THESIS

ARCTIC CHAR *SALVELINUS ALPINUS* CAN ENHANCE FISHERIES IN RESERVOIRS WITH TROPHIC CONSTRAINTS

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ABSTRACT

ARCTIC CHAR *SALVELINUS ALPINUS* CAN ENHANCE FISHERIES IN RESERVOIRS WITH TROPHIC CONSTRAINTS

The 20th century was a period of rapid reservoir construction in the western United States. Initially, many of these reservoirs hosted productive recreational fisheries for introduced salmonids, but then waned from oligotrophication, dam operations, and the effects of introduced opossum shrimp *Mysis diluviana*. Managers have sought alternative fish species that could withstand these trophic constraints. In 1990 the state of Colorado introduced Arctic Char *Salvelinus alpinus* into Dillon Reservoir hoping they would prey on *Mysis* and produce a valuable “boutique fishery”. My study investigated the outcomes of this introduction. I found that the introduction resulted in a reproducing population, creating one of the only public fisheries for Arctic Char in the lower 48 states of the USA, and the southernmost population in the world. Arctic Char diet was composed primarily of *Mysis* shrimp, and their growth was among the fastest of lacustrine populations worldwide. While bioenergetics simulations showed that approximately 3-6 times as many Arctic Char would need to be stocked annually to effectively control *Mysis* shrimp, Arctic Char did channel energy formerly sequestered in *Mysis* into desirable recreational fish biomass. Despite this desirable ecosystem service, the stocking program is paradoxical. In an era when nonnative species comprise a primary threat to aquatic biodiversity, condoning new introductions is concerning. However, in many human-dominated environments such as reservoirs, exotic fishes already comprise the majority of species. Fishery managers are left with

the problem of choosing relatively innocuous strategies that can still provide recreational benefits in systems plagued by a variety of anthropogenic stressors.

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Introduction

The 20th century was a period of rapid reservoir construction in the western United States (Billington et al. 2005). Many of these reservoirs hosted productive sport fisheries for introduced salmonids. However, within a few decades fisheries often declined from a combination of factors that limited energy flow to sport fishes. Water level fluctuations precluded a productive littoral zone (Gasith and Gafny 1990) and benthic resources were further depleted by large populations of catostomids (Hubert and Chamberlain 1996). Catostomids are often cited for decreasing the productivity of salmonid sport fisheries. Studies in Canadian Laurentian Shield lakes showed that Brook Trout *Salvelinus fontinalis* became pelagic specialists and their production declined by up to 46% when sympatric with White Suckers *Catostomus commersonii* (Lacasse and Magnan 1992; Bourke et al. 1999; Brodeur et al. 2001). In western reservoirs pelagic sport fish such as Kokanee Salmon *Oncorhynchus nerka* sustained fisheries but oligotrophication affected these fisheries too (Stockner et al. 2000; Wilson et al. 2013).

Contrary to their intended purpose of providing salmonid prey, the introduction of Opossum Shrimp *Mysis diluviana* to coldwater lakes and reservoirs throughout the region in the 1960s and 1970s only compounded trophic constraints for sport fishes (Nesler and Bergersen 1991). Although mediated by hydroclimate (Northcote 1991; Johnson and Martinez 2012), *Mysis* can virtually eliminate large zooplankton that support growth of trout and salmon in reservoirs (Nesler and Bergersen 1991) and some natural lakes (Goldman et al. 1979; Ellis et al. 2011). Their diel vertical migration to the profundal during the day often spatially segregates *Mysis* from their intended salmonid predators resulting in a redirection of planktonic energy flow away from pelagic sport fish (Nesler and Bergersen 1991).

Lake Trout *Salvelinus namaycush* were also widely introduced throughout the region (Martinez et al. 2009). *Mysis* relieved a recruitment bottleneck for young Lake Trout by providing a nutritious food supply before they could transition to piscivory (Ellis et al. 2011). However, some burgeoning Lake Trout populations were not sustainable as they preyed heavily upon and began collapsing trout and salmon fisheries already food limited by edaphic constraints and competition with *Mysis* (Martinez et al. 2009). Although introduced Lake Trout do exploit *Mysis* biomass that is otherwise short-circuiting energy flow through the food web, their predation on other sport fishes limits their utility for enhancing fishing in some systems. Managers have sought alternative fish species to make use of, and even control *Mysis* biomass (Northcote 1991) without putting prey fish populations at risk.

Many coldwater reservoirs in Colorado experience all of the trophic constraints described above. These reservoirs' fish communities are composed of introduced species, including Lake Trout, Rainbow Trout *Oncorhynchus mykis*s, Brown Trout *Salmo trutta*, Kokanee and *Mysis*. *Mysis* are abundant in most of the state's largest reservoirs and large zooplankton are only present if epilimnetic temperatures in summer provide a thermal refuge from *Mysis* predation (Martinez et al. 2010). The competition-predation "one-two punch" delivered by *Mysis* and Lake Trout to stocked Rainbow Trout and Kokanee populations has increased the cost and reduced the sustainability of these fisheries (Johnson and Martinez 2000). A number of less piscivorous fishes were considered as potential biological control agents for *Mysis* (Martinez and Bergersen

1989), and in 1990 Colorado Parks and Wildlife (CPW) chose Arctic Char *Salvelinus alpinus*. They hoped the Arctic Char would prey on *Mysis* as they have where *Mysis* had been introduced into Arctic Char lakes or where their natural distributions overlapped (Aass 1984; Langeland et al. 1991; Gregersen et al. 2006).

This experimental stocking was initiated in 1990 at Dillon Reservoir, Colorado, establishing one of the only public fisheries for Arctic Char in the lower 48 states of the United States (Martinez 1994). Fish were reared from eggs obtained from Nauyuk Lake stock (N.W.T., Canada) via Sun Valley Trout Farms, B.C., Canada. Stocking was sporadic until 2008 and the introduction had never been studied so little was known about its outcome. I initiated this study to investigate the results of the Arctic Char introduction and its potential risks and benefits. My objectives were to determine Arctic Char relative abundance, age and growth, diet, and their consumptive demand upon *Mysis.* I also looked for evidence of natural reproduction, and simulated how the Arctic Char population would respond to various natural and fishing mortality scenarios.

Methods

Study area

Dillon Reservoir is a 1,308 ha reservoir in the Rocky Mountains of central Colorado. Its surface elevation is 2,748 m above sea level, with maximum and mean depths of 63 m and 24 m, respectively. The reservoir is ice-free during May through early November but surface temperatures rarely exceed 18 °C. Dillon Reservoir is the largest water supply for the City of Denver and nutrient controls in the watershed maintain oligotrophic conditions (Lewis et al. 1984; Carlin 1992). Annual water level changes are about 5 m but drawdowns of > 10 m also occur. *Mysis* were introduced into

Dillon Reservoir in 1970 (Nesler 1986). Prior to their introduction, *Daphnia* were reported to be relatively abundant (Nelson 1981). However, by 1978 *Daphnia* became nearly non-existent (Nelson 1981) and remain so currently (Martinez et al. 2010).

The near extirpation of *Daphnia* resulted in deterioration of the reservoir's Kokanee, Rainbow Trout, and Brown Trout fishery (Davis 1982; Nelson 1981; Stuber et al. 1985). Although Kokanees and Brown Trout are naturally reproducing, a creel survey we conducted in summer 2012 confirmed Dillon Reservoir's reputation as a poor fishery. The mean size of Kokanees, Rainbow Trout, and Brown Trout harvested was < 300 mm TL, and total fishing effort (May-August) was just 20.8 h/ha (B. M. Johnson, Colorado State University, unpublished data). Catostomids are abundant, comprising 83 % of our catch in gill nets set shallower than 15 m. The abiotic and biotic constraints on Dillon Reservoir have resulted in a fishery dominated by slow growing salmonids with poor body condition. Annual stocking of catchable (~250 mm TL) Rainbow Trout has been the primary management strategy to offset trophic limitations and provide recreational fishing opportunities as is so common in unproductive reservoirs in the Western US (Johnson and Martinez 2000; Wiley et al. 1993). As an alternate management strategy, Arctic Char were stocked in 1990, 1992, 1996, 1998 and then annually beginning in 2008 (Figure 2).

Fish sampling

Sampling for Arctic Char was conducted primarily with experimental horizontal gill nets set overnight. Gill nets were deployed during May-September 2012, 2013. Each net measured 45.75 m in length by 1.8 m high consisting of six 7.6 m panel sizes of 1.27, 1.91, 2.54, 3.18, 3.81, and 5.08 cm mesh. Early exploratory netting revealed no

Arctic Char in depths less than 14 m and few in depths greater than 28 m. Subsequent nets were deployed between these depths to maximize Arctic Char catch. My samples were augmented with Arctic Char captured by directed angling during open water and ice covered periods of 2012 and 2013.

Growth and energy density

Saggital otoliths were removed from Arctic Char (n=98) with non-metallic forceps and sonicated in water for 5 minutes. One otolith from each individual was randomly chosen for age analysis. Otoliths were embedded in epoxy and sectioned transversely with an Isomet™ low speed saw fitted with diamond wafering blades. Sections were sanded with 2000 grit sandpaper to < 0.5 mm thickness and polished to expose the inner annuli. Digital images were taken at 32x magnification and used for age estimation. Two experienced readers estimated the age of the Arctic Char independently. If disagreement arose then readers conferred until agreement was reached.

Arctic Char size at age was described by a von Bertalanffy growth function (VBGF) (Isely and Grabowski 2007). The function was fitted to Arctic Char ages 3-9 (n = 98). I determined the two age 10 fish to be outliers unrepresentative of growth after they shifted to a subsidy of stocked Rainbow Trout fingerlings in 2012 which altered their growth trajectory. Stocking of Rainbow Trout fingerlings has been discontinued, therefore I excluded the piscivorous Char as they may not be representative of future growth.

I measured the energy density of a length-stratified sample of Arctic Char from Dillon Reservoir (n = 44). Whole frozen Arctic Char were cut into ~1.5 cm cubes and dried to a constant weight at 60 ˚C to calculate water content. Dried cubes were then ground and homogenized into a fine powder. Samples from each fish (1 g ± 0.1g) were analyzed in a Parr 1261 isoperibol bomb calorimeter. Dry sample energy density was converted back to wet-weight energy density using the calculated water content of each fish.

Char origin

To determine whether the Arctic Char we captured were of hatchery or wild origin, we used strontium isotope analysis ($^{87}Sr/^{86}Sr$) of the natal and edge regions of Arctic Char otoliths. Previously sectioned otoliths were further prepared following the protocol outlined in Wolff et al. (2012). Otolith sections were ablated with a laser and assayed for $^{87}Sr/^{86}Sr$ with a New Wave Research UP 193 laser ablation system coupled to a Thermo Finnigan Neptune multicollector inductively coupled plasma mass spectrometer (MC-ICP-MS) at the Woods Hole Oceanographic Institution Plasma Mass Spectrometry Laboratory in Woods Hole, Massachusetts. I configured the laser to run at 80% intensity, 10 Hz pulse rate, 35 μm laser beam diameter, 7 $\mu m \cdot s^{-1}$ laser scan speed, and 650 μm scan distance for each ablation. Ablated otolith material was carried from the laser cell to the MC-ICP-MS with helium gas. It was then mixed in a spray chamber with argon gas and a wet aerosol where the following isotopes were measured: ^{83}Kr, ^{84}Sr, ^{85}Rb, ^{86}Sr, ^{87}Sr, and ^{88}Sr (Wolff et al. 2012). A set of 25 cycles provided sub-samples to estimate variance within each individual's otolith material.

Otoliths of Arctic Char as well as wild Brown Trout and Kokanees were ablated along the outermost edge which represented the $^{87}Sr/^{86}Sr$ signature of Dillon Reservoir. Arctic Char otoliths were also ablated near the core representing the natal $^{87}Sr/^{86}Sr$

signature of the water body where each Arctic Char resided during its early life history. This signature corresponded to either Dillon Reservoir if the Arctic Char was of wild origin or that of the CPW Mt. Shavano Hatchery where Arctic Char were reared to fingerling size before stocking. Ten fingerlings from the Mt. Shavano Hatchery were sampled to form the baseline $^{87}Sr/^{86}Sr$ signature for the hatchery. Arctic Char captured in Dillon Reservoir were designated as of wild or hatchery origin if their core $^{87}Sr/^{86}Sr$ signature was within 2·SD of the mean signature for either respective natal location.

Diet

Stomach samples were collected from Arctic Char sampled during May-September 2011-2013 (n =103) and January 2013 (n = 23). Fish were sampled by gill netting and angling in summer and by angling in winter. Stomachs were excised and preserved in 10% formalin. Contents were identified categorically as fish, fish eggs, insects, molluscs, and *Mysis*. Fish eggs were from salmonids and presumed to be from Kokanees because Arctic Char that had consumed fish eggs were all caught in areas where Kokanees were known to be spawning, and after Arctic Char and Brown Trout spawning had ceased. Prey items were blotted briefly before taking wet weights of each category found in each stomach. Diet composition was computed for each season as frequency of occurrence and proportion by wet mass (Olson 2013). Energy density of *Mysis* and Kokanee eggs were measured using the methods described above and literature values used for energy density of insects (James et al. 2011) and molluscs (Eggleton and Schramm 2004).

Population modeling

I employed the Fishery Analysis and Modeling Simulator (FAMS; Slipke and Maceina 2010) to predict Arctic Char population size under a range of harvest scenarios. I used the Dynamic Pool model within FAMS to predict population level effects of variable exploitation and natural mortality rates. Required inputs were: species of fish, asymptotic length (L_∞), growth rate (K), and theoretical age at zero size (t_0) from a corresponding VBGF, the intercept (a) and slope (b) of the Arctic Char $\log_e$ transformed weight-length regression, conditional natural and fishing mortality by age, annual recruitment, and minimum total length at recruitment to the fishery (Table 1).

I lacked sufficient sample size for a traditional catch curve analysis to estimate total mortality and knew the assumption of constant recruitment was violated because of variable stocking and an uncertain mix of stocked and wild recruits (Miranda and Bettoli 2007). Instead, we derived natural mortality schedules from the literature (age-0 stocked fish), and from two alternative estimation models (age-1 and older fish).

I used data on first year survival of four stocked Arctic Char populations in Alaska (mean cm = 0.65 ± 0.15, (95% CI)); Havens et al. 1995) to estimate expected mean and variation in natural mortality of stocked age-0 Arctic Char in Dillon Reservoir. To estimate a range of plausible natural mortality rates for older fish we used the methods of Quinn and Deriso (1999), and Hoenig (1983; Slipke and Maceina 2010).

The Quinn and Deriso model:

$$M = -\ln(P_s)/t_{max}$$

and the Hoenig model:

$\ln(M) = 1.46 – 1.01 \cdot \ln(t_{max})$

both predict natural mortality from longevity, where M is instantaneous natural mortality and P_s is the proportion of the annual recruits that survive to maximum age, t_{max}. I set P_s to 0.01 (Slipke and Maceina 2010) and computed t_{max} from the parameters of the von Bertalanffy equation (King 2007):

$t_{max} = (-1/K) \cdot \ln[1-(0.95L_\infty)/L_\infty]$

where K and L_∞ are parameters of the Dillon Arctic Char population's von Bertalanffy growth function. For simulations, we combined the various age-specific conditional natural mortality (*cm* hereafter) estimates into low (ages 0 to 1 *cm* = 0.50, ages 1 to 14 *cm* = 0.26), medium (ages 0 to 1 *cm* = 0.65, ages 1 to 14 *cm* = 0.27) and high (ages 0 to 1 *cm* = 0.80, ages 1 to 14 *cm* = 0.28) *cm* scenarios.

Fishing mortality of Arctic Char was unknown but presumed to be low. No Arctic Char were observed in an open water creel survey (B. M. Johnson, Colorado State University unpublished data), and anecdotal evidence suggested that only a few specialized anglers were able to catch Arctic Char at any time of the year. However, Arctic Char are considered easy to catch in areas where they are more common (Hegge et al. 1991) and we assumed that fishing mortality could increase once the fishery was "discovered". I assumed that Arctic Char recruited to the sport fishery at 254 mm, or age-4, because none of the fish we caught on hook and line were below this threshold. To understand the effects of a range of future exploitation, we modeled four scenarios: incidental or catch and release with nominal hooking mortality (conditional fishing mortality = 5%; *cf* hereafter), and three levels of increasing fishing mortality without size restrictions (*cf* = 15%, 30%, and 45%). There was no size limit on Arctic Char in Colorado and the daily bag limit was part of the four fish aggregate trout bag. Initial cohort size was set at 19,237 age-0 fish, which was the average number of Arctic Char fingerling stocked from 2008-2012, and future production of wild year-classes was unknown. Thus, our projections are probably conservative if natural reproduction continues. Proportional size distribution (Neumann et al. 2012) categories do not exist for Arctic Char so we defined trophy Arctic Char as fish greater than or equal to the Colorado Master Angler qualifying length for Arctic Char (457 mm). Arctic Char in Dillon Reservoir reached designated trophy size within their 8th year.

Bioenergetics modeling

I adapted Fish Bioenergetics 3.0 (Hanson et al. 1997) to estimate consumptive demand of the Arctic Char population. No bioenergetics model parameterized for Arctic Char has been published. Therefore, we employed a recently published Bull Trout model as the closest available physiological surrogate for Arctic Char (Mesa et al. 2012). Because we had no field data on younger age-classes, we simulated growth and resulting consumption by Arctic Char over age-2 through age-14. Lengths at age were converted to weights with the VBGF and the regression:

$$W = 8 \cdot 10^{-6} \cdot TL^{2.998} \; (r^2 = 0.98)$$

calculated for Dillon Arctic Char (Table 1), where W is wet weight (g) and TL is total length (mm). Monthly mean water temperatures from the depth zone where Arctic Char were found (14-28 m) were derived from observed data and used for thermal experience (Table 2). No trend was found in Arctic Char energy density versus length; therefore, we used the average Arctic Char energy density of 5,500 J/g in simulations.

Seasonal diet composition and energy density of prey were determined from stomach and calorimetric data described above. Mass lost due to spawning was set to 5.4%, the average male and female body weight loss in Arctic Char reported by Sparholt (1985), on model day 335 for age 5 and older Arctic Char. Annual consumption of prey was computed for the population using the range of natural and fishing mortality rates and associated mean abundance of each age class estimated from FAMS simulations (Table 3).

