Controls on Bacterial Productivity in Arctic Lakes and Streams

by

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View of the Brooks Range from I-8 inlet, 2005.

DEDICATION

In Memory of Bernice Somerville
1919-2007

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ABSTRACT

Controls on Bacterial Productivity in Arctic Lakes and Streams

This dissertation investigates heterotrophic bacterial production in arctic lakes and streams in northern Alaska. Temperature, dissolved organic matter, and inorganic nutrients all control bacterial production, but interactions of these controls with each other and with bacterial community composition is poorly understood. These interactions were examined using lab and field observations and experiments to provide a better understanding of factors influencing bacterial activity in nature.

DNA analysis indicated that shifts in the composition of bacterial communities were driven more by temperature than by differences in dissolved organic matter source. Aquatic bacterial communities incubated at different temperatures had different rates of production, and two distinct optima (12 and 20 °C) were evident after three days. Therefore, predicting the impact of warmer temperature on bacterial productivity is more complex than simple Q_{10} responses, and requires consideration of the interaction with community composition.

Bacterial nutrient limitation and response to storm events (changes in water temperature and nutrient concentrations) were investigated in mesocosm experiments. Nutrient additions increased bacterial production up to seven times greater than the control, while warmer temperatures shortened the bacterial response time to added nutrients. Community composition shifted rapidly (2 days) in response to nutrient addition in all habitats, but exhibited habitat-specific responses to temperature. Although nutrients were more important, temperature and nutrient levels interact to control the onset and magnitude of increased bacterial growth and the corresponding shifts in community composition.

Metacommunity processes of species sorting (e.g., competition) and mass effects (dispersal) were investigated at an 18 ha area lake. Inlet and outlet community composition was most similar (61.5%) after large storm events, indicating the importance of dispersal. However, transplant experiments and DNA analyses indicated that resident lake populations out-compete many bacterial populations in stream water entering the lake. While mass effects may be important during storm events, species sorting appears to be the predominant mechanism controlling community composition and function.

Despite being considered a single functional group, the heterotrophic bacteria examined here exhibit community-specific responses to drivers and shifts in dominant community members that occur on ecologically relevant time scales. This highlights the importance of community composition to productivity.

CHAPTER I

Introduction to controls on aquatic bacterial activity

To understand how ecosystems function it is necessary to determine controls on organismal activity. Specifically, we must investigate how abiotic factors interact with the mix of species that form a community and how this relationship controls activity. Examining these interactions within the context of short or long-term perturbations, such as storm events or climate change, is required to make robust predictions of changes in activity over time. Bacterial activity is particularly important to understand because bacteria are central to ecosystem function and to the cycling of carbon and nutrients. For example, bacteria mediate nutrient mineralization and decompose organic matter in both aquatic and terrestrial habitats. However, much of the focus in prior research has been on bacteria as larger functional groups, or only on single bacterial species (especially related to disease dynamics), and this research has overlooked the potential importance of how bacterial community composition both changes over time and interacts with environmental and ecological drivers to set limits on bacterial activity in nature.

Bacterial communities differ in their optimal temperature (Morita 1975), ability to use carbon substrates (Rublee 1992, Foreman and Covert 2003), and nutrient requirements (Van Wambeke et al. 2009), suggesting that community composition may control overall patterns of bacterial activity across a heterogeneous landscape. Such heterogeneous landscapes vary with respect to the type of vegetation that provides carbon substrates, the density of lake and stream water, and the effects of aperiodic storm events that pulse carbon substrates, nutrients, and bacterial communities from land into the aquatic environment. Although these different potential controls on activity interact, the relative strength of the controls and the interactions in any particular environment are unknown.

In many systems, bacteria were historically thought to be primarily carbon limited (Wright and Hobbie 1966, Hobbie 1980). However, in laboratory assays and empirical studies both temperature and nutrients have been found to be important factors for bacterial production (Obrien et al. 1992, Kirchman and Rich 1997, Vadstein 2000). Organic carbon provides the basic energy source for heterotrophic bacteria, but its biochemical structure can be complex. To break down complex structures bacteria need to produce specific enzymes. At higher temperatures, the rates of reactions increase, which in turn increases the metabolic rate and the activity of bacterial enzymes and allows bacteria to break down more complex substrates (Pomeroy and Wiebe 2001). Additionally, bacteria require inorganic nutrients for both growth and enzyme production. When bacteria use complex carbon structures with low nutrient content, they need to increase the uptake of inorganic nutrients from the environment to sustain microbial activity (Findlay 2003).

I developed a conceptual model (**Fig. 1.1**) to reflect the relationships among various controls on bacterial production. Temperature can modify bacterial response to both dissolved organic matter (DOM) and inorganic nutrients (dashed arrows, **Fig. 1.1**). Streams bring nutrients and carbon subsidies from land into surface waters, and variations in discharge change the supply rate of carbon and nutrients to bacteria in streams and lakes. Stream flow can also transport bacterial communities between habitats, impacting dispersal and community composition (gray shaded oval, **Fig. 1.1**). Water temperature and discharge are not directly linked in the conceptual model because they are often decoupled, particularly during cold storm events. While nutrients and DOM directly impact bacterial production, they are predicted to indirectly affect community composition. Judd et al. (2006) suggested that bacterial community composition responds directly to environmental factors and that shifts in composition need to occur before major differences in bacterial production occur. However, their conclusion is based on community-wide activity over a relatively long time scale (two weeks) as opposed to short time scale metabolic responses of individuals or populations. For example, if dispersal and predation (including viral lysis) are excluded as mechanisms for shifting community composition, the remaining mechanism for such shifts is the differential growth of bacterial populations. This differential growth is the result of competition between bacterial populations in response to environmental factors, and will directly alter community composition and eventual lead to differences in community-wide activity (two-headed arrow, **Fig. 1.1**). Understanding the operation and full extent of this mechanism is only possible by coupling the response in bacterial activity to environmental drivers with changes in community composition on very fine time scales (days).

Throughout this dissertation, experiments were performed on bacterial communities found in the water column because they are a mixture of bacteria from habitat types including soils, streams, and lakes. These bacterioplankton are being dispersed between different habitats and therefore ideal for answering questions concerning species dispersal. Changes in community composition were documented using fingerprinting with denaturant gradient gel electrophoresis (DGGE) of an amplified section of 16s rRNA which is fairly conservative from an evolutionary standpoint. Communities were detected on a presence-absence basis; DGGE detects populations of ~1% or greater abundance. Given that changes in very rare populations are probably below detection, and the fact that the DGGE bands may (rarely) be constituted by two slightly different (~1 base pair) sequences, the shifts in community composition detected by DGGE are considered to be minimal (conservative) estimates of change.

It has been demonstrated that temperature can affect bacterial activity either directly by altering the kinetics of enzymatic reactions or indirectly by favoring populations with different metabolic capabilities (Feller et al. 1997, Russell 2000, D'Amico et al. 2006). In Chapter 2, both direct and indirect mechanisms of temperature control on bacterial activity are examined in laboratory incubations and *in situ* measurements across an arctic lake district upstream of Toolik Lake, Alaska.

