Pre-Treatment Assessment of Habitat and Biota in the Knife River Mainstem, MN

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Executive Summary

Pre-restoration surveys are important for demonstrating the effectiveness of restoration activities. Good documentation of stream condition, and the organisms that live there, allow post-restoration comparisons, assessment of the most cost-effective restoration activities, and the ability to track trends over time. During 2016 the Lake Superior Steelhead Association (LSSA) requested University of Minnesota Duluth, Natural Resources Research Institute (NRRI) staff to complete surveys of 3 Knife River mainstem reaches (two pre-treatment, and one reference) for fish, macroinvertebrates, and stream habitat. The 2016 Knife River surveys followed our standard methods used in past LSSA contracts. Reaches were named "Reach 12", "Reach 9", and "Reference" (listed in upstream progression). Reach 12 and Reach 9 were considered "pre-treatment" assessments, as habitat improvement projects to reduce stream bank erosion and improve pool and cover habitat for larger salmonids in these reaches occurred following our surveys. Data from the Reference reach will be important for distinguishing whether changes detected over time are natural or from the applied stream work.

Our surveys revealed that all three reaches were quite similar in habitat, as well as macroinvertebrate and fish communities. Reach 9 had the most fish species due to one very large pool, but otherwise, was not very different from Reach 12. Reaches 12 and 9 had areas with unstable channel conditions and eroding banks, which were not present in the Reference reach. Therefore, the Reference reach ranked highest in the MPCA Stream Habitat Assessment (MSHA) protocol scoring system and percent canopy cover over the stream channel. The Reference reach also had more pools with slower-flowing water and woody debris, which Brook Trout favor. Thus, we found greater Brook Trout abundance and fitness in the Reference reach. In summary, our survey indicates all reaches were relatively similar. This assessment is important because it demonstrates the section of the river we selected for the Reference reach will adequately capture natural changes over time, while still being a comparable river segment to Reach 12 and 9.

Introduction

Minnesota's Lake Superior shoreline offers about 180 river-miles that are accessible to anadromous salmonids, although much of this habitat is unsuitable for reproduction (Schreiner 2003). The Knife River and its tributaries provide 70 accessible river-miles and contain 43% of the total available habitat suitable for spawning of all Minnesota North Shore streams (Hassinger *et al.* 1974; Schreiner 1992). The Knife River watershed has received considerable attention by the Lake Superior Steelhead Association (LSSA) because it has a history of supporting salmonid populations, and it is one of the larger watersheds flowing from Minnesota into the Western arm of Lake Superior. Most segments of the Knife River watershed have experienced various amounts of logging, beaver activity, and migratory fish passage obstructions in the past. In 2013 LSSA worked with the Minnesota Department of Natural Resources (MNDNR) to improve fish passage conditions over the second falls of the Knife River, and also contracted Natural Resources Research Institute (NRRI) to assess in-stream habitat and biotic communities of fish and macroinvertebrates at several reaches along the West Knife River (Dumke *et al*. 2014).

In 2015 LSSA contracted NRRI to perform assessments in Stanley Creek, which is a tributary to the mainstem Knife River. The LSSA worked with MN DNR to mark (via left pelvic fin clip) and transport nearly 1,250 age1+ rainbow trout (*Oncorhynchus mykiss*, commonly called "steelhead") upstream into the Stanley Creek watershed. NRRI's role was to perform our standard stream assessment on four reaches in Stanley Creek and report where and how many clipped steelhead were encountered. However, during mid-August 2015 the majority of Stanley Creek, including reaches scheduled to be sampled, wer not flowing. Qualitative information was collected in an August visit to Stanley Creek, but subsequent effort was immediately re-directed into four reaches of the Knife River mainstem. Full summaries of 2015 Stanley Creek and Knife River mainstem surveys can be found in Dumke *et al.* (2016).

The LSSA again requested stream surveys within the Knife River watershed in 2016, in a section of the river scheduled to undergo stream modifications intended to reduce sediment inputs from eroding banks and to improve in-stream habitat for salmonids (Figure 1). This request aligned with the NRRI standard Before-After-Control-Impact (BACI) survey design for stream studies; where pre- and post-treatment surveys of physical habitat and biotic communities are compared to assess how much a treatment changed stream condition, and the effects of those changes on the macroinvertebrate and fish communities. Two back-to-back reaches (12 and 9) were established within the designated work area in 2016 as pre-treatment surveys of stream condition and biotic assemblages. An upstream reference reach was simultaneously surveyed during the pre-treament time period, so when the reaches are re-surveyed (post-treatment), the changes that were caused by the applied treatment verus natural changes over time can be assessed (Figure 2).

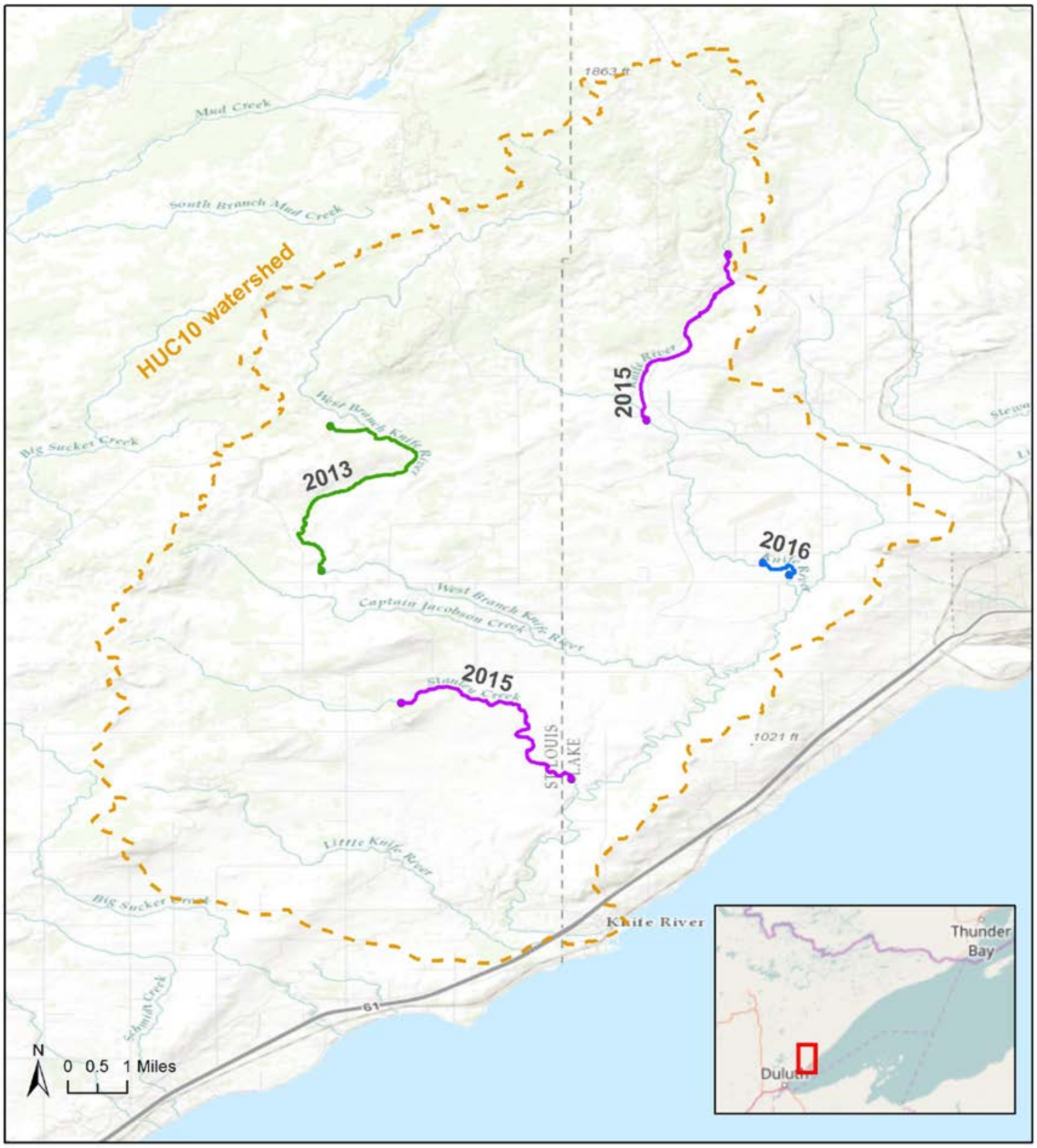

Figure 1. Knife River watershed which includes river segments surveyed by NRRI in prior years.

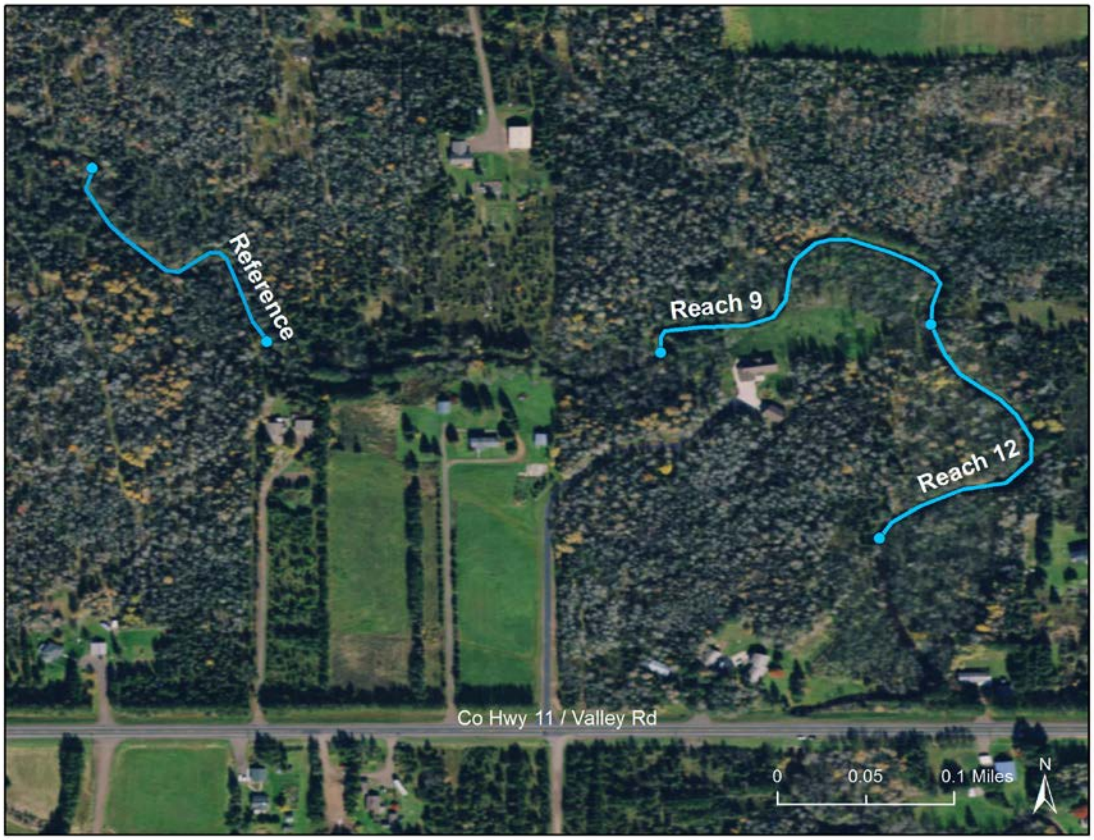

Figure 2. Reach locations sampled by NRRI on the Knife River mainstem in 2016. Refer to Figure 1 for the extent of this map within the Knife River watershed.

Methods

Habitat Survey

Habitat surveys were conducted at Reach 12 and Reach 9 on July 19th, 2017, and within the Reference on July 20th, 2017. Stream surveys need to be conducted at or near baseflow, so we performed all habitat surveys quickly while the weather was cooperative. Stream width was measured ten times across different features (riffle, run, pool) and averaged to calculate the mean stream width (MSW) for each reach. Total reach length was determined by multiplying MSW by 35, which is a standard method for stream surveys because this stream length generally includes 3 riffles and 3 pools habitats (Leopold *et al.* 1964). The minimum reach length for habitat surveys is 100 m and maximum is 350 m. A rock grade-control served as a nice location to divide Reach 12 from Reach 9 (Figure 3). Reaches 12 and 9 were placed consecutively to ensure we captured data from the entire river segment receiving treatment. When possible, we place reach endpoints 10x MSW from road crossings, bridges, tributaries, or other features that may influence channel or habitat conditions. However, the begining location of the Reference reach was near a private bridge across the stream, as we had little room to shift the Reference reach location due to a complex debris jam on the upstream end. Start and end locations of all reaches were marked using handheld GPS (Table 1).

Figure 3. Photo showing the rock riffle grade-control that marks the end of Reach 12 and the beginning of Reach 9.

Table 1. GPS coordinates (WGS84) of reach beginning and endpoints for the Knife River mainstem.

	Start Location		End Location	
Reach	**Latitude**	**Longitude**	**Latitude**	**Longitude**
Reach 12	N47.03436	W091.73895	N47.03611	W091.73853
Reach 9	N47.03611	W091.73853	N47.03588	W091.74074
Reference	N47.03597	W091.74397	N47.03739	W091.74540

Habitat surveys were conducted walking from downstream to upstream within the reach to limit our own disturbance during the survey. Start locations were chosen at the downstream end of reaches in glides immediately upstream of a riffle, where water movement was relatively homogenous and at a depth that was sufficient for water velocity measurement. Water velocity was measured during all biotic surveys (fish or macroinvertebrates) near reach start locations. Discharge (total volume of flowing water) was calculated following the methods of Platts *et al.* (1983). Water quality was measured just upstream of each reach's start location using a Hydrolab MS5 sonde and surveyor to record stream temperature (°C), dissolved oxygen (percent saturation and concentration (mg/L)), specific conductivity (µS/cm), and pH. Readings were taken in slow moving water (avoiding turbulent flow as well as slack water). Water clarity (cm) was measured with a secchi tube near each reach's start location.

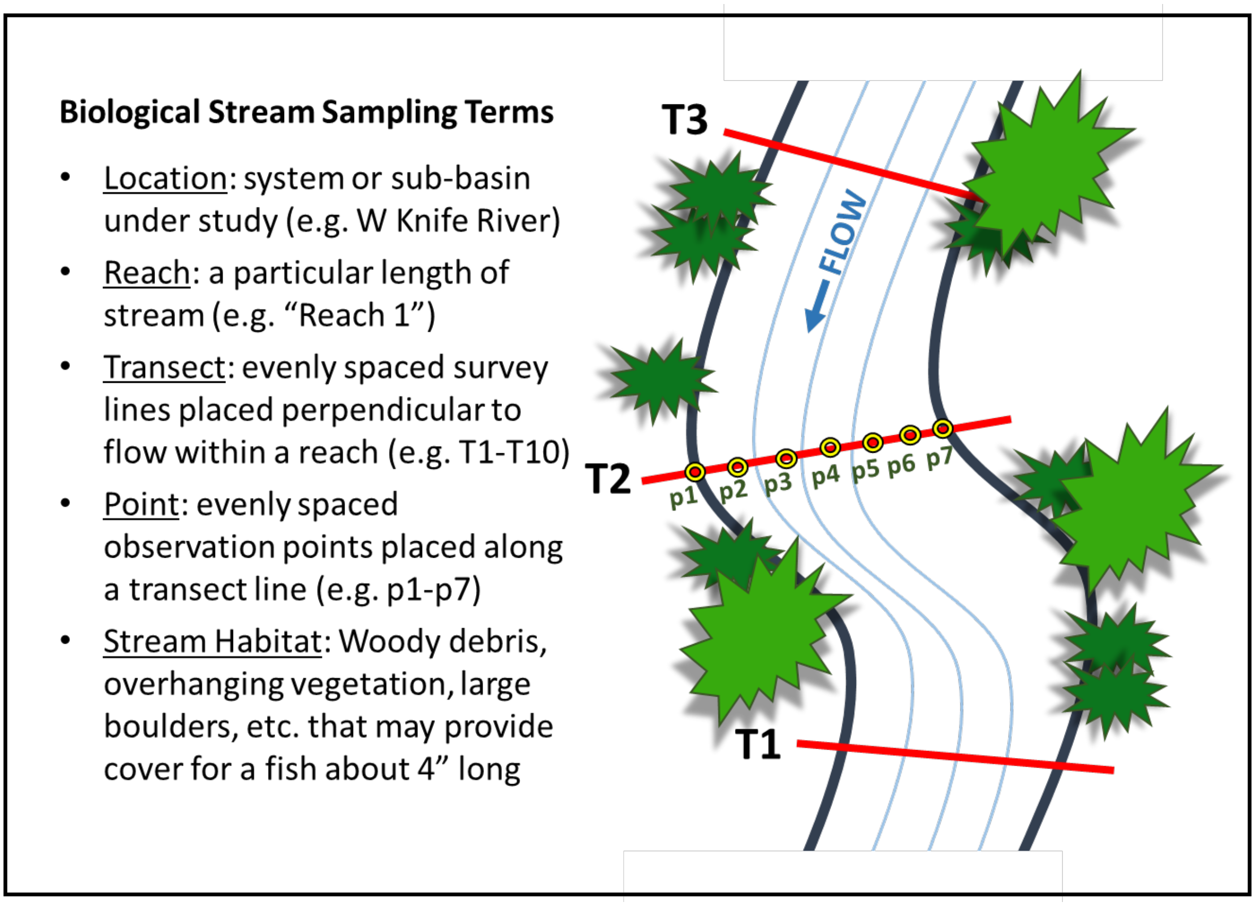

Figure 4. Definitions of survey terminology and example diagram of transect and point measure placements within reaches.

Within each reach we established 10 evenly-spaced transects for measurements across the stream channel (Figure 4). At each transect the stream channel feature type was noted (riffle, run, pool, or other), and measurements were recorded for wetted stream width (m), bankfull width and bankfull depth, lowest bank height (measures the ability of the stream to connect with its floodplain), count of large wood (>10 cm diameter; good fish cover), and nearest tree diameter at breast height (DBH) on left and right banks (indicates time since last major flood or beaver occupancy). All of these measurements are important for characterizing stream channel shape and habitat for stream fish. The percent of the stream channel shaded by trees, bushes, or even tall streamside grass was measured at several positions on each transect with a densiometer. A densitometer is a handheld foresters tool that measures canopy cover (amount of shade is inferred) using a dome-shaped mirror with overlain gridlines. Streamside vegetation type was noted next to the stream (0-10 m from each bank) and further away from the stream (10-30 m from water's edge) on left and right banks. Percent slope of left and right banks was estimated with a clinometer; this helps assess bank stability and danger of erosion (in combination with bank substrate type). Digital photographs were taken of each transect.

We counted pieces of coarse woody debris (CWD) within 1 m up and downstream of each transect. We defined CWD as any pieces >10 cm diameter and 1 m length. At each transect we evaluated stream conditions by evenly spacing 7 points across the wetted channel (Figure 4). Points 1 and 7 are the left and right waters-edge, respectively, and points 2 through 6 are within the wetted channel. At every point across each transect we measured water depth (m) and visually estimated the percent composition of bottom substrates within a 0.5 m^2 area. Substrates types were boulder (>256 mm), cobble (256-64 mm), large gravel (64-32 mm), small gravel (32-2 mm), sand (2-0.062 mm), silt (0.062-0.004 mm), and clay (<0.004 mm) (Dumke *et al.* 2013).

When coarse substrates (gravels, cobble, and boulder) were present along with fine substrates (sand, silt, and clay), we visually estimated the percentage that large substrates were embedded (buried or surrounded) by fine substrates. This shows the amount of habitat space available under and around the rocks for fish eggs, small fish, and the aquatic macroinvertebrates that fish feed on. At each point we also measured the depth of fine substrates (sand, silt, and clay), called refusal depth, with a 1 m long rod. This is another measure of the amount of fine particles burying the more preferred rocky substrates in each stream reach. At each point we also recorded any boulder, CWD, overhanging bank, vegetation, or other type of functional cover available for larger trout (about 4" long, or >100 mm). For CWD to be considered fish habitat they need to be in water >0.2 m deep and partially fixed to the stream bank or bottom so that they are relatively stable and not easily dislodged by flow.

We sketched a stream map (Appendix I) and counted the pieces of large wood present in the entire reach to get a better measure of large wood available as fish habitat. Stream slope (%) for all reaches was determined by getting elevation of reach beninning and end locations from the vertical datum NAVD88 (in our GIS lab), and then calculating the change in elevation over the measured stream distance (rise/run). We used the measurements from the habitat survey to calculate a habitat quality score using the MPCA Stream Habitat Assessment (MSHA) protocol (MPCA 2014). The MSHA differs slightly from the Ohio EPA Qualitative Habitat Evaluation Index (Rankin 2006) that NRRI used in the past. The MSHA contains scoring criteria selected to be of importance in Minnesota streams and should be more representative of our region than a scoring system developed for Ohio. We used one-way analysis of variance (ANOVA) in the R statistical program (alpha ≤ 0.05; R Core Team 2015) to determine if differences between means were statistically significant.

Macroinvertebrate Survey

Aquatic macroinvertebrates are animals without backbones (snails, crayfish, insects, worms) that are larger than plankton and live all or much of their life in the water. Aquatic macroinvertebrates are important food for fish and the different types found can tell us a lot about year-round environmental conditions because they are less mobile than fish and cannot easily move to other sections of the stream if conditions become suboptimal. Aquatic macroinvertebrates were collected from all three reaches with several different sampling devices (each type of device performs optimally in different sampling conditons). We took three quantitative samples (sampling a known area of stream bed) using a Hess sampler (Figure 5), as well as one qualitative D-frame dip net (D-net) from each reach. The Hess sampler functions properly in 15-35 cm water depth with gravel bottom substrates where the bottom of the Hess can be pushed into the stream bed to create a seal. The Hess is an excellent quanitative sampling device for calculating the abundance of macroinvetebrates per unit area, which is one way to compare productivity and quality of forage available to fish. Qualitative D-net samples capture organisms occupying a variety of other habitat types so we can collect species from places that a Hess cannot sample. D-net samples are collected by sweeping vegetation hanging or growing in the water, undercut banks, large wood, organic material, turning over large boulders, and other unique habitat types.

Figure 5. A Hess sampler similar to the equipment used by NRRI. Rocks are thoroughly scrubbed to dislodge macroinvertebrates, which are captured in an attached catch net.

All samples were sieved (250 µm mesh) to remove fine (silty) sediment, and the remaining sample was preserved with 95% ethyl alcohol. Preserved samples were labeled and logged into a chain of custody to ensure all samples were tracked from the field to the laboratory. In the laboratory we use standard identification guides (Thorp and Covich 2010; Merritt *et al.* 2008; Wiggins 1996) to identify macroinvertebrates as completely as possible, which was usually to genus. Macroinvertebrate sample processing, identification, and quality control procedures are explained in the NRRI Standard Operating Procedures (Dumke *et al.* 2013).

Fish Survey

Fish were sampled by NRRI field crews in three reaches from July 25th through 27th, 2016. Timing of electrofishing surveys typically must fall between July 1 and September 15. July is late enough that steelhead fry have emerged from stream gravels, and the later date is important not to exceed for two reasons: 1) to limit disruption of brook trout (*Salvelinus fontinalis*) reproduction, and 2) leaf-off for deciduous trees in our area is usually near the end of September, and leaves flowing down the stream during electrofishing surveys make spotting fish more difficult. Multiple-depletions are a standard survey method used by NRRI, which allows estimation of fish populations within the surveyed reaches. However, a “closed” population of fish is required to meet the population estimate assumptions. This can be attempted by setting up 3/16” mesh block nets on the downstream and upstream ends of each reach. In this case, there was too much flow and the Knife River was too large for nets to be deployed effectively. We used natural barriers (riffles) as locations to begin and end our electrofishing reaches. We calculated stream discharge at the beginning of each reach before electrofishing. We also recorded temperature, dissolved oxygen, pH, and specific conductivity. A holding pen held the fish captured in each electrofishing pass until they could be processed. The holding pen was divided into three separate compartments; one for each electrofishing pass. Each electrofishing pass was timed so we could standardize fish capture as catch per unit effort (CPUE) to allow comparison among stream reaches.

We used two different direct current (DC) backpack electrofishing units: an ETS APB-3 and Smith-Root 12-B. The pulse rate of both units was set at 60 Hertz (Hz). We calibrated the voltage for units within each reach by increasing voltage when fish were observed escaping the electrical field, and decreasing voltage if fish were immediately paralyzed. We continued adjusting within the voltage endpoints of “too little” and “too much” until we had a good electrotaxis response (involuntary swimming toward the anode) of a distance about 1 m from each anode. Inducing a proper electrotaxis response greatly increases the capture rate of fish because the operator can “pull” fish from cover or the stream bottom and guide them to a capture net. Fish can be injured by voltage settings which are too high, so we constantly inspected fish for signs of injury or distress during sampling to ensure that voltage settings were in the correct range.

Electrofishing began at the downstream end of each reach and continued while working upstream, shocking all habitats and collecting all stunned fish. Special attention was given to deep pools, overhanging banks or vegetation, scour-pools underneath logs, or other habitats where fish could find refuge. All fish were identified during processing, and twenty individuals from each size class of 0-100, 101-250, and >251 mm were measured for total length (TL). Trout species were also weighed (g) after their length was measured. After 20 individuals were measured, we counted fish within each of the three size classes. Any dead fish were noted so we could calculate a mortality rate, and a few fish were preserved for positive laboratory identification. All other fish were released back into the stream after processing.

Population estimates are usually only calculated for game fish, and electrofishing gear samples larger individuals more effectively than small fish, so a field assistant kept count of trout ≥100 mm TL collected in each pass. Our depletion efficiency of trout ≥100 mm TL was greater than 50% between passes 1 and 2 for all reaches, so we stopped electrofishing after two passes. Had depletion between the 1st and 2nd passes been under 50% for larger trout, we would have performed a 3rd depletion pass to improve the accuracy of population estimates. Population estimates of trout species were calculated using the Fisheries Stock Analsysis (FSA) package (Ogle 2016a) in R statistical program. Fulton's condition factor (K) was calculated for individual trout and averaged by age class among reaches. Significant differences of means were determined by one-way ANOVA. The formula for Fulton's Condition Factor (K) is:

$$K = 100\frac{W}{L^3}$$

where W = weight (g), L = length (cm), and 100 is a unity constant (Froese 2006).

Results and Discussion

Habitat

Among all reaches we found the water quality parameters such as dissolved oxygen, pH, temperature, and water clarity, to be acceptable for trout (Table 2). Bankfull width diminished progressively from Reach 12 upstream to the Reference reach, which is typical; as streams generally get smaller moving up the watershed. Bankfull is the stream flow that creates and maintains the shape of the stream channel, with a recurrence interval of approximately every 1.5 years (Rosgen 1994). This means about every year and a half storm flows fill the stream to the bankfull amount, and this is the size of the storm event that creates the general shape and form of the stream channel.

Table 2. Summary of habitat survey measurements. Means are displayed in bold, with their associated standard error in parenthesis: **mean** (SE). MCD = mixed conifer and deciduous forest, CWD = large (coarse) wood (>10 cm diameter and >1 m long), DBH = tree diameter at breast height.

Survey Measure	Reach 12	Reach 9	Reference
Station Length (m)	264	274	234
Habitat Survey Date	7/19/2016	7/19/2016	7/20/2016
Discharge (m3/sec)	0.428	Not measured, use 12 discharge	0.357
Discharge (ft3/sec)	15.13	Not measured, use 12 discharge	12.62
Riparian Type (0-10 m)	MCD	MCD/Residential	MCD
Riparian Type (10-30 m)	MCD	MCD/Residential	MCD
MSHA Score[1]	67.9	66.1	82.6
Temperature °C	15.55	18.36	17.97
Temperature °F	59.99	65.05	64.35
Specific Conductivity (µS/cm)	133	134.3	138.5
Dissolved Oxygen (%)	103.1	109.1	104.8
Dissolved Oxygen (mg/L)	9.84	9.81	9.53
pH	7.37	7.41	7.43
Secchi Tube (cm)	> 100 cm	> 100 cm	> 100 cm
Percent Slope	0.83%	0.48%	0.54%
Width/Depth Ratio	25.40	21.25	21.86
Cross-sectional Area (m^2)[2]	2.29	2.18	1.84
Total Coarse Woody Debris (CWD)	5	0	10
Mean Pieces CWD	**0.40** (0.27)	**0.0** (NA)	**0.0** (NA)
Mean Stream Fish Cover	**0.90** (0.48)	**0.70** (0.50)	**0.80** (0.39)
Mean Bank Fish Cover	**0.0** (NA)	**0.10** (0.10)	**0.70** (0.21)
Mean Stream Canopy Cover (%)	**48.7** (4.41)	**68.1** (5.10)	**81.0** (2.54)
Mean Bank Canopy Cover (%)	**92.5** (3.83)	**96.2** (1.79)	**95.0** (1.80)
Mean Stream Width (m)	**7.62** (0.22)	**6.80** (0.51)	**6.34** (0.31)
Mean Water Depth (m)	**0.30** (0.02)	**0.32** (0.03)	**0.29** (0.02)
Mean Thalweg Water Depth (m)	**0.42** (0.05)	**0.45** (0.06)	**0.41** (0.04)
Mean Bank Slope (%)	**46.6** (5.95)	**46.3** (4.03)	**41.5** (3.53)
Mean Tree DBH (cm)	**9.70** (1.72)	**12.95** (2.72)	**17.50** (3.50)
Mean Embeddedness (%)	**10.7** (1.84)	**10.4** (2.45)	**17.6** (3.38)
Mean Refusal Depth (cm)	**2.83** (0.50)	**3.61** (0.97)	**3.20** (0.66)
Mean Bankfull Width (m)	**9.98** (0.63)	**8.99** (0.47)	**7.15** (0.26)
Mean Bankfull Depth (m)	**0.47** (0.04)	**0.33** (0.02)	**0.37** (0.03)
Mean Low Bank Height (m)	**0.75** (0.07)	**0.59** (0.04)	**0.70** (0.03)
Floodprone Height (m)	1.78	1.56	1.56
Flood Plain Access Height (m)	1.17	1.04	1.11

[1] See Appendix II for all sub-scores. [2] Calculated from mean stream width and mean water depth.

Bankfull height and low bank height were measured as distance above the water's surface, so mean thalweg water depth was added to mean bankfull height and to low bank height to calculate the height above the stream channel within a floodprone area (Table 2). The thalweg is the area of fastest current velocity. While it is sometimes in the center of the stream, particularly in a straight reach, this fast-flow area meanders from side to side as the stream rounds bends. The floodprone area is the portion of the flood plain that would be flooded if the water depth was twice as high as the maximum bankfull depth. This water depth should include flood events up to a 50 year flood (occurs on average only once every 50 years; Rosgen 1994). An entrenchment ratio indicates vertical channel confinement, or in other words, how much the stream channel is confined within high banks or valley walls that do not allow flood waters to spill out onto a floodplain. Entrenchment ratio is calculated as the width of the floodprone area divided by the bankfull width (Rosgen 1996), with higher values indicating lower levels of entrenchment. The low bank height in all reaches was lower than the height of the floodprone area, which means floods are frequently able to top the low bank height and access an expansive floodplain. None of the surveyed reaches were entrenched.