Results

Fish sampling

Arctic Char were relatively rare in gill nets despite the fact that we focused our netting in expected Arctic Char habitat between 15-28 m; no Arctic Char were captured in n = 8 nets set in water shallower than 14 m. White suckers comprised the bulk of the catch in shallow nets (83%) followed by Brown Trout (15%). In 2012 we captured only 26 Arctic Char (0.034 fish/net-hour) while the catch rates of most other species were at least 3x higher (Kokanee: 0.090 fish/net-hour; Brown Trout: 0.097 fish/net-hour; White Sucker: 0.194 fish/net-hour). Netting in 2013 produced 48 Arctic Char (0.049 fish/net-hour), partly because we set more nets in areas we believed were inhabited by Arctic Char. Catch rates of other species were lower in 2013 (Kokanee: 0.042 fish/net-hour; Brown Trout: 0.089 fish/net-hour; White Sucker: 0.114 fish/net-hour). Catch per net-hour was negligible for Rainbow Trout in both years. Arctic Char recruited to our nets in their 3rd year at 175-200 mm total length (Figure 1). No smaller Arctic Char were gill netted despite appropriate mesh sizes, suggesting that they were occupying other habitat. Along with several other anglers, I caught 26 Arctic Char by ice fishing in 2012 and

2013. Angling selected for larger Arctic Char than gill nets, with fish as old as age-10 and as large as 546 mm captured by angling (Figure 1).

Char origin

The gap from 1998 to 2008 in the stocking schedule allowed us to infer origin of some Arctic Char from age information. Year-classes were detected in 2003-2007, when no stocking had occurred. There were clear differences between the otolith $^{87}Sr/^{86}Sr$ signatures of Dillon Reservoir and the Mt. Shavano hatchery which provided strong evidence for assignment of origin (Figure 3). The mean $^{87}Sr/^{86}Sr$ signature of Mt. Shavano Arctic Char fingerlings was 0.7124 ± 0.0008 whereas the mean signature of otolith edge ablations from Dillon Reservoir was 0.7191 ± 0.0025. Of the 57 Arctic Char cores analyzed, 35 were classified as wild in origin (mean = 0.7192 ± 0.0013) while 22 were classified as hatchery in origin (mean = 0.7119 ± 0.0010). All fish of year classes from 2003 to 2007 before Arctic Char stocking resumed (n = 24) were correctly classified as wild. Of the 33 fish analyzed from the year classes 2008-2009, 11 individuals were classified as wild fish and 22 were classified as hatchery fish. This suggested natural reproduction was contributing 1/3 of the adults in the population that arose from year classes when stocking occurred.

Diet

Dillon Reservoir Arctic Char displayed a very narrow diet breadth. In summer, *Mysis* occurred in 70% of Arctic Char stomachs and comprised 91.2% of prey biomass. Other summer prey items included chironomids and fingernail clams (*Sphaeriidae*). Chironomids were found in 11% of stomachs and comprised 2.6% of the diet biomass. Fingernail clams were found in 24% of stomachs and comprised 6.2% of the diet biomass. Winter diet differed, but *Mysis* were still an important diet component. In winter, diets consisted exclusively of fish eggs and *Mysis*. I caught Arctic Char through the ice where they were concentrated near shoals of shore spawning Kokanees. During this time, *Mysis* and Kokanee eggs were each found in 57% of Arctic Char stomachs, and no other prey types were found. Fish eggs contributed the most mass to their diet (81%) while *Mysis* declined to 19% of the diet biomass (Olson 2013). Because energy density of Kokanee eggs was almost triple that of *Mysis* (Table 2), Arctic Char gained nearly all of their energy during this period from Kokanee eggs. Anecdotal evidence from anglers seeking spawning Kokanees suggested that this period of egg consumption was about 6 weeks in duration.

Population dynamics

The low, medium, or high natural mortality modeling scenarios predicted that the stocking program was producing about 3,900, 2,600, or 1,400 age-4 recruits, respectively, when they reached 254 mm TL and became vulnerable to angling. Natural mortality had a greater predicted effect than fishing mortality on total abundance of fish ≥ age-1 partly because much of the population was ≤ age-4 and invulnerable to angling harvest (Figure 4A). The lowest natural mortality scenario predicted the abundance of Arctic Char ≥ age-1 was between 28,925 and 34,950 fish (22 to 27 fish/ha) depending upon the level of fishing mortality (Table 3). Corresponding Arctic Char abundance ranges for the medium and high natural mortality scenarios were (19,842, 23,690) and (11,112, 13,119) respectively. The maximum harvest of all sizes occurred at cf = 0.45 (866 to 2,437 fish) but harvest of trophy sized fish was maximized at cf = 0.15 (67 to 213 fish; Table 3).

The number of trophy sized Arctic Char in the population differed greatly among harvest levels within each natural mortality scenario (Figure 4B). In the low natural mortality scenario the number of trophy Arctic Char ranged from 204 at *cf* = 0.45 to 2,964 at *cf* = 0.05. Corresponding trophy abundance in the medium natural mortality scenario ranged from 128 (*cf* =0.45) to 1,843 (*cf* = 0.05) and from 66 (*cf* = 0.45) to 935 (*cf* = 0.05) in the high natural mortality scenario (Table 3). Thus, high intensities of harvest would greatly limit the abundance of trophy Arctic Char regardless of the level of natural mortality.

Consumptive demand

Almost 90% of the annual per capita consumptive demand of Arctic Char was *Mysis*. Molluscs, insects, and Kokanee eggs made up 6.1%, 2.5% and 1.9% of annual consumption, respectively. Per capita consumption of *Mysis* increased nearly 17-fold from age-2 (124 g) through age-14 (2,150 g) and totaled 17,930 g over a lifetime. At the lowest fishing mortality rate (*cf* = 0.05), population level consumption of *Mysis* peaked at age-5 (774, 1,140, or 2,185 kg/year at high, medium, or low *cm*), and at age-4 when *cf* was set to 0.15, 0.30, or 0.45 (633 to 1,900 kg/year at lowest and highest *cf* and *cm*). Consumption of *Mysis* by the population ranged between about 6,400 kg/year and 14,700 kg/year in low natural mortality scenarios. Corresponding *Mysis* consumption ranged from approximately 4,800 to 9,500 kg/year in the medium natural mortality scenarios and from 2,300 to 5,000 kg/year in the high natural mortality scenarios (Figure 4C). Based on the size distribution and mean density of *Mysis* in Dillon Reservoir during 1991-2009 (261 mysids/m^2; Martinez et al. 2010) I estimated that total *Mysis* biomass in the lake averaged approximately 35,500 kg (95% CL: 23,081 - 47,974 kg). The average consumption across the mortality scenarios (6,774 kg) amounted to about 19% of *Mysis* biomass. Under the medium natural mortality scenario with the lowest fishing mortality, managers would need to stock 61,169 Arctic Char annually for consumptive demand to match *Mysis* biomass. Assuming the same medium natural mortality scenario but with the highest fishing mortality 121,704 Arctic Char would need to be stocked to achieve this consumptive demand.

Across all the simulations the estimated average total consumption of Kokanee eggs by the Arctic Char population was about 148 kg. At the mean size of female spawners in Dillon Reservoir (290 mm), associated fecundity (803 eggs, Martinez 1996) and egg mass (0.062g), we estimated that Arctic Char consumed the reproductive output of about 2,980 Kokanees. The abundance of Kokanees and their relative proportion in the pelagic fish community in Dillon Reservoir is unknown, but hydroacoustics surveys estimated a total of 40,400 pelagic fish targets in 2012 (J. Lepak, Colorado Parks and Wildlife, unpublished data).

Discussion

A relatively modest stocking program (total 58.2 fish/ha in four years) appears to have established a reproducing population of Arctic Char in Dillon Reservoir. To our knowledge, this population now represents the southernmost reproducing Arctic Char population throughout their native and introduced range. These fish inhabited hypolimnetic waters throughout the summer, and their annual consumptive demand was dominated by *Mysis*. Thus, Arctic Char offer a potential solution to the pelagic energy sink often created after the introduction of *Mysis* shrimp (Northcote 1991). Angling for Arctic Char may not substitute for the reductions of highly sought after Kokanees after

Mysis introductions (Beattie and Clancey 1991; Lasenby et al. 1986), and a much larger stocking effort would be needed to suppress *Mysis* biomass at Dillon Reservoir. However, Arctic Char do convert *Mysis* shrimp into sport fish biomass and show promise for providing an ice fishery in Dillon Reservoir.

The hypolimnetic habits of Dillon Reservoir Arctic Char followed a pattern established in Scandinavian populations. When Arctic Char are allopatric they occupy both hypolimnetic and littoral habitats but they retreat to hypolimnetic or pelagic waters where they occur in sympatry with Brown Trout (Hegge et al. 1989; Langeland et al. 1991). Differences in foraging modes between Arctic Char and Brown Trout may predispose them to feeding in spatially segregated locations and preying on different taxa to minimize competition (Jansen et al. 2002). Arctic Char have been shown to feed capably in low light to complete darkness (Jørgensen and Jobling 1990) and may be capable of finding benthos under the surface of the substrate (Schutz and Northcote 1972). These capabilities facilitate Arctic Char predation on *Mysis* which occupy dark hypolimnetic habitat during daytime hours, often along the sediment-water interface (Morgan et al. 1978). This same pattern of niche and spatial segregation appears to exist between Dolly Varden Char *Salvelinus malma* and Cutthroat Trout *Oncorhynchus clarkii* due to similar patterns of littoral exclusion by Cutthroat Trout and superior low light foraging in Dolly Varden (Jonsson et al. 2008).

Overall, growth of Arctic Char in Dillon Reservoir appears to be above average for landlocked Arctic Char populations throughout much of their range (Figure 5). Populations in Maine, Canada, and Alaska display slower growth rates than the Arctic Char in Dillon Reservoir (Phaedra Budy, Utah State University, Logan, UT, unpublished data; Michaud 2006; Gallagher 2010). However, the Arctic Char in Lake Geneva, Switzerland display rapid growth which surpasses that of Dillon Reservoir. Lake Geneva hosts the most southerly native population of Arctic Char in Europe at 46˚N and growth likely benefits from a longer growing season as well as recent eutrophication (Rubin 1993). Dillon Reservoir is a high elevation montane reservoir (2,748 m) which partially offsets the potential benefits to growth of its southerly latitude (39˚N). However, it still benefits from a longer growing season than experienced by many northerly populations of Arctic Char throughout their native range. Length at age has been found to be negatively correlated with latitude in lacustrine Arctic Char of eastern North America despite evidence of counter-gradient growth rates at northerly latitudes (Chavarie et al. 2010). Therefore, growth of Arctic Char introduced to other southern locales might be expected to be above average with the availability of sufficient food resources.

Much of the literature on exotic species introductions, whether accidental or purposeful, has focused on the unanticipated negative ecological interactions that often result (Moyle and Leidy 1992; Mills et al. 1993; Côté et al. 2013). Indeed, the introduction of *Mysis* into Dillon Reservoir and a host of other waters in North America and Scandinavia demonstrated undesirable effects on ecosystems and sport fishing (Nesler and Bergersen 1991). Therefore, it seems unwise to consider the introduction of yet another species as a means of *Mysis* biological control or at least to benefit anglers (Magnuson 1976). However, many waters where *Mysis* have been introduced, including Dillon Reservoir, are already composed of an entirely exotic fish fauna. In such cases the assemblage may be viewed as primarily of value to anglers and management agencies as a fishery resource, rather than as a unit of biodiversity to be conserved.

Therefore, management agencies may seek strategies to improve sport fishing in the face of a *Mysis*-dominated food web.

I have shown that introduced Arctic Char exploit *Mysis* but Arctic Char also have the potential to produce a novel “boutique” fishery in locations where anglers would otherwise have to travel great distances to catch them. The value of a “boutique” fishery is exemplified by the resurgence of management focus on Golden Trout *Oncorhynchus mykiss aguabonita* in Wyoming as a result of immense angler interest (P. Gerrity Wyoming Game and Fish, Lander, WY, personal communication, 2012). Likewise, in Utah, Tiger Trout *Salmo trutta x Salvelinus fontinalis* have also become a management focus and were stocked into 77 waters in 2013 (Utah Division of Wildlife Resources 2013). The present study may be used by managers as a precedent to justify future introductions of Arctic Char for both ecological and specialized fishery management purposes.

I am not advocating new introductions of Arctic Char, but the risks from further introductions of the species should be examined. I believe the Dillon Reservoir Arctic Char population is trapped on an island of high elevation habitat surrounded by a relatively unsuitable thermal environment downstream with no accessible lacustrine habitat upstream. Nonetheless, the history of fishery management dictates that introduced species are inherently risky to fish communities but also ecosystems (Moyle et al. 1986; Eby et al. 2006). Negative impacts of exotic fish introductions can be generalized to include diseases, predation, niche overlap and competition, and hybridization (Gozlan 2008), and all of these impacts potentially apply to Arctic Char introductions.

Novel diseases are always a threat when new fish species are imported to a region, but once a species has been incorporated into an agency's fish culture program, the risk of disease introduction should be no more than is the case for other species that are routinely stocked.

While Arctic Char are useful as predators on *Mysis*, the species can also be piscivorous. Piscivory in Arctic Char is generally associated with cannibalism or predation on small fish such as sticklebacks (L'Abée-Lund et al. 1992; Hobson and Welch 1995). In waters with high growth potential for Arctic Char, piscivory by large individuals should be expected. However, this transition to piscivory occurs at a later age than in most Lake Trout populations. Therefore, it is likely that if Arctic Char or Lake Trout were to be introduced into the same system, a smaller segment of the Arctic Char population would rely upon piscivory than in the Lake Trout population.

In the presence of other salmonids Arctic Char display the ability to segregate spatially and occupy hypolimnetic habitats which may not be profitable for other species. Even in allopatry, Arctic Char populations can partition resources through the emergence of pelagic and benthic morphs (Skúlason et al. 1989). In sympatry other salmonids may continue to occupy their preferred habitat with little spatial or resource overlap with Arctic Char (Jonsson et al. 2008; Langeland et al. 1991). Further, few other fish species have been shown to exploit *Mysis* to the degree that Arctic Char do, nor would it be problematic if they did.

Hybridization between native and introduced salmonids is a well-documented problem, particularly in the western U.S. where widely introduced Rainbow Trout have compromised the genetic integrity of several native Cuttthroat Trout subspecies

(Henderson et al. 2000; Hitt et al. 2003). The introduced range of *Mysis* in western North America (Rieman and Falter 1981; Martinez and Bergersen 1989) overlaps with native Char species, such as Dolly Varden Char and Bull Trout, and hybrid populations of Char do occur, including Brook Trout x Bull Trout, and Brook Trout x Lake Trout (Behnke 2002). Thus, Arctic Char introduced for *Mysis* control could hybridize with native chars. Arctic Char in two Alaskan lakes hybridized only occasionally when sympatric with Dolly Varden Char (Taylor et al. 2008), presumably because of reproductive isolation. However, such reproductive isolation may break down in other systems, or when Arctic Char are sympatric with Bull Trout, which are declining over much of their native range and listed as threatened (US Fish and Wildlife Service 1999). Given that hybridization among Chars is a possibility, Arctic Char introductions do present a potential threat to the integrity of native Char populations. This threat remains even if Arctic Char are introduced to systems unconnected to and far away from native Chars because unauthorized transplants of sport fish are common and difficult to control (Johnson et al. 2009). If Arctic Char are introduced elsewhere outside their native range, they should be certified triploids to reduce the hybridization and invasion threat.

In cold, oligotrophic systems with *Mysis* and an exotic fish fauna, Arctic Char can produce new sport fish biomass from energy that otherwise would be sequestered in *Mysis*. This “boutique” species also represents an option which may be more recreationally valuable than the typical strategy of stocking catchable Rainbow Trout in low productivity waters. Still, the Arctic Char introduction at Dillon Reservoir is paradoxical. In an era when nonnative species comprise a primary threat to aquatic biodiversity, condoning new introductions is concerning. However, in many human-dominated environments such as reservoirs, exotic fishes already comprise the majority of species. Fishery managers are left with the challenge of choosing relatively innocuous strategies that can still provide recreational benefits in systems plagued by a variety of anthropogenic stressors. Certainly, before any new introductions of Arctic Char are considered, management agencies should conduct a thorough risk analysis to minimize the chances for unintentional and undesirable outcomes.

Table 1. Input parameters and values used in FAMS to predict Arctic Char population response to differing levels of exploitation. See Methods for explanation of mortality scenarios.

Parameter	Meaning/Definition	Value
b	Weight-length parameter	2.689
a	Weight-length parameter	-4.300
L_∞(mm)	VBGF theoretical maximum length	580
Num Years	Duration of model run	15
K	VBGF growth coefficient	0.214
t_0 (years)	Theoretical time when TL = 0	1.43
t_{max}	Maximum age of fish	14
Recruitment	Abundance of young of year	19237[a]
cm_0	Probability of natural mortality age 0	0.500 = low, 0.650 = medium, 0.800 = high
cm_{1-12}	Probability of natural mortality age 1-12	0.260 = low, 0.270 = medium, 0.280 = high
fm_{0-3}	Probability of fishing mortality age 0-3	0.0
fm_{4-12}	Probability of fishing mortality age 4-12	0.050, 0.150, 0.300, or 0.450

[a]Average number of stocked Arctic Char fingerlings 2008-2012

Table 2. Seasonal thermal experience and diet composition used in bioenergetics simulations. Diet values reflect the proportional biomass found in Arctic Char stomach contents. Energy density of *Mysis* and fish eggs were measured from Dillon Reservoir; literature values were used for chironomids (James et al. 2012) and molluscs (adjusted for indigestibility of the shell; Eggleton and Schramm 2004).

Date	Simulation day	Temperature (˚C)	*Mysis* (3,246 J/g)	Insects (2,922 J/g)	Molluscs (209 J/g)	Fish eggs (8,909 J/g)
1-Jan	1	3.1	0.19	0.00	0.00	0.81
30-Jan	30	3.1	0.91	0.03	0.06	0.00
8-Mar	67	3.3	0.91	0.03	0.06	0.00
14-Apr	104	3.3	0.91	0.03	0.06	0.00
24-May	144	6.1	0.91	0.03	0.06	0.00
7-Jun	158	7.3	0.91	0.03	0.06	0.00
5-Jul	186	8.5	0.91	0.03	0.06	0.00
25-Jul	206	8.9	0.91	0.03	0.06	0.00
31-Jul	212	9.6	0.91	0.03	0.06	0.00
14-Aug	226	10.4	0.91	0.03	0.06	0.00
30-Aug	242	11.3	0.91	0.03	0.06	0.00
27-Sep	270	12.2	0.91	0.03	0.06	0.00
5-Nov	309	8.0	0.91	0.03	0.06	0.00
15-Nov	319	4.0	0.91	0.03	0.06	0.00
15-Dec	349	3.1	0.19	0.00	0.00	0.81
31-Dec	365	3.1	0.19	0.00	0.00	0.81

Table 3. Predicted population abundance and harvest of two age groups of Arctic Char in three conditional natural mortality scenarios subjected to four levels of conditional fishing mortality. The levels of conditional natural mortality (cm) were as follows: Low age 0 to 1 cm = 0.50, age 1 to 14 cm = 0.26; Medium age 0 to 1 cm = 0.65, age 1 to 14 cm = 0.27; High age 0 to 1 cm = 0.80, age 1 to 14 cm = 0.28. Trophies were Arctic Char ≥ 457 mm.

