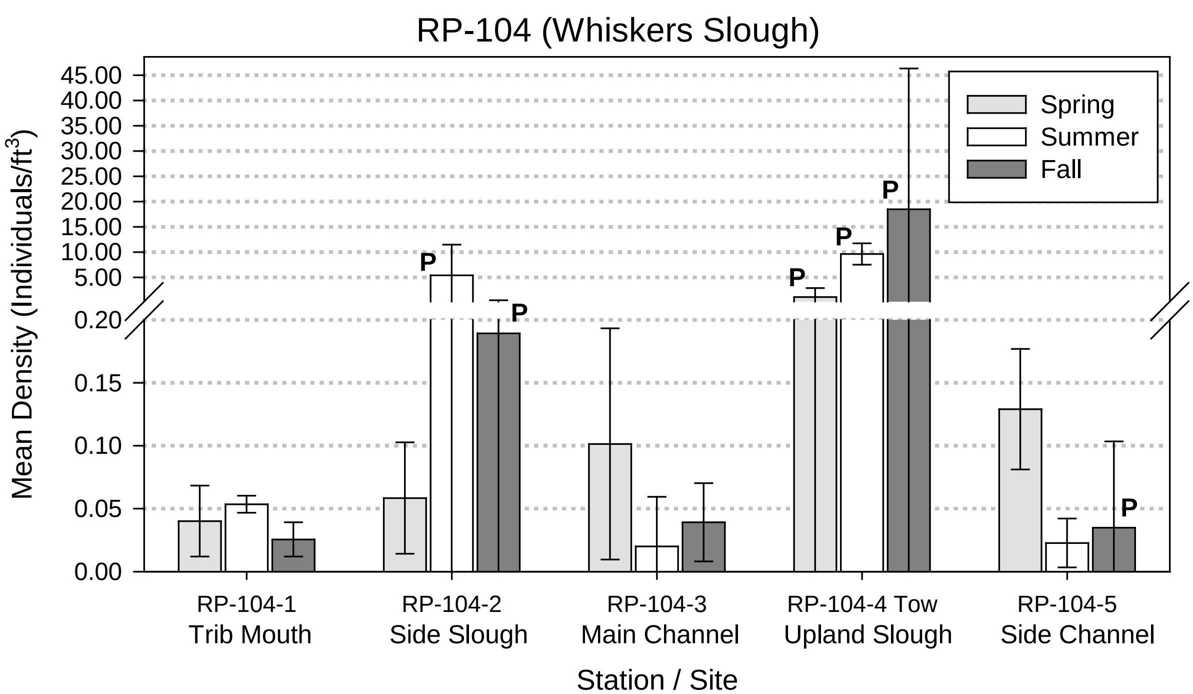

Figure 3.2-4. Mean drift density estimates from drift samples (n=2) and plankton tows (n=5) collected in 2013 during three index events for sites within the Whiskers Slough Focus Area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals. Bars marked with a “P” are plankton tows.

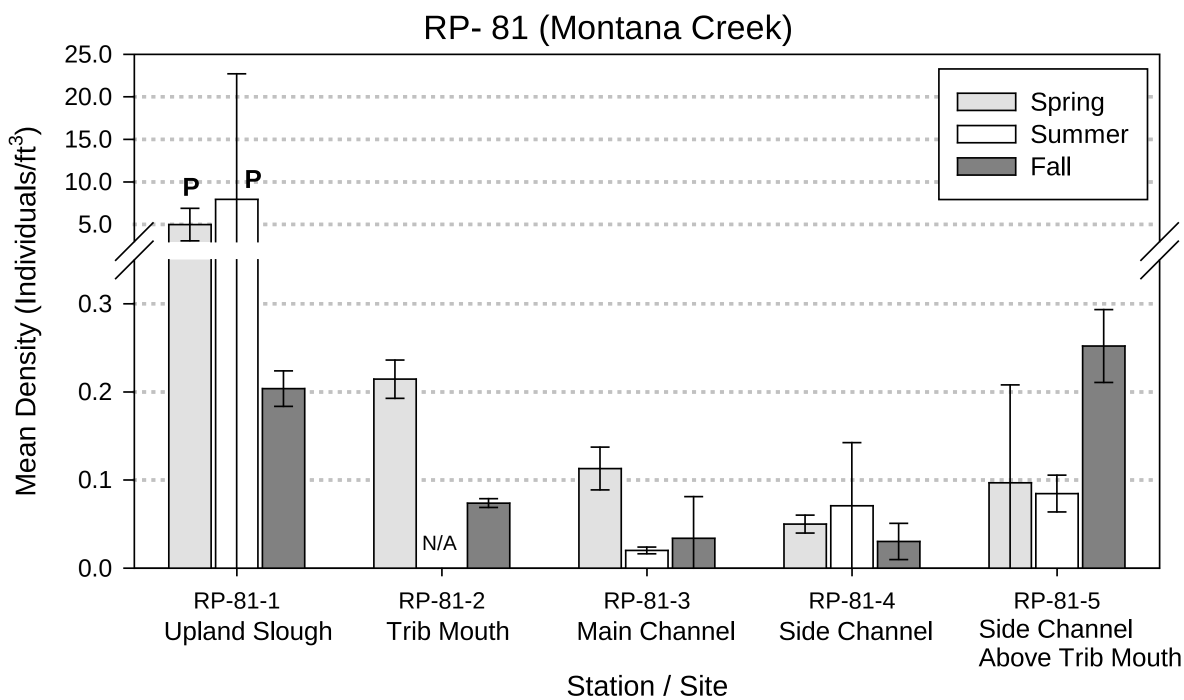

Figure 3.2-5. Mean drift density estimates from drift samples (n=2) and plankton tows (n=5) collected in 2013 during three index events for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study. Error bars represent 95-percent confidence intervals. Bars marked with a “P” are plankton tows.

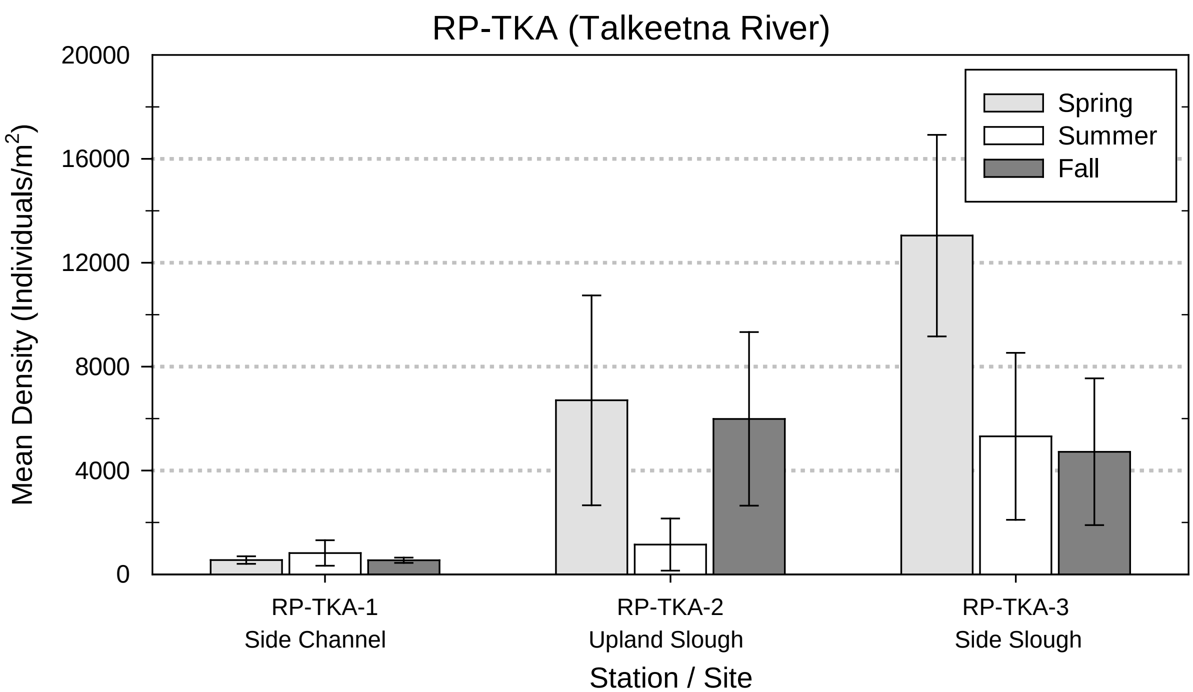

Figure 3.3-1. Mean density estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for three sites on the Talkeetna River (TKA) for the River Productivity Study. Error bars represent 95-percent confidence intervals.

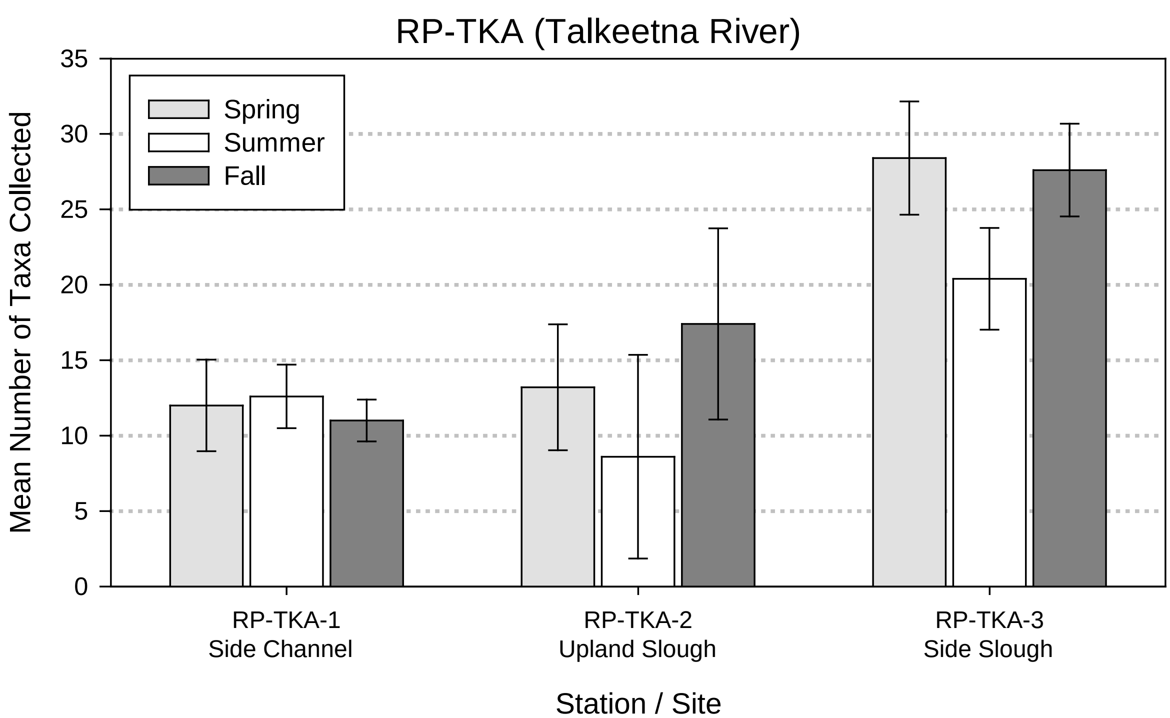

Figure 3.3-2. Mean taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for three sites on the Talkeetna River (TKA) for the River Productivity Study. Error bars represent 95-percent confidence intervals.

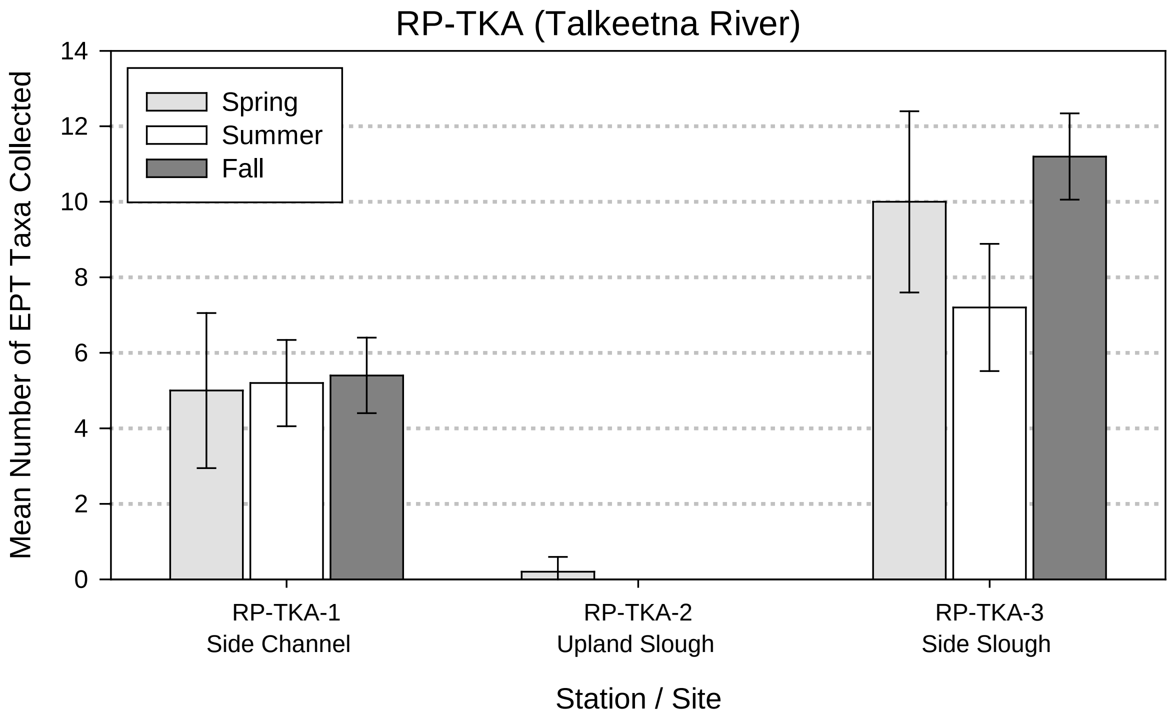

Figure 3.3-3. Mean EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa richness estimates (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for three sites on the Talkeetna River (TKA) for the River Productivity Study. Error bars represent 95-percent confidence intervals.

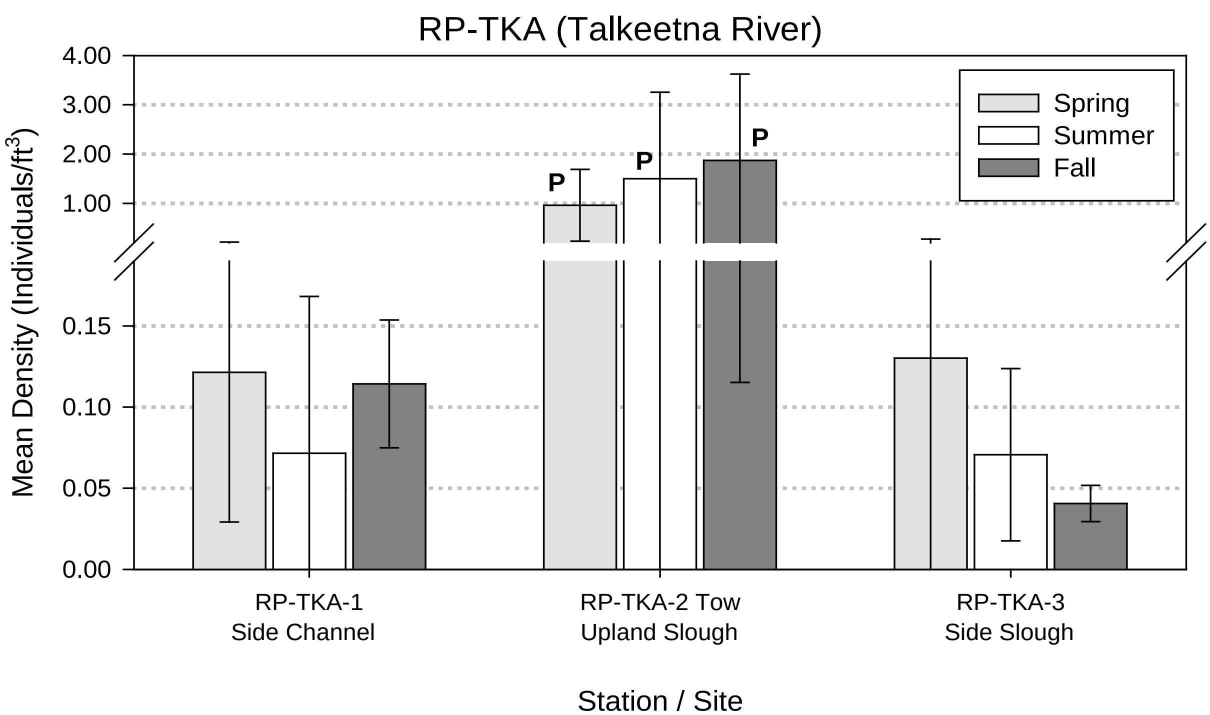

Figure 3.3-4. Mean drift density estimates (individuals/ft^3) from drift samples (n=2) and plankton tows (n=5) collected in 2013 during three index events for three sites on the Talkeetna River (TKA) for the River Productivity Study. Error bars represent 95-percent confidence intervals. Bars marked with a “P” are plankton tows.

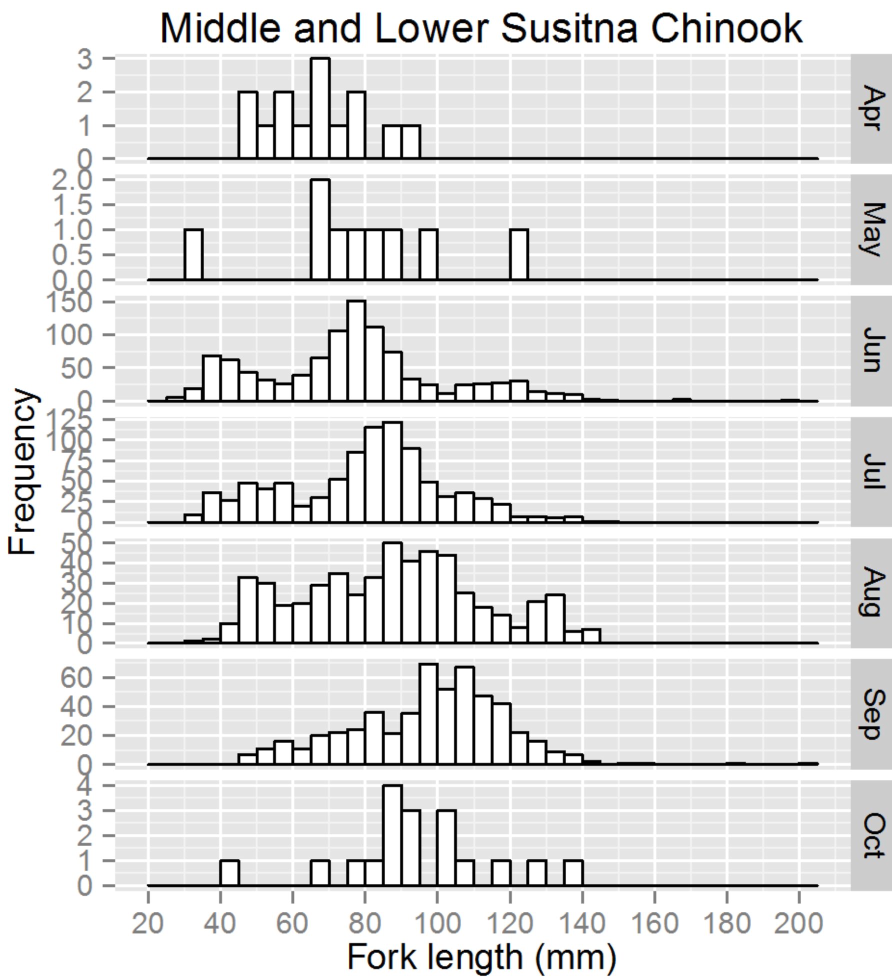

Figure 3.4-1. Monthly length-frequency distributions of juvenile Chinook salmon sampled in the Middle and Lower Susitna River during 2013. *Y*-axes differ among plots.

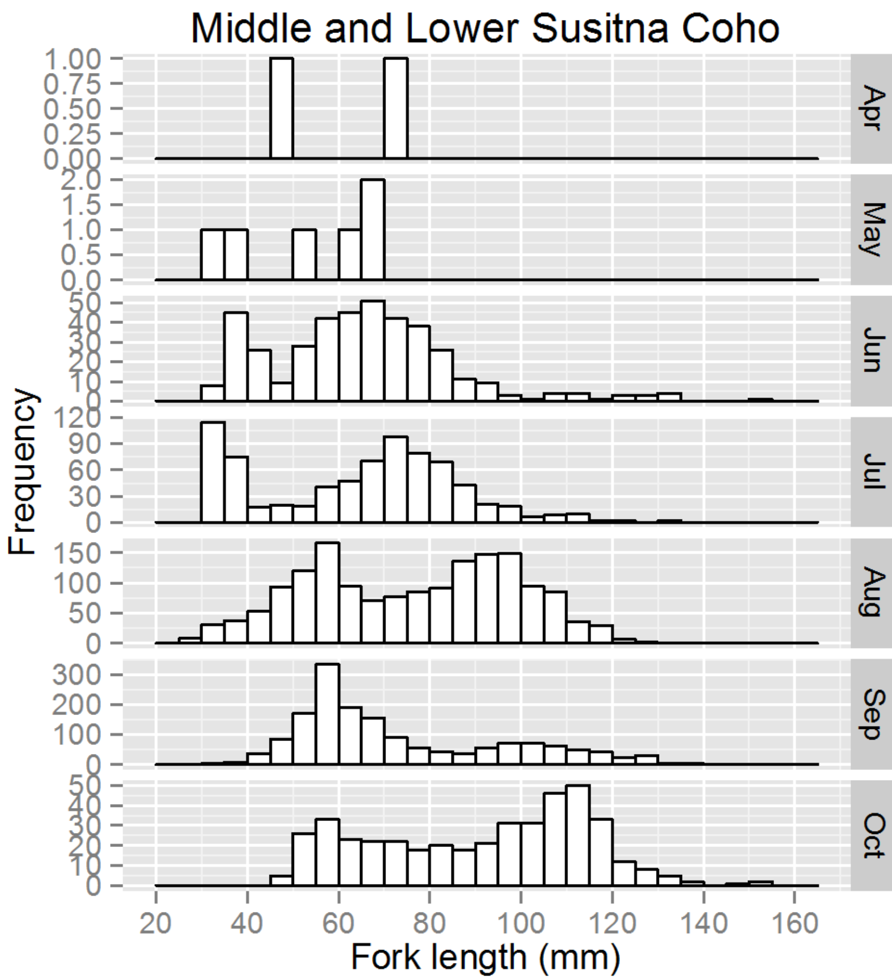

Figure 3.4-2. Monthly length-frequency distributions of juvenile coho salmon sampled in the Middle and Lower Susitna River during 2013. *Y*-axes differ among plots.

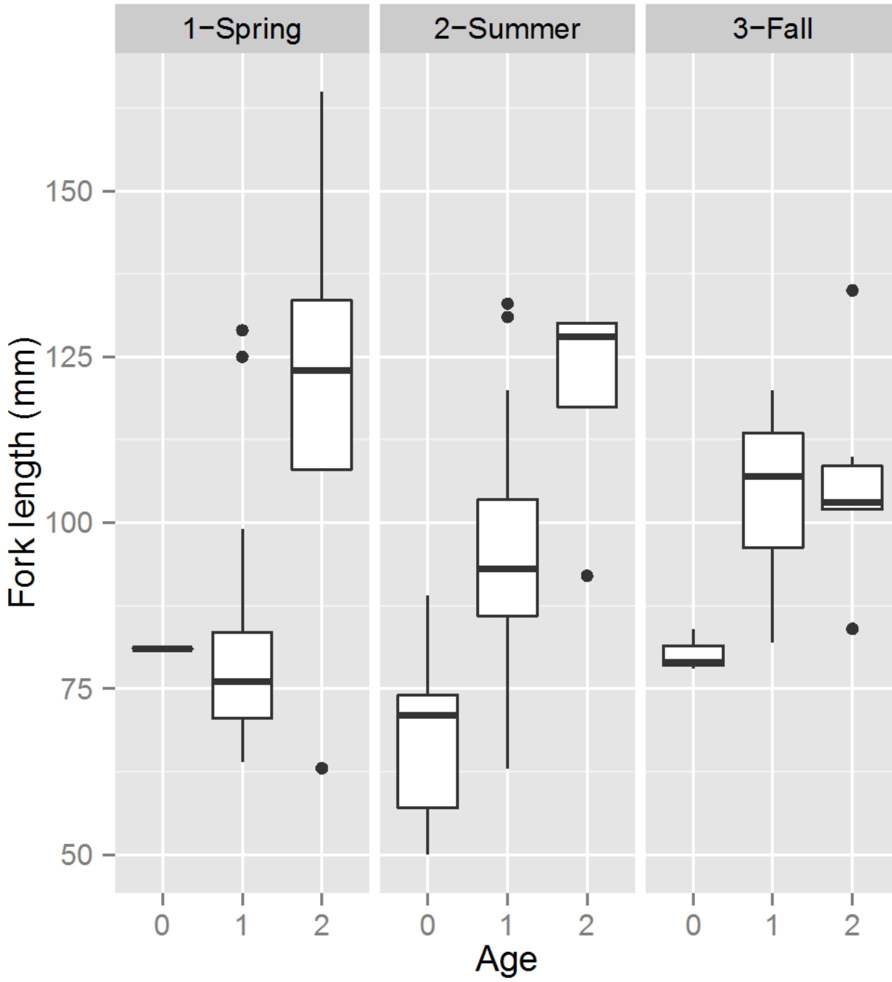

Figure 3.4-3. Box plots showing the length distribution of Chinook salmon as determined by the scale analysis. No Chinook salmon smaller than 50 mm were aged, so the true length distribution of age-0 fish extends to smaller sizes than indicated in the figure. Horizontal lines indicate the median value of each group, rectangles indicate the 25th and 75th percentiles, and whiskers and closed circles indicate values outside this range.

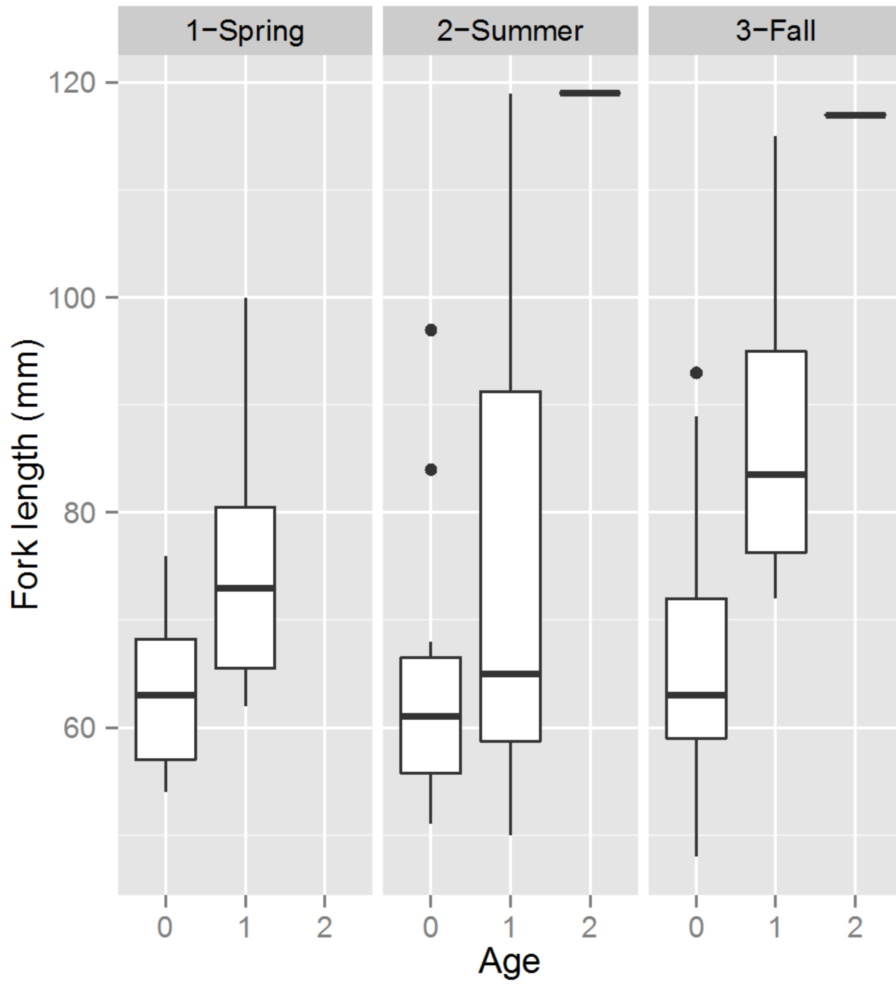

Figure 3.4-4. Box plots showing the length distribution of coho salmon as determined by the scale analysis. No coho salmon smaller than 48 mm were aged, so the true length distribution of age-0 fish extends to smaller sizes than indicated in the figure. Horizontal lines indicate the median value of each group, rectangles indicate the 25th and 75th percentiles, and whiskers and closed circles indicate values outside this range.