Eroding banks and some locations where the stream channel was unstable (such as the upper end of Reach 9) reduced the occurance of fish cover near the banks in Reaches 12 and 9 when compared to the Reference. Though differences between means seem small (Table 2), there was significantly more ($p < 0.05$) fish cover along the banks of the river in the Reference reach than either Reach 12 or 9. However, there was no difference among reaches when considering in-stream fish cover. Fish cover in the steam channel is often influenced by the presence of large boulders that only move during the greatest of floods, so they tend to be rather evenly distributed among reaches in close proximity. Pieces of wood large enough for fish cover, or coarse woody debris (CWD), were not very evenly distributed among any of the reaches. The Reference reach had the most total observed pieces of CWD, however, none of our transects encountered them (mean CWD=0 in Reference Reach; Table 2), indicating they all may have come from a pool between transects 9 and 10. Reach 9 did not have any CWD within its entire length, and Reach 12 had five pieces that were somewhat more evenly distributed (mean of 1 piece every 2-3 transects; Table 2). Mean bank slopes were slightly lower in the Reference reach than Reach 12 or 9, but the difference was not significant.

The amount of stream shading (% canopy cover) near the banks was similar among all reaches at 92-96% (Table 2), which is typical, as this measure captures small trees and tall grasses. However, mean canopy cover over the middle of the stream channel was significantly greater ($p < 0.05$) in the Reference (81.0%)

than either Reach 12 (48.7%), or Reach 9 (68.1%). Factors influencing this are likely the slightly smaller channel dimensions in the Reference reach, as well as the eroding banks in Reach 12 and mowed residential land use in Reach 9, which diminish the presence of riparian vegetation tall enough to cover the majority of the stream channel. At each transect we examined left and right banks for erosion, which yields a total of 20 evaluations per reach. We only identified one point of bank erosion in the Reference reach, but recorded five in Reach 12, and four within Reach 9. Riparian trees were largest on average in the Reference reach (Table 2), yet these measures were highly variable and the differences among DBH means were not significant. Mature trees in the riparian area are important because their canopy blocks solar radiation in the summertime and reduces rates of stream warming (a known stressor of concern in Minnesota trout streams). Mature forests also supply allochthonous inputs of coarse woody debris to the channel, which is important for macroinvertebrates and fish.

Table 3. Summary of all stream bottom substrate compositions from within the wetted stream width of each reach. Displayed as means in bold with standard error in parenthesis: **mean** (SE).

Mean Substrate	Reach 12	Reach 9	Reference
% Bedrock	**0.0** (NA)	**1.6** (1.6)	**0.0** (NA)
% Boulder	**11.5** (2.7)	**3.3** (1.8)	**5.8** (1.9)
% Cobble	**41.2** (3.89	**18.1** (3.0)	**13.5** (2.6)
% Gravel, lg	**24.8** (2.8)	**52.6** (3.4)	**54.0** (4.3)
% Gravel, sm	**13.3** (1.4)	**17.6** (1.6)	**7.4** (0.9)
% Sand	**8.5** (1.8)	**5.3** (1.6)	**15.1** (3.5)
% Silt	**0.3** (0.2)	**0.8** (0.3)	**2.7** (1.3)
% Clay	**0.4** (0.4)	**0.7** (0.4)	**1.5** (1.0)

The Reference reach had the highest MPCA Stream Habitat Assessment (MSHA) score at 82.6 (higher is better). The MSHA scores integrate multiple stream characteristics into one value, and can be used to compare streams. Scoring is based on adding subscores for categories of 1) Watershed Landuse, 2) Riparian Zone, 3) Instream Substrate, 4) Instream Cover, and 5) Channel Morphology; the Reference reach ranked highly in all of these. Appendix II includes full scoring criteria for all reaches. The Reference was dominated by large gravels (Table 3) and had the most stable stream conditions, but Reach's 12 and 9 also contained a majority of coarse substrates. The ability of fish to move gravel is a function of body size, so the prevalence of large gravels and cobbles in all surveyed reaches indicate this section of the

Knife River aligns best with the spawning activities of large-bodied migratory fish, which use larger substrates. The Reference reach had the greatest proportion of fine sediment (Table 3) and percent embeddedness of coarse substrates (Table 2) when compared to Reach's 12 and 9, but the values are still relatively low. Relatively-clean gravels indicate the stream has enough power, and low enough amounts of sand, silt, and clay entering it, to transport most fine sediment downstream rather than allowing it to accumulate on the stream bed.

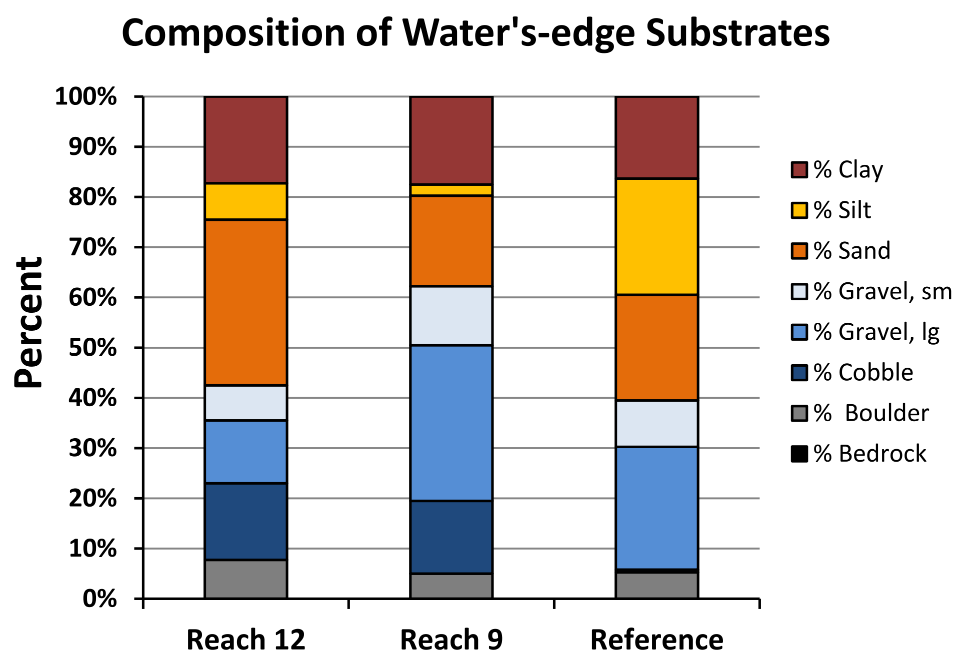

Figure 6. Cumulative percent composition of substrates located on the water's edge. Sand, silt, and clay are more likely than rockier substrates to erode during high flows.

Retention of some fine sediment is normal, improves habitat variability, and indicates there are slower-flowing areas within a reach that can be important habitat for young and small fish. The substrate along the water's edge is typically dominated by fine substrates (sands, silts, clays) since these locations are where stream power is very low and deposition of fines occurs. Among all reaches we still found 40-60% of the wetted-edge substrates to be coarse substrates rather than fines (Figure 6). Pool habitats also tend to hold more fine sediment than faster-flowing sections of river. We compared substrate composition within reaches by the transect feature types of Pool/Glide or Riffle/Run combinations, which separates the typically slow water velocity (pool/glide) from the typically fast (riffle/run) sections. There were not many Pool/Glide feature types to use in this analysis (Reach 12: n=1, Reach 9: n=2, Reference: n=1), but the pools in Reaches 12 and 9 tended to hold more fine sediments (Figure 7). The Reference reach had fine sediment more evenly-distributed throughout all features than Reach 12 or Reach 9.

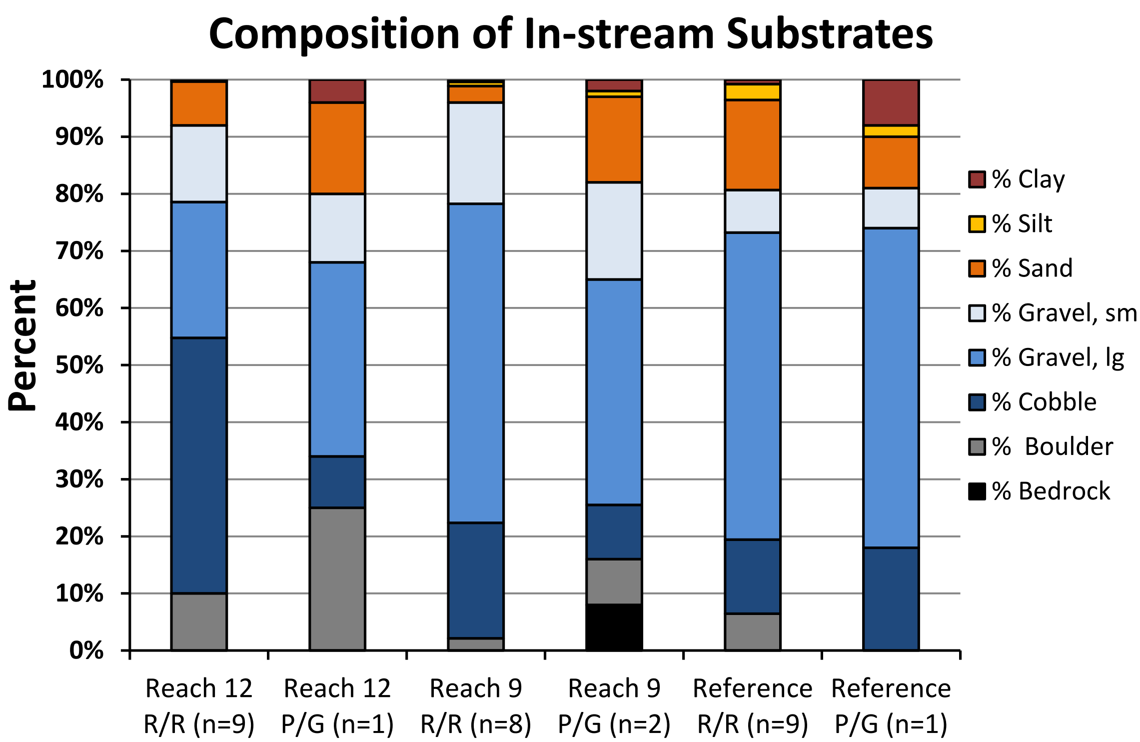

Figure 7. Cumulative percent composition of stream bottom substrates within the wetted channel by feature type: **R/R**=riffles/runs, **P/G**=pools/glides. Number of occurances of each feature type in each reach is shown as **n=x**. See methods section for size ranges of each substrate.

Macroinvertebrates

Aquatic macroinvertebrates include snails, crayfish, insects, worms and other small animals without vertebrae. Many are the larval life stages of insects that will eventually emerge and become flying adults. These larval life stages are often difficult to identify, so most identification is only to genus, not species. Macroinvertebrates that are very young and undeveloped (i.e., early instars), or those that are damaged, are left at the taxonomic resolution of family. Aquatic worms are even more difficult to identify and are often left at very coarse identification (e.g., roundworms are left at the phylum level). Larvae of non-biting midges (family Chironomidae) require extra processing and cost to identify to genus, so these are typically left at tribe or subfamily taxonomic resolution. Thus, the different types of macroinvertebrates are simply called “taxa”, rather than “species”, because of this uneven level of identification.

To characterize the aquatic macroinvertebrates of a stream reach we attempt to sample all of the major habitat types using a variety of sampling equipment. Riffle areas that have rocks smaller than cobble (softball-size) and deep-enough water were sampled quantitatively with a Hess sampler, allowing us to estimate the number ofmacroinvertebrates available to support the stream food web in a square meter of riffle. Other habitats were sampled qualitatively using a D-net, which allowed us to sample all possible habitat types, thus providing a more complete inventory of stream macroinvertebrates present in each reach. The locations and types of samples taken in each reach are shown in Table 4.

Table 4. GPS coordinates (WGS84) of sample locations. Taxonomic richness (number of different types of macroinvertebrates collected) and EPT (mayfly, stonefly, and caddisfly) sample percent compositions. EPT taxa are considered the most sensitive groups of aquatic macroinvertebrates.

Site	Sample	Latitude	Longitude	Type	Habitat	%EPT	Richness
Reach 12	1	N47.03455	W091.73879	Hess	Run	25	49
Reach 12	2	N47.03471	W091.73827	Hess	Run	29	47
Reach 12	3	N47.03558	W091.73811	Hess	Riffle	28	46
Reach 12	4	NA	NA	Dnet	Qualitative (all)	26	66
Reach 9	1	N47.03629	W091.73843	Hess	Riffle	27	50
Reach 9	2	N47.03675	W091.73894	Hess	Riffle	34	49
Reach 9	3	N47.03622	W091.73977	Hess	Riffle	34	49
Reach 9	4	NA	NA	Dnet	Qualitative (all)	24	73
Reference	1	N47.03622	W091.74417	Hess	Riffle	44	42
Reference	2	N47.03658	W091.74469	Hess	Riffle	36	49
Reference	3	N47.03717	W091.74541	Hess	Run	30	57
Reference	4	NA	NA	Dnet	Qualitative (all)	28	64

Macroinvertebrates were sampled in all three reaches of this project. Over 100 different taxa were collected and identified across all reaches (Appendix III). One way to evaluate the condition of streams using macroinvertebrates is to use metrics that have been shown to indicate particular things about stream ecosystem condition. Typically, metrics are selected to help examine whether or not there have been human impacts to a stream, or to examine if the stream condition is poor for macroinvertebrates for some reason. As expected in a North Shore stream, there were many taxa in groups considered sensitive to human impacts and poor habitat conditions. Mayflies (Ephemeroptera; 16 taxa), caddisflies (Trichoptera; 30 taxa), stoneflies (Plecoptera; 10 taxa), dragonflies and damselflies (Odonata; 7 taxa), and fishflies and alderflies (Megaloptera; 3 taxa) have members that are considered among the least tolerant of stressors (Appendix III). Stoneflies and some mayflies are particularly intolerant of low dissolved oxygen.

The metric EPT (Ephemeroptera, Plecoptera, and Trichoptera) combines all the mayflies, stoneflies, and caddisflies into one group of particularly sensitive insects. All damselflies and dragonflies, and most stoneflies, are predators; their hunting lifestyle and specific habitat requirements can make them sensitive to habitat loss. The members of these groups that live in streams often prefer to live under rocks in areas of higher current velocity. Thus, they need areas that provide relatively unembedded riffle habitat. As riffles become filled with fine sediments, these fauna lose their habitat space and are present in smaller numbers. Finally, giant stoneflies (*Pteronarcys*) have slow-growing, long-lived nymphs that specialize in shredding up leaves from the fall. Their presence in all 3 reaches indicates sufficient stable habitats are present to allow *Pteronarcys* nymphs to complete their 3-year life cycle.

All streams, even those in the best condition, also contain macroinvertebrates that are tolerant of harsher conditions. Most streams have some lower quality habitats such as muddy, silty, sandy areas or areas of slower-moving water that these taxa can tolerate and where they are better competitors than more sensitive taxa. These opportunistic, shorter-lived tolerant taxa serve as a food resource for predatory macroinvertebrates. One of these groups is the non-biting midges of family Chironomidae. Chironomidae midge adults superficially resemble mosquitoes, but have no proboscis with which to bite and the males have antennae that resemble bottle brushes. These larval flies are ubiquitous in aquatic environments (it is unusual not to find many of them); they are often one of the most abundant groups, and they are incredibly diverse. Some species have hemoglobin and are tolerant of slower-moving water, lower oxygen conditions, and higher amounts of nutrients.

On the other end of the spectrum, some species require flowing water to capture algae, and others are active predators. As is often the case, Chironomidae midge larvae were proportionately the most abundant group in all stream habitats sampled, composing between 32-53% of the communities by abundance (Figure 8). Other tolerant taxa that we collected included snails (Gastropoda), beetles (Coleoptera), clams (Bivalvia), and aquatic worms (Oligochaeta and Nematoda) (Figure 8). In Figure 8 we summarized macroinvertebrate data by habitat type within each reach. Mayflies, stoneflies, and caddisflies (EPT; sensitive taxa) made up 24-44% of the total macroinvertebrates collected in all habitats and stream reaches. The percent EPT taxa amongst habitats (riffle, run, or all-habitats) was similar, with slightly higher proportions of EPT taxa in the riffles and runs. Riffles are typically where the most sensitive macroinvertebrates are found due to the higher quality habitats, including more stable substrates, such as gravel and cobbles. Among reaches, the percent EPT taxa was highest in the Reference reach riffle habitats, 33-46% (Figure 8). The Reference reach had the most total coarse woody debris and greater canopy cover (Table 2) than the two other reaches, which may provide additional habitat and food resources for taxa in this reach.

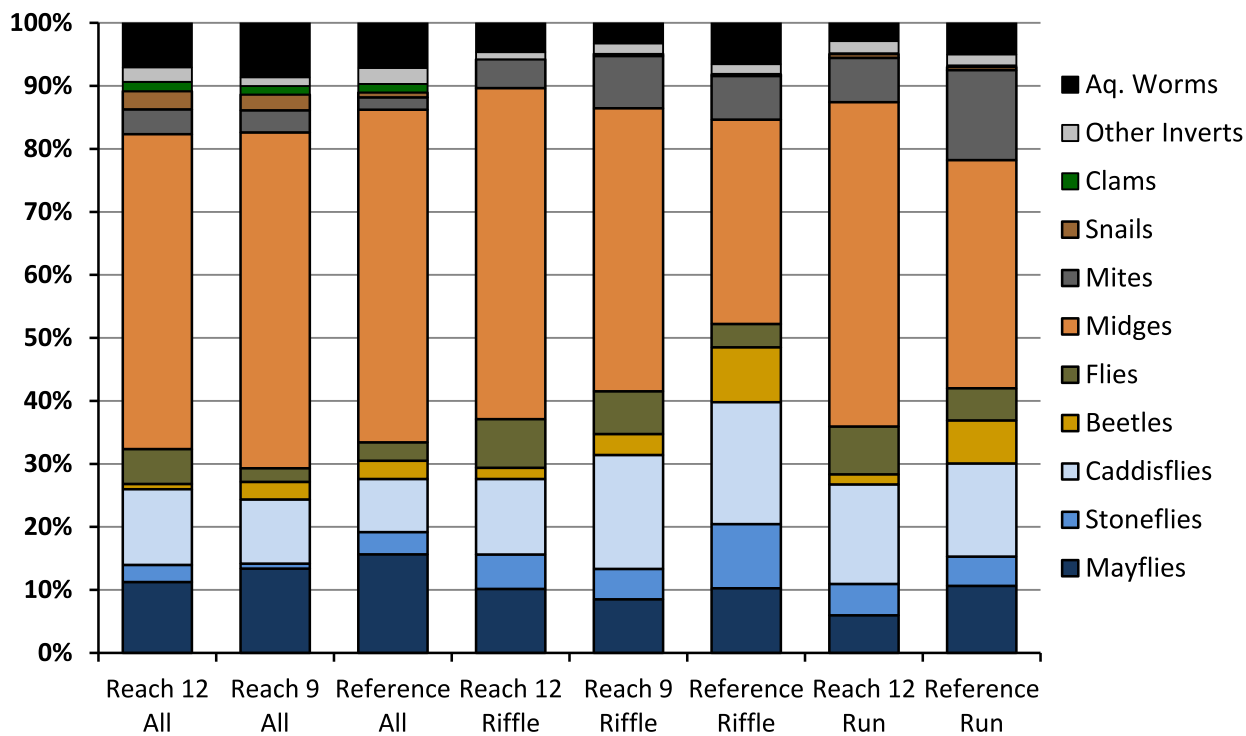

Figure 8. Macroinvertebrate assemblages of each Knife River mainstem reach and major habitat type sampled, presented as proportions of all macroinvertebrates collected. Greater proportions of mayflies, stoneflies, and caddisflies typically indicate better stream conditions.

Mayflies, stoneflies, and caddisflies (EPT), typically considered the most sensitive macroinvertebrate orders, made up 24 to 44% of macroinvertebrates in all habitats sampled (Table 4). EPT taxa composed 27 to 44% of riffle habitat samples, and 24-30% of macroinvertebrate samples from runs and all-habitat samples (Table 4). Riffles have faster-flowing water and often contain more cobble or gravel substrates; these areas typically provide abundant living space among crevices and crannies, along with higher dissolved oxygen and more frequent replenishment of food particles carried by the current. Thus, riffles are almost always the most taxa-rich habitat in a stream system. Combining all samples provides another picture of the total macroinvertebrate richness by reach (Table 5); however, in this comparison richenss is similar across all reaches, indicating the general condition of these reaches is similar.

Table 5. Macroinvertebrate taxa richness by reach for all habitats combined.

	Reach 12	Reach 9	Reference
Mayflies (Ephemeroptera)	13	15	13
Stoneflies (Plecoptera)	9	8	10
Caddsiflies (Trichoptera)	23	22	23
Dragon/damselflies (Odonata)	6	7	7
Beetles (Coleoptera)	2	5	3
Flies (Diptera)	20	19	18
Other insects	4	4	4
Snails (Gastropoda)	3	6	2
Other invertebrates	6	6	6
Total	**86**	**92**	**86**

In terms of tolerant macroinvertebrates, non-biting midges (Chironomidae) composed between 32-53% of total macroinvertebrates collected from each habitat at each site (Figure 8). Midge larvae are often the most abundant and taxa-rich group in aquatic ecosystems, and the percentage of these larvae was similar to other North Shore streams that are considered to be in good conditon. A variety of other types of flies were collected, but they did not compose a large part of most macroinvertebrate assemblages. Other macroinvertebrate groups (snails, clams, worms, etc.) made up quite minor components of the community. Finally, at least 75% of all macroinvertebrates collected in each habitat were insects of some type.

Cumulatively, this information indicates moderate quality macroinvertebrate assemblages in the 3 reaches sampled. The macroinvertebrate assemblage most dominated by macroinvertebrates considered sensitive was collected in the upper most reach, the Reference reach, but assemblages were fairly similar among all reaches. Habitat conditions were also generally similar amongst reaches. However, the Reference reach had some habitat characteristics and conditions that may be slightly better for macroinvertebrate communities and contribute to the slightly higher percentage of EPT taxa in the reach. For example, the Reference reach had a higher MHSA score than other reaches (82 versus 66 and 67) and ranked highly in all MHSA categories. It also had the most stable stream conditions and riffles were dominated by large gravels. Therefore, the slightly better habitat conditions that are more suitable for sensitive EPT taxa may contribute to the higher abundances. In addition, the Reference reach contained more total pieces of coarse woody debris, which provides additional habitat and potential food resources for some taxa. Finally, the Refrence reach was surrounded by more mature riparian trees and canopy. Those trees may contribute more leaf litter (an important food resource) to the reach.

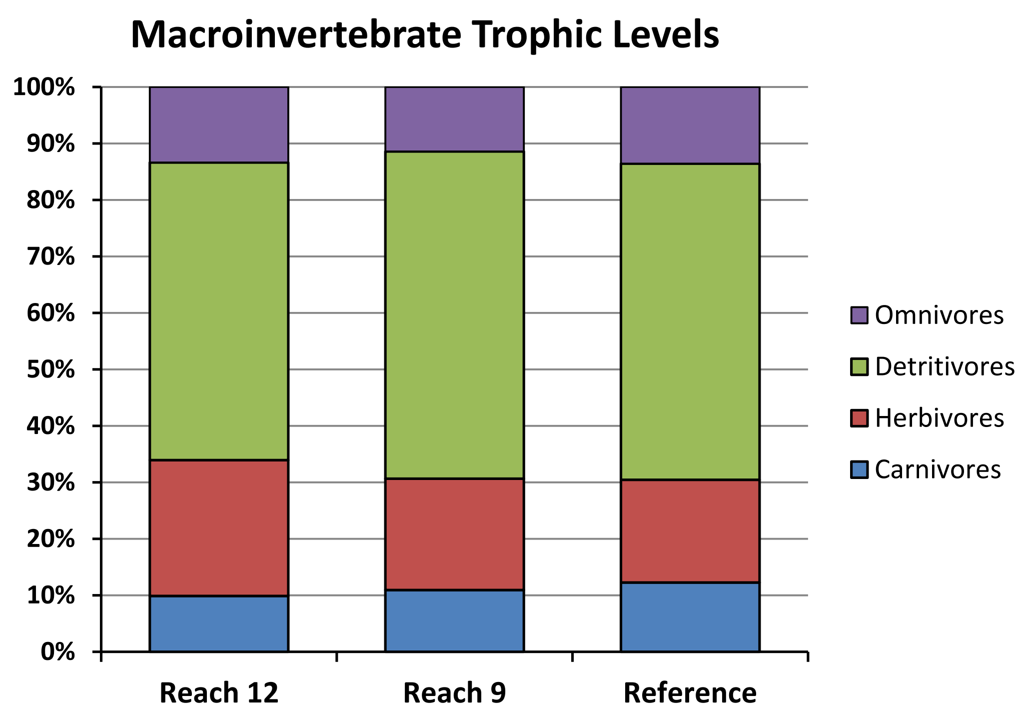

Figure 9. Macroinvertebrate trophic levels of each Knife River mainstem reach sampled, presented as proportions of all macroinvertebrates collected. Generally, the more carnivores a system supports, and the fewer detritivores and omnivores, the higher the quality of the stream.

Another way to examine macroinvertebrate communities is to assign them to their trophic (feeding) levels. This was done at the whole reach level across all habitats (Figure 9). As expected, detritivores (macroinvertebrates that feed on the leftover litter and particles, such as leaf fragments) were the most abundant of the four trophic levels, composing 51-57% of the macroinvertebrates in each reach, followed by herbivores (17-23%), omnivores (11-13%), and finally carnivores (9-12%). These reaches were all quite shaded (between 48%-81% canopy cover), thus limiting the algae that would grow to support herbivores such as snails. As expected, Reach 12, the least shaded reach, contained the highest percentage of herbivores, and the Reference reach, the most shaded reach, contained the least (Figure 9). In contrast, the trees and shading provide leaves for the detritivores, particularly those that are "shredders" and chew up these leaves for food (Figure 10). Carnivores, the predators, are by necessity less abundant than their prey. They range from the obvious and large (e.g., dragonfly larvae) to the surprisingly small (e.g., some midge larvae, tiny mites).

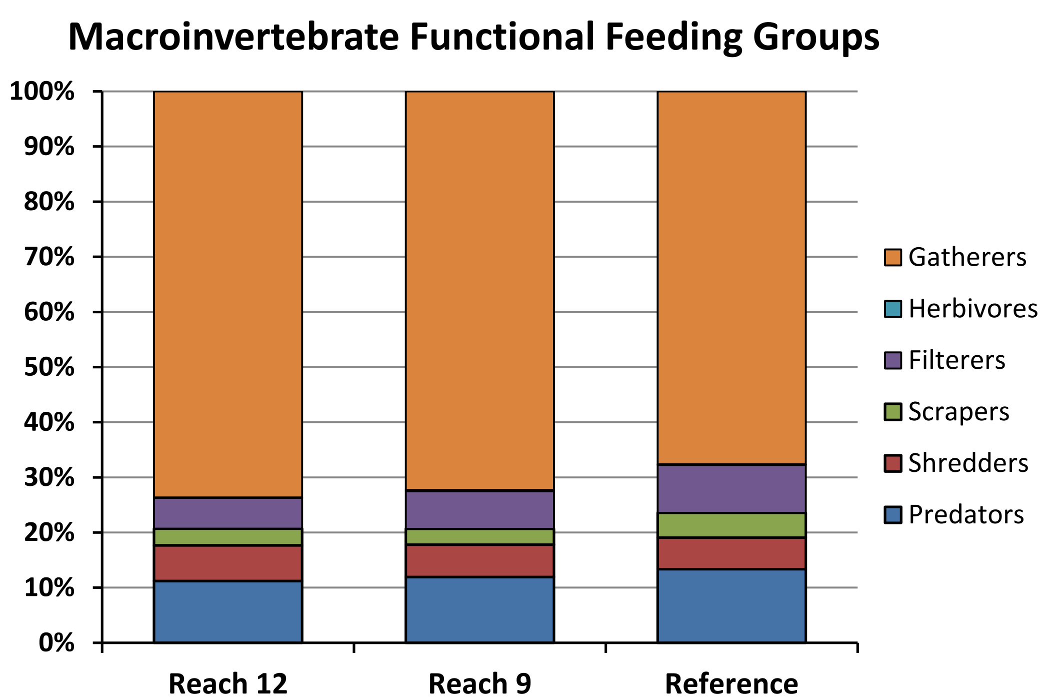

Figure 10. Macroinvertebrate functional feeding groups of each Knife River mainstem reach sampled, presented as proportions of all macroinvertebrates collected. While gatherers are often most abundant, better-condition streams have quite a few predators and shredders.

The mechanisms that macroinvertebrates use to get their food can provide additional clues about the stream and habitat. These "functional feeding groups" (Figure 10) include the herbivores that graze on plant material or they may scrape algae off of stream rocks and other hard surfaces ("scrapers"). Because of the stream shading, neither of these feeding mechanisms is common in the mainstem Knife

River. This indicates that the base of the food web for these reaches is primarily materials from outside the stream that fall into it, most obviously the leaves that drop in the fall and which get colonized by bacteria and fungi and eaten by the detritivores. The tiny pieces of broken down leaves and other food bits are collected from the current by filterers that spin tiny nets or use special fans to filter out food. Slightly larger food particles that settle to the bottom are collected by gatherers (basically scavengers). Because most midge larvae are gatherers, this feeding mechanism will usually be the most common when midges dominate the system. Predators were the second most common feeding group.

Organisms within the shredder functional feeding group can make use of very low-quality food (dead leaves, wood) that other macroinvertebrates cannot digest. This poor quality food often causes their larval stages to be quite extended. For example, between the poor food quality and the short summer season in our region, giant *Pteronarcys* stonefly larvae (a large, leaf-shredding stonefly) require 3 years to reach the adult stage. In streams with good leaf litter, good water quality and habitat, and reaches that do not quit flowing in the summer, it is possible to find all 3 age-classes of *Pteryonarcys* in the same accumulation of fall leaves. *Pteronarcys* larvae are a substantial meal to stream fish and are good indicators; they were found in all three reaches, with slightly higher proportions in the Reference reach, possibly due to higher amounts of leaf litter.

To ensure that samples are comparable when sampled by other methods, and in order to compare absolute numbers (rather than just proportions) collected in each reach, we often extrapolate and convert the numbers collected to number of macroinvertebrates per square meter of stream bottom. These are shown in Table 6. Macroinvertebrate densities can be quite high, both in good and poor quality habitat, with the difference being whether most of the macroinvertebrates are tolerant or sensitive individuals. Examining absolute densities shows that Reach 9, had the highest densities, followed by Reach 12, and then Reference reach. The number of macroinvertebrates supported in a square meter of Reach 9 riffle habitat was almost double that of the Reference reach. However, densities are only a poor estimator of food web support because they do not take into account the size of the macroinvertebrates, which varies from tiny worms about the size of an eyelash to very large alderflies, dragonflies, and stoneflies that may be nearly the size of a small pinky finger. Thus, biomass is the preferred estimate for food web support, but this requires extra laboratory effort and destroys the macroinvertebrates in the process. We are not able to provide biomass estimates; however, because the types of macroinvertebrates were similar in all three reaches it is reasonable to assume that greater abundances likely indicate greater biomass.

Table 6. Extrapolated estimates of numbers of macroinvertebrates in a square meter of stream bottom in each Knife River mainstem reach and major habitat type.