		Abundance		Harvest	
Natural mortality	Fishing mortality	Ages 1-14	Trophies (ages 8-14)	Total	Trophies (ages 8-14)
Low	0.05	34,950	2,964	521	128
	0.15	32,667	1,634	1,276	213
	0.30	30,402	620	1,985	162
	0.45	28,925	204	2,437	80
Medium	0.05	23,690	1,843	337	79
	0.15	22,246	1,020	831	132
	0.30	20,797	389	1,303	101
	0.45	19,842	128	1,608	50
High	0.05	13,119	935	178	40
	0.15	12,373	520	442	67
	0.30	11,616	199	698	51
	0.45	11,112	66	866	26

Table 4. Annual population consumptive demand (kg) of Arctic Char feeding on four prey types under a range of natural and fishing mortality rates.

Natural mortality	Fishing mortality	*Mysis*	Insects	Molluscs	Eggs
Low	0.05	14,654	416	991	319
	0.15	11,240	319	760	245
	0.3	8,178	232	553	179
	0.45	6,417	182	434	141
Medium	0.05	9,516	270	644	207
	0.15	73,363	209	498	161
	0.3	5,415	154	366	118
	0.45	4,282	121	290	94
High	0.05	5,034	143	340	110
	0.15	3,933	112	266	86
	0.3	2,925	83	198	64
	0.45	2,332	66	158	51

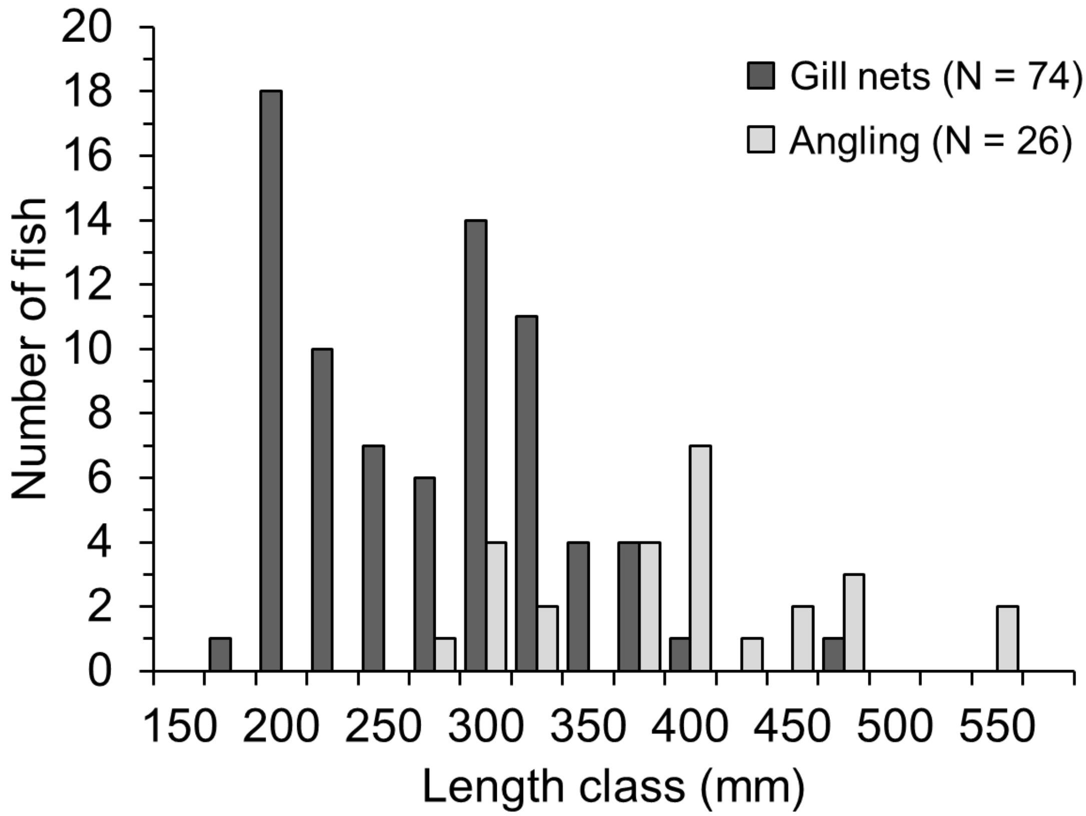

Figure 1. Length and frequency of Arctic Char captured in Dillon Reservoir. Netted fish are represented by dark gray bars and angled fish are represented by light gray bars.

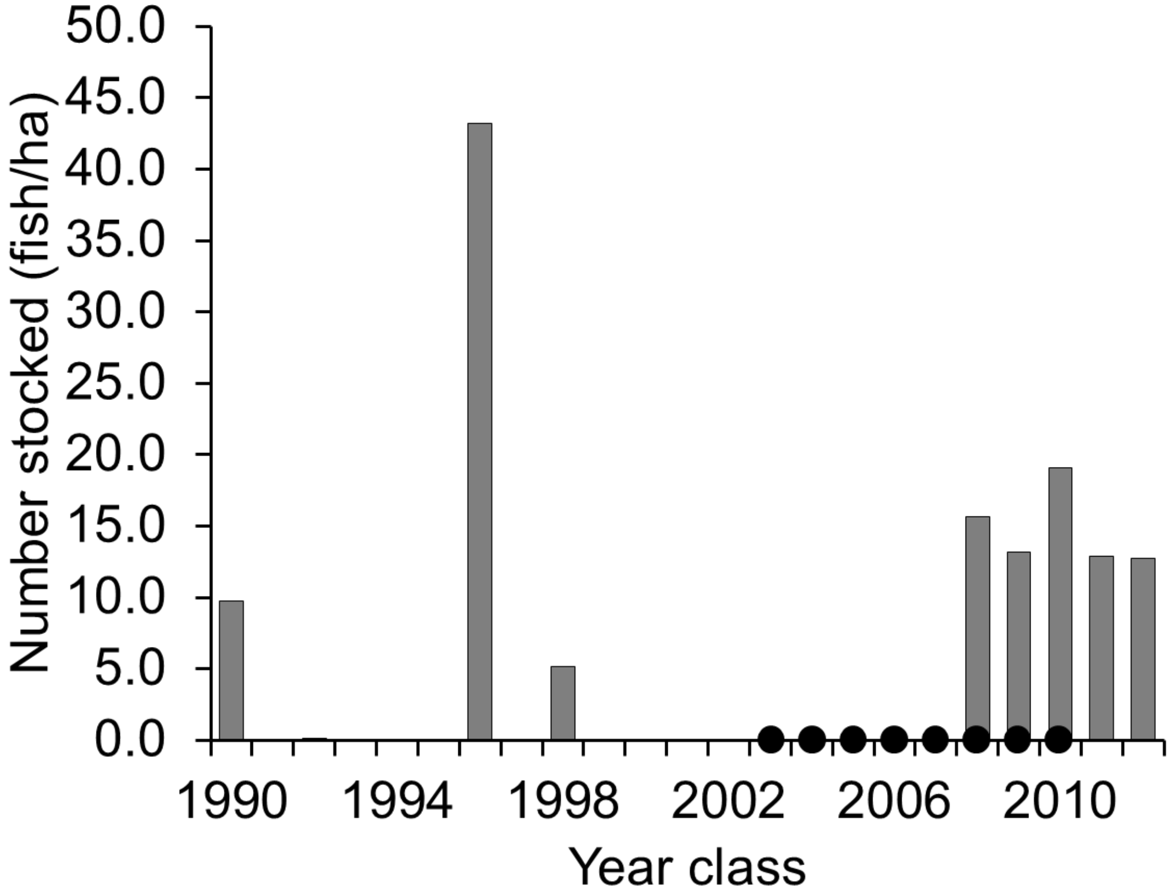

Figure 2. Number of Arctic Char stocked into Dillon Reservoir during 1990 – 2013. Fingerlings (~90 mm TL) were stocked in all years except 1992, when 125 adults were stocked. Closed circles indicate year-classes detected in aging of fish collected during 2011-2013. On average, 19,237 Arctic Char were stocked from 2008 to 2012.

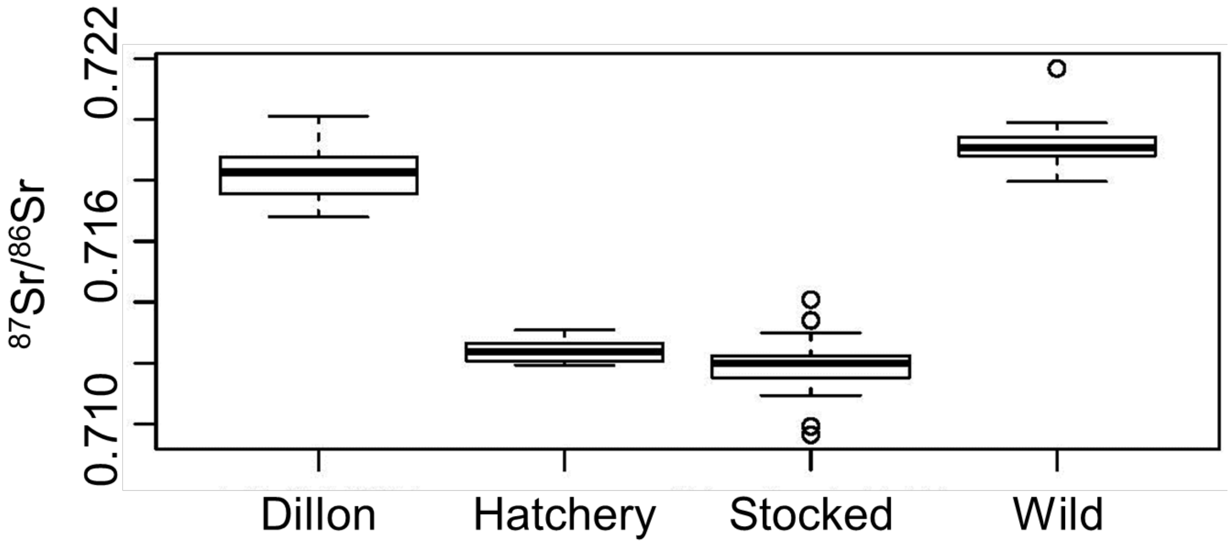

Figure 3. Otolith $^{87}Sr/^{86}Sr$ signatures from Dillon (Kokanees and Brown Trout), Hatchery Arctic Char fingerlings from the Colorado Parks and Wildlife Mount Shavano Hatchery, and Arctic Char captured in Dillon Reservoir and designated as either stocked or wild.

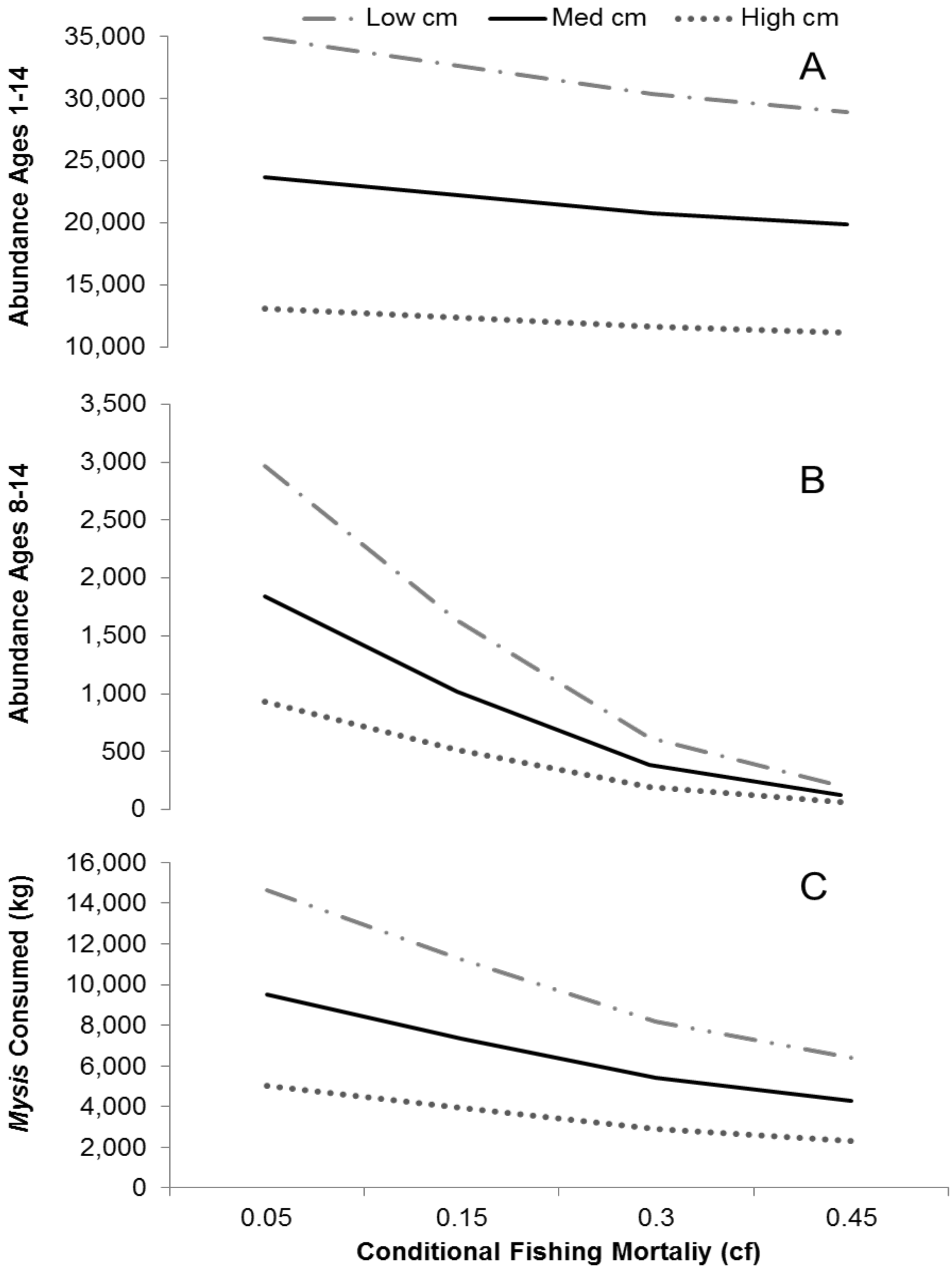

Figure 4. Abundance of Arctic Char A) ages 1-14, B) trophy size Arctic Char, ages 8-14, and C) biomass of *Mysis* consumed by the Arctic Char population in three natural mortality scenarios subjected to four levels of fishing mortality.

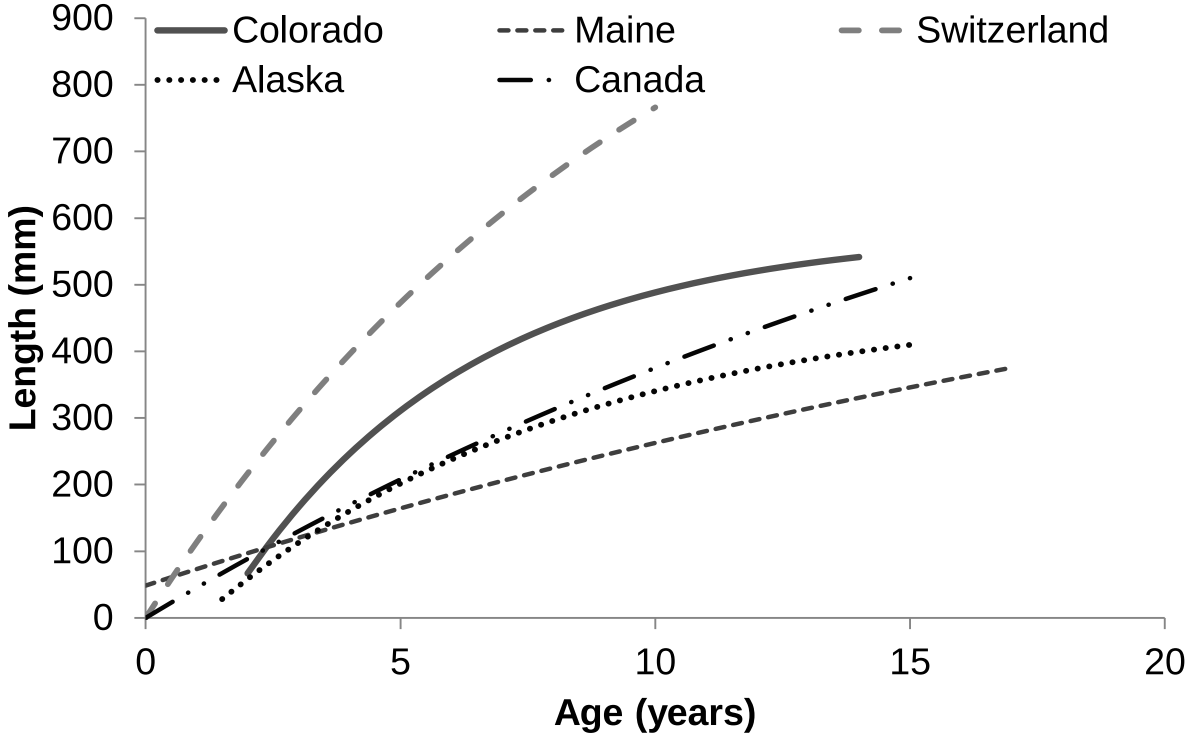

Figure 5. Von Bertalanffy growth curves for landlocked Arctic Char populations across much of their range. Populations are from Dillon Reservoir, Colorado (present study), Flood Pond, Maine (Michaud 2006), Lake Geneva, Austria (Rubin 1993), Toolik Lakes, Alaska (Phaedra Budy, Utah State University, Logan, UT, unpublished data), and the higher trophic group of Lake Iqalugaajuruluit, Baffin Island, Canada (Gallagher 2010).

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Appendix A: $\delta^{13}C$ and $\delta^{15}N$ stable isotope analyses of the Dillon Reservoir food web.