Inorganic nutrients can limit bacterial production during conditions of pulsed nutrient supply (Vadstein 2000), low temperatures (Nedwell 1999), and large amounts of complex carbon sources (Hessen et al. 1994). All three conditions occur at my field site, indicating that nutrient limitation may be an important control. Although storm events flush in resources from upstream, cold storms decouple nutrient flushing from temperature increases. Because temperature potentially interacts with other controls on activity such as inorganic nutrient uptake and carbon use, the extent of these interactions is specifically examined in Chapter 3 (nutrient limitation and temperature). Here, field measurements and laboratory experiments were conducted on samples from the inlet and outlet of Toolik Lake and a smaller upstream lake, Lake I-8. The overall metabolic response of bacteria to increasing temperature or nutrients was characterized, in conjunction with measuring the rates at which community composition shifted as well as the feedback of different community structure on community-wide activity.

To understand community-specific responses to the environment, I examined the bacterial community dynamics for Lake I-8. Shifts in bacterial community composition occur predominantly through predation, competition, and dispersal. Bacterial populations differ in their ability to process substrates, and differential growth rates eventually result in a change in dominance of populations within a community. This process of competition for resources within a habitat is referred to as the “species sorting” mechanism of community structure (Van der Gucht et al. 2007). For aquatic bacteria, dispersal occurs predominantly in unidirectional water flow from terrestrial or other upstream habitats into streams and lakes. “Mass effects” (dispersal) structure the community when introduced populations persist not because they are superior competitors but because of high dispersal rates (Lindstrom and Bergstrom 2004, Crump et al. 2007). Chapter 4 examines the balance of species sorting and mass effects and the resulting metacommunity dynamics of aquatic bacteria in the Lake I-8 catchment.

Shifts in community structure also feed back into levels of bacterial activity, making it difficult to determine the ultimate control on bacterial productivity in a natural habitat. Chapter 5 presents a predictive model of activity based on empirical data from the Lake I-8 catchment. Using a Bayesian approach, the predictive model incorporates temperature, nutrients, and carbon as well as site identity and community composition as predictors of bacterial productivity.

Each chapter in this dissertation features a different approach to understanding the controls of environmental conditions on bacterial activity in arctic lakes and streams and highlights the importance of bacterial community composition. While understanding how a single control or factor affects bacteria is an important step to understanding functionality, in the natural environment factors interact in several ways. Storm events can decouple temperature and nutrients as well as bring in new carbon, nutrients, and bacterial communities from upstream. Additionally, bacterial populations each have a different response to environmental factors and compete with other bacterial populations. In this dissertation I show how various controls on bacterial activity interact, which controls are dominant in which situations, and how changes in community composition are both driven by changes in environment on very fast time scales and are integral in setting the levels of community-wide bacterial activity.

Figure

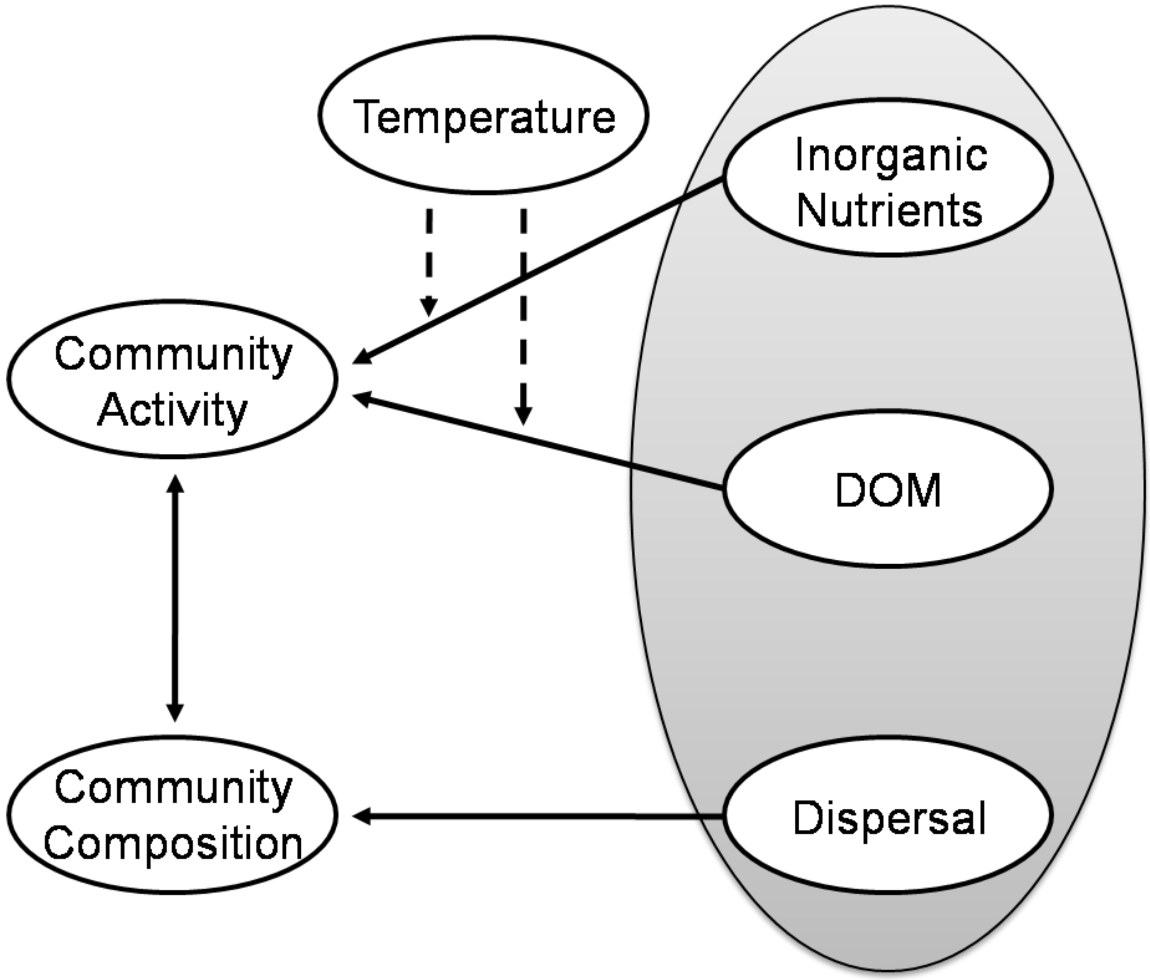

Figure 1.1. Conceptual model of controls on aquatic bacterial activity. Drivers within gray shaded ellipse are influenced by stream discharge. Dashed line indicates that temperature modifies bacterial activity in response to carbon (DOM) and nutrients.

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CHAPTER II

Temperature controls on aquatic bacterial production and community dynamics in arctic lakes and streams

Abstract

The impact of temperature on bacterial activity and community composition was investigated in arctic lakes and streams in northern Alaska. Aquatic bacterial communities incubated at different temperatures had different rates of production, as measured by ^{14}C-leucine uptake, indicating that populations within the communities had different temperature optima. Samples from Toolik Lake inlet and outlet were collected at water temperatures of 14.2 and 15.9 °C, respectively, and subsamples incubated at temperatures ranging from 6 to 20 °C. After five days, productivity rates varied from 0.5 to ~13.7 µg C/L/day and two distinct activity optima appeared at 12 and 20 °C. At these optima, activity was two to eleven-fold higher than at other incubation temperatures. The presence of two temperature optima indicates psychrophilic and psychrotolerant bacteria dominate under different conditions. Community fingerprinting via DGGE of 16S rRNA genes showed strong shifts in the composition of communities driven more by temperature than by differences in dissolved organic matter source; e.g., four and seven unique OTUs were found only at 2 and 25 °C, respectively, and not found at other incubation temperatures after five days. The impact of temperature on bacteria is complex, influencing both bacterial productivity and community composition. Path

analysis of measurements of 24 streams and lakes sampled across a catchment 12 times in 4 years indicates variable timing and strength of correlation between temperature and bacterial production, possibly due to bacterial community differences between sites. As indicated by both field and laboratory experiments, shifts in dominant community members can occur on ecologically relevant time scales (days), and have important implications for understanding the relationship of bacterial diversity and function.