Reach	Habitat	Number per square meter
Reach 12	Riffle	25,189
Reach 12	Run	18,461
Reach 9	Riffle	31,604
Reference	Riffle	16,289
Reference	Run	12,856

The Knife River mainstem reaches sampled for macroinvertebrates all exhibited reasonably-high taxonomic richness, moderate percentages of sensitive macroinvertebrates, moderate percentages of tolerant macroinvertebrates, and trophic level and functional feeding group compositions that were generally dominated by the more tolerant groups. Although we did not analyze their status specifically, these reaches would rank moderately in macroinvertebrate community quality. The Reference reach had the most stable stream conditions and fewer eroding banks than Reaches 12 and 9, which may contribute to the slightly higher quality macroinvertebrate community in this reach. Appendix IV contains complete identifications of all macroinvertebrates.

Fish

Two backpack electrofishing units were used simultaneously to sample fish among all three reaches. In 2016 The NRRI field crew acquired a new ABP-3 electrofishing backpack (aka “Wisconsin pack”) from ETS Electrofishing Systems, LLC in Madision, Wisconsin. The Knife River survey was the first field operation of the new equipment, so backpack settings were sometimes adjusted during surveys as we became more familiar with the new equipment. Electrofishing effectiveness is also influenced by ambient conductivity of the water, rather than specific conductivity (specific conductivity is standardized to 25°C), which is typically recorded during water chemistry surveys. Ambient conductivity can be calculated from specific conductivity in the equation below (T is water temperature in celcius):

$$Ambient\ conductivity = \frac{Scond}{1.023^{(25-T)}}$$

Ambient conductivities were 100.7, 107.5, and 110.9 µS/cm in Reach 12, Reach 9, and the Reference, respectively, which is very low for electrofishing surveys, but not abnormal for MN North Shore streams. Effective fish capture was difficult at our standard 30 Hz frequency typically used for salmonid surveys (AFMD, 2004), so we increased our frequency to 60 Hz and reduced voltage. The NRRI field crew operated a Smith-Root 12-B backpack electrofisher set at 60 hertz, 4 miliseconds, and 500 volts, and the ETS backpack unit was set at 60 hertz, 20% duty, and 400 volts. Fish capture improved with the increased frequency, but slightly higher fish mortality than typical for our team occurred in Reach 9 (Table 7). This may also have been influenced by not finding an ideal location for the holding pen near the middle of Reach 9, as there were not many areas with deeper slow-flowing water.

Table 7. Summary of fish survey by reach. Catch per unit effort (CPUE) standardizes fish catch by the time spent electrofishing.

Electrofishing Measure	Reach 12	Reach 9	Reference
Fish Survey Date	7/25/2016	7/26/2016	7/27/2016
Discharge (m^3/sec)	0.321	0.207	0.271
Discharge (ft^3/sec)	11.34	7.30	9.56
Temperature °C	19.06	18.88	18.61
Temperature °F	66.3	66.0	65.5
Specific Conductivity (µS/cm)	115.3	123.6	128.3
Dissolved Oxygen (%)	114	109.4	107.9
Dissolved Oxygen (mg/L)	10.15	9.75	9.68
pH	7.84	7.69	7.82
Electrofishing Effort (hr)*	4.0	3.8	2.5
Depletion % (pass1 - pass2)	69.3%	68.7%	75.0%
Total Fish	1040	1133	624
Total Trout	457	497	307
Total $CPUE_{fish}$ (all fish/hr)	260.0	298.2	249.6
Total $CPUE_{trout}$ (all trout/hr)	114.3	130.8	122.8
% $Mortality_{total}$	0.9%	5.5%	2.9%

**Effort determined as sum of operating minutes from two depletion passes multiplied by 2 (two units).*

All fish surveys were completed after 2 removal passes because depletion efficiency of large trout (≥100 mm TL) between first and second passes was over 50% among all reaches (Table 7); thus, a 3rd removal pass was not performed in any reach. Reach 9 had the highest numbers of total fish, total trout, and greatest relative abudance of fishes measured as total CPUE (Table 7). Reach 9 began as a large pool right above a rock grade control (Figure 3), which was the most expansive pool among all reaches surveyed. Large pools tend to explain a lot about the total abundance and species richness of surveyed stream reaches, so it was not surprising that Reach 9 also had the greatest number of observed fish species (Table 8). Brook Stickleback, Northern Redbelly Dace, Common Shiner, Central Mudminnow, Johnny Darter, and Fathead Minnow are all typical non-game fish species of North Shore trout streams, but they tend to inhabit large pools or slack water areas. As a result, they are commonly found in reaches with big pools or within beaver-influenced segments with reduced stream flow.

Table 8. Total count of fish taxa captured after 2 electrofishing passes in Knife River mainstem reaches. Shaded boxes indicate these particular fish species were not caught in that reach.

Common Name	Scientific Name	Reach 12	Reach 9	Reference
Brook trout	*Salvelinus fontinalis*	13	22	29
Rainbow trout	*Oncorhynchus mykiss*	383	400	248
Brown trout	*Salmo trutta*	61	75	30
Blacknose dace	*Rhinichthys atratulus*	341	345	177
Brook stickleback	*Culaea inconstans*	1	7	
Central Mudminnow	*Umbra limi*		1	2
Common shiner	*Luxilus cornutus*		6	3
Creek chub	*Semotilus atromaculatus*	19	34	28
Fathead minnow	*Pimephales promelas*		6	1
Johnny darter	*Etheostoma nigrum*		3	4
Longnose dace	*Rhinichthys cataractae*	188	205	64
Northern redbelly dace	*Phoxinus eos*		1	
Pearl dace	*Margariscus margarita*	13	18	31
White sucker	*Catostomus commersonii*	21	10	7
	Species Richness	**9**	**14**	**12**

Blacknose Dace and Longnose Dace were the most abundant non-game fish species encountered among all reaches, which is typical of the Knife River (Dumke *et al.* 2014, 2016) and other North Shore streams (Hassinger *et al.* 1974). Longnose dace have long streamlined bodies and prefer swift riffles with large gravel and cobble substrates with low rates of embeddedness. Reaches 12 and 9 had the most habitats suitable for Longnose dace. White sucker were detected within all reaches (Table 8). White sucker are benthic invertivores and can grow to very large size if they find large pools to inhabit. Stream connectivity is also important to White sucker because they typically migrate from lakes or larger rivers to upstream tributaries to spawn in the spring. All measured non-trout species are summarized together

(Table 9). Appendix V contains the total counts of fish species by each electrofishing pass, and Appendix VI includes data for all measured fish.

Table 9. Summary of all non-trout species captured and measured from two electrofishing passes in all reaches sampled in the Knife River mainstem (Reach 12, Reach 9, and Reference). Included are mean total length (TL) in mm, standard error of the mean (SE), and minimum and maximum length.

Common Name	Collected	Measured	Mean TL	SE	Min TL	Max TL
Blacknose dace	863	61	67.1	1.36	45	104
Brook stickleback	8	7	49.4	2.80	42	65
Central mudminnow	3	3	53.0	4.04	46	60
Common shiner	9	9	92.8	3.00	80	108
Creek chub	81	62	80.5	3.47	42	165
Fathead minnow	7	6	53.7	1.02	50	56
Johnny darter	7	7	68.3	3.43	50	78
Longnose dace	457	72	77.8	2.07	52	120
Northern redbelly dace	1	1	56.0	NA	56	56
Pearl dace	62	56	81.3	1.97	51	107
White sucker	38	38	125.7	6.38	76	224

Examination of the proportions of fish species collected within each reach demonstrates fish assemblages were similar amongst reaches (Figure 11). The proportion of trout to non-trout was nearly identical, and ranged from 44-49% salmonids (Figure 11). The proportions of just trout species were also very similar among reaches (Figure 12). One difference noticed in our 2016 survey of the Knife River mainstem was a greater abundance of Brown Trout than observed in prior surveys (Dumke *et al.* 2014, 2016). It appears Brown Trout prefer to occupy the lower segments of the Knife River where there is more sustained flow compared to upstream tributaries. In contrast, Brook Trout were encountered in relatively low numbers throughout our 2016 survey, but their numbers increased gradually as we progressed upstream. This matches data from prior surveys, which indicate Brook Trout become proportionally more dominant as surveys progress from the mainstem into small tributaries (Dumke *et al.* 2014, 2016). Rainbow Trout were the most abundant salmonid encountered in both total numbers (Table 8) and proportion (Figures 11 &12) among all Knife River mainstem reaches surveyed in 2016.

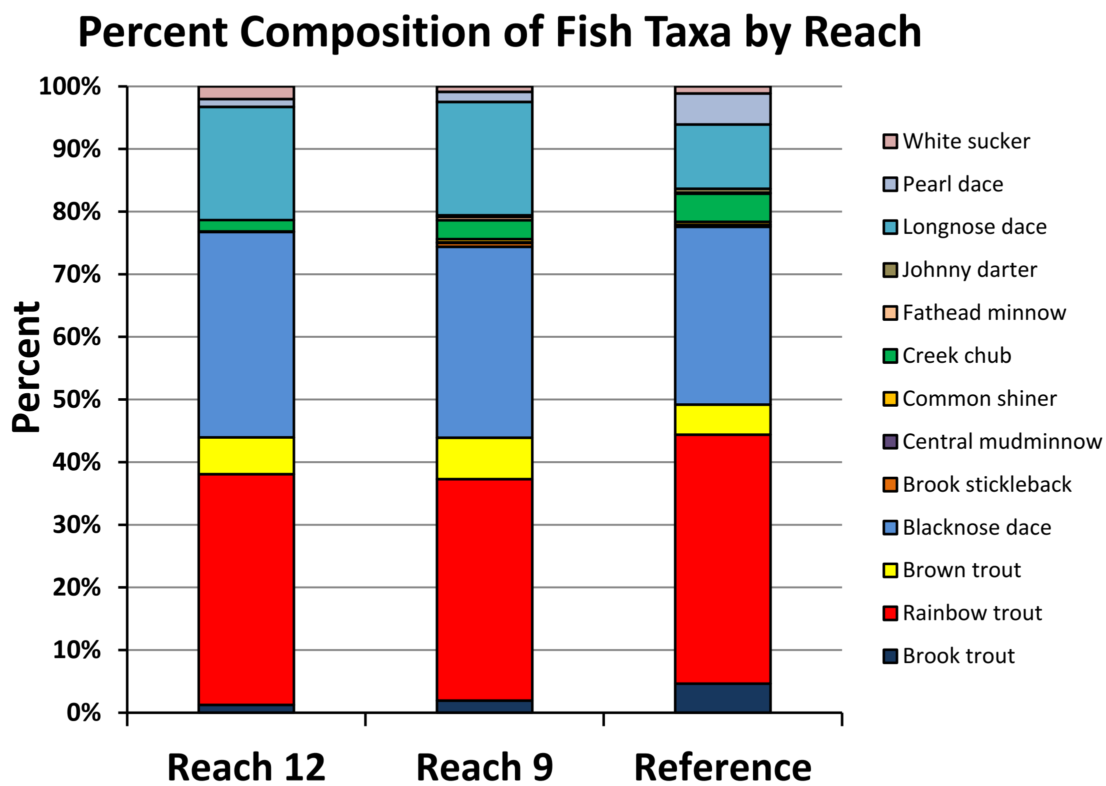

Figure 11. Percent composition of fish taxa collected from two electrofishing passes of each reach. Note that Northern redbelly dace are omitted because only one was captured in Reach 9.

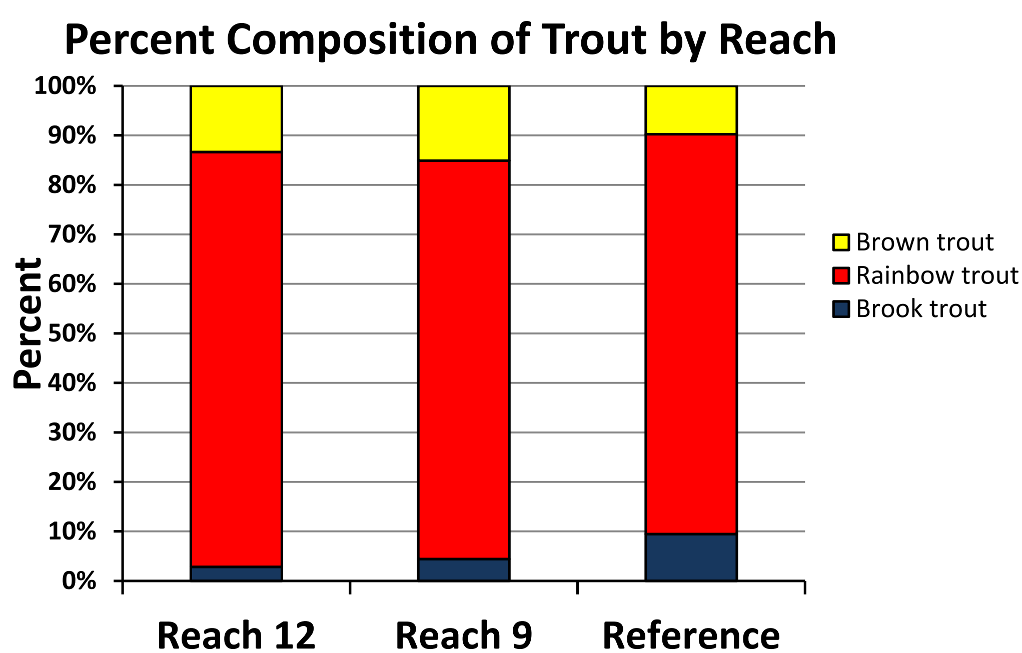

Figure 12. Percent composition of just trout species collected from two electrofishing passes.

Lengths and weights of trout were recorded so additional analyses were possible. Since we did not age fish directly, we used the total length of trout from all reaches to create histograms that allowed us to estimate abundance of age0 (young-of-year) and age1+ (all fish age 1 and older) trout. A histogram displays the frequency at which the same values occur in a dataset. Pooling the fish data from all reaches was necessary because we did not capture enough fish to do this analysis for individual reaches. Fish were identified and assigned an estimated age in the field to accompany measurements or total counts. This ensured we would measure enough individuals per age class for analysis and add counts of fish not measured into the correct age assignment. However, the separation of age0 and age1+ is not truly known until all fish are plotted in a histogram. When the frequency of measured trout from all reaches was plotted in 5 mm length bins, we found that the correct length to separate age0 and age1+ trout in our late-July survey was at about 75 mm TL for all species (Figure 13).

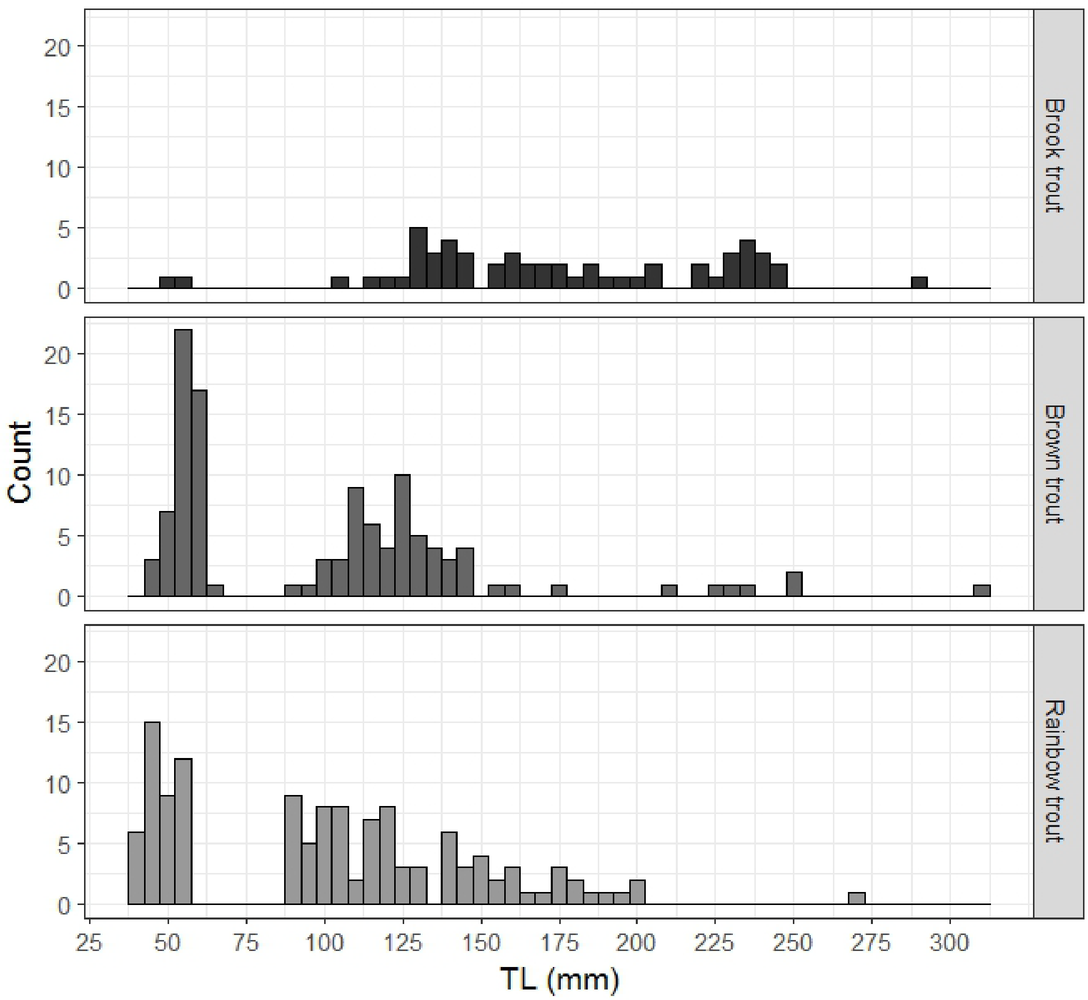

Figure 13. Histogram of all trout measured among all reaches in 5 mm length bins. Total measured brook trout = 56, brown trout = 113, and rainbow trout = 126.

The number of Brook and Rainbow trout present in stream reaches is often not accurately estimated by only comparing total numbers of individuals captured. This is because a 2-pass removal does not deplete all fish from a reach, so we use a model to estimate the total number of fish likely to be in the population based on how effective we were at capturing fish from passes 1 and 2. Population estimates and 95% confidence intervals were calculated for all trout and age class's using the FSA package in R statistical software, which uses a maximum likelihood model from Carle and Strub (1978) that was determined to be more accurate and robust against assumption violations (Ogle 2016b). The greatest Brook Trout age1+ population estimate was in the Reference reach, which was the farthest upstream reach surveyed and had the greatest canopy cover (Figure 14). However, there were very few age0 Brook Trout captured in any of the reaches, which indicates this segment of the Knife River is not being selected by Brook Trout for reproduction.

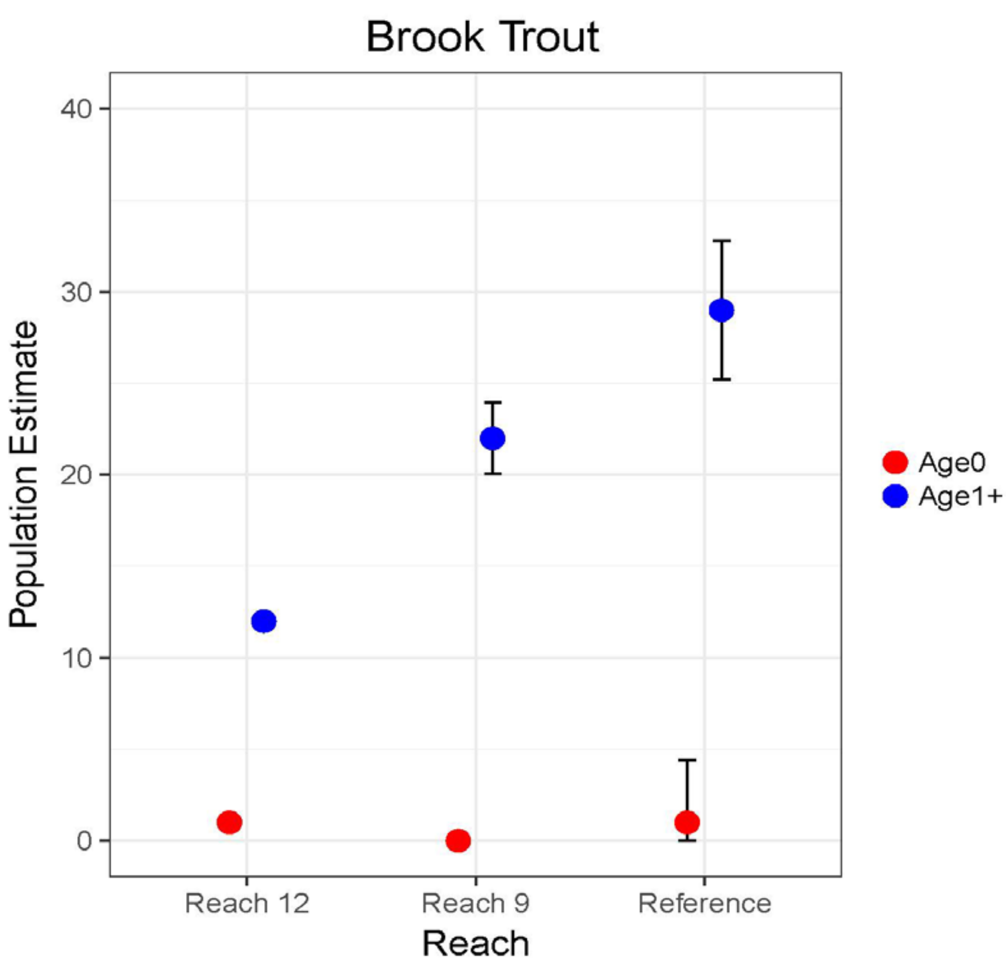

Figure 14. Population estimates of Brook Trout age0 and age1+ fish for all reaches. Error bars are upper and lower 95% confidence intervals. Note that only 2 age0 Brook Trout were captured in our surveys.

Brown Trout age0 and age1+ fish were present in all of the surveyed reaches. Interestingly, while age1+ Brook Trout populations increased from Reach 12 to the upstream Reference (Figure 14), Brown Trout age1+ population estimates decreased (Figure 15). We do not have enough information to determine whether this is due to habitat suitability differences between the species, competition, or simply coincidence (however, in nature inverse relationships are rarely coincidences). The presence of 10-40 age0 Brown Trout among all reaches indicates adults are utilizing these segments of the Knife River mainstem for spawning.

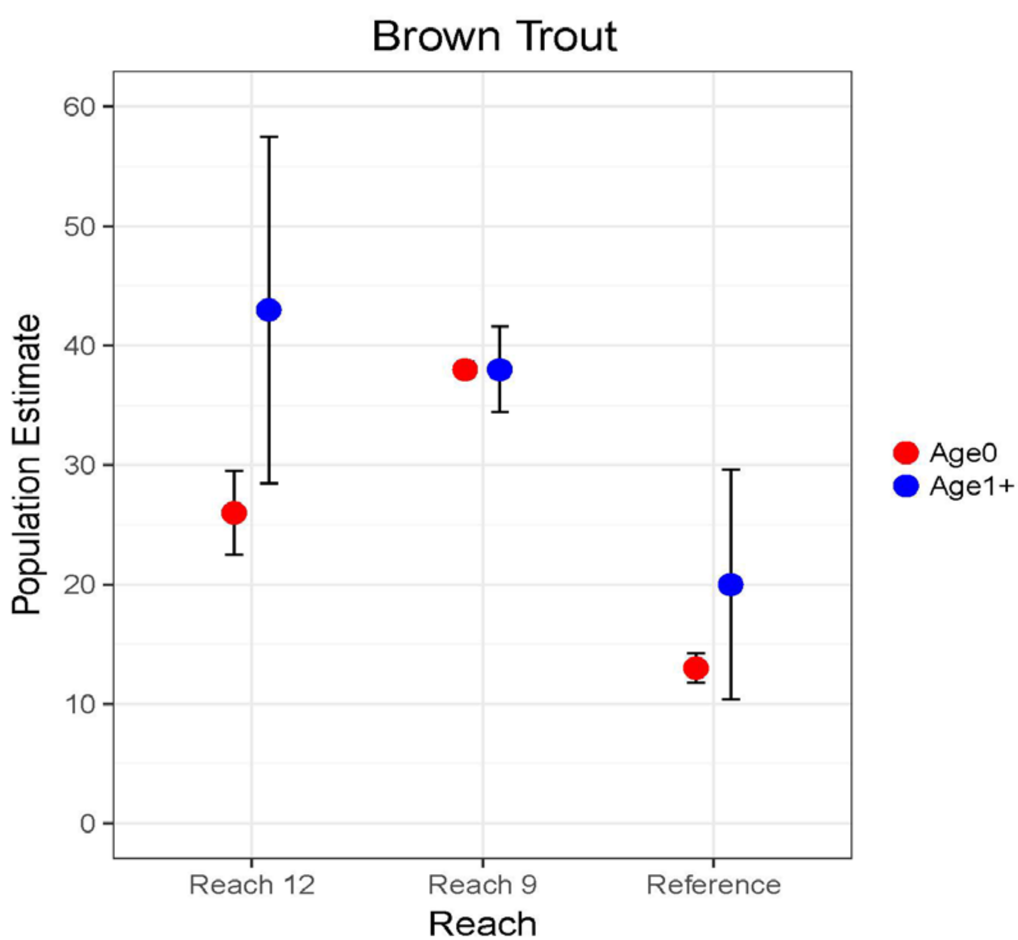

Figure 15. Population estimates of Brown Trout age0 and age1+ fish for all reaches. Error bars are upper and lower 95% confidence intervals.

Rainbow Trout were the most abundant salmonid among all reaches (Figure 16). The Reference reach had the lowest estimate of age0 Rainbow Trout, but the error was large enough that we cannot be certain there is a true difference from Reaches 12 or 9. Our capture efficiency was high for age1+ individuals because they were easier to see in the deep water. Many of the small age0 fish were very difficult to see in the large pool at the upstream end of the Reference reach, which reduced our capture efficiency of this age class.

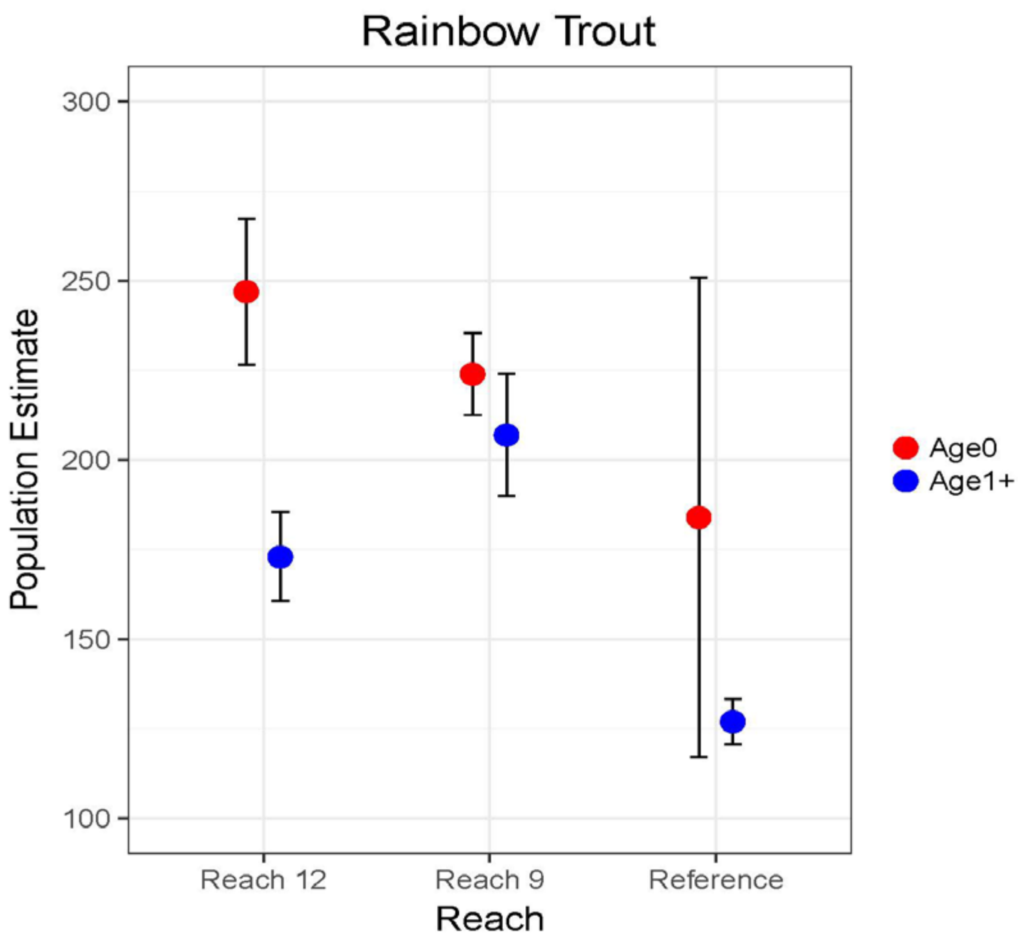

Figure 16. Population estimates of Rainbow Trout age0 and age1+ fish for all reaches. Error bars are upper and lower 95% confidence intervals.

There are other ways to compare trout populations among reaches besides the observed totals or estimated population size. Comparing the mean lengths and weights of fish from each reach, by age class, can provide information about whether the habitat, food abundance, and water temperatures may influence growth. Separation between age0 and age1+ for all trout was determined to be at 75 mm TL for all species (Figure 13). Little information can be inferred from age0 Brook Trout, as only two individuals were captured among all three reaches (Table 10). However, the assemblage of age1+ Brook Trout was comprised of longer and heavier fish as we progressed from downstream to upstream reaches (Table 10). There were two relatively large pools within the Reference reach that also had coarse woody debris (Appendix I), which is the prefered habitat of large-bodied brook trout.

Table 10. Mean total length (TL) and total weight (TW) of Brook Trout age0 and age1+ fish measured by reach. Sample size of measured fish (n) is provided, with means in bold and standard error in parentheses: **mean** (SE). A difference in n between TL and TW indicates fish escaped before weighing.

	Brook Trout age0				Brook Trout age1+			
	n	TL (mm)	n	TW (g)	n	TL (mm)	n	TW (g)
Reach 12	1	**48.0** (NA)	0	**NA** (NA)	12	**158.0** (12.9)	10	**34.4** (9.7)
Reach 9	0	**NA** (NA)	0	**NA** (NA)	20	**176.3** (8.9)	18	**58.1** (11.0)
Reference	1	**55.0** (NA)	1	**1.0** (NA)	22	**194.0** (9.7)	18	**86.3** (15.8)

Brown Trout age0 and age1+ fish were fairly similar in length and weight among all reaches (Table 11). This was also observed for the populations of Rainbow Trout (Table 12). Most of the age0 Rainbow Trout were similar in length, but it should be noted there is likely error in the weight data for age0 individuals. Our survey occurred in late-July, which is earlier than we typically perform surveys and the age0 Rainbow Trout were fairly small because they are the only spring-spawning salmonid in North Shore streams. The scale we used in the field to weigh fish was not accurately reading weights of individual fish because they were so small, and while we have included the average weights in Table 12, we have omitted Rainbow Trout age0 weights from further analysis.