Introduction

The analyses of the stable isotopes ^{13}C and ^{15}N has improved the understanding of energy flow through food webs in aquatic ecosystems (Vander Zanden and Rasmussen 2001). In lacustrine food webs, benthic algae exhibit less fractionation during carbon fixation and are generally enriched in ^{13}C relative to pelagic based phytoplankton (Vander Zanden and Rasmussen 1999). Carbon isotopes exhibit little fractionation (<1‰) between consumers and producers and can be useful for identifying the carbon source of consumers (Vander Zanden et al. 1999). With each step in the food chain, consumers become enriched in ^{15}N relative to their prey typically by 1.5-4‰ (Vander Zanden and Rasmussen 2001; McCutchan et al. 2003). Therefore, $\delta^{15}N$ is often used as a predictor of trophic position (Vander Zanden and Rasmussen 1999). Stomach content analysis provides a direct short term description of a fish's diet at the time of sampling while stable isotope analysis provides an integrated longer term view of a fish's diet. Together, stomach contents and stable isotopes provide the best overall assessment of a fish's diet. In this appendix, I employed ^{13}C and ^{15}N isotopes to describe possible long term contributions of prey sources to the isotopic signatures of Arctic Char in Dillon Reservoir.

Methods

Stable carbon and nitrogen isotope samples were collected from fish and prey items to illustrate food web structure. Epaxial muscle plugs (1 cm^3) were removed between the lateral line and dorsal fin of all Arctic Char and from a length stratified sample (up to 10 in each 25 mm size class) of Brown Trout, Kokanee, Rainbow Trout, and White Sucker in 2011, 2012, and 2013. Zooplankton, *Mysis*, chironomids, Kokanee eggs, and terrestrial insects were collected from within the reservoir or whole from fish stomachs (Table A1). Kokanee eggs could only be sourced from one spawning female. Isotopic values were nearly identical between that individual's muscle and egg tissue. Therefore, the mean signature of all Kokanee samples was used as a surrogate for the Kokanee egg signature. Samples from fingerling hatchery Arctic Char and Rainbow Trout were also collected before stocking. All muscle plugs and whole invertebrate or composite prey samples were frozen and stored at -20 ˚C until processing. Samples were dried at 60 ˚C for 72 hours and ground to powder with a mortar and pestle. Samples were analyzed at the Cornell University Stable Isotope Laboratory with a Thermo Delta V isotope ratio mass spectrometer interfaced with an NC2500 elemental analyzer. Isotopic differences from C and N standards were expressed as δ values in parts per thousand (‰) relative to the reference standards of PeeDee belemnite for ^{13}C and nitrogen gas in ambient air for ^{15}N as follows:

$$\delta_{sample} = \left(\frac{R_{sample}}{R_{standard}} - 1\right) \times 1000$$

Where R is the carbon or nitrogen isotopic ratio ($^{13}C/^{12}C$ or $^{15}N/^{14}N$, Fry 2006). To correct for differences in ^{13}C depleted lipid concentrations (Johnson et al. 2002) we used the correction for lipid content from Post et al. (2007):

$$\delta^{13}\mathrm{C}_{\mathrm{normalized}} = \delta^{13}\mathrm{C}_{\mathrm{measured}} - 3.32 + 0.99 \times \mathrm{C:N}$$

where C:N is the carbon to nitrogen ratio.

To estimate the proportional contribution of different prey items to the diet of Arctic Char we used the MixSIR Bayesian stable isotopic mixing model (Semmens and Moore 2008). MixSIR calculates probability distributions for the proportion each prey source contributes to a predator's diet. MixSIR inputs include individual predator isotopic signatures and the mean isotopic signatures of prey items with their associated standard deviations. The values of expected carbon and nitrogen isotopic fractionation with standard deviations are also included. However, we believed the standard MixSIR default fractionation values for ^{15}N from McCutchan et al. (2003) were too low and overestimated the Kokanee egg contribution to Arctic Char signatures. Post (2002) and Vander Zanden and Rasmussen (2001) found ^{15}N fractionation to be higher in consumers eating high protein diets typified by low C:N in prey items. I believed the ^{15}N fractionation in Vander Zanden and Rasmussen (2001) to be more appropriate than that in McCutchan et al. (2003) because the C:N of both *Mysis* and Kokanee eggs were low (4.33 and 4.45 respectively). Therefore, we completed runs with both the default fractionation values for ^{15}N of 2.3 ± 1.61‰ and 0.4 ± 1.2‰ for ^{13}C and the field estimate of Lake Trout fractionation from Vander Zanden and Rasmussen (2001) of 3.49 ± 0.23‰ for ^{15}N and 0.05 ± 0.63‰ for ^{13}C.

Arctic Char were divided into two size groups for the MixSIR model (< 475mm N = 57 and > 475mm N = 2) because isotopic signatures of the larger fish appeared to be distinct from those of smaller fish, and we suspected that the larger fish were preying on fingerling Rainbow Trout. The model was run for 1×10^7 iterations to assure more than 1,000 posterior draws and a maximum importance ratio < 0.001 (Semmens and Moore 2008). A first run of the model for each size grouping included all possible prey sources. To reduce noise and increase the accuracy in estimation of prey source isotopic contribution, a second run of the model included only prey sources whose median proportional contribution to the Arctic Char isotopic signature from the first model run was ≥ 5% and/or prey sources which were directly found in the stomach contents. Of the potential prey items sampled for isotopic signatures, only *Mysis*, chironomids, and Kokanee eggs were found in the stomach contents of Arctic Char < 475 mm and only *Mysis* and Kokanee eggs were found in the two Arctic Char > 475 mm. Therefore, White Sucker fry, Rainbow Trout fingerling, zooplankton, and terrestrials were not included in second MixSIR runs unless their proportional contribution from the first run for each size class was ≥ 5%.

Results and Discussion

In Dillon Reservoir, Brown Trout and White Sucker appear to be opportunistic generalists as a group but often individuals are specialists. Brown Trout and White Sucker displayed mean isotopic signatures reflecting a mix of pelagic and littoral food types ($\delta^{13}C$ = -23.71 SD ± 2.01 for Brown Trout and $\delta^{13}C$ = -22.54 SD ± 2.63 for White Sucker; Figure A1). Their high variability in $\delta^{13}C$ is a result of individuals which specialized in pelagic or littoral food sources. Arctic Char < 475mm and Kokanee displayed pelagic based signatures with lower variances as a result of few individuals with littoral based $\delta^{13}C$ signatures ($\delta^{13}C$ = -25.95 SD ± 1.06 for Arctic Char and $\delta^{13}C$ = -25.52 SD ± 0.68; Figure A1). Arctic Char > 475mm experienced a large isotopic shift toward a ^{13}C enriched prey source ($\delta^{13}C$ = -21.49 SD ± 0.01). Rainbow Trout were enriched in ^{13}C relative to other predators ($\delta^{13}C$ = -20.71 SD ± 1.45; Figure A1). Their signatures were based mainly on the marine isotopic signature of food they receive in the hatchery. Arctic Char > 475mm showed the highest mean $\delta^{15}N$ value (17.49 SD ± 0.60) followed by Brown Trout (15.89 SD ± 1.55), Kokanee (15.42 SD ± 1.66), Arctic Char > 475mm (15.19 SD ± 0.16), White Sucker (14.46 SD ± 0.95), and Rainbow Trout (10.64 SD ± 2.03).

Only *Mysis*, Kokanee eggs, and chironomids were found in the diets of Arctic Char < 475mm (Chapter 1 of this thesis). All other sources contributed a median < 2% and were not used in the second MixSIR run. Using the default MixSIR fractionation values in the second run, median proportional prey contributions to the < 475mm Arctic Char isotopic signature were 45%, 54% and 1% for Kokanee eggs, *Mysis*, and chironomids respectively (Table A2). Employing the fractionation values from Vander Zanden and Rasmussen (2001), median proportional prey contributions for Kokanee eggs, *Mysis*, and chironomids were 35%, 55%, and 10% respectively (Table A2).

Rainbow Trout fingerling, *Mysis*, and Kokanee eggs were included in the final MixSIR run for Arctic Char > 475mm. No other prey sources contributed a proportional median > 5%. Using the default fractionation values, median proportional prey contributions were 58%, 23%, and 17% for Rainbow Trout fingerling, Kokanee eggs, and *Mysis* respectively (Table A3). Employing Vander Zanden and Rasmussen's (2001) fractionation values, median prey contributions were 72%, 6%, and 20% for Rainbow Trout fingerling, Kokanee eggs, and *Mysis* respectively (Table A3). Regardless of assumed fractionation values, MixSIR results suggested that large Arctic Char > 475mm experienced an ontogenetic shift and preyed upon the subsidy of fingerling Rainbow Trout currently being stocked in Dillon Reservoir to benefit Brown Trout growth. However, only two individuals of this size were captured and a larger sample size is needed to understand if most or all individuals > 475mm exhibit similar isotopic signatures.

Regardless of the fractionation values used, it appears that both *Mysis* and Kokanee eggs contribute greatly to the isotopic signature of Arctic Char < 475mm.

These results are supported by the narrow diet breadth found in stomach samples of Arctic Char dominated by *Mysis* in the summer and *Mysis* and Kokanee eggs in the winter (Chapter 1 of this thesis). However, the values for these two prey items are only separated by a $\delta^{15}N$ of 1.28 and by a $\delta^{13}C$ of 1.88 with overlapping variances (Figure A1). These values may not have been disparate enough to generate reliable estimates of the true proportional contribution of Kokanee eggs and *Mysis* to the Arctic Char isotopic signature. Regardless of their high energy density, given the short time period Kokanee eggs are available in early winter and the sub-optimal temperatures during this period; it seems likely that Kokanee eggs are overrepresented in the MixSIR results. Another stable isotopic metric, such as $\delta^{34}S$, may be useful in generating supporting evidence for the proportional contribution of *Mysis* and Kokanee eggs to the Arctic Char diet. Alternatively, a laboratory study aimed at understanding the exact fractionation for these two food sources when fed to Arctic Char would provide higher confidence in the proportional contributions estimated by MixSIR.

Table A1. Potential prey items sampled for isotopic signatures with associated gear, origin, sampling site, and date(s).

Prey item	Sampling gear or origin	Sampling site(s)	Sampling dates
Mysis	500μ mesh 1m plankton net	Multiple *Mysis* sites and dam outflow	July and October 2011, May, June, July, August, and September 2012, March 2013
Zooplankton	500μ mesh 0.5m plankton net	Ten Mile Arm	June 23 and Oct 11, 2011
Chironomids	White Sucker stomach contents	Multiple gill nets in Blue River and Ten Mile arm	June and July 2013
Terrestrial insects	Brown Trout stomach contents	Snake River arm	June 2013
White Sucker fry	Aquarium hand net	Dillon Marina	July 19, 2012
Juvenile Arctic Char	Mt. Shavano fish hatchery	Hatchery	August 2, 2012
Juvenile Rainbow Trout	Rifle Falls fish hatchery	Hatchery	August 26, 2011

Table A2. Proportional prey contributions to the isotopic signature of Arctic Char ≤ 475mm as predicted by MixSIR. Percentile values are from the distribtution associated with the proportional contribution of each source to the mixture predicted by the Bayesian sampling importance resampling algorithm. The 50th percentile represents the median value of each prey item's proportional contribution to the Arctic Char isotopic mixture. The default fractionation values were 0.4 SD ± 1.2‰ for $\delta^{13}C$ and 2.3 SD ± 1.61‰ for $\delta^{15}N$. Fractionation values from Vander Zanden and Rasmussen (2001) were 0.05 SD ± 0.63‰ for $\delta^{13}C$ and 3.49 SD ± 0.23‰ for $\delta^{15}N$.

	McCutchan et al. (2003)					Vander Zanden and Rasmussen 2001				
Prey Item	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
Kokanee eggs	0.38	0.42	0.45	0.48	0.52	0.28	0.32	0.35	0.37	0.41
Mysis	0.47	0.51	0.54	0.57	0.61	0.49	0.53	0.55	0.58	0.62
Chironomids	0.00	0.01	0.01	0.02	0.03	0.08	0.09	0.10	0.11	0.13

Table A3. Proportional prey contributions to the isotopic signature of Arctic Char ≥ 475 mm as predicted by MixSIR. Percentile explanation and fractionation values are listed in Table A2.

	McCutchan et al. (2003)					Vander Zanden and Rasmussen (2001)				
Prey Item	5%	25%	50%	75%	95%	5%	25%	50 %	75%	95%
Rainbow Trout fingerling	0.45	0.53	0.58	0.64	0.72	0.63	0.68	0.72	0.75	0.79
Kokanee eggs	0.03	0.13	0.23	0.33	0.47	0.01	0.03	0.06	0.13	0.28
Mysis	0.02	0.09	0.17	0.26	0.38	0.05	0.15	0.20	0.25	0.31

Table A4. Summary of predator and prey isotopic samples collected for Dillon Reservoir 2010-2013. Arctic Char and Rainbow Trout Fingerling were sourced directly from their respective hatchery. All fish samples were muscle while all invertebrates were amalgamated whole specimens. The 1 m *Mysis* net and the ½ m zooplankton net both consisted of 500 μm Nitex mesh. Corrected $\delta^{13}C$ values employ the lipid correction method of Post (2007). Site codes are as follows: 1 = Blue River Inlet, 2 = Blue River Arm, 3 = Brown's Point, 4 = Dillon Dam, 5 = Dillon Marina, 6 = Fishhook Island, 7 = Frisco Marina, 8 = Giberson Bay, 9 = Mt. Shavano Hatchery, 10 = Rifle Falls Hatchery, 11 = Sentinel Island, 12 = Snake River Arm, 13 = Ten Mile Arm, 14 = Ten Mile Creek, and 15 = Windy Point

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL062912016	6/29/12	gill net	Arctic Char	189	75	f	2	3.16	18.18	-27.04	-27.22
DIL071113015	7/11/13	gill net	Arctic Char	232	95	f	2	3.26	17.61	-25.15	-25.15
DIL070913016	7/9/13	gill net	Arctic Char	246	126	f	2	3.72	18.18	-26.36	-26.36
DIL061213016	6/12/13	gill net	Arctic Char	259	128	f	2	3.38	17.23	-25.63	-25.63
DIL070913024	7/9/13	gill net	Arctic Char	265	132	f	2	3.26	17.70	-25.16	-25.16
DIL070213021	7/2/13	gill net	Arctic Char	280	186	f	2	3.22	18.46	-26.13	-26.13
DIL070313003	7/3/13	gill net	Arctic Char	309	213	f	2	4.43	18.39	-27.80	-27.80
DIL070913055	7/9/13	gill net	Arctic Char	310	221	f	2	3.52	17.85	-26.84	-26.84
DIL071113027	7/11/13	gill net	Arctic Char	335	285	f	2	3.22	18.02	-25.73	-25.73
DIL070913040	7/9/13	gill net	Arctic Char	326	303	f	2	3.35	18.54	-26.01	-26.01
DIL071712011	7/17/12	gill net	Arctic Char	357	316	f	2	3.23	17.76	-26.38	-26.50
DIL061213017	6/12/13	gill net	Arctic Char	356	325	f	2	3.86	17.87	-26.60	-26.60
DIL062912020	6/29/12	gill net	Arctic Char	187	53	m	2	3.03	16.45	-25.44	-25.77
DIL071112026	7/11/12	gill net	Arctic Char	205	56	m	2	3.14	18.16	-25.97	-26.18
DIL062912021	6/29/12	gill net	Arctic Char	207	62	m	2	3.14	16.12	-25.41	-25.62
DIL062912013	6/29/12	gill net	Arctic Char	187	65	m	2	3.08	17.20	-26.09	-26.37
DIL062912014	6/29/12	gill net	Arctic Char	200	65	m	2	3.04	17.98	-26.40	-26.71
DIL071712015	7/17/12	gill net	Arctic Char	238	101	m	2	3.16	17.46	-25.75	-25.95
DIL071113007	7/11/13	gill net	Arctic Char	265	145	m	2	3.28	17.81	-25.91	-25.91
DIL071712014	7/17/12	gill net	Arctic Char	280	165	m	2	3.14	17.06	-25.92	-26.13
DIL071013020	7/10/13	gill net	Arctic Char	275	167	m	2	3.35	18.14	-25.82	-25.82

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL061213006	6/12/13	gill net	Arctic Char	284	173	m	2	3.07	17.76	-25.80	-25.80
DIL070913041	7/9/13	gill net	Arctic Char	291	178	m	2	3.23	18.07	-26.05	-26.05
DIL071112024	7/11/12	gill net	Arctic Char	290	194	m	2	3.28	17.94	-26.74	-26.82
DIL062912017	6/29/12	gill net	Arctic Char	305	195	m	2	2.99	16.91	-26.58	-26.94
DIL070913015	7/9/13	gill net	Arctic Char	305	212	m	2	3.43	17.86	-26.29	-26.29
DIL070213036	7/2/13	gill net	Arctic Char	296	219	m	2	3.48	17.86	-26.38	-26.38
DIL062912011	6/29/12	gill net	Arctic Char	308	228	m	2	3.20	16.82	-27.30	-27.45
DIL071112011	7/11/12	gill net	Arctic Char	326	270	m	2	3.90	17.62	-26.95	-26.41
DIL071113020	7/11/13	gill net	Arctic Char	321	291	m	2	3.31	17.72	-26.41	-26.41
DIL070213035	7/2/13	gill net	Arctic Char	324	294	m	2	3.21	18.47	-25.98	-25.98
DIL061213009	6/12/13	gill net	Arctic Char	342	356	m	2	4.16	18.17	-27.42	-27.42
DIL061313005	6/13/13	gill net	Arctic Char	364	386	m	2	3.21	17.44	-26.27	-26.27
DIL071113036	7/11/13	gill net	Arctic Char	461	747	m	2	3.41	17.54	-26.95	-26.95
DIL061213014	6/12/13	gill net	Arctic Char	174	44		2	5.77	16.37	-24.91	-24.91
DIL061313006	6/13/13	gill net	Arctic Char	193	51		2	3.48	17.52	-25.24	-25.24
DIL071013037	7/10/13	gill net	Arctic Char	188	52		2	3.23	17.11	-24.93	-24.93
DIL061313003	6/13/13	gill net	Arctic Char	197	57		2	3.29	17.67	-24.62	-24.62
DIL061313008	6/13/13	gill net	Arctic Char	200	64		2	3.67	17.95	-25.67	-25.67
DIL071113006	7/11/13	gill net	Arctic Char	195	67		2	3.17	17.54	-24.68	-24.68
DIL061213015	6/12/13	gill net	Arctic Char	197	68		2	3.31	17.40	-24.31	-24.31
DIL071013022	7/10/13	gill net	Arctic Char	216	79		2	3.34	17.60	-24.78	-24.78
DIL071113014	7/11/13	gill net	Arctic Char	219	93		2	3.23	17.72	-24.63	-24.63
DIL070313010	7/3/13	gill net	Arctic Char	240	108		2	3.16	17.25	-23.91	-23.91
DIL071013024	7/10/13	gill net	Arctic Char	296	174		2	3.10	17.33	-24.96	-24.96
DIL070711002	7/7/11	angled	Arctic Char	260	129		1	3.23	17.65	-26.53	-26.66
DIL070611002	7/6/11	angled	Arctic Char	380	447		1	3.24	17.07	-26.27	-26.38
DIL010313012	1/3/13	angled	Arctic Char	290	231	f	4	3.53	17.27	-26.45	-26.27
DIL010313013	1/3/13	angled	Arctic Char	318	294	f	4	3.30	17.58	-26.39	-26.44
DIL012113002	1/21/13	angled	Arctic Char	358	398	f	4	3.71	17.51	-27.35	-27.00