Introduction

Bacteria are important organisms in ecosystems, performing the critical tasks of decomposing organic matter, regenerating nutrients, and forming the base of microbial food webs. The rates of these critical tasks can be modified by temperature, and understanding the bacterial response to temperature is necessary for understanding ecosystem function. For example, at higher temperatures, metabolic rates increase considerably and bacteria are able to break down organic substrates more rapidly (Pomeroy and Wiebe 2001) and increase secondary production (Kirchman and Rich 1997). Here I examine the links between temperature and ecosystem function as measured by aquatic bacterial production both directly and indirectly through alteration of bacterial community composition.

The metabolic activity of aquatic bacteria is directly limited by temperature in many systems. A strong relationship between bacterial-specific growth rate and temperature was found in a metadata analysis of 57 studies in freshwater, coastal, and marine habitats (White et al. 1991), and temperature limitation has been found in estuaries (Shiah and Ducklow 1994, Almeida et al. 2001, Almeida et al. 2007), sea grass beds (Danovaro and Fabiano 1995), rivers (Freese et al. 2006), coastal systems (Sherr et al. 2001), marine systems (Longnecker et al. 2006), and lakes of various nutrient regimes (Sommaruga and Conde 1997, Simon and Wunsch 1998, Friedrich et al. 1999, Gurung and Urabe 1999, Ram et al. 2005, Vrede 2005) including high arctic lakes (Panzenbock et al. 2000). A few studies found that temperature is not limiting to bacteria; in these studies only small increases in temperature were tested (Ducklow et al. 1999), or it was found that carbon quality was more important (McKnight et al. 1993).

Temperature can also interact with carbon availability or substrate affinity to control bacterial activity. At colder temperatures, bacteria begin to lose substrate affinity, leading to carbon limitation despite available sources in the environment, possibly due to stiffening lipid membranes (Nedwell 1999). Wiebe et al. (1992) found that psychrophilic bacteria have an increased need for substrate at lower temperatures when tested from -1.5 to 35 °C. However, Yager and Deming (1999) found no enhanced substrate requirement by bacteria in arctic polynyas during incubations from -1 to 5 °C. Likewise, Kirchman et al. (2005) found that cold adapted bacteria have shown responses to temperature and carbon similar to those in temperate habitats, although leucine incorporation rates per cell did tend to be lower at lower temperatures within their experiments. Substrate affinity of bacterial enzymes is fundamental to activity, and elevated temperature increases activity provided there is ample substrate (carbon). Arctic aquatic systems receive relatively large amounts of terrestrial carbon subsidies which can increase the amount of bioavailable DOM, and thus with ample DOM it is likely that temperature constrains bacterial activity.

Bacterial response to temperature can go beyond a general metabolic effect and can be population or community specific. Psychrophiles grow optimally at temperatures

< 15 °C, with an upper cardinal temperature of 20 °C (Morita 1975), and are found in a wide range of environments such as the coastal Arctic Ocean (Connelly et al. 2006), sea ice (Kottmeier and Sullivan 1988, Huston et al. 2000), and Antarctic saline lakes (McMeekin and Franzmann 1988). Psychrotolerant bacteria are also found in cold habitats, but have higher optimal growth temperatures (~20 °C) and can withstand temperatures as low as -10 °C (Bowman et al. 1997, Bakermans et al. 2006). Psychrophilic and psychrotolerant bacteria respond differently to a given temperature based on functional constraints such as membrane fluidity and enzyme structure (Feller et al. 1997, Russell 2000, D'Amico et al. 2006). Both of these groups of bacteria are likely present in many regions, and their competition due to population-specific growth rates may also be controlled by temperature, resulting in measured community-specific temperature responses.

While individual cells shift their physiology to respond to temperature changes, the dominance of a population within a community will change based on competition between groups that have different growth rates at different temperatures or environmental conditions. Bacteria living at sub-optimal temperatures may be present, albeit at low densities or relatively inactive, but may increase in dominance when conditions become favorable. In natural communities, the observed optimal temperature for a community can shift seasonally (Tison et al. 1980), indicating shifts in abundance between bacterial populations with different optimal temperatures and substrate affinities (Ogilvie et al. 1997). A community should adapt to the temperature ranges for its habitat, given enough time for shifts in populations to occur.

The rate of changing environmental conditions is likely to impact both bacterial activity and community composition. Water temperatures change rapidly with storm events, leaving bacterial communities little time to adjust composition to populations with different temperature optima. Pettersson and Baath (2003) found in humic soil that the rate of community compositional change was not related to temperature, although bacterial activity still indicated temperature limitation in the soils. However, Upton et al. (1990) found that temperatures could determine outcomes of competition between different bacterial populations. The impact of changes in temperature is likely to be most immediate on productivity by acting directly on enzymatic reactions. Shifts in bacterial community composition in response to temperature should be slower because the dominance of bacteria results from differential growth rates between populations in response to environmental conditions. However, bacterial populations also vary in enzymatic capabilities and preferred carbon substrates in addition to preferred temperature ranges. Therefore, changes in community structure resulting from temperature changes will also change potential levels of activity.

Evidence of temperature limitation and coexistence of bacterial populations with different preferred temperatures leads to the question of how temperature impacts bacterial production (BP), both directly by affecting enzyme activity and other cellular functions and indirectly through shifts in community composition. In this chapter I show that the direct mechanism impacts BP at very short time scales (hours). The indirect mechanism operates through shifts in community composition, and I support my hypothesis that communities consist of bacterial populations that have different temperature optima (e.g., phylogenetically distinct psycrophilic and psychrotolerant populations), resulting in multiple temperature optima for the community as a whole. I also demonstrate that communities shift dominant members based on water temperature, and these shifts can occur rapidly over periods of days.

Methods

Site description

Sites are located on the North Slope of Alaska, at the Toolik Field Station Arctic LTER (long-term ecological research) site. Toolik Lake is located at 68°38’00”N, 149°36’15”W at an elevation of 720 m, and has an ice-free season lasting from mid- June through September (O'Brien et al. 1997). The terrestrial system is largely tussock tundra with dwarf birch-willow riparian zones and wet sedge wetlands with large amounts of organic matter accumulation in histel soils (Chapin et al. 1995). The area has continuous permafrost and thaw depth typically varies from ~15 cm in June to a maximum of ~40 cm depth in August (data available at http://ecosystems.mbl.edu/ARC/). Due to the presence of continuous permafrost, there is very little water exchange between surface waters and deeper, frozen soils or aquifers. Snow melt in the spring and pulsed storm events throughout the summer bring terrestrial carbon subsidies into aquatic systems; this results in much higher bacterial production (BP) relative to primary production in lakes than is found in temperate systems (O'Brien et al. 1997).