Table 11. Mean total length (TL) and total weight (TW) of brown trout age0 and age1+ fish measured by reach. Sample size of measured fish (n) is provided, with means in bold and standard error in parentheses: **mean** (SE). A difference in n between TL and TW indicates fish escaped before weighing.

	Brown Trout age0				Brown Trout age1+			
	n	TL (mm)	n	TW (g)	n	TL (mm)	n	TW (g)
Reach 12	18	**55.2** (1.1)	17	**1.2** (0.1)	24	**141.1** (10.8)	**23**	**28.7** (7.5)
Reach 9	19	**54.9** (0.8)	17	**1.2** (0.1)	22	**135.9** (8.1)	**19**	**32.3** (8.6)
Reference	13	**56.6** (1.1)	13	**1.3** (0.1)	17	**132.2** (8.2)	**17**	**26.6** (8.5)

Table 12. Mean total length (TL) and total weight (TW) of rainbow trout age0 and age1+ fish measured by reach. Sample size of measured fish (n) is provided, with means in bold and standard error in parentheses: **mean** (SE). A difference in n between TL and TW indicates fish escaped before weighing.

	Rainbow Trout age0				Rainbow Trout age1+			
	n	TL (mm)	n	TW (g)	n	TL (mm)	n	TW (g)
Reach 12	13	**49.5** (1.4)	13	**0.9** (0.1)*	28	**120.4** (4.9)	27	**18.4** (3.0)
Reach 9	12	**48.2** (1.3)	11	**1.0** (0.1)*	32	**135.2** (7.8)	28	**31.9** (7.6)
Reference	17	**47.1** (1.4)	15	**0.6** (0.05)*	24	**129.6** (5.5)	22	**22.7** (3.0)

**Rainbow Trout age0 were often too-small to get confident weights with our field scale.*

Comparisons of fish length and weight as individual metrics are helpful, but not completely informative because individual fish fitness involves both length and weight simultaneously (i.e., is a fish “fat” or “lean” for its length?). Several fitness measures exist, but we selected Fulton’s Condition Factor (K) because it is relatively simple to compute with observed TL and TW data. Fulton’s K is a relative scale where higher K means improved condition (essentially, higher K means a fish is heavier than another fish of equal length). For entire-reach comparisons we maintained our speciation of salmonids, and also our age classifications of age0 and age1+ to keep our comparisons among the same species and within similar length ranges. Age0 Brook Trout were omitted from this analysis due to low sample size, and age0 Rainbow Trout were omitted due to expected errors in weight. One-way ANOVA were used to determine significant differences between means, and are indicated within plots as non-matching letters denoting a significant difference (Figure 17). The only difference noticed among all species and ages in this analysis was age1+ Brook Trout experienced increased K as reaches progressed upstream (Figure 17), which is a similar result found in Dumke *et al.* (2016). While Brook Trout age1+ K was significantly higher in the Reference when compared to Reach 12, we did not find any significant differences among Brown Trout or Rainbow Trout.

In prior investigations we have plotted the $\log_{10}$ transformed lengths and weights of measured age1+ trout to examine if Knife River trout species accumulate body mass equally. We found that age1+ trout weight is predicted very well by fish length (Dumke *et al.* 2016). This conclusion was supported by very high R^2 values of 0.97 (which means 97% of the variability in trout weight is explained by their length). We found similar results from the length and weight data collected during our 2016 surveys, with R^2 values 0.98 to 0.99 among all observed trout species. Trout length and weight are plotted with normal values in Figure 18, so sizes of fish captured are easier to review.

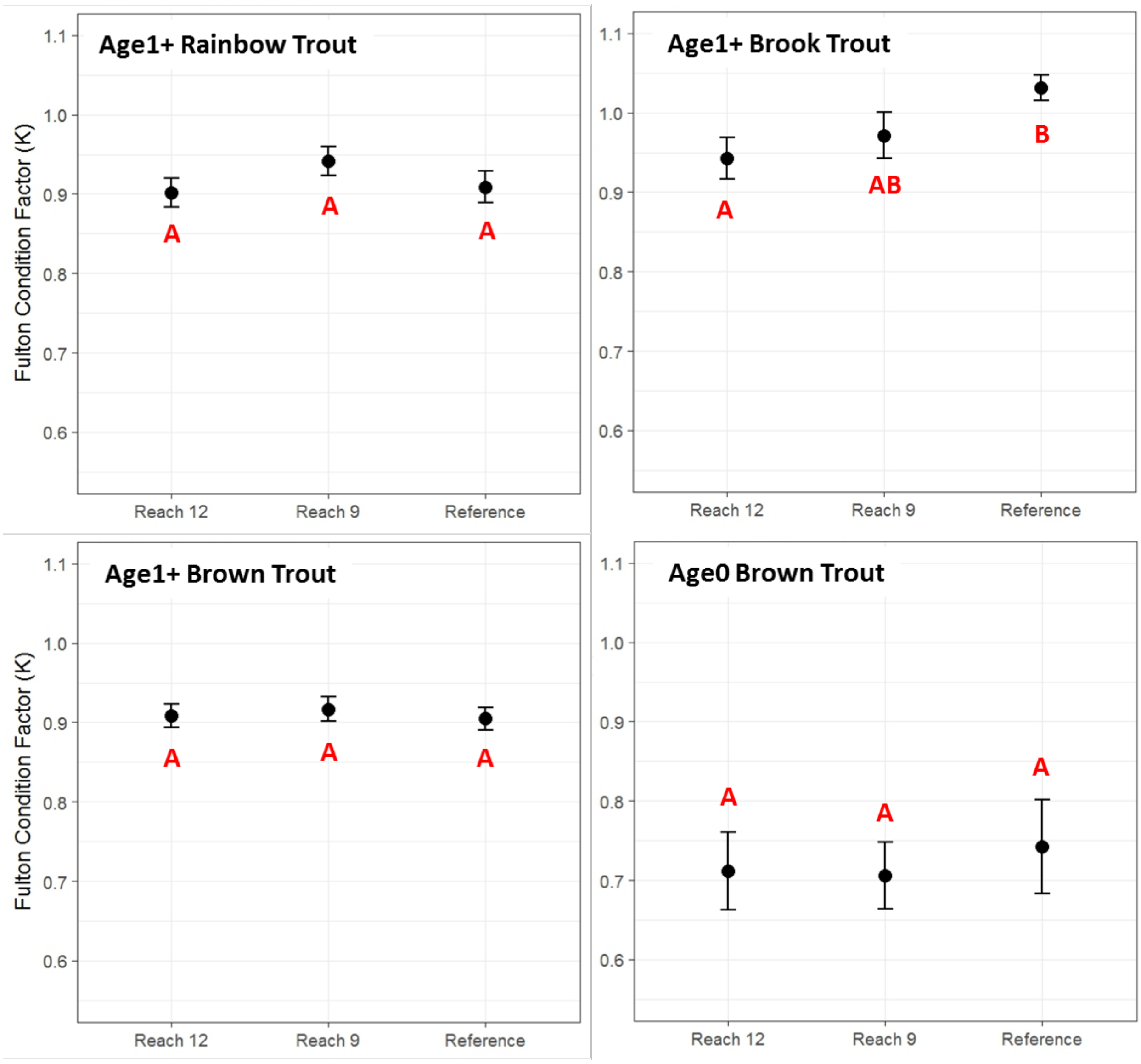

Figure 17. Mean condition factor (K) per reach with SE error bars. Significant differences (ANOVA, p<0.05) of mean fish condition are indicated by different letters within each plot box.

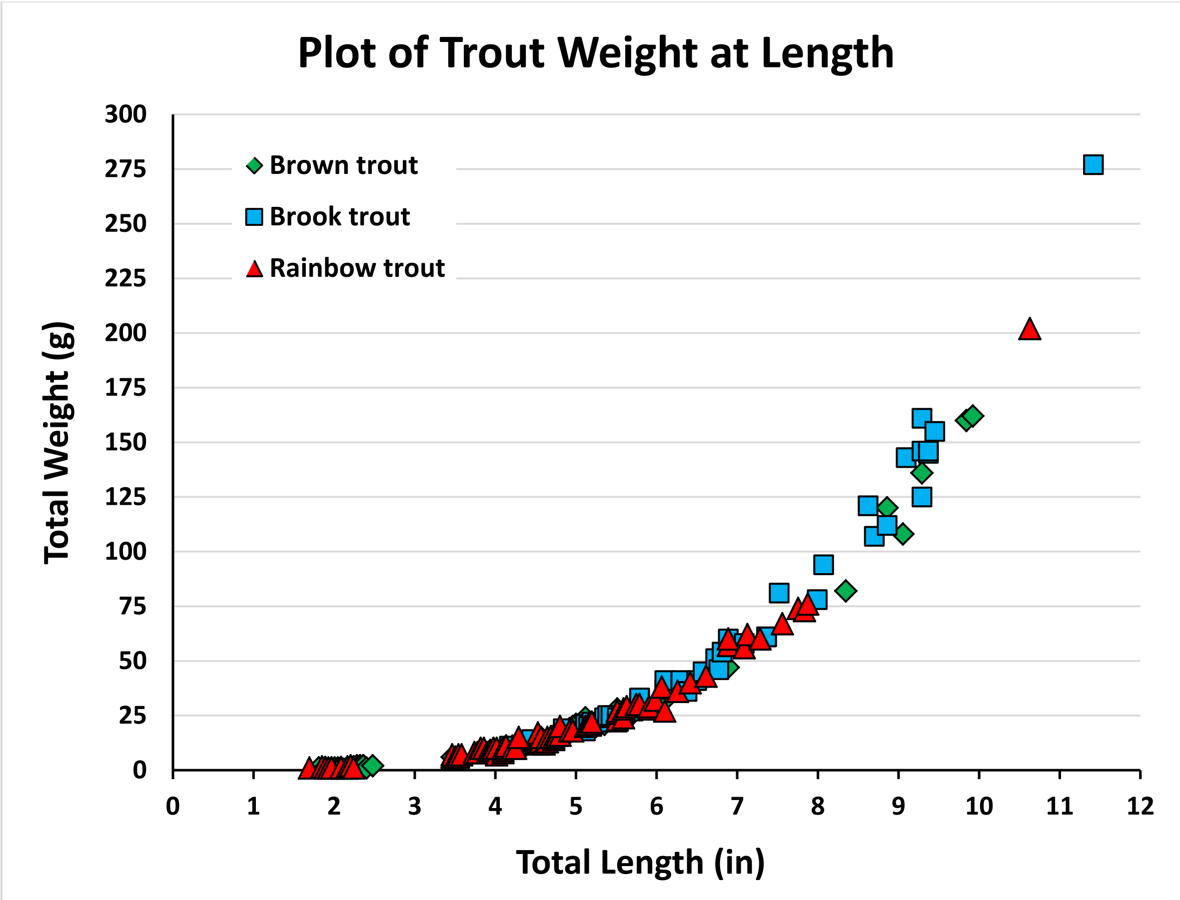

Figure 18. All measured Brook, Brown, and Rainbow Trout length and weight XY scatter plot, with length converted to inches. Fish weighing less than 1 gram are omitted, as is the largest Brown Trout, which escaped before being weighed.

Reach Summaries

Reaches 12 and 9 were very similar in most comparisons, which was expected because they were located in a continuous section of the Knife River. Most habitat measures were not different between the two reaches, so it is logical that the macroinvertebrate and fish communities are also relatively comparable. Importantly, we surveyed Reach 12 and Reach 9 before any of the stream improvement work was initiated, so we have true pre-treatment data that will be invaluable in the future. When these surveys of habitat and biota are repeated in a post-treatment analysis, it will be possible to use the pre-treatment data reported here to examine how the stream modifications affect the channel and the creatures that live within it. Long-term valuation of stream construction projects intended to improve aquatic habitat are not often performed, so this is a unique opportunity to evaluate results through a pre-to-post comparison.

However, it would not be possible to attribute observed changes in the stream channel or biota to the treatment without the Reference reach. Streams undergo natural change over time, but we can account for natural change by resurveying the Reference reach inconjuction with the post-treatment survey and analysis of Reach 12 and Reach 9. Overall, we found that all reaches were strikingly-similar. A few measures indicated better conditions in the Reference reach, which is likely because the Reference reach was not impacted by an unstable channel and eroding stream banks. The Reference reach metrics differed from the other reaches with significantly greater canopy cover, higher MSHA scores, greater proportion of EPT macroinvertebrate taxa, and more Brook Trout. Many of those metrics are related to stream channel stability, pool quality, and presence of coarse woody debris. The results presented here indicate the Reference reach will be an adequate segment for later comparisons when post-treatment surveys of Reach 12 and Reach 9 are performed.

Acknowledgements

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Literature Cited

AFMD (Alberta Fisheries Management Division). 2004. Electrofishing Policy Respecting Injuries to Fish. Environmental and Sustainable Resource Development. Government of Alberta, Canada.

Carle, F.L. and Strub, M.R. 1978. A new method for estimating population size from removal data. Biometrics, 34:621-630.

Dumke, J.D., V.J. Brady, R.V. Hell. 2013. Standard Operating Procedure (SOP); Aquatic Invertebrate Collection, Habitat Assessment, and Laboratory Sample Processing. NRRI/TR-2013/42.

Dumke, J.D., V.J. Brady, H.A. Wellard-Kelly. 2014. Assessment of habitat and biota in the West branch of the Knife River, MN. NRRI/TR-2014/10.

Dumke, J.D., and V.J. Brady. 2016. Overview of Stanley Creek and Assessment of Habitat and Biota in the Knife River Mainstem, MN. NRRI/TR-2016/08.

Froese, R. 2006. Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. Journal of Applied Ichthyology, 22:241-253.

Hassinger, R.L., J.G. Hale, and D.E. Woods. 1974. Steelhead on the Minnesota North shore. Minnesota Department of Natural Resources, Section of Fisheries Technical Bulletin 11, St. Paul, MN.

Leopold, L.B., M.G. Wolman, J.P. Miller. 1964. Fluvial processes in geomorphology. Freeman Company. St. Louis, MO. 522 pp.

Merritt, R.W., K.W. Cummins, and M.B. Berg. 2008. An introduction to the Aquatic Insects of North America, 4th ed. Kendall/Hunt Publishing Co., Dubuque, Iowa. 1158 pp.

MPCA (Minnesota Polution Control Agency). 2014. MPCA stream habitat assessment (MSHA) protocol for stream monitoring sites. Biological Monitoring Program. https://www.pca.state.mn.us/sites/default/files/wq-bsm3-02.pdf

Ogle, D.H. 2016a. FSA: Fisheries Stock Analysis. R package version 0.8.5.

Ogle, D.H. 2016b. Introductory Fisheries Analyses with R. CRC Press. Boca Raton, FL. 317 p.

Platts, W.S., W.F. Megahan, G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. U.S. Forest Service General Technical Report INT-138.

Rankin, E.T. 2006. *Methods for assessing habitat in flowing water: using the qualitative habitat evaluation index (QHEI)*. Ohio Department of Environmental Protection. Groveport, Ohio. Technical Bulletin EAS/2006-06-1.

R Core Team. 2015. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Rosgen, D.L. 1994. A classification of natural rivers. Catena, 22:169-199.

Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

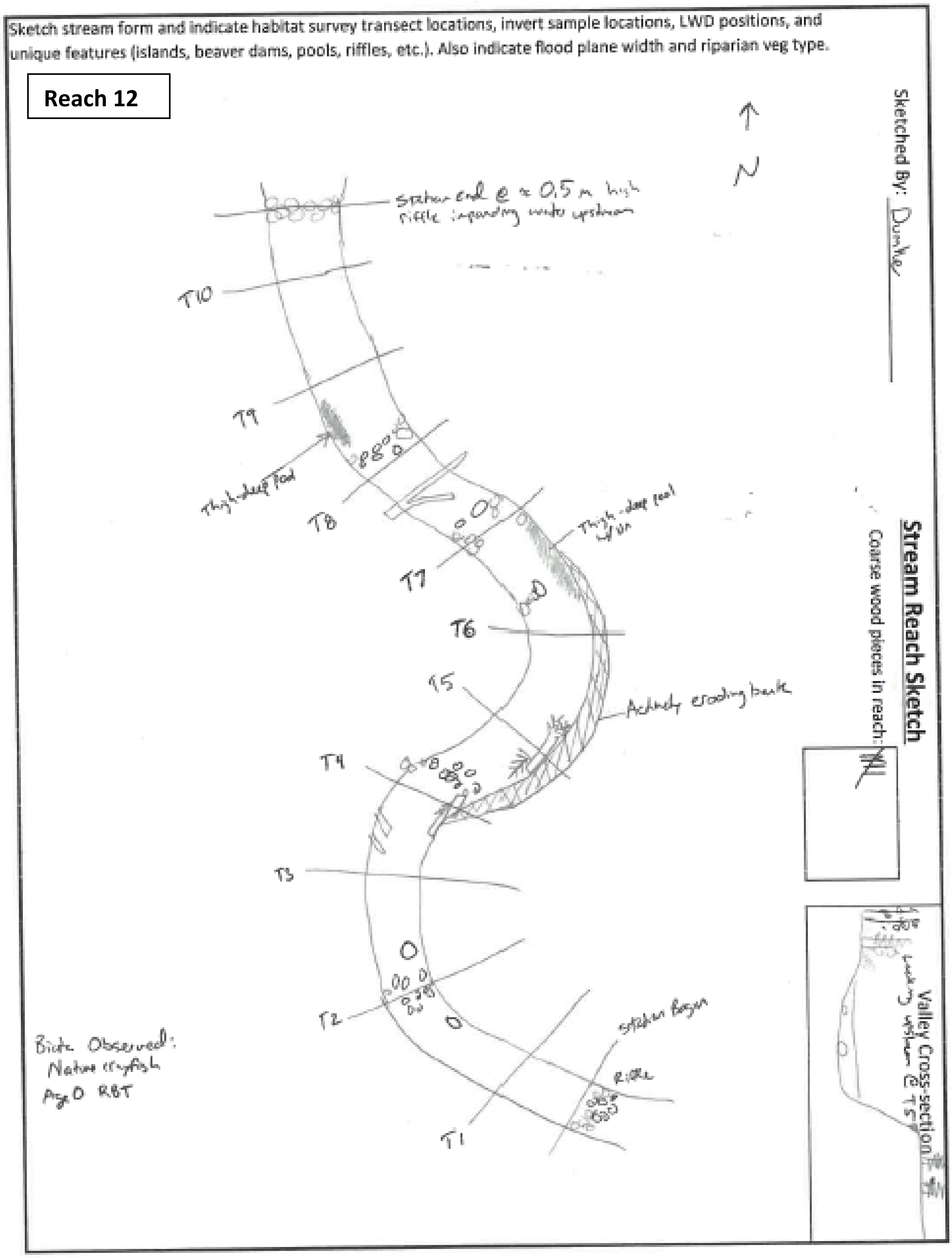
Schreiner, D.R. [ED]. 1992. North shore steelhead plan. Minnesota Department of Natural Resources, St. Paul, MN.

Schreiner, D.R. [ED]. 2003. Rainbow trout management plan for the Minnesota waters of Lake Superior. Minnesota Department of Natural Resources Special Publication 157, St. Paul, MN. 17 pp.

Thorp, J.H. and A.P. Covich. 2010. Ecology and Classification of North American Freshwater Invertebrates, 3rd ed. Academic Press, Inc. 1021 pp.

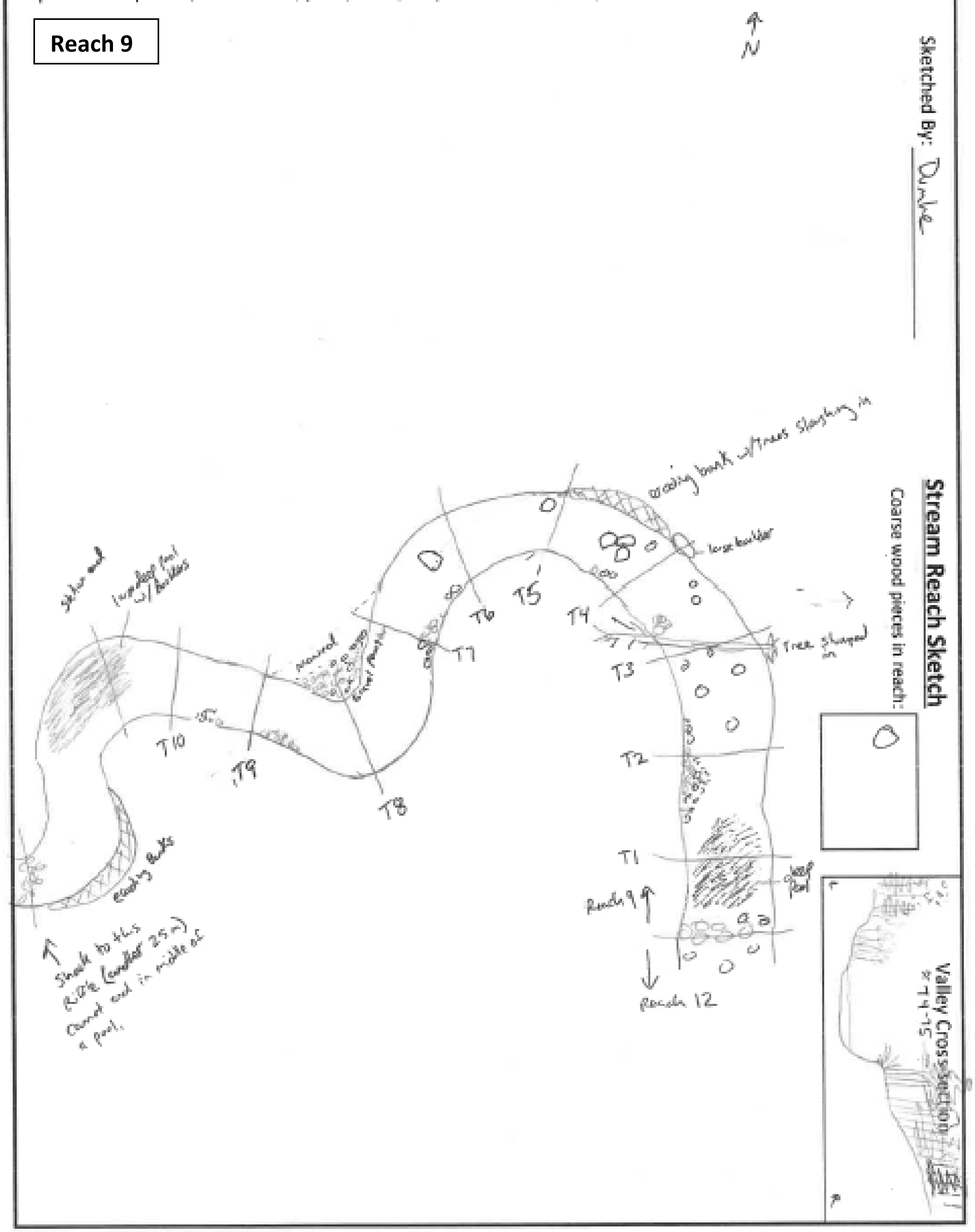
Wiggins, G.B. 1996. Larvae of the North American Caddisfly Genera (Trichoptera). University of Toronto Press Inc., Toronto, Canada.

Appendix I. Stream reach sketch maps made during habitat surveys of mainstem Knife River.

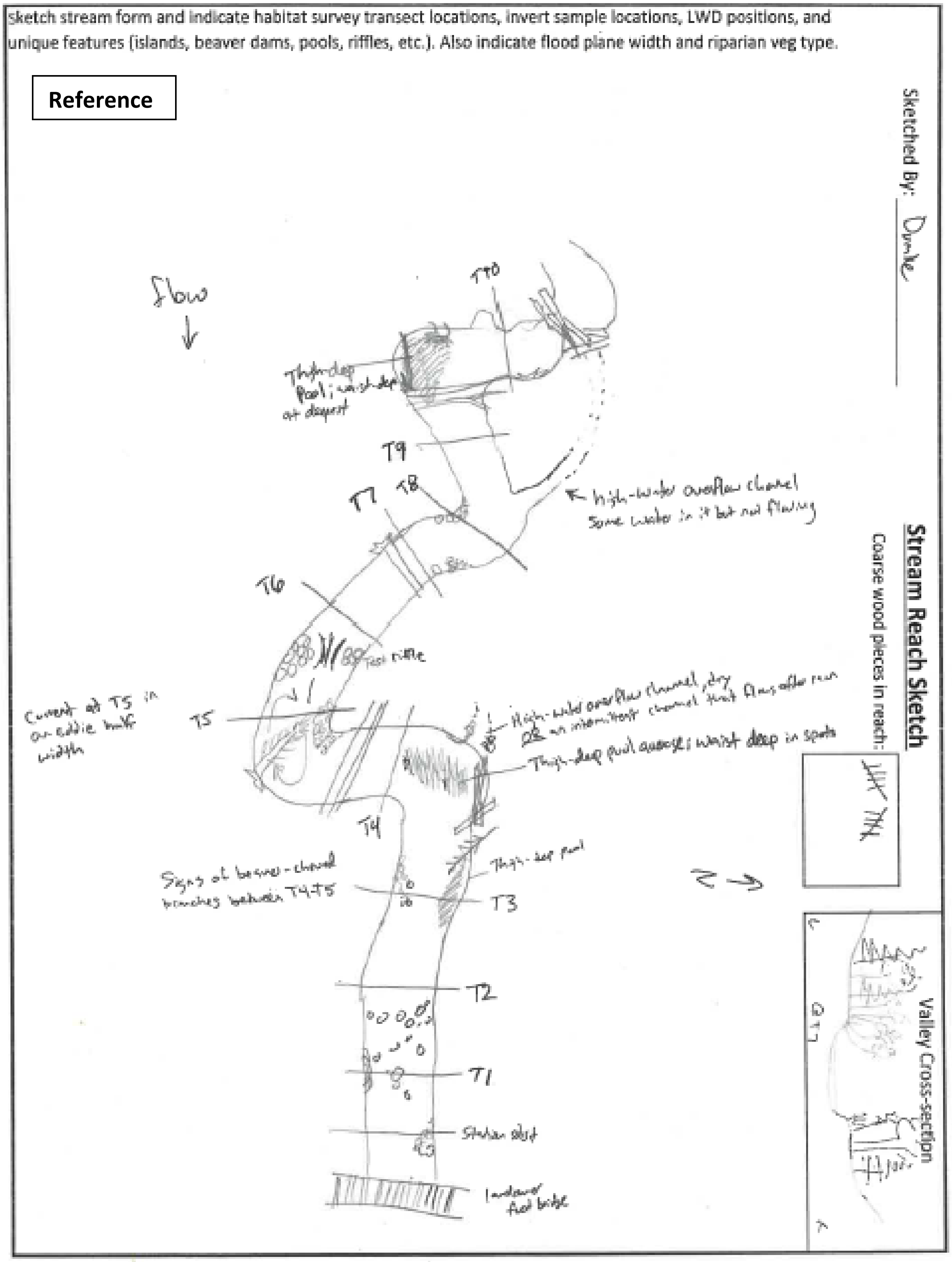


Appendix I. (continued)

Sketch stream form and indicate habitat survey transect locations, invert sample locations, LWD positions, and unique features (islands, beaver dams, pools, riffles, etc.). Also indicate flood plane width and riparian veg type.