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL011113003	1/11/13	angled	Arctic Char	362	416	f	4	3.47	17.61	-27.12	-27.01
DIL010313001	1/3/13	angled	Arctic Char	390	472	f	4	3.64	17.31	-27.49	-27.21
DIL010313016	1/3/13	angled	Arctic Char	393	493	f	4	3.48	17.52	-27.32	-27.20
DIL010313008	1/3/13	angled	Arctic Char	365	495	f	4	4.03	17.25	-27.47	-26.81
DIL012113001	1/21/13	angled	Arctic Char	382	540	f	4	3.61	17.68	-26.24	-25.98
DIL010412001	1/4/12	angled	Arctic Char	414	550	f	4	3.17	17.74	-27.02	-27.21
DIL010313004	1/3/13	angled	Arctic Char	385	582	f	4	3.34	17.67	-26.95	-26.96
DIL010313002	1/3/13	angled	Arctic Char	460	591	f	4	3.07	17.70	-26.72	-26.99
DIL011113004	1/11/13	angled	Arctic Char	431	591	f	4	3.13	17.60	-26.34	-26.56
DIL010313006	1/3/13	angled	Arctic Char	465	797	f	4	3.27	17.60	-27.10	-27.18
DIL010313009	1/3/13	angled	Arctic Char	435	850	f	4	3.82	17.60	-27.78	-27.32
DIL010313007	1/3/13	angled	Arctic Char	546	1445	f	4	3.73	15.30	-21.87	-21.49
DIL062012037	6/20/12	gill net	Arctic Char	205	62	f	4	2.97	14.96	-23.48	-23.86
DIL010313014	1/3/13	angled	Arctic Char	268	216	m	4	3.49	18.10	-26.95	-26.82
DIL010313015	1/3/13	angled	Arctic Char	285	221	m	4	3.21	16.98	-25.78	-25.92
DIL010313005	1/3/13	angled	Arctic Char	302	287	m	4	3.30	17.82	-27.07	-27.12
DIL010313003	1/3/13	angled	Arctic Char	364	427	m	4	3.12	17.96	-26.14	-26.37
DIL011113002	1/11/13	angled	Arctic Char	389	449	m	4	3.35	16.75	-26.23	-26.23
DIL010313017	1/3/13	angled	Arctic Char	457	841	m	4	3.14	17.89	-26.42	-26.63
DIL010313010	1/3/13	angled	Arctic Char	540	1333	m	4	3.11	15.07	-21.26	-21.50
DIL123011003	12/30/11	angled	Arctic Char	295	245		4	3.45	18.69	-27.15	-27.06
DIL010313011	1/3/13	angled	Arctic Char	300	270		4	3.41	17.24	-26.37	-26.31
DIL123011002	12/30/11	angled	Arctic Char	385	377		4	3.16	18.47	-25.92	-26.12
DIL123011001	12/30/11	angled	Arctic Char	390	389		4	3.68	17.93	-27.57	-27.25
DIL061213026	6/12/13	gill net	Arctic Char	226	85	f	13	3.32	18.14	-25.61	-25.61
DIL091412029	9/14/12	gill net	Arctic Char	300	206	f	13	3.23	16.74	-25.23	-25.35
DIL091412017	9/14/12	gill net	Arctic Char	282	218	f	13	3.31	16.70	-25.57	-25.61
DIL082212033	8/22/12	gill net	Arctic Char	368	445	f	13	3.82	17.75	-27.44	-26.98
DIL061313019	6/13/13	gill net	Arctic Char	202	76	m	13	3.23	17.04	-23.77	-23.77

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL082212013	8/22/12	gill net	Arctic Char	225	90	m	13	3.33	16.60	-25.56	-25.58
DIL082212025	8/22/12	gill net	Arctic Char	223	104	m	13	4.05	17.74	-27.30	-26.62
DIL082212029	8/22/12	gill net	Arctic Char	245	127	m	13	3.59	17.70	-26.75	-26.52
DIL082212014	8/22/12	gill net	Arctic Char	284	154	m	13	3.40	17.21	-25.93	-25.88
DIL082112009	8/21/12	gill net	Arctic Char	280	170	m	13	3.21	16.81	-26.26	-26.40
DIL061313022	6/13/13	gill net	Arctic Char	280	180	m	13	3.34	17.75	-26.19	-26.19
DIL082212012	8/22/12	gill net	Arctic Char	308	185	m	13	3.31	16.17	-26.12	-26.16
DIL091412016	9/14/12	gill net	Arctic Char	309	236	m	13	3.29	16.73	-25.56	-25.62
DIL091412015	9/14/12	gill net	Arctic Char	310	242	m	13	3.24	17.15	-25.78	-25.89
DIL082212002	8/22/12	vertical net	Arctic Char	282	189	m	13	3.22	17.14	-25.76	-25.89
DIL070213037	7/2/13	gill net	Arctic Char	190	46		13	3.19	17.63	-25.02	-25.02
DIL061413008	6/14/13	gill net	Arctic Char	178	52		13	5.85	15.88	-24.24	-24.24
DIL061213027	6/12/13	gill net	Arctic Char	185	53		13	3.29	17.38	-24.61	-24.61
DIL061313021	6/13/13	gill net	Arctic Char	178	53		13	5.64	16.28	-24.14	-24.14
DIL061413007	6/14/13	gill net	Arctic Char	185	57		13	3.32	17.28	-24.23	-24.23
DIL070213015	7/2/13	gill net	Arctic Char	194	58		13	3.20	17.32	-24.56	-24.56
DIL061413017	6/14/13	gill net	Arctic Char	194	64		13	3.33	17.36	-24.81	-24.81
DIL070213038	7/2/13	gill net	Arctic Char	221	76		13	3.36	17.90	-25.53	-25.53
DIL061313009	6/13/13	gill net	Arctic Char	230	80		13	3.39	17.44	-24.87	-24.87
DIL061213023	6/12/13	gill net	Arctic Char	224	98		13	3.29	17.22	-24.67	-24.67
DIL061413003	6/14/13	gill net	Arctic Char	260	138		13	3.29	17.53	-25.84	-25.84
DIL061413021	6/14/13	gill net	Arctic Char	300	220		13	3.14	18.24	-26.30	-26.30
DIL070213039	7/2/13	gill net	Arctic Char	320	258		13	3.25	18.14	-26.33	-26.33
DIL060710012	6/7/10	gill net	Arctic Char	364	358	f		3.50	16.92	-27.14	-26.99
DIL060710001	6/7/10	gill net	Arctic Char	423	685	f		3.36	16.99	-26.79	-26.78
DIL062310515	6/23/10	gill net	Arctic Char	264	123	m		3.42	16.83	-26.38	-26.31
DIL062310516	6/23/10	gill net	Arctic Char	324	262	m		3.44	17.83	-26.54	-26.45
DIL080911003	8/9/11	angled	Arctic Char	193	50			3.21	17.81	-26.35	-26.49

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL011113003E	1/11/13	angled	Arctic Char Egg				4	4.51	18.13	-28.02	-26.88
MSH1	8/2/12		Arctic Char fing.	100			9	4.45	12.58	-19.80	-18.72
MSH2	8/2/12		Arctic Char fing.	85			9	3.73	13.67	-18.87	-18.50
MSH3	8/2/12		Arctic Char fing.	83			9	4.33	12.68	-19.81	-18.84
MSH4	8/2/12		Arctic Char fing.	98			9	3.66	13.26	-18.88	-18.58
MSH5	8/2/12		Arctic Char fing.	102			9	3.80	13.28	-19.03	-18.59
chironomids 1	July 2013	lavage	chironomid					8.37	7.49	-26.08	-26.08
chironomids 2	July 2013	lavage	chironomid					8.22	7.68	-31.00	-31.00
Flying ants	June 2013	lavage	flying ants				12	9.90	3.38	-22.90	-22.90
DIL080310009A	8/3/10	angled	Kokanee	243	120	m	1	4.06	16.05	-26.74	-26.05
DIL080310014A	8/3/10	angled	Kokanee	258		m	1	3.59	16.54	-26.04	-25.81
DIL080310006A	8/3/10	angled	Kokanee	248			1	3.90	15.87	-26.32	-25.78
DIL080310015A	8/3/10	angled	Kokanee	234			1	3.84	15.86	-26.37	-25.89
DIL062912012	6/29/12	gill net	Kokanee	136	23	f	2	3.32	18.13	-27.87	-27.90
DIL071712002	7/17/12	gill net	Kokanee	260	136	f	2	4.29	15.30	-27.27	-26.35
DIL070312014	7/3/12	gill net	Kokanee	265	143	f	2	5.39	16.05	-30.05	-28.03
DIL071112025	7/11/12	gill net	Kokanee	275	148	f	2	3.60	16.58	-26.95	-26.70
DIL071112027	7/11/12	gill net	Kokanee	125	15	m	2	3.14	17.41	-25.81	-26.03
DIL071712024	7/17/12	gill net	Kokanee	129	19	m	2	3.22	17.61	-26.21	-26.33
DIL071712013	7/17/12	gill net	Kokanee	127	20	m	2	3.39	17.70	-27.25	-27.22
DIL071112016	7/11/12	gill net	Kokanee	135	21	m	2	3.44	17.02	-26.81	-26.73

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL070312016	7/3/12	gill net	Kokanee	174	42	m	2	3.34	17.15	-27.11	-27.12
DIL070312008	7/3/12	gill net	Kokanee	231	111	m	2	3.95	15.07	-27.00	-26.41
DIL071112031	7/11/12	gill net	Kokanee	265	128	m	2	4.32	17.44	-28.21	-27.25
DIL071112030	7/11/12	gill net	Kokanee	256	137	m	2	4.11	17.14	-27.92	-27.17
DIL071112017	7/11/12	gill net	Kokanee	260	136		2	4.63	17.34	-28.84	-27.58
DIL061213011	6/12/13	gill net	Kokanee	135			2	3.32	18.96	-25.99	-25.99
DIL061213012	6/12/13	gill net	Kokanee	120			2	3.30	18.81	-25.85	-25.85
DIL061313007	6/13/13	gill net	Kokanee	123			2	3.42	19.26	-26.73	-26.73
DIL070313024	7/3/13	gill net	Kokanee	129			2	3.13	18.73	-25.73	-25.73
DIL071011002	7/10/11	angled	Kokanee	220	110		1	4.09	16.02	-27.23	-26.50
DIL011113001	1/11/13	angled	Kokanee			f	4	3.16	14.91	-25.63	-25.82
DIL012113003	1/21/13	angled	Kokanee	280		f	4	3.04	16.42	-26.30	-26.61
DIL100311001	10/3/11	angled	Kokanee	250	152		6	4.05	15.31	-27.41	-26.72
DIL100311008	10/3/11	angled	Kokanee	300	239		6	3.88	15.51	-27.72	-27.20
DIL052112001	5/21/12	angled	Kokanee	221	88		7	4.37	15.08	-28.48	-27.47
DIL081411001	8/14/11	angled	Kokanee	230	116		8	3.82	15.87	-27.15	-26.68
DIL092911003	9/29/11	angled	Kokanee	235	117		8	4.02	14.45	-27.40	-26.74
DIL091611001	9/16/11	angled	Kokanee	270	152		8	3.49	16.74	-26.74	-26.60
DIL092911001	9/29/11	angled	Kokanee	260	179		8	3.35	15.19	-26.70	-26.71
DIL092911005	9/29/11	angled	Kokanee	265	185		8	3.87	14.02	-27.77	-27.26
DIL093011001	9/30/11	angled	Kokanee	274	185		8	3.71	15.67	-27.48	-27.13
DIL091711005	9/17/11	angled	Kokanee	285	196		8	3.54	15.80	-26.94	-26.76
DIL093011006	9/30/11	angled	Kokanee	285	200		8	4.04	16.63	-27.41	-26.74
DIL092911004	9/29/11	angled	Kokanee	280	208		8	3.60	15.74	-27.13	-26.89
DIL093011003	9/30/11	angled	Kokanee	291	249		8	3.50	14.87	-26.92	-26.78
DIL081611002	8/16/11	angled	Kokanee	260	372		8	3.58	14.98	-26.39	-26.17
DIL091711001	9/17/11	angled	Kokanee	275			8	3.82	15.09	-27.58	-27.11
DIL080310006	8/3/10	gill net	Kokanee	254	123	m	11	5.61	16.34	-29.05	-26.82
DIL071012002	7/10/12	angled	Kokanee	185	51	m	12	3.30	15.09	-25.50	-25.55

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL091412035	9/14/12	gill net	Kokanee	184	56	f	13	3.80	14.58	-24.69	-24.25
DIL082212030	8/22/12	gill net	Kokanee	238	98	f	13	5.99	17.62	-30.00	-27.40
DIL091412019	9/14/12	gill net	Kokanee	245	114	f	13	3.41	16.45	-26.10	-26.04
DIL082112008	8/21/12	gill net	Kokanee	270	170	f	13	3.91	17.01	-27.60	-27.05
DIL082212010	8/22/12	gill net	Kokanee	301	263	f	13	3.82	16.60	-27.53	-27.06
DIL091412003	9/14/12	gill net	Kokanee	329	311	f	13	3.98	15.90	-27.32	-26.70
DIL082212026	8/22/12	gill net	Kokanee	339	312	f	13	4.01	15.90	-27.66	-27.01
DIL091412005	9/14/12	gill net	Kokanee	355	384	f	13	3.59	16.29	-26.22	-25.99
DIL082212015	8/22/12	gill net	Kokanee	135		f	13	3.34	17.42	-26.00	-26.02
DIL091412027	9/14/12	gill net	Kokanee	249	121	m	13	5.65	15.10	-28.46	-26.18
DIL082212024	8/22/12	gill net	Kokanee	260	132	m	13	3.49	15.87	-26.57	-26.44
DIL082212022	8/22/12	gill net	Kokanee	265	147	m	13	4.11	15.38	-27.41	-26.65
DIL061413011	6/14/13	gill net	Kokanee	265	155	m	13	6.69	16.14	-29.13	-29.13
DIL082112010	8/21/12	gill net	Kokanee	270	169	m	13	3.79	16.89	-27.40	-26.97
DIL091412031	9/14/12	gill net	Kokanee	268	187	m	13	4.35	17.27	-27.61	-26.62
DIL091412028	9/14/12	gill net	Kokanee	280	208	m	13	4.00	16.08	-27.37	-26.73
DIL082212009	8/22/12	gill net	Kokanee	306	236	m	13	4.82	16.02	-28.67	-27.21
DIL082212003	8/22/12	gill net	Kokanee	309	257	m	13	5.05	16.00	-28.87	-27.19
DIL091412023	9/14/12	gill net	Kokanee	330	285	m	13	3.91	16.52	-27.43	-26.87
DIL091412001	9/14/12	gill net	Kokanee	215	301	m	13	6.32	16.93	-29.53	-26.60
DIL091412036	9/14/12	gill net	Kokanee	171	47		13	5.08	14.77	-25.78	-24.07
DIL091412039	9/14/12	gill net	Kokanee	255	142		13	3.82	15.43	-26.26	-25.80
DIL091412020	9/14/12	gill net	Kokanee	295	215		13	3.32	15.36	-25.63	-25.66
DIL082212016	8/22/12	gill net	Kokanee	131			13	3.40	17.40	-26.20	-26.15
DIL061413001	6/14/13	gill net	Kokanee	130			13	3.19	18.81	-26.16	-26.16
DIL070911002	7/9/11	angled	Kokanee	235	110		13	4.79	15.14	-27.77	-26.35
DIL070311015	7/3/11	angled	Kokanee	265	146		13	3.95	15.42	-27.83	-27.24
DIL070311014	7/3/11	angled	Kokanee	265	173		13	3.31	9.08	-20.57	-20.61
DIL070311028	7/3/11	angled	Kokanee	280	175		13	4.80	16.36	-27.84	-26.40

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL080310001	8/3/10	gill net	Kokanee	250	128	m	15	3.49	15.45	-26.49	-26.35
DIL080310003	8/3/10	gill net	Kokanee	192	56		15	4.17	15.31	-28.14	-27.33
DIL080510014B	8/5/10	angled	Kokanee	229		f		4.13	15.71	-27.78	-27.01
DIL062310521	6/23/10	gill net	Kokanee	200	54	f		3.39	16.22	-25.92	-25.88
DIL062310505	6/23/10	gill net	Kokanee	200	59	f		3.52	15.51	-25.54	-25.38
DIL062310527	6/23/10	gill net	Kokanee	219	71	f		4.08	15.76	-27.79	-27.07
DIL060810518	6/8/10	gill net	Kokanee	247	114	f		8.74	16.58	-30.81	-25.48
DIL080510012B	8/5/10	angled	Kokanee	232		m		3.59	15.96	-26.60	-26.36
DIL080510013B	8/5/10	angled	Kokanee	216		m		4.69	15.27	-26.85	-25.53
DIL080510015B	8/5/10	angled	Kokanee	227		m		3.48	15.83	-27.81	-27.68
DIL080510016B	8/5/10	angled	Kokanee	245		m		4.66	16.08	-27.21	-25.92
DIL080510017B	8/5/10	angled	Kokanee	241		m		3.65	15.34	-28.11	-27.81
DIL062310517	6/23/10	gill net	Kokanee	192	50	m		3.52	16.68	-26.45	-26.28
DIL062310502	6/23/10	gill net	Kokanee	195	56	m		3.67	15.49	-28.17	-27.85
DIL062310519	6/23/10	gill net	Kokanee	265	145	m		7.17	16.29	-30.43	-26.65
DIL080911004	8/9/11	angled	Kokanee	203	60			3.70	15.47	-26.86	-26.52
DIL071711002	7/17/11	angled	Kokanee	260	120			3.84	15.47	-27.12	-26.64
DIL071611001	7/16/11	angled	Kokanee	250	124			4.36	16.97	-28.15	-27.16
DIL080511001	8/5/11	angled	Kokanee	255	131			5.61	15.80	-28.81	-26.58
DIL073011006	7/30/11	angled	Kokanee	250	134			3.67	16.96	-27.20	-26.89
DIL073011004	7/30/11	angled	Kokanee	260	144			5.25	7.18	-28.91	-27.04
DIL073011003	7/30/11	angled	Kokanee	260	148			4.24	16.95	-27.81	-26.93
DIL073011005	7/30/11	angled	Kokanee	270	156			4.22	17.07	-28.24	-27.39
DIL012113003E	1/21/13	angled	Kokanee egg				4	4.45	15.42	-26.61	-25.52
DIL052312036	5/23/12	gill net	Longnose Sucker	274	205	m	2	5.26	15.66	-20.96	-19.07
DIL080410123	8/4/10	gill net	Longnose Sucker	302	302	m	4	3.72	14.71	-19.50	-19.14
DIL071712012	7/17/12	gill net	Brown Trout	195	58	f	2	3.19	15.03	-26.28	-26.44