The I-series catchment, the largest sub-basin of the Toolik Lake catchment, is 46.6 km^2 and contains ten lakes as well as the largest inlet to Toolik Lake, Toolik Inlet (see Kling et al., 2000 for further descriptions). Toolik Lake is a multi-basin lake draining a catchment of 66.9 km^2, and has a single outlet (MacIntyre et al. 2006). Upstream, in a sub-basin of the I-series catchment, Lake I-8 (0.182 km^2 in area) was sampled frequently, and has a large catchment area (29.1 km^2) without upstream lakes. All of the lakes in the Toolik Lake catchment are oligotrophic, with mean primary productivity of 3.23 µmol C/L/day and mean summer chlorophyll *a* (chl) of 1.02 µg/L. There are typically 2-3 storm events during the summer season, post snow-melt, which carry terrestrial and upstream DOM into downstream habitats. Concentrations of DOC are typically much higher (~500 µM, Kling et al., 2000) than those found in coastal ocean areas (Ducklow et al. 1999), and storm events can have a large impact on DOM available downstream.

Field measurements

All I-series lakes and major inlet streams were sampled three times each summer from 2003 to 2006 over two-day periods (late June, mid-July, and early August) for BP, temperature, DOC, and chl; precise sampling locations followed Kling et al. (2000). Stream samples were collected in 2 L bottles from under the water surface but without disturbing the stream bottom, and lake samples were either taken from ~0.5 m depth by boat or at the lake outlet which represents an integrated sample of epilimnetic water (details in Kling et al., 2000). Lake I-8 inlet and outlet as well as Toolik Inlet were sampled weekly for DNA, BP, and temperature. Temperature was measured with a digital thermometer during sample collection. BP was measured immediately or within ~1 hr of field collection using ^{14}C-labeled leucine uptake following Kirchman (1992) with an isotopic dilution of 1, resulting in a conversion factor of 1.55 kg C/mol. Each measure was calculated from the incubation of three unfiltered 10 mL subsamples (taken from 2 L collection bottles) and one 10 mL trichloroacetic acid (TCA) killed control with ^{14}C leucine for approximately three hours before ending with addition of 5% TCA.

Samples were filtered onto 0.22 μm nitro-cellulose filters and extracted using ice-cold TCA. Filters were then dissolved with 1 mL ethylene glycol monoethyl ether in scintillation vials, and analyzed with a liquid scintillation counter (Packard Tri-Carb 2100TR) after the addition of 5 mL Scintisafe scintillation cocktail. The BP measurements had an average coefficient of variation (CV) of 18%. Ultraviolet (UV) absorbance of DOM was measured on unfiltered samples using a quartz cell with a 5 cm path length on a Shimadzu 1601-UV scanning spectrophotometer in the wavelength range of 220 to 400 nm. DOC samples were filtered through Whatman GF/F filters in the field, acidified to pH 3, and stored in the dark at 4 °C until analysis on a Shimadzu TOC 5000 using platinum-catalyzed high-temperature combustion to CO_2 followed by infrared detection. The chl samples were filtered onto Whatman GF/F filters in the field and kept dark until frozen upon returning from the field. After overnight freezing at ~20 °C, filters were extracted for 24 hrs with acetone, read on a Turner Designs 10 AU fluorometer configured with a chlorophyll optical kit (10-037R), and corrected for phaeopigment using acidification with HCl. Stream discharge and temperature were monitored every 30 minutes at Toolik Lake inlet using a Stevens PGIII Pulse Generator (and manual discharge measurements to generate a rating curve) and a Campbell Scientific Model 247 conductivity and temperature probe connected to a Campbell Scientific CR510 datalogger.

Path analysis of I-series data was conducted using a structural equation modeling program (AMOS 6.0) to calculate standardized regression coefficients; natural log transformations of BP, chl, and stream discharge measurements were performed to normalize input data when required and any discrepancies were addressed via maximum likelihood. Temperature quotient (Q_{10}) was calculated for samples collected from Lake I-8 inlet and outlet on 3 July 2003 and at Toolik Inlet on 24 June, 1, 15, 22, July, and 5 August 2003. BP was measured in samples incubated at a range of temperatures within one hour of sample collection: Lake I-8 inlet and outlet samples were incubated at 6 and 16 °C and Toolik Inlet samples were incubated at 6, 9, 12, 14, 17 and 20 °C. The Q_{10} value was calculated as $Q_{10} = e^{10k}$ where k = slope of log-transformed R vs. T, where R = leucine incorporation rate (pmol/L/hr), and T = incubation temperature (°C) as described by Atkin et al. (2005).

Temperature experiments

Three experiments were conducted to test the influence of water temperature on BP and bacterial community composition. The experiments were performed in different years, were designed to answer different questions, and included different measurements; they are presented here in logical progression of answering our hypotheses. All experiments included temperature manipulations: experiment A measured BP and community composition, experiment B measured BP, and experiment C measured community composition. Experimental incubations used whole water collected from the field and partitioned to include 50% 1.0 µm filtered water (used as the bacterial inoculum) with 50% 0.2 µm filtered water (particle-free water, used as the DOM source). Treatment mesocosms were started within eight hours of water collection and kept in the dark in HDPE amber Nalgene bottles at set temperatures (+/- 1 °C). The starting time point of the incubations was considered to be the time of inoculation and collection times were within a few hours of 24 hours (1 day), 68 hours (2 days), or 116 hours (5 days) due to the length of time to required to sample all treatments (two to four hours). Filtration intentionally excluded both grazers and larger primary producers, while dark incubation minimized photosynthesis; this was done to focus on the impacts of temperature and bacterial community composition. Experiment A was conducted from 26 to 31 July 2006. Three replicate bottles were collected in the field from Toolik Lake inlet and filtered as described above to result in each replicate having 1 L total volume. From each replicate, 40 mL sub-samples were taken at the end of 1, 3, and 5 days for BP measurement, and on the fifth day 500 mL was filtered for DNA analysis. Experiment B was performed on Toolik Lake inlet and outlet samples from 26 to 31 July 2004, with factorial combinations of bacterial inoculum and DOM source from each habitat for a total volume of 250 mL, with 40 mL sub-samples taken for BP after 1, 3, and 5 days (no DNA collected). Experiment C was set-up the same as experiment B and run from 28 June to 3 July 2004, but with a total 1 L volume and DNA collected on day 5. In summary, experiment A was fully replicated; experiments B and C were done first, without field replicates, but the time course of changes and the end-of-experiment BP and DNA results were similar in all three experiments and consistently support our conclusions.

Community fingerprinting

DNA samples were collected from the field and from laboratory mesocosms by filtering ~500 mL of sample through a 0.2 μm pore-size Sterivex filter. Filters were preserved using a DNA extraction buffer described by Crump et al. (2003) and stored at -80 °C until extraction. Bacterial DNA was extracted using a phenol-chloroform extraction and PCR amplified using 357f with a G-C clamp and 519r universal 16S rRNA gene bacterial primers on a Bio-Rad thermocycler (Crump et al. 2003, 2007). The amplified DNA was then separated using denaturant gradient gel electrophoresis (DGGE) with 8% acrylamide gels cast with a 30-40% to 50-70% gradient of urea and formamide. Standard lanes were created using a mixture of previously identified Toolik Lake clone isolates (Crump et al. 2003) and used to standardize within and between gels. Gels were run on a CBS scientific system for 18 to 24 hours at 75 volts and 65 °C. Imaging was performed with Quantity One software on a Chemi-Doc gel documentation system (Bio-Rad), and gel bands were identified using GelCompar software to create a presence-absence matrix as described by Crump and Hobbie (2005). Each band represents an operational taxonomic unit (OTU) of bacteria. Dice transformation (SPSS 14.0, 15.0) was used to condense presence-absence data into percent community similarities between samples. The software PROXCAL (SPSS Categories, v. 14.0, 15.0) was used to create multi-dimensional scaling (MDS) proximity graphs.