Appendix I. (continued)



Appendix II. MPCA Stream Habitat Assessment (MSHA) scoring datasheets

MPCA STREAM HABITAT ASSESSMENT (MSHA)

(revised April 2014)

1. Stream Documentation

Field Number: Reach 12 Stream Name: Knife River Date: 7-19-16

Person Scoring: Dunke Water Level (circle one): Flood / High / **(Normal)** / Low / Interstitial (slightly high)

MSHA SCORE: 67.9 Max=100

2. Surrounding Land Use (Streams) or Floodplain Quality (Rivers)

(check the most predominant or check two and average scores) [L=left bank/R =right bank, facing UP-stream]

L	R			L	R		
☒	☒	Forest, Wetland, Prairie, Shrub	[5]	☐	☐	Diked Wetland	[2]
☐	☐	Old Field/Hay Field	[3]	☐	☐	Urban/Industrial	[0]
☐	☐	Fenced Pasture	[2]	☐	☐	Open Pasture	[0]
☐	☐	Residential/Park	[2]	☐	☐	Mining/Construction	[0]
☐	☐	Conservation Tillage, No Till	[2]	☐	☐	Row Crop	[0]

Land Use: 5 Max=5

3. Riparian Zone (check the most predominant)

A. Riparian Width ≈ 4.5

L	R			
☒	☐	Extensive	> 100 m	[5]
☐	☒	Wide	50-100 m	[4]
☐	☐	Moderate	10-50 m	[3]
☐	☐	Narrow	5-10 m	[2]
☐	☐	Very Narrow	1-5 m	[1]
☐	☐	None		[0]

B. Bank Erosion ≈ 2.0

L	R			
☐	☐	None		[5]
☒	☐	Little	5-25%	[4]
☐	☐	Moderate	25-50%	[3]
☐	☐	Heavy	50-75%	[1]
☐	☒	Severe	75-100%	[0]

C. Shade

L	R			
☐	☐	Heavy	>75%	[4]
☒	☒	Substantial	50-75%	[3]
☐	☐	Moderate	25-50%	[2]
☐	☐	Light	5-25%	[1]
☐	☐	None		[0]

Riparian: 9.5 Max=14

4. Instream Zone

A. Substrate (check two for each channel type)

	Boulder [10]	Cobble [9]	Gravel [8]	Sand [6]	Clay [5]	Bedrock [5]	Silt [2]	Muck [1]	Detritus [1]	Sludge [0]	Channel Type %
Pool	☐	☐	☒	☒	☐	☐	☐	☐	☐	☐	20 2.8
Riffle	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	35 5.95
Run	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	45 7.65
~~Glide~~	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Note	☒	☒	☒	☒	☒	☒	☒	☐	☐	☐	Presence 16.4

B. Embeddedness

- ☐ None [5]
- ☒ Light 25-50% [3]
- ☐ Moderate 50-75% [1]
- ☐ Severe 75-100% [-1]
- ☐ No coarse substrate [0]

C. Siltation

- ☐ Silt Free [1]
- ☒ Silt Normal [0]
- ☐ Silt Moderate [-1]
- ☐ Silt Heavy [-2]

D. Substrate Types

- ☒ ≥4 [2]
- ☐ <4 [0]

Substrate: 21.4 Max=28

E. Cover Type (check all that apply)

- ☒ Undercut Banks [1]
- ☐ Overhanging Vegetation [1]
- ☒ Deep Pools [1]
- ☒ Logs or Woody Debris [1]
- ☒ Boulders [1]
- ☒ Rootwads [1]
- ☐ Oxbows, Backwaters [1]
- ☒ Shallows (in slow water) [1]
- ☐ Macrophytes [1]
  - ☐ Submergent
  - ☐ Emergent
  - ☐ Floating Leaf

F. Cover Amount (check one)

- ☐ Extensive >50% [9]
- ☐ Moderate 25-50% [7]
- ☒ Sparse 5-25% [3]
- ☐ Nearly Absent [0]
- ☐ Choking Vegetation only [-1]

Cover: 9 Max=18

5. Channel Morphology

A. Depth Variability

- ☒ Greatest Depth >4X Shallow Depth [4]
- ☐ Greatest Depth 2-4X Shallow Depth [2]
- ☐ Greatest Depth <2X Shallow Depth [0]

B. Channel Stability

- ☐ High [9]
- ☐ Moderate/High [6]
- ☒ Moderate [3]
- ☐ Low [0]

C. Velocity Types (check all that apply)

- ☒ Fast [1]
- ☒ Moderate [1]
- ☒ Slow [1]
- ☐ Eddies [1]
- ☐ Torrential [-1]
- ☐ None [-1]
- ☐ Interstitial [-1]
- ☐ Intermittent [-2]

D. Sinuosity

- ☐ Excellent [4]
- ☒ Good [3]
- ☐ Fair [2]
- ☐ Poor [0]

E. Pool Width/Riffle Width

- ☐ Pool Width > Riffle Width [2]
- ☒ Pool Width = Riffle Width [1]
- ☐ Pool Width < Riffle Width [0]
- ☐ No Riffle [0]
- ☐ No Pool [0]
- ☐ Impounded [-2]

F. Channel Development

- ☒ Excellent [9]
- ☐ Good [6]
- ☐ Fair [3]
- ☐ Poor [0]

G. Modifications (check all that apply) none

- ☐ Leveed [-1]
- ☐ Dredged [-1]
- ☐ Bank Shaping [-1]
- ☐ Railroad Ties [-1]
- ☐ Cemented [-2]
- ☐ Bulkheads [-2]
- ☐ Rip Rap [1]
- ☐ Const. Island [1]
- ☐ Wood Pilings [1]

Channel: 23 Max=35

Appendix II. (continued)

MPCA STREAM HABITAT ASSESSMENT (MSHA)

(revised April 2014)

1. Stream Documentation

Field Number: Reach 9 Stream Name: Knife River Date: 7-19-16

Person Scoring: Dunke Water Level (circle one): Flood / High / Normal / Low / Interstitial

MSHA SCORE Max=100: 64.1

2. Surrounding Land Use (Streams) or Floodplain Quality (Rivers)

(check the most predominant or check two and average scores) [L=left bank/R =right bank, facing UP-stream]

L	R			L	R		
☒	☒	Forest, Wetland, Prairie, Shrub	[5]	☐	☐	Diked Wetland	[2]
☐	☐	Old Field/Hay Field	[3]	☐	☐	Urban/Industrial	[0]
☐	☐	Fenced Pasture	[2]	☐	☐	Open Pasture	[0]
☐	☐	Residential/Park	[2]	☐	☐	Mining/Construction	[0]
☐	☐	Conservation Tillage, No Till	[2]	☐	☐	Row Crop	[0]

Land Use Max=5: 5

3. Riparian Zone (check the most predominant)

A. Riparian Width 4.0

L	R			
☐	☒	Extensive	> 100 m	[5]
☐	☐	Wide	50-100 m	[4]
☒	☐	Moderate	10-50 m	[3]
☐	☐	Narrow	5-10 m	[2]
☐	☐	Very Narrow	1-5 m	[1]
☐	☐	None		[0]

B. Bank Erosion 3.5

L	R			
☐	☐	None		[5]
☒	☐	Little	5-25%	[4]
☐	☒	Moderate	25-50%	[3]
☐	☐	Heavy	50-75%	[1]
☐	☐	Severe	75-100%	[0]

C. Shade

L	R			
☐	☐	Heavy	>75%	[4]
☒	☒	Substantial	50-75%	[3]
☐	☐	Moderate	25-50%	[2]
☐	☐	Light	5-25%	[1]
☐	☐	None		[0]

Riparian Max=14: 10.5

4. Instream Zone

A. Substrate (check two for each channel type)

	Boulder [10]	Cobble [9]	Gravel [8]	Sand [6]	Clay [5]	Bedrock [5]	Silt [2]	Muck [1]	Detritus [1]	Sludge [0]	Channel Type %
Pool	☐	☐	☒	☒	☐	☐	☐	☐	☐	☐	15 2.1
Riffle	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	30 5.1
Run	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	55 9.35
~~Glide~~	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Note	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Presence

B. Embeddedness

☐	None		[5]
☒	Light	25-50%	[3]
☐	Moderate	50-75%	[1]
☐	Severe	75-100%	[-1]
☐	No coarse substrate		[0]

C. Siltation

☐	Silt Free	[1]
☒	Silt Normal	[0]
☐	Silt Moderate	[-1]
☐	Silt Heavy	[-2]

D. Substrate Types

☒	≥4	[2]
☐	<4	[0]

Substrate Max=28: 21.6

E. Cover Type (check all that apply)

☒	Undercut Banks	[1]	☐	Oxbows, Backwaters	[1]
☐	Overhanging Vegetation	[1]	☐	Shallows (in slow water)	[1]
☒	Deep Pools	[1]	☐	Macrophytes	[1]
☒	Logs or Woody Debris	[1]	☐	Submergent	
☒	Boulders	[1]	☐	Emergent	
☐	Rootwads	[1]	☐	Floating Leaf	

F. Cover Amount (check one)

☐	Extensive	>50%	[9]
☐	Moderate	25-50%	[7]
☒	Sparse	5-25%	[3]
☐	Nearly Absent		[0]
☐	Choking Vegetation only		[-1]

Cover Max=18: 7

5. Channel Morphology

A. Depth Variability

☒	Greatest Depth >4X Shallow Depth	[4]
☐	Greatest Depth 2-4X Shallow Depth	[2]
☐	Greatest Depth <2X Shallow Depth	[0]

B. Channel Stability

☐	High	[9]
☐	Moderate/High	[6]
☒	Moderate	[3]
☐	Low	[0]

C. Velocity Types (check all that apply)

☒	Fast	[1]
☒	Moderate	[1]
☒	Slow	[1]
☒	Eddies	[1]
☐	Torrential	[-1]
☐	None	[-1]
☐	Interstitial	[-1]
☐	Intermittent	[-2]

D. Sinuosity

☐	Excellent	[4]
☒	Good	[3]
☐	Fair	[2]
☐	Poor	[0]

E. Pool Width/Riffle Width

☒	Pool Width > Riffle Width	[2]
☐	Pool Width = Riffle Width	[1]
☐	Pool Width < Riffle Width	[0]
☐	No Riffle	[0]
☐	No Pool	[0]
☐	Impounded	[-2]

F. Channel Development

☐	Excellent	[9]
☒	Good	[6]
☐	Fair	[3]
☐	Poor	[0]

G. Modifications (check all that apply) past

☐	Leveed	[-1]	☐	Rip Rap	[1]
☐	Dredged	[-1]	☐	Const. Island	[1]
☐	Bank Shaping	[-1]	☐	Wood Pilings	[1]
☐	Railroad Ties	[-1]			
☐	Cemented	[-2]			
☐	Bulkheads	[-2]			

Channel Max=35: 22

Appendix II. (continued)

MPCA STREAM HABITAT ASSESSMENT (MSHA)

(revised April 2014)

1. Stream Documentation

Field Number: Reference   Stream Name: Knife River   Date: 7-20-16

Person Scoring: Dumke   Water Level (circle one): Flood / High / (Normal) / Low / Interstitial

MSHA SCORE: 82.6 (Max=100)

2. Surrounding Land Use (Streams) or Floodplain Quality (Rivers)

(check the most predominant or check two and average scores)   [L=left bank/R =right bank, facing UP-stream]

L	R			L	R		
☒	☒	Forest, Wetland, Prairie, Shrub	[5]	☐	☐	Diked Wetland	[2]
☐	☐	Old Field/Hay Field	[3]	☐	☐	Urban/Industrial	[0]
☐	☐	Fenced Pasture	[2]	☐	☐	Open Pasture	[0]
☐	☐	Residential/Park	[2]	☐	☐	Mining/Construction	[0]
☐	☐	Conservation Tillage, No Till	[2]	☐	☐	Row Crop	[0]

Land Use: 5 (Max=5)

3. Riparian Zone (check the most predominant)

A. Riparian Width

L	R			
☒	☒	Extensive	> 100 m	[5]
☐	☐	Wide	50-100 m	[4]
☐	☐	Moderate	10-50 m	[3]
☐	☐	Narrow	5-10 m	[2]
☐	☐	Very Narrow	1-5 m	[1]
☐	☐	None		[0]

B. Bank Erosion

L	R			
☒	☒	None		[5]
☐	☐	Little	5-25%	[4]
☐	☐	Moderate	25-50%	[3]
☐	☐	Heavy	50-75%	[1]
☐	☐	Severe	75-100%	[0]

C. Shade

L	R			
☒	☒	Heavy	>75%	[4]
☐	☐	Substantial	50-75%	[3]
☐	☐	Moderate	25-50%	[2]
☐	☐	Light	5-25%	[1]
☐	☐	None		[0]

Riparian: 14 (Max=14)

4. Instream Zone

A. Substrate (check two for each channel type)

	Boulder [10]	Cobble [9]	Gravel [8]	Sand [6]	Clay [5]	Bedrock [5]	Silt [2]	Muck [1]	Detritus [1]	Sludge [0]	Channel Type %
Pool	☐	☐	☒	☒	☐	☐	☐	☐	☐	☐	25 35
Riffle	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	20 34
Run	☐	☐	☒	☒	☐	☐	☐	☐	☐	☐	55 7.7
~~Glide~~	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Note	☒	☒	☒	☒	☒	☐	☒	☐	☒	☐	Presence

B. Embeddedness

- ☐ None [5]
- ☒ Light 25-50% [3]
- ☐ Moderate 50-75% [1]
- ☐ Severe 75-100% [-1]
- ☐ No coarse substrate [0]

C. Siltation

- ☐ Silt Free [1]
- ☒ Silt Normal [0]
- ☐ Silt Moderate [-1]
- ☐ Silt Heavy [-2]

D. Substrate Types

- ☒ ≥4 [2]
- ☐ <4 [0]

Substrate: 19.6 (Max=28)

E. Cover Type (check all that apply)

- ☒ Undercut Banks [1]
- ☒ Overhanging Vegetation [1]
- ☒ Deep Pools [1]
- ☒ Logs or Woody Debris [1]
- ☒ Boulders [1]
- ☒ Rootwads [1]
- ☒ Oxbows, Backwaters [1]
- ☒ Shallows (in slow water) [1]
- ☐ Macrophytes [1]
  - ☐ Submergent
  - ☐ Emergent
  - ☐ Floating Leaf

F. Cover Amount (check one)

- ☐ Extensive >50% [9]
- ☒ Moderate 25-50% [7]
- ☐ Sparse 5-25% [3]
- ☐ Nearly Absent [0]
- ☐ Choking Vegetation only [-1]

Cover: 15 (Max=18)

5. Channel Morphology

A. Depth Variability

- ☒ Greatest Depth >4X Shallow Depth [4]
- ☐ Greatest Depth 2-4X Shallow Depth [2]
- ☐ Greatest Depth <2X Shallow Depth [0]

B. Channel Stability

- ☒ High [9]
- ☐ Moderate/High [6]
- ☐ Moderate [3]
- ☐ Low [0]

C. Velocity Types (check all that apply)

- ☒ Fast [1]
- ☒ Moderate [1]
- ☒ Slow [1]
- ☒ Eddies [1]
- ☐ Torrential [-1]
- ☐ None [-1]
- ☐ Interstitial [-1]
- ☐ Intermittent [-2]

D. Sinuosity

- ☒ Excellent [4]
- ☐ Good [3]
- ☐ Fair [2]
- ☐ Poor [0]

E. Pool Width/Riffle Width

- ☒ Pool Width > Riffle Width [2]
- ☐ Pool Width = Riffle Width [1]
- ☐ Pool Width < Riffle Width [0]
- ☐ No Riffle [0]
- ☐ No Pool [0]
- ☐ Impounded [-2]

F. Channel Development

- ☐ Excellent [9]
- ☒ Good [6]
- ☐ Fair [3]
- ☐ Poor [0]

G. Modifications (check all that apply)

none

- ☐ Leveed [-1]
- ☐ Dredged [-1]
- ☐ Bank Shaping [-1]
- ☐ Railroad Ties [-1]
- ☐ Cemented [-2]
- ☐ Bulkheads [-2]
- ☐ Rip Rap [1]
- ☐ Const. Island [1]
- ☐ Wood Pilings [1]

Channel: 29 (Max=35)

Appendix III. Macroinvertebrate taxa collected in each reach of the Knife River mainstem.

	Taxa	Reach 12	Reach 9	Reference
1	**Annelida (Segmented worms)**			
2	Oligochaeta (Aquatic earthworms)	X	X	X
3	**Arthropoda**			
4	Acari (Aquatic mites)	X	X	X
5	Collembola (Springtails)	X	X	X
6	**Insecta (Insects)**			
7	**Coleoptera (Beetles)**			
8	Elmidae (Riffle beetles)	X	X	X
9	Dubiraphia		X	X
10	Optioservus	X	X	X
11	Haliplidae (Water beetles)			
12	Haliplus		X	
13	Hydrophilidae (Diving beetles)			
14	Sperchopsis		X	
15	**Diptera (Flies)**	X		
16	Athericidae (Watersnipe flies)			
17	Atherix	X	X	X
18	Ceratopogonidae (Biting midges)	X	X	X
19	Ceratopogon	X		
20	Chironomidae (Non-biting midges)	X	X	X
21	Chironominae	X	X	X
22	Chironomini or Pseudochironomini	X	X	X
23	Orthocladiinae	X	X	X
24	Tanypodinae	X	X	X
25	Tanytarsini	X	X	X
26	Dixidae (Dixid midges)	X	X	
27	Dixa	X		
28	Dixella		X	X
29	Empididae (Dance flies)			X
30	Hemerodromia	X	X	X
31	Neoplasta		X	X
32	Ephydridae (Shore flies)		X	
33	Simuliidae (Black flies)	X	X	X
34	Tabanidae (Deer flies and horse-flies)			
35	Chrysops	X	X	X
36	Tipulidae (Crane flies)	X	X	X
37	Antocha	X	X	X
38	Dicranota	X	X	X
39	Hexatoma	X	X	X

Appendix III. (Continued)

	Taxa	Reach 12	Reach 9	Reference
40	Limoniinae	X		
41	**Ephemeroptera (Mayflies)**	X	X	X
42	Baetidae (Small minnow mayflies)	X	X	X
43	Baetis	X	X	X
44	Heterocloeon		X	X
45	Procloeon		X	
46	Caenidae (Small squaregilled mayflies)			
47	Caenis	X	X	X
48	Ephemerellidae (Spiny crawlers)	X	X	X
49	Eurylophella	X	X	X
50	Serratella	X	X	
51	Ephemeridae (Hexes and Big drakes)			
52	Ephemera	X	X	X
53	Heptageniidae (Flat-headed mayflies)	X	X	X
54	Leucrocuta		X	X
55	Maccaffertium	X		X
56	Leptohyphidae (Little stout crawler)			
57	Tricorythodes	X	X	X
58	Leptophlebiidae (Pronggills)	X	X	X
59	Paraleptophlebia	X	X	
60	**Hemiptera (True bugs)**			
61	Corixidae (Water boatmen)		X	
62	**Lepidoptera (Moths)**			
63	Crambidae (Grass moth)			X
64	**Megaloptera (Alderflies and Dobsonflies)**	X		
65	**Corydalidae**			
66	Nigronia (Dobsonflies, hellgrammites)	X	X	X
67	Sialidae (Alderflies)			
68	Sialis	X	X	X
69	**Odonata (Dragonflies and damselflies)**			
70	Aeshnidae (Darners)		X	X
71	Boyeria	X	X	X
72	Calopterygidae (Broadwinged damselflies)			
73	Calopteryx	X	X	X
74	Coenagrionidae (Narrowwinged damselflies)	X	X	X
75	Cordulegastridae (Biddies)			
76	Cordulegaster	X	X	X
77	Gomphidae (Clubtails)	X	X	X
78	Ophiogomphus	X	X	X

Appendix III. (Continued)

	Taxa	Reach 12	Reach 9	Reference
79	**Plecoptera (Stoneflies)**	X	X	X
80	Capniidae (Slender winter stoneflies)	X	X	X
81	Chloroperlidae (Sallflies)	X	X	X
82	Leuctridae (Rolledwing stoneflies)	X	X	X
83	Leuctra	X	X	X
84	Perlidae (Common stoneflies)	X	X	X
85	Acroneuria	X	X	X
86	Paragnetina			X
87	Pteronarcyidae (Giant stoneflies)			
88	Pteronarcys	X	X	X
89	Taeniopterygidae (Broadbacks)			
90	Taeniopteryx	X		X
91	**Trichoptera (Caddisflies)**	X	X	X
92	Brachycentridae (Humpless case makers)			X
93	Brachycentrus	X	X	X
94	Micrasema	X	X	X
95	Dipseudopsidae			
96	Phylocentropus		X	
97	Glossosomatidae (Saddlecase makers)	X	X	X
98	Glossosoma	X	X	X
99	Protoptila	X	X	X
100	Goeridae			X
101	Helicopsychidae (Snail-case Caddisflies)			
102	Helicopsyche			X
103	Hydropsychidae (Common netspinners)	X	X	X
104	Cheumatopsyche	X	X	
105	Hydropsyche	X	X	X
106	Hydroptilidae (Micro caddisflies)	X	X	X
107	Hydroptila	X		
108	Lepidostomatidae		X	
109	Lepidostoma	X	X	X
110	Leptoceridae (Longhorned case makers)	X	X	X
111	Mystacides	X		
112	Oecetis	X	X	X
113	Limnephilidae (Northern case makers)	X	X	X
114	Hydatophylax	X	X	
115	Pycnopsyche	X	X	X
116	Molannidae (Hooded case makers)			
117	Molanna	X		X

Appendix III. (Continued)

	Taxa	Reach 12	Reach 9	Reference
118	Phryganeidae (Giant casemakers)		X	
119	Polycentropodidae (Trumpetnets)	X		X
120	Polycentropus	X	X	X
121	Psychomyiidae (Nettube caddisflies)	X	X	X
122	Lype			X
123	Psychomyia	X	X	X
124	**Malacostraca**			
125	Decapoda (Crustaceans)			
126	Cambaridae (Crayfish)	X		
127	**Mollusca (Snails and clams)**			
128	Bivalvia (Clams)			
129	Pisidiidae	X	X	X
130	Pisidium	X	X	X
131	Gastropoda (Snails)			
132	Ancylidae	X	X	
133	Ferrissia	X	X	X
134	Lymnaeidae		X	
135	Pseudosuccinea		X	
136	Physidae			
137	Physa	X	X	X
138	Planorbidae		X	
139	**Nematoda (Roundworms)**	X	X	X
140	**Turbellaria (Flatworms)**		X	X
	Total Taxa Count	**86**	**92**	**86**

Appendix IV. Macroinvertebrate identifications and taxa counts for each Knife River mainstem sample.

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
1	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	116	Acari		
2	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	60	Nematoda		
3	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	147	Oligochaeta		
4	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Ancylidae	Ancylidae	Basommatophora
5	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	77	Physa	Physidae	Basommatophora
6	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	24	Elmidae	Elmidae	Coleoptera
7	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	12	Collembola		Collembola
8	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	1	Cambaridae	Cambaridae	Decapoda
9	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	5	Atherix	Athericidae	Diptera
10	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Ceratopogon	Ceratopogonidae	Diptera
11	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	20	Ceratopogonidae	Ceratopogonidae	Diptera
12	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	108	Chironomidae	Chironomidae	Diptera
13	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	356	Chironomini/ Pseudochironomini	Chironomidae	Diptera
14	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	483	Orthocladiinae	Chironomidae	Diptera
15	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	148	Tanypodinae	Chironomidae	Diptera
16	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	372	Tanytarsini	Chironomidae	Diptera
17	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Dixa	Dixidae	Diptera
18	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Dixidae	Dixidae	Diptera
19	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Hemerodromia	Empididae	Diptera
20	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	84	Simuliidae	Simuliidae	Diptera
21	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Chrysops	Tabanidae	Diptera
22	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	13	Antocha	Tipulidae	Diptera
23	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	1	Hexatoma	Tipulidae	Diptera
24	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Limoniinae	Tipulidae	Diptera
25	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Tipulidae	Tipulidae	Diptera
26	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	112	Ephemeroptera		Ephemeroptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
27	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	56	Baetidae	Baetidae	Ephemeroptera
28	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Baetis	Baetidae	Ephemeroptera
29	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	16	Ephemerellidae	Ephemerellidae	Ephemeroptera
30	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	9	Eurylophella	Ephemerellidae	Ephemeroptera
31	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	41	Ephemera	Ephemeridae	Ephemeroptera
32	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Heptageniidae	Heptageniidae	Ephemeroptera
33	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	24	Tricorythodes	Leptohyphidae	Ephemeroptera
34	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	60	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
35	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Nigronia	Corydalidae	Megaloptera
36	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	1	Boyeria	Aeshnidae	Odonata
37	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	11	Calopteryx	Calopterygidae	Odonata
38	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Coenagrionidae	Coenagrionidae	Odonata
39	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	1	Cordulegaster	Cordulegastridae	Odonata
40	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	24	Gomphidae	Gomphidae	Odonata
41	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	6	Ophiogomphus	Gomphidae	Odonata
42	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	56	Plecoptera		Plecoptera
43	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Capniidae	Capniidae	Plecoptera
44	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Leuctra	Leuctridae	Plecoptera
45	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Leuctridae	Leuctridae	Plecoptera
46	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	3	Acroneuria	Perlidae	Plecoptera
47	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Perlidae	Perlidae	Plecoptera
48	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	1	Pteronarcys	Pteronarcyidae	Plecoptera
49	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	101	Trichoptera		Trichoptera
50	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	1	Brachycentrus	Brachycentridae	Trichoptera
51	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Micrasema	Brachycentridae	Trichoptera
52	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Glossosoma	Glossosomatidae	Trichoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
53	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Hydropsyche	Hydropsychidae	Trichoptera
54	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	144	Hydropsychidae	Hydropsychidae	Trichoptera
55	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	16	Lepidostoma	Lepidostomatidae	Trichoptera
56	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	32	Leptoceridae	Leptoceridae	Trichoptera
57	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Mystacides	Leptoceridae	Trichoptera
58	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	16	Oecetis	Leptoceridae	Trichoptera
59	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	2	Hydatophylax	Limnephilidae	Trichoptera
60	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Limnephilidae	Limnephilidae	Trichoptera
61	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	5	Pycnopsyche	Limnephilidae	Trichoptera
62	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Molanna	Molannidae	Trichoptera
63	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	4	Polycentropodidae	Polycentropodidae	Trichoptera
64	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Psychomyia	Psychomyiidae	Trichoptera
65	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	35	Pisidiidae	Pisidiidae	Veneroida
66	Reach 12	8/4/2016	D-net_ALL	All	1	Dnet	8	Pisidium	Pisidiidae	Veneroida
67	Reach 12	8/4/2016	Hess_1	Run	1	Hess	124	Acari		
68	Reach 12	8/4/2016	Hess_1	Run	1	Hess	11	Nematoda		
69	Reach 12	8/4/2016	Hess_1	Run	1	Hess	14	Oligochaeta		
70	Reach 12	8/4/2016	Hess_1	Run	1	Hess	12	Ferrissia	Ancylidae	Basommatophora
71	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Physa	Physidae	Basommatophora
72	Reach 12	8/4/2016	Hess_1	Run	1	Hess	8	Elmidae	Elmidae	Coleoptera
73	Reach 12	8/4/2016	Hess_1	Run	1	Hess	26	Optioservus	Elmidae	Coleoptera
74	Reach 12	8/4/2016	Hess_1	Run	1	Hess	2	Collembola		Collembola
75	Reach 12	8/4/2016	Hess_1	Run	1	Hess	4	Atherix	Athericidae	Diptera
76	Reach 12	8/4/2016	Hess_1	Run	1	Hess	5	Ceratopogonidae	Ceratopogonidae	Diptera
77	Reach 12	8/4/2016	Hess_1	Run	1	Hess	29	Chironomidae	Chironomidae	Diptera
78	Reach 12	8/4/2016	Hess_1	Run	1	Hess	81	Chironomini/ Pseudochironomini	Chironomidae	Diptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
79	Reach 12	8/4/2016	Hess_1	Run	1	Hess	399	Orthocladiinae	Chironomidae	Diptera
80	Reach 12	8/4/2016	Hess_1	Run	1	Hess	15	Tanypodinae	Chironomidae	Diptera
81	Reach 12	8/4/2016	Hess_1	Run	1	Hess	464	Tanytarsini	Chironomidae	Diptera
82	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Dixidae	Dixidae	Diptera
83	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Hemerodromia	Empididae	Diptera
84	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Simuliidae	Simuliidae	Diptera
85	Reach 12	8/4/2016	Hess_1	Run	1	Hess	90	Antocha	Tipulidae	Diptera
86	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Dicranota	Tipulidae	Diptera
87	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Hexatoma	Tipulidae	Diptera
88	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Tipulidae	Tipulidae	Diptera
89	Reach 12	8/4/2016	Hess_1	Run	1	Hess	2	Ephemeroptera		Ephemeroptera
90	Reach 12	8/4/2016	Hess_1	Run	1	Hess	17	Baetidae	Baetidae	Ephemeroptera
91	Reach 12	8/4/2016	Hess_1	Run	1	Hess	10	Ephemerellidae	Ephemerellidae	Ephemeroptera
92	Reach 12	8/4/2016	Hess_1	Run	1	Hess	6	Eurylophella	Ephemerellidae	Ephemeroptera
93	Reach 12	8/4/2016	Hess_1	Run	1	Hess	2	Serratella	Ephemerellidae	Ephemeroptera
94	Reach 12	8/4/2016	Hess_1	Run	1	Hess	15	Heptageniidae	Heptageniidae	Ephemeroptera
95	Reach 12	8/4/2016	Hess_1	Run	1	Hess	5	Tricorythodes	Leptohyphidae	Ephemeroptera
96	Reach 12	8/4/2016	Hess_1	Run	1	Hess	20	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
97	Reach 12	8/4/2016	Hess_1	Run	1	Hess	10	Nigronia	Corydalidae	Megaloptera
98	Reach 12	8/4/2016	Hess_1	Run	1	Hess	29	Gomphidae	Gomphidae	Odonata
99	Reach 12	8/4/2016	Hess_1	Run	1	Hess	15	Plecoptera		Plecoptera
100	Reach 12	8/4/2016	Hess_1	Run	1	Hess	50	Capniidae	Capniidae	Plecoptera
101	Reach 12	8/4/2016	Hess_1	Run	1	Hess	3	Chloroperlidae	Chloroperlidae	Plecoptera
102	Reach 12	8/4/2016	Hess_1	Run	1	Hess	2	Leuctridae	Leuctridae	Plecoptera
103	Reach 12	8/4/2016	Hess_1	Run	1	Hess	4	Perlidae	Perlidae	Plecoptera
104	Reach 12	8/4/2016	Hess_1	Run	1	Hess	2	Taeniopteryx	Taeniopterygidae	Plecoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
105	Reach 12	8/4/2016	Hess_1	Run	1	Hess	54	Trichoptera		Trichoptera
106	Reach 12	8/4/2016	Hess_1	Run	1	Hess	9	Micrasema	Brachycentridae	Trichoptera
107	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Protoptila	Glossosomatidae	Trichoptera
108	Reach 12	8/4/2016	Hess_1	Run	1	Hess	3	Cheumatopsyche	Hydropsychidae	Trichoptera
109	Reach 12	8/4/2016	Hess_1	Run	1	Hess	22	Hydropsyche	Hydropsychidae	Trichoptera
110	Reach 12	8/4/2016	Hess_1	Run	1	Hess	83	Hydropsychidae	Hydropsychidae	Trichoptera
111	Reach 12	8/4/2016	Hess_1	Run	1	Hess	1	Hydroptila	Hydroptilidae	Trichoptera
112	Reach 12	8/4/2016	Hess_1	Run	1	Hess	4	Lepidostoma	Lepidostomatidae	Trichoptera
113	Reach 12	8/4/2016	Hess_1	Run	1	Hess	2	Oecetis	Leptoceridae	Trichoptera
114	Reach 12	8/4/2016	Hess_1	Run	1	Hess	89	Psychomyia	Psychomyiidae	Trichoptera
115	Reach 12	8/4/2016	Hess_1	Run	1	Hess	17	Psychomyiidae	Psychomyiidae	Trichoptera
116	Reach 12	8/4/2016	Hess_2	Run	2	Hess	110	Acari		
117	Reach 12	8/4/2016	Hess_2	Run	2	Hess	34	Nematoda		
118	Reach 12	8/4/2016	Hess_2	Run	2	Hess	34	Oligochaeta		
119	Reach 12	8/4/2016	Hess_2	Run	2	Hess	1	Ferrissia	Ancylidae	Basommatophora
120	Reach 12	8/4/2016	Hess_2	Run	2	Hess	6	Physa	Physidae	Basommatophora
121	Reach 12	8/4/2016	Hess_2	Run	2	Hess	12	Elmidae	Elmidae	Coleoptera
122	Reach 12	8/4/2016	Hess_2	Run	2	Hess	8	Optioservus	Elmidae	Coleoptera
123	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Collembola		Collembola
124	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Atherix	Athericidae	Diptera
125	Reach 12	8/4/2016	Hess_2	Run	2	Hess	11	Ceratopogonidae	Ceratopogonidae	Diptera
126	Reach 12	8/4/2016	Hess_2	Run	2	Hess	62	Chironomidae	Chironomidae	Diptera
127	Reach 12	8/4/2016	Hess_2	Run	2	Hess	17	Chironominae	Chironomidae	Diptera
128	Reach 12	8/4/2016	Hess_2	Run	2	Hess	34	Chironomini/ Pseudochironomini	Chironomidae	Diptera
129	Reach 12	8/4/2016	Hess_2	Run	2	Hess	378	Orthocladiinae	Chironomidae	Diptera
130	Reach 12	8/4/2016	Hess_2	Run	2	Hess	8	Tanypodinae	Chironomidae	Diptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
131	Reach 12	8/4/2016	Hess_2	Run	2	Hess	234	Tanytarsini	Chironomidae	Diptera
132	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Hemerodromia	Empididae	Diptera
133	Reach 12	8/4/2016	Hess_2	Run	2	Hess	127	Antocha	Tipulidae	Diptera
134	Reach 12	8/4/2016	Hess_2	Run	2	Hess	6	Ephemeroptera		Ephemeroptera
135	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Baetidae	Baetidae	Ephemeroptera
136	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Caenis	Caenidae	Ephemeroptera
137	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Ephemerellidae	Ephemerellidae	Ephemeroptera
138	Reach 12	8/4/2016	Hess_2	Run	2	Hess	10	Eurylophella	Ephemerellidae	Ephemeroptera
139	Reach 12	8/4/2016	Hess_2	Run	2	Hess	60	Heptageniidae	Heptageniidae	Ephemeroptera
140	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Tricorythodes	Leptohyphidae	Ephemeroptera
141	Reach 12	8/4/2016	Hess_2	Run	2	Hess	26	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
142	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Paraleptophlebia	Leptophlebiidae	Ephemeroptera
143	Reach 12	8/4/2016	Hess_2	Run	2	Hess	8	Nigronia	Corydalidae	Megaloptera
144	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Sialis	Sialidae	Megaloptera
145	Reach 12	8/4/2016	Hess_2	Run	2	Hess	12	Gomphidae	Gomphidae	Odonata
146	Reach 12	8/4/2016	Hess_2	Run	2	Hess	20	Plecoptera		Plecoptera
147	Reach 12	8/4/2016	Hess_2	Run	2	Hess	48	Capniidae	Capniidae	Plecoptera
148	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Leuctra	Leuctridae	Plecoptera
149	Reach 12	8/4/2016	Hess_2	Run	2	Hess	8	Leuctridae	Leuctridae	Plecoptera
150	Reach 12	8/4/2016	Hess_2	Run	2	Hess	3	Acroneuria	Perlidae	Plecoptera
151	Reach 12	8/4/2016	Hess_2	Run	2	Hess	5	Perlidae	Perlidae	Plecoptera
152	Reach 12	8/4/2016	Hess_2	Run	2	Hess	28	Trichoptera		Trichoptera
153	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Micrasema	Brachycentridae	Trichoptera
154	Reach 12	8/4/2016	Hess_2	Run	2	Hess	8	Hydropsyche	Hydropsychidae	Trichoptera
155	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Hydropsychidae	Hydropsychidae	Trichoptera
156	Reach 12	8/4/2016	Hess_2	Run	2	Hess	4	Hydroptilidae	Hydroptilidae	Trichoptera
157	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Leptoceridae	Leptoceridae	Trichoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
158	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Oecetis	Leptoceridae	Trichoptera
159	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Polycentropus	Polycentropodidae	Trichoptera
160	Reach 12	8/4/2016	Hess_2	Run	2	Hess	151	Psychomyia	Psychomyiidae	Trichoptera
161	Reach 12	8/4/2016	Hess_2	Run	2	Hess	36	Psychomyiidae	Psychomyiidae	Trichoptera
162	Reach 12	8/4/2016	Hess_2	Run	2	Hess	2	Pisidiidae	Pisidiidae	Veneroida
163	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	104	Acari		
164	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	22	Nematoda		
165	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	83	Oligochaeta		
166	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	24	Elmidae	Elmidae	Coleoptera
167	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	16	Optioservus	Elmidae	Coleoptera
168	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	6	Collembola		Collembola
169	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Diptera		Diptera
170	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	3	Atherix	Athericidae	Diptera
171	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	9	Ceratopogonidae	Ceratopogonidae	Diptera
172	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	59	Chironomidae	Chironomidae	Diptera
173	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	49	Chironomini/ Pseudochironomini	Chironomidae	Diptera
174	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	493	Orthocladiinae	Chironomidae	Diptera
175	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	8	Tanypodinae	Chironomidae	Diptera
176	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	583	Tanytarsini	Chironomidae	Diptera
177	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	26	Hemerodromia	Empididae	Diptera
178	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	132	Antocha	Tipulidae	Diptera
179	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	3	Hexatoma	Tipulidae	Diptera
180	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Ephemeroptera		Ephemeroptera
181	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	72	Baetidae	Baetidae	Ephemeroptera
182	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	4	Baetis	Baetidae	Ephemeroptera
183	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	4	Ephemerellidae	Ephemerellidae	Ephemeroptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
184	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Eurylophella	Ephemerellidae	Ephemeroptera
185	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	50	Heptageniidae	Heptageniidae	Ephemeroptera
186	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Maccaffertium	Heptageniidae	Ephemeroptera
187	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	94	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
188	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Megaloptera		Megaloptera
189	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	11	Nigronia	Corydalidae	Megaloptera
190	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Sialis	Sialidae	Megaloptera
191	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	1	Boyeria	Aeshnidae	Odonata
192	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	4	Gomphidae	Gomphidae	Odonata
193	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	10	Plecoptera		Plecoptera
194	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	57	Capniidae	Capniidae	Plecoptera
195	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	6	Chloroperlidae	Chloroperlidae	Plecoptera
196	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	4	Leuctra	Leuctridae	Plecoptera
197	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	32	Leuctridae	Leuctridae	Plecoptera
198	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	7	Acroneuria	Perlidae	Plecoptera
199	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	8	Perlidae	Perlidae	Plecoptera
200	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	72	Trichoptera		Trichoptera
201	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Glossosoma	Glossosomatidae	Trichoptera
202	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	4	Glossosomatidae	Glossosomatidae	Trichoptera
203	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	30	Hydropsyche	Hydropsychidae	Trichoptera
204	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	70	Hydropsychidae	Hydropsychidae	Trichoptera
205	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	4	Lepidostoma	Lepidostomatidae	Trichoptera
206	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	2	Polycentropus	Polycentropodidae	Trichoptera
207	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	82	Psychomyia	Psychomyiidae	Trichoptera
208	Reach 12	8/4/2016	Hess_3	Riffle	3	Hess	6	Psychomyiidae	Psychomyiidae	Trichoptera
209	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	156	Acari		
210	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Nematoda		