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL071112033	7/11/12	gill net	Brown Trout	238	120	f	2	3.28	15.29	-26.18	-26.26
DIL071112012	7/11/12	gill net	Brown Trout	315	265	f	2	3.53	16.04	-26.59	-26.42
DIL070312021	7/3/12	gill net	Brown Trout	345	335	f	2	3.25	16.45	-22.74	-22.84
DIL071013018	7/10/13	gill net	Brown Trout	344	353	f	2	3.10	16.41	-23.66	-23.66
DIL071112019	7/11/12	gill net	Brown Trout	365	415	f	2	3.64	17.61	-27.19	-26.90
DIL070312018	7/3/12	gill net	Brown Trout	431	431	f	2	3.45	18.61	-25.05	-24.95
DIL070312003	7/3/12	gill net	Brown Trout	361	464	f	2	3.08	16.89	-26.07	-26.34
DIL071112014	7/11/12	gill net	Brown Trout	396	582	f	2	3.41	15.65	-22.52	-22.47
DIL080911008	8/9/11	gill net	Brown Trout	435	647	f	2	3.39	16.69	-26.34	-26.31
DIL070313004	7/3/13	gill net	Brown Trout	441	808	f	2	3.32	16.64	-21.61	-21.61
DIL071112018	7/11/12	gill net	Brown Trout	332	334	m	2	3.31	16.83	-22.37	-22.41
DIL071112007	7/11/12	gill net	Brown Trout	381	520	m	2	3.41	16.78	-21.77	-21.71
DIL071712019	7/17/12	gill net	Brown Trout	391	557	m	2	3.62	13.78	-23.58	-23.32
DIL061213019	6/12/13	gill net	Brown Trout	405	644	m	2	4.79	14.34	-20.64	-20.64
DIL071112032	7/11/12	gill net	Brown Trout	403	655	m	2	4.20	17.34	-26.38	-25.54
DIL071112003	7/11/12	gill net	Brown Trout	396	692	m	2	3.44	17.84	-23.12	-23.03
DIL071113018	7/11/13	gill net	Brown Trout	478	965	m	2	3.05	17.21	-22.39	-22.39
DIL071013015	7/10/13	gill net	Brown Trout	598	1759	m	2	3.00	17.18	-23.76	-23.76
DIL060912003	6/9/12	angled	Brown Trout	330	375		2	3.16	14.17	-21.88	-22.08
DIL061912002	6/19/12	angled	Brown Trout	405	805		2	4.97	13.27	-21.81	-20.20
DIL052312006	5/23/12	gill net	Brown Trout	295	225		2	3.56	15.13	-26.32	-26.12
DIL070913060	7/9/13	gill net	Brown Trout	454	890		2	3.38	16.80	-22.27	-22.27
DIL071013004	7/10/13	gill net	Brown Trout	471	891		2	3.45	15.59	-22.34	-22.34
DIL061213003	6/12/13	gill net	Brown Trout	185	54		2	4.64	17.21	-25.05	-25.05
DIL070711001	7/7/11	angled	Brown Trout	290	199		1	3.37	16.60	-24.46	-24.44
DIL070611001	7/6/11	angled	Brown Trout	290	241		1	3.54	9.69	-21.30	-21.12
DIL070911007	7/9/11	angled	Brown Trout	330	294		1	3.19	16.08	-24.71	-24.87
DIL070611005	7/6/11	angled	Brown Trout	315	340		1	3.36	15.34	-25.57	-25.57
DIL070911004	7/9/11	angled	Brown Trout	355	374		1	3.40	17.31	-26.65	-26.61

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL080410119	8/10/10	gill net	Brown Trout	414	614	f	3	3.28	18.05	-24.67	-24.74
DIL080410106	8/9/10	gill net	Brown Trout	495	1095	f	3	3.52	17.65	-22.95	-22.79
DIL080410091	8/8/10	gill net	Brown Trout	477	1415	f	3	4.82	16.24	-25.78	-24.33
DIL080410068	8/7/10	gill net	Brown Trout	428	564	m	3	3.03	15.31	-24.11	-24.43
DIL080410048	8/6/10	gill net	Brown Trout	560	1825	m	3	4.11	16.18	-21.00	-20.25
DIL062012035	6/20/12	gill net	Brown Trout	270	182	f	4	3.11	14.91	-24.53	-24.78
DIL062012117	6/20/12	gill net	Brown Trout	325	354	f	4	3.32	15.82	-22.91	-22.94
DIL062012115	6/20/12	gill net	Brown Trout	335	390	f	4	3.09	18.26	-23.81	-24.07
DIL062012129	6/20/12	gill net	Brown Trout	365	492	f	4	3.58	15.42	-23.96	-23.74
DIL062012042	6/20/12	gill net	Brown Trout	384	615	f	4	3.91	14.96	-24.14	-23.59
DIL062012109	6/20/12	gill net	Brown Trout	231	108	m	4	3.00	11.29	-24.12	-24.47
DIL062012108	6/20/12	gill net	Brown Trout	365	385	m	4	3.06	17.58	-24.77	-25.05
DIL062012038	6/20/12	gill net	Brown Trout	446	1019	m	4	5.77	13.56	-22.28	-19.89
DIL060112002	6/1/12	angled	Brown Trout	310	250		4	3.15	14.94	-24.80	-25.00
DIL060112003	6/1/12	angled	Brown Trout	385	528		4	3.26	16.73	-22.40	-22.49
DIL060112004	6/1/12	angled	Brown Trout	410	696		4	4.81	13.55	-21.43	-19.98
DIL062012039	6/20/12	gill net	Brown Trout	375	582		4	3.69	17.04	-27.83	-27.50
DIL062012142	6/20/12	gill net	Brown Trout	420	871		4	3.74	15.50	-23.69	-23.31
DIL061912007	6/19/12	angled	Brown Trout	340	235		5	3.11	16.35	-23.30	-23.54
DIL061912006	6/19/12	angled	Brown Trout	358	435		5	3.33	16.08	-22.82	-22.84
DIL_FORD_LOC	May 2013	angled	Brown Trout	737	4309		5	4.23	18.44	-24.37	-24.37
DIL080410001	8/4/10	gill net	Brown Trout	444	551	f	6	3.15	16.10	-21.21	-21.42
DIL080410002	8/5/10	gill net	Brown Trout	370	404	m	6	3.25	16.11	-25.06	-25.16
DIL052112002	5/21/12	gill net	Brown Trout	209	93	f	7	3.21	14.40	-21.31	-21.45
DIL092911002	9/29/11	angled	Brown Trout	370	366		8	3.16	16.24	-24.59	-24.78
DIL061812010	6/18/12	angled	Brown Trout	215	78		8	3.16	15.51	-21.74	-21.93
DIL080310011	8/3/10	gill net	Brown Trout	318	258	f	11	3.43	15.02	-21.70	-21.62
DIL080310021	8/3/10	gill net	Brown Trout	330	314	f	11	3.44	17.25	-25.01	-24.93

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL080310014	8/3/10	gill net	Brown Trout	348	351	f	11	3.67	17.62	-26.83	-26.52
DIL080310010	8/3/10	gill net	Brown Trout	302	231	m	11	3.19	17.02	-26.14	-26.30
DIL080310015	8/3/10	gill net	Brown Trout	356	313	m	11	3.47	16.13	-24.56	-24.45
DIL080310013	8/3/10	gill net	Brown Trout	360	341	m	11	3.23	16.02	-25.74	-25.86
DIL080310022	8/3/10	gill net	Brown Trout	347	376	m	11	3.22	16.86	-25.82	-25.96
DIL080310009	8/3/10	gill net	Brown Trout	350	383	m	11	3.32	15.84	-22.99	-23.02
DIL080310007	8/3/10	gill net	Brown Trout	346	390	m	11	3.17	15.95	-24.80	-24.98
DIL080310012	8/3/10	gill net	Brown Trout	377	446	m	11	3.16	14.42	-23.94	-24.13
DIL052212006	5/22/12	angled	Brown Trout	365	456	f	12	3.50	16.76	-21.96	-21.81
DIL052212016	5/22/12	angled	Brown Trout	395	494	f	12	3.45	16.70	-19.95	-19.86
DIL052312049	5/23/12	gill net	Brown Trout	175	41	f	12	3.17	14.24	-24.77	-24.95
DIL052312052	5/23/12	gill net	Brown Trout	184	89	f	12	3.24	12.17	-25.09	-25.20
DIL052312050	5/23/12	gill net	Brown Trout	355	443	f	12	3.81	15.57	-23.91	-23.46
DIL052312037	5/23/12	gill net	Brown Trout	374	443	m	12	3.37	16.09	-21.19	-21.18
DIL052312039	5/23/12	gill net	Brown Trout	400	695	m	12	3.62	17.52	-24.20	-23.93
DIL052312003	5/23/12	angled	Brown Trout	130	17		12	3.44	11.08	-31.80	-31.72
DIL053112002	5/31/12	angled	Brown Trout	315	410		12	3.52	15.99	-23.01	-22.84
DIL060212001	6/2/12	angled	Brown Trout	375	602		12	3.63	15.40	-22.62	-22.35
DIL061912003	6/19/12	angled	Brown Trout	425	712		12	3.82	13.86	-21.28	-20.82
DIL053112001	5/31/12	angled	Brown Trout	425	734		12	3.52	15.88	-22.83	-22.67
DIL061313025	6/13/13	angled	Brown Trout	435	760		12	4.80	15.77	-22.16	-22.16
DIL061313029	6/13/13	angled	Brown Trout	450	818		12	3.53	14.08	-19.86	-19.86
DIL061313030	6/13/13	angled	Brown Trout	430	840		12	4.84	14.80	-20.86	-20.86
DIL061313031	6/13/13	angled	Brown Trout	445	880		12	3.69	16.58	-21.06	-21.06
DIL061313024	6/13/13	angled	Brown Trout	478	1130		12	3.33	14.99	-19.99	-19.99
DIL061213037	6/12/13	angled	Brown Trout	494	1154		12	3.43	16.97	-23.46	-23.46
DIL061213033	6/12/13	angled	Brown Trout	505	1388		12	3.96	16.98	-24.31	-24.31
DIL061213035	6/12/13	angled	Brown Trout	452			12	3.62	14.37	-19.74	-19.74
DIL052312054	5/23/12	gill net	Brown Trout	173	46		12	3.15	13.43	-24.07	-24.27

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL052312053	5/23/12	gill net	Brown Trout	254	147		12	3.20	11.31	-23.83	-23.98
DIL052312064	5/23/12	gill net	Brown Trout	320	258		12	3.13	12.79	-23.74	-23.96
DIL062012002	6/20/12	gill net	Brown Trout	282	181	f	13	3.07	15.22	-25.20	-25.48
DIL082212027	8/22/12	gill net	Brown Trout	288	202	f	13	3.36	16.90	-25.67	-25.67
DIL082112003	8/21/12	gill net	Brown Trout	345	342	f	13	3.18	16.92	-26.30	-26.47
DIL082212031	8/22/12	gill net	Brown Trout	376	386	f	13	3.19	16.18	-25.17	-25.33
DIL091412014	9/14/12	gill net	Brown Trout	354	393	f	13	3.18	16.44	-23.15	-23.32
DIL082212018	8/22/12	gill net	Brown Trout	384	458	f	13	3.15	15.94	-24.16	-24.36
DIL061413016	6/14/13	gill net	Brown Trout	417	637	f	13	3.46	14.99	-20.12	-20.12
DIL091412007	9/14/12	gill net	Brown Trout	456	813	f	13	3.39	16.07	-23.44	-23.40
DIL082212006	8/22/12	gill net	Brown Trout	451	965	f	13	3.91	14.91	-21.57	-21.02
DIL061413013	6/14/13	gill net	Brown Trout	479	1212	f	13	3.40	16.99	-24.40	-24.40
DIL091412037	9/14/12	gill net	Brown Trout	283	193	m	13	3.19	14.02	-26.33	-26.50
DIL082212007	8/22/12	gill net	Brown Trout	405	539	m	13	3.29	15.14	-25.74	-25.80
DIL061413018	6/14/13	gill net	Brown Trout	418	645	m	13	7.01	16.63	-23.71	-23.71
DIL070313016	7/3/13	gill net	Brown Trout	437	760	m	13	4.10	16.83	-23.98	-23.98
DIL082212017	8/22/12	gill net	Brown Trout	426	854	m	13	3.42	18.11	-24.18	-24.11
DIL091412022	9/14/12	gill net	Brown Trout	471	1094	m	13	3.44	16.52	-24.34	-24.25
DIL061413014	6/14/13	gill net	Brown Trout	540	1852	m	13	3.10	14.87	-18.25	-18.25
DIL061213025	6/12/13	gill net	Brown Trout	323	262		13	3.27	16.93	-25.03	-25.03
DIL091412040	9/14/12	gill net	Brown Trout	330	290		13	3.10	13.98	-23.09	-23.34
DIL091412042	9/14/12	gill net	Brown Trout	370	446		13	3.19	16.35	-24.56	-24.73
DIL091412047	9/14/12	gill net	Brown Trout	401	623		13	3.40	16.00	-23.67	-23.62
DIL070911001	7/9/11	angled	Brown Trout	300	247		13	3.21	15.15	-24.70	-24.84
DIL053110001	5/31/11	angled	Brown Trout	360	338		13	3.25	15.35	-24.47	-24.57
DIL070311009	7/3/11	angled	Brown Trout	370	422		13	3.21	15.75	-23.17	-23.31
DIL060511006	6/5/11	angled	Brown Trout	390	442		13	3.56	15.81	-25.44	-25.23
DIL060411001	6/4/11	angled	Brown Trout	360	448		13	3.18	14.81	-22.00	-22.18
DIL060511007	6/5/11	angled	Brown Trout	365	459		13	3.16	10.76	-20.46	-20.65

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL060511001	6/5/11	angled	Brown Trout	375	487		13	3.64	15.88	-25.54	-25.25
DIL060911002	6/10/11	angled	Brown Trout	390	554		13	3.23	16.49	-20.11	-20.24
DIL080310002	8/3/10	gill net	Brown Trout	350	396	f	15	3.27	17.10	-25.85	-25.94
DIL080310004	8/3/10	gill net	Brown Trout	351	341		15	3.46	15.42	-24.71	-24.61
DIL062310544	6/23/10	gill net	Brown Trout	363	343		15	3.35	16.40	-24.82	-24.83
DIL062310543	6/23/10	gill net	Brown Trout	353	359		15	3.27	16.10	-25.58	-25.66
DIL080911002	8/9/11	angled	Brown Trout	361	330	f		3.30	17.84	-26.24	-26.29
DIL062411002	6/24/11	angled	Brown Trout	270		f		3.27	14.82	-22.76	-22.84
DIL062310504	6/23/10	gill net	Brown Trout	183	50	f		3.35	14.49	-22.23	-22.23
DIL062310523	6/23/10	gill net	Brown Trout	268	157	f		3.43	13.44	-24.22	-24.15
DIL062310533	6/23/10	gill net	Brown Trout	270	172	f		3.44	14.93	-25.03	-24.95
DIL060710019	6/7/10	gill net	Brown Trout	289	198	f		3.38	13.21	-23.66	-23.63
DIL062310537	6/23/10	gill net	Brown Trout	298	207	f		3.23	16.15	-23.57	-23.69
DIL062310529	6/23/10	gill net	Brown Trout	322	258	f		3.44	15.66	-25.18	-25.10
DIL062310511	6/23/10	gill net	Brown Trout	318	272	f		3.25	16.11	-24.81	-24.91
DIL060710021	6/7/10	gill net	Brown Trout	329	310	f		3.53	15.81	-24.44	-24.26
DIL060810542	6/8/10	gill net	Brown Trout	337	319	f		3.47	15.77	-23.91	-23.80
DIL062310514	6/23/10	gill net	Brown Trout	373	339	f		3.30	18.23	-23.45	-23.50
DIL060710015	6/7/10	gill net	Brown Trout	363	353	f		3.54	15.69	-25.30	-25.12
DIL060710017	6/7/10	gill net	Brown Trout	410	359	f		3.20	18.05	-23.66	-23.82
DIL062310541	6/23/10	gill net	Brown Trout	389	366	f		3.30	17.64	-25.65	-25.70
DIL062310531	6/23/10	gill net	Brown Trout	388	369	f		3.32	15.70	-22.19	-22.22
DIL062310539	6/23/10	gill net	Brown Trout	356	377	f		3.37	18.52	-22.31	-22.30
DIL060710023	6/7/10	gill net	Brown Trout	406	399	f		3.32	18.57	-23.70	-23.73
DIL060810545	6/8/10	gill net	Brown Trout	380	446	f		3.38	18.06	-24.20	-24.18
DIL060810509	6/8/10	gill net	Brown Trout	338	458	f		3.43	16.80	-25.72	-25.64
DIL062310528	6/23/10	gill net	Brown Trout	466	928	f		3.52	17.93	-25.25	-25.09
DIL060810508	6/8/10	gill net	Brown Trout	555	1716	f		3.84	17.30	-23.59	-23.11
DIL062310503	6/23/10	gill net	Brown Trout	204	65	m		3.23	11.54	-24.05	-24.18