Results

Temperature quotient

Laboratory incubations indicated direct temperature control on bacterial activity at several sites. Bacteria from Toolik Inlet and Lake I-8 inlet and outlet increased in activity when incubated at higher temperatures; the calculated Q_{10} values for these sites ranged from 1.3 to 2.9 (**Fig. 2.1**). Q_{10} averages 1.5 for aquatic bacterial specific growth rates (Rivkin et al. 1996), and has been calculated as high as 4.8 for leucine incorporation rate of arctic bacteria (Bussmann 1999). At Lake I-8, Q_{10} was much higher for the inlet site (2.92) compared to the outlet (1.53) on the same collection date in July 2003. There was greater spatial than temporal variation; the Q_{10} for Toolik Inlet during summer 2005 had a range from 1.32 to 2.41 with an average SE (standard error of the mean) of 0.14, smaller than the range among the sites. The Q_{10} values had a negative relationship with *in situ* collection temperature ($r^2 = 0.41$, $p = 0.12$,), and a positive relationship with other environmental variables such as pH ($r^2 = 0.64$, $p = 0.03$), conductivity ($r^2 = 0.36$, $p = 0.15$), and NO_3 ($r^2 = 0.36$, $p = 0.29$) but not with stream flow, DOC, TDN, DON, NH_4, or PO_4 ($r^2 < 0.3$ and $p > 0.2$).

Temperature experiments

The importance of community composition was seen in re-growth experiments at different temperatures. In Experiment A, performed on water from Toolik Inlet, there was an initial, short-term (day 1) increase in activity at all temperatures (**Fig. 2.2**, top). However, by day 3 distinct peaks in activity developed only at 12 and 20 °C (**Fig. 2.2**, bottom). The same water and bacteria incubated at 8 and 16 °C had significantly lower BP than those incubated at 12 and 20 °C, and at 16 °C the activity actually declined from that measured on day 1. Experiment B produced similar results, but used a wider range of incubation temperatures (every 2 °C) at both the inlet and outlet of Toolik Lake. In this experiment all combinations of bacterial inoculum and DOM source water showed the development of multiple temperature optima over time (**Fig. 2.3**), suggesting that temperature was more important to growth than were the different DOM sources found at the lake inlet and outlet. Similar to Experiment A, peaks in activity were most distinct after 5 days and at 12 or 20 °C. There were, however, slight differences in activity among the treatments (inlet versus outlet DOM source water) after 5 days. These differences may be due to DOM chemistry or to community composition; the inlet and outlet communities were 66.7% similar at the time of field collection based on DGGE banding patterns, and while the two sites had similar protein and phenolic concentrations the DOC concentration and DOM absorbance were slightly higher at Toolik Inlet.

Temperature also influenced bacterial community composition. Community fingerprinting performed on Experiment A, where Toolik Inlet samples were incubated at 8, 12, 16, and 20 °C and re-grown from a 50% inoculum for five days, indicated the development of more similar communities within a temperature treatment (**Fig. 2.4**). Replicates grown at the same temperature had 85 to 93% average similarity (1.1 to 6.8% standard deviation) while those grown at 8 and 20 °C had the lowest average similarity compared to each other (79% similarity after five days, 5.1% standard deviation). In Experiment C, when Toolik Lake inlet and outlet samples were combined in a factorial of inoculum and DOM source at temperatures of 2, 12, and 25 °C for five days, community fingerprinting again clustered samples by temperature (**Fig. 2.5**) within either the inlet or outlet community inoculum. At the end of the experiment, these bacterial communities had statistically more OTUs in common with other inocula from their same collection sites (starting community) or with samples incubated at the same temperature, despite incubation DOM source as indicated by ANOVA on pair-wise similarities and dummy variables representing incubation conditions (**Table 2.1**). As was first seen in experiment B, in this experiment the influence of temperature was clearly a stronger driver of community structure than was DOM source during the five day incubation period.

Psychrophilic and psychrotolerant bacterial populations were distinguished by BP peaks and by community similarity (DGGE) in laboratory incubations at different temperatures. While genomic sequences and structural differences may also distinguish these two populations, I assign the operational description of communities based on optimal temperature of productivity. Within collection habitat, bacteria incubated at 2 °C had an average 69% similarity to those incubated at 12 °C and a slightly lower average similarity (58%) to those incubated at 25 °C, while the 12 °C and 25 °C incubations had an average 61% similarity at the end of Experiment C. Based on Morita's (1975) definition of cardinal temperature ranges, psychrophilic bacteria would be able to persist in the 2 and 12 °C incubations which had the highest similarity between temperatures, while psychrotolerant bacteria can survive at all tested temperatures and should dominate at 25 °C. Given these definitions and incubation temperatures, out of 79 total OTUs identified (**Table 2.2**) there were 4 to 12 detectable psychrophilic OTUs and 6 to 24 psychrotolerant OTUs within the environment at the time of sample collection.

In situ responses of BP to temperature

From 2003 to 2007, summer (mid-June through August) stream water temperatures at Toolik Inlet ranged from 4 to 19 °C, averaging 11 °C, with a mean daily temperature fluctuation of 3.5 °C that ranged from 0.4 to 10.4 °C diel change in water temperature. Stream discharge was also quite variable and ranged from 0.02 to 10.2 m^3/sec (**Table 2.3)**. Path analysis of discharge, temperature, and BP at Toolik Inlet ($p < 0.001$ for the entire model) for 2003-2006 showed a standardized correlation coefficient of 0.45 ($p < 0.001$) for stream discharge (natural log transformed) on BP and of 0.25 ($p = 0.053$) for water temperature on BP. Upstream of Toolik Inlet at Lake I-8, path analysis of discharge, water temperature, and BP for 2003-2006 at both the inlet and outlet ($p < 0.001$) had a similar correlation between discharge and BP ($\beta = 0.43$, $p < 0.001$) and a higher correlation between temperature and BP ($\beta = 0.60$, $p < 0.001$). In this variable habitat, BP showed strong spatial and seasonal patterns across several sites and over longer time periods.

I-8 outlet BP was consistently higher than the inlet of I-8, but both the inlet and the outlet responded synchronously during most summer seasons (**Fig. 2.6**). In 2003, UV absorbance by DOM, an indicator of the extent of photo-degradation (Moran and Covert 2003), increased with the first summer rain event indicating freshly exposed DOM from terrestrial habitats. The BP initially increased along with UV absorbance; however, later storm events were accompanied by smaller increases in BP despite continued high UV absorbance of DOM (**Fig. 2.6**). Temperature was colder during these later rain events, and consequently temperature may have constrained the bacterial response at Lake I-8 in the later part of the season.