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	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
211	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	377	Oligochaeta		
212	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Ferrissia	Ancylidae	Basommatophora
213	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Lymnaeidae	Lymnaeidae	Basommatophora
214	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Pseudosuccinea	Lymnaeidae	Basommatophora
215	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	92	Physa	Physidae	Basommatophora
216	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Planorbidae	Planorbidae	Basommatophora
217	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	76	Dubiraphia	Elmidae	Coleoptera
218	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Elmidae	Elmidae	Coleoptera
219	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	36	Optioservus	Elmidae	Coleoptera
220	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	5	Haliplus	Haliplidae	Coleoptera
221	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Sperchopsis	Hydrophilidae	Coleoptera
222	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Collembola		Collembola
223	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Atherix	Athericidae	Diptera
224	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	20	Ceratopogonidae	Ceratopogonidae	Diptera
225	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	128	Chironomidae	Chironomidae	Diptera
226	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	636	Chironomini/ Pseudochironomini	Chironomidae	Diptera
227	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	473	Orthocladiinae	Chironomidae	Diptera
228	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	219	Tanypodinae	Chironomidae	Diptera
229	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	920	Tanytarsini	Chironomidae	Diptera
230	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Dixella	Dixidae	Diptera
231	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Dixidae	Dixidae	Diptera
232	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Hemerodromia	Empididae	Diptera
233	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Ephydridae	Ephydridae	Diptera
234	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	32	Simuliidae	Simuliidae	Diptera
235	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	20	Chrysops	Tabanidae	Diptera
236	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Antocha	Tipulidae	Diptera

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	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
237	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	48	Ephemeroptera		Ephemeroptera
238	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	76	Baetidae	Baetidae	Ephemeroptera
239	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	12	Baetis	Baetidae	Ephemeroptera
240	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Procloeon	Baetidae	Ephemeroptera
241	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Caenis	Caenidae	Ephemeroptera
242	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	20	Eurylophella	Ephemerellidae	Ephemeroptera
243	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Serratella	Ephemerellidae	Ephemeroptera
244	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	68	Ephemera	Ephemeridae	Ephemeroptera
245	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	28	Heptageniidae	Heptageniidae	Ephemeroptera
246	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	100	Tricorythodes	Leptohyphidae	Ephemeroptera
247	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	228	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
248	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Corixidae	Corixidae	Hemiptera
249	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Nigronia	Corydalidae	Megaloptera
250	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Aeshnidae	Aeshnidae	Odonata
251	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	1	Boyeria	Aeshnidae	Odonata
252	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	1	Calopteryx	Calopterygidae	Odonata
253	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	16	Coenagrionidae	Coenagrionidae	Odonata
254	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	1	Cordulegaster	Cordulegastridae	Odonata
255	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	21	Gomphidae	Gomphidae	Odonata
256	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	2	Ophiogomphus	Gomphidae	Odonata
257	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	16	Plecoptera		Plecoptera
258	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Capniidae	Capniidae	Plecoptera
259	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Leuctridae	Leuctridae	Plecoptera
260	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	3	Acroneuria	Perlidae	Plecoptera
261	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Pteronarcys	Pteronarcyidae	Plecoptera
262	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	77	Trichoptera		Trichoptera
263	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Brachycentrus	Brachycentridae	Trichoptera

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	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
264	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Micrasema	Brachycentridae	Trichoptera
265	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Phylocentropus	Dipseudopsidae	Trichoptera
266	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Glossosomatidae	Glossosomatidae	Trichoptera
267	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	20	Hydropsyche	Hydropsychidae	Trichoptera
268	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	80	Hydropsychidae	Hydropsychidae	Trichoptera
269	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	24	Hydroptilidae	Hydroptilidae	Trichoptera
270	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	20	Lepidostoma	Lepidostomatidae	Trichoptera
271	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Lepidostomatidae	Lepidostomatidae	Trichoptera
272	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	84	Leptoceridae	Leptoceridae	Trichoptera
273	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	48	Oecetis	Leptoceridae	Trichoptera
274	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	18	Hydatophylax	Limnephilidae	Trichoptera
275	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	33	Limnephilidae	Limnephilidae	Trichoptera
276	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	6	Pycnopsyche	Limnephilidae	Trichoptera
277	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Polycentropus	Polycentropodidae	Trichoptera
278	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	4	Psychomyia	Psychomyiidae	Trichoptera
279	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	8	Psychomyiidae	Psychomyiidae	Trichoptera
280	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	54	Pisidiidae	Pisidiidae	Veneroida
281	Reach 9	8/4/2016	D-net_ALL	All	1	Dnet	6	Pisidium	Pisidiidae	Veneroida
282	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	250	Acari		
283	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	25	Nematoda		
284	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	90	Oligochaeta		
285	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	2	Ancylidae	Ancylidae	Basommatophora
286	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	15	Ferrissia	Ancylidae	Basommatophora
287	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	36	Elmidae	Elmidae	Coleoptera
288	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	54	Optioservus	Elmidae	Coleoptera
289	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	2	Collembola		Collembola
290	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	8	Atherix	Athericidae	Diptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
291	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	14	Ceratopogonidae	Ceratopogonidae	Diptera
292	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	62	Chironomidae	Chironomidae	Diptera
293	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	5	Chironomini/ Pseudochironomini	Chironomidae	Diptera
294	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	473	Orthocladiinae	Chironomidae	Diptera
295	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	24	Tanypodinae	Chironomidae	Diptera
296	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	520	Tanytarsini	Chironomidae	Diptera
297	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	2	Neoplasta	Empididae	Diptera
298	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	4	Simuliidae	Simuliidae	Diptera
299	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	142	Antocha	Tipulidae	Diptera
300	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	2	Dicranota	Tipulidae	Diptera
301	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	1	Hexatoma	Tipulidae	Diptera
302	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	4	Tipulidae	Tipulidae	Diptera
303	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	4	Ephemeroptera		Ephemeroptera
304	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	30	Baetidae	Baetidae	Ephemeroptera
305	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	4	Baetis	Baetidae	Ephemeroptera
306	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	12	Ephemerellidae	Ephemerellidae	Ephemeroptera
307	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	14	Eurylophella	Ephemerellidae	Ephemeroptera
308	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	26	Heptageniidae	Heptageniidae	Ephemeroptera
309	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	12	Tricorythodes	Leptohyphidae	Ephemeroptera
310	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	72	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
311	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	4	Paraleptophlebia	Leptophlebiidae	Ephemeroptera
312	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	4	Nigronia	Corydalidae	Megaloptera
313	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	1	Boyeria	Aeshnidae	Odonata
314	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	18	Gomphidae	Gomphidae	Odonata
315	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	30	Plecoptera		Plecoptera
316	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	58	Capniidae	Capniidae	Plecoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
317	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	22	Leuctridae	Leuctridae	Plecoptera
318	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	1	Acroneuria	Perlidae	Plecoptera
319	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	6	Perlidae	Perlidae	Plecoptera
320	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	72	Trichoptera		Trichoptera
321	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	16	Micrasema	Brachycentridae	Trichoptera
322	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	10	Glossosomatidae	Glossosomatidae	Trichoptera
323	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	13	Hydropsyche	Hydropsychidae	Trichoptera
324	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	22	Hydropsychidae	Hydropsychidae	Trichoptera
325	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	2	Hydroptilidae	Hydroptilidae	Trichoptera
326	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	1	Lepidostoma	Lepidostomatidae	Trichoptera
327	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	8	Oecetis	Leptoceridae	Trichoptera
328	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	2	Phryganeidae	Phryganeidae	Trichoptera
329	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	2	Polycentropus	Polycentropodidae	Trichoptera
330	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	177	Psychomyia	Psychomyiidae	Trichoptera
331	Reach 9	8/4/2016	Hess_1	Riffle	1	Hess	24	Psychomyiidae	Psychomyiidae	Trichoptera
332	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	240	Acari		
333	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	12	Nematoda		
334	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	53	Oligochaeta		
335	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	8	Ferrissia	Ancylidae	Basommatophora
336	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	30	Elmidae	Elmidae	Coleoptera
337	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	82	Optioservus	Elmidae	Coleoptera
338	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	8	Collembola		Collembola
339	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Atherix	Athericidae	Diptera
340	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	12	Ceratopogonidae	Ceratopogonidae	Diptera
341	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	42	Chironomidae	Chironomidae	Diptera
342	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	18	Chironominae	Chironomidae	Diptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
343	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	42	Chironomini/ Pseudochironomini	Chironomidae	Diptera
344	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	528	Orthocladiinae	Chironomidae	Diptera
345	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	14	Tanypodinae	Chironomidae	Diptera
346	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	706	Tanytarsini	Chironomidae	Diptera
347	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Hemerodromia	Empididae	Diptera
348	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	2	Simuliidae	Simuliidae	Diptera
349	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	142	Antocha	Tipulidae	Diptera
350	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	2	Dicranota	Tipulidae	Diptera
351	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	2	Hexatoma	Tipulidae	Diptera
352	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Ephemeroptera		Ephemeroptera
353	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	54	Baetidae	Baetidae	Ephemeroptera
354	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Ephemerellidae	Ephemerellidae	Ephemeroptera
355	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	86	Heptageniidae	Heptageniidae	Ephemeroptera
356	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	2	Leucrocuta	Heptageniidae	Ephemeroptera
357	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	84	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
358	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	10	Paraleptophlebia	Leptophlebiidae	Ephemeroptera
359	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	8	Nigronia	Corydalidae	Megaloptera
360	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Sialis	Sialidae	Megaloptera
361	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	66	Gomphidae	Gomphidae	Odonata
362	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	18	Plecoptera		Plecoptera
363	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	86	Capniidae	Capniidae	Plecoptera
364	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Chloroperlidae	Chloroperlidae	Plecoptera
365	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	2	Leuctra	Leuctridae	Plecoptera
366	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	14	Leuctridae	Leuctridae	Plecoptera
367	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	2	Acroneuria	Perlidae	Plecoptera
368	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	22	Perlidae	Perlidae	Plecoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
369	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	156	Trichoptera		Trichoptera
370	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	12	Micrasema	Brachycentridae	Trichoptera
371	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Glossosoma	Glossosomatidae	Trichoptera
372	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	18	Glossosomatidae	Glossosomatidae	Trichoptera
373	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	62	Hydropsyche	Hydropsychidae	Trichoptera
374	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	74	Hydropsychidae	Hydropsychidae	Trichoptera
375	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Lepidostoma	Lepidostomatidae	Trichoptera
376	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	2	Leptoceridae	Leptoceridae	Trichoptera
377	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	1	Oecetis	Leptoceridae	Trichoptera
378	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	4	Polycentropus	Polycentropodidae	Trichoptera
379	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	235	Psychomyia	Psychomyiidae	Trichoptera
380	Reach 9	8/4/2016	Hess_2	Riffle	2	Hess	72	Psychomyiidae	Psychomyiidae	Trichoptera
381	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	204	Acari		
382	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	49	Nematoda		
383	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	40	Oligochaeta		
384	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Turbellaria		
385	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Ferrissia	Ancylidae	Basommatophora
386	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	20	Elmidae	Elmidae	Coleoptera
387	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	58	Optioservus	Elmidae	Coleoptera
388	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Collembola		Collembola
389	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	19	Atherix	Athericidae	Diptera
390	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	16	Ceratopogonidae	Ceratopogonidae	Diptera
391	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	77	Chironomidae	Chironomidae	Diptera
392	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	49	Chironomini/ Pseudochironomini	Chironomidae	Diptera
393	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	657	Orthocladiinae	Chironomidae	Diptera
394	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	6	Tanypodinae	Chironomidae	Diptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
395	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	612	Tanytarsini	Chironomidae	Diptera
396	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Neoplasta	Empididae	Diptera
397	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	108	Simuliidae	Simuliidae	Diptera
398	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	82	Antocha	Tipulidae	Diptera
399	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Dicranota	Tipulidae	Diptera
400	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Hexatoma	Tipulidae	Diptera
401	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	4	Ephemeroptera		Ephemeroptera
402	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	194	Baetidae	Baetidae	Ephemeroptera
403	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	5	Heterocloeon	Baetidae	Ephemeroptera
404	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	18	Ephemerellidae	Ephemerellidae	Ephemeroptera
405	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	10	Serratella	Ephemerellidae	Ephemeroptera
406	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	34	Heptageniidae	Heptageniidae	Ephemeroptera
407	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Tricorythodes	Leptohyphidae	Ephemeroptera
408	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	44	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
409	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Nigronia	Corydalidae	Megaloptera
410	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Sialis	Sialidae	Megaloptera
411	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	18	Gomphidae	Gomphidae	Odonata
412	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	3	Ophiogomphus	Gomphidae	Odonata
413	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	50	Plecoptera		Plecoptera
414	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	38	Capniidae	Capniidae	Plecoptera
415	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Chloroperlidae	Chloroperlidae	Plecoptera
416	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	10	Leuctra	Leuctridae	Plecoptera
417	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	28	Leuctridae	Leuctridae	Plecoptera
418	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	18	Perlidae	Perlidae	Plecoptera
419	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Pteronarcys	Pteronarcyidae	Plecoptera
420	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	35	Trichoptera		Trichoptera
421	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Micrasema	Brachycentridae	Trichoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
422	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	8	Glossosoma	Glossosomatidae	Trichoptera
423	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	6	Glossosomatidae	Glossosomatidae	Trichoptera
424	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	2	Protoptila	Glossosomatidae	Trichoptera
425	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	16	Cheumatopsyche	Hydropsychidae	Trichoptera
426	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	119	Hydropsyche	Hydropsychidae	Trichoptera
427	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	293	Hydropsychidae	Hydropsychidae	Trichoptera
428	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	77	Psychomyia	Psychomyiidae	Trichoptera
429	Reach 9	8/4/2016	Hess_3	Riffle	3	Hess	16	Psychomyiidae	Psychomyiidae	Trichoptera
430	Reference	8/4/2016	D-net_ALL	All	1	Dnet	60	Acari		
431	Reference	8/4/2016	D-net_ALL	All	1	Dnet	32	Nematoda		
432	Reference	8/4/2016	D-net_ALL	All	1	Dnet	187	Oligochaeta		
433	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Ferrissia	Ancylidae	Basommatophora
434	Reference	8/4/2016	D-net_ALL	All	1	Dnet	20	Physa	Physidae	Basommatophora
435	Reference	8/4/2016	D-net_ALL	All	1	Dnet	32	Dubiraphia	Elmidae	Coleoptera
436	Reference	8/4/2016	D-net_ALL	All	1	Dnet	40	Elmidae	Elmidae	Coleoptera
437	Reference	8/4/2016	D-net_ALL	All	1	Dnet	16	Optioservus	Elmidae	Coleoptera
438	Reference	8/4/2016	D-net_ALL	All	1	Dnet	12	Collembola		Collembola
439	Reference	8/4/2016	D-net_ALL	All	1	Dnet	18	Atherix	Athericidae	Diptera
440	Reference	8/4/2016	D-net_ALL	All	1	Dnet	26	Ceratopogonidae	Ceratopogonidae	Diptera
441	Reference	8/4/2016	D-net_ALL	All	1	Dnet	117	Chironomidae	Chironomidae	Diptera
442	Reference	8/4/2016	D-net_ALL	All	1	Dnet	339	Chironomini/ Pseudochironomini	Chironomidae	Diptera
443	Reference	8/4/2016	D-net_ALL	All	1	Dnet	376	Orthocladiinae	Chironomidae	Diptera
444	Reference	8/4/2016	D-net_ALL	All	1	Dnet	135	Tanypodinae	Chironomidae	Diptera
445	Reference	8/4/2016	D-net_ALL	All	1	Dnet	648	Tanytarsini	Chironomidae	Diptera
446	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Neoplasta	Empididae	Diptera
447	Reference	8/4/2016	D-net_ALL	All	1	Dnet	24	Simuliidae	Simuliidae	Diptera

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	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
448	Reference	8/4/2016	D-net_ALL	All	1	Dnet	13	Chrysops	Tabanidae	Diptera
449	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Hexatoma	Tipulidae	Diptera
450	Reference	8/4/2016	D-net_ALL	All	1	Dnet	1	Tipulidae	Tipulidae	Diptera
451	Reference	8/4/2016	D-net_ALL	All	1	Dnet	25	Ephemeroptera		Ephemeroptera
452	Reference	8/4/2016	D-net_ALL	All	1	Dnet	28	Baetidae	Baetidae	Ephemeroptera
453	Reference	8/4/2016	D-net_ALL	All	1	Dnet	16	Baetis	Baetidae	Ephemeroptera
454	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Caenis	Caenidae	Ephemeroptera
455	Reference	8/4/2016	D-net_ALL	All	1	Dnet	24	Ephemerellidae	Ephemerellidae	Ephemeroptera
456	Reference	8/4/2016	D-net_ALL	All	1	Dnet	22	Eurylophella	Ephemerellidae	Ephemeroptera
457	Reference	8/4/2016	D-net_ALL	All	1	Dnet	172	Ephemera	Ephemeridae	Ephemeroptera
458	Reference	8/4/2016	D-net_ALL	All	1	Dnet	28	Heptageniidae	Heptageniidae	Ephemeroptera
459	Reference	8/4/2016	D-net_ALL	All	1	Dnet	48	Tricorythodes	Leptohyphidae	Ephemeroptera
460	Reference	8/4/2016	D-net_ALL	All	1	Dnet	112	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
461	Reference	8/4/2016	D-net_ALL	All	1	Dnet	13	Nigronia	Corydalidae	Megaloptera
462	Reference	8/4/2016	D-net_ALL	All	1	Dnet	8	Sialis	Sialidae	Megaloptera
463	Reference	8/4/2016	D-net_ALL	All	1	Dnet	8	Aeshnidae	Aeshnidae	Odonata
464	Reference	8/4/2016	D-net_ALL	All	1	Dnet	2	Boyeria	Aeshnidae	Odonata
465	Reference	8/4/2016	D-net_ALL	All	1	Dnet	2	Calopteryx	Calopterygidae	Odonata
466	Reference	8/4/2016	D-net_ALL	All	1	Dnet	12	Coenagrionidae	Coenagrionidae	Odonata
467	Reference	8/4/2016	D-net_ALL	All	1	Dnet	1	Cordulegaster	Cordulegastridae	Odonata
468	Reference	8/4/2016	D-net_ALL	All	1	Dnet	16	Gomphidae	Gomphidae	Odonata
469	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Ophiogomphus	Gomphidae	Odonata
470	Reference	8/4/2016	D-net_ALL	All	1	Dnet	32	Plecoptera		Plecoptera
471	Reference	8/4/2016	D-net_ALL	All	1	Dnet	20	Capniidae	Capniidae	Plecoptera
472	Reference	8/4/2016	D-net_ALL	All	1	Dnet	20	Leuctra	Leuctridae	Plecoptera
473	Reference	8/4/2016	D-net_ALL	All	1	Dnet	12	Leuctridae	Leuctridae	Plecoptera
474	Reference	8/4/2016	D-net_ALL	All	1	Dnet	3	Acroneuria	Perlidae	Plecoptera

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	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
475	Reference	8/4/2016	D-net_ALL	All	1	Dnet	12	Perlidae	Perlidae	Plecoptera
476	Reference	8/4/2016	D-net_ALL	All	1	Dnet	9	Pteronarcys	Pteronarcyidae	Plecoptera
477	Reference	8/4/2016	D-net_ALL	All	1	Dnet	36	Trichoptera		Trichoptera
478	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Brachycentrus	Brachycentridae	Trichoptera
479	Reference	8/4/2016	D-net_ALL	All	1	Dnet	12	Protoptila	Glossosomatidae	Trichoptera
480	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Helicopsyche	Helicopsychidae	Trichoptera
481	Reference	8/4/2016	D-net_ALL	All	1	Dnet	16	Hydropsyche	Hydropsychidae	Trichoptera
482	Reference	8/4/2016	D-net_ALL	All	1	Dnet	64	Hydropsychidae	Hydropsychidae	Trichoptera
483	Reference	8/4/2016	D-net_ALL	All	1	Dnet	8	Hydroptilidae	Hydroptilidae	Trichoptera
484	Reference	8/4/2016	D-net_ALL	All	1	Dnet	48	Leptoceridae	Leptoceridae	Trichoptera
485	Reference	8/4/2016	D-net_ALL	All	1	Dnet	24	Oecetis	Leptoceridae	Trichoptera
486	Reference	8/4/2016	D-net_ALL	All	1	Dnet	1	Limnephilidae	Limnephilidae	Trichoptera
487	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Pycnopsyche	Limnephilidae	Trichoptera
488	Reference	8/4/2016	D-net_ALL	All	1	Dnet	21	Molanna	Molannidae	Trichoptera
489	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Lype	Psychomyiidae	Trichoptera
490	Reference	8/4/2016	D-net_ALL	All	1	Dnet	8	Psychomyia	Psychomyiidae	Trichoptera
491	Reference	8/4/2016	D-net_ALL	All	1	Dnet	4	Psychomyiidae	Psychomyiidae	Trichoptera
492	Reference	8/4/2016	D-net_ALL	All	1	Dnet	20	Pisidiidae	Pisidiidae	Veneroida
493	Reference	8/4/2016	D-net_ALL	All	1	Dnet	21	Pisidium	Pisidiidae	Veneroida
494	Reference	8/4/2016	Hess_1	Riffle	1	Hess	120	Acari		
495	Reference	8/4/2016	Hess_1	Riffle	1	Hess	12	Nematoda		
496	Reference	8/4/2016	Hess_1	Riffle	1	Hess	47	Oligochaeta		
497	Reference	8/4/2016	Hess_1	Riffle	1	Hess	2	Turbellaria		
498	Reference	8/4/2016	Hess_1	Riffle	1	Hess	7	Ferrissia	Ancylidae	Basommatophora
499	Reference	8/4/2016	Hess_1	Riffle	1	Hess	64	Elmidae	Elmidae	Coleoptera
500	Reference	8/4/2016	Hess_1	Riffle	1	Hess	34	Optioservus	Elmidae	Coleoptera
501	Reference	8/4/2016	Hess_1	Riffle	1	Hess	2	Collembola		Collembola