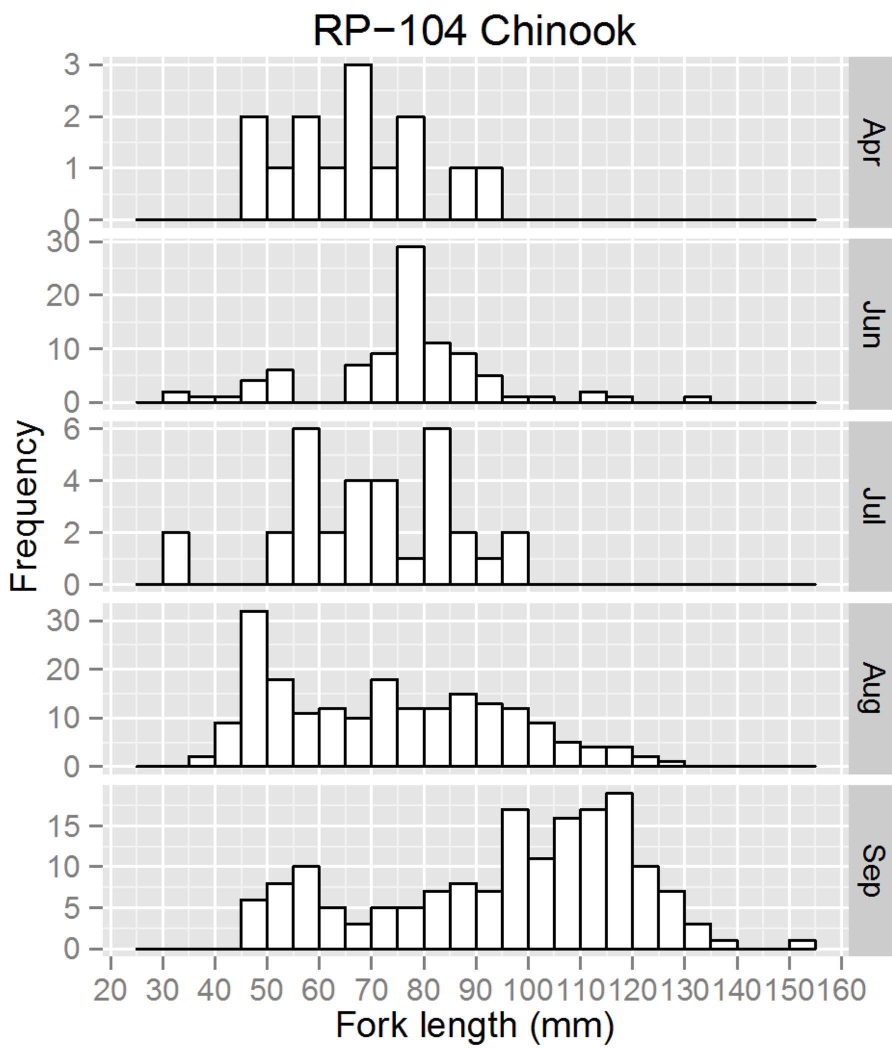

Figure 3.4-5. Monthly length-frequency distributions of juvenile Chinook salmon sampled at station RP-104, Whiskers Creek and Slough, during 2013. *Y*-axes differ among plots.

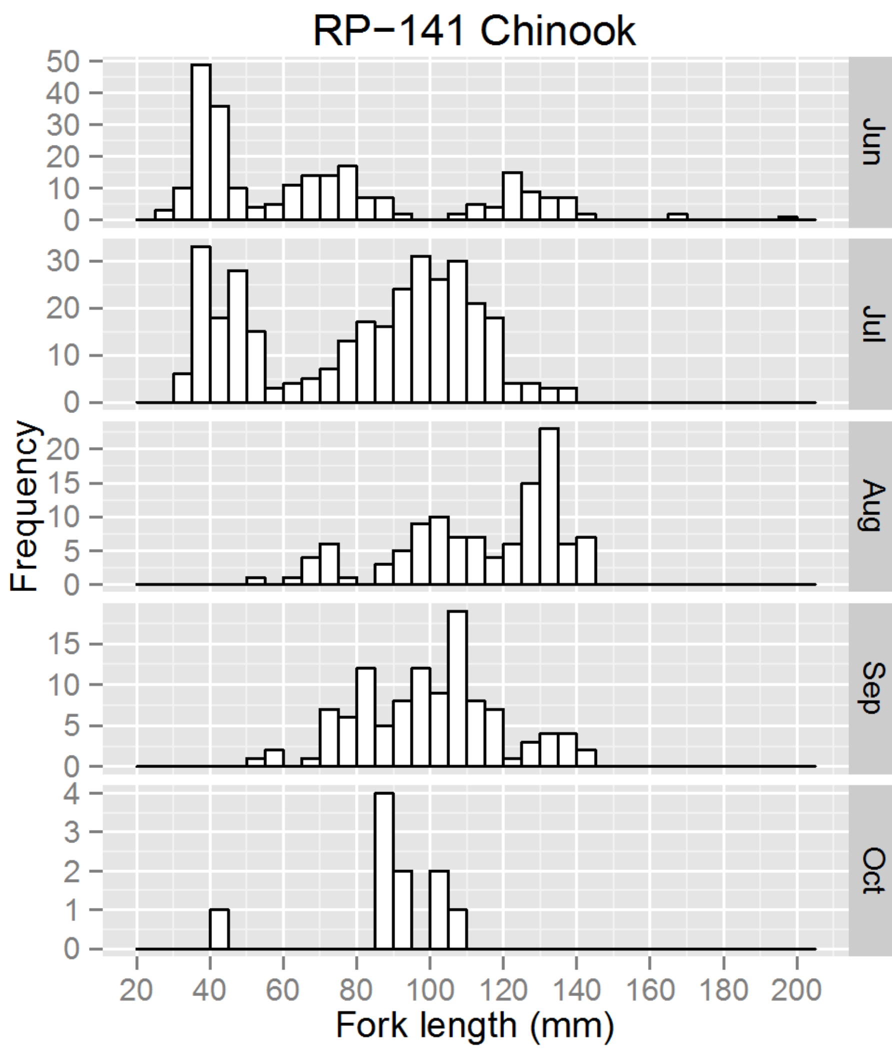

Figure 3.4-6. Monthly length-frequency distributions of juvenile Chinook salmon sampled at station RP-141, Indian River, during 2013. *Y*-axes differ among plots.

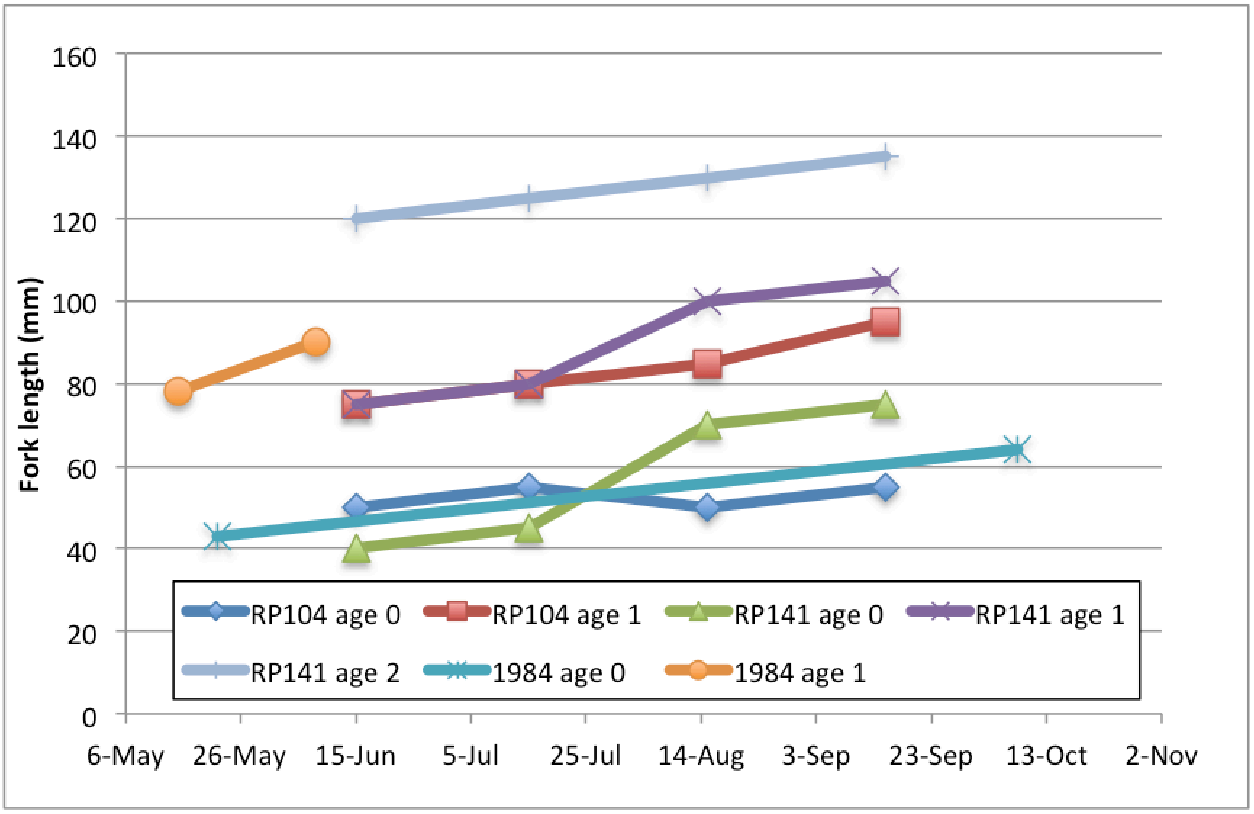

Figure 3.4-7. Generalized growth trajectories for age-0, age-1, and age-2 Chinook salmon, developed from empirical data for bioenergetics model inputs. Separate growth patterns were developed using data from RP-104 (Whiskers Creek and Slough) and RP-141 (Indian River). The growth rates reported in the Middle Susitna River during 1984 are shown for comparison.

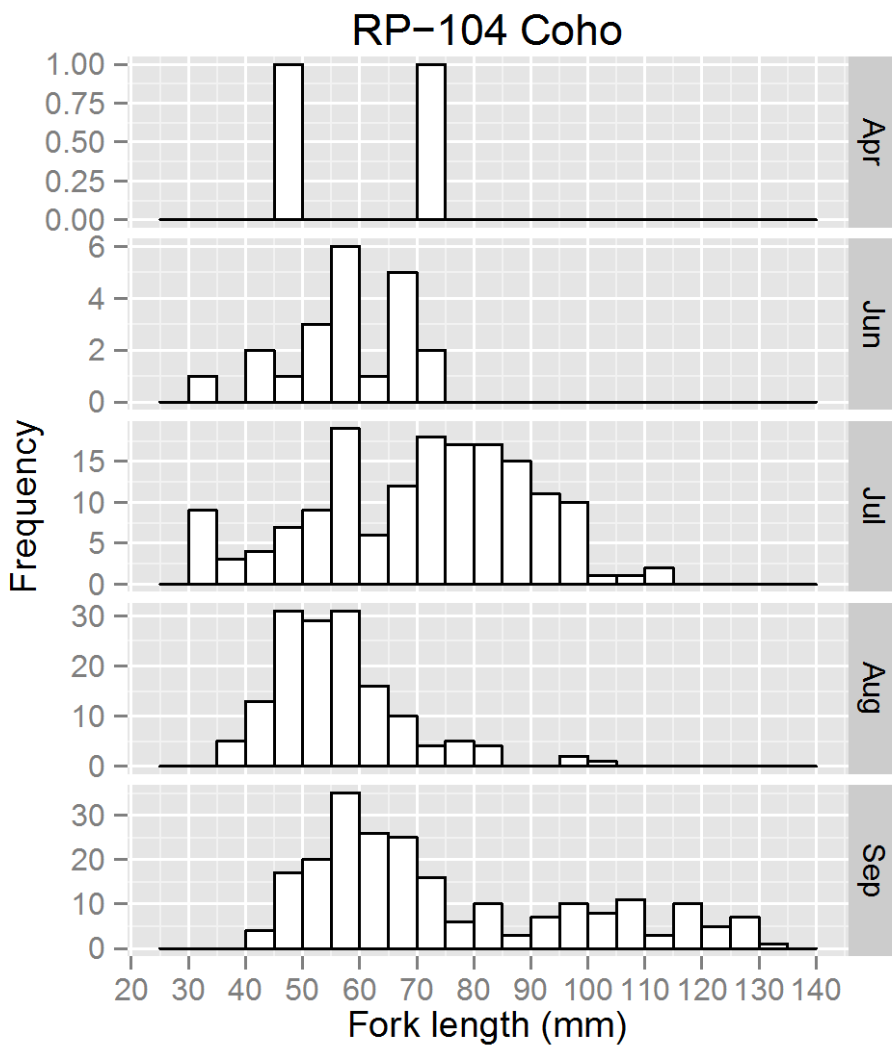

Figure 3.4-8. Monthly length-frequency distributions of juvenile coho salmon sampled at station RP-104, Whiskers Creek and Slough, during 2013. *Y*-axes differ among plots.

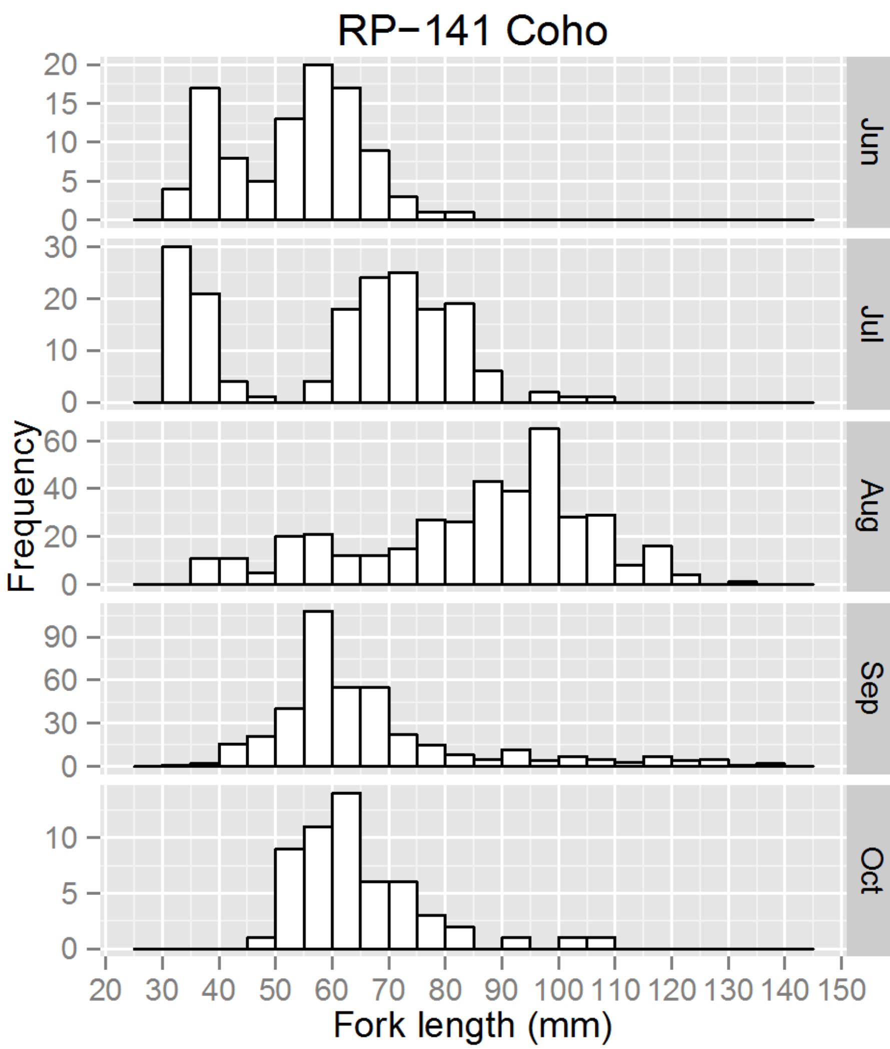

Figure 3.4-9. Monthly length-frequency distributions of juvenile coho salmon sampled at station RP-141, Indian River, during 2013. *Y*-axes differ among plots.

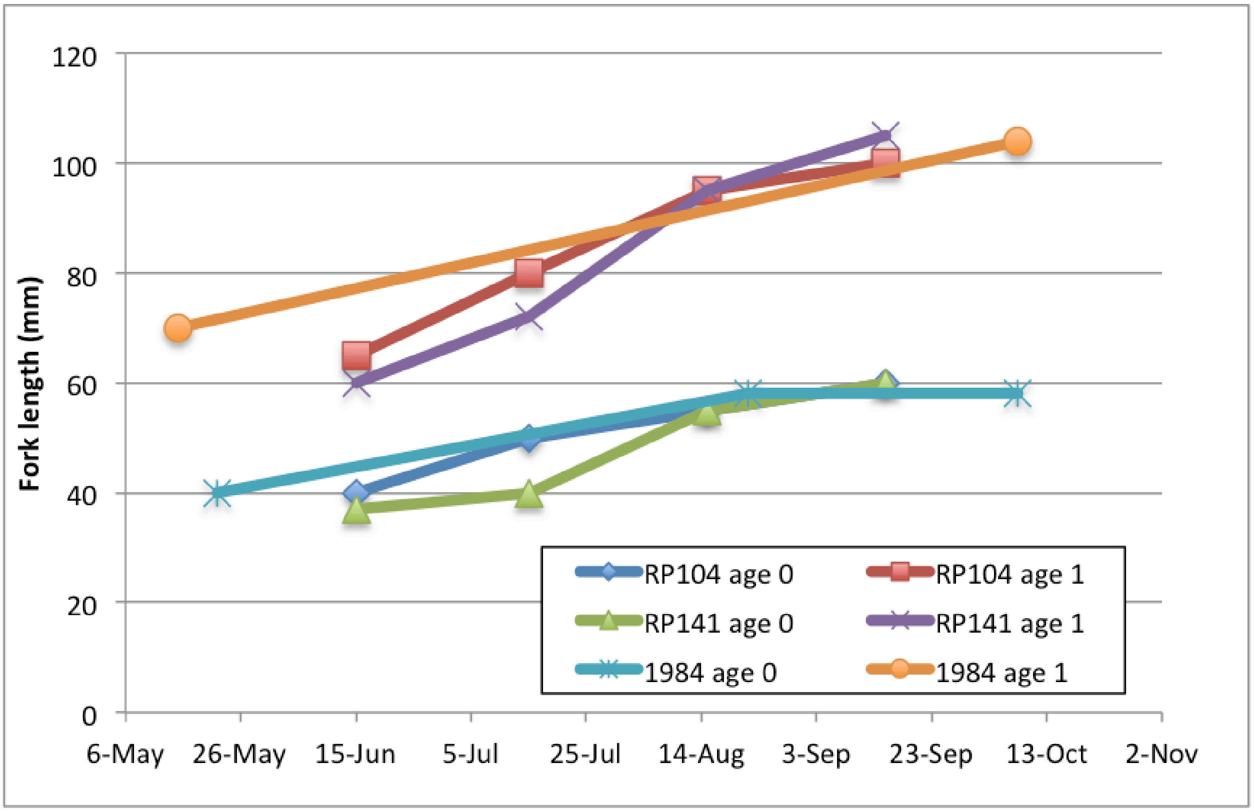

Figure 3.4-10. Generalized growth trajectories for age-0 and age-1 coho salmon, developed from empirical data for bioenergetics model inputs. Separate growth patterns were developed using data from RP-104 (Whiskers Creek and Slough) and RP-141 (Indian River). The growth rates reported in the Middle Susitna River during 1984 are shown for comparison.

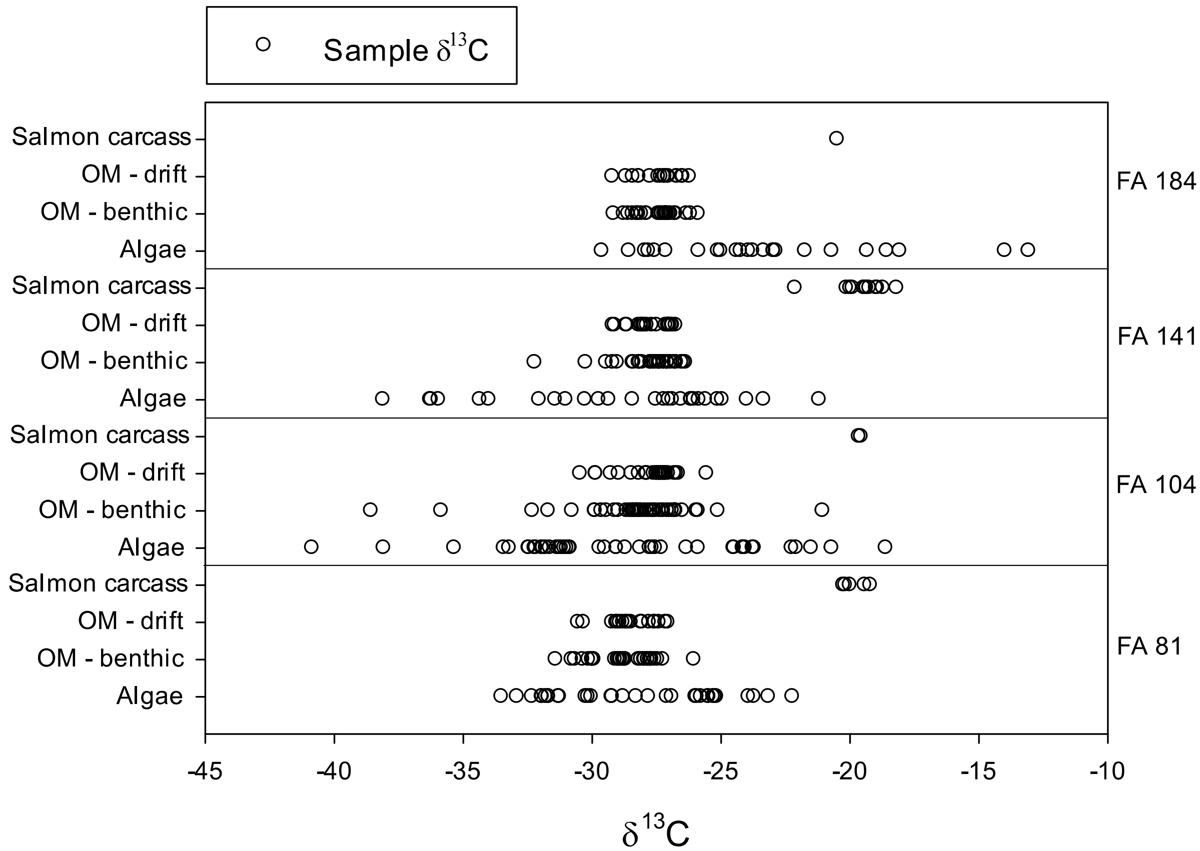

Figure 3.4-11. Stable isotope $\delta^{13}C$ values of all endmember samples collected in 2013 within Focus Areas 81, 104, 141, and 184.

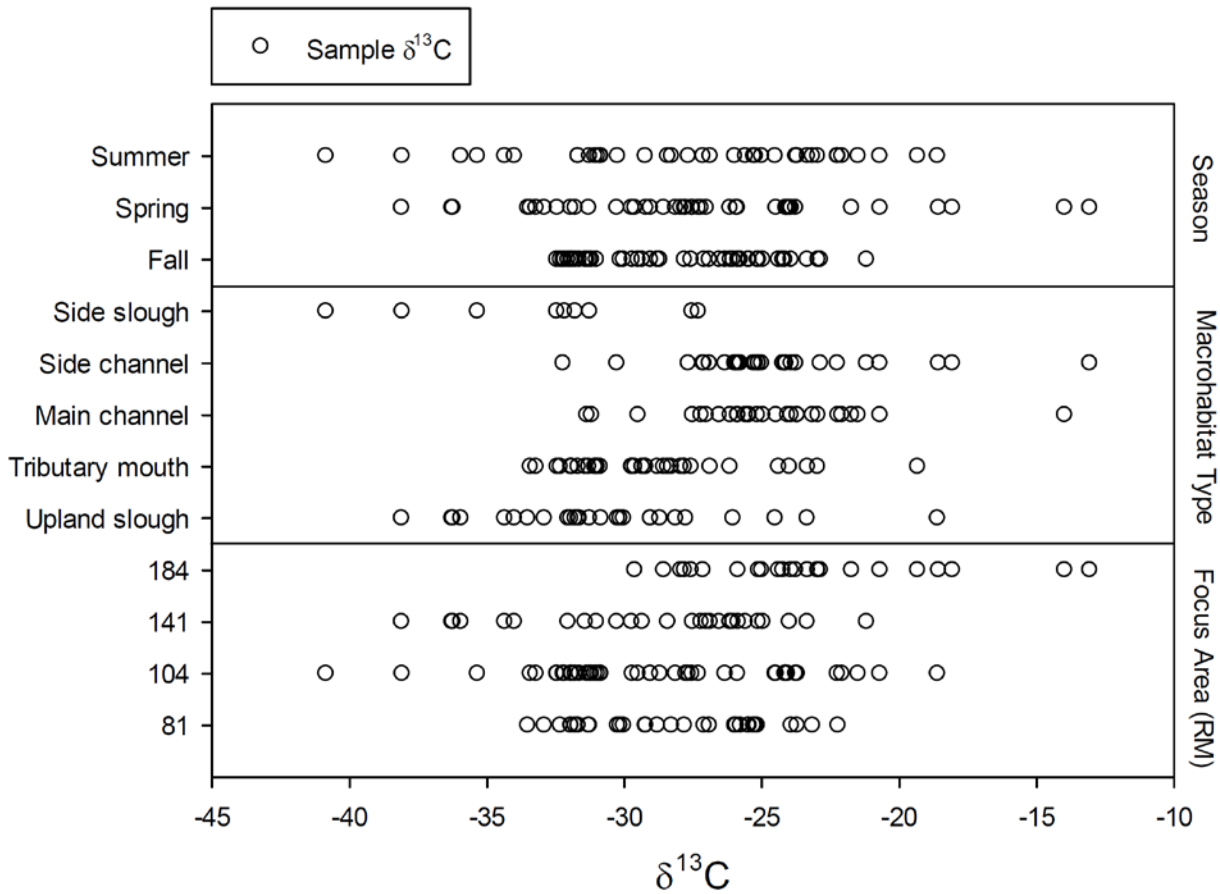

Figure 3.4-12. Stable isotope $\delta^{13}C$ of all algae samples collected in 2013. Data points are stratified by season, macrohabitat type, and Focus Area.

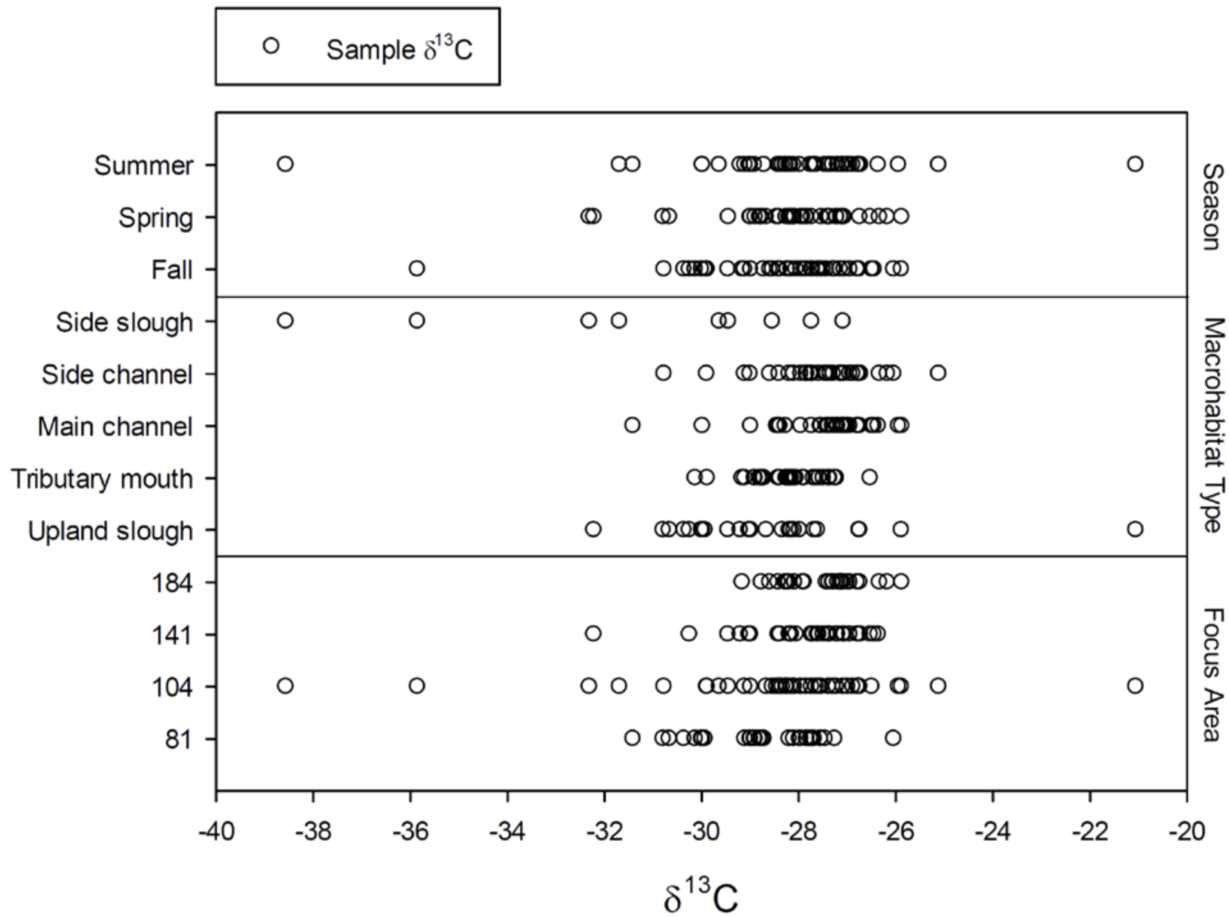

Figure 3.4-13. Stable isotope $\delta^{13}C$ of all benthic organic matter samples collected in 2013. Data points are stratified by season, macrohabitat type, and Focus Area.