Data from three sampling surveys performed on lakes across the larger catchment also indicate that bacteria probably switched from carbon limitation in the early season to temperature limitation later in the season in 2003, but this pattern varied annually. Across the I-series catchment, path analysis (**Fig. 2.7**) of BP, temperature, DOC, and chl in all the lakes and inlet sites showed both a direct effect of temperature on BP and an indirect effect of temperature on BP through chl. The DOC concentrations were not statistically significant in our model for any of the sample sets examined (data not shown), and it is likely that chl reflects the labile portion of the DOC pool in our system. In 2003, 2004, and 2006, BP in the entire catchment correlated with chl in the early season (late June) before the first rain event ($\beta = 0.69$, **Table 2.4**). Later in the summer of 2003, temperature was the strongest correlate for BP ($\beta = 0.41$, **Table 2.4**), verifying that the patterns observed at Lake I-8 (**Fig. 2.6**) were synchronous across the larger catchment. For the data set “all” , the indirect pathway of temperature to chl to BP is statistically significant, as is the model as a whole (**Table 2.4**). However, separating lake and stream inlet sites into early, mid, and late summer seasons as well as by year indicates that the direct effect of temperature on BP is usually greater than the indirect effect through chl. Additionally, the beta coefficient for the direct effect of temperature on BP has a weak inverse correlation with temperature range among all sites in each of the I-series samplings, similar to the trend of higher Q_{10} at lower *in situ* temperatures. While the pattern of early season carbon limitation holds across several years, the strength of correlation of temperature with BP varies seasonally and annually in the I-series catchment.

Discussion

Both field and laboratory experiments indicate variability in the temperature control on bacterial activity during the ice-free summer. Temperature dependence of BP (leucine incorporation) was directly measured with Q_{10} values greater than 1. However, despite the general indication of temperature limitation, the range in Q_{10} was quite large (**Fig. 2.1**) and varied both spatially and temporally. Such variation is commonly found; for example, Rivkin et al. (1996) calculated an average Q_{10} of 1.5 in a literature review of aquatic bacterial specific growth rate, while Bussmann (1999) measured a Q_{10} of 4.8 for leucine incorporation rate of arctic bacteria. Atkin and Tjoelker (2003) found that the Q_{10} of plant respiration decreases with increases in measurement temperature across biomes. They explained this difference across biomes as enzymatic capacity impacting temperature response at low temperature, and substrate supply constraining Q_{10} at higher temperatures. Shiah and Ducklow (1994) found temperature limitation to be more important than substrate limitation for specific growth rate of estuarine bacteria in colder (non-summer) seasons, with a high Q_{10} of 2.72. Similarly, Bridgeman et al. (2000) found that substrate supply of DOM constrained bacterial production at high temperatures, and that the quality of DOM, which influences enzymatic capacity, constrained BP at low temperatures. However, it is also possible that there is an enzymatic capacity of the entire community, where different populations adapted to processing different biochemical compounds (i.e., quality of DOM) comprise a range of capacity to enzymatically degrade DOM. In this case, shifts in community composition would be consistent with shifts in the enzymatic capacity of individuals or populations, and could explain the spatial and temporal variation in Q_{10} that I observed.

The spatial variation in Q_{10} was characterized by a negative relationship of Q_{10} with *in situ* temperature (**Fig. 2.1**, $r^2 = 0.41$; $p = 0.12$). This higher Q_{10} at lower temperature has been found in growth rates of estuarine bacteria (Hoch and Kirchman 1993) and is consistent with studies showing that cold-grown plants acclimatize with higher Q_{10} values (Atkin et al. 2005), and that soil respiration acclimatizes to warmer temperatures with lower Q_{10} values (Luo et al. 2001). This temperature acclimatization is analogous to changes in Q_{10} caused by shifts in bacterial communities with different enzymatic capacities, such as populations of psychrophilic or psychrotolerant bacteria. Populations also likely differ in optimal pH, which may explain the strong positive relationship between pH and Q_{10}. Therefore, the differences I observed in Q_{10} could be attributed to the differences I measured in bacterial community composition at different sites. For example, the Q_{10} at I-8 inlet was the highest (2.9) and had the lowest *in situ* temperature, while at I-8 outlet the Q_{10} was 1.5 and had one of the highest *in situ* temperatures (**Fig. 2.1**). Furthermore, these two sites had very low community similarity at the time of measurement (18%) and, in fact, the bacterial communities at these two sites are consistently different and had a mean similarity of only 42% during the 2003 summer season.

The variation in bacterial response to temperature was seen not only among sites in environmental samples, but also within communities incubated at different temperatures. Multiple temperature optima developing within the same community indicate the presence of both psychrophilic and psychrotolerant bacteria within the initial community. This suggests that the inoculated bacterial populations best adapted to incubation temperatures out-compete other populations via increased growth. In both re-growth temperature experiments, the 12 and 20 ºC treatments developed the highest BP relative to other incubation temperatures (**Figs. 2.2** and **2.3**). Since psychrophilic bacteria have optimal temperatures < 15 ºC and maximal temperatures of < 20 ºC (Morita 1975), the populations with optimal growth in our experiment of 12 ºC can be characterized as psychrophilic and the populations with optimal growth at 20 ºC can be characterized as psychrotolerant. Under field conditions, the relative dominance of psychrophilic and psychrotolerant bacteria is likely to shift continuously toward the group whose optimal temperatures are closest to current water temperature, with BP shifting accordingly.

The DNA evidence also indicates shifts in dominance by different bacterial populations at different temperatures. Bacterial community fingerprints changed after incubation at different temperatures, within the relatively short time scale of five days. In both the temperature re-growth experiment at 8, 12, 16, and 20 ºC (**Fig. 2.4**) and the incubations at 2, 12, and 25 ºC (**Fig. 2.5**), populations shifted in dominance and the community as a whole shifted in levels of productivity. There was no clear relationship between the total number of bands (“taxonomic diversity”) and temperature. However, some OTUs in the community fingerprinting analysis (**Table 2.2**) were only present at certain temperatures, which indicate that certain OTUs in the community can only reach PCR-detectable levels when held at a constant low or high temperature.

The competitive interactions of psychrophilic and psychrotolerant groups of bacteria in response to temperature affect productivity because the groups have different levels of activity dependent on temperature. Bennet and Lenski (1997) found that *E. coli* acclimated at different temperatures were competitively superior at the temperature at which the bacterial populations had evolved. Rutter and Nedwell (1994) found that two psychrotolerant bacterial species differed in the rate of their response to changing temperature, with *Brevibacterium* sp. responding rapidly and *Hydrogenophaga pseudoflava* showing a time lag in growth after a temperature change. Under steady temperature conditions, or slow shifts in temperature, *H. pseudoflava* was able to out-compete the *Brevibacterium*, while *Brevibacterium* performed best when temperatures changed dramatically. This suggests that competition between psychrophilic and psychrotolerant bacteria may also be affected by the rates of temperature changes, not just the mean daily water temperature. Upton et al. (1990) also found that stable versus fluctuating temperatures could control the outcome of bacterial competition in Antarctic lake sediments, with greater diversity occurring under fluctuating temperatures. Using laboratory-bred *E. coli*, Cooper et al. (2001) found that cold-adapted bacteria did poorly when moved to higher temperatures, but that warmer-adapted bacteria did not suffer the same relative decrease when moved to colder temperatures. This implies that psychrophilic bacteria are worse off at higher temperatures than psychrotolerant bacteria are at lower temperatures, potentially giving psychrotolerant bacteria the competitive edge during times when temperatures are warmer. Fluctuating temperatures, then, may allow the persistence of both types of bacteria.

In the field, bacterial communities are subject to daily changes in temperature as well as frequent changes in stream flow, which carries DOM and nutrients from upstream. At Toolik Inlet, both temperature and discharge were significantly related to BP for the path analysis of 2003-2006, even though all four years had very different temperature and storm event patterns (**Table 2.3**). Path analysis is useful for distinguishing between direct and indirect effects (Wright 1934) and standardized regression correlation coefficients (β) can be compared in different paths of effect within a specified model (e.g. **Fig. 2.7**) from driver to response variable. The path analysis (Table 4) showed that discharge had a larger effect (β coefficient = 0.45) than water temperature (β = 0.25) on BP, although the effect of discharge may be due to drivers of BP that co-vary with discharge such as DOM and nutrients. These results were similar to those found at Lake I-8 inlet and outlet, where path analysis of discharge, water temperature, and BP showed a strong correlation (β = 0.60) of water temperature and BP, probably related to consistent differences in temperature between the inlet and outlet of the lake.