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
DIL062310525	6/23/10	gill net	Brown Trout	254	132	m		3.29	13.10	-20.79	-20.85
DIL060710022	6/7/10	gill net	Brown Trout	301	223	m		3.33	16.22	-26.64	-26.67
DIL060810538	6/8/10	gill net	Brown Trout	306	232	m		3.34	13.08	-22.99	-23.00
DIL062310501	6/23/10	gill net	Brown Trout	329	300	m		3.19	15.48	-24.87	-25.04
DIL062310512	6/23/10	gill net	Brown Trout	324	302	m		3.30	16.24	-25.47	-25.53
DIL062310536	6/23/10	gill net	Brown Trout	346	332	m		3.37	17.20	-25.98	-25.96
DIL062310534	6/23/10	gill net	Brown Trout	357	388	m		3.15	14.95	-25.20	-25.40
DIL060710018	6/7/10	gill net	Brown Trout	387	482	m		3.46	15.03	-25.18	-25.07
DIL062310535	6/23/10	gill net	Brown Trout	389	520	m		3.37	18.76	-23.55	-23.53
DIL062310530	6/23/10	gill net	Brown Trout	415	637	m		3.43	18.09	-25.62	-25.54
DIL060710016	6/7/10	gill net	Brown Trout	614	2045	m		3.40	17.03	-24.01	-23.97
DIL080911001	8/9/11	angled	Brown Trout	400	530			3.26	16.91	-25.80	-25.89
DIL071211002	7/12/11	angled	Brown Trout	350	303			3.23	17.70	-24.07	-24.20
DIL071511001	7/15/11	angled	Brown Trout	355	400			3.34	16.20	-25.37	-25.38
DIL062311001	6/23/11	angled	Brown Trout	410	530			3.42	15.26	-20.36	-20.30
DIL060710020	6/7/10	gill net	Brown Trout	262	156			3.37	16.46	-25.12	-25.10
DIL052812004	5/28/12	gill net	Brown Trout	305	269			3.15	17.09	-23.05	-23.25
DIL060710002	6/7/10	gill net	Brown Trout	311	283			3.45	16.30	-25.52	-25.42
DIL052612001	5/26/12	gill net	Brown Trout	315	283			3.14	17.59	-24.36	-24.58
DIL052412002	5/24/12	gill net	Brown Trout	310	316			3.65	15.36	-23.52	-23.23
DIL060710014	6/7/10	gill net	Brown Trout	372	430			3.32	17.39	-23.83	-23.86
DIL052612002	5/26/12	gill net	Brown Trout	365	442			3.34	16.66	-22.75	-22.76
DIL060710003	6/7/10	gill net	Brown Trout	378	462			3.44	16.27	-25.37	-25.28
DIL052412005	5/24/12	gill net	Brown Trout	380	530			3.12	15.95	-22.35	-22.58
DIL052412003	5/24/12	gill net	Brown Trout	373	553			3.27	16.28	-24.43	-24.52
DIL052612003	5/26/12	gill net	Brown Trout	390	585			3.27	15.41	-21.95	-22.04
DIL070611001M	7/6/11	1 m net	*Mysis*					6.48	15.94	-31.47	-28.38
DIL070611003M	7/6/11	1 m	*Mysis*					4.74	15.12	-30.08	-28.71

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
		net									
DIL070811002M	7/8/11	1 m net	*Mysis*					4.93	13.61	-29.37	-27.81
DIL100311001M	10/3/11	1 m net	*Mysis*					4.86	12.52	-29.07	-27.58
DIL052112001M	5/21/12	1 m net	*Mysis*					4.46	14.25	-29.35	-28.25
DIL052112002M	5/21/12	1 m net	*Mysis*					4.51	14.49	-28.67	-27.53
DIL061812001M	6/18/12	1 m net	*Mysis*					3.90	14.68	-29.62	-29.08
DIL061812002M	6/18/12	1 m net	*Mysis*					3.96	12.93	-28.18	-27.58
DIL071712004M	7/17/12	1 m net	*Mysis*					4.08	12.68	-27.80	-27.07
DIL071712005M	7/17/12	1 m net	*Mysis*					4.46	14.16	-29.10	-28.01
DIL082112001M	8/21/12	1 m net	*Mysis*					3.88	13.34	-25.23	-24.71
DIL082112002M	8/21/12	1 m net	*Mysis*					4.37	12.97	-26.27	-25.26
DIL091312001M	9/13/12	1 m net	*Mysis*					5.10	13.51	-27.29	-25.56
DIL091312002M	9/13/12	1 m net	*Mysis*					4.55	13.09	-27.09	-25.90
001 mysis	June 2013	1 m net	*Mysis*					3.47	15.50	-28.20	-28.20
002 mysis	June 2013	1 m net	*Mysis*					3.44	16.01	-28.48	-28.48
003 mysis	June	1 m	*Mysis*					3.43	15.67	-28.03	-28.03

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
	2013	net									
DIL080310011A	8/3/10	angled	Rainbow Trout	284	215	m	1	3.21	11.59	-19.00	-19.14
DIL080310001A	8/3/10	angled	Rainbow Trout	277			1	3.32	9.98	-20.36	-20.40
DIL080310005A	8/3/10	angled	Rainbow Trout	268			1	3.08	11.63	-18.96	-19.23
DIL080310016A	8/3/10	angled	Rainbow Trout	256			1	3.22	13.18	-22.08	-22.21
DIL062912024	6/29/12	gill net	Rainbow Trout	350	390	m	2	3.10	10.43	-22.28	-22.53
DIL070611004	7/6/11	angled	Rainbow Trout	270	196		1	3.69	9.85	-21.67	-21.34
DIL070611003	7/6/11	angled	Rainbow Trout	270	204		1	3.35	9.81	-20.52	-20.52
DIL071011001	7/10/11	angled	Rainbow Trout	290	215		1	3.40	9.02	-20.76	-20.71
DIL070911003	7/9/11	angled	Rainbow Trout	285	230		1	3.21	13.71	-20.80	-20.94
DIL070911005	7/9/11	angled	Rainbow Trout	285			1	3.21	12.65	-21.67	-21.81
DIL070911006	7/9/11	angled	Rainbow Trout	270			1	3.28	9.87	-21.00	-21.07
DIL080410072	8/4/10	gill net	Rainbow Trout	294	244	m	3	3.39	10.74	-19.81	-19.77
DIL061912009	6/19/12	angled	Rainbow Trout	329	271		5	3.08	10.08	-21.58	-21.85
DIL062912009	6/29/12	angled	Rainbow Trout	358	543		5	3.21	12.59	-22.39	-22.53
DIL100311002	10/3/11	angled	Rainbow	220	105		6	5.90	4.60	-25.20	-22.68

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Trout								
DIL100211002	10/2/11	angled	Rainbow Trout	240	130		6	3.22	10.33	-20.81	-20.94
DIL100311006	10/3/11	angled	Rainbow Trout	230	143		6	8.28	4.90	-23.07	-18.20
DIL100211004	10/2/11	angled	Rainbow Trout	260	165		6	3.27	10.57	-20.80	-20.88
DIL100311003	10/3/11	angled	Rainbow Trout	260	165		6	3.29	10.22	-20.77	-20.84
DIL100311004	10/3/11	angled	Rainbow Trout	265	168		6	4.26	2.07	-27.08	-26.18
DIL100311005	10/3/11	angled	Rainbow Trout	260	178		6	3.30	9.58	-20.27	-20.32
DIL100211003	10/2/11	angled	Rainbow Trout	255	201		6	3.44	10.22	-20.90	-20.82
DIL100311007	10/3/11	angled	Rainbow Trout	295	250		6	3.28	9.79	-20.34	-20.41
DIL091412062	9/14/12	angled	Rainbow Trout	162	46		8	3.41	13.28	-21.51	-21.46
DIL091412063	9/14/12	angled	Rainbow Trout	181	66		8	3.12	13.53	-15.38	-15.60
DIL091611008	9/16/11	angled	Rainbow Trout	190	76		8	3.29	10.73	-22.55	-22.61
DIL091611007	9/16/11	angled	Rainbow Trout	205	92		8	3.28	9.84	-20.09	-20.16
DIL081511001	8/15/11	angled	Rainbow Trout	240	149		8	3.28	10.59	-20.91	-20.98
DIL093011005	9/30/11	angled	Rainbow Trout	260	155		8	3.24	10.21	-21.33	-21.44
DIL091611002	9/16/11	angled	Rainbow	250	156		8	3.20	10.23	-21.18	-21.33

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Trout								
DIL082011008	8/20/11	angled	Rainbow Trout	245	158		8	3.18	9.75	-20.98	-21.15
DIL081711001	8/17/11	angled	Rainbow Trout	250	165		8	3.35	10.31	-21.02	-21.03
DIL081311004	8/13/11	angled	Rainbow Trout	265	169		8	3.20	10.08	-20.83	-20.98
DIL083011006	8/30/11	angled	Rainbow Trout	270	173		8	4.13	14.53	-27.99	-27.22
DIL081311002	8/13/11	angled	Rainbow Trout	260	175		8	3.17	9.76	-20.24	-20.43
DIL082011001	8/20/11	angled	Rainbow Trout	270	179		8	3.22	9.43	-20.42	-20.55
DIL081311003	8/13/11	angled	Rainbow Trout	270	181		8	3.17	10.49	-20.39	-20.57
DIL061812002	6/18/12	angled	Rainbow Trout	281	181		8	3.09	11.21	-20.50	-20.76
DIL091611003	9/16/11	angled	Rainbow Trout	270	188		8	3.23	10.04	-21.19	-21.32
DIL091611005	9/16/11	angled	Rainbow Trout	260	190		8	3.55	10.33	-21.61	-21.41
DIL081911001	8/19/11	angled	Rainbow Trout	280	205		8	3.23	9.82	-20.89	-21.02
DIL093011004	9/30/11	angled	Rainbow Trout	270	207		8	3.27	10.95	-21.62	-21.70
DIL082011003	8/20/11	angled	Rainbow Trout	280	209		8	3.25	9.45	-21.22	-21.32
DIL061812005	6/18/12	angled	Rainbow Trout	290	211		8	3.06	12.45	-22.24	-22.53
DIL082011004	8/20/11	angled	Rainbow	280	216		8	3.17	9.55	-20.71	-20.89

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Trout								
DIL091611004	9/16/11	angled	Rainbow Trout	295	221		8	3.21	10.18	-21.03	-21.17
DIL091611009	9/16/11	angled	Rainbow Trout	305	238		8	3.28	10.18	-21.01	-21.08
DIL082011007	8/20/11	angled	Rainbow Trout	300	240		8	3.30	10.19	-20.94	-20.99
DIL081511002	8/15/11	angled	Rainbow Trout	300	262		8	3.23	9.77	-20.81	-20.94
DIL082011005	8/20/11	angled	Rainbow Trout	320	263		8	3.33	9.94	-20.92	-20.95
DIL081311001	8/13/11	angled	Rainbow Trout	350	405		8	3.30	13.07	-22.59	-22.64
DIL081611001	8/16/11	angled	Rainbow Trout	320	628		8	3.28	12.47	-19.60	-19.67
DIL091611010	9/16/11	angled	Rainbow Trout	250			8	3.34	9.75	-20.07	-20.09
DIL052212005	5/22/12	angled	Rainbow Trout	296	280		12	3.57	9.92	-20.50	-20.28
DIL052212012	5/22/12	angled	Rainbow Trout	383	501		12	3.19	10.91	-23.42	-23.58
DIL070313012	7/3/13	gill net	Rainbow Trout	350	450	f	13	3.04	13.77	-22.11	-22.11
DIL070511004	7/5/11	angled	Rainbow Trout	235	132		13	3.49	9.31	-20.41	-20.28
DIL070311004	7/3/11	angled	Rainbow Trout	245	137		13	3.43	9.85	-21.09	-21.01
DIL061111005	6/15/11	angled	Rainbow Trout	255	146		13	3.51	9.43	-20.62	-20.47
DIL070311003	7/3/11	angled	Rainbow	250	148		13	3.55	9.13	-20.94	-20.75

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Trout								
DIL070311005	7/3/11	angled	Rainbow Trout	250	153		13	3.68	9.30	-21.02	-20.69
DIL061111003	6/13/11	angled	Rainbow Trout	260	165		13	3.60	9.59	-20.57	-20.33
DIL060511010	6/5/11	angled	Rainbow Trout	255	171		13	3.22	11.24	-20.63	-20.75
DIL070511009	7/5/11	angled	Rainbow Trout	260	171		13	3.61	9.25	-20.93	-20.67
DIL070311022	7/3/11	angled	Rainbow Trout	270	177		13	3.55	9.13	-20.75	-20.55
DIL070511006	7/5/11	angled	Rainbow Trout	265	180		13	3.89	9.66	-20.95	-20.42
DIL070311027	7/3/11	angled	Rainbow Trout	260	183		13	3.56	9.18	-20.76	-20.55
DIL070311029	7/3/11	angled	Rainbow Trout	270	183		13	3.71	9.37	-20.72	-20.37
DIL061111001	6/11/11	angled	Rainbow Trout	265	186		13	3.81	9.52	-20.76	-20.31
DIL070311001	7/3/11	angled	Rainbow Trout	275	186		13	3.36	9.24	-20.45	-20.45
DIL070311023	7/3/11	angled	Rainbow Trout	260	191		13	3.57	10.09	-21.00	-20.79
DIL061111004	6/14/11	angled	Rainbow Trout	300	200		13	3.21	11.81	-19.61	-19.75
DIL070311021	7/3/11	angled	Rainbow Trout	275	201		13	3.59	9.38	-21.13	-20.89
DIL070311026	7/3/11	angled	Rainbow Trout	270	207		13	3.72	9.27	-20.89	-20.52
DIL070311008	7/3/11	angled	Rainbow	285	217		13	3.49	9.18	-20.51	-20.38

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Trout								
DIL070311006	7/3/11	angled	Rainbow Trout	280	223		13	3.82	9.41	-20.97	-20.51
DIL070511001	7/5/11	angled	Rainbow Trout	275	224		13	3.82	9.35	-20.70	-20.24
DIL070511002	7/5/11	angled	Rainbow Trout	310	232		13	3.23	12.36	-20.66	-20.78
DIL070311002	7/3/11	angled	Rainbow Trout	315	252		13	3.26	11.57	-20.06	-20.15
DIL060511011	6/5/11	angled	Rainbow Trout	315	255		13	3.52	9.72	-20.43	-20.27
DIL060911003	6/11/11	angled	Rainbow Trout	315	280		13	3.23	11.31	-20.17	-20.29
DIL060910001	6/9/11	angled	Rainbow Trout	280	297		13	3.71	9.25	-20.90	-20.54
DIL060111002	6/1/11	angled	Rainbow Trout	335	298		13	3.20	11.60	-19.62	-19.77
DIL061111002	6/12/11	angled	Rainbow Trout	355	385		13	3.21	11.89	-19.38	-19.52
DIL080510003B	8/5/10	angled	Rainbow Trout	270		f		3.37	10.63	-19.81	-19.80
DIL080510004B	8/5/10	angled	Rainbow Trout	253		f		3.18	11.89	-19.36	-19.53
DIL080510005B	8/5/10	angled	Rainbow Trout	254		f		3.43	11.99	-19.31	-19.24
DIL080510007B	8/5/10	angled	Rainbow Trout	270		f		3.38	10.64	-19.81	-19.79
DIL080510009B	8/5/10	angled	Rainbow Trout	323		f		3.31	11.94	-19.22	-19.27
DIL080510010B	8/5/10	angled	Rainbow	273		f		4.06	12.44	-19.58	-18.87

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Trout								
DIL060810506	6/8/10	gill net	Rainbow Trout	248	117	f		3.27	12.44	-19.50	-19.59
DIL062310520	6/23/10	gill net	Rainbow Trout	253	138	f		3.27	13.70	-20.29	-20.37
DIL062310507	6/23/10	gill net	Rainbow Trout	255	150	f		3.09	13.84	-21.76	-22.02
DIL062310510	6/23/10	gill net	Rainbow Trout	314	272	f		3.49	10.37	-19.89	-19.76
DIL080310100A	8/3/10	angled	Rainbow Trout	293		m		3.23	10.74	-19.77	-19.88
DIL080510001B	8/5/10	angled	Rainbow Trout	279		m		3.10	10.54	-19.65	-19.90
DIL080510002B	8/5/10	angled	Rainbow Trout	274		m		3.12	10.49	-19.87	-20.10
DIL080510006B	8/5/10	angled	Rainbow Trout	265		m		3.13	11.69	-19.41	-19.63
DIL080510008B	8/5/10	angled	Rainbow Trout	279		m		3.17	11.12	-20.08	-20.26
DIL062310513	6/23/10	gill net	Rainbow Trout	268	91	m		3.24	13.25	-19.70	-19.81
DIL062310522	6/23/10	gill net	Rainbow Trout	267	160	m		3.26	13.12	-19.61	-19.70
DIL062310524	6/23/10	gill net	Rainbow Trout	284	172	m		3.22	12.45	-18.58	-18.71
DIL062310526	6/23/10	gill net	Rainbow Trout	279	198	m		3.30	12.78	-19.87	-19.92
DIL062310540	6/23/10	gill net	Rainbow Trout	290	213	m		3.50	10.52	-20.04	-19.90
DIL060810532	6/8/10	gill net	Rainbow	278	215	m		3.44	11.49	-19.11	-19.03

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Trout								
DIL062411001	6/24/11	angled	Rainbow Trout	275				3.44	9.53	-20.69	-20.60
DIL080311001	8/3/11	angled	Rainbow Trout	290	176			7.58	16.55	-30.04	-25.86
DIL080111002	8/1/11	angled	Rainbow Trout	320	229			3.15	11.10	-20.97	-21.18
DIL071711001	7/17/11	angled	Rainbow Trout	330	325			3.17	13.72	-21.89	-22.07
DIL071211001	7/12/11	angled	Rainbow Trout	330	339			3.45	14.36	-21.47	-21.38
DIL080111001	8/1/11	angled	Rainbow Trout	330	393			3.56	13.49	-21.35	-21.14
DIL080410001A	8/4/10	angled	Rainbow Trout	311				3.19	11.25	-19.37	-19.53
DIL080410002A	8/4/10	angled	Rainbow Trout	242				3.11	12.32	-18.98	-19.22
DIL080410004A	8/4/10	angled	Rainbow Trout	271				3.29	10.48	-20.10	-20.16
DIL080410005A	8/4/10	angled	Rainbow Trout	241				3.34	12.43	-19.83	-19.84
DIL080410006A	8/4/10	angled	Rainbow Trout	270				3.31	10.24	-19.87	-19.91
RIF082611001	8/26/11		Rainbow Trout fing.				10	3.74	11.16	-19.45	-19.06
RIF082611002	8/26/11		Rainbow Trout fing.				10	4.11	11.15	-19.71	-18.96
RIF082611003	8/26/11		Rainbow Trout fing.				10	4.56	11.31	-20.19	-19.00
RIF082611004	8/26/11		Rainbow				10	4.41	11.14	-20.08	-19.04