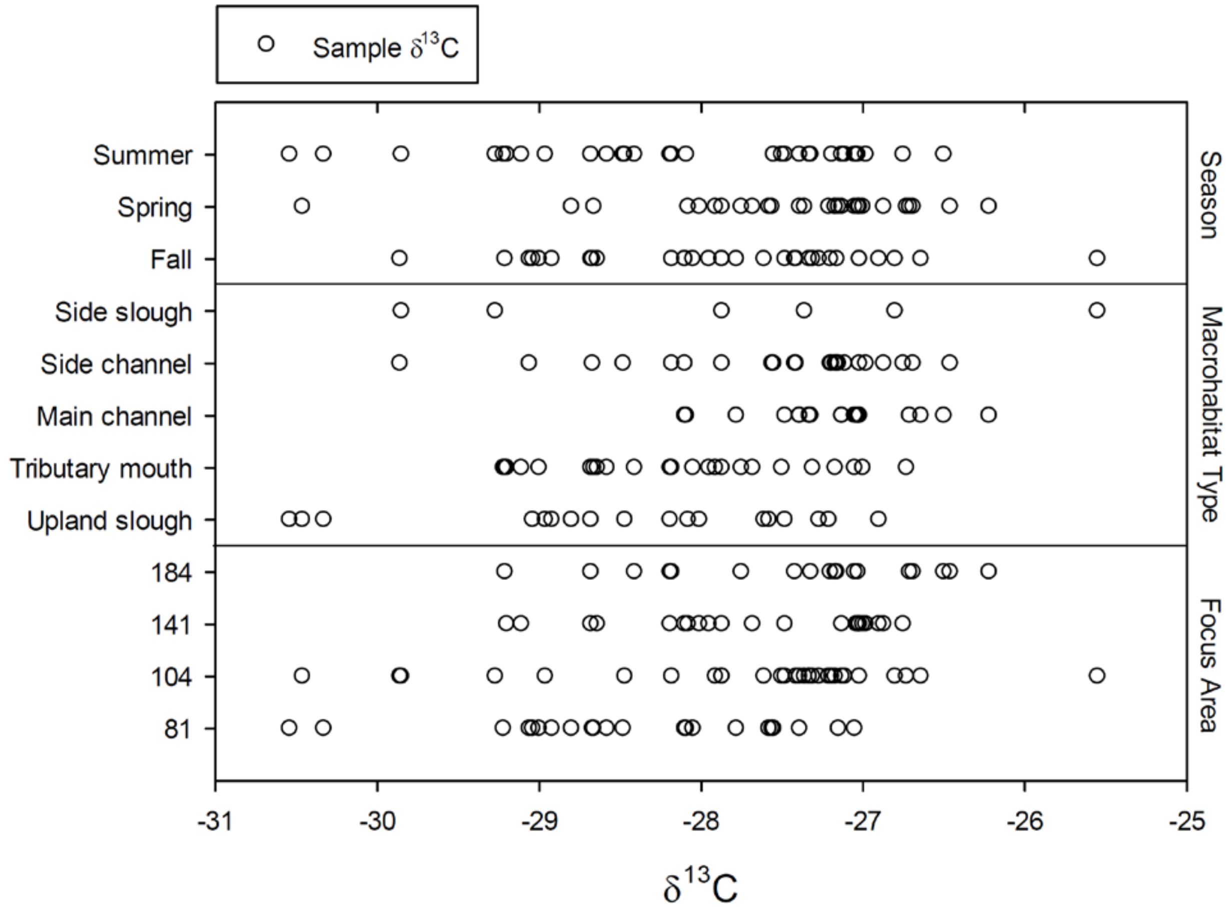

Figure 3.4-14. Stable isotope $\delta^{13}C$ of all organic matter drift samples collected in 2013. Data points are stratified by season, macrohabitat type, and Focus Area.

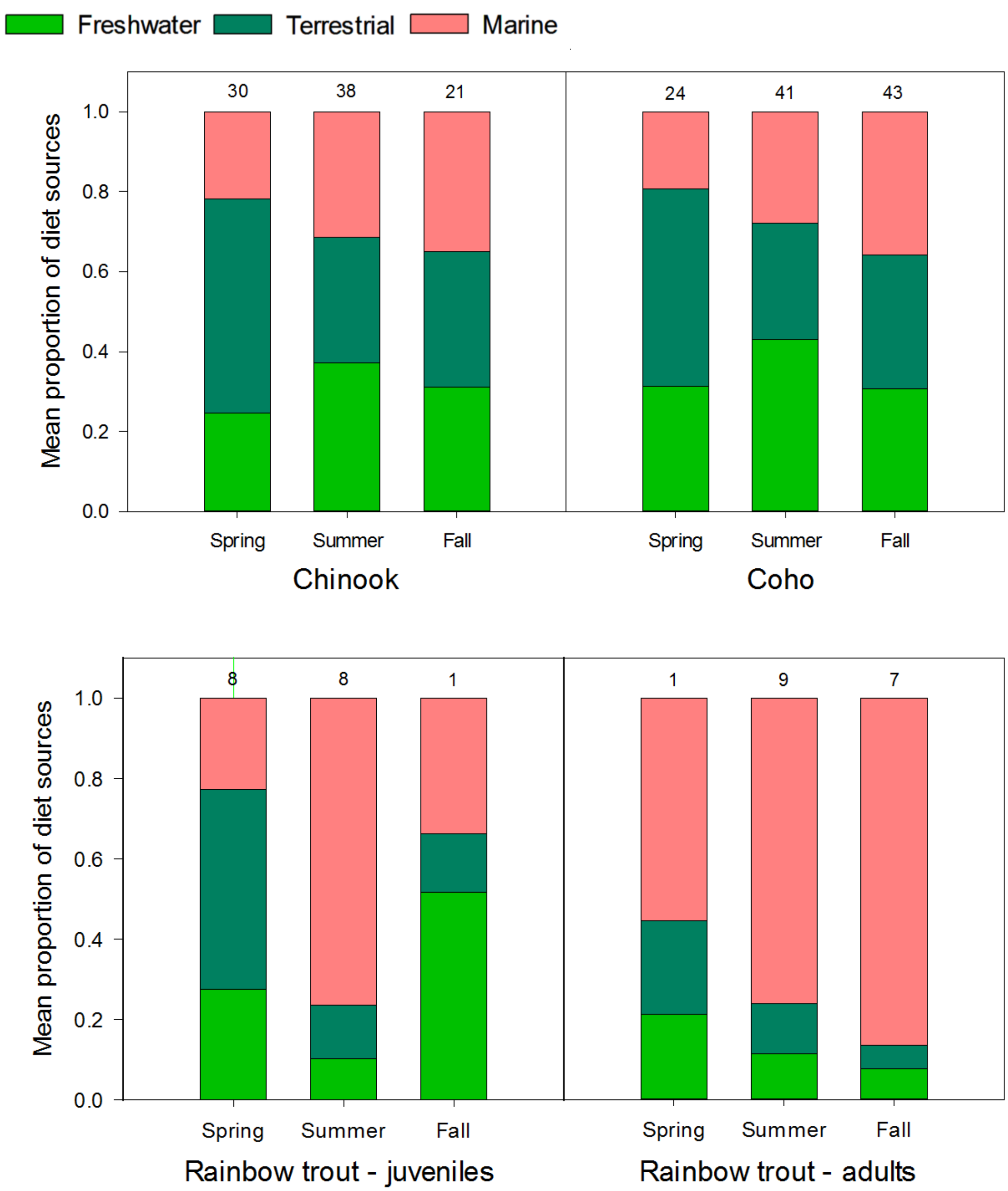

Figure 3.4-15. Diet proportion estimates from stable isotope mixing model showing seasonal trends in diet composition of juvenile Chinook salmon, juvenile coho salmon, and juvenile and adult rainbow trout sampled between June and October. Sample sizes for each species – age class collected during each seasonal sampling event are listed above each bar. The "freshwater" source type includes all aquatic macroinvertebrate functional feeding groups, the "terrestrial" source type includes terrestrial macroinvertebrates, and the "marine" source type includes spawning salmon carcass and eggs.

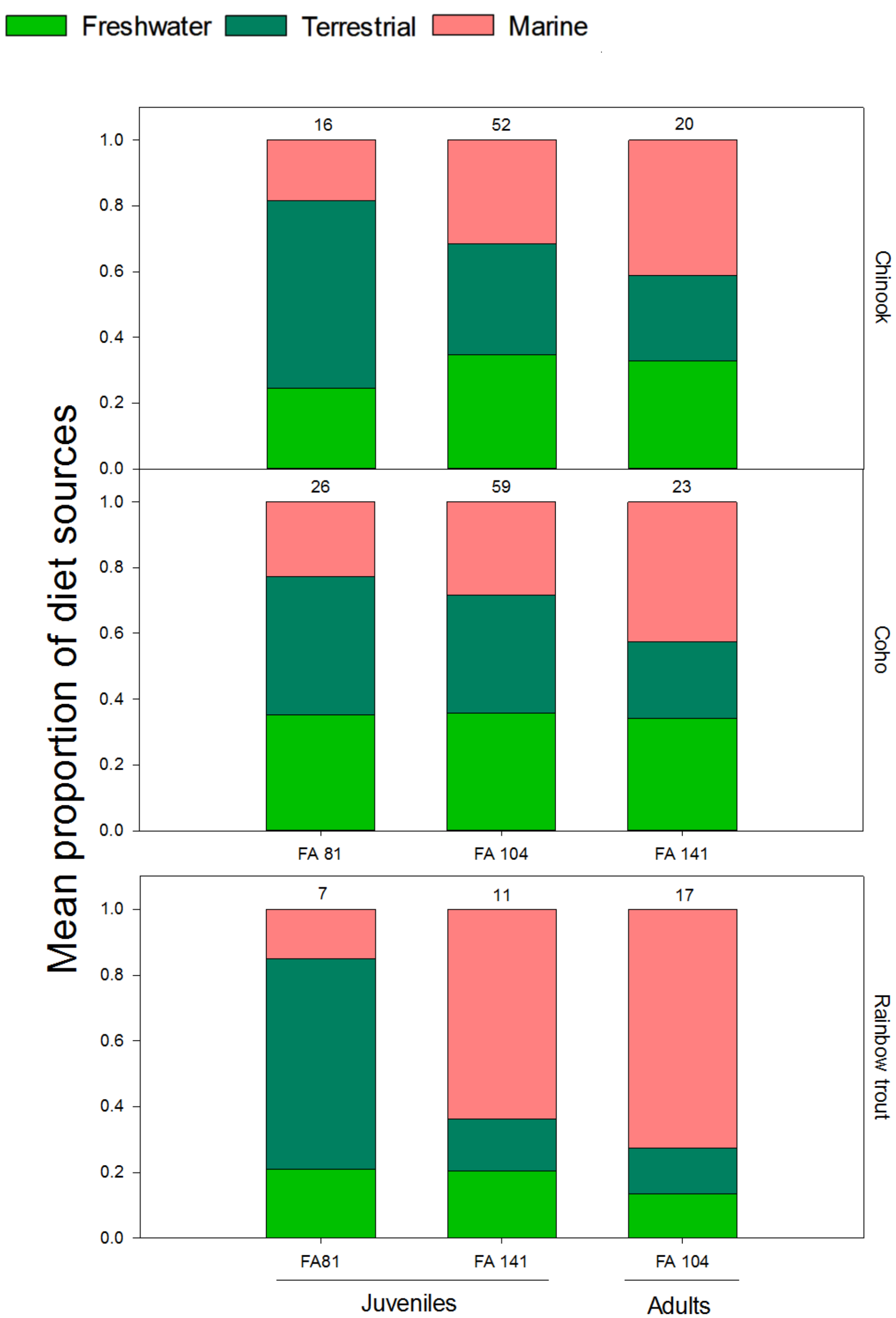

Figure 3.4-16. Diet proportion estimates from stable isotope mixing model showing trends among study reaches in diet composition of juvenile Chinook salmon, juvenile coho salmon, and juvenile and adult rainbow trout sampled between June and October. "FA" refers to Focus Area and its associated river mile. Sample sizes for each species – age class collected during each seasonal sampling event are listed above each bar. The "freshwater" source type includes all aquatic macroinvertebrate functional feeding groups, the "terrestrial" source type includes terrestrial macroinvertebrates, and the "marine" source type includes spawning salmon carcass and eggs.

Freshwater Terrestrial Marine

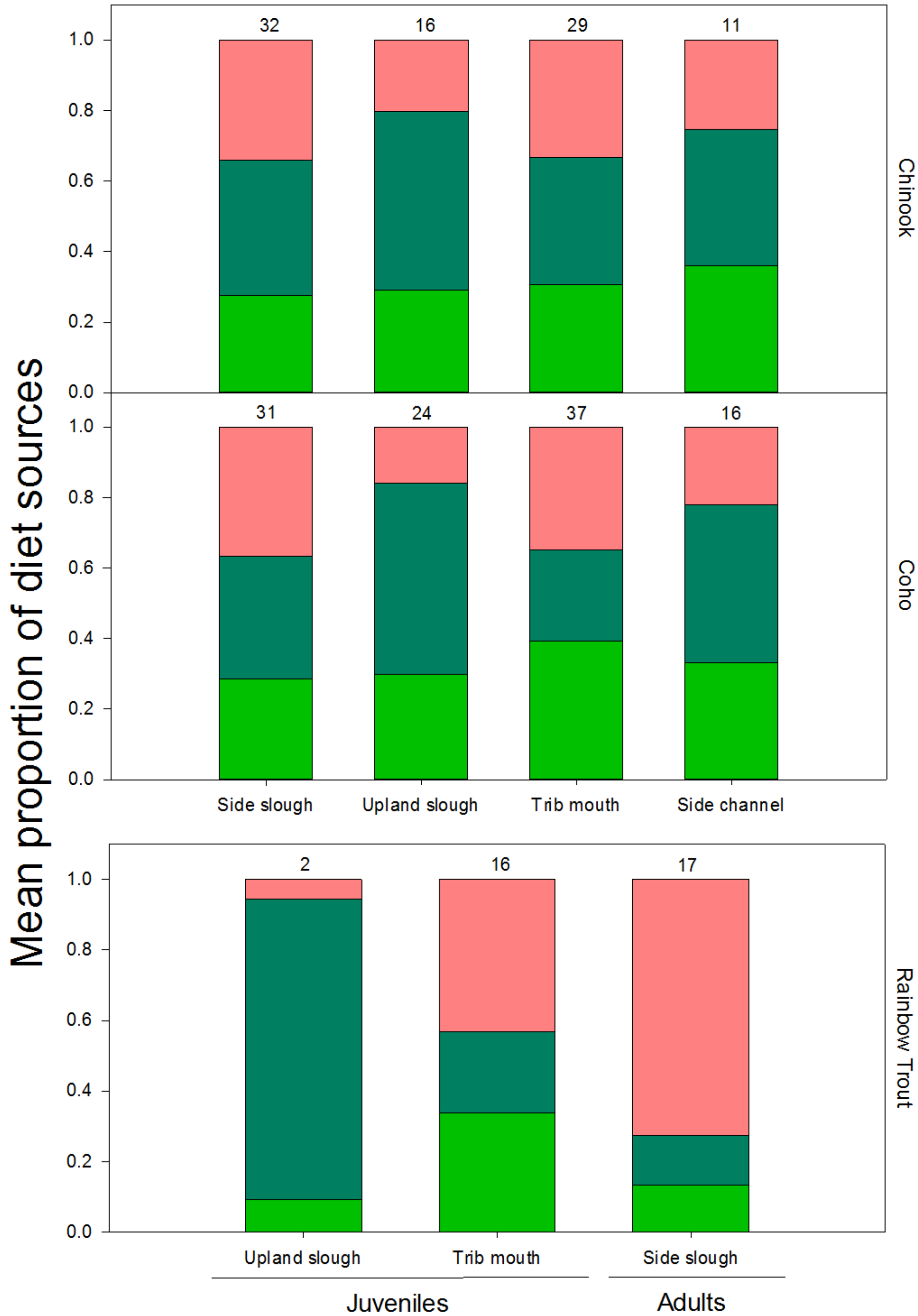

Figure 3.4-17. Diet proportion estimates from stable isotope mixing model showing trends between macrohabitat types in diet composition of juvenile Chinook salmon, juvenile coho salmon, and juvenile and adult rainbow trout sampled between June and October. Sample sizes for each species – age class collected during each seasonal sampling event are listed above each bar. The "freshwater" source type includes all aquatic macroinvertebrate functional feeding groups, the "terrestrial" source type includes terrestrial macroinvertebrates, and the "marine" source type includes spawning salmon carcass and eggs.

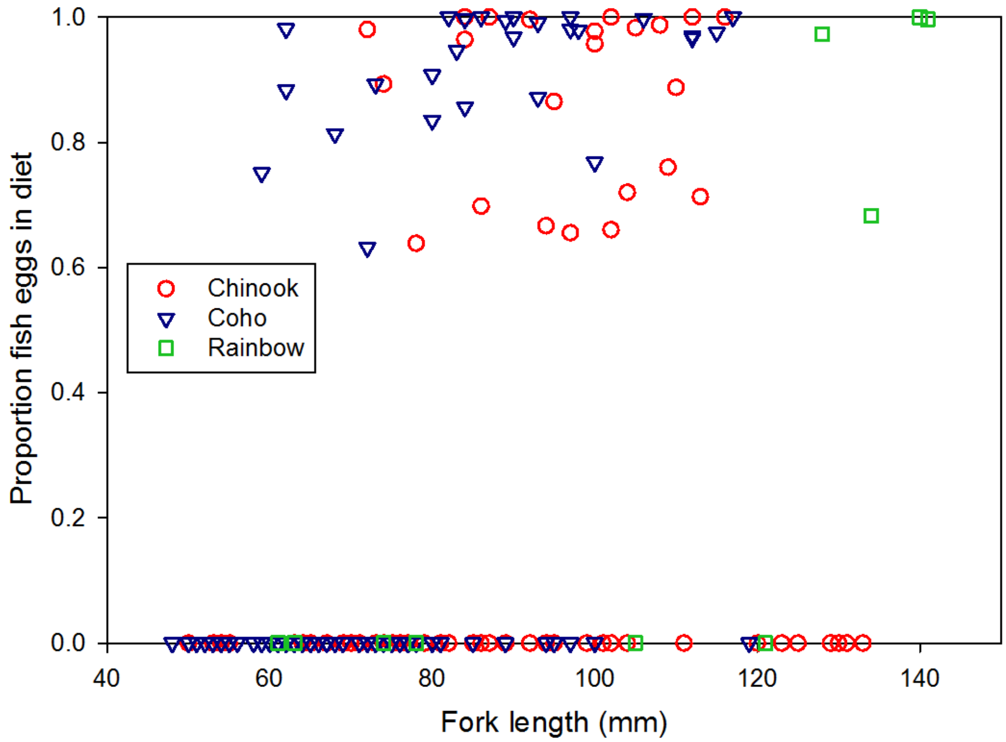

Figure 3.5-1. Proportion (by dry mass) of fish eggs in the stomach contents of individual fish sampled by gastric lavage, as a function of fork length. Figure is truncated at 150 mm fork length to show detail at smaller lengths.

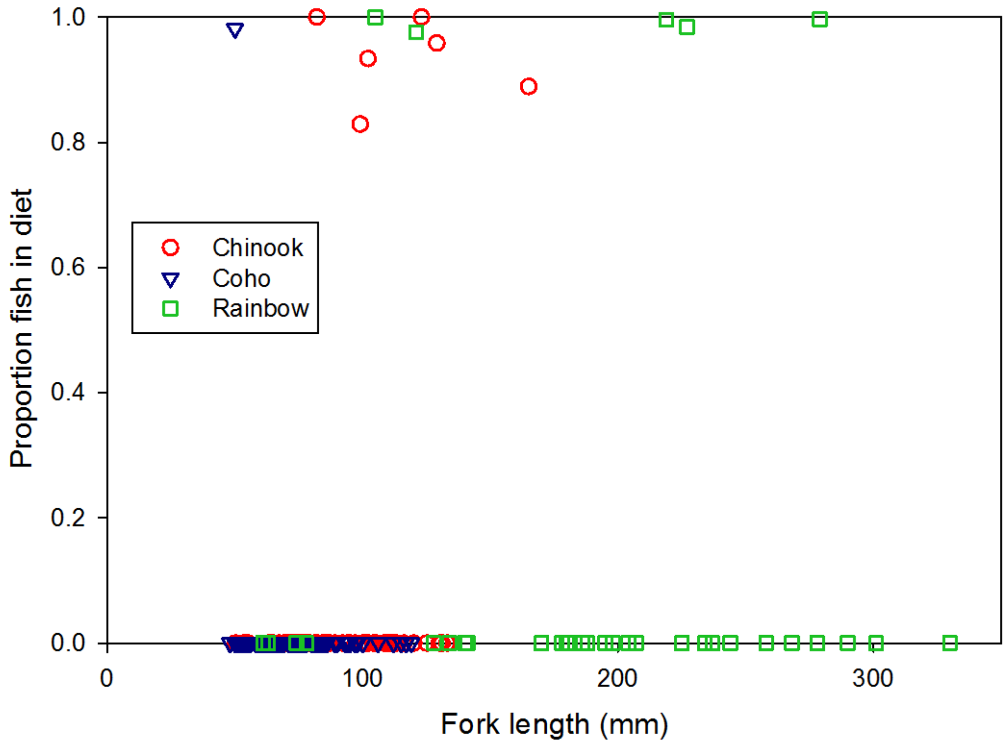

Figure 3.5-2. Proportion (by dry mass) of prey fish in the stomach contents of individual fish sampled by gastric lavage, as a function of fork length.

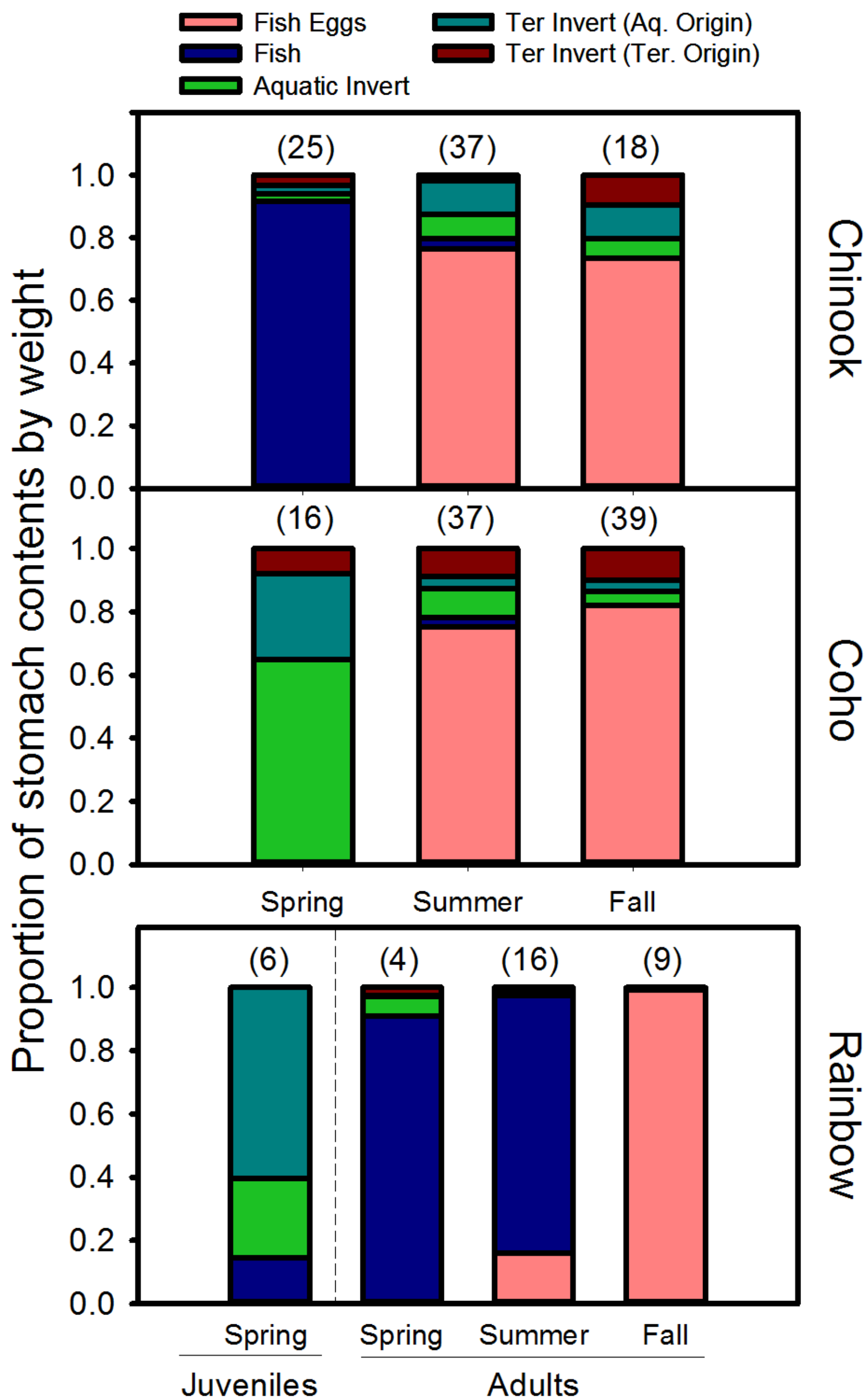

Figure 3.5-3. Seasonal trends in diet composition of juvenile Chinook salmon, juvenile coho salmon, and juvenile and adult rainbow trout sampled between June and October in the Susitna River. Diet proportions (by dry mass) were determined by stomach content analysis, and the numbers of non-empty samples are shown in parentheses. Terrestrial invertebrates are broken down by aquatic and terrestrial origin of their larval stage.

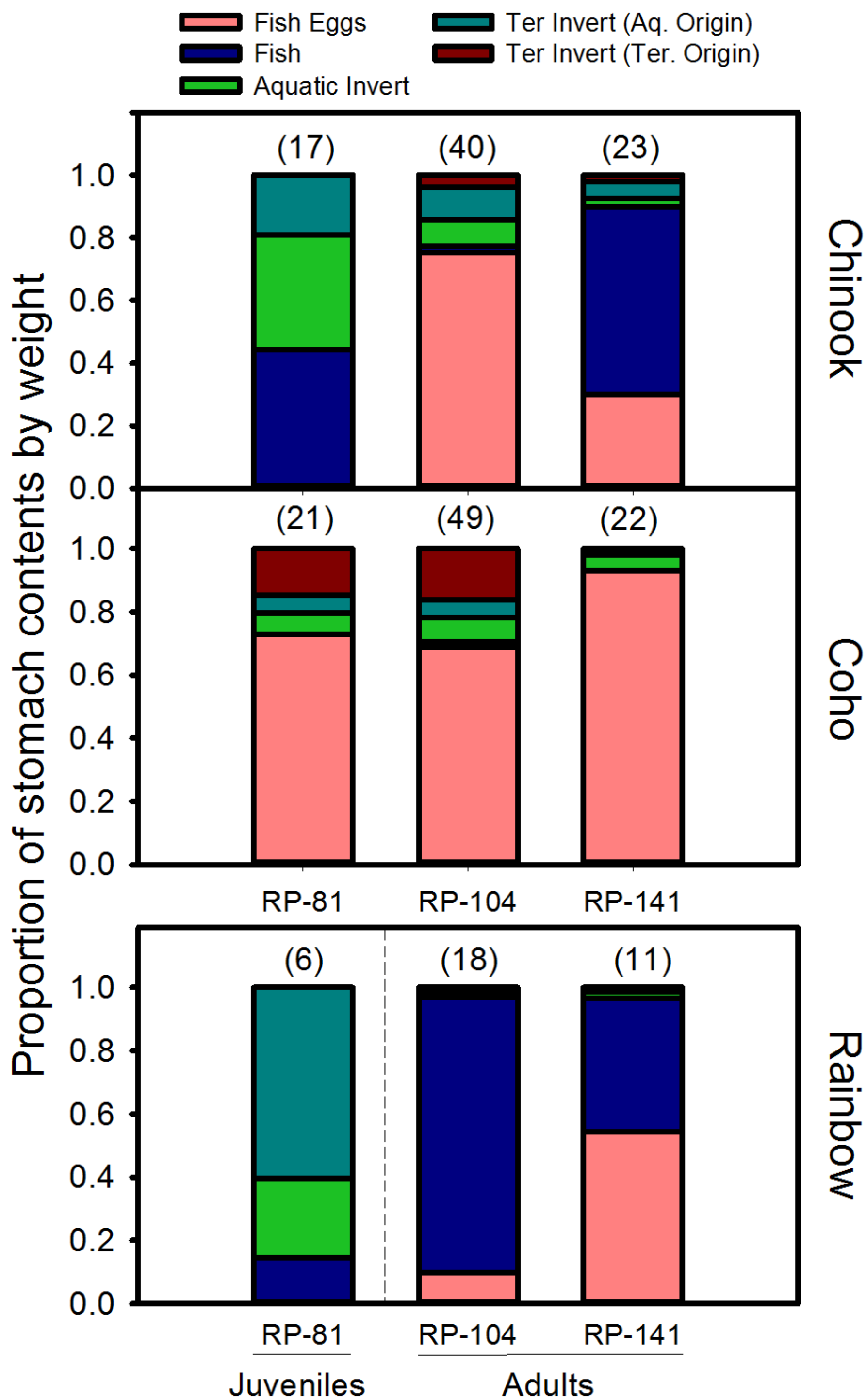

Figure 3.5-4. Large-scale spatial trends in diet composition of juvenile Chinook salmon, juvenile coho salmon, and juvenile and adult rainbow trout sampled at three focus areas Susitna River. Diet proportions (by dry mass) were determined by stomach content analysis, and the numbers of non-empty samples are shown in parentheses. Terrestrial invertebrates are broken down by aquatic and terrestrial origin of their larval stage.