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
502	Reference	8/4/2016	Hess_1	Riffle	1	Hess	9	Atherix	Athericidae	Diptera
503	Reference	8/4/2016	Hess_1	Riffle	1	Hess	24	Chironomidae	Chironomidae	Diptera
504	Reference	8/4/2016	Hess_1	Riffle	1	Hess	14	Chironomini/ Pseudochironomini	Chironomidae	Diptera
505	Reference	8/4/2016	Hess_1	Riffle	1	Hess	266	Orthocladiinae	Chironomidae	Diptera
506	Reference	8/4/2016	Hess_1	Riffle	1	Hess	10	Tanypodinae	Chironomidae	Diptera
507	Reference	8/4/2016	Hess_1	Riffle	1	Hess	290	Tanytarsini	Chironomidae	Diptera
508	Reference	8/4/2016	Hess_1	Riffle	1	Hess	2	Empididae	Empididae	Diptera
509	Reference	8/4/2016	Hess_1	Riffle	1	Hess	6	Hemerodromia	Empididae	Diptera
510	Reference	8/4/2016	Hess_1	Riffle	1	Hess	30	Simuliidae	Simuliidae	Diptera
511	Reference	8/4/2016	Hess_1	Riffle	1	Hess	32	Antocha	Tipulidae	Diptera
512	Reference	8/4/2016	Hess_1	Riffle	1	Hess	2	Hexatoma	Tipulidae	Diptera
513	Reference	8/4/2016	Hess_1	Riffle	1	Hess	87	Baetidae	Baetidae	Ephemeroptera
514	Reference	8/4/2016	Hess_1	Riffle	1	Hess	24	Baetis	Baetidae	Ephemeroptera
515	Reference	8/4/2016	Hess_1	Riffle	1	Hess	20	Heterocloeon	Baetidae	Ephemeroptera
516	Reference	8/4/2016	Hess_1	Riffle	1	Hess	6	Ephemerellidae	Ephemerellidae	Ephemeroptera
517	Reference	8/4/2016	Hess_1	Riffle	1	Hess	28	Heptageniidae	Heptageniidae	Ephemeroptera
518	Reference	8/4/2016	Hess_1	Riffle	1	Hess	44	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
519	Reference	8/4/2016	Hess_1	Riffle	1	Hess	13	Nigronia	Corydalidae	Megaloptera
520	Reference	8/4/2016	Hess_1	Riffle	1	Hess	1	Boyeria	Aeshnidae	Odonata
521	Reference	8/4/2016	Hess_1	Riffle	1	Hess	20	Gomphidae	Gomphidae	Odonata
522	Reference	8/4/2016	Hess_1	Riffle	1	Hess	24	Plecoptera		Plecoptera
523	Reference	8/4/2016	Hess_1	Riffle	1	Hess	76	Capniidae	Capniidae	Plecoptera
524	Reference	8/4/2016	Hess_1	Riffle	1	Hess	18	Leuctridae	Leuctridae	Plecoptera
525	Reference	8/4/2016	Hess_1	Riffle	1	Hess	18	Perlidae	Perlidae	Plecoptera
526	Reference	8/4/2016	Hess_1	Riffle	1	Hess	14	Trichoptera		Trichoptera
527	Reference	8/4/2016	Hess_1	Riffle	1	Hess	2	Micrasema	Brachycentridae	Trichoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
528	Reference	8/4/2016	Hess_1	Riffle	1	Hess	1	Glossosoma	Glossosomatidae	Trichoptera
529	Reference	8/4/2016	Hess_1	Riffle	1	Hess	18	Glossosomatidae	Glossosomatidae	Trichoptera
530	Reference	8/4/2016	Hess_1	Riffle	1	Hess	8	Protoptila	Glossosomatidae	Trichoptera
531	Reference	8/4/2016	Hess_1	Riffle	1	Hess	141	Hydropsyche	Hydropsychidae	Trichoptera
532	Reference	8/4/2016	Hess_1	Riffle	1	Hess	184	Hydropsychidae	Hydropsychidae	Trichoptera
533	Reference	8/4/2016	Hess_1	Riffle	1	Hess	24	Lepidostoma	Lepidostomatidae	Trichoptera
534	Reference	8/4/2016	Hess_1	Riffle	1	Hess	20	Psychomyia	Psychomyiidae	Trichoptera
535	Reference	8/4/2016	Hess_1	Riffle	1	Hess	24	Psychomyiidae	Psychomyiidae	Trichoptera
536	Reference	8/4/2016	Hess_2	Riffle	2	Hess	82	Acari		
537	Reference	8/4/2016	Hess_2	Riffle	2	Hess	6	Nematoda		
538	Reference	8/4/2016	Hess_2	Riffle	2	Hess	106	Oligochaeta		
539	Reference	8/4/2016	Hess_2	Riffle	2	Hess	2	Turbellaria		
540	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Ferrissia	Ancylidae	Basommatophora
541	Reference	8/4/2016	Hess_2	Riffle	2	Hess	64	Elmidae	Elmidae	Coleoptera
542	Reference	8/4/2016	Hess_2	Riffle	2	Hess	73	Optioservus	Elmidae	Coleoptera
543	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Collembola		Collembola
544	Reference	8/4/2016	Hess_2	Riffle	2	Hess	2	Atherix	Athericidae	Diptera
545	Reference	8/4/2016	Hess_2	Riffle	2	Hess	2	Ceratopogonidae	Ceratopogonidae	Diptera
546	Reference	8/4/2016	Hess_2	Riffle	2	Hess	11	Chironomidae	Chironomidae	Diptera
547	Reference	8/4/2016	Hess_2	Riffle	2	Hess	8	Chironomini/ Pseudochironomini	Chironomidae	Diptera
548	Reference	8/4/2016	Hess_2	Riffle	2	Hess	180	Orthocladiinae	Chironomidae	Diptera
549	Reference	8/4/2016	Hess_2	Riffle	2	Hess	6	Tanypodinae	Chironomidae	Diptera
550	Reference	8/4/2016	Hess_2	Riffle	2	Hess	151	Tanytarsini	Chironomidae	Diptera
551	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Empididae	Empididae	Diptera
552	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Hemerodromia	Empididae	Diptera
553	Reference	8/4/2016	Hess_2	Riffle	2	Hess	8	Simuliidae	Simuliidae	Diptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
554	Reference	8/4/2016	Hess_2	Riffle	2	Hess	16	Antocha	Tipulidae	Diptera
555	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Dicranota	Tipulidae	Diptera
556	Reference	8/4/2016	Hess_2	Riffle	2	Hess	2	Hexatoma	Tipulidae	Diptera
557	Reference	8/4/2016	Hess_2	Riffle	2	Hess	52	Baetidae	Baetidae	Ephemeroptera
558	Reference	8/4/2016	Hess_2	Riffle	2	Hess	5	Baetis	Baetidae	Ephemeroptera
559	Reference	8/4/2016	Hess_2	Riffle	2	Hess	6	Ephemerellidae	Ephemerellidae	Ephemeroptera
560	Reference	8/4/2016	Hess_2	Riffle	2	Hess	9	Heptageniidae	Heptageniidae	Ephemeroptera
561	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Tricorythodes	Leptohyphidae	Ephemeroptera
562	Reference	8/4/2016	Hess_2	Riffle	2	Hess	28	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
563	Reference	8/4/2016	Hess_2	Riffle	2	Hess	2	Nigronia	Corydalidae	Megaloptera
564	Reference	8/4/2016	Hess_2	Riffle	2	Hess	6	Gomphidae	Gomphidae	Odonata
565	Reference	8/4/2016	Hess_2	Riffle	2	Hess	10	Plecoptera		Plecoptera
566	Reference	8/4/2016	Hess_2	Riffle	2	Hess	89	Capniidae	Capniidae	Plecoptera
567	Reference	8/4/2016	Hess_2	Riffle	2	Hess	2	Chloroperlidae	Chloroperlidae	Plecoptera
568	Reference	8/4/2016	Hess_2	Riffle	2	Hess	7	Leuctridae	Leuctridae	Plecoptera
569	Reference	8/4/2016	Hess_2	Riffle	2	Hess	7	Acroneuria	Perlidae	Plecoptera
570	Reference	8/4/2016	Hess_2	Riffle	2	Hess	30	Perlidae	Perlidae	Plecoptera
571	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Taeniopteryx	Taeniopterygidae	Plecoptera
572	Reference	8/4/2016	Hess_2	Riffle	2	Hess	13	Trichoptera		Trichoptera
573	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Brachycentridae	Brachycentridae	Trichoptera
574	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Micrasema	Brachycentridae	Trichoptera
575	Reference	8/4/2016	Hess_2	Riffle	2	Hess	35	Glossosoma	Glossosomatidae	Trichoptera
576	Reference	8/4/2016	Hess_2	Riffle	2	Hess	2	Glossosomatidae	Glossosomatidae	Trichoptera
577	Reference	8/4/2016	Hess_2	Riffle	2	Hess	6	Protoptila	Glossosomatidae	Trichoptera
578	Reference	8/4/2016	Hess_2	Riffle	2	Hess	9	Hydropsyche	Hydropsychidae	Trichoptera
579	Reference	8/4/2016	Hess_2	Riffle	2	Hess	59	Hydropsychidae	Hydropsychidae	Trichoptera
580	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Oecetis	Leptoceridae	Trichoptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
581	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Polycentropus	Polycentropodidae	Trichoptera
582	Reference	8/4/2016	Hess_2	Riffle	2	Hess	28	Psychomyia	Psychomyiidae	Trichoptera
583	Reference	8/4/2016	Hess_2	Riffle	2	Hess	8	Psychomyiidae	Psychomyiidae	Trichoptera
584	Reference	8/4/2016	Hess_2	Riffle	2	Hess	1	Pisidium	Pisidiidae	Veneroida
585	Reference	8/4/2016	Hess_3	Run	3	Hess	165	Acari		
586	Reference	8/4/2016	Hess_3	Run	3	Hess	15	Nematoda		
587	Reference	8/4/2016	Hess_3	Run	3	Hess	43	Oligochaeta		
588	Reference	8/4/2016	Hess_3	Run	3	Hess	3	Ferrissia	Ancylidae	Basommatophora
589	Reference	8/4/2016	Hess_3	Run	3	Hess	3	Physa	Physidae	Basommatophora
590	Reference	8/4/2016	Hess_3	Run	3	Hess	62	Elmidae	Elmidae	Coleoptera
591	Reference	8/4/2016	Hess_3	Run	3	Hess	17	Optioservus	Elmidae	Coleoptera
592	Reference	8/4/2016	Hess_3	Run	3	Hess	2	Collembola		Collembola
593	Reference	8/4/2016	Hess_3	Run	3	Hess	5	Atherix	Athericidae	Diptera
594	Reference	8/4/2016	Hess_3	Run	3	Hess	7	Ceratopogonidae	Ceratopogonidae	Diptera
595	Reference	8/4/2016	Hess_3	Run	3	Hess	26	Chironomidae	Chironomidae	Diptera
596	Reference	8/4/2016	Hess_3	Run	3	Hess	11	Chironominae	Chironomidae	Diptera
597	Reference	8/4/2016	Hess_3	Run	3	Hess	16	Chironomini/ Pseudochironomini	Chironomidae	Diptera
598	Reference	8/4/2016	Hess_3	Run	3	Hess	148	Orthocladiinae	Chironomidae	Diptera
599	Reference	8/4/2016	Hess_3	Run	3	Hess	16	Tanypodinae	Chironomidae	Diptera
600	Reference	8/4/2016	Hess_3	Run	3	Hess	202	Tanytarsini	Chironomidae	Diptera
601	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Dixella	Dixidae	Diptera
602	Reference	8/4/2016	Hess_3	Run	3	Hess	6	Empididae	Empididae	Diptera
603	Reference	8/4/2016	Hess_3	Run	3	Hess	11	Hemerodromia	Empididae	Diptera
604	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Neoplasta	Empididae	Diptera
605	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Simuliidae	Simuliidae	Diptera
606	Reference	8/4/2016	Hess_3	Run	3	Hess	26	Antocha	Tipulidae	Diptera

Appendix IV. (Continued)

	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
607	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Hexatoma	Tipulidae	Diptera
608	Reference	8/4/2016	Hess_3	Run	3	Hess	11	Baetidae	Baetidae	Ephemeroptera
609	Reference	8/4/2016	Hess_3	Run	3	Hess	6	Baetis	Baetidae	Ephemeroptera
610	Reference	8/4/2016	Hess_3	Run	3	Hess	10	Ephemerellidae	Ephemerellidae	Ephemeroptera
611	Reference	8/4/2016	Hess_3	Run	3	Hess	5	Eurylophella	Ephemerellidae	Ephemeroptera
612	Reference	8/4/2016	Hess_3	Run	3	Hess	60	Heptageniidae	Heptageniidae	Ephemeroptera
613	Reference	8/4/2016	Hess_3	Run	3	Hess	2	Leucrocuta	Heptageniidae	Ephemeroptera
614	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Maccaffertium	Heptageniidae	Ephemeroptera
615	Reference	8/4/2016	Hess_3	Run	3	Hess	28	Leptophlebiidae	Leptophlebiidae	Ephemeroptera
616	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Crambidae	Crambidae	Lepidoptera
617	Reference	8/4/2016	Hess_3	Run	3	Hess	5	Nigronia	Corydalidae	Megaloptera
618	Reference	8/4/2016	Hess_3	Run	3	Hess	5	Sialis	Sialidae	Megaloptera
619	Reference	8/4/2016	Hess_3	Run	3	Hess	7	Gomphidae	Gomphidae	Odonata
620	Reference	8/4/2016	Hess_3	Run	3	Hess	13	Plecoptera		Plecoptera
621	Reference	8/4/2016	Hess_3	Run	3	Hess	21	Capniidae	Capniidae	Plecoptera
622	Reference	8/4/2016	Hess_3	Run	3	Hess	2	Leuctra	Leuctridae	Plecoptera
623	Reference	8/4/2016	Hess_3	Run	3	Hess	7	Leuctridae	Leuctridae	Plecoptera
624	Reference	8/4/2016	Hess_3	Run	3	Hess	3	Acroneuria	Perlidae	Plecoptera
625	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Paragnetina	Perlidae	Plecoptera
626	Reference	8/4/2016	Hess_3	Run	3	Hess	7	Perlidae	Perlidae	Plecoptera
627	Reference	8/4/2016	Hess_3	Run	3	Hess	11	Trichoptera		Trichoptera
628	Reference	8/4/2016	Hess_3	Run	3	Hess	10	Micrasema	Brachycentridae	Trichoptera
629	Reference	8/4/2016	Hess_3	Run	3	Hess	13	Glossosoma	Glossosomatidae	Trichoptera
630	Reference	8/4/2016	Hess_3	Run	3	Hess	8	Glossosomatidae	Glossosomatidae	Trichoptera
631	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Goeridae	Goeridae	Trichoptera
632	Reference	8/4/2016	Hess_3	Run	3	Hess	13	Hydropsyche	Hydropsychidae	Trichoptera
633	Reference	8/4/2016	Hess_3	Run	3	Hess	33	Hydropsychidae	Hydropsychidae	Trichoptera

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	Reach	Date	Sample ID	Habitat	Rep	Type	Total	Taxa	Family	Order
634	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Lepidostoma	Lepidostomatidae	Trichoptera
635	Reference	8/4/2016	Hess_3	Run	3	Hess	3	Oecetis	Leptoceridae	Trichoptera
636	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Limnephilidae	Limnephilidae	Trichoptera
637	Reference	8/4/2016	Hess_3	Run	3	Hess	2	Polycentropodidae	Polycentropodidae	Trichoptera
638	Reference	8/4/2016	Hess_3	Run	3	Hess	61	Psychomyia	Psychomyiidae	Trichoptera
639	Reference	8/4/2016	Hess_3	Run	3	Hess	14	Psychomyiidae	Psychomyiidae	Trichoptera
640	Reference	8/4/2016	Hess_3	Run	3	Hess	2	Pisidiidae	Pisidiidae	Veneroida
641	Reference	8/4/2016	Hess_3	Run	3	Hess	1	Pisidium	Pisidiidae	Veneroida

Appendix V. Electrofishing pass totals from each reach sampled on the Knife River mainstem.

	Reach	Date	Pass	Common Name	Age	Total
1	Reach 12	7/25/2016	1	Blacknose dace	Other	253
2	Reach 12	7/25/2016	1	Brook stickleback	Other	1
3	Reach 12	7/25/2016	1	Creek chub	Other	12
4	Reach 12	7/25/2016	1	Longnose dace	Other	120
5	Reach 12	7/25/2016	1	Pearl dace	Other	8
6	Reach 12	7/25/2016	1	White sucker	Other	15
7	Reach 12	7/25/2016	1	Brook trout	Other	12
8	Reach 12	7/25/2016	1	Brook trout	YOY	1
9	Reach 12	7/25/2016	1	Brown trout	Other	24
10	Reach 12	7/25/2016	1	Brown trout	YOY	20
11	Reach 12	7/25/2016	1	Rainbow trout	Other	126
12	Reach 12	7/25/2016	1	Rainbow trout	YOY	167
13	Reach 12	7/25/2016	2	Blacknose dace	Other	88
14	Reach 12	7/25/2016	2	Creek chub	Other	7
15	Reach 12	7/25/2016	2	Longnose dace	Other	68
16	Reach 12	7/25/2016	2	Pearl dace	Other	5
17	Reach 12	7/25/2016	2	White sucker	Other	6
18	Reach 12	7/25/2016	2	Brown trout	Other	12
19	Reach 12	7/25/2016	2	Brown trout	YOY	5
20	Reach 12	7/25/2016	2	Rainbow trout	Other	35
21	Reach 12	7/25/2016	2	Rainbow trout	YOY	55
22	Reach 9	7/26/2016	1	Blacknose dace	Other	276
23	Reach 9	7/26/2016	1	Brook stickleback	Other	3
24	Reach 9	7/26/2016	1	Central mudminnow	Other	1
25	Reach 9	7/26/2016	1	Common shiner	Other	6
26	Reach 9	7/26/2016	1	Creek chub	Other	25
27	Reach 9	7/26/2016	1	Fathead minnow	Other	6
28	Reach 9	7/26/2016	1	Johnny darter	Other	2
29	Reach 9	7/26/2016	1	Longnose dace	Other	156
30	Reach 9	7/26/2016	1	Northern redbelly dace	Other	1
31	Reach 9	7/26/2016	1	Pearl dace	Other	11
32	Reach 9	7/26/2016	1	White sucker	Other	9
33	Reach 9	7/26/2016	1	Brook trout	Other	18
34	Reach 9	7/26/2016	1	Brown trout	Other	30
35	Reach 9	7/26/2016	1	Brown trout	YOY	36
36	Reach 9	7/26/2016	1	Rainbow trout	Other	143
37	Reach 9	7/26/2016	1	Rainbow trout	YOY	171
38	Reach 9	7/26/2016	2	Blacknose dace	Other	69

Appendix V. (Continued)

	Reach	Date	Pass	Common Name	Age	Total
39	Reach 9	7/26/2016	2	Brook stickleback	Other	4
40	Reach 9	7/26/2016	2	Creek chub	Other	9
41	Reach 9	7/26/2016	2	Johnny darter	Other	1
42	Reach 9	7/26/2016	2	Longnose dace	Other	49
43	Reach 9	7/26/2016	2	Pearl dace	Other	7
44	Reach 9	7/26/2016	2	White sucker	Other	1
45	Reach 9	7/26/2016	2	Brook trout	Other	4
46	Reach 9	7/26/2016	2	Brown trout	Other	7
47	Reach 9	7/26/2016	2	Brown trout	YOY	2
48	Reach 9	7/26/2016	2	Rainbow trout	Other	45
49	Reach 9	7/26/2016	2	Rainbow trout	YOY	41
50	Reference	7/27/2016	1	Blacknose dace	Other	121
51	Reference	7/27/2016	1	Central mudminnow	Other	2
52	Reference	7/27/2016	1	Common shiner	Other	1
53	Reference	7/27/2016	1	Creek chub	Other	23
54	Reference	7/27/2016	1	Fathead minnow	Other	1
55	Reference	7/27/2016	1	Johnny darter	Other	4
56	Reference	7/27/2016	1	Longnose dace	Other	32
57	Reference	7/27/2016	1	Pearl dace	Other	23
58	Reference	7/27/2016	1	White sucker	Other	5
59	Reference	7/27/2016	1	Brook trout	Other	22
60	Reference	7/27/2016	1	Brown trout	Other	11
61	Reference	7/27/2016	1	Brown trout	YOY	11
62	Reference	7/27/2016	1	Rainbow trout	Other	102
63	Reference	7/27/2016	1	Rainbow trout	YOY	78
64	Reference	7/27/2016	2	Blacknose dace	Other	56
65	Reference	7/27/2016	2	Common shiner	Other	2
66	Reference	7/27/2016	2	Creek chub	Other	5
67	Reference	7/27/2016	2	Longnose dace	Other	32
68	Reference	7/27/2016	2	Pearl dace	Other	8
69	Reference	7/27/2016	2	White sucker	Other	2
70	Reference	7/27/2016	2	Brook trout	Other	6
71	Reference	7/27/2016	2	Brook trout	YOY	1
72	Reference	7/27/2016	2	Brown trout	Other	6
73	Reference	7/27/2016	2	Brown trout	YOY	2
74	Reference	7/27/2016	2	Rainbow trout	Other	21
75	Reference	7/27/2016	2	Rainbow trout	YOY	47

Appendix VI. Individual fish measurements from by electrofishing pass among reaches on the Knife River mainstem. TL = total length, W = weight.

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
1	Reach 12	7/25/2016	1	Blacknose dace	Other	90	na
2	Reach 12	7/25/2016	1	Blacknose dace	Other	88	na
3	Reach 12	7/25/2016	1	Blacknose dace	Other	75	na
4	Reach 12	7/25/2016	1	Blacknose dace	Other	70	na
5	Reach 12	7/25/2016	1	Blacknose dace	Other	70	na
6	Reach 12	7/25/2016	1	Blacknose dace	Other	67	na
7	Reach 12	7/25/2016	1	Blacknose dace	Other	67	na
8	Reach 12	7/25/2016	1	Blacknose dace	Other	66	na
9	Reach 12	7/25/2016	1	Blacknose dace	Other	66	na
10	Reach 12	7/25/2016	1	Blacknose dace	Other	65	na
11	Reach 12	7/25/2016	1	Blacknose dace	Other	65	na
12	Reach 12	7/25/2016	1	Blacknose dace	Other	65	na
13	Reach 12	7/25/2016	1	Blacknose dace	Other	62	na
14	Reach 12	7/25/2016	1	Blacknose dace	Other	62	na
15	Reach 12	7/25/2016	1	Blacknose dace	Other	61	na
16	Reach 12	7/25/2016	1	Blacknose dace	Other	60	na
17	Reach 12	7/25/2016	1	Blacknose dace	Other	60	na
18	Reach 12	7/25/2016	1	Blacknose dace	Other	60	na
19	Reach 12	7/25/2016	1	Blacknose dace	Other	56	na
20	Reach 12	7/25/2016	1	Blacknose dace	Other	56	na
21	Reach 12	7/25/2016	1	Brook stickleback	Other	50	na
22	Reach 12	7/25/2016	1	Brook trout	Other	247	na
23	Reach 12	7/25/2016	1	Brook trout	Other	225	112
24	Reach 12	7/25/2016	1	Brook trout	Other	200	na
25	Reach 12	7/25/2016	1	Brook trout	Other	175	60
26	Reach 12	7/25/2016	1	Brook trout	Other	155	37
27	Reach 12	7/25/2016	1	Brook trout	Other	145	27
28	Reach 12	7/25/2016	1	Brook trout	Other	137	25
29	Reach 12	7/25/2016	1	Brook trout	Other	132	20
30	Reach 12	7/25/2016	1	Brook trout	Other	131	20
31	Reach 12	7/25/2016	1	Brook trout	Other	130	18
32	Reach 12	7/25/2016	1	Brook trout	Other	113	14
33	Reach 12	7/25/2016	1	Brook trout	Other	106	11
34	Reach 12	7/25/2016	1	Brook trout	YOY	48	na
35	Reach 12	7/25/2016	1	Brown trout	Other	310	na
36	Reach 12	7/25/2016	1	Brown trout	Other	230	108
37	Reach 12	7/25/2016	1	Brown trout	Other	175	47
38	Reach 12	7/25/2016	1	Brown trout	Other	162	40

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
39	Reach 12	7/25/2016	1	Brown trout	Other	155	32
40	Reach 12	7/25/2016	1	Brown trout	Other	136	21
41	Reach 12	7/25/2016	1	Brown trout	Other	135	22
42	Reach 12	7/25/2016	1	Brown trout	Other	130	24
43	Reach 12	7/25/2016	1	Brown trout	Other	130	22
44	Reach 12	7/25/2016	1	Brown trout	Other	127	20
45	Reach 12	7/25/2016	1	Brown trout	Other	125	19
46	Reach 12	7/25/2016	1	Brown trout	Other	120	14
47	Reach 12	7/25/2016	1	Brown trout	Other	120	15
48	Reach 12	7/25/2016	1	Brown trout	Other	120	14
49	Reach 12	7/25/2016	1	Brown trout	Other	116	15
50	Reach 12	7/25/2016	1	Brown trout	Other	115	14
51	Reach 12	7/25/2016	1	Brown trout	Other	112	13
52	Reach 12	7/25/2016	1	Brown trout	Other	110	11
53	Reach 12	7/25/2016	1	Brown trout	Other	110	12
54	Reach 12	7/25/2016	1	Brown trout	Other	107	11
55	Reach 12	7/25/2016	1	Brown trout	Other	102	9
56	Reach 12	7/25/2016	1	Brown trout	Other	100	9
57	Reach 12	7/25/2016	1	Brown trout	Other	88	6
58	Reach 12	7/25/2016	1	Brown trout	YOY	63	2
59	Reach 12	7/25/2016	1	Brown trout	YOY	59	1
60	Reach 12	7/25/2016	1	Brown trout	YOY	59	na
61	Reach 12	7/25/2016	1	Brown trout	YOY	59	2
62	Reach 12	7/25/2016	1	Brown trout	YOY	59	1
63	Reach 12	7/25/2016	1	Brown trout	YOY	58	1
64	Reach 12	7/25/2016	1	Brown trout	YOY	58	2
65	Reach 12	7/25/2016	1	Brown trout	YOY	56	1
66	Reach 12	7/25/2016	1	Brown trout	YOY	56	1
67	Reach 12	7/25/2016	1	Brown trout	YOY	55	1
68	Reach 12	7/25/2016	1	Brown trout	YOY	55	1
69	Reach 12	7/25/2016	1	Brown trout	YOY	55	1
70	Reach 12	7/25/2016	1	Brown trout	YOY	55	1
71	Reach 12	7/25/2016	1	Brown trout	YOY	55	1
72	Reach 12	7/25/2016	1	Brown trout	YOY	52	1
73	Reach 12	7/25/2016	1	Brown trout	YOY	48	1
74	Reach 12	7/25/2016	1	Brown trout	YOY	46	1
75	Reach 12	7/25/2016	1	Brown trout	YOY	46	1
76	Reach 12	7/25/2016	1	Creek chub	Other	165	na
77	Reach 12	7/25/2016	1	Creek chub	Other	155	na

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
78	Reach 12	7/25/2016	1	Creek chub	Other	120	na
79	Reach 12	7/25/2016	1	Creek chub	Other	105	na
80	Reach 12	7/25/2016	1	Creek chub	Other	81	na
81	Reach 12	7/25/2016	1	Creek chub	Other	76	na
82	Reach 12	7/25/2016	1	Creek chub	Other	75	na
83	Reach 12	7/25/2016	1	Creek chub	Other	75	na
84	Reach 12	7/25/2016	1	Creek chub	Other	74	na
85	Reach 12	7/25/2016	1	Creek chub	Other	72	na
86	Reach 12	7/25/2016	1	Creek chub	Other	70	na
87	Reach 12	7/25/2016	1	Creek chub	Other	61	na
88	Reach 12	7/25/2016	1	Longnose dace	Other	100	na
89	Reach 12	7/25/2016	1	Longnose dace	Other	90	na
90	Reach 12	7/25/2016	1	Longnose dace	Other	80	na
91	Reach 12	7/25/2016	1	Longnose dace	Other	80	na
92	Reach 12	7/25/2016	1	Longnose dace	Other	70	na
93	Reach 12	7/25/2016	1	Longnose dace	Other	68	na
94	Reach 12	7/25/2016	1	Longnose dace	Other	68	na
95	Reach 12	7/25/2016	1	Longnose dace	Other	67	na
96	Reach 12	7/25/2016	1	Longnose dace	Other	66	na
97	Reach 12	7/25/2016	1	Longnose dace	Other	66	na
98	Reach 12	7/25/2016	1	Longnose dace	Other	65	na
99	Reach 12	7/25/2016	1	Longnose dace	Other	64	na
100	Reach 12	7/25/2016	1	Longnose dace	Other	64	na
101	Reach 12	7/25/2016	1	Longnose dace	Other	62	na
102	Reach 12	7/25/2016	1	Longnose dace	Other	61	na
103	Reach 12	7/25/2016	1	Longnose dace	Other	61	na
104	Reach 12	7/25/2016	1	Longnose dace	Other	60	na
105	Reach 12	7/25/2016	1	Longnose dace	Other	60	na
106	Reach 12	7/25/2016	1	Longnose dace	Other	60	na
107	Reach 12	7/25/2016	1	Longnose dace	Other	55	na
108	Reach 12	7/25/2016	1	Pearl dace	Other	99	na
109	Reach 12	7/25/2016	1	Pearl dace	Other	99	na
110	Reach 12	7/25/2016	1	Pearl dace	Other	97	na
111	Reach 12	7/25/2016	1	Pearl dace	Other	85	na
112	Reach 12	7/25/2016	1	Pearl dace	Other	72	na
113	Reach 12	7/25/2016	1	Pearl dace	Other	69	na
114	Reach 12	7/25/2016	1	Pearl dace	Other	65	na
115	Reach 12	7/25/2016	1	Pearl dace	Other	62	na
116	Reach 12	7/25/2016	1	Rainbow trout	Other	200	76

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
117	Reach 12	7/25/2016	1	Rainbow trout	Other	175	57
118	Reach 12	7/25/2016	1	Rainbow trout	Other	155	27
119	Reach 12	7/25/2016	1	Rainbow trout	Other	143	29
120	Reach 12	7/25/2016	1	Rainbow trout	Other	142	24
121	Reach 12	7/25/2016	1	Rainbow trout	Other	140	26
122	Reach 12	7/25/2016	1	Rainbow trout	Other	131	21
123	Reach 12	7/25/2016	1	Rainbow trout	Other	130	20
124	Reach 12	7/25/2016	1	Rainbow trout	Other	126	18
125	Reach 12	7/25/2016	1	Rainbow trout	Other	125	18
126	Reach 12	7/25/2016	1	Rainbow trout	Other	122	16
127	Reach 12	7/25/2016	1	Rainbow trout	Other	120	14
128	Reach 12	7/25/2016	1	Rainbow trout	Other	118	15
129	Reach 12	7/25/2016	1	Rainbow trout	Other	118	13
130	Reach 12	7/25/2016	1	Rainbow trout	Other	115	12
131	Reach 12	7/25/2016	1	Rainbow trout	Other	115	14
132	Reach 12	7/25/2016	1	Rainbow trout	Other	108	10
133	Reach 12	7/25/2016	1	Rainbow trout	Other	107	10
134	Reach 12	7/25/2016	1	Rainbow trout	Other	105	11
135	Reach 12	7/25/2016	1	Rainbow trout	Other	104	na
136	Reach 12	7/25/2016	1	Rainbow trout	Other	104	8
137	Reach 12	7/25/2016	1	Rainbow trout	Other	100	9
138	Reach 12	7/25/2016	1	Rainbow trout	Other	98	10
139	Reach 12	7/25/2016	1	Rainbow trout	Other	97	10
140	Reach 12	7/25/2016	1	Rainbow trout	Other	96	8
141	Reach 12	7/25/2016	1	Rainbow trout	Other	95	8
142	Reach 12	7/25/2016	1	Rainbow trout	Other	91	7
143	Reach 12	7/25/2016	1	Rainbow trout	Other	90	7
144	Reach 12	7/25/2016	1	Rainbow trout	YOY	56	2
145	Reach 12	7/25/2016	1	Rainbow trout	YOY	55	1
146	Reach 12	7/25/2016	1	Rainbow trout	YOY	55	1
147	Reach 12	7/25/2016	1	Rainbow trout	YOY	55	1.3
148	Reach 12	7/25/2016	1	Rainbow trout	YOY	53	0.5
149	Reach 12	7/25/2016	1	Rainbow trout	YOY	53	1
150	Reach 12	7/25/2016	1	Rainbow trout	YOY	48	0.7
151	Reach 12	7/25/2016	1	Rainbow trout	YOY	46	0.5
152	Reach 12	7/25/2016	1	Rainbow trout	YOY	45	0.5
153	Reach 12	7/25/2016	1	Rainbow trout	YOY	45	0.5
154	Reach 12	7/25/2016	1	Rainbow trout	YOY	45	0.7
155	Reach 12	7/25/2016	1	Rainbow trout	YOY	44	0.7

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
156	Reach 12	7/25/2016	1	Rainbow trout	YOY	44	0.7
157	Reach 12	7/25/2016	1	White sucker	Other	200	na
158	Reach 12	7/25/2016	1	White sucker	Other	182	na
159	Reach 12	7/25/2016	1	White sucker	Other	180	na
160	Reach 12	7/25/2016	1	White sucker	Other	145	na
161	Reach 12	7/25/2016	1	White sucker	Other	144	na
162	Reach 12	7/25/2016	1	White sucker	Other	143	na
163	Reach 12	7/25/2016	1	White sucker	Other	135	na
164	Reach 12	7/25/2016	1	White sucker	Other	128	na
165	Reach 12	7/25/2016	1	White sucker	Other	127	na
166	Reach 12	7/25/2016	1	White sucker	Other	101	na
167	Reach 12	7/25/2016	1	White sucker	Other	100	na
168	Reach 12	7/25/2016	1	White sucker	Other	100	na
169	Reach 12	7/25/2016	1	White sucker	Other	100	na
170	Reach 12	7/25/2016	1	White sucker	Other	97	na
171	Reach 12	7/25/2016	1	White sucker	Other	82	na
172	Reach 12	7/25/2016	2	Brown trout	Other	252	162
173	Reach 12	7/25/2016	2	Creek chub	Other	138	na
174	Reach 12	7/25/2016	2	Creek chub	Other	120	na
175	Reach 12	7/25/2016	2	Creek chub	Other	109	na
176	Reach 12	7/25/2016	2	Creek chub	Other	96	na
177	Reach 12	7/25/2016	2	Creek chub	Other	75	na
178	Reach 12	7/25/2016	2	Creek chub	Other	71	na
179	Reach 12	7/25/2016	2	Creek chub	Other	70	na
180	Reach 12	7/25/2016	2	Longnose dace	Other	109	na
181	Reach 12	7/25/2016	2	Longnose dace	Other	105	na
182	Reach 12	7/25/2016	2	Pearl dace	Other	105	na
183	Reach 12	7/25/2016	2	Pearl dace	Other	100	na
184	Reach 12	7/25/2016	2	Pearl dace	Other	90	na
185	Reach 12	7/25/2016	2	Pearl dace	Other	75	na
186	Reach 12	7/25/2016	2	Pearl dace	Other	70	na
187	Reach 12	7/25/2016	2	White sucker	Other	151	na
188	Reach 12	7/25/2016	2	White sucker	Other	146	na
189	Reach 12	7/25/2016	2	White sucker	Other	125	na
190	Reach 12	7/25/2016	2	White sucker	Other	105	na
191	Reach 12	7/25/2016	2	White sucker	Other	88	na
192	Reach 12	7/25/2016	2	White sucker	Other	88	na
193	Reach 9	7/26/2016	1	Blacknose dace	Other	88	na
194	Reach 9	7/26/2016	1	Blacknose dace	Other	87	na