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
RIF082611005	8/26/11		Trout fing. Rainbow Trout fing.				10	4.08	11.19	-19.82	-19.10
RIF082611006	8/26/11		Rainbow Trout fing.				10	4.27	10.98	-19.97	-19.07
DIL080310002A	8/3/10	angled	Cutthroat Trout	267	210	f	1	4.48	11.19	-20.40	-19.29
DIL080310012A	8/3/10	angled	Cutthroat Trout	265	190	m	1	3.62	11.18	-19.53	-19.27
DIL080310004A	8/3/10	angled	Cutthroat Trout	272		m	1	3.51	11.74	-19.64	-19.48
DIL080310010A	8/3/10	angled	Cutthroat Trout	264		m	1	3.58	11.39	-19.43	-19.21
DIL080310007A	8/3/10	angled	Cutthroat Trout	269			1	3.53	11.61	-19.52	-19.35
DIL080310008A	8/3/10	angled	Cutthroat Trout	284			1	3.49	11.05	-19.38	-19.25
DIL080310013A	8/3/10	angled	Cutthroat Trout	275			1	3.54	11.49	-19.38	-19.19
DIL052212015	5/22/12	angled	Cutthroat Trout	365	437		12	3.43	14.47	-19.92	-19.85
DIL060511002	6/5/11	angled	Cutthroat Trout	290	207		13	3.28	12.31	-20.59	-20.67
DIL060511004	6/5/11	angled	Cutthroat Trout	310	233		13	3.16	11.93	-20.19	-20.38
DIL060511003	6/5/11	angled	Cutthroat Trout	300	245		13	3.16	12.12	-19.14	-19.33
DIL060511008	6/5/11	angled	Cutthroat Trout	315	305		13	3.62	9.51	-20.77	-20.51
DIL080410003A	8/4/10	angled	Cutthroat	232				3.24	11.83	-20.07	-20.18

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
BLU072811001	7/28/11	lavage	Trout stream invertebrate				1	5.28	7.86	-29.21	-27.31
BLU072811002	7/28/11	lavage	stream invertebrate				1	4.64	7.07	-28.92	-27.65
BLU072811003	7/28/11	lavage	stream invertebrate				1	5.00	6.53	-29.40	-27.76
BLU072811004	7/28/11	lavage	stream invertebrate				1	7.17	7.02	-31.97	-28.19
BLU072811005	7/28/11	lavage	stream invertebrate				1	5.86	5.53	-29.67	-27.19
BLU072811009	7/28/11	lavage	stream invertebrate				1	5.69	7.09	-28.47	-26.16
TMC072811003	7/28/11	lavage	stream invertebrate				14	7.20	3.91	-27.68	-23.87
TMC072811001	7/28/11	lavage	stream invertebrate				14	7.82	5.21	-26.30	-21.88
TMC072811002	7/28/11	lavage	stream invertebrate				14	5.75	5.82	-27.13	-24.75
TMC072811006	7/28/11	lavage	stream invertebrate				14	5.30	7.42	-24.58	-22.65
TMC072811007	7/28/11	lavage	stream invertebrate				14	10.90	3.76	-26.58	-19.10
TMC072811008	7/28/11	lavage	stream invertebrate				14	8.25	5.54	-29.39	-24.55
TMC072811008	7/28/11	lavage	stream invertebrate				14	7.48	5.05	-28.29	-24.21
DIL080911012	8/9/11	gill net	White Sucker	348	400	f	2	3.28	15.42	-25.13	-25.20
DIL080911011	8/9/11	gill net	White	358	410	f	2	3.27	14.06	-23.50	-23.58

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Correct ed δ13C
			Sucker								
DIL080911013	8/9/11	gill net	White Sucker	369	480	f	2	3.32	14.85	-24.60	-24.64
DIL080911006	8/9/11	gill net	White Sucker	332	362	m	2	3.36	15.16	-25.61	-25.60
DIL080911007	8/9/11	gill net	White Sucker	335	370	m	2	3.77	15.22	-25.17	-24.76
DIL080911009	8/9/11	gill net	White Sucker	370	540	m	2	3.40	15.41	-25.56	-25.51
DIL080911010	8/9/11	gill net	White Sucker	340	370		2	3.36	14.81	-25.32	-25.31
DIL061313018	6/13/13	gill net	White Sucker	170	49		2	3.41	14.96	-19.92	-19.92
DIL061213005	6/12/13	gill net	White Sucker	180	53		2	3.14	15.08	-20.11	-20.11
DIL061213004	6/12/13	gill net	White Sucker	180	54		2	3.19	14.78	-19.82	-19.82
DIL070711003	7/7/11	angled	White Sucker	355	462		1	3.66	13.73	-23.33	-23.03
DIL080410090	8/4/10	gill net	White Sucker	183	66		3	3.42	13.34	-19.23	-19.16
DIL080410089	8/4/10	gill net	White Sucker	243	145		3	3.33	13.44	-19.02	-19.04
DIL080410079	8/4/10	gill net	White Sucker	244	154		3	3.67	14.10	-20.63	-20.32
DIL080410044	8/4/10	gill net	White Sucker	265	202		3	3.77	14.15	-21.16	-20.74
DIL091412060	9/14/12	gill net	White Sucker	315	372		3	3.44	14.82	-21.12	-21.03
DIL091412053	9/14/12	gill net	White	335	383		3	3.41	14.34	-20.64	-20.58

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Sucker								
DIL091412061	9/14/12	gill net	White Sucker	340	404		3	3.44	13.39	-19.26	-19.17
DIL091412055	9/14/12	gill net	White Sucker	340	435		3	3.49	14.29	-17.99	-17.86
DIL091412058	9/14/12	gill net	White Sucker	360	438		3	3.54	14.21	-19.99	-19.80
DIL091412059	9/14/12	gill net	White Sucker	345	444		3	4.22	15.27	-22.24	-21.38
DIL091412052	9/14/12	gill net	White Sucker	370	500		3	3.48	14.14	-17.33	-17.21
DIL091412057	9/14/12	gill net	White Sucker	360	562		3	3.78	13.36	-17.91	-17.48
DIL080410035	8/4/10	gill net	White Sucker	420	753		3	3.44	14.72	-24.78	-24.69
DIL080410005	8/4/10	gill net	White Sucker	281	228		6	3.41	13.90	-21.27	-21.21
DIL080410029	8/4/10	gill net	White Sucker	275	245		6	3.88	13.38	-21.55	-21.03
DIL080410006	8/4/10	gill net	White Sucker	313	313		6	3.20	13.01	-21.07	-21.22
DIL080410003	8/4/10	gill net	White Sucker	285	326		6	3.35	14.03	-23.72	-23.72
DIL080410014	8/4/10	gill net	White Sucker	344	359		6	3.41	14.13	-22.99	-22.93
DIL080410016	8/4/10	gill net	White Sucker	376	448		6	3.28	13.62	-22.28	-22.34
DIL080310019	8/3/10	gill net	White Sucker	402	558	f	11	3.36	15.17	-25.52	-25.51
DIL080310020	8/3/10	gill net	White	304	372	m	11	3.25	15.42	-25.54	-25.64

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Sucker								
DIL080310016	8/3/10	gill net	White Sucker	339	388	m	11	3.72	15.26	-26.80	-26.43
DIL080310017	8/3/10	gill net	White Sucker	380	491	m	11	3.35	15.48	-26.20	-26.21
DIL091412025	9/14/12	gill net	White Sucker	373	554	m	13	3.19	15.56	-25.02	-25.18
DIL091412021	9/14/12	gill net	White Sucker	434	902	m	13	3.39	16.64	-26.65	-26.61
DIL061413022	6/14/13	gill net	White Sucker	165	42		13	3.11	15.03	-20.43	-20.43
DIL061413002	6/14/13	gill net	White Sucker	170	49		13	3.33	15.24	-21.34	-21.34
DIL061413009	6/14/13	gill net	White Sucker	176	57		13	3.23	13.95	-18.46	-18.46
DIL091412034	9/14/12	gill net	White Sucker	340	436		13	3.92	15.85	-24.88	-24.31
DIL091412013	9/14/12	gill net	White Sucker	348	474		13	3.22	14.21	-22.43	-22.57
DIL091412012	9/14/12	gill net	White Sucker	370	550		13	3.71	15.58	-25.86	-25.51
DIL091412011	9/14/12	gill net	White Sucker	365	556		13	3.90	15.28	-24.12	-23.58
DIL091412010	9/14/12	gill net	White Sucker	370	559		13	3.91	15.92	-25.64	-25.09
DIL091412002	9/14/12	gill net	White Sucker	561	1570		13	3.40	15.17	-22.55	-22.50
DIL062411006	6/24/11	gill net	White Sucker	353	380	f		3.28	14.01	-22.44	-22.51
DIL062411007	6/24/11	gill net	White	352	380	f		4.22	16.61	-26.92	-26.07

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Sucker								
DIL062311002	6/23/11	gill net	White Sucker	320	385	f		3.56	15.76	-26.89	-26.68
DIL062411008	6/24/11	gill net	White Sucker	334	390	f		3.27	14.13	-19.86	-19.95
DIL062311003	6/23/11	gill net	White Sucker	346	405	f		3.33	13.97	-20.61	-20.63
DIL062411009	6/24/11	gill net	White Sucker	367	440	f		3.26	14.30	-22.12	-22.21
DIL062411004	6/24/11	gill net	White Sucker	400	770	f		3.30	11.54	-25.31	-25.37
DIL062411005	6/24/11	gill net	White Sucker	450	995	f		4.91	15.32	-27.55	-26.01
DIL062411014	6/24/11	gill net	White Sucker	357		f		3.31	13.71	-21.20	-21.24
DIL062411019	6/24/11	gill net	White Sucker	344		f		3.25	13.75	-18.28	-18.38
DIL062311004	6/23/11	gill net	White Sucker	320	300	m		3.28	14.57	-22.13	-22.20
DIL062411003	6/24/11	gill net	White Sucker	385	685	m		3.64	15.22	-25.69	-25.41
DIL062411010	6/24/11	gill net	White Sucker	322		m		3.57	13.78	-22.15	-21.95
DIL062411011	6/24/11	gill net	White Sucker	328		m		3.33	14.40	-19.65	-19.67
DIL062411012	6/24/11	gill net	White Sucker	362		m		3.28	13.84	-25.62	-25.69
DIL062411013	6/24/11	gill net	White Sucker	351		m		3.39	13.58	-21.90	-21.85
DIL062411015	6/24/11	gill net	White	336		m		3.32	15.38	-24.58	-24.61

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
			Sucker								
DIL062411016	6/24/11	gill net	White Sucker	336		m		3.32	14.19	-21.94	-21.97
DIL062411018	6/24/11	gill net	White Sucker	357		m		3.30	13.31	-21.86	-21.91
DIL060710004	6/7/10	gill net	White Sucker	324				3.36	13.79	-22.49	-22.48
DIL060710005	6/7/10	gill net	White Sucker	313				3.47	14.11	-23.48	-23.36
DIL060710006	6/7/10	gill net	White Sucker	317				3.99	15.56	-26.95	-26.32
DIL060710007	6/7/10	gill net	White Sucker	318				3.36	13.55	-19.92	-19.91
DIL060710008	6/7/10	gill net	White Sucker	328				3.43	14.49	-24.21	-24.14
DIL060710009	6/7/10	gill net	White Sucker	340				3.55	16.07	-25.49	-25.29
DIL060710010	6/7/10	gill net	White Sucker	420				6.12	14.37	-26.67	-23.94
DIL060710011	6/7/10	gill net	White Sucker	333				4.28	15.21	-26.91	-25.99
DIL060710013	6/7/10	gill net	White Sucker	394				3.49	14.46	-24.06	-23.92
DIL081912001	8/19/12	hand net	White Sucker fry				7	4.30	12.67	-20.98	-20.04
DIL081912002	8/19/12	hand net	White Sucker fry				7	4.16	12.97	-20.70	-19.90
DIL081912003	8/19/12	hand net	White Sucker fry				7	3.90	12.65	-20.63	-17.21
DIL081912004	8/19/12	hand	White				7	4.59	13.47	-21.69	-20.47

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
		net	Sucker fry								
DIL071812002z	7/18/12	1/2 m net	Zooplankton				8	46.95	7.90	-24.06	-19.10
DIL080412001z	8/4/12	1/2 m net	Zooplankton				8	5.36	10.94	-24.83	-22.84
DIL080412002z	8/4/12	1/2 m net	Zooplankton				8	5.42	11.63	-25.88	-23.84
DIL081912001z	8/19/12	1/2 m net	Zooplankton				8	5.51	12.33	-25.97	-23.83
DIL081912002z	8/19/12	1/2 m net	Zooplankton				8	5.99	11.93	-25.53	-22.93
DIL082112001z	8/21/12	1/2 m net	Zooplankton				8	5.91	10.38	-27.06	-24.52
DIL091312001z	9/13/12	1/2 m net	Zooplankton				8	6.17	11.04	-28.90	-26.11
DIL100211001z	10/2/11	1/2 m net	Zooplankton				13	4.70	8.59	-29.97	-28.64
DIL100211004z	10/2/11	1/2 m net	Zooplankton				13	5.21	8.56	-29.86	-28.02
DIL100411001	10/4/11	1/2 m net	Zooplankton				13	4.79	9.35	-30.54	-29.11
DIL100411002	10/4/11	1/2 m net	Zooplankton				13	8.56	8.46	-29.96	-24.80
DIL100411003	10/4/11	1/2 m net	Zooplankton				13	5.21	9.76	-30.80	-28.97
DIL100411006	10/4/11	1/2 m net	Zooplankton				13	4.67	9.03	-30.29	-28.98
DIL100411007	10/4/11	1/2 m net	Zooplankton				13	3.81	9.24	-28.44	-27.98
DIL100441005	10/4/11	1/2 m	Zooplankton				13	4.70	9.15	-30.35	-29.02

Sample number	Sample date	Gear	Species	Length (mm)	Weight (g)	Sex	Site	C:N	δ15N	δ13C	Corrected δ13C
		net									
DIL062311001z	6/23/11	1/2 m net	Zooplankton					6.32	9.55	-30.96	-28.02
DIL091412001z	9/14/12	1/2 m net	Zooplankton					7.97	12.36	-26.03	-21.46
DIL091412002z	9/14/12	1/2 m net	Zooplankton					7.11	12.72	-26.47	-22.75

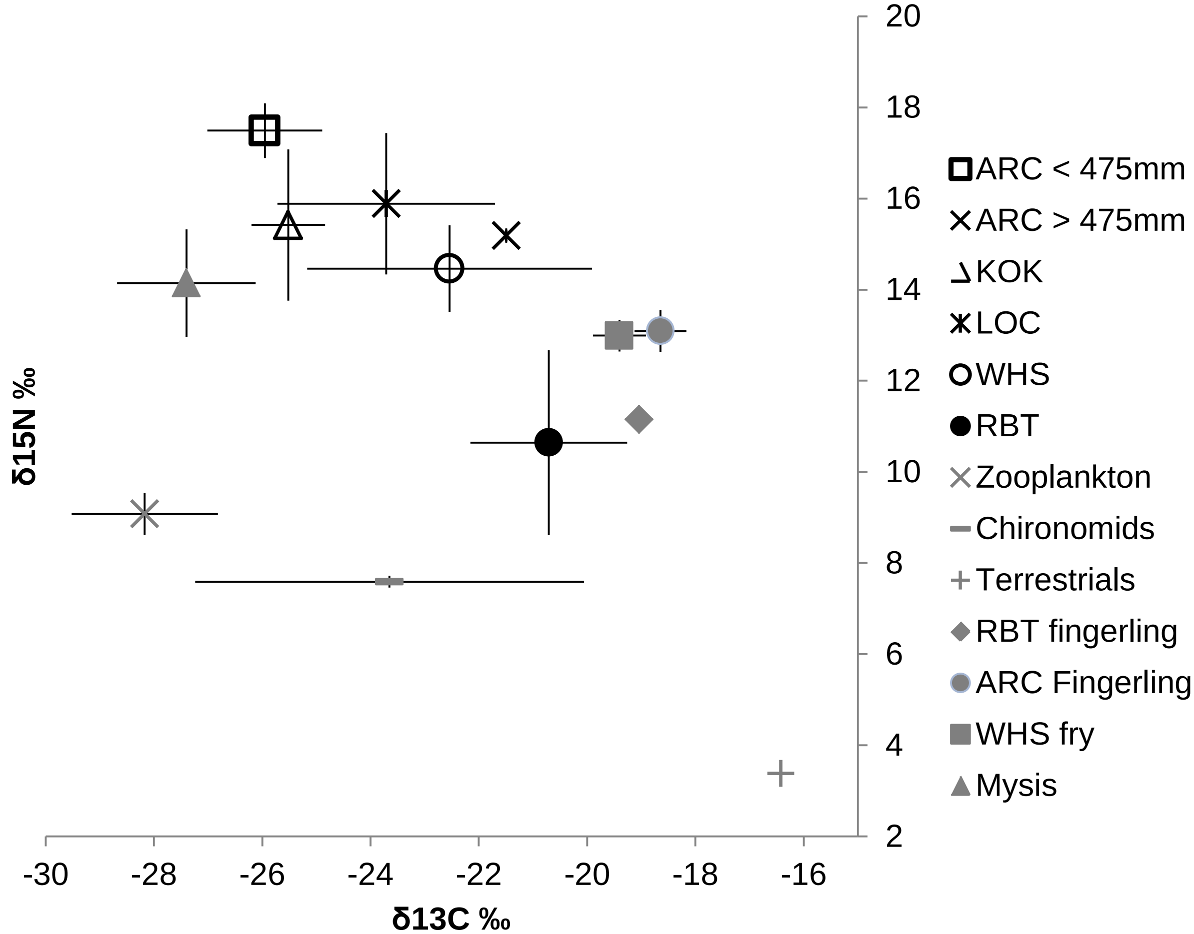

Figure A1. Mean ^{15}N vs ^{13}C signatures for Arctic Char (Arctic Char) < 475mm, Arctic Char > 475mm, Kokanee (Kokanee), Brown Trout (Brown Trout), White Sucker (White Sucker), Rainbow Trout (Rainbow Trout), and potential prey items in Dillon Reservoir. Error bars represent 1 SD. Samples were collected 2010-2013. Rainbow Trout and Arctic Char fingerling were sourced directly from the hatchery prior to stocking. All other prey sources were collected from Dillon Reservoir.

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