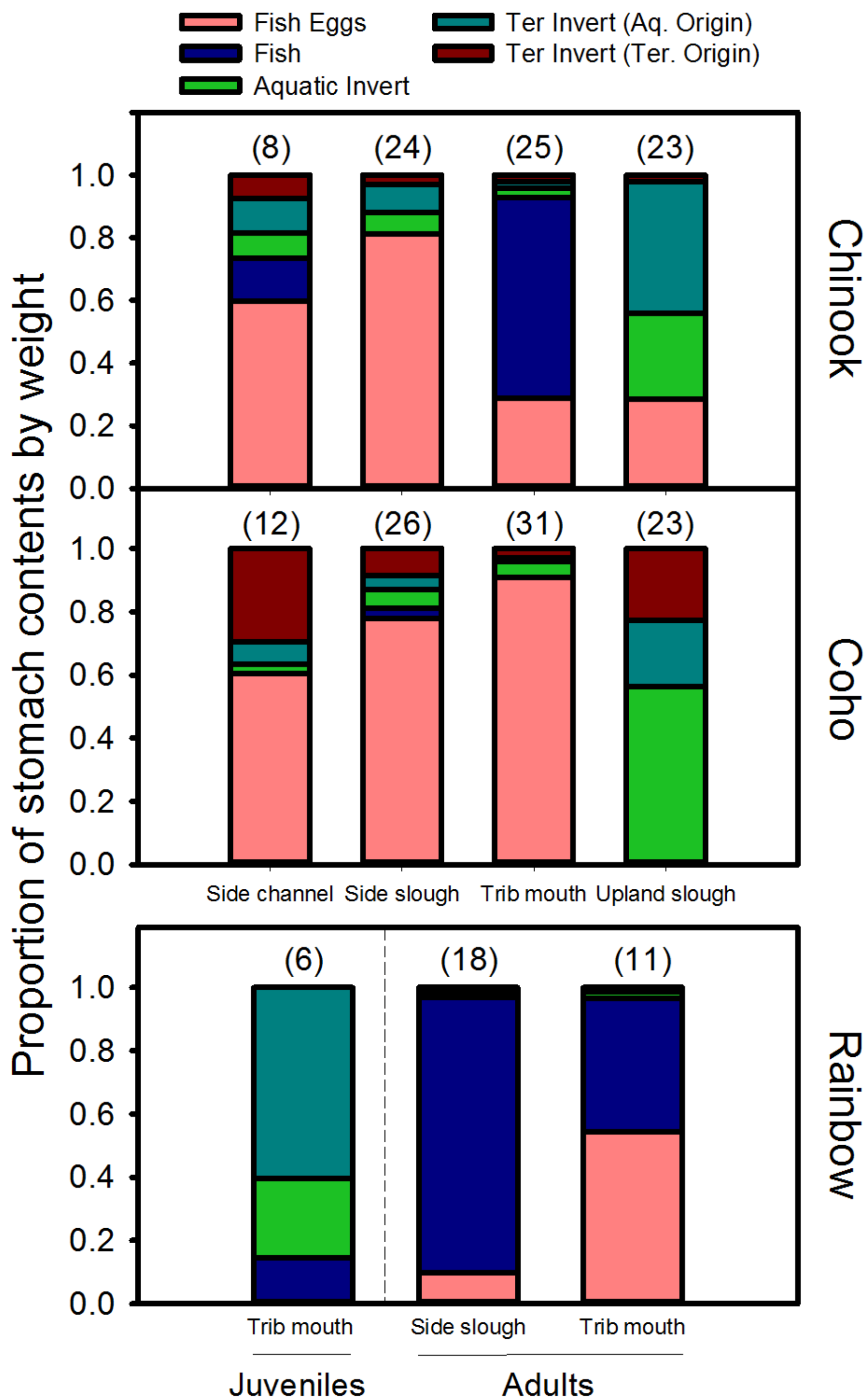

Figure 3.5-5. Small-scale spatial trends in diet composition of juvenile Chinook salmon, juvenile coho salmon, and juvenile and adult rainbow trout sampled in four macrohabitat types in the Susitna River. Diet proportions (by dry mass) were determined by stomach content analysis, and the numbers of non-empty samples are shown in parentheses. Terrestrial invertebrates are broken down by aquatic and terrestrial origin of their larval stage.

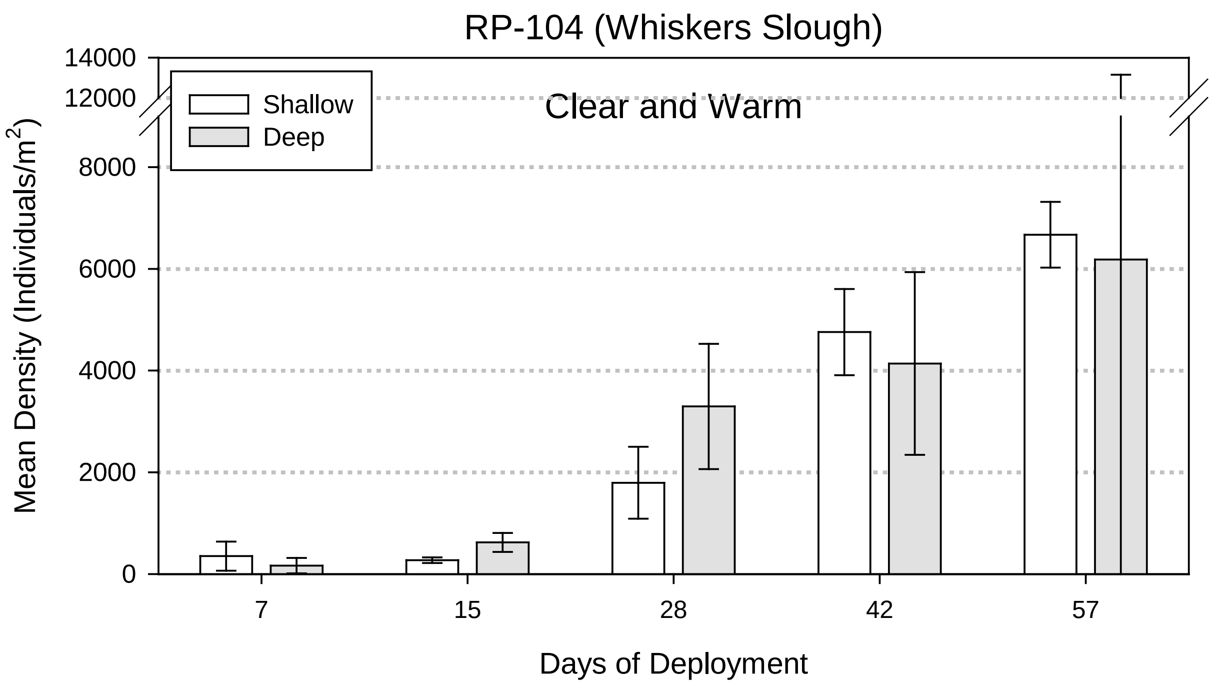

Figure 3.6-1. Mean density estimates (n=3) from Hester-Dendy multiplate samplers collected in clear and warm water conditions (HD-1) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

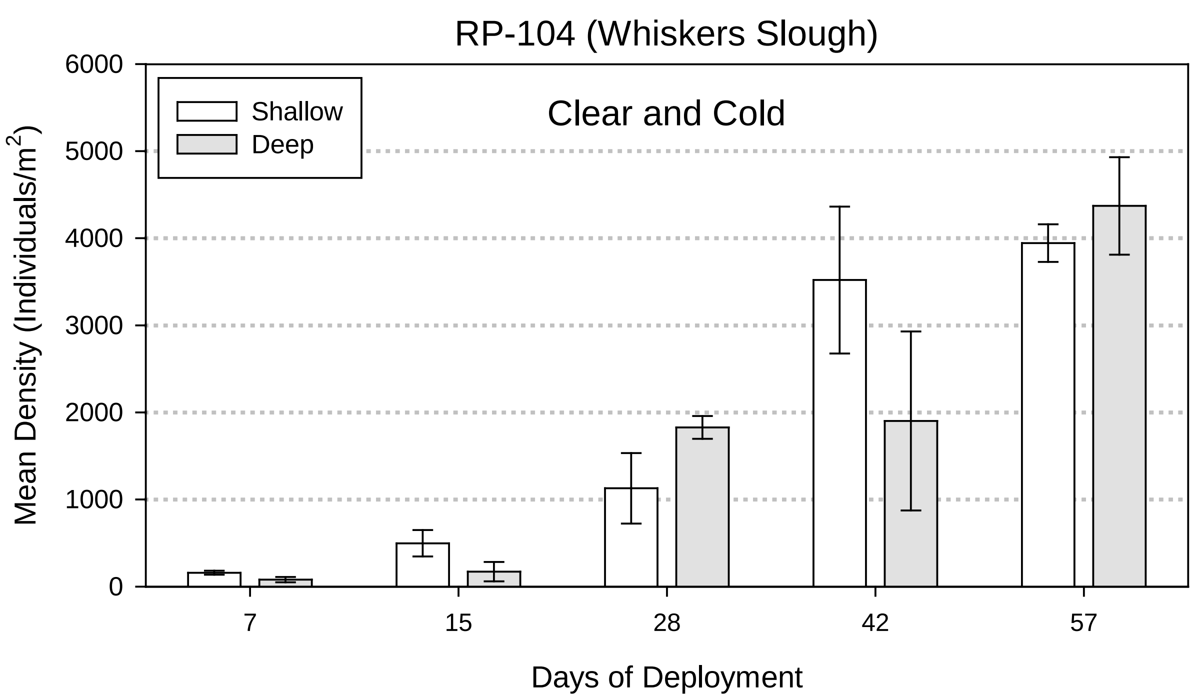

Figure 3.6-2. Mean density estimates (n=3) from Hester-Dendy multiplate samplers collected in clear and cold water conditions (HD-2) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

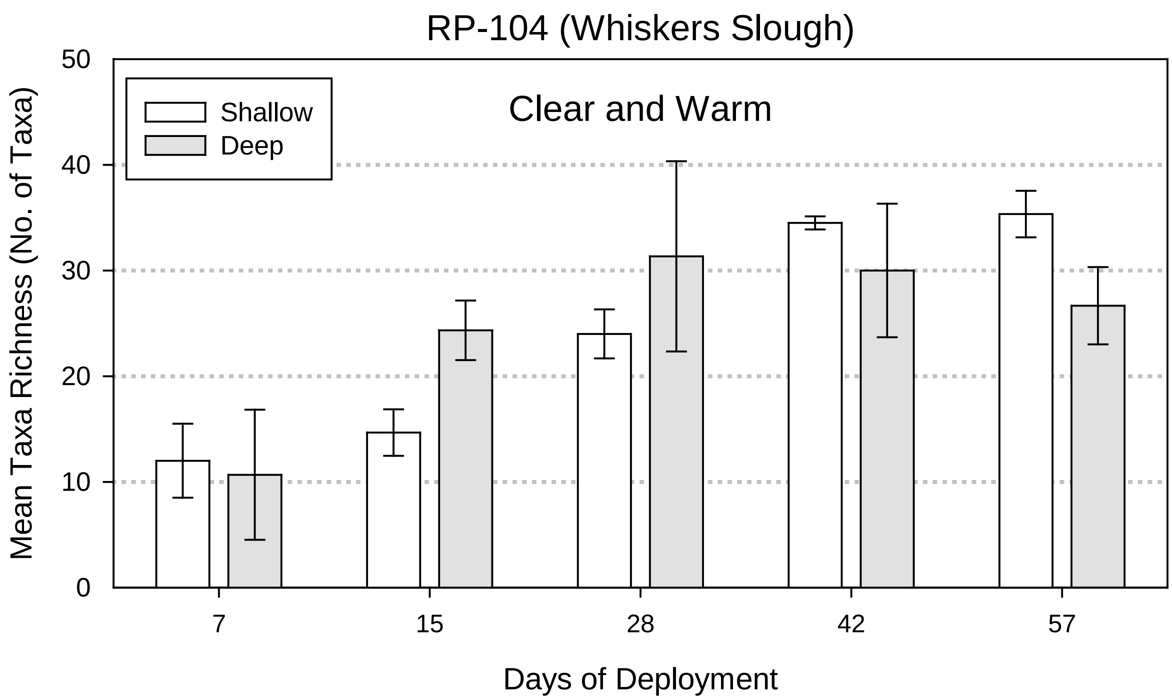

Figure 3.6-3. Mean taxa richness estimates (n=3) from Hester-Dendy multiplate samplers collected in clear and warm water conditions (HD-1) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

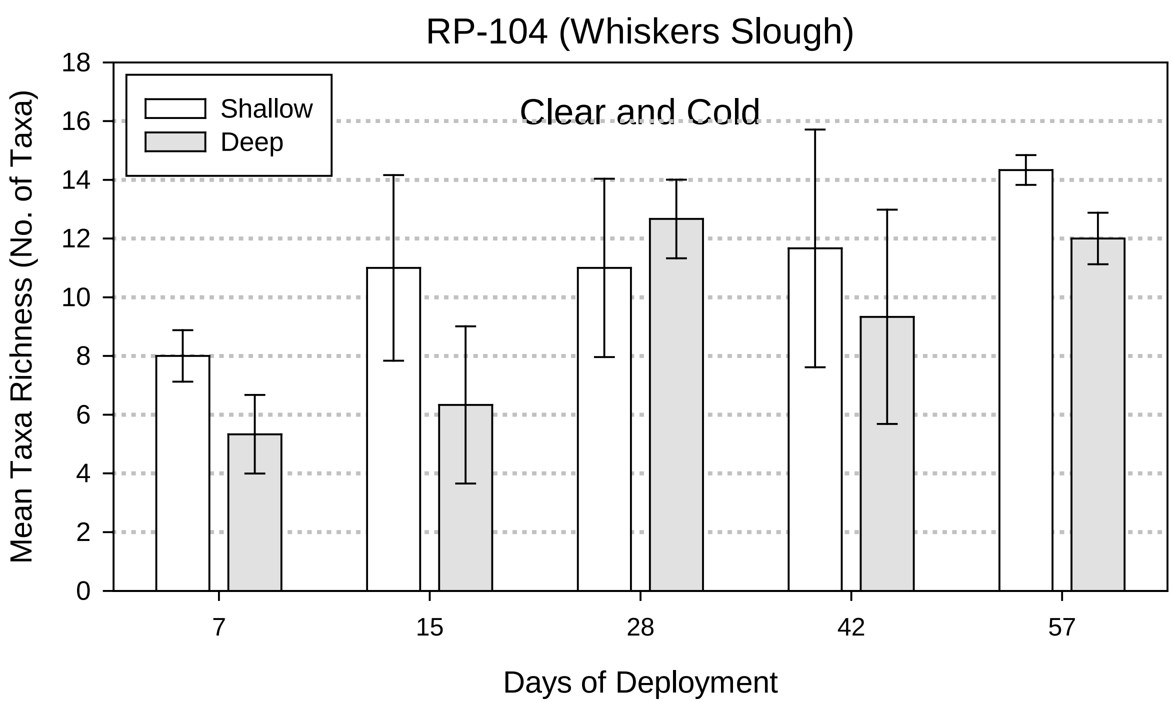

Figure 3.6-4. Mean taxa richness estimates (n=3) from Hester-Dendy multiplate samplers collected in clear and cold water conditions (HD-2) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

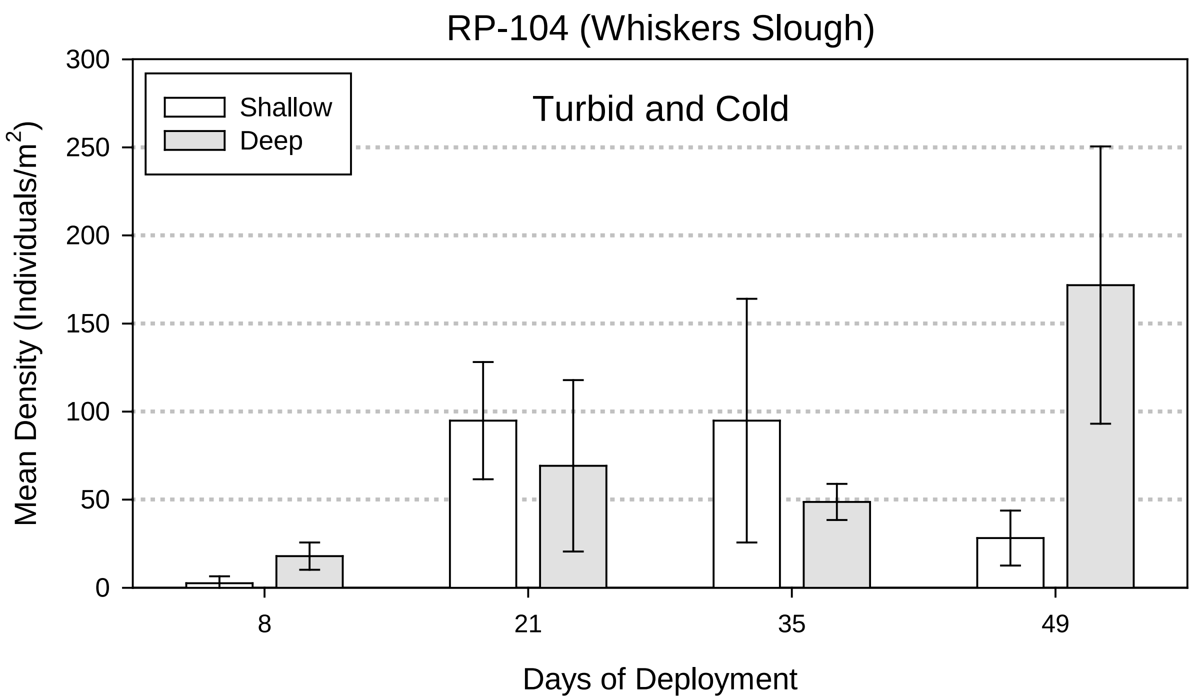

Figure 3.6-5. Mean density estimates (n=3) from Hester-Dendy multiplate samplers collected in turbid and cold water conditions (HD-3) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

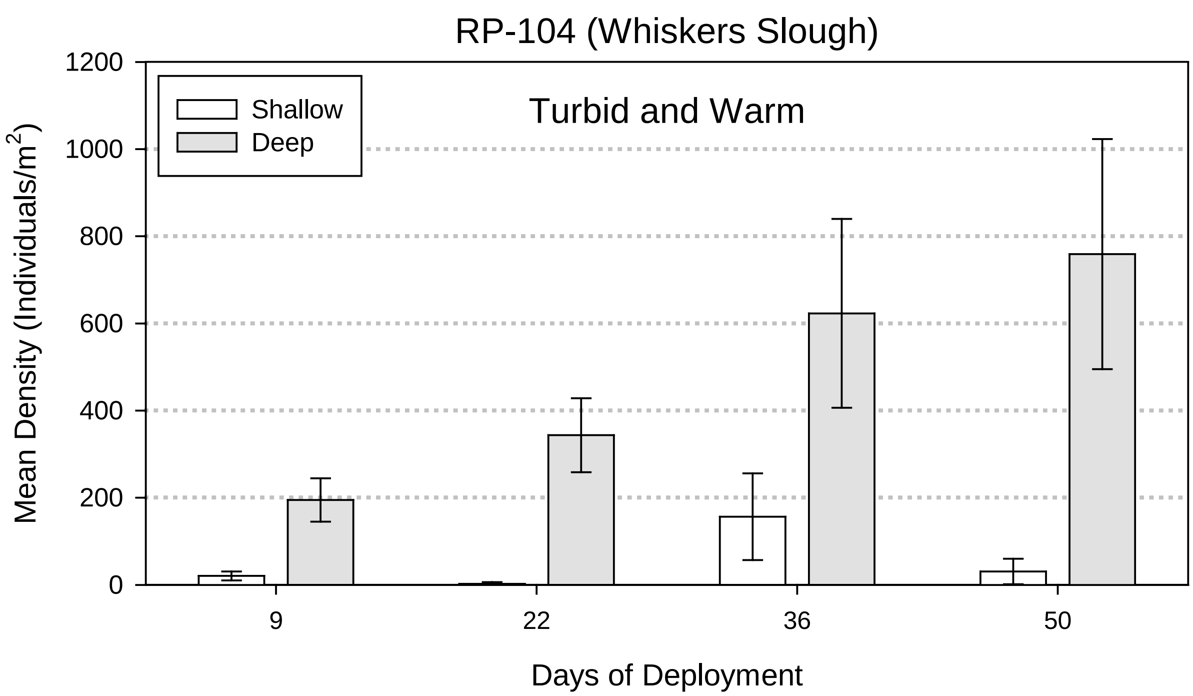

Figure 3.6-6. Mean density estimates (n=3) from Hester-Dendy multiplate samplers collected in turbid and warm water conditions (HD-4) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

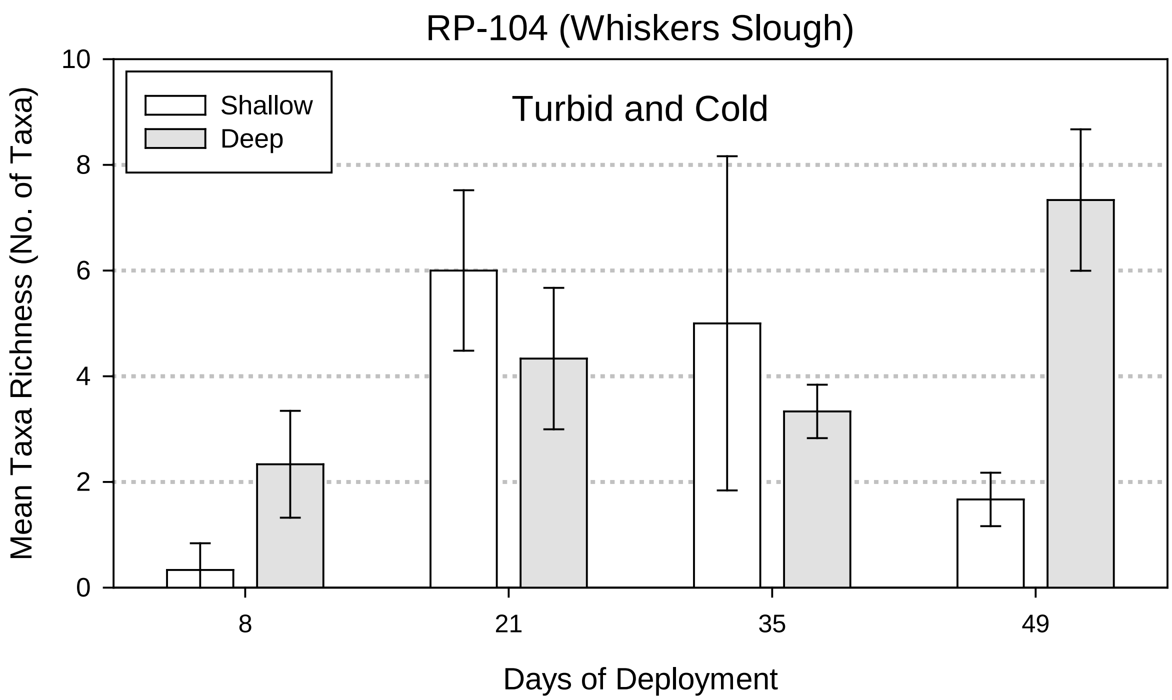

Figure 3.6-7. Mean taxa richness estimates (n=3) from Hester-Dendy multiplate samplers collected in turbid and cold water conditions (HD-3) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

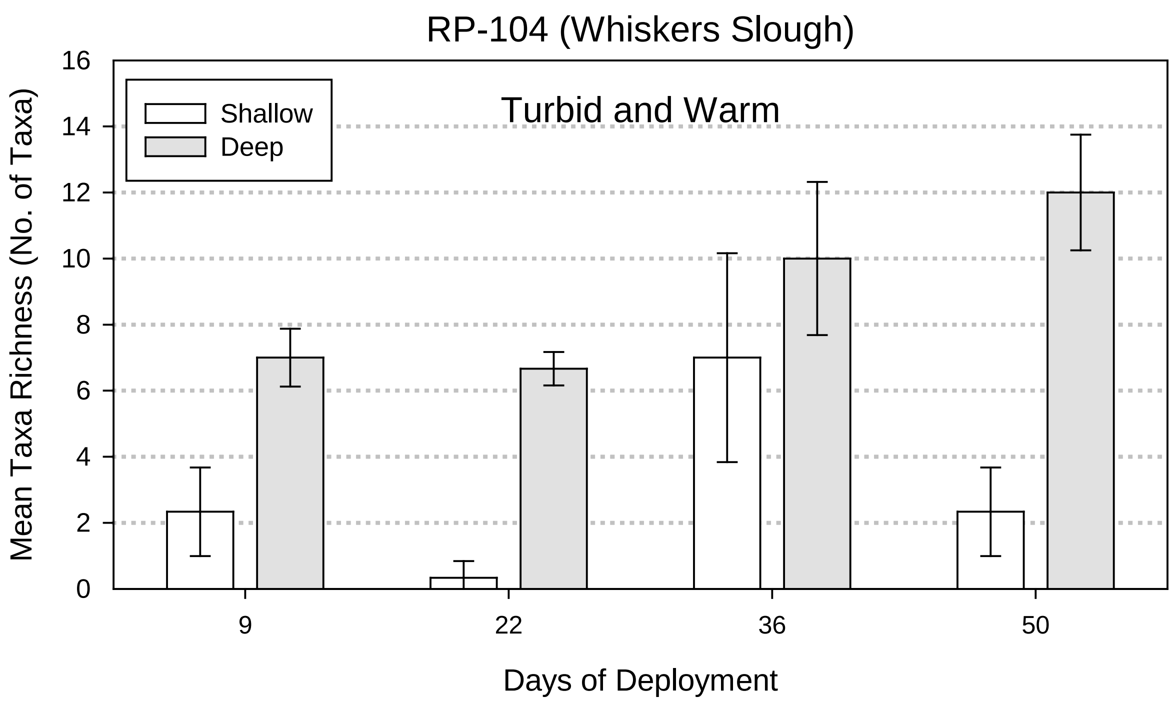

Figure 3.6-8. Mean taxa richness estimates (n=3) from Hester-Dendy multiplate samplers collected in turbid and warm water conditions (HD-4) in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study. Error bars represent 95-percent confidence intervals.