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
195	Reach 9	7/26/2016	1	Blacknose dace	Other	80	na
196	Reach 9	7/26/2016	1	Blacknose dace	Other	75	na
197	Reach 9	7/26/2016	1	Blacknose dace	Other	75	na
198	Reach 9	7/26/2016	1	Blacknose dace	Other	74	na
199	Reach 9	7/26/2016	1	Blacknose dace	Other	74	na
200	Reach 9	7/26/2016	1	Blacknose dace	Other	72	na
201	Reach 9	7/26/2016	1	Blacknose dace	Other	71	na
202	Reach 9	7/26/2016	1	Blacknose dace	Other	70	na
203	Reach 9	7/26/2016	1	Blacknose dace	Other	66	na
204	Reach 9	7/26/2016	1	Blacknose dace	Other	66	na
205	Reach 9	7/26/2016	1	Blacknose dace	Other	65	na
206	Reach 9	7/26/2016	1	Blacknose dace	Other	62	na
207	Reach 9	7/26/2016	1	Blacknose dace	Other	60	na
208	Reach 9	7/26/2016	1	Blacknose dace	Other	59	na
209	Reach 9	7/26/2016	1	Blacknose dace	Other	59	na
210	Reach 9	7/26/2016	1	Blacknose dace	Other	58	na
211	Reach 9	7/26/2016	1	Blacknose dace	Other	57	na
212	Reach 9	7/26/2016	1	Blacknose dace	Other	57	na
213	Reach 9	7/26/2016	1	Brook stickleback	Other	49	na
214	Reach 9	7/26/2016	1	Brook stickleback	Other	45	na
215	Reach 9	7/26/2016	1	Brook stickleback	Other	42	na
216	Reach 9	7/26/2016	1	Brook trout	Other	238	146
217	Reach 9	7/26/2016	1	Brook trout	Other	236	161
218	Reach 9	7/26/2016	1	Brook trout	Other	231	143
219	Reach 9	7/26/2016	1	Brook trout	Other	231	na
220	Reach 9	7/26/2016	1	Brook trout	Other	230	na
221	Reach 9	7/26/2016	1	Brook trout	Other	203	78
222	Reach 9	7/26/2016	1	Brook trout	Other	191	81
223	Reach 9	7/26/2016	1	Brook trout	Other	187	61
224	Reach 9	7/26/2016	1	Brook trout	Other	180	58
225	Reach 9	7/26/2016	1	Brook trout	Other	172	46
226	Reach 9	7/26/2016	1	Brook trout	Other	155	41
227	Reach 9	7/26/2016	1	Brook trout	Other	140	22
228	Reach 9	7/26/2016	1	Brook trout	Other	136	24
229	Reach 9	7/26/2016	1	Brook trout	Other	135	22
230	Reach 9	7/26/2016	1	Brook trout	Other	130	21
231	Reach 9	7/26/2016	1	Brook trout	Other	122	16
232	Reach 9	7/26/2016	1	Brown trout	Other	236	136
233	Reach 9	7/26/2016	1	Brown trout	Other	225	120

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
234	Reach 9	7/26/2016	1	Brown trout	Other	212	82
235	Reach 9	7/26/2016	1	Brown trout	Other	141	24
236	Reach 9	7/26/2016	1	Brown trout	Other	139	25
237	Reach 9	7/26/2016	1	Brown trout	Other	136	24
238	Reach 9	7/26/2016	1	Brown trout	Other	135	22
239	Reach 9	7/26/2016	1	Brown trout	Other	131	21
240	Reach 9	7/26/2016	1	Brown trout	Other	130	20
241	Reach 9	7/26/2016	1	Brown trout	Other	127	21
242	Reach 9	7/26/2016	1	Brown trout	Other	126	na
243	Reach 9	7/26/2016	1	Brown trout	Other	126	20
244	Reach 9	7/26/2016	1	Brown trout	Other	125	17
245	Reach 9	7/26/2016	1	Brown trout	Other	125	na
246	Reach 9	7/26/2016	1	Brown trout	Other	118	14
247	Reach 9	7/26/2016	1	Brown trout	Other	113	13
248	Reach 9	7/26/2016	1	Brown trout	Other	112	13
249	Reach 9	7/26/2016	1	Brown trout	Other	111	12
250	Reach 9	7/26/2016	1	Brown trout	Other	109	11
251	Reach 9	7/26/2016	1	Brown trout	Other	109	na
252	Reach 9	7/26/2016	1	Brown trout	Other	107	10
253	Reach 9	7/26/2016	1	Brown trout	Other	97	8
254	Reach 9	7/26/2016	1	Brown trout	YOY	60	2
255	Reach 9	7/26/2016	1	Brown trout	YOY	59	2
256	Reach 9	7/26/2016	1	Brown trout	YOY	58	1
257	Reach 9	7/26/2016	1	Brown trout	YOY	58	1
258	Reach 9	7/26/2016	1	Brown trout	YOY	57	1
259	Reach 9	7/26/2016	1	Brown trout	YOY	57	1
260	Reach 9	7/26/2016	1	Brown trout	YOY	57	1.5
261	Reach 9	7/26/2016	1	Brown trout	YOY	56	1
262	Reach 9	7/26/2016	1	Brown trout	YOY	56	na
263	Reach 9	7/26/2016	1	Brown trout	YOY	56	1
264	Reach 9	7/26/2016	1	Brown trout	YOY	56	1.5
265	Reach 9	7/26/2016	1	Brown trout	YOY	55	1
266	Reach 9	7/26/2016	1	Brown trout	YOY	55	1
267	Reach 9	7/26/2016	1	Brown trout	YOY	55	1
268	Reach 9	7/26/2016	1	Brown trout	YOY	53	1.2
269	Reach 9	7/26/2016	1	Brown trout	YOY	51	1
270	Reach 9	7/26/2016	1	Brown trout	YOY	50	1
271	Reach 9	7/26/2016	1	Brown trout	YOY	49	na
272	Reach 9	7/26/2016	1	Brown trout	YOY	46	1

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
273	Reach 9	7/26/2016	1	Central mudminnow	Other	46	na
274	Reach 9	7/26/2016	1	Common shiner	Other	105	na
275	Reach 9	7/26/2016	1	Common shiner	Other	104	na
276	Reach 9	7/26/2016	1	Common shiner	Other	99	na
277	Reach 9	7/26/2016	1	Common shiner	Other	98	na
278	Reach 9	7/26/2016	1	Common shiner	Other	85	na
279	Reach 9	7/26/2016	1	Common shiner	Other	80	na
280	Reach 9	7/26/2016	1	Creek chub	Other	115	na
281	Reach 9	7/26/2016	1	Creek chub	Other	110	na
282	Reach 9	7/26/2016	1	Creek chub	Other	100	na
283	Reach 9	7/26/2016	1	Creek chub	Other	100	na
284	Reach 9	7/26/2016	1	Creek chub	Other	97	na
285	Reach 9	7/26/2016	1	Creek chub	Other	91	na
286	Reach 9	7/26/2016	1	Creek chub	Other	90	na
287	Reach 9	7/26/2016	1	Creek chub	Other	89	na
288	Reach 9	7/26/2016	1	Creek chub	Other	81	na
289	Reach 9	7/26/2016	1	Creek chub	Other	81	na
290	Reach 9	7/26/2016	1	Creek chub	Other	79	na
291	Reach 9	7/26/2016	1	Creek chub	Other	78	na
292	Reach 9	7/26/2016	1	Creek chub	Other	75	na
293	Reach 9	7/26/2016	1	Creek chub	Other	70	na
294	Reach 9	7/26/2016	1	Creek chub	Other	67	na
295	Reach 9	7/26/2016	1	Creek chub	Other	65	na
296	Reach 9	7/26/2016	1	Creek chub	Other	54	na
297	Reach 9	7/26/2016	1	Creek chub	Other	54	na
298	Reach 9	7/26/2016	1	Creek chub	Other	53	na
299	Reach 9	7/26/2016	1	Creek chub	Other	53	na
300	Reach 9	7/26/2016	1	Creek chub	Other	50	na
301	Reach 9	7/26/2016	1	Creek chub	Other	45	na
302	Reach 9	7/26/2016	1	Fathead minnow	Other	56	na
303	Reach 9	7/26/2016	1	Fathead minnow	Other	55	na
304	Reach 9	7/26/2016	1	Fathead minnow	Other	55	na
305	Reach 9	7/26/2016	1	Fathead minnow	Other	51	na
306	Reach 9	7/26/2016	1	Fathead minnow	Other	50	na
307	Reach 9	7/26/2016	1	Johnny darter	Other	78	na
308	Reach 9	7/26/2016	1	Johnny darter	Other	50	na
309	Reach 9	7/26/2016	1	Longnose dace	Other	116	na
310	Reach 9	7/26/2016	1	Longnose dace	Other	115	na
311	Reach 9	7/26/2016	1	Longnose dace	Other	109	na

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
312	Reach 9	7/26/2016	1	Longnose dace	Other	105	na
313	Reach 9	7/26/2016	1	Longnose dace	Other	103	na
314	Reach 9	7/26/2016	1	Longnose dace	Other	102	na
315	Reach 9	7/26/2016	1	Longnose dace	Other	94	na
316	Reach 9	7/26/2016	1	Longnose dace	Other	82	na
317	Reach 9	7/26/2016	1	Longnose dace	Other	82	na
318	Reach 9	7/26/2016	1	Longnose dace	Other	81	na
319	Reach 9	7/26/2016	1	Longnose dace	Other	77	na
320	Reach 9	7/26/2016	1	Longnose dace	Other	75	na
321	Reach 9	7/26/2016	1	Longnose dace	Other	75	na
322	Reach 9	7/26/2016	1	Longnose dace	Other	74	na
323	Reach 9	7/26/2016	1	Longnose dace	Other	73	na
324	Reach 9	7/26/2016	1	Longnose dace	Other	72	na
325	Reach 9	7/26/2016	1	Longnose dace	Other	70	na
326	Reach 9	7/26/2016	1	Longnose dace	Other	69	na
327	Reach 9	7/26/2016	1	Longnose dace	Other	69	na
328	Reach 9	7/26/2016	1	Longnose dace	Other	68	na
329	Reach 9	7/26/2016	1	Longnose dace	Other	63	na
330	Reach 9	7/26/2016	1	Longnose dace	Other	62	na
331	Reach 9	7/26/2016	1	Longnose dace	Other	62	na
332	Reach 9	7/26/2016	1	Longnose dace	Other	61	na
333	Reach 9	7/26/2016	1	Longnose dace	Other	55	na
334	Reach 9	7/26/2016	1	Longnose dace	Other	52	na
335	Reach 9	7/26/2016	1	Northern redbelly dace	Other	56	na
336	Reach 9	7/26/2016	1	Pearl dace	Other	90	na
337	Reach 9	7/26/2016	1	Pearl dace	Other	85	na
338	Reach 9	7/26/2016	1	Pearl dace	Other	84	na
339	Reach 9	7/26/2016	1	Pearl dace	Other	84	na
340	Reach 9	7/26/2016	1	Pearl dace	Other	77	na
341	Reach 9	7/26/2016	1	Pearl dace	Other	76	na
342	Reach 9	7/26/2016	1	Pearl dace	Other	75	na
343	Reach 9	7/26/2016	1	Pearl dace	Other	74	na
344	Reach 9	7/26/2016	1	Pearl dace	Other	69	na
345	Reach 9	7/26/2016	1	Pearl dace	Other	64	na
346	Reach 9	7/26/2016	1	Pearl dace	Other	51	na
347	Reach 9	7/26/2016	1	Rainbow trout	Other	270	202
348	Reach 9	7/26/2016	1	Rainbow trout	Other	199	73
349	Reach 9	7/26/2016	1	Rainbow trout	Other	192	67
350	Reach 9	7/26/2016	1	Rainbow trout	Other	185	60

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
351	Reach 9	7/26/2016	1	Rainbow trout	Other	181	62
352	Reach 9	7/26/2016	1	Rainbow trout	Other	177	na
353	Reach 9	7/26/2016	1	Rainbow trout	Other	175	60
354	Reach 9	7/26/2016	1	Rainbow trout	Other	160	na
355	Reach 9	7/26/2016	1	Rainbow trout	Other	158	na
356	Reach 9	7/26/2016	1	Rainbow trout	Other	147	30
357	Reach 9	7/26/2016	1	Rainbow trout	Other	142	28
358	Reach 9	7/26/2016	1	Rainbow trout	Other	140	26
359	Reach 9	7/26/2016	1	Rainbow trout	Other	140	23
360	Reach 9	7/26/2016	1	Rainbow trout	Other	140	27
361	Reach 9	7/26/2016	1	Rainbow trout	Other	121	16
362	Reach 9	7/26/2016	1	Rainbow trout	Other	117	12
363	Reach 9	7/26/2016	1	Rainbow trout	Other	116	13
364	Reach 9	7/26/2016	1	Rainbow trout	Other	115	17
365	Reach 9	7/26/2016	1	Rainbow trout	Other	109	15
366	Reach 9	7/26/2016	1	Rainbow trout	Other	105	10
367	Reach 9	7/26/2016	1	Rainbow trout	Other	104	10
368	Reach 9	7/26/2016	1	Rainbow trout	Other	102	10
369	Reach 9	7/26/2016	1	Rainbow trout	Other	101	10
370	Reach 9	7/26/2016	1	Rainbow trout	Other	99	8
371	Reach 9	7/26/2016	1	Rainbow trout	Other	96	8
372	Reach 9	7/26/2016	1	Rainbow trout	Other	95	8
373	Reach 9	7/26/2016	1	Rainbow trout	Other	90	6
374	Reach 9	7/26/2016	1	Rainbow trout	Other	90	na
375	Reach 9	7/26/2016	1	Rainbow trout	Other	88	6
376	Reach 9	7/26/2016	1	Rainbow trout	Other	88	7
377	Reach 9	7/26/2016	1	Rainbow trout	Other	88	6
378	Reach 9	7/26/2016	1	Rainbow trout	YOY	55	1.5
379	Reach 9	7/26/2016	1	Rainbow trout	YOY	53	1.1
380	Reach 9	7/26/2016	1	Rainbow trout	YOY	53	1.1
381	Reach 9	7/26/2016	1	Rainbow trout	YOY	50	1
382	Reach 9	7/26/2016	1	Rainbow trout	YOY	50	1
383	Reach 9	7/26/2016	1	Rainbow trout	YOY	49	1
384	Reach 9	7/26/2016	1	Rainbow trout	YOY	48	1
385	Reach 9	7/26/2016	1	Rainbow trout	YOY	47	1.5
386	Reach 9	7/26/2016	1	Rainbow trout	YOY	45	0.5
387	Reach 9	7/26/2016	1	Rainbow trout	YOY	44	0.5
388	Reach 9	7/26/2016	1	Rainbow trout	YOY	43	0.8
389	Reach 9	7/26/2016	1	Rainbow trout	YOY	41	na

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
390	Reach 9	7/26/2016	1	White sucker	Other	224	na
391	Reach 9	7/26/2016	1	White sucker	Other	185	na
392	Reach 9	7/26/2016	1	White sucker	Other	140	na
393	Reach 9	7/26/2016	1	White sucker	Other	101	na
394	Reach 9	7/26/2016	1	White sucker	Other	99	na
395	Reach 9	7/26/2016	1	White sucker	Other	90	na
396	Reach 9	7/26/2016	1	White sucker	Other	87	na
397	Reach 9	7/26/2016	1	White sucker	Other	76	na
398	Reach 9	7/26/2016	1	White sucker	Other	76	na
399	Reach 9	7/26/2016	2	Brook stickleback	Other	65	na
400	Reach 9	7/26/2016	2	Brook stickleback	Other	49	na
401	Reach 9	7/26/2016	2	Brook stickleback	Other	46	na
402	Reach 9	7/26/2016	2	Brook trout	Other	165	41
403	Reach 9	7/26/2016	2	Brook trout	Other	162	36
404	Reach 9	7/26/2016	2	Brook trout	Other	142	25
405	Reach 9	7/26/2016	2	Brook trout	Other	140	24
406	Reach 9	7/26/2016	2	Johnny darter	Other	67	na
407	Reach 9	7/26/2016	2	Longnose dace	Other	120	na
408	Reach 9	7/26/2016	2	Pearl dace	Other	89	na
409	Reach 9	7/26/2016	2	Pearl dace	Other	78	na
410	Reach 9	7/26/2016	2	Pearl dace	Other	70	na
411	Reach 9	7/26/2016	2	Pearl dace	Other	67	na
412	Reach 9	7/26/2016	2	Pearl dace	Other	65	na
413	Reach 9	7/26/2016	2	Pearl dace	Other	61	na
414	Reach 9	7/26/2016	2	Rainbow trout	Other	197	74
415	Reach 9	7/26/2016	2	White sucker	Other	85	na
416	Reference	7/27/2016	1	Blacknose dace	Other	104	na
417	Reference	7/27/2016	1	Blacknose dace	Other	80	na
418	Reference	7/27/2016	1	Blacknose dace	Other	80	na
419	Reference	7/27/2016	1	Blacknose dace	Other	79	na
420	Reference	7/27/2016	1	Blacknose dace	Other	73	na
421	Reference	7/27/2016	1	Blacknose dace	Other	70	na
422	Reference	7/27/2016	1	Blacknose dace	Other	70	na
423	Reference	7/27/2016	1	Blacknose dace	Other	69	na
424	Reference	7/27/2016	1	Blacknose dace	Other	68	na
425	Reference	7/27/2016	1	Blacknose dace	Other	67	na
426	Reference	7/27/2016	1	Blacknose dace	Other	67	na
427	Reference	7/27/2016	1	Blacknose dace	Other	62	na
428	Reference	7/27/2016	1	Blacknose dace	Other	61	na

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
429	Reference	7/27/2016	1	Blacknose dace	Other	61	na
430	Reference	7/27/2016	1	Blacknose dace	Other	59	na
431	Reference	7/27/2016	1	Blacknose dace	Other	58	na
432	Reference	7/27/2016	1	Blacknose dace	Other	56	na
433	Reference	7/27/2016	1	Blacknose dace	Other	52	na
434	Reference	7/27/2016	1	Blacknose dace	Other	52	na
435	Reference	7/27/2016	1	Blacknose dace	Other	51	na
436	Reference	7/27/2016	1	Blacknose dace	Other	45	na
437	Reference	7/27/2016	1	Brook trout	Other	290	277
438	Reference	7/27/2016	1	Brook trout	Other	246	na
439	Reference	7/27/2016	1	Brook trout	Other	240	155
440	Reference	7/27/2016	1	Brook trout	Other	238	145
441	Reference	7/27/2016	1	Brook trout	Other	236	na
442	Reference	7/27/2016	1	Brook trout	Other	236	146
443	Reference	7/27/2016	1	Brook trout	Other	221	107
444	Reference	7/27/2016	1	Brook trout	Other	219	121
445	Reference	7/27/2016	1	Brook trout	Other	205	94
446	Reference	7/27/2016	1	Brook trout	Other	196	na
447	Reference	7/27/2016	1	Brook trout	Other	173	54
448	Reference	7/27/2016	1	Brook trout	Other	171	51
449	Reference	7/27/2016	1	Brook trout	Other	167	45
450	Reference	7/27/2016	1	Brook trout	Other	160	41
451	Reference	7/27/2016	1	Brook trout	Other	160	na
452	Reference	7/27/2016	1	Brook trout	Other	147	32
453	Reference	7/27/2016	1	Brook trout	Other	147	33
454	Reference	7/27/2016	1	Brook trout	Other	138	25
455	Reference	7/27/2016	1	Brook trout	Other	132	22
456	Reference	7/27/2016	1	Brook trout	Other	123	19
457	Reference	7/27/2016	1	Brown trout	Other	250	160
458	Reference	7/27/2016	1	Brown trout	Other	146	28
459	Reference	7/27/2016	1	Brown trout	Other	145	28
460	Reference	7/27/2016	1	Brown trout	Other	144	27
461	Reference	7/27/2016	1	Brown trout	Other	140	28
462	Reference	7/27/2016	1	Brown trout	Other	131	21
463	Reference	7/27/2016	1	Brown trout	Other	124	17
464	Reference	7/27/2016	1	Brown trout	Other	115	13
465	Reference	7/27/2016	1	Brown trout	Other	113	12
466	Reference	7/27/2016	1	Brown trout	Other	112	12
467	Reference	7/27/2016	1	Brown trout	Other	105	11

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
468	Reference	7/27/2016	1	Brown trout	YOY	61	1
469	Reference	7/27/2016	1	Brown trout	YOY	60	2
470	Reference	7/27/2016	1	Brown trout	YOY	60	2
471	Reference	7/27/2016	1	Brown trout	YOY	59	2
472	Reference	7/27/2016	1	Brown trout	YOY	59	1
473	Reference	7/27/2016	1	Brown trout	YOY	57	1.5
474	Reference	7/27/2016	1	Brown trout	YOY	56	1.5
475	Reference	7/27/2016	1	Brown trout	YOY	55	1
476	Reference	7/27/2016	1	Brown trout	YOY	55	1.2
477	Reference	7/27/2016	1	Brown trout	YOY	50	1
478	Reference	7/27/2016	1	Brown trout	YOY	48	1.2
479	Reference	7/27/2016	1	Central mudminnow	Other	60	na
480	Reference	7/27/2016	1	Central mudminnow	Other	53	na
481	Reference	7/27/2016	1	Common shiner	Other	89	na
482	Reference	7/27/2016	1	Creek chub	Other	145	na
483	Reference	7/27/2016	1	Creek chub	Other	98	na
484	Reference	7/27/2016	1	Creek chub	Other	94	na
485	Reference	7/27/2016	1	Creek chub	Other	93	na
486	Reference	7/27/2016	1	Creek chub	Other	90	na
487	Reference	7/27/2016	1	Creek chub	Other	88	na
488	Reference	7/27/2016	1	Creek chub	Other	82	na
489	Reference	7/27/2016	1	Creek chub	Other	79	na
490	Reference	7/27/2016	1	Creek chub	Other	77	na
491	Reference	7/27/2016	1	Creek chub	Other	75	na
492	Reference	7/27/2016	1	Creek chub	Other	60	na
493	Reference	7/27/2016	1	Creek chub	Other	57	na
494	Reference	7/27/2016	1	Creek chub	Other	56	na
495	Reference	7/27/2016	1	Creek chub	Other	55	na
496	Reference	7/27/2016	1	Creek chub	Other	53	na
497	Reference	7/27/2016	1	Creek chub	Other	53	na
498	Reference	7/27/2016	1	Creek chub	Other	48	na
499	Reference	7/27/2016	1	Creek chub	Other	48	na
500	Reference	7/27/2016	1	Creek chub	Other	47	na
501	Reference	7/27/2016	1	Creek chub	Other	45	na
502	Reference	7/27/2016	1	Creek chub	Other	42	na
503	Reference	7/27/2016	1	Fathead minnow	Other	55	na
504	Reference	7/27/2016	1	Johnny darter	Other	74	na
505	Reference	7/27/2016	1	Johnny darter	Other	73	na
506	Reference	7/27/2016	1	Johnny darter	Other	70	na

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
507	Reference	7/27/2016	1	Johnny darter	Other	66	na
508	Reference	7/27/2016	1	Longnose dace	Other	114	na
509	Reference	7/27/2016	1	Longnose dace	Other	104	na
510	Reference	7/27/2016	1	Longnose dace	Other	95	na
511	Reference	7/27/2016	1	Longnose dace	Other	90	na
512	Reference	7/27/2016	1	Longnose dace	Other	88	na
513	Reference	7/27/2016	1	Longnose dace	Other	87	na
514	Reference	7/27/2016	1	Longnose dace	Other	85	na
515	Reference	7/27/2016	1	Longnose dace	Other	83	na
516	Reference	7/27/2016	1	Longnose dace	Other	83	na
517	Reference	7/27/2016	1	Longnose dace	Other	79	na
518	Reference	7/27/2016	1	Longnose dace	Other	79	na
519	Reference	7/27/2016	1	Longnose dace	Other	78	na
520	Reference	7/27/2016	1	Longnose dace	Other	75	na
521	Reference	7/27/2016	1	Longnose dace	Other	75	na
522	Reference	7/27/2016	1	Longnose dace	Other	71	na
523	Reference	7/27/2016	1	Longnose dace	Other	68	na
524	Reference	7/27/2016	1	Longnose dace	Other	67	na
525	Reference	7/27/2016	1	Longnose dace	Other	64	na
526	Reference	7/27/2016	1	Longnose dace	Other	63	na
527	Reference	7/27/2016	1	Longnose dace	Other	62	na
528	Reference	7/27/2016	1	Longnose dace	Other	60	na
529	Reference	7/27/2016	1	Longnose dace	Other	57	na
530	Reference	7/27/2016	1	Pearl dace	Other	107	na
531	Reference	7/27/2016	1	Pearl dace	Other	105	na
532	Reference	7/27/2016	1	Pearl dace	Other	104	na
533	Reference	7/27/2016	1	Pearl dace	Other	103	na
534	Reference	7/27/2016	1	Pearl dace	Other	102	na
535	Reference	7/27/2016	1	Pearl dace	Other	96	na
536	Reference	7/27/2016	1	Pearl dace	Other	94	na
537	Reference	7/27/2016	1	Pearl dace	Other	93	na
538	Reference	7/27/2016	1	Pearl dace	Other	88	na
539	Reference	7/27/2016	1	Pearl dace	Other	80	na
540	Reference	7/27/2016	1	Pearl dace	Other	78	na
541	Reference	7/27/2016	1	Pearl dace	Other	78	na
542	Reference	7/27/2016	1	Pearl dace	Other	75	na
543	Reference	7/27/2016	1	Pearl dace	Other	74	na
544	Reference	7/27/2016	1	Pearl dace	Other	73	na
545	Reference	7/27/2016	1	Pearl dace	Other	69	na

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
546	Reference	7/27/2016	1	Pearl dace	Other	68	na
547	Reference	7/27/2016	1	Pearl dace	Other	67	na
548	Reference	7/27/2016	1	Pearl dace	Other	65	na
549	Reference	7/27/2016	1	Pearl dace	Other	62	na
550	Reference	7/27/2016	1	Pearl dace	Other	60	na
551	Reference	7/27/2016	1	Rainbow trout	Other	180	56
552	Reference	7/27/2016	1	Rainbow trout	Other	168	43
553	Reference	7/27/2016	1	Rainbow trout	Other	163	40
554	Reference	7/27/2016	1	Rainbow trout	Other	159	36
555	Reference	7/27/2016	1	Rainbow trout	Other	154	38
556	Reference	7/27/2016	1	Rainbow trout	Other	152	32
557	Reference	7/27/2016	1	Rainbow trout	Other	150	28
558	Reference	7/27/2016	1	Rainbow trout	Other	150	na
559	Reference	7/27/2016	1	Rainbow trout	Other	150	29
560	Reference	7/27/2016	1	Rainbow trout	Other	146	30
561	Reference	7/27/2016	1	Rainbow trout	Other	132	22
562	Reference	7/27/2016	1	Rainbow trout	Other	125	18
563	Reference	7/27/2016	1	Rainbow trout	Other	122	20
564	Reference	7/27/2016	1	Rainbow trout	Other	120	15
565	Reference	7/27/2016	1	Rainbow trout	Other	119	15
566	Reference	7/27/2016	1	Rainbow trout	Other	116	15
567	Reference	7/27/2016	1	Rainbow trout	Other	116	13
568	Reference	7/27/2016	1	Rainbow trout	Other	105	10
569	Reference	7/27/2016	1	Rainbow trout	Other	104	9
570	Reference	7/27/2016	1	Rainbow trout	Other	102	7
571	Reference	7/27/2016	1	Rainbow trout	Other	101	10
572	Reference	7/27/2016	1	Rainbow trout	Other	99	na
573	Reference	7/27/2016	1	Rainbow trout	Other	89	6
574	Reference	7/27/2016	1	Rainbow trout	Other	88	7
575	Reference	7/27/2016	1	Rainbow trout	YOY	57	1
576	Reference	7/27/2016	1	Rainbow trout	YOY	56	na
577	Reference	7/27/2016	1	Rainbow trout	YOY	56	0.7
578	Reference	7/27/2016	1	Rainbow trout	YOY	52	0.5
579	Reference	7/27/2016	1	Rainbow trout	YOY	51	0.5
580	Reference	7/27/2016	1	Rainbow trout	YOY	50	0.5
581	Reference	7/27/2016	1	Rainbow trout	YOY	50	0.7
582	Reference	7/27/2016	1	Rainbow trout	YOY	47	0.5
583	Reference	7/27/2016	1	Rainbow trout	YOY	46	0.5
584	Reference	7/27/2016	1	Rainbow trout	YOY	45	0.5

Appendix VI. (Continued)

	Reach	Date	Pass	Taxa	Age	TL (mm)	W (g)
585	Reference	7/27/2016	1	Rainbow trout	YOY	44	0.5
586	Reference	7/27/2016	1	Rainbow trout	YOY	43	1
587	Reference	7/27/2016	1	Rainbow trout	YOY	42	0.5
588	Reference	7/27/2016	1	Rainbow trout	YOY	41	na
589	Reference	7/27/2016	1	Rainbow trout	YOY	41	0.5
590	Reference	7/27/2016	1	Rainbow trout	YOY	40	0.7
591	Reference	7/27/2016	1	Rainbow trout	YOY	40	0.5
592	Reference	7/27/2016	1	White sucker	Other	189	na
593	Reference	7/27/2016	1	White sucker	Other	165	na
594	Reference	7/27/2016	1	White sucker	Other	135	na
595	Reference	7/27/2016	1	White sucker	Other	85	na
596	Reference	7/27/2016	1	White sucker	Other	77	na
597	Reference	7/27/2016	2	Brook trout	Other	236	125
598	Reference	7/27/2016	2	Brook trout	Other	187	61
599	Reference	7/27/2016	2	Brook trout	YOY	55	1
600	Reference	7/27/2016	2	Brown trout	Other	145	26
601	Reference	7/27/2016	2	Brown trout	Other	126	18
602	Reference	7/27/2016	2	Brown trout	Other	125	18
603	Reference	7/27/2016	2	Brown trout	Other	115	14
604	Reference	7/27/2016	2	Brown trout	Other	111	11
605	Reference	7/27/2016	2	Brown trout	Other	100	9
606	Reference	7/27/2016	2	Brown trout	YOY	58	1
607	Reference	7/27/2016	2	Brown trout	YOY	58	1
608	Reference	7/27/2016	2	Common shiner	Other	90	na
609	Reference	7/27/2016	2	Common shiner	Other	85	na
610	Reference	7/27/2016	2	Longnose dace	Other	111	na
611	Reference	7/27/2016	2	Pearl dace	Other	107	na
612	Reference	7/27/2016	2	Pearl dace	Other	99	na
613	Reference	7/27/2016	2	Pearl dace	Other	95	na
614	Reference	7/27/2016	2	Pearl dace	Other	91	na
615	Reference	7/27/2016	2	Pearl dace	Other	71	na
616	Reference	7/27/2016	2	White sucker	Other	149	na
617	Reference	7/27/2016	2	White sucker	Other	148	na