Even though temperature was related to BP over all sites over all years, the specific response of sites varied from year to year. This variation is probably due to interactions of temperature with carbon availability, although nutrient availability, viral lysis, or grazing could also be important differences between sites. For example, at Lake

I-8 in the summer of 2003, bacterial production increased as DOM entered the system early in the summer when water temperatures were warm (**Fig. 2.6**). However, DOM absorbance (i.e., freshness or quality) remained high later in the summer but BP dropped; it appears that lower water temperatures during late summer storm events constrained the bacterial response to the available DOM by reducing the ability of bacteria to take up substrates. The impact of DOM quality on BP can also depend on the source and prior processing of DOM upslope (Judd et al. 2007), and the quality of DOM may vary among different storm events. In experiment B, the magnitude of response in BP at 12 and 20 °C in different DOM treatments may be due to differences in DOM absorbance or other unmeasured differences in DOM (**Fig. 2.3**), although replication would be needed to confirm this effect. Despite this potential variation, similar interactions between temperature and carbon limitation have been observed elsewhere. Rivkin et al. (1996) found empirical evidence of an inverse relationship between temperature and carbon limitation in a meta-analysis, and I found alternation of temperature and chl (a proxy for algal carbon source) as a significant effect on seasonal differences in BP within the path analysis. Kirschner and Velimirov (1997) also found that temperature and chl explained 69% of the seasonal variation in BP in the Danube River. Temperature and DOC accounted for 50% of the bacterial growth rate in the Greenland Sea (Middelboe and Lundsgaard 2003), and were correlated with bacterial abundance in the N. Adriatic Sea (Paoli et al. 2006). It is clear that both temperature and carbon are important controls of BP at individual sites in natural ecosystems.

The interaction between temperature and carbon limitation I observed at the individual site Lake I-8 was found also in all I-series streams and lakes in summer 2003

(**Table 2.4**). Summer rain events flush terrestrial carbon subsidies into the aquatic system, and because from 2003 to 2006 there was low flow (and warm water temperature) in the early summer season, BP was likely constrained by carbon availability; this was indicated by positive correlations of BP with chl (which reflects the labile portion of the DOC pool in our system; **Table 2.4**). Later in the summer, air and water temperatures often decline with rain events, and thus temperature constrains the metabolic activity of the bacteria and limits the response of BP to terrestrial carbon subsidies supplied by rain events. However, the pattern of a strong shift to temperature limitation late in the summer season was seen only in 2003, perhaps because this was the wettest and coolest year of the study and thus provided the strongest contrasts between potential temperature versus carbon limitation.

The variable effect of temperature on BP seen in the field results over all years may be due to (1) variation in chl, (2) the range of water temperature, or (3) differences in community composition among sites. The control by temperature across the catchment was indicated directly by correlations of temperature with BP and indirectly through chl. The indirect effect of temperature on BP through chl appears to be driven by results from stream sampling sites, where direct effects of temperature on chl were higher and statistically significant (**Table 2.4**). This correlation could be due to the covariance of temperature and light levels (through storms and cloudiness), and light is well known to impact algal productivity and autochthonous DOM in streams (Dodds 2007). However, the indirect effect for the pathway from temperature to BP was usually weak (beta values < 0.2), and stronger direct pathways from temperature to BP and chl to BP were more common.

The second possible explanation for the variation in control by temperature on BP may be related to the range of water temperature. Higher beta values for the direct effect of temperature on BP were calculated during time periods when catchment surface waters had lower ranges in temperature. More stable water temperatures would allow bacterial populations and communities time to respond physiologically to the current water temperature. This increased impact of temperature on BP during periods of more stable temperature is consistent in effect to the inverse relationship between Q_{10} and *in situ* temperature observed at Lake I-8 and Toolik Inlet. Storm events tend to have both less variable and lower temperatures, suggesting that the variation in trade-off between carbon versus temperature limitation may be due to the timing and magnitude of storm events.

Finally, I have shown that bacterial communities vary at sites across the catchment, and that different communities respond differentially to temperature. For example, community similarities among all sites in the catchment during July 2003 ranged from 23 to 95% and averaged 61% (see also (Crump et al. 2007)). The variation in communities reflects distances between sites as well as the degree of hydrologic connectivity and habitat similarity (Crump et al. 2007). As indicated by the laboratory experiments discussed above, bacterial communities shift when temperature changes, and the new communities may have either higher or lower BP depending on the specific community optimum (**Figs. 2.2, 2.3**). This interaction between temperature, community composition, and activity optima may partially explain the fact that the strong temperature dependence of BP measured in our lab experiments was weaker and more variable in the field observations.

The impact of temperature on bacteria community composition and activity has implications for the response to climate warming in the Arctic. If air temperatures increase 5 °C, lake temperatures are predicted to increase ~3 °C and the ice-free season to lengthen by seven weeks (Hobbie et al. 1999). Warmer, more stable temperature conditions would decrease the predominance of psychrophiles during the summer season and psychrotolerant bacteria may become dominant. However, psychrophilic marine bacteria have been shown to have enhanced heat tolerance at 17 °C under starvation conditions (Preyer and Oliver 1993), a possible mechanism of psychrophilic persistence in oligotrophic waters during conditions which should favor psychrotolerant bacteria. A shift to more psychrotolerant bacteria does not necessarily mean higher overall activity, because moderate warming of surface waters may depress psychrophilic activity but temperatures could still be too low for optimal activity of psychrotolerant bacteria as seen by the bi-modal responses in our temperature re-growth experiments. In other words, a shift of the average water temperature in aquatic habitats from 12 to 16 °C may actually result in lower bacterial activity (see **Figs. 2.2, 2.3**). This emphasizes the central role of shifts in bacterial community composition and their interactions with temperature in determining rates of activity in natural bacterial communities.

Conclusions

Temperature controls on aquatic bacteria are more complex than previously thought due to the interactions of changing temperature and rapid shifts in community composition. I found seasonal temperature limitation of bacterial activity across several spatial scales as well as multiple temperature optima of populations within bacterial communities. In addition, temperature plays a key role controlling bacterial community dynamics because composition shifts rapidly with changing temperature. These shifts occur at ecologically relevant time scales (days), and bacterial community characteristics will ultimately constrain the potential bacterial production resulting from increasing temperatures or from changes in temperature variability.

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Tables

Table 2.1. ANOVA results from community similarity of samples from Figure 5. Community samples were scored as having either the same or different experimental conditions as their comparison samples (dummy variables). Similarity values used to create Figure 5 were then compared to the commonalities in conditions between samples. Starting community indicates whether or not both samples were collected at the inlet or at the outlet of Toolik Lake. Incubation temperature indicates if compared samples were both incubated at 2, 12, or 20 °C. The DOM source category indicates if both samples were incubated in 0.2μm-filtered DOM collected from the same site.