APPENDIX A. ADDITIONAL TABLES AND FIGURES

TABLES

Table A3.1-1. Mean density and taxonomic richness values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Watana Dam Focus area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-184-1	TM	Hess	3284.5	24.6 (44)	5.8 (8)	4.4 (5)	1.4 (3)	0 (0)	14.4 (25)	2.29	0.72
Spr	RP-184-2	SC	Hess	125.6	5.8 (17)	1.2 (4)	0.4 (2)	0.8 (2)	0 (0)	3.6 (10)	1.42	0.87
Spr	RP-184-3	MC	Hess	246.5	8.4 (20)	2 (5)	1.2 (3)	0.8 (2)	0 (0)	4.4 (10)	1.84	0.90
Sum	RP-184-1	TM	Hess	2114.0	25 (49)	5.6 (11)	2.6 (5)	3 (6)	0 (0)	13 (25)	1.97	0.62
Sum	RP-184-2	SC	Hess	239.5	7.4 (23)	1.2 (4)	0.4 (2)	0.8 (2)	0 (0)	4 (15)	1.46	0.77
Sum	RP-184-3	MC	Hess	216.3	8.8 (24)	1 (2)	0.2 (1)	0.8 (1)	0 (0)	4.2 (15)	1.80	0.88
Fall	RP-184-1	TM	Hess	2560.5	19 (38)	7.4 (11)	3.6 (4)	3.6 (6)	0.2 (1)	6.4 (16)	1.70	0.58
Fall	RP-184-2	SC	Hess	646.5	9.4 (24)	4.6 (8)	1.4 (3)	3.2 (5)	0 (0)	2.8 (11)	1.56	0.75
Fall	RP-184-3	MC	Hess	193.0	6.6 (15)	3.4 (6)	1 (2)	2.4 (4)	0 (0)	1.6 (6)	1.43	0.81

Table A3.1-2. Mean taxonomic composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Watana Dam Focus area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Non-insect	EPT:Chiro Ratio	Percent Top Taxa	Percent Top 3 Taxa
Spr	RP-184-1	TM	Hess	24.01	9.51	0.00	61.39	1.70	0.00	3.39	0.35	30.72	60.64
Spr	RP-184-2	SC	Hess	2.79	12.81	0.00	57.02	24.88	0.00	2.50	0.19	43.78	75.71
Spr	RP-184-3	MC	Hess	6.84	8.14	0.00	55.77	23.45	0.00	5.80	0.21	30.67	67.22
Sum	RP-184-1	TM	Hess	2.74	50.80	0.00	21.61	9.61	0.00	15.24	0.71	48.44	70.26
Sum	RP-184-2	SC	Hess	1.72	6.65	0.00	68.13	7.03	0.00	16.47	0.10	52.64	80.00
Sum	RP-184-3	MC	Hess	0.61	6.47	0.00	43.37	33.41	0.00	16.15	0.12	35.92	69.02
Fall	RP-184-1	TM	Hess	7.27	36.12	0.13	13.13	40.69	0.00	2.67	0.77	50.17	78.44
Fall	RP-184-2	SC	Hess	7.90	41.10	0.00	11.71	35.96	0.00	3.33	0.82	43.62	76.97
Fall	RP-184-3	MC	Hess	7.63	34.26	0.00	9.23	48.37	0.00	0.51	0.86	48.30	79.25

Table A3.1-3. Mean functional feeding group composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Watana Dam Focus area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Collector Gatherers	Percent Collector Filterers	Percent Scrapers	Percent Shredders	Percent Predators	Percent Parasites	Percent Other FFGs
Spr	RP-184-1	TM	Hess	65.79	1.50	20.02	0.32	12.37	0.00	0.00
Spr	RP-184-2	SC	Hess	58.27	24.88	1.25	1.54	14.06	0.00	0.00
Spr	RP-184-3	MC	Hess	61.90	23.45	0.48	0.48	11.56	2.14	0.00
Sum	RP-184-1	TM	Hess	33.40	7.75	1.95	50.79	4.06	2.04	0.00
Sum	RP-184-2	SC	Hess	81.38	7.03	1.72	3.54	4.22	2.11	0.00
Sum	RP-184-3	MC	Hess	44.04	33.41	0.61	0.61	14.61	6.74	0.00
Fall	RP-184-1	TM	Hess	14.76	40.15	6.24	34.85	3.87	0.13	0.00
Fall	RP-184-2	SC	Hess	15.32	35.96	5.69	37.04	5.16	0.83	0.00
Fall	RP-184-3	MC	Hess	14.17	48.37	3.21	30.88	3.38	0.00	0.00

Table A3.1-4. Mean density and taxonomic richness values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Stephan Lake Complex Focus area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-173-1	TM	Hess	2620.9	26.4 (52)	6 (10)	3.8 (5)	1.6 (3)	0.6 (2)	15.8 (31)	2.56	0.79
Spr	RP-173-2	MC	Hess	95.3	5.2 (21)	1 (4)	0.4 (2)	0.4 (1)	0.2 (1)	3.4 (15)	1.37	0.75
Spr	RP-173-3	SC	Hess	1851.2	21.8 (42)	5 (11)	3 (7)	1.6 (3)	0.4 (1)	11.2 (22)	2.26	0.75
Spr	RP-173-4	SS	P. Ponar	930.0	7.6 (28)	0 (0)	0 (0)	0 (0)	0 (0)	5.2 (19)	1.27	0.73
Spr	RP-173-4	SS	Hess	11769.5	25.4 (42)	4.4 (8)	3 (5)	1.2 (2)	0.2 (1)	16.2 (28)	2.32	0.72
Sum	RP-173-1	TM	Hess	1441.2	26.8 (54)	7.6 (15)	3.2 (7)	3.6 (6)	0.8 (2)	11.2 (23)	2.40	0.80
Sum	RP-173-2	MC	Hess	127.9	5.8 (21)	1.6 (7)	0.4 (2)	1 (4)	0.2 (1)	1.8 (8)	1.42	0.93
Sum	RP-173-3	SC	Hess	5930.2	25.2 (46)	3.4 (8)	1 (3)	2 (3)	0.4 (2)	16.6 (28)	2.18	0.67
Sum	RP-173-4	SS	P. Ponar	4520.8	13.4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	10.6 (20)	1.89	0.73
Sum	RP-173-4	SS	Hess	28720.0	26 (45)	4 (8)	1 (2)	2.2 (3)	0.8 (3)	15.6 (25)	2.40	0.74
Post-Storm	RP-173-4	SS	P. Ponar	783.6	9.2 (28)	0.2 (1)	0 (0)	0.2 (1)	0 (0)	6.4 (20)	1.94	0.94
Post-Storm	RP-173-4	SS	Hess	17066.8	18.8 (41)	2.6 (7)	0.4 (2)	2 (4)	0.2 (1)	11.8 (22)	1.75	0.60
Fall	RP-173-1	TM	Hess	1430.2	18.6 (42)	7.2 (11)	4 (6)	2.6 (3)	0.6 (2)	7.4 (21)	2.10	0.72
Fall	RP-173-2	MC	Hess	1095.3	12.4 (29)	6 (12)	1.8 (5)	3.8 (5)	0.4 (2)	3 (8)	1.57	0.64
Fall	RP-173-3	SC	Hess	3211.6	23.6 (50)	5.6 (11)	1.8 (4)	3.4 (5)	0.4 (2)	12 (27)	2.07	0.66
Fall	RP-173-4	SS	P. Ponar	361.7	4.6 (14)	0.2 (1)	0 (0)	0.2 (1)	0 (0)	4.2 (12)	1.35	0.95
Fall	RP-173-4	SS	Hess	7391.5	33 (44)	7.5 (10)	2 (3)	4.5 (6)	1 (1)	17.5 (24)	2.31	0.66

Table A3.1-5. Mean taxonomic composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Stephan Lake Complex Focus area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Non-insect	EPT:Chiro Ratio	Percent Top Taxa	Percent Top 3 Taxa
Spr	RP-173-1	TM	Hess	26.91	3.24	0.69	59.64	2.89	0.00	6.63	0.34	20.64	50.77
Spr	RP-173-2	MC	Hess	6.50	5.18	1.18	69.91	7.00	0.00	10.24	0.15	43.24	71.32
Spr	RP-173-3	SC	Hess	3.74	2.06	0.24	52.70	0.26	0.00	41.01	0.10	28.75	60.13
Spr	RP-173-4	SS	P. Ponar	0.00	0.00	0.00	71.30	5.56	0.00	23.15	0.00	32.80	61.68
Spr	RP-173-4	SS	Hess	2.21	0.70	0.07	73.31	0.06	0.00	23.64	0.04	26.74	58.80
Sum	RP-173-1	TM	Hess	8.71	11.82	0.88	42.01	9.46	0.00	27.11	0.29	33.74	56.52
Sum	RP-173-2	MC	Hess	1.38	19.58	0.69	28.07	4.58	0.00	45.71	0.42	39.08	80.83
Sum	RP-173-3	SC	Hess	0.79	3.79	0.12	76.44	1.10	0.00	17.77	0.06	36.05	64.86
Sum	RP-173-4	SS	P. Ponar	0.00	0.00	0.00	62.36	2.28	0.00	35.37	0.00	41.31	66.74
Sum	RP-173-4	SS	Hess	1.41	2.05	0.26	52.82	17.26	0.00	26.20	0.07	27.34	54.99
Post-Storm	RP-173-4	SS	P. Ponar	0.00	1.67	0.00	76.70	3.38	0.00	18.26	0.02	27.51	60.87
Post-Storm	RP-173-4	SS	Hess	0.19	2.44	0.06	74.73	0.69	0.00	21.88	0.04	43.37	77.28
Fall	RP-173-1	TM	Hess	18.21	13.99	0.76	25.49	35.18	0.33	6.04	0.56	36.57	61.48
Fall	RP-173-2	MC	Hess	6.61	33.40	0.49	8.69	47.26	0.00	3.55	0.84	51.03	77.29
Fall	RP-173-3	SC	Hess	3.94	44.28	0.24	32.27	5.54	0.00	13.73	0.60	41.84	66.42
Fall	RP-173-4	SS	P. Ponar	0.00	4.00	0.00	92.92	0.00	0.00	3.08	0.04	38.97	78.82
Fall	RP-173-4	SS	Hess	1.19	9.80	1.34	76.24	6.39	0.00	5.05	0.14	39.40	59.85

Table A3.1-6. Mean functional feeding group composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Stephan Lake Complex Focus area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Collector Gatherers	Percent Collector Filterers	Percent Scrapers	Percent Shredders	Percent Predators	Percent Parasites	Percent Other FFGs
Spr	RP-173-1	TM	Hess	76.90	2.37	13.62	2.34	4.52	0.21	0.05
Spr	RP-173-2	MC	Hess	73.29	10.68	2.50	10.35	1.18	0.00	2.00
Spr	RP-173-3	SC	Hess	63.16	0.65	0.83	1.70	15.56	18.11	0.00
Spr	RP-173-4	SS	P. Ponar	50.00	4.63	21.30	8.33	2.78	12.96	0.00
Spr	RP-173-4	SS	Hess	82.00	0.00	0.86	4.02	5.38	6.17	1.57
Sum	RP-173-1	TM	Hess	64.28	5.58	5.89	15.03	4.45	2.56	2.20
Sum	RP-173-2	MC	Hess	50.21	2.76	0.69	6.38	17.77	12.81	9.38
Sum	RP-173-3	SC	Hess	76.62	1.42	3.52	4.08	4.42	9.64	0.29
Sum	RP-173-4	SS	P. Ponar	30.38	4.16	21.32	10.97	0.00	33.00	0.18
Sum	RP-173-4	SS	Hess	65.88	17.23	0.89	4.39	5.51	5.60	0.50
Post-Storm	RP-173-4	SS	P. Ponar	51.92	1.21	22.51	3.77	2.62	12.98	5.00
Post-Storm	RP-173-4	SS	Hess	64.79	0.71	0.77	27.13	2.98	3.55	0.06
Fall	RP-173-1	TM	Hess	30.17	36.13	6.04	24.81	2.26	0.30	0.29
Fall	RP-173-2	MC	Hess	9.39	46.80	4.33	31.43	7.80	0.26	0.00
Fall	RP-173-3	SC	Hess	36.10	5.57	0.82	46.98	10.23	0.21	0.08
Fall	RP-173-4	SS	P. Ponar	38.97	1.54	34.97	17.44	4.00	3.08	0.00
Fall	RP-173-4	SS	Hess	64.80	6.39	1.34	10.63	16.25	0.45	0.15

Table A3.1-7. Mean density and taxonomic richness values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Indian River Focus area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-141-1	TM	Hess	1402.3	14.6 (31)	5 (9)	3.4 (5)	1.4 (3)	0.2 (1)	6.6 (15)	1.91	0.72
Spr	RP-141-2	SC	Hess	346.5	14 (37)	4.4 (11)	2.2 (4)	1.4 (4)	0.8 (3)	6.8 (19)	2.33	0.94
Spr	RP-141-3	MC	Hess	83.7	4 (12)	0.4 (2)	0.2 (1)	0.2 (1)	0 (0)	3.2 (8)	1.19	0.90
Spr	RP-141-4	US	Hess	19438.1	14.4 (26)	1.6 (3)	0.4 (1)	0.2 (1)	1 (1)	8.8 (18)	1.86	0.70
Spr	RP-141-4	US	P. Ponar	8645.0	18 (44)	0.4 (2)	0.4 (2)	0 (0)	0 (0)	13 (31)	1.94	0.67
Sum	RP-141-1	TM	Hess	4705.4	28.2 (51)	8.2 (14)	4.2 (6)	3.2 (5)	0.8 (3)	13.2 (22)	1.87	0.56
Sum	RP-141-2	SC	Hess	972.1	14.4 (38)	4.6 (11)	1.8 (5)	2.6 (5)	0.2 (1)	6.2 (17)	1.92	0.73
Sum	RP-141-3	MC	Hess	134.9	7.2 (21)	3.8 (12)	1.8 (6)	1.8 (5)	0.2 (1)	2.2 (5)	1.78	0.92
Sum	RP-141-4	US	Hess	19040.3	13.5 (23)	0.75 (2)	0 (0)	0.5 (1)	0.25 (1)	9 (16)	1.55	0.60
Sum	RP-141-4	US	P. Ponar	9261.9	10.4 (24)	0 (0)	0 (0)	0 (0)	0 (0)	5.8 (15)	1.37	0.61
Fall	RP-141-1	TM	Hess	1297.7	17.6 (39)	8.4 (14)	4.4 (6)	2.8 (5)	1.2 (3)	4.8 (13)	1.92	0.68
Fall	RP-141-2	SC	P. Ponar	1162.5	5.6 (17)	0.6 (2)	0 (0)	0.4 (1)	0.2 (1)	5 (15)	0.96	0.64
Fall	RP-141-3	MC	Hess	69.8	3.8 (15)	0.6 (3)	0.4 (2)	0.2 (1)	0 (0)	2 (8)	1.08	0.74
Fall	RP-141-4	US	Hess	2065.9	19 (30)	3.33 (7)	1 (2)	1.67 (3)	0.667 (2)	11 (16)	2.20	0.75
Fall	RP-141-4	US	P. Ponar	3108.6	8.4 (16)	0 (0)	0 (0)	0 (0)	0 (0)	5.2 (10)	1.50	0.73

Table A3.1-8. Mean taxonomic composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Indian River Focus area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Non-insect	EPT:Chiro Ratio	Percent Top Taxa	Percent Top 3 Taxa
Spr	RP-141-1	TM	Hess	48.88	24.45	0.14	20.98	2.64	0.00	2.92	0.78	29.73	70.02
Spr	RP-141-2	SC	Hess	17.19	6.79	2.98	41.80	18.68	0.00	12.56	0.36	20.03	46.71
Spr	RP-141-3	MC	Hess	6.67	3.33	0.00	85.49	4.51	0.00	0.00	0.11	47.25	89.80
Spr	RP-141-4	US	Hess	0.33	0.09	1.33	72.86	0.33	0.00	25.07	0.03	39.47	67.39
Spr	RP-141-4	US	P. Ponar	0.30	0.00	0.00	43.63	0.98	0.00	55.09	0.01	44.54	68.61
Sum	RP-141-1	TM	Hess	10.38	21.86	0.34	60.52	1.40	0.00	5.50	0.35	50.54	71.92
Sum	RP-141-2	SC	Hess	5.27	15.61	0.26	60.44	3.97	0.00	14.45	0.27	41.69	65.58
Sum	RP-141-3	MC	Hess	20.20	27.33	2.22	36.72	8.85	0.00	4.68	0.57	31.37	62.24
Sum	RP-141-4	US	Hess	0.00	0.13	0.36	91.26	0.48	0.00	7.77	0.01	40.93	84.30
Sum	RP-141-4	US	P. Ponar	0.00	0.00	0.00	36.07	1.97	0.00	61.97	0.00	50.94	82.49
Fall	RP-141-1	TM	Hess	20.14	56.71	1.66	9.92	6.22	0.00	5.36	0.89	47.01	64.64
Fall	RP-141-2	SC	P. Ponar	0.00	1.20	1.43	97.37	0.00	0.00	0.00	0.03	67.43	93.49
Fall	RP-141-3	MC	Hess	6.67	3.33	0.00	70.00	13.33	0.00	6.67	0.23	29.58	67.50
Fall	RP-141-4	US	Hess	0.82	1.66	0.55	74.84	0.38	1.32	20.41	0.04	29.03	61.35
Fall	RP-141-4	US	P. Ponar	0.00	0.00	0.00	40.68	0.44	0.00	58.87	0.00	46.45	81.02

Table A3.1-9. Mean functional feeding group composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Indian River Focus area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Collector Gatherers	Percent Collector Filterers	Percent Scrapers	Percent Shredders	Percent Predators	Percent Parasites	Percent Other FFGs
Spr	RP-141-1	TM	Hess	33.60	1.76	36.19	0.99	27.46	0.00	0.00
Spr	RP-141-2	SC	Hess	55.61	10.62	5.75	10.12	15.51	0.00	2.38
Spr	RP-141-3	MC	Hess	82.16	3.33	7.84	3.33	3.33	0.00	0.00
Spr	RP-141-4	US	Hess	75.99	0.00	17.67	1.59	0.50	4.24	0.00
Spr	RP-141-4	US	P. Ponar	47.68	6.12	1.83	0.89	10.31	32.17	1.01
Sum	RP-141-1	TM	Hess	62.39	0.50	9.72	15.48	11.91	0.00	0.00
Sum	RP-141-2	SC	Hess	65.80	0.26	1.65	23.06	8.01	1.22	0.00
Sum	RP-141-3	MC	Hess	43.26	8.21	10.81	24.83	10.03	2.86	0.00
Sum	RP-141-4	US	Hess	82.61	0.00	14.39	0.79	0.61	1.60	0.00
Sum	RP-141-4	US	P. Ponar	25.49	12.76	0.00	0.07	21.28	39.52	0.88
Fall	RP-141-1	TM	Hess	18.27	6.23	13.45	52.55	9.50	0.00	0.00
Fall	RP-141-2	SC	P. Ponar	26.66	2.03	0.33	70.07	0.91	0.00	0.00
Fall	RP-141-3	MC	Hess	70.00	13.33	3.33	6.67	6.67	0.00	0.00
Fall	RP-141-4	US	Hess	87.69	0.38	3.21	3.44	0.90	1.11	3.28
Fall	RP-141-4	US	P. Ponar	50.72	6.62	0.00	4.42	21.37	16.87	0.00

Table A3.1-10. Mean density and taxonomic richness values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Whiskers Slough Focus area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-104-1	TM	Hess	1662.8	24 (53)	3.4 (9)	1.8 (4)	0.6 (2)	1 (3)	14.2 (29)	2.39	0.78
Spr	RP-104-2	SS	Hess	379.1	12.4 (30)	3 (6)	2 (4)	1 (2)	0 (0)	6.4 (15)	2.13	0.89
Spr	RP-104-3	MC	Hess	220.9	7.4 (16)	0.2 (1)	0 (0)	0.2 (1)	0 (0)	5.4 (10)	1.55	0.81
Spr	RP-104-4	US	P. Ponar	1420.8	9.6 (32)	0.2 (1)	0 (0)	0 (0)	0.2 (1)	5.8 (19)	1.74	0.87
Spr	RP-104-5	SC	Hess	176.7	7.8 (22)	1.2 (5)	0.6 (3)	0.6 (2)	0 (0)	5 (13)	1.70	0.90
Sum	RP-104-1	TM	Hess	5696.1	27.2 (53)	1.4 (6)	0.4 (2)	0.4 (2)	0.6 (2)	18.2 (31)	2.20	0.67
Sum	RP-104-2	SS	Hess	21695.3	26.2 (61)	4 (11)	1.2 (3)	1.2 (4)	1.6 (4)	16.2 (33)	2.42	0.74
Sum	RP-104-3	MC	Hess	109.3	4.6 (17)	0.4 (2)	0.2 (1)	0.2 (1)	0 (0)	2.6 (8)	1.14	0.68
Sum	RP-104-4	US	P.Ponar	7267.8	18.2 (40)	0 (0)	0 (0)	0 (0)	0 (0)	14.4 (30)	2.05	0.74
Sum	RP-104-5	SC	Hess	41.9	2.6 (8)	1.2 (4)	0.6 (2)	0.6 (2)	0 (0)	0.4 (2)	0.78	0.74
Post-Storm	RP-104-2	SS	Hess	3246.5	26.6 (52)	2.4 (5)	0.6 (1)	1.6 (3)	0.2 (1)	17.6 (34)	2.05	0.63
Fall	RP-104-1	TM	Hess	8915.8	26.6 (47)	4.6 (10)	1 (3)	1.4 (3)	2.2 (4)	16.4 (24)	2.19	0.67
Fall	RP-104-2	SS	P.Ponar	3134.5	13.4 (30)	0 (0)	0 (0)	0 (0)	0 (0)	10.2 (25)	1.83	0.72
Fall	RP-104-2	SS	Hess	13200.0	38 (48)	5.5 (8)	1.5 (2)	2 (3)	2 (3)	25.5 (30)	2.59	0.71
Fall	RP-104-3	MC	Hess	111.6	5.8 (17)	1 (3)	0.2 (1)	0.8 (2)	0 (0)	3.8 (11)	1.61	0.92
Fall	RP-104-4	US	P. Ponar	12384.5	21.4 (37)	0 (0)	0 (0)	0 (0)	0 (0)	16 (27)	1.67	0.55
Fall	RP-104-5	SC	Hess	172.1	6.6 (17)	2.4 (6)	0.2 (1)	2 (4)	0.2 (1)	3 (8)	1.56	0.83

Table A3.1-11. Mean taxonomic composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Whiskers Slough Focus area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Non-insect	EPT:Chiro Ratio	Percent Top Taxa	Percent Top 3 Taxa
Spr	RP-104-1	TM	Hess	12.05	0.58	3.05	49.48	3.44	0.00	31.41	0.24	31.82	55.08
Spr	RP-104-2	SS	Hess	14.75	5.13	0.00	48.48	22.34	0.34	8.95	0.25	29.57	52.40
Spr	RP-104-3	MC	Hess	0.00	2.00	0.00	74.22	21.21	0.00	2.57	0.03	44.33	76.59
Spr	RP-104-4	US	P. Ponar	0.00	0.00	1.38	45.96	9.54	0.00	43.12	0.03	37.82	68.58
Spr	RP-104-5	SC	Hess	3.00	4.50	0.00	70.00	22.50	0.00	0.00	0.09	38.33	66.89
Sum	RP-104-1	TM	Hess	0.13	0.10	0.20	83.82	2.48	0.00	13.27	0.01	43.62	60.42
Sum	RP-104-2	SS	Hess	3.69	0.72	1.49	72.39	0.73	0.48	20.49	0.07	28.21	56.01
Sum	RP-104-3	MC	Hess	2.13	4.26	0.00	68.09	12.77	0.00	12.77	0.04	37.84	62.88
Sum	RP-104-4	US	P.Ponar	0.00	0.00	0.00	61.06	1.59	0.00	37.34	0.00	36.92	64.21
Sum	RP-104-5	SC	Hess	15.00	26.67	0.00	25.00	8.33	0.00	25.00	0.73	60.00	91.67
Post-Storm	RP-104-2	SS	Hess	0.57	2.74	0.25	45.19	1.10	0.00	50.15	0.07	46.47	68.46
Fall	RP-104-1	TM	Hess	0.61	2.64	1.86	89.87	0.71	0.00	4.32	0.05	41.58	62.07
Fall	RP-104-2	SS	P.Ponar	0.00	0.00	0.00	65.68	4.57	0.00	29.75	0.00	39.03	67.64
Fall	RP-104-2	SS	Hess	1.75	1.55	1.28	72.03	1.90	0.00	21.50	0.06	30.27	54.57
Fall	RP-104-3	MC	Hess	5.71	10.56	0.00	65.16	16.07	0.00	2.50	0.22	36.79	66.63
Fall	RP-104-4	US	P. Ponar	0.00	0.00	0.00	60.06	6.21	0.00	33.73	0.00	55.81	77.48
Fall	RP-104-5	SC	Hess	1.33	48.33	3.00	31.67	0.00	0.00	15.67	0.61	43.00	73.78

Table A3.1-12. Mean functional feeding group composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events for sites (Spr= Spring, Sum=Summer, Fall) within the Whiskers Slough Focus area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Collector Gatherers	Percent Collector Filterers	Percent Scrapers	Percent Shredders	Percent Predators	Percent Parasites	Percent Other FFGs
Spr	RP-104-1	TM	Hess	73.76	12.49	1.74	4.37	6.29	0.00	1.34
Spr	RP-104-2	SS	Hess	54.21	20.17	11.02	5.25	9.01	0.34	0.00
Spr	RP-104-3	MC	Hess	76.79	19.35	0.00	0.57	3.29	0.00	0.00
Spr	RP-104-4	US	P. Ponar	54.01	17.51	0.00	6.76	5.78	4.13	11.82
Spr	RP-104-5	SC	Hess	71.67	18.83	2.83	1.33	5.33	0.00	0.00
Sum	RP-104-1	TM	Hess	53.73	4.39	0.36	5.86	10.91	3.02	21.73
Sum	RP-104-2	SS	Hess	78.08	3.45	3.11	4.48	6.93	0.05	3.88
Sum	RP-104-3	MC	Hess	32.45	2.13	0.00	44.15	21.28	0.00	0.00
Sum	RP-104-4	US	P.Ponar	70.27	7.73	10.15	0.21	6.47	0.75	4.42
Sum	RP-104-5	SC	Hess	61.67	0.00	3.33	0.00	31.67	0.00	3.33
Post-Storm	RP-104-2	SS	Hess	88.99	1.48	0.99	4.65	3.41	0.12	0.36
Fall	RP-104-1	TM	Hess	65.67	18.48	1.36	8.12	4.99	0.06	1.31
Fall	RP-104-2	SS	P.Ponar	79.10	2.24	0.00	8.78	2.02	1.24	6.62
Fall	RP-104-2	SS	Hess	75.91	10.98	1.02	4.62	7.48	0.00	0.00
Fall	RP-104-3	MC	Hess	61.19	13.57	6.83	18.41	0.00	0.00	0.00
Fall	RP-104-4	US	P. Ponar	58.74	36.58	1.14	0.30	3.07	0.12	0.05
Fall	RP-104-5	SC	Hess	28.78	2.33	1.33	60.89	6.67	0.00	0.00

Table A3.1-13. Mean density and taxonomic richness values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-81-1	US	P. Ponar	4107.5	13.6 (36)	0.2 (1)	0.2 (1)	0 (0)	0 (0)	9.6 (28)	1.76	0.70
Spr	RP-81-2	TM	Hess	7579.1	21.2 (42)	6 (11)	4 (7)	1.4 (2)	0.6 (2)	11 (22)	1.73	0.58
Spr	RP-81-3	MC	Hess	153.5	4.4 (14)	0.4 (2)	0.2 (1)	0.2 (1)	0 (0)	2.6 (7)	0.98	0.71
Spr	RP-81-4	SC	Hess	123.3	7.8 (24)	1.4 (5)	0.6 (3)	0.8 (2)	0 (0)	4.2 (12)	1.90	0.95
Sum	RP-81-1	US	P. Ponar	6412.4	9 (16)	0.2 (1)	0 (0)	0 (0)	0.2 (1)	5.6 (10)	1.58	0.73
Sum	RP-81-2	TM	Hess	3014.0	31.6 (61)	10.2 (20)	5.4 (10)	3.8 (6)	1 (4)	14.8 (28)	2.59	0.75
Sum	RP-81-3	MC	Hess	7.0	0.6 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0.4 (2)	0.14	0.20
Sum	RP-81-4	SC	Hess	114.0	6.4 (19)	3.2 (10)	1.8 (5)	1.4 (5)	0 (0)	2 (5)	1.72	0.95
Fall	RP-81-1	US	Hess	1074.4	17 (42)	0.8 (4)	0.4 (2)	0 (0)	0.4 (2)	10.6 (27)	2.19	0.79
Fall	RP-81-2	TM	Hess	1397.7	26.8 (53)	8.6 (14)	3.2 (5)	4.2 (5)	1.2 (4)	12.8 (28)	2.63	0.81
Fall	RP-81-3	MC	Hess	174.4	6 (13)	3.4 (7)	1.6 (4)	1.8 (3)	0 (0)	1.6 (5)	1.41	0.72
Fall	RP-81-4	SC	Hess	616.3	9.6 (18)	7.4 (11)	2.8 (5)	4 (5)	0.6 (1)	1 (4)	1.71	0.77

Table A3.1-14. Mean taxonomic composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Non-insect	EPT:Chiro Ratio	Percent Top Taxa	Percent Top 3 Taxa
Spr	RP-81-1	US	P. Ponar	0.31	0.00	0.00	52.79	1.55	0.00	45.35	0.00	46.15	72.95
Spr	RP-81-2	TM	Hess	4.98	3.10	0.17	86.54	3.28	0.00	1.93	0.09	47.55	76.91
Spr	RP-81-3	MC	Hess	4.00	1.43	0.00	58.86	33.33	0.00	2.38	0.07	66.71	90.48
Spr	RP-81-4	SC	Hess	12.32	9.52	0.00	48.22	23.64	0.00	6.30	0.28	28.76	56.92
Sum	RP-81-1	US	P. Ponar	0.00	0.00	0.31	42.56	0.22	0.00	56.91	0.01	40.54	80.70
Sum	RP-81-2	TM	Hess	12.33	6.43	0.47	72.03	5.63	0.00	3.11	0.21	27.37	51.06
Sum	RP-81-3	MC	Hess	0.00	0.00	0.00	66.67	0.00	0.00	33.33	0.00	30.00	40.00
Sum	RP-81-4	SC	Hess	24.15	26.87	0.00	31.95	7.08	0.00	9.95	0.61	27.08	64.56
Fall	RP-81-1	US	Hess	0.51	0.00	0.38	43.37	2.08	0.00	53.67	0.02	29.42	58.03
Fall	RP-81-2	TM	Hess	9.54	27.72	1.30	45.29	12.72	0.00	3.43	0.46	25.00	50.31
Fall	RP-81-3	MC	Hess	13.90	21.93	0.00	20.39	43.78	0.00	0.00	0.52	47.05	73.19
Fall	RP-81-4	SC	Hess	17.77	71.74	1.41	4.66	3.93	0.00	0.48	0.95	39.68	73.57

Table A3.1-15. Mean functional feeding group composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Collector Gatherers	Percent Collector Filterers	Percent Scrapers	Percent Shredders	Percent Predators	Percent Parasites	Percent Other FFGs
Spr	RP-81-1	US	P. Ponar	61.23	9.72	0.33	2.14	2.78	22.96	0.84
Spr	RP-81-2	TM	Hess	88.23	3.60	2.04	0.36	5.78	0.00	0.00
Spr	RP-81-3	MC	Hess	65.95	30.71	0.95	0.00	2.38	0.00	0.00
Spr	RP-81-4	SC	Hess	48.77	12.56	10.50	11.76	16.41	0.00	0.00
Sum	RP-81-1	US	P. Ponar	51.48	28.78	1.18	0.31	5.41	12.85	0.00
Sum	RP-81-2	TM	Hess	69.78	6.33	9.88	6.72	5.55	0.30	1.44
Sum	RP-81-3	MC	Hess	66.67	0.00	0.00	33.33	0.00	0.00	0.00
Sum	RP-81-4	SC	Hess	31.69	7.08	17.28	18.00	25.95	0.00	0.00
Fall	RP-81-1	US	Hess	54.77	10.57	3.46	11.65	9.08	10.22	0.25
Fall	RP-81-2	TM	Hess	47.09	8.58	3.72	27.46	12.43	0.20	0.52
Fall	RP-81-3	MC	Hess	24.78	43.78	7.51	12.84	11.09	0.00	0.00
Fall	RP-81-4	SC	Hess	16.92	3.46	3.61	56.71	19.31	0.00	0.00