Between-Subjects Factors			
		Value Label	N
Starting Community	0	different	40
	1	same	33
Incubation Temperature	0	different	49
	1	same	24
DOM source	0	different	40
	1	same	33

Tests of Between-Subjects Effects
Dependent Variable: Ending community similarity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.36	6	0.23	23.49	**0.00**
Intercept	19.9	1	19.9	2060	**0.00**
Starting Community	1.02	1	1.02	105.8	**0.00**
Incubation Temperature	0.22	1	0.22	23.14	**0.00**
DOM source	<0.01	1	<0.01	0.02	0.89
Community * Temperature	0.02	1	0.02	1.67	0.20
Community * DOM source	<0.01	1	<0.01	0.01	0.94
Temperature * DOM source	<0.01	1	<0.01	0.02	0.89
Error	0.64	66	0.01		
Total	23.34	73			
Corrected Total	1.99	72			
	R Squared = .681 (Adjusted R Squared = .652)				

Table 2.2. Number of unique OTUs found only at certain temperatures. The DGGE bands are from samples incubated for five days at 2, 12, and 25 °C, out of 79 total identified bands (OTUs).

Temperature	**# bands**
Only at 2 °C	4
2 and 12 °C	8
Only at 12 °C	7
12 and 25 °C	12
Only at 25 °C	6
All temperatures	6

Table 2.3. Stream discharge and water temperature of Toolik Inlet from the ice-free summer season, generally measured from 15 June to 20 August except 20 June to 16 August in 2003 and 21 June to 16 August in 2004.

	Water temperature (°C)			**Stream discharge** (m^3/sec)		
Year	Minimum	Mean	Maximum	Minimum	Mean	Maximum
2003	4.6	9.6	19.3	0.04	1.65	9.01
2004	6.8	12.2	18.7	0.12	1.24	7.03
2005	5.0	11.2	18.9	0.02	0.31	3.22
2006	4.6	10.7	14.7	0.18	0.86	3.33
2007	8.3	12.9	18.8	0.01	0.31	2.83

Table 2.4. Path analysis results with asterisks indicating p-values: ***<0.001, **<0.01, and *<0.05. Sample set "All" includes data from all I-series sampling from 2003-2006. Early, mid, and late season samples were split by month of collection date (June, July, or August). Standardized regression weights are equivalent to the standardized total and direct effects for temperature to chl, and chl to BP, while temperature to BP is only the direct effect. The indirect effects are for temperature to BP via chl. The DOC concentration was included in the model, but was not statistically significant for the sample sets analyzed.

				Standardized regression weights, p-value						
Sample set	n	X^2	p-value	Temp => Chl a		Chl a => BP		Temp=> BP		Indirect effects
all	283	46.848	***	0.280	***	0.247	***	0.009	0.884	0.069
all, lakes	120	18.785	***	-0.095	0.302	-0.002	0.98	-0.187	*	0.000
all, streams	163	27.583	***	0.396	***	0.181	*	0.12	0.142	0.072
all, early	93	12.993	**	-0.111	0.284	0.342	***	0.204	*	-0.038
all, mid	96	17.197	***	0.487	***	0.404	***	-0.189	0.085	0.196
all, late	94	8.842	*	0.493	***	0.119	0.312	-0.031	0.795	0.059
2003	70	3.638	0.162	0.308	**	0.468	***	0.169	0.111	0.052
2003, early	23	2.901	0.235	-0.173	0.411	0.694	***	0.276	0.062	-0.032
2003, mid	24	8.058	*	0.614	***	0.461	*	0.320	0.074	0.283
2003, late	23	0.471	0.790	0.370	0.062	0.317	0.066	0.406	*	0.117
2004	72	35.164	***	0.429	***	0.475	***	0.051	0.650	0.204
2004, early	24	1.906	0.386	0.308	0.121	0.543	**	0.010	0.956	0.167
2004, mid	24	6.514	*	0.620	***	0.264	0.233	0.335	0.130	0.093
2004, late	24	5.739	0.057	0.566	**	0.474	*	-0.066	0.770	0.142
2005	69	10.679	**	0.065	0.593	0.051	0.643	0.418	***	0.003
2005, early	22	5.843	0.054	0.105	0.630	0.037	0.855	0.281	0.163	0.004
2005, mid	24	4.557	0.102	0.512	**	0.123	0.573	0.280	0.199	0.063
2005, late	23	8.384	**	0.059	0.781	-0.123	0.541	0.145	0.472	-0.007
2006	72	1.024	0.599	0.134	0.257	0.190	0.091	0.277	*	0.026
2006, early	24	1.699	0.428	-0.021	0.921	0.483	**	0.266	0.119	-0.004
2006, mid	24	0.942	0.624	0.100	0.638	0.023	0.898	0.465	**	0.001
2006, late	24	2.406	0.300	0.564	**	-0.081	0.741	0.220	0.371	-0.046

Figures

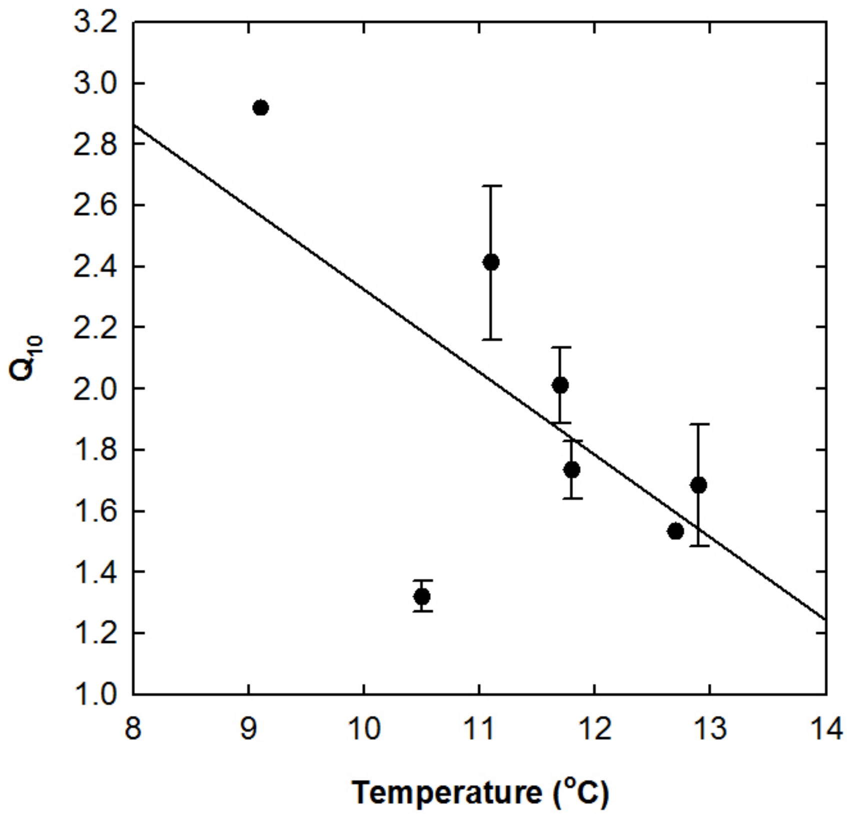


Figure 2.1. Bacterial Q_{10} versus in situ collection temperature, $R^2 = 0.41$, $p=0.12$. Values of Q_{10} greater than 1 indicate temperature control of leucine incorporation. Error bars are +/- 1 standard error (SE, N=6, N=7 for 15 July 2005 sample), calculated from replicates of different temperature pairs within a Q_{10} measurement. SE is not calculated for I-8 inlet and I-8 outlet Q_{10} which were based on two incubation temperatures.