Table A3.2-1. Mean drift density and taxonomic richness values from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Watana Dam Focus area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Drift Density (#/ft^3)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Chironomid Taxa Avg (Total)	Zooplankton Taxa Avg (Total)	Other Non-Insect (T)Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-184-1	TM	Drift	0.222	37 (53)	6 (9)	15.5 (20)	0	5 (7)	1.99	0.55
Spr	RP-184-2	SC	Drift	0.075	23.5 (34)	2 (4)	15.5 (21)	0	4.5 (7)	2.05	0.65
Spr	RP-184-3	MC	Drift	0.052	20 (28)	2.5 (5)	9.5 (13)	0	5.5 (7)	1.94	0.65
Sum	RP-184-1	TM	Drift	0.125	41.5 (62)	5.5 (10)	23 (33)	0	5.5 (7)	2.71	0.73
Sum	RP-184-2	SC	Drift	0.007	8 (13)	1 (2)	3 (6)	0	2.5 (3)	1.92	0.93
Sum	RP-184-3	MC	Drift	0.041	7 (12)	0.5 (1)	5 (8)	0	1 (2)	1.77	0.91
Fall	RP-184-1	TM	Drift	1.250	12.5 (20)	3.5 (5)	4 (7)	0	3 (5)	0.92	0.35
Fall	RP-184-2	SC	Drift	0.081	27.5 (40)	4.5 (7)	10.5 (17)	0	10 (13)	2.42	0.73
Fall	RP-184-3	MC	Drift	0.268	26.5 (36)	5 (6)	10 (17)	0	8 (9)	2.00	0.61

Table A3.2-2. Mean taxonomic composition metric values (n=5) from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Watana Dam Focus area (FA-184) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Zoo-plankton	Percent Other Non-insects	EPT:Chiro Ratio	Percent Top 3 Taxa
Spr	RP-184-1	TM	Drift	5.85	0.81	0.00	80.22	6.10	2.70	0	4.32	0.08	67.28
Spr	RP-184-2	SC	Drift	2.04	0.43	0.00	63.85	29.16	0.32	0	4.20	0.04	72.73
Spr	RP-184-3	MC	Drift	0.84	0.94	0.35	47.54	33.11	0.59	0.35	16.28	0.04	73.74
Sum	RP-184-1	TM	Drift	0.88	3.11	1.13	72.91	6.86	4.84	0	10.27	0.07	52.57
Sum	RP-184-2	SC	Drift	0.00	5.56	2.08	42.64	15.00	0.00	0	34.72	0.16	59.44
Sum	RP-184-3	MC	Drift	0.00	3.85	0.00	73.85	9.62	0.00	0	12.69	0.06	61.92
Fall	RP-184-1	TM	Drift	4.17	0.88	0.86	16.66	76.12	0.30	0	1.02	0.30	88.22
Fall	RP-184-2	SC	Drift	1.32	4.50	0.51	10.19	26.14	0.00	35.11	22.24	0.38	57.62
Fall	RP-184-3	MC	Drift	0.74	3.17	0.00	5.94	23.83	0.00	34.38	31.94	0.40	72.05

Table A3.2-3. Mean drift density and taxonomic richness values from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Stephan Lake Complex Focus area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Drift Density (#/ft³)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Chironomid Taxa Avg (Total)	Zooplankton Taxa Avg (Total)	Other Non-Insect (T)Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-173-1	TM	Drift	0.084	51.5 (64)	5.5 (7)	23.5 (27)	0	10 (14)	3.16	0.80
Spr	RP-173-2	MC	Drift	0.154	26.5 (37)	3.5 (4)	13.5 (20)	0	5.5 (6)	2.74	0.84
Spr	RP-173-3	SC	Drift	0.080	30.5 (41)	3.5 (4)	11 (13)	0	5.5 (8)	2.64	0.77
Spr	RP-173-4	SS	Plankton Net	0.427	2.4 (6)	0.4 (1)	1.6 (4)	0.4 (1)	0	0.76	0.73
Sum	RP-173-1	TM	Drift	0.144	38 (52)	9 (13)	16.5 (23)	0	6 (8)	3.17	0.88
Sum	RP-173-2	MC	Drift	0.188	20.5 (35)	3 (5)	8 (14)	0	3.5 (6)	2.66	0.88
Sum	RP-173-3	SC	Drift	0.037	3 (5)	0.5 (1)	2.5 (4)	0	0	0.96	0.94
Sum	RP-173-4	SS	Plankton Net	4.254	8.8 (22)	0	4.4 (12)	2.4 (6)	1 (2)	1.37	0.65
Fall	RP-173-1	TM	Drift	0.184	30.5 (40)	7.5 (9)	7 (9)	0	8 (11)	2.00	0.59
Fall	RP-173-2	MC	Drift	0.153	27.5 (39)	6.5 (9)	7.5 (11)	0	10 (13)	2.10	0.64
Fall	RP-173-3	SC	Plankton Net	0.931	3.2 (9)	0.2 (1)	1.8 (4)	0.6 (2)	0.6 (2)	1.17	0.93
Fall	RP-173-4	SS	Plankton Net	0.493	1.8 (7)	0	1.4 (5)	0	0.4 (2)	0.60	0.69

Table A3.2-4. Mean taxonomic composition metric values (n=5) from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Stephan Lake Complex Focus area (FA-173) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Zoo-plankton	Percent Other Non-insects	EPT:Chiro Ratio	Percent Top 3 Taxa
Spr	RP-173-1	TM	Drift	4.38	0.69	0.11	34.29	20.10	14.79	0.46	25.18	0.13	38.27
Spr	RP-173-2	MC	Drift	2.24	2.68	0.00	55.43	19.36	2.68	4.89	12.72	0.08	48.19
Spr	RP-173-3	SC	Drift	9.59	0.44	0.63	58.93	6.71	12.10	2.94	8.66	0.15	48.18
Spr	RP-173-4	SS	Plankton Net	4.41	0.00	0.00	83.79	0.00	0.00	11.80	0	0.03	79.09
Sum	RP-173-1	TM	Drift	2.72	7.58	1.56	55.49	11.03	7.51	0	14.11	0.18	32.65
Sum	RP-173-2	MC	Drift	0.88	4.67	1.16	47.23	13.14	21.56	0	11.36	0.12	44.98
Sum	RP-173-3	SC	Drift	0.00	0.00	10.00	90.00	0.00	0.00	0	0	0.10	95.00
Sum	RP-173-4	SS	Plankton Net	0.00	0.00	0.00	81.37	0.77	0.00	13.25	4.60	0.00	78.79
Fall	RP-173-1	TM	Drift	9.93	5.33	0.64	23.70	50.98	1.13	0.32	7.97	0.38	71.73
Fall	RP-173-2	MC	Drift	1.41	5.84	1.58	5.06	36.51	0.32	30.39	18.89	0.61	66.24
Fall	RP-173-3	SC	Plankton Net	0.00	4.36	0.00	69.12	0.00	0.00	13.42	13.09	0.02	67.38
Fall	RP-173-4	SS	Plankton Net	0.00	0.00	0.00	87.08	0.00	0.00	0	12.92	0.00	78.18

Table A3.2-5. Mean drift density and taxonomic richness values from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Indian River Focus area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Drift Density (#/ft^3)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Chironomid Taxa Avg (Total)	Zooplankton Taxa Avg (Total)	Other Non-Insect (T)Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-141-1	TM	Drift	0.653	41.5 (56)	7.5 (9)	17.5 (22)	0	7 (10)	3.00	0.81
Spr	RP-141-2	SC	Drift	0.195	47 (68)	4 (7)	21 (32)	0	10.5 (13)	2.89	0.75
Spr	RP-141-3	MC	Drift	0.018	10 (18)	0	7 (13)	0	1.5 (3)	1.62	0.91
Spr	RP-141-4	US	Plankton Net	2.638	9.2 (27)	0.6 (2)	2.6 (11)	3.6 (7)	2 (5)	1.62	0.75
Sum	RP-141-1	TM	Drift	0.309	40.5 (53)	11.5 (13)	16.5 (19)	0	6.5 (10)	2.60	0.70
Sum	RP-141-2	SC	Drift	0.011	19.5 (29)	5 (6)	5.5 (9)	0	5.5 (8)	2.54	0.86
Sum	RP-141-3	MC	Drift	0.042	13.5 (23)	3.5 (6)	5 (8)	0	1.5 (3)	2.23	0.96
Sum	RP-141-4	US	Plankton Net	0.783	3 (10)	0	1 (4)	0.2 (1)	1.8 (5)	1.03	0.82
Sum	RP-141-5	MC, Above TM	Drift	0.013	11.5 (21)	2.5 (4)	3.5 (7)	0	2 (3)	1.46	0.62
Fall	RP-141-1	TM	Drift	0.471	41 (55)	9.5 (11)	15 (21)	0	7 (9)	2.12	0.57
Fall	RP-141-2	SC	Plankton Net	0.038	0.6 (3)	0.2 (1)	0.2 (1)	0	0	0.35	0.50
Fall	RP-141-3	MC	Drift	0.025	21.5 (31)	3 (5)	8 (13)	0	7.5 (9)	2.08	0.68
Fall	RP-141-4	US	Plankton Net	0.393	4 (16)	0.2 (1)	1.2 (5)	1.2 (5)	1.2 (4)	1.19	0.96

Table A3.2-6. Mean taxonomic composition metric values (n=5) from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Indian River Focus area (FA-141) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Zoo-plankton	Percent Other Non-insects	EPT:Chiro Ratio	Percent Top 3 Taxa
Spr	RP-141-1	TM	Drift	24.11	8.04	1.74	43.52	6.81	7.98	0.14	7.66	0.44	36.55
Spr	RP-141-2	SC	Drift	4.58	1.46	0.17	44.56	29.84	3.68	7.65	8.05	0.12	48.75
Spr	RP-141-3	MC	Drift	0.00	0.00	0.00	71.14	25.20	0.00	1.22	2.44	0.00	71.43
Spr	RP-141-4	US	Plankton Net	0.58	0.00	0.89	24.14	1.89	0.00	53.15	19.36	0.19	73.57
Sum	RP-141-1	TM	Drift	5.04	10.31	5.59	63.80	5.51	0.78	0	8.98	0.25	55.83
Sum	RP-141-2	SC	Drift	5.07	14.56	0.00	36.31	13.33	2.34	0	28.39	0.35	46.05
Sum	RP-141-3	MC	Drift	13.66	7.32	0.00	37.85	21.42	3.66	0	16.10	0.36	49.07
Sum	RP-141-4	US	Plankton Net	0.00	0.00	0.00	76.60	0.00	0.00	6.20	17.20	0.00	75.87
Sum	RP-141-5	MC, Above TM	Drift	0.98	6.67	62.84	9.51	2.94	9.80	0	7.25	0.86	78.04
Fall	RP-141-1	TM	Drift	4.19	7.67	3.64	25.80	51.99	2.29	0.32	4.10	0.37	70.00
Fall	RP-141-2	SC	Plankton Net	0.00	0.00	32.50	32.50	35.00	0.00	0.00	0.00	0.10	40.00
Fall	RP-141-3	MC	Drift	0.00	3.36	0.95	14.36	12.77	1.00	7.41	60.14	0.23	65.35
Fall	RP-141-4	US	Plankton Net	0.00	0.00	2.78	36.11	2.78	0.00	27.78	30.56	0.02	84.57

Table A3.2-7. Mean drift density and taxonomic richness values from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Whiskers Slough Focus area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Drift Density (#/ft^3)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Chironomid Taxa Avg (Total)	Zooplankton Taxa Avg (Total)	Other Non-Insect (T)Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-104-1	TM	Drift	0.040	26.5 (40)	3 (4)	13 (17)	0	7 (13)	2.77	0.85
Spr	RP-104-2	SS	Drift	0.058	9 (15)	2 (3)	4.5 (8)	0	0	1.38	0.64
Spr	RP-104-3	MC	Drift	0.101	16.5 (27)	1.5 (2)	8.5 (14)	0	2 (4)	2.49	0.90
Spr	RP-104-4	US	Plankton Net	1.125	3.6 (13)	0.2 (1)	0.2 (1)	1.8 (6)	1 (4)	1.38	0.90
Spr	RP-104-5	SC	Drift	0.129	33 (49)	3 (4)	17 (26)	0	5.5 (8)	2.73	0.78
Sum	RP-104-1	TM	Drift	0.054	20.5 (27)	2.5 (3)	13 (16)	0	5 (8)	2.34	0.77
Sum	RP-104-2	SS	Plankton Net	5.420	7.4 (15)	0.8 (2)	3.4 (7)	1.8 (3)	0.8 (2)	1.26	0.71
Sum	RP-104-3	MC	Drift	0.020	7 (14)	2 (4)	2.5 (5)	0	1.5 (3)	1.24	0.47
Sum	RP-104-4	US	Plankton Net	9.643	15.6 (31)	0.4 (1)	3.4 (8)	7.6 (13)	3.4 (6)	2.07	0.76
Sum	RP-104-5	SC	Drift	0.023	15.5 (24)	7 (10)	4.5 (8)	0	1.5 (2)	2.46	0.90
Post Storm	RP-104-2	SS	Plankton Net	0.561	3.4 (11)	0.4 (1)	0.8 (2)	1.6 (5)	0.4 (2)	1.10	0.69
Sum	RP-104-1	TM	Drift	0.026	18 (26)	3 (3)	9 (15)	0	4.5 (6)	2.41	0.83
Fall	RP-104-2	SS	Plankton Net	0.189	1.6 (7)	0.2 (1)	0.8 (3)	0.2 (1)	0.4 (2)	0.51	0.29
Fall	RP-104-3	MC	Drift	0.039	17.5 (26)	3.5 (5)	4 (8)	0	8 (10)	2.05	0.72
Fall	RP-104-4	US	Plankton Net	18.475	12.4 (26)	0	3.8 (10)	6.2 (9)	2 (5)	2.12	0.85
Fall	RP-104-5	SC	Plankton Net	0.035	0.4 (2)	0	0	0.2 (1)	0.2 (1)	0.64	0.92

Table A3.2-8. Mean taxonomic composition metric values (n=5) from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Whiskers Slough Focus area (FA-104) in the Middle River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Zoo-plankton	Percent Other Non-insects	EPT:Chiro Ratio	Percent Top 3 Taxa
Spr	RP-104-1	TM	Drift	1.09	0.68	8.06	57.37	7.24	2.94	4.08	18.53	0.14	41.00
Spr	RP-104-2	SS	Drift	1.64	61.20	0.00	18.28	14.78	4.10	0	0.00	0.77	82.97
Spr	RP-104-3	MC	Drift	5.93	0.00	0.00	52.46	28.91	8.62	1.02	3.06	0.10	47.61
Spr	RP-104-4	US	Plankton Net	0.00	0.00	1.72	3.33	2.52	0.00	72.78	19.65	0.20	48.25
Spr	RP-104-5	SC	Drift	3.46	2.20	0.00	57.41	23.35	4.17	2.50	6.92	0.09	55.11
Sum	RP-104-1	TM	Drift	0.30	0.00	3.99	82.96	0.00	0.00	0	12.75	0.05	56.43
Sum	RP-104-2	SS	Plankton Net	0.27	0.00	0.88	71.49	0.27	0.00	21.76	5.33	0.02	87.39
Sum	RP-104-3	MC	Drift	4.00	16.00	4.00	36.00	16.00	4.00	0	20.00	0.40	41.71
Sum	RP-104-4	US	Plankton Net	0.00	0.00	0.39	12.76	1.18	0.00	57.99	27.67	0.04	61.85
Sum	RP-104-5	SC	Drift	19.88	16.43	17.35	26.45	6.41	5.17	0	8.30	0.67	47.25
Post Storm	RP-104-2	SS	Plankton Net	0.00	0.00	9.31	27.13	2.71	0.00	56.96	3.89	0.24	68.46
Sum	RP-104-1	TM	Drift	9.55	4.06	6.69	22.51	17.24	1.43	7.47	31.05	0.47	53.23
Fall	RP-104-2	SS	Plankton Net	0.00	0.00	21.30	56.80	0.00	0.00	7.10	14.79	0.06	55.00
Fall	RP-104-3	MC	Drift	0.00	4.42	1.47	5.88	19.50	0.89	29.03	38.81	0.50	67.98
Fall	RP-104-4	US	Plankton Net	0.00	0.00	0.00	21.43	0.13	0.58	42.88	34.97	0.00	58.37
Fall	RP-104-5	SC	Plankton Net	0.00	0.00	0.00	0.00	0.00	0.00	66.67	33.33	0.00	20.00

Table A3.2-9. Mean drift density and taxonomic richness values from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Drift Density (#/ft^3)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Chironomid Taxa Avg (Total)	Zooplankton Taxa Avg (Total)	Other Non-Insect (T)Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-81-1	US	Plankton Net	4.983	9.2 (24)	0	2.8 (8)	5 (11)	1 (3)	1.67	0.76
Spr	RP-81-2	TM	Drift	0.215	35 (46)	8.5 (11)	15.5 (20)	0	7 (10)	2.52	0.71
Spr	RP-81-3	MC	Drift	0.113	18 (30)	1.5 (2)	7 (12)	0	3.5 (5)	2.41	0.83
Spr	RP-81-4	SC	Drift	0.050	13.5 (20)	1.5 (2)	7.5 (10)	0	1 (2)	2.27	0.91
Spr	RP-81-5	SC, Above TM	Drift	0.097	21.5 (32)	3 (4)	9.5 (15)	0	4.5 (7)	2.74	0.90
Sum	RP-81-1	US	Plankton Net	7.960	5.6 (22)	0.4 (2)	2 (8)	1.8 (6)	1.2 (5)	1.11	0.89
Sum	RP-81-2	TM	Drift	-	-	-	-	-	-	-	-
Sum	RP-81-3	MC	Drift	0.020	28.5 (40)	7 (9)	12.5 (18)	0	4 (5)	3.15	0.94
Sum	RP-81-4	SC	Drift	0.071	23 (36)	5.5 (9)	7 (10)	0	5 (8)	2.95	0.95
Sum	RP-81-5	SC, Above TM	Drift	0.085	33 (51)	6.5 (8)	10.5 (18)	0	2.5 (4)	3.05	0.87
Sum	RP-81-1	US	Drift	0.204	20.5 (29)	1 (2)	4.5 (7)	0	9 (11)	1.36	0.45
Fall	RP-81-2	TM	Drift	0.074	44.5 (58)	6 (8)	19.5 (27)	0	11.5 (13)	3.14	0.83
Fall	RP-81-3	MC	Drift	0.034	29 (46)	5 (9)	9 (16)	0	9 (13)	2.85	0.86
Fall	RP-81-4	SC	Drift	0.030	22.5 (30)	8 (10)	2.5 (4)	0	5.5 (7)	1.94	0.62
Fall	RP-81-5	SC, Above TM	Drift	0.252	22 (34)	5 (8)	2 (4)	0	9 (13)	2.20	0.71

Table A3.2-10. Mean taxonomic composition metric values (n=5) from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites within the Montana Creek area (RP-81) in the Lower River Segment of the Susitna River for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Zoo-plankton	Percent Other Non-insects	EPT:Chiro Ratio	Percent Top 3 Taxa
Spr	RP-81-1	US	Plankton Net	0.00	0.00	0.00	13.83	0.39	0.60	77.19	7.99	0.00	73.90
Spr	RP-81-2	TM	Drift	14.39	0.63	2.81	61.15	13.57	0.15	0.43	6.86	0.23	57.12
Spr	RP-81-3	MC	Drift	2.44	1.22	0.00	32.86	41.54	6.10	1.22	14.63	0.11	52.73
Spr	RP-81-4	SC	Drift	11.04	1.35	0.00	48.79	29.36	4.05	0	5.41	0.20	49.01
Spr	RP-81-5	SC, Above TM	Drift	8.30	4.68	0.00	32.52	16.21	7.01	3.95	22.33	0.30	40.96
Sum	RP-81-1	US	Plankton Net	0.00	0.00	0.83	18.95	0.83	0.00	11.85	67.54	0.01	73.77
Sum	RP-81-2	TM	Drift							-	-		27.48
Sum	RP-81-3	MC	Drift	4.96	12.40	4.96	53.23	3.31	7.28	0	13.85	0.29	29.70
Sum	RP-81-4	SC	Drift	7.72	9.45	5.72	35.26	14.33	11.17	0	16.34	0.38	37.62
Sum	RP-81-5	SC, Above TM	Drift	19.55	9.41	12.22	31.98	6.13	13.88	0	6.83	0.56	88.29
Sum	RP-81-1	US	Drift	0.00	0.19	0.15	3.25	1.90	1.80	24.5	68.22	0.11	38.13
Fall	RP-81-2	TM	Drift	2.33	4.91	3.62	28.65	4.98	3.82	16.87	34.81	0.27	42.58
Fall	RP-81-3	MC	Drift	1.59	3.93	1.59	19.17	5.04	8.60	24.65	35.44	0.32	70.90
Fall	RP-81-4	SC	Drift	1.59	22.71	50.02	3.43	3.61	8.57	0.88	9.19	0.96	61.91
Fall	RP-81-5	SC, Above TM	Drift	1.28	3.86	16.72	4.51	3.03	4.10	47.33	19.16	0.85	73.90

Table A3.3-1. Mean density and taxonomic richness values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites on the Talkeetna River (RP-TKA) for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-TKA-1	SC	Hess	548.8	12 (23)	5 (9)	3.4 (6)	1.4 (2)	0.2 (1)	5.4 (11)	1.90	0.77
Spr	RP-TKA-2	US	Petite Ponar	6699.5	13.2 (28)	0.2 (1)	0 (0)	0 (0)	0.2 (1)	9 (19)	1.44	0.59
Spr	RP-TKA-3	SS	Hess	13040.1	28.4 (51)	10 (16)	6 (8)	3.2 (5)	0.8 (3)	14.4 (23)	2.19	0.65
Sum	RP-TKA-1	SC	Hess	820.9	12.6 (27)	5.2 (10)	1.8 (5)	3 (4)	0.4 (1)	5.8 (12)	1.73	0.69
Sum	RP-TKA-2	US	Petite Ponar	1145.3	8.6 (29)	0 (0)	0 (0)	0 (0)	0 (0)	6.8 (24)	1.49	0.84
Sum	RP-TKA-3	SS	Hess	5311.0	20.4 (39)	7.2 (12)	3.2 (4)	3.2 (6)	0.8 (2)	9.2 (16)	1.93	0.64
Fall	RP-TKA-1	SC	Hess	541.9	11 (23)	5.4 (9)	1.4 (3)	3.8 (5)	0.2 (1)	3.2 (8)	2.05	0.86
Fall	RP-TKA-2	US	Petite Ponar	5984.7	17.4 (38)	0 (0)	0 (0)	0 (0)	0 (0)	13 (29)	1.89	0.67
Fall	RP-TKA-3	SS	Hess	4719.0	27.6 (49)	11.2 (17)	4.4 (6)	4.6 (6)	2.2 (5)	10.8 (22)	2.67	0.80

Table A3.3-2. Mean taxonomic composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites on the Talkeetna River (RP-TKA) for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Non-insect	EPT:Chiro Ratio	Percent Top Taxa	Percent Top 3 Taxa
Spr	RP-TKA-1	SC	Hess	16.90	19.65	0.42	56.65	4.15	0.00	2.24	0.40	39.38	68.28
Spr	RP-TKA-2	US	Petite Ponar	0.00	0.00	0.13	43.96	1.46	0.00	54.45	0.01	54.19	79.53
Spr	RP-TKA-3	SS	Hess	8.36	8.82	0.23	77.35	0.80	0.00	4.45	0.18	36.10	66.35
Sum	RP-TKA-1	SC	Hess	5.02	19.32	0.50	70.52	1.11	0.00	3.53	0.26	47.24	73.37
Sum	RP-TKA-2	US	Petite Ponar	0.00	0.00	0.00	69.30	0.00	0.00	30.70	0.00	45.08	79.78
Sum	RP-TKA-3	SS	Hess	4.34	20.28	0.43	61.56	1.49	0.00	11.90	0.29	33.48	71.27
Fall	RP-TKA-1	SC	Hess	8.41	36.14	0.59	41.26	12.79	0.00	0.81	0.53	27.65	60.12
Fall	RP-TKA-2	US	Petite Ponar	0.00	0.00	0.00	65.02	5.12	0.00	29.86	0.00	40.82	71.77
Fall	RP-TKA-3	SS	Hess	12.28	43.92	5.26	28.72	2.79	0.00	7.02	0.68	21.55	44.71

Table A3.3-3. Mean functional feeding group composition metric values (n=5) from Hess and petite Ponar grab samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites on the Talkeetna River (RP-TKA) for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Percent Collector Gatherers	Percent Collector Filterers	Percent Scrapers	Percent Shredders	Percent Predators	Percent Parasites	Percent Other FFGs
Spr	RP-TKA-1	SC	Hess	64.43	3.65	9.22	1.92	20.78	0.00	0.00
Spr	RP-TKA-2	US	Petite Ponar	82.83	5.64	0.00	2.86	2.07	5.13	1.47
Spr	RP-TKA-3	SS	Hess	83.93	0.69	3.90	2.02	9.19	0.22	0.05
Sum	RP-TKA-1	SC	Hess	74.46	0.44	4.17	16.59	4.34	0.00	0.00
Sum	RP-TKA-2	US	Petite Ponar	80.75	8.21	0.00	8.33	2.38	0.33	0.00
Sum	RP-TKA-3	SS	Hess	74.80	0.05	2.82	16.72	5.61	0.00	0.00
Fall	RP-TKA-1	SC	Hess	43.85	10.41	5.00	21.25	19.48	0.00	0.00
Fall	RP-TKA-2	US	Petite Ponar	72.68	18.21	0.08	1.08	6.96	0.57	0.41
Fall	RP-TKA-3	SS	Hess	40.06	0.78	4.98	35.82	18.36	0.00	0.00

Table A3.3-4. Mean drift density and taxonomic richness values from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites on the Talkeetna River (RP-TKA) for the River Productivity Study.

Event	Site	Macro-habitat Type	Sampling Device	Drift Density (#/ft^3)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Chironomid Taxa Avg (Total)	Zooplankton Taxa Avg (Total)	Other Non-Insect (T)Taxa Avg (Total)	Diversity (H')	Evenness (J')
Spr	RP-TKA-1	SC	Drift	0.121	21 (27)	5 (5)	8.5 (11)	0	2 (3)	2.70	0.89
Spr	RP-TKA-2	US	Plankton Net	0.960	5.4 (16)	0.2 (1)	3 (10)	1.2 (2)	1 (3)	1.35	0.74
Spr	RP-TKA-3	SS	Drift	0.130	31 (43)	6.5 (9)	15.5 (20)	0	4.5 (7)	2.43	0.71
Sum	RP-TKA-1	SC	Drift	0.072	22.5 (34)	5 (7)	12 (18)	0	2.5 (3)	2.55	0.82
Sum	RP-TKA-2	US	Plankton Net	1.499	4.2 (16)	0.6 (2)	2 (7)	1.2 (4)	0.4 (2)	1.30	0.85
Sum	RP-TKA-3	SS	Drift	0.071	40.5 (56)	8.5 (11)	17.5 (26)	0	7 (10)	2.87	0.78
Fall	RP-TKA-1	SC	Drift	0.114	27 (38)	6.5 (8)	6.5 (10)	0	5 (7)	2.52	0.77
Fall	RP-TKA-2	US	Plankton Net	1.870	5.4 (14)	0.4 (1)	1.8 (5)	1.6 (3)	1.4 (4)	1.51	0.92
Fall	RP-TKA-3	SS	Drift	0.041	18.5 (28)	7 (9)	4 (6)	0	4 (7)	2.27	0.78

Table A3.3-5. Mean taxonomic composition metric values (n=5) from drift net and plankton tow samples collected in 2013 during three index events (Spr= Spring, Sum=Summer, Fall) for sites on the Talkeetna River (RP-TKA) for the River Productivity Study

Event	Site	Macro-habitat Type	Sampling Device	Percent Mayflies	Percent Stoneflies	Percent Caddisflies	Percent Chiro-nomids	Percent Other Diptera	Percent Other insects	Percent Zoo-plankton	Percent Other Non-insects	EPT:Chiro Ratio	Percent Top 3 Taxa
Spr	RP-TKA-1	SC	Drift	6.96	12.03	0.00	49.16	19.19	5.06		7.59	0.28	38.92
Spr	RP-TKA-2	US	Plankton Net	1.49	0.00	0.00	42.44	0.00	0.00	29.10	26.96	0.05	75.40
Spr	RP-TKA-3	SS	Drift	12.67	7.29	0.00	68.74	5.79	1.16		4.34	0.23	58.45
Sum	RP-TKA-1	SC	Drift	4.14	5.95	12.01	59.07	2.00	3.05		13.78	0.27	53.10
Sum	RP-TKA-2	US	Plankton Net	0.00	1.66	3.99	67.11	0.00	0.00	22.96	4.27	0.04	69.06
Sum	RP-TKA-3	SS	Drift	2.77	10.01	12.69	53.03	3.92	3.83		13.75	0.33	44.38
Fall	RP-TKA-1	SC	Drift	1.67	8.08	20.35	34.56	18.64	6.82		9.87	0.47	58.85
Fall	RP-TKA-2	US	Plankton Net	0.00	0.00	4.67	45.39	1.17	0.00	35.38	13.40	0.20	73.36
Fall	RP-TKA-3	SS	Drift	6.75	18.06	29.22	27.59	8.61	1.89		7.87	0.68	59.58

Table A3.4-1. Mean δ^{13}C and δ^{15}N ± SD for all sample types collected at FA 81 during spring sampling.

Spring Focus Area 81		Upland Slough (RP-81-1)			Tributary Mouth (RP-81-2)			Main Channel (RP-81-3)			Side Channel (RP-81-4)		
Category	Sample Type	δ^{13}C	δ^{15}N	*n*	δ^{13}C	δ^{15}N	*n*	δ^{13}C	δ^{15}N	*n*	δ^{13}C	δ^{15}N	*n*
Endmembers	Benthic algae	-32.7 ± 0.7	-1.5 ± 1.4	3	-29.4 ± 1.8	1.6 ± 1.5	3	-	-	-	-24.9 ± 1.4	6.3 ± 4.6	2
	Organic matter - drift	-28.1 ± 0.8	1.3 ± 4.0	2	-27.8 ± 1.1	-1.8 ± 0.2	2	-	-	-	-27.3 ± 0.2	-2.4 ± 0.9	2
	Organic matter - benthic	-30.7 ± 0.0	-0.8 ± 1.5	2	-28.8 ± 0.0	-2.1 ± 0.4	3	-	-	-	-28.3 ± 0.5	-2.8 ± 0.5	3
	Salmon carcass	-	-	-	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-32.1 ± 3.4	4.8 ± 1.6	8	-31.6 ± 4.3	3.6 ± 1.1	9	-	-	-	-29.7 ± 3.7	1.7 ± 0.5	4
	Benthic - collectors	-33.3 ± 0.4	4.7 ± 1.6	3	-29.6 ± 0.5	2.9 ± 0.8	3	-	-	-	-	-	-
	Benthic - grazers	-29.354	2.669	1	-30.2 ± 2.2	4.7 ± 0.3	3	-	-	-	-28.077	1.262	1
	Benthic - predators	-32.0 ± 5.9	5.8 ± 1.6	3	-	-	-	-	-	-	-30.3 ± 4.3	1.9 ± 0.5	3
	Benthic - shredders	-31.966	4.06	1	-34.9 ± 6.8	3.1 ± 1.2	3	-	-	-	-	-	-
	Emergents	-31.0 ± 0.5	5.2 ± 0.1	3	-	-	-	-26.2 ± 0.1	2.2 ± 1.9	3	-25.5 ± 0.4	1.7 ± 0.2	2
	Terrestrial	-29.9 ± 1.1	5.0 ± 0.3	2	-	-	-	-	-	-	-	-	-
Fish	Rainbow trout - juveniles	-26.1 ± 0.0	8.0 ± 0.3	2	-25.5 ± 3.1	7.7 ± 0.3	5	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-26.8 ± 2.4	6.8 ± 0.7	6	-25.9 ± 0.6	8.0 ± 1.3	8	-	-	-	-	-	-
	Coho salmon - juveniles	-28.4 ± 2.4	7.8 ± 0.3	8	-27.4 ± 2.3	8.9 ± 1.7	8	-	-	-	-	-	-
	Totals			44			44			3			17

Table A3.4-2. Mean δ13C and δ15N ± SD for all sample types collected at FA 81 during summer sampling.

Summer Focus Area 81		Upland Slough (RP-81-1)			Tributary Mouth (RP-81-2)			Main Channel (RP-81-3)			Side Channel (RP-81-4)		
Category	Sample Type	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*
Endmembers	Benthic algae	-31.0 ± 0.7	-3.3 ± 4.5	3	-29.7 ± 1.7	6.5 ± 2.9	3	-23.0 ± 0.8	3.3 ± 4.5	3	-25.4 ± 0.4	4.0 ± 1.0	3
	Organic matter - drift	-30.4 ± 0.1	0.5 ± 0.3	2	-28.8 ± 0.4	0.7 ± 1.7	2	-27.7 ± 0.4	-4.3 ± 0.2	2	-28.0 ± 0.6	-3.4 ± 1.4	2
	Organic matter - benthic	-28.5 ± 1.2	-3.3 ± 1.0	3	-28.9 ± 0.1	-1.6 ± 1.2	3	-20.5 ± 17.	-4.1 ± 5.6	3	-27.7 ± 0.3	-4.6 ± 0.3	3
	Salmon carcass	-20.481	10.446	1	-19.9 ± 0.3	10.0 ± 0.6	4	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-33.2 ± 2.0	4.1 ± 1.2	9	-30.6 ± 1.8	4.9 ± 1.4	9	-26.0 ± 1.0	1.7 ± 3.1	8	-25.7 ± 0.4	1.0 ± 2.8	7
	Benthic - collectors	-34.9 ± 2.3	4.8 ± 0.7	3	-30.8 ± 3.0	4.2 ± 2.2	3	-26.9 ± 1.7	1.7 ± 0.2	2	-25.778	2.365	1
	Benthic - grazers	-	-	-	-30.6 ± 1.5	5.0 ± 1.3	2	-26.4 ± 0.5	-2. ± 2.6	2	-25.7 ± 0.5	-1.7 ± 1.8	3
	Benthic - predators	-32.3 ± 2.1	3.7 ± 0.3	3	-30.1 ± 1.4	5.8 ± 0.6	3	-25.5 ± 0.4	4.5 ± 1.0	3	-25.8 ± 0.4	3.3 ± 0.5	3
	Benthic - shredders	-32.4 ± 0.7	3.7 ± 2.1	3	-31.644	4.31	1	-25.013	1.608	1	-	-	-
	Emergents	-32.6 ± 1.1	5.2 ± 0.5	6	-29.0 ± 1.1	3.6 ± 1.1	3	-24.5 ± 0.2	2.6 ± 0.4	3	-25.5 ± 0.3	1.7 ± 0.7	4
	Terrestrial	-24.9 ± 0.5	3.2 ± 0.7	2	-25.5 ± 1.9	4.5 ± 1.7	3	-25.9 ± 2.8	0.9 ± 0.2	2	-26.1 ± 0.4	1.1 ± 1.0	2
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-	-	-	-24.089	8.214	1	-	-	-	-	-	-
	Coho salmon - juveniles	-	-	-	-27.8 ± 2.6	9.1 ± 1.3	4	-	-	-	-	-	-
	Totals			3 5			4 1			2 6			2 8

Table A3.4-3. Mean $\delta^{13}C$ and $\delta^{15}N$ ± SD for all sample types collected at FA 81 during fall sampling.

Fall Focus Area 81		Upland Slough (RP-81-1)			Tributary Mouth (RP-81-2)			Main Channel (RP-81-3)			Side Channel (RP-81-4)		
Category	Sample Type	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*
Endmembers	Benthic algae	-30.6 ± 0.9	1.3 ± 1.2	3	-31.0 ± 1.9	3.7 ± 0.3	3	-25.3 ± 0.1	7.0 ± 1.1	3	-26.5 ± 0.7	4.2 ± 3.1	3
	Organic matter - drift	-28.9 ± 0.0	-4. ± 2.4	2	-28.5 ± 0.6	-4. ± 3.2	2	-27.9 ± 0.2	-3. ± 0.5	2	-28.8 ± 0.2	-3. ± 0.3	2
	Organic matter - benthic	-30.0 ± 0.2	-6. ± 2.5	3	-28.6 ± 1.4	-1. ± 0.6	3	-28.1 ± 0.7	-4. ± 0.9	3	-27.1 ± 1.0	-3. ± 1.6	3
	Salmon carcass	-	-	-	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-30.8 ± 6.2	2.9 ± 2.9	8	-28.3 ± 1.6	4.6 ± 1.4	11	-27.7 ± 1.5	0.3 ± 2.1	8	-27.1 ± 0.9	0.8 ± 2.4	12
	Benthic - collectors	-30.8 ± 8.1	1.7 ± 3.6	4	-28.6 ± 0.6	4.9 ± 0.5	3	-29.1 ± 1.0	0.0 ± 1.3	3	-27.0 ± 0.3	0.9 ± 2.0	3
	Benthic - grazers	-32.7 ± 7.4	4.7 ± 2.2	2	-27.1 ± 1.8	5.0 ± 2.1	3	-26.7	2.3	1	-26.3 ± 0.3	-1. ± 2.9	3
	Benthic - predators	-29.8	4.5	1	-30.3 ± 2.6	4.0 ± 0.0	2	-26.7 ± 2.2	0.8 ± 4.3	2	-27.3 ± 0.7	2.4 ± 1.2	3
	Benthic - shredders	-28.5	3.1	1	-27.8 ± 0.4	4.4 ± 2.1	3	-27.2 ± 0.5	-0. ± 1.3	2	-27.5 ± 1.7	1.9 ± 1.5	3
	Emergents	-	-	-	-	-	-	-	-	-	-	-	-
	Terrestrial	-31.7 ± 6.0	1.2 ± 2.9	4	-	-	-	-25.5 ± 0.9	1.7 ± 1.1	3	-26.2 ± 0.9	-1.0 ± 1.4	2
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-26.1	8.4	1	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-26.1 ± 1.6	8.4 ± 1.8	4	-26.7 ± 1.9	9.0 ± 0.3	2	-	-	-	-	-	-
	Totals			33			32			27			34

Table A3.4-4. Mean $\delta^{13}C$ and $\delta^{15}N$ ± SD for all sample types collected at FA 104 during spring sampling.

Spring Focus Area 104		Tributary Mouth (RP-104-1)			Side Slough (RP-104-2)			Main Channel (RP-104-3)			Upland Slough (RP-104-4)			Side Channel (RP-104-5)		
Category	Sample Type	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*
Endmembers	Benthic algae	-33.0 ± 0.5	2.9 ± 0.2	3	-28.8 ± 2.5	2.2 ± 0.4	3	-24.8 ± 0.9	4.1 ± 1.2	3	-28.3 ± 0.6	2.1 ± 0.8	3	-23.9 ± 0.2	3.2 ± 0.1	3
	Organic matter - drift	-27.3 ± 0.8	-0.1 ± 0.3	2	-27.6 ± 0.3	-0.2 ± 0.4	2	-27.2 ± 0.1	-1.2 ± 0.1	2	-28.8 ± 2.2	0.3 ± 0.7	2	-27.0 ± 0.1	-0.3 ± 0.4	2
	Organic matter - benthic	-27.8 ± 0.5	0.6 ± 1.2	3	-29.6 ± 2.6	0.4 ± 1.3	3	-27.7 ± 0.5	-1.1 ± 0.5	3	-28.5 ± 0.4	-1.0 ± 1.1	3	-28.0 ± 0.2	-0.7 ± 0.3	3
	Salmon carcass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-32.7 ± 2.4	5.0 ± 1.2	12	-32.8 ± 2.1	5.2 ± 1.8	9	-30.0	2.6	1	-35.6 ± 3.2	3.9 ± 1.1	5	-31.0 ± 1.7	4.1 ± 1.6	5
	Benthic - collectors	-31.9 ± 2.6	4.5 ± 0.4	3	-33.6 ± 1.1	3.9 ± 0.5	3	-30.0	2.6	1	-37.7 ± 1.7	3.3 ± 1.0	3	-29.7	3.1	1
	Benthic - grazers	-31.5 ± 0.1	4.5 ± 0.2	3	-31.3 ± 1.6	4.5 ± 0.6	2	-	-	-	-	-	-	-	-	-
	Benthic - predators	-32.3 ± 1.6	6.3 ± 0.1	3	-34.4 ± 0.6	5.6 ± 0.9	3	-	-	-	-32.3 ± 0.4	4.7 ± 1.1	2	-31.9 ± 1.6	5.2 ± 1.1	3
	Benthic - shredders	-35.0 ± 3.4	5.0 ± 2.1	3	-28.6	9.6	1	-	-	-	-	-	-	-29.6	2.2	1
	Emergents	-31.8 ± 1.4	3.5 ± 0.4	3	-31.9 ± 1.6	2.0 ± 0.3	3	-	-	-	-34.3 ± 1.1	2.9 ± 1.0	3	-	-	-
	Terrestrial	-27.6	3.9	1	-30.0 ± 4.9	4.5 ± 1.2	2	-	-	-	-27.6 ± 1.7	4.5 ± 3.3	3	-28.3 ± 2.6	3.0 ± 2.4	3
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-24.0	12.0	1	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-27.4 ± 1.2	8.3 ± 0.3	8	-	-	-	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Totals			45			31			10			24			21

Table A3.4-5. Mean $\delta^{13}C$ and $\delta^{15}N$ ± SD for all sample types collected at FA 104 during summer sampling.

Summer Focus Area 104		Tributary Mouth (RP-104-1)			Side Slough (RP-104-2)			Main Channel (RP-104-3)			Upland Slough (RP-104-4)			Side Channel (RP-104-5)		
Category	Sample Type	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*
Endmembers	Benthic algae	-30.9 ± 0.0	1.8 ± 0.1	3	-38.0 ± 2.7	0.6 ± 0.9	3	-22.4 ± 1.1	2.6 ± 2.8	3	-24.6 ± 6.1	-2.6 ± 2.0	3	-23.5 ± 3.6	1.4 ± 1.7	3
	Organic matter - drift	-27.8 ± 0.4	-0.5 ± 0.0	2	-29.5 ± 0.4	-0.6 ± 0.6	2	-27.4 ± 0.1	-2.6 ± 0.1	2	-28.7 ± 0.3	-0.2 ± 0.8	2	-27.1 ± 0.0	-4.0 ± 0.1	2
	Organic matter - benthic	-28.0 ± 0.3	-1.6 ± 0.8	3	-33.2 ± 4.6	-2.6 ± 0.8	3	-26.5 ± 0.5	-4.0 ± 0.2	3	-25.3 ± 3.8	-2.9 ± 1.4	3	-26.2 ± 0.9	-4.4 ± 0.7	3
	Salmon carcass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-33.0 ± 1.1	4.6 ± 1.1	6	-38.9 ± 1.7	1.9 ± 2.1	9	-27.7 ± 1.8	3.1 ± 1.5	7	-34.0 ± 1.8	2.7 ± 1.2	10	-26.2 ± 0.7	3.5 ± 0.9	9
	Benthic - collectors	-32.9 ± 1.5	4.3 ± 0.5	3	-38.5 ± 2.6	0.9 ± 1.7	3	-26.5 ± 1.2	2.1 ± 1.2	3	-34.0 ± 1.5	2.8 ± 0.2	3	-25.9 ± 1.1	3.4 ± 1.3	3
	Benthic - grazers	-	-	-	-38.7 ± 2.1	1.2 ± 0.3	2	-27.5	5.0	1	-	-	-	-26.3 ± 0.3	3.8 ± 1.1	3
	Benthic - predators	-33.4 ± 1.1	5.8 ± 0.3	2	-39.5 ± 1.5	3.8 ± 2.5	3	-29.0 ± 1.9	3.6 ± 1.2	3	-34.4 ± 2.9	3.1 ± 1.8	4	-26.4 ± 0.7	3.4 ± 0.6	3
	Benthic - shredders	-32.9	3.0	1	-38.6	0.4	1	-	-	-	-33.4 ± 0.4	2.1 ± 0.8	3	-	-	-
	Emergents	-33.1 ± 1.1	4.8 ± 0.7	2	-31.0 ± 2.3	5.4 ± 1.4	3	-26.0 ± 0.6	3.4 ± 0.9	3	-35.1 ± 0.5	2.6 ± 0.4	3	-	-	-
	Terrestrial	-	-	1	-27.0 ± 1.3	2.5 ± 1.2	3	-26.0 ± 0.7	1.3 ± 2.8	3	-27.8 ± 2.8	2.8 ± 1.9	3	-25.4 ± 1.0	3.3 ± 1.9	2
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-22.9 ± 2.2	11.2 ± 0.6	9	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-27.1 ± 0.9	9.2 ± 0.5	7	-27.4 ± 3.8	8.8 ± 0.7	8	-	-	-	-28.7 ± 2.0	7.3 ± 1.3	8	-26.6 ± 3.4	9.0 ± 1.0	8
	Coho salmon - juveniles	-27.1 ± 1.5	8.6 ± 1.0	8	-27.7 ± 1.3	8.8 ± 0.5	8	-	-	-	-28.2 ± 2.2	7.4 ± 1.0	7	-25.9 ± 2.0	8.1 ± 0.9	7
	Totals			38			57			28			49			43

Table A3.4-6. Mean δ13C and δ15N ± SD for all sample types collected at FA 104 during fall sampling.

Fall Focus Area 104		Tributary Mouth (RP-104-1)			Side Slough (RP-104-2)			Main Channel (RP-104-3)			Upland Slough (RP-104-4)			Side Channel (RP-104-5)		
Category	Sample Type	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*
Endmembers	Benthic algae	-31.1 ± 1.2	6.4 ± 3.0	3	-31.9 ± 0.6	3.4 ± 3.8	3	-30.6 ± 1.0	3.8 ± 0.2	3	-29.7 ± 1.5	-0. ± 0.4	3	-27.5 ± 4.1	0.1 ± 2.0	3
	Organic matter - drift	-27.5 ± 0.3	0.2 ± 0.6	2	-26.1 ± 0.8	-0. ± 1.6	2	-26.9 ± 0.4	-1. ± 0.9	2	-27.4 ± 0.2	-0. ± 1.6	2	-28.6 ± 1.7	-0.4 ± 0.6	2
	Organic matter - benthic	-28.5 ± 1.1	-1. ± 0.7	3	-30.7 ± 4.4	-0. ± 0.8	3	-27.3 ± 0.9	-1. ± 0.9	3	-26.4 ± 0.5	-2. ± 0.2	3	-29.9 ± 0.8	-1.2 ± 0.8	3
	Salmon carcass	-19.2	11.9	1	-	-	-	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-32.0 ± 2.3	4.8 ± 1.1	11	-35.2 ± 3.2	2.8 ± 0.9	10	-27.3 ± 1.3	1.6 ± 1.6	8	-31.8 ± 4.8	1.4 ± 2.1	8	-26.0 ± 2.8	1.2 ± 3.3	11
	Benthic - collectors	-31.8 ± 2.0	4.8 ± 0.9	3	-36.7 ± 2.3	2.8 ± 1.3	3	-27.9 ± 0.3	1.9 ± 0.4	2	-35.0 ± 3.5	2.9 ± 1.0	3	-26.2 ± 2.6	3.6 ± 4.5	3
	Benthic - grazers	-34.2 ± 3.1	5.1 ± 0.6	2	-38.2	3.4	1	-27.9 ± 1.6	2.9 ± 0.7	2	-	-	-	-27.3 ± 0.1	3.4 ± 0.2	2
	Benthic - predators	-32.1 ± 0.9	6.0 ± 0.1	3	-34.2 ± 2.0	3.2 ± 0.8	3	-27.1 ± 1.8	1.0 ± 2.2	3	-28.1 ± 5.8	0.3 ± 3.2	3	-24.4 ± 5.1	-1.6 ± 2.9	3
	Benthic - shredders	-30.6 ± 3.2	3.4 ± 0.9	3	-33.6 ± 4.8	2.3 ± 1.0	3	-25.9	0	1	-32.6 ± 0.3	1.0 ± 0.2	2	-26.5 ± 0.9	0.3 ± 0.7	3
	Emergents	-31.3	3.4	1	-30.3	3.7	1	-30.1	1.5	1	-34.8 ± 4.5	3.3 ± 0.6	3	-	-	-
	Terrestrial	-26.2	2.3	1	-32.6 ± 4.3	2.4 ± 1.3	2	-28.1 ± 2.6	3.0 ± 0.8	2	-28.6	7.7	1	-25.2 ± 1.1	1.5 ± 2.8	3
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-22.0 ± 4.0	11.5 ± 1.4	7	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-25.3 ± 2.1	10. ± 1.3	7	-22.3	10.0	1	-	-	-	-24.3	9.8	1	-27.1 ± 4.7	8.8 ± 1.8	3
	Coho salmon - juveniles	-24.9 ± 2.6	8.9 ± 1.8	7	-26.4 ± 2.8	9.6 ± 1.2	8	-	-	-	-28.7 ± 1.9	7.9 ± 0.6	5	-23.4 ± 2.0	9.9 ± 2.0	9
	Totals			54			40			27			34			45

Table A3.4-7. Mean $\delta^{13}C$ and $\delta^{15}N$ ± SD for all sample types collected at FA 141 during spring sampling.

Spring Focus Area 141		Tributary Mouth (RP-141-1)			Side Channel (RP-141-2)			Main Channel (RP-141-3)			Upland Slough (RP-141-4)		
Category	Sample Type	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*
Endmembers	Benthic algae	-26.6 ± 2.9	4.5 ± 1.0	3	-27.2 ± 0.2	1.1 ± 1.7	3	-30.3	2.9	3	-36.8 ± 1.0	-0.7 ± 0.7	3
	Organic matter - drift	-27.3 ± 0.4	-0.3 ± 0.2	2	-26.9	0.5	2	-27.0 ± 0.0	-0.7 ± 1.6	2	-28.0 ± 0.0	-0.7 ± 0.0	2
	Organic matter - benthic	-27.3 ± 1.1	-1.0 ± 0.4	3	-27.4 ± 0.2	-1.0 ± 0.4	3	-27.2 ± 0.1	-0.1 ± 0.2	3	-29.5 ± 2.3	-0.3 ± 0.5	3
	Salmon carcass	-	-	-	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-29.3 ± 2.8	2.9 ± 1.8	12	-29.7 ± 3.2	2.9 ± 2.0	11	-32.2 ± 4.0	2.7 ± 1.9	9	-29.6 ± 3.1	2.9 ± 2.4	10
	Benthic - collectors	-31.6 ± 0.8	2.5 ± 0.5	3	-31.5 ± 3.6	3.1 ± 1.4	3	-32.5 ± 5.6	0.9 ± 2.1	3	-29.5 ± 3.7	3.7 ± 0.9	3
	Benthic - grazers	-30.0 ± 2.7	3.0 ± 0.1	3	-30.9 ± 4.6	3.6 ± 1.7	2	-31.4 ± 1.9	3.1 ± 1.3	3	-28.3	0.9	1
	Benthic - predators	-26.7 ± 0.2	4.5 ± 2.7	3	-30.5 ± 1.8	4.7 ± 0.8	3	-29.7 ± 0.3	4.3 ± 0.4	2	-32.5 ± 2.3	5.6 ± 1.1	3
	Benthic - shredders	-28.9 ± 3.9	1.8 ± 2.3	3	-26.5 ± 0.9	0.4 ± 1.5	3	-39.0	3.7	1	-27.3 ± 1.6	0.3 ± 1.0	3
	Emergents	-26.9 ± 1.1	3.8 ± 2.0	3	-24.5 ± 1.0	2.8 ± 0.5	3	-	-	-	-27.1 ± 0.0	5.0 ± 0.3	3
	Terrestrial	-26.1 ± 1.8	1.9 ± 1.8	2	-25.1	4.0	1	-25.4	3.6	1	-26.1 ± 1.3	2.2 ± 1.8	2
Fish	Rainbow trout - juveniles	-24.3	8.7	1	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-25.3 ± 0.9	9.4 ± 0.6	8	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-27.2 ± 1.8	7.8 ± 0.9	8	-	-	-	-	-	-	-	-	-
	Totals			54			34			27			33

Table A3.4-8. Mean $\delta^{13}C$ and $\delta^{15}N$ ± SD for all sample types collected at FA 141 during summer sampling.

Summer Focus Area 141		Tributary Mouth (RP-141-1)			Side Channel (RP-141-2)			Main Channel (RP-141-3)			Upland Slough (RP-141-4)		
Category	Sample Type	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*
Endmembers	Benthic algae	-27.6 ± 1.0	4.7 ± 0.0	2	-25.6	-0.8	3	-	-	-	-34.7 ± 1.0	0.2 ± 0.4	3
	Organic matter - drift	-29.1 ± 0.0	0.8 ± 0.6	2	-26.8 ± 0.1	-0.6 ± 0.3	2	-27.0 ± 0.0	-2.0 ± 0.1	2	-28.4 ± 0.3	1.4 ± 0.2	2
	Organic matter - benthic	-27.8 ± 0.5	-0.0 ± 0.5	3	-26.9 ± 0.1	-0.6 ± 1.2	3	-26.7 ± 0.4	0.9 ± 6.3	3	-29.0 ± 0.1	-1.1 ± 0.7	3
	Salmon carcass	-19.5 ± 0.5	10. ± 0.6	7	-	-	-	-	-	-	-	-	-
	Salmon eggs	-23.4 ± 0.8	11.3 ± 0.0	2	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-28.0 ± 1.5	4.3 ± 1.1	12	-27.2 ± 1.2	3.2 ± 0.5	7	-26.6 ± 0.9	1.9 ± 1.0	5	-31.9 ± 4.4	2.9 ± 1.7	7
	Benthic - collectors	-26.7 ± 1.7	4.6 ± 0.9	3	-27.6 ± 2.0	3.0 ± 0.8	3	-26.8 ± 0.8	1.4 ± 1.1	3	-35.1 ± 3.4	2.6 ± 1.3	3
	Benthic - grazers	-29.4 ± 1.0	5.0 ± 0.3	3	-26.9 ± 0.5	3.3 ± 0.1	3	-26.4 ± 1.3	2.6 ± 0.5	2	-	-	-
	Benthic - predators	-28.2 ± 0.4	4.7 ± 0.8	3	-27.1	3.4	1	-	-	-	-26.2 ± 0.0	4.8 ± 1.7	2
	Benthic - shredders	-27.6 ± 1.9	2.8 ± 0.8	3	-	-	-	-	-	-	-32.9 ± 0.1	1.5 ± 0.7	2
	Emergents	-	-	-	-24.0 ± 0.1	2.3 ± 0.4	3	-	-	-	-	-	-
	Terrestrial	-28.0	5.2	1	-25.6 ± 1.2	2.6 ± 0.9	2	-28.0	3.3	1	-26.2	7.8	1
Fish	Rainbow trout - juveniles	-20.1 ± 1.0	10.8 ± 0.8	8	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-23.4 ± 1.1	9.0 ± 1.3	6	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-22.7 ± 1.8	9.3 ± 1.8	7	-	-	-	-	-	-	-	-	-
	Totals			62			27			16			23

Table A3.4-9. Mean δ13C and δ15N ± SD for all sample types collected at FA 141 during fall sampling.

Fall Focus Area 141		Tributary Mouth (RP-141-1)			Side Channel (RP-141-2)			Main Channel (RP-141-3)			Upland Slough (RP-141-4)		
Category	Sample Type	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*
Endmembers	Benthic algae	-30.5 ± 1.0	1.5 ± 1.9	3	-24.1 ± 2.5	-0.7 ± 0.8	3	-25.8 ± 0.8	3.1 ± 5.9	3	-27.1 ± 4.5	0.7 ± 1.1	3
	Organic matter - drift	-28.2 ± 0.4	0.6 ± 0.1	2	-27.9 ± 0.1	-1.0 ± 0.3	2	-27.0 ± 0.0	0.4 ± 1.0	2	-27.1 ± 0.4	0.6 ± 1.0	2
	Organic matter - benthic	-27.8 ± 0.3	2.6 ± 0.6	3	-27.1 ± 0.4	0.8 ± 0.7	3	-27.5 ± 1.0	-1.0 ± 0.6	3	-29.1 ± 1.3	-0.3 ± 0.5	3
	Salmon carcass	-19.4 ± 0.0	11.2 ± 0.5	3	-	-	-	-	-	-	-19.5 ± 1.4	11.6 ± 0.6	5
	Salmon eggs	-	-	-	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-27.3 ± 1.3	4.1 ± 1.1	12	-28.4 ± 2.0	2.6 ± 1.3	11	-25.7 ± 3.3	1.4 ± 1.5	5	-29.8 ± 2.7	3.1 ± 1.9	6
	Benthic - collectors	-27.2 ± 0.7	3.4 ± 0.9	3	-29.6 ± 3.6	2.4 ± 0.5	3	-23.8 ± 5.4	1.4 ± 1.3	2	-30.0 ± 3.9	4.7 ± 1.2	3
	Benthic - grazers	-28.6 ± 2.0	4.5 ± 0.7	3	-27.5 ± 0.8	1.8 ± 1.0	2	-26.4 ± 0.5	1.2 ± 2.8	2	-	-	-
	Benthic - predators	-27.0 ± 1.1	5.5 ± 0.3	3	-28.5 ± 1.7	4.2 ± 0.8	3	-	-	-	-	-	-
	Benthic - shredders	-26.4 ± 0.2	3.0 ± 0.7	3	-27.9 ± 0.6	1.7 ± 1.0	3	-28.321	1.877	1	-29.6 ± 1.7	1.5 ± 0.7	3
	Emergents	-	-	-	-	-	-	-	-	-	-	-	-
	Terrestrial	-25.6 ± 1.6	1.7 ± 2.0	2	-25.7 ± 0.2	3.2 ± 1.2	2	-27.8 ± 0.6	0.1 ± 1.2	2	-24.9 ± 0.6	3.0 ± 2.3	3
Fish	Rainbow trout - juveniles	-25.0 ± 0.5	8.6 ± 0.0	2	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-23.5 ± 1.9	9.7 ± 1.1	6	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-23.2 ± 1.3	9.0 ± 1.5	8	-	-	-	-	-	-	-	-	-
	Totals			53			32			20			28

Table A3.4-10. Mean δ13C and δ15N ± SD for all sample types collected at FA 184 during spring sampling.

Spring Focus Area 184		Tributary Mouth (RP-184-1)			Main Channel (RP-184-2)			Side Channel (RP-184-3)		
Category	Sample Type	δ13C	δ15N	*n*	δ13C	δ15N	*n*	δ13C	δ15N	*n*
Endmembers	Benthic algae	-28.7 ± 0.8	1.0 ± 0.5	3	-18.8 ± 4.2	3.9 ± 0.2	3	-16.5 ± 3.0	4.2 ± 0.1	3
	Organic matter - drift	-27.4 ± 0.4	-3.9 ± 0.2	2	-26.5 ± 0.1	-2.0 ± 0.2	2	-26.4 ± 0.3	-2.7 ± 0.8	2
	Organic matter - benthic	-28.2 ± 0.4	-3.3 ± 0.6	3	-26.5 ± 0.5	-3.4 ± 0.5	3	-26.5 ± 0.6	-4.7 ± 0.4	3
	Salmon carcass	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-25.7 ± 1.5	0.8 ± 1.1	9	-27.8 ± 2.8	3.6 ± 2.1	6	-28.8 ± 2.4	2.9 ± 0.9	7
	Benthic - collectors	-23.8 ± 0.4	-0.2 ± 0.3	3	-27.9 ± 0.4	1.7 ± 0.8	3	-28.0 ± 0.8	1.8 ± 0.4	2
	Benthic - grazers	-27.2 ± 0.8	0.8 ± 0.7	3	-	-	-	-29.4 ± 4.1	2.9 ± 0.4	3
	Benthic - predators	-26.1 ± 0.4	1.9 ± 1.1	3	-27.7 ± 4.5	5.5 ± 0.3	3	-28.6 ± 0.2	4.1 ± 0.0	2
	Benthic - shredders	-	-	-	-	-	-	-	-	-
	Emergents	-26.6 ± 0.8	1.3 ± 0.5	3	-	-	-	-22.8 ± 0.6	1.7 ± 0.2	3
	Terrestrial	-25.5 ± 0.5	1.8 ± 3.3	2	-24.8 ± 0.9	-2.6 ± 0.9	2	-25.7 ± 0.9	2.5 ± 2.0	2
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-	-	-	-	-	-	-	-	-
	Totals			31			22			27

Table A3.4-11. Mean δ^{13}C and δ^{15}N ± SD for all sample types collected at FA 184 during summer sampling.

Summer Focus Area 184		Tributary Mouth (RP-184-1)			Main Channel (RP-184-2)			Side Channel (RP-184-3)		
Category	Sample Type	δ^{13}C	δ^{15}N	*n*	δ^{13}C	δ^{15}N	*n*	δ^{13}C	δ^{15}N	*n*
Endmembers	Benthic algae	-21.8 ± 2.2	1.9 ± 1.0	3	-	-	-	-25.2 ± 1.7	2.8 ± 0.3	3
	Organic matter - drift	-28.2 ± 0.1	-4.2 ± 1.2	2	-27.1 ± 0.1	-3.9 ± 0.5	2	-26.7 ± 0.3	-4.7 ± 1.1	2
	Organic matter - benthic	-27.9 ± 0.5	-4.9 ± 0.4	3	-27.5 ± 0.6	-4.5 ± 0.2	3	-27.1 ± 0.1	-7.2 ± 1.1	3
	Salmon carcass	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-26.9 ± 1.9	0.5 ± 2.2	10	-25.3 ± 1.3	5.0 ± 2.8	3	-27.9 ± 0.1	2.1 ± 0.8	3
	Benthic - collectors	-27.1 ± 2.0	1.2 ± 0.2	3	-24.6 ± 0.8	5.4 ± 3.8	2	-27.9 ± 0.1	2.1 ± 0.8	3
	Benthic - grazers	-27.5 ± 2.8	-1.0 ± 1.8	3	-	-	-	-	-	-
	Benthic - predators	-26.3 ± 1.7	2.7 ± 0.3	3	-26.7	4.2	1	-	-	-
	Benthic - shredders	-26.4	-3.4	1	-	-	-	-	-	-
	Emergents	-	-	-	-	-	-	-25.9 ± 0.3	0.9 ± 0.4	3
	Terrestrial	-25.4 ± 0.8	3.0 ± 5.2	3	-	-	-	-26.0	1.6	1
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-	-	-	-	-	-	-	-	-
	Totals			31			11			18

Table A3.4-12. Mean $\delta^{13}C$ and $\delta^{15}N$ ± SD for all sample types collected at FA 184 during fall sampling.

Fall Focus Area 184		Tributary Mouth (RP-184-1)			Main Channel (RP-184-2)			Side Channel (RP-184-3)		
Category	Sample Type	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*	$\delta^{13}C$	$\delta^{15}N$	*n*
Endmembers	Benthic algae	-26.5 ± 1.9	1.2 ± 0.6	3	-24.1 ± 1.1	3.5 ± 0.8	3	-24.2 ± 1.5	0.7 ± 0.4	3
	Organic matter - drift	-28.9 ± 0.3	-7.8 ± 0.7	2	-27.2 ± 0.1	-7.3 ± 0.5	2	-27.6 ± 0.6	-2.8 ± 1.6	2
	Organic matter - benthic	-28.4 ± 0.6	-7.2 ± 3.1	3	-27.6 ± 0.8	-5.8 ± 2.3	3	-27.0 ± 0.3	-3.7 ± 0.5	3
	Salmon carcass	-	-	-	-	-	-	-	-	-
	Salmon eggs	-	-	-	-	-	-	-	-	-
Invertebrates	Aquatic Invertebrates	-27.6 ± 1.1	0.8 ± 0.7	11	-27.8 ± 1.6	2.0 ± 0.5	6	-28.4 ± 1.8	2.1 ± 1.1	4
	Benthic - collectors	-26.8 ± 0.6	0.3 ± 0.0	3	-29.2 ± 0.5	2.2 ± 0.3	3	-29.6 ± 2.2	2.1 ± 0.5	2
	Benthic - grazers	-29.1 ± 0.8	1.0 ± 0.3	3	-26.3	2.3	1	-27.2	3.5	1
	Benthic - predators	-27.0 ± 1.3	2.0 ± 0.9	2	-25.5	2.3	1	-	-	-
	Benthic - shredders	-27.1 ± 0.3	0.3 ± 0.1	3	-27.6	0.9	1	-27.5	0.7	1
	Emergents	-27.3	2.8	1	-	-	-	-26.3 ± 2.3	0.2 ± 1.7	3
	Terrestrial	-	-	-	-	-	-	-	-	-
Fish	Rainbow trout - juveniles	-	-	-	-	-	-	-	-	-
	Rainbow trout - adults	-	-	-	-	-	-	-	-	-
	Chinook salmon - juveniles	-	-	-	-	-	-	-	-	-
	Coho salmon - juveniles	-	-	-	-	-	-	-	-	-
	Totals			31			20			19

Table A3.5-1. Diet composition of Chinook juveniles sampled by gastric lavage (proportions by dry mass). The isotopic origin of each prey category is indicated in parentheses.

Species / Life stage	Season	Focus Area	Hab-itat	*n* (total)	*n* (non-empty)	Mean diet mass (mg dry)	Diet proportions by dry mass: Fish Eggs (Marine)	Fish (Marine or Aquatic)	Aquatic Inverts (Aquatic)	Terrestrial Inverts (Aquatic)	Terrestrial Inverts (Terrestrial)
Chinook Juv	Spring	RP-81	TM	8	8	2.1	-	0.70	0.07	0.23	-
			US	8	7	0.3	-	-	0.46	0.54	-
		RP-104	SS	8	4	1.1	-	-	0.91	0.09	-
		RP-141	TM	8	6	45.5	-	0.96	0.00	0.00	0.04
Chinook Juv	Summer	RP-81	TM	1	1	0.4	-	-	-	1.00	-
		RP-104	SC	8	6	7.9	0.55	0.27	0.04	-	0.15
			SS	17	11	6.9	0.96	-	0.03	0.01	0.00
			US	8	7	0.4	-	-	0.82	0.18	-
		RP-141	TM	5	5	8.8	0.86	-	0.10	0.03	-
			US	8	7	0.8	0.25	-	0.03	0.73	0.00
Chinook Juv	Fall	RP-81	US	1	1	62.2	-	-	-	-	1.00
		RP-104	SC	3	2	1.5	0.65	-	0.12	0.23	-
			SS	10	9	13.8	0.76	-	0.07	0.13	0.05
			US	1	1	6.5	0.64	-	0.02	0.26	0.08
		RP-141	TM	6	5	8.4	0.96	-	0.04	-	-

Table A3.5-2. Diet composition of coho juveniles sampled by gastric lavage (proportions by dry mass). The isotopic origin of each prey category is indicated in parentheses.

Species / Life stage	Season	Focus Area	Hab-itat	*n* (total)	*n* (non-empty)	Mean diet mass (mg dry)	Diet proportions by dry mass				
							Fish Eggs (Marine)	Fish (Marine or Aquatic)	Aquatic Inverts (Aquatic)	Terrestrial Inverts (Aquatic)	Terrestrial Inverts (Terrestrial)
Coho Juv	Spring	RP-81	TM	9	7	0.3	-	-	0.60	0.37	0.02
			US	8	6	0.2	-	-	0.49	0.34	0.17
		RP-141	TM	8	3	0.6	-	-	1.00	-	-
Coho Juv	Summer	RP-81	TM	4	4	1.3	0.45	-	0.06	0.14	0.35
		RP-104	SC	9	3	4.0	-	-	0.11	-	0.89
			SS	19	12	0.4	0.17	0.32	0.23	0.16	0.13
			US	8	7	0.3	-	-	0.93	0.07	-
		RP-141	TM	8	8	10.8	0.96	-	0.04	0.00	-
			US	3	3	0.4	-	-	0.13	0.85	0.02
Coho Juv	Fall	RP-81	TM	2	2	15.3	0.96	-	0.03	0.01	-
			US	4	2	1.5	-	-	0.14	-	0.86
		RP-104	SC	9	9	4.1	0.66	-	0.02	0.08	0.24
			SS	16	14	6.3	0.85	-	0.04	0.03	0.08
			US	5	4	0.2	-	-	0.83	0.17	-
		RP-141	TM	8	7	4.9	0.93	-	0.05	0.00	0.02
			US	1	1	0.8	-	-	0.12	0.88	0.00

Table A3.5-3. Diet composition of rainbow trout adults and juveniles sampled by gastric lavage (proportions by dry mass). The isotopic origin of each prey category is indicated in parentheses.

Species / Life stage	Season	Focus Area	Hab-itat	*n* (total)	*n* (non-empty)	Mean diet mass (mg dry)	Diet proportions by dry mass				
							Fish Eggs (Marine)	Fish (Marine or Aquatic)	Aquatic Inverts (Aquatic)	Terrestrial Inverts (Aquatic)	Terrestrial Inverts (Terrestrial)
Rainbow Trout Adult	Spring	RP-104	SS	3	3	8.8	-	-	0.64	-	0.36
		RP-141	TM	1	1	79.5	-	0.98	0.02	0.00	-
	Summer	RP-104	SS	9	8	82.4	0.00	0.98	0.01	0.00	0.01
		RP-141	TM	8	8	30.3	0.96	-	0.02	0.02	-
	Fall	RP-104	SS	8	7	47.9	1.00	-	0.00	-	-
		RP-141	TM	2	2	28.1	0.97	-	0.02	0.01	-
Rainbow Trout Juv	Spring	RP-81	TM	9	6	0.1	-	0.15	0.25	0.60	-

Table A3.6-1. Mean taxa richness and taxonomic richness estimates (n=3) from Hester-Dendy multiplate samplers collected in clear and warm water conditions in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study.

Site	Turbidity/ Temperature Condition*	Sample Set Depth	Days Colonized	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
RP-HD-1-5S	CW	Shallow	7	351.28	12 (20)	1.67 (3)	0 (0)	1.33 (2)	0.33 (1)	9.33 (14)	1.96	0.80
RP-HD-1-4S	CW	Shallow	15	271.79	14.67 (22)	2 (3)	0 (0)	1.33 (2)	0.67 (1)	11.33 (16)	2.40	0.90
RP-HD-1-3S	CW	Shallow	28	1794.36	24 (35)	1.67 (4)	0 (0)	0.67 (2)	1 (2)	17.67 (23)	2.54	0.80
RP-HD-1-2S	CW	Shallow	42	4757.24	34.5 (44)	3.5 (5)	0.5 (1)	0.5 (1)	2.5 (3)	23.5 (29)	2.74	0.77
RP-HD-1-1S	CW	Shallow	57	6670.02	35.33 (58)	5 (11)	1.67 (4)	1 (2)	2.33 (5)	21.67 (31)	2.67	0.75
RP-HD-1-5D	CW	Deep	7	164.10	10.67 (24)	1 (2)	0 (0)	0.67 (1)	0.33 (1)	7.33 (16)	2.05	0.94
RP-HD-1-4D	CW	Deep	15	620.51	24.33 (40)	4 (8)	0.67 (2)	1.33 (2)	2 (4)	16.67 (24)	2.82	0.88
RP-HD-1-3D	CW	Deep	28	3294.36	31.33 (51)	3.67 (6)	0.33 (1)	1.67 (2)	1.67 (3)	23 (33)	2.54	0.75
RP-HD-1-2D	CW	Deep	42	4139.68	30 (50)	2.33 (6)	0.67 (2)	0.33 (1)	1.33 (3)	22 (31)	2.57	0.76
RP-HD-1-1D	CW	Deep	57	6184.98	26.67 (42)	0.67 (2)	0.33 (1)	0 (0)	0.33 (1)	20 (29)	2.50	0.76

* CC=Clear & Cold; CW=Clear & Warm; TC=Turbid & Cold; TW=Turbid & Warm.

Table A3.6-2. Mean taxa richness and taxonomic richness estimates (n=3) from Hester-Dendy multiplate samplers collected in clear and cold water conditions in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study.

Site	Turbidity/ Temperature Condition*	Sample Set Depth	Days Colonized	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
RP-HD-2-5S	CC	Shallow	7	158.97	8 (14)	0 (0)	0 (0)	0 (0)	0 (0)	7 (13)	1.83	0.88
RP-HD-2-4S	CC	Shallow	15	497.44	11 (19)	0.33 (1)	0 (0)	0.33 (1)	0 (0)	9.67 (17)	1.80	0.76
RP-HD-2-3S	CC	Shallow	28	1128.21	11 (17)	0 (0)	0 (0)	0 (0)	0 (0)	10 (16)	1.47	0.62
RP-HD-2-2S	CC	Shallow	42	3520.23	11.67 (18)	0 (0)	0 (0)	0 (0)	0 (0)	10.33 (16)	1.36	0.57
RP-HD-2-1S	CC	Shallow	57	3943.68	14.33 (23)	0.33 (1)	0 (0)	0 (0)	0.33 (1)	12.67 (20)	1.38	0.52
RP-HD-2-5D	CC	Deep	7	79.49	5.33 (10)	0 (0)	0 (0)	0 (0)	0 (0)	4.33 (9)	1.47	0.90
RP-HD-2-4D	CC	Deep	15	171.79	6.33 (12)	0 (0)	0 (0)	0 (0)	0 (0)	5 (9)	1.43	0.84
RP-HD-2-3D	CC	Deep	28	1828.21	12.67 (20)	0 (0)	0 (0)	0 (0)	0 (0)	10.67 (16)	1.52	0.60
RP-HD-2-2D	CC	Deep	42	1901.47	9.33 (13)	0.33 (1)	0 (0)	0 (0)	0.33 (1)	7.33 (9)	1.10	0.51
RP-HD-2-1D	CC	Deep	57	4370.60	12 (17)	0.33 (1)	0 (0)	0.33 (1)	0 (0)	10.33 (14)	1.41	0.57

* CC=Clear & Cold; CW=Clear & Warm; TC=Turbid & Cold; TW=Turbid & Warm.

Table A3.6-3. Mean taxa richness and taxonomic richness estimates (n=3) from Hester-Dendy multiplate samplers collected in turbid and cold water conditions in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study.

Site	Turbidity/ Temperature Condition*	Sample Set Depth	Days Colonized	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
RP-HD-3-4S	TC	Shallow	8	2.56	0.33 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0.33 (1)	0.00	0.00
RP-HD-3-3S	TC	Shallow	21	94.87	6 (12)	0.67 (1)	0 (0)	0 (0)	0.67 (1)	3.67 (8)	1.62	0.92
RP-HD-3-2S	TC	Shallow	35	94.87	5 (10)	0.67 (1)	0 (0)	0.67 (1)	0 (0)	3.33 (7)	0.99	0.52
RP-HD-3-1S	TC	Shallow	49	28.21	1.67 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0.67 (2)	0.33	0.48
RP-HD-3-4D	TC	Deep	8	17.95	2.33 (6)	0.33 (1)	0 (0)	0 (0)	0.33 (1)	0.67 (2)	0.73	0.00
RP-HD-3-3D	TC	Deep	21	69.23	4.33 (8)	0.67 (1)	0 (0)	0 (0)	0.67 (1)	2.33 (4)	1.27	0.91
RP-HD-3-2D	TC	Deep	35	48.72	3.33 (7)	0.67 (2)	0 (0)	0.33 (1)	0.33 (1)	1.33 (3)	1.01	0.85
RP-HD-3-1D	TC	Deep	49	171.79	7.33 (14)	2.33 (4)	0.33 (1)	1.33 (2)	0.67 (1)	3 (6)	1.60	0.80

* CC=Clear & Cold; CW=Clear & Warm; TC=Turbid & Cold; TW=Turbid & Warm.

Table A3.6-4. Mean taxa richness and taxonomic richness estimates (n=3) from Hester-Dendy multiplate samplers collected in turbid and warm water conditions in the Whiskers Slough Focus Area (FA-104) during August and September 2013 for an 8-week colonization period for the River Productivity Study.

Site	Turbidity/ Temperature Condition*	Sample Set Depth	Days Colonized	Density (sq m)	Taxa Richness Avg (Total)	EPT Richness Avg (Total)	Mayfly (E) Taxa Avg (Total)	Stonefly (P) Taxa Avg (Total)	Caddisfly (T)Taxa Avg (Total)	Chironomid Taxa Avg (Total)	Diversity (H')	Evenness (J')
RP-HD-4-4S	TW	Shallow	9	20.51	2.33 (6)	0.33 (1)	0 (0)	0.33 (1)	0 (0)	1.67 (4)	0.67	0.64
RP-HD-4-3S	TW	Shallow	22	2.56	0.33 (1)	0.33 (1)	0 (0)	0.33 (1)	0 (0)	0 (0)	0.00	0.00
RP-HD-4-2S	TW	Shallow	36	156.41	7 (14)	2.33 (5)	0.67 (2)	1 (2)	0.67 (1)	4.67 (9)	1.46	0.77
RP-HD-4-1S	TW	Shallow	50	30.77	2.33 (5)	0 (0)	0 (0)	0 (0)	0 (0)	2.33 (5)	0.63	0.62
RP-HD-4-4D	TW	Deep	9	194.87	7 (14)	1 (2)	0 (0)	0.67 (1)	0.33 (1)	5.67 (11)	1.44	0.74
RP-HD-4-3D	TW	Deep	22	343.59	6.67 (10)	2.67 (4)	0.67 (1)	1.33 (2)	0.67 (1)	3.67 (5)	1.33	0.70
RP-HD-4-2D	TW	Deep	36	623.08	10 (20)	2.67 (5)	0.67 (1)	1.33 (2)	0.67 (2)	6.67 (13)	1.28	0.55
RP-HD-4-1D	TW	Deep	50	758.97	12 (21)	3 (5)	1 (2)	1.33 (2)	0.67 (1)	9 (16)	1.70	0.69

* CC=Clear & Cold; CW=Clear & Warm; TC=Turbid & Cold; TW=Turbid & War

FIGURES

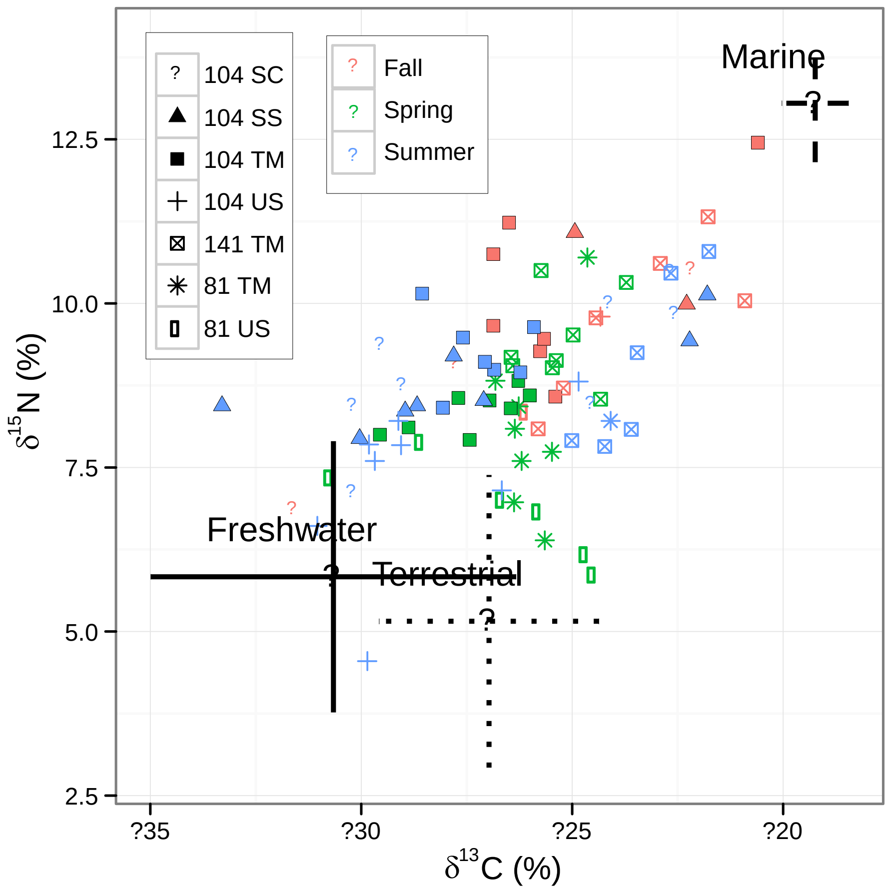

Figure A3.4-1. $\delta^{15}N$ vs. $\delta^{13}C$ bi-plot for all juvenile Chinook salmon samples collected at each site (marker shapes) and across all seasons (marker colors) with average freshwater, terrestrial, and marine diet sources shown in black.

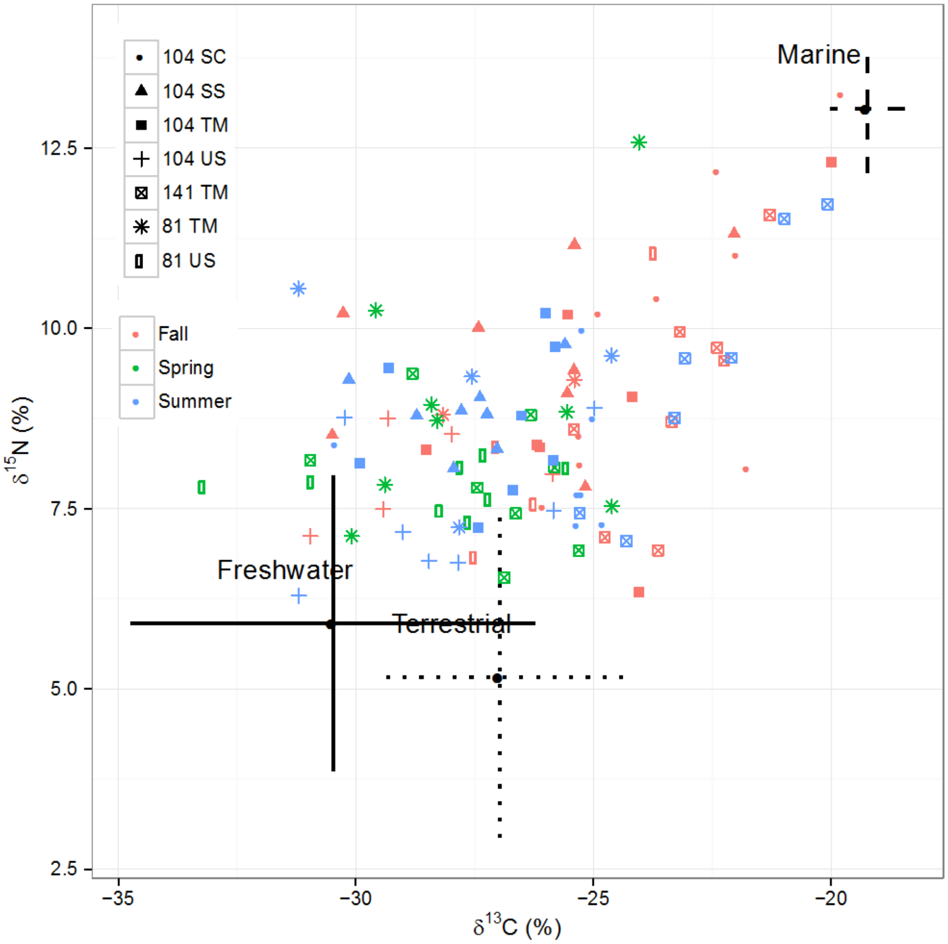

Figure A3.4-2. $\delta^{15}N$ vs. $\delta^{13}C$ bi-plot for all juvenile coho salmon samples collected at each site (marker shapes) and across all seasons (marker colors) with average freshwater, terrestrial, and marine diet sources shown in black.

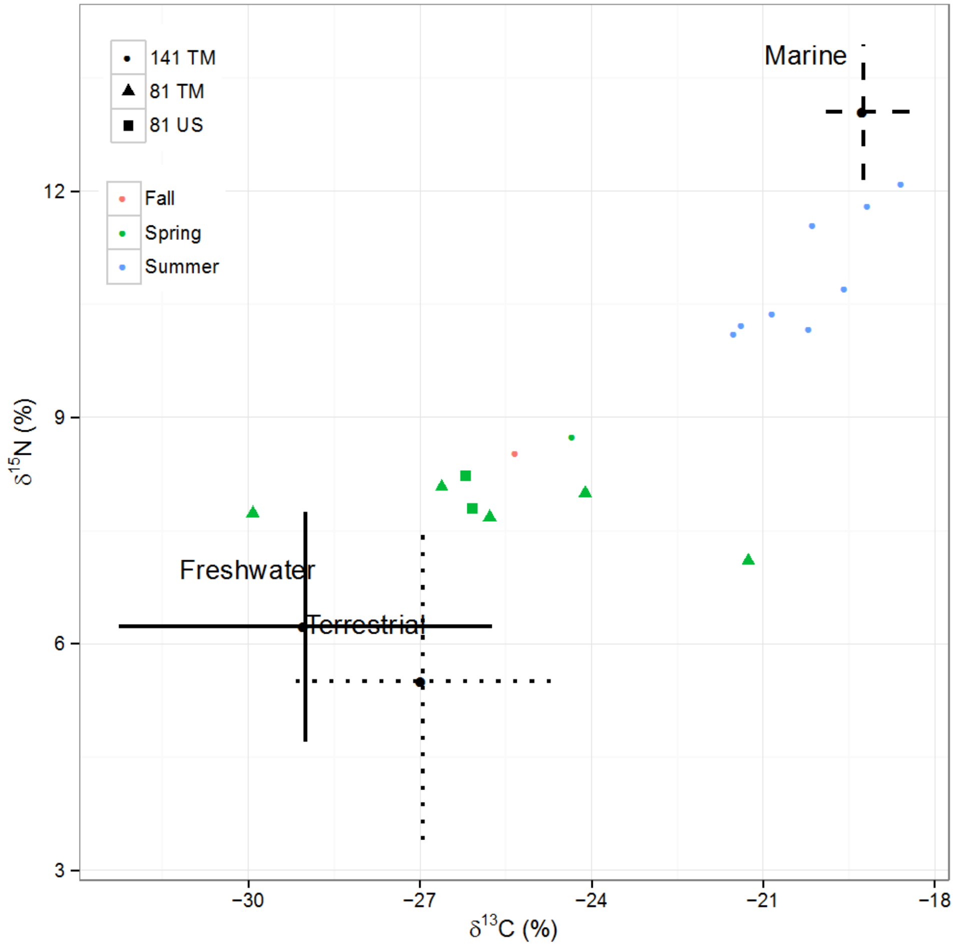

Figure A3.4-3. $\delta^{15}N$ vs. $\delta^{13}C$ bi-plot for all juvenile rainbow trout samples collected at each site (marker shapes) and across all seasons (marker colors) with average freshwater, terrestrial, and marine diet sources shown in black.

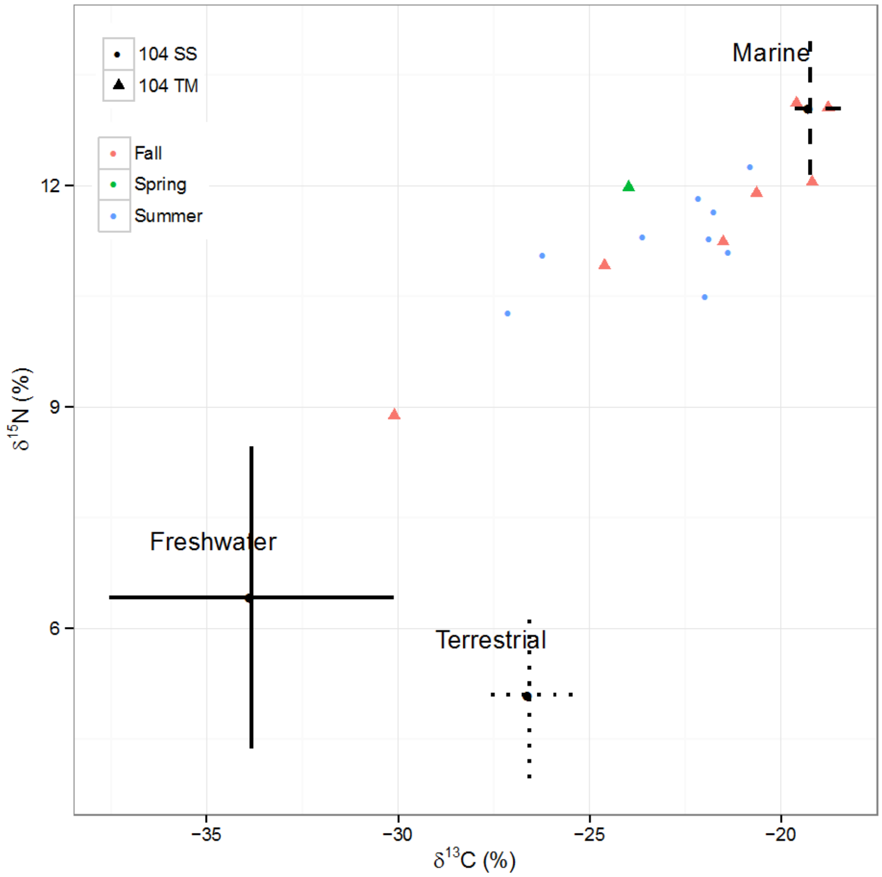

Figure A3.4-4. δ15N vs. δ13C bi-plot for all adult rainbow trout samples collected at each site (marker shapes) and across all seasons (marker colors) with average freshwater, terrestrial, and marine diet sources shown in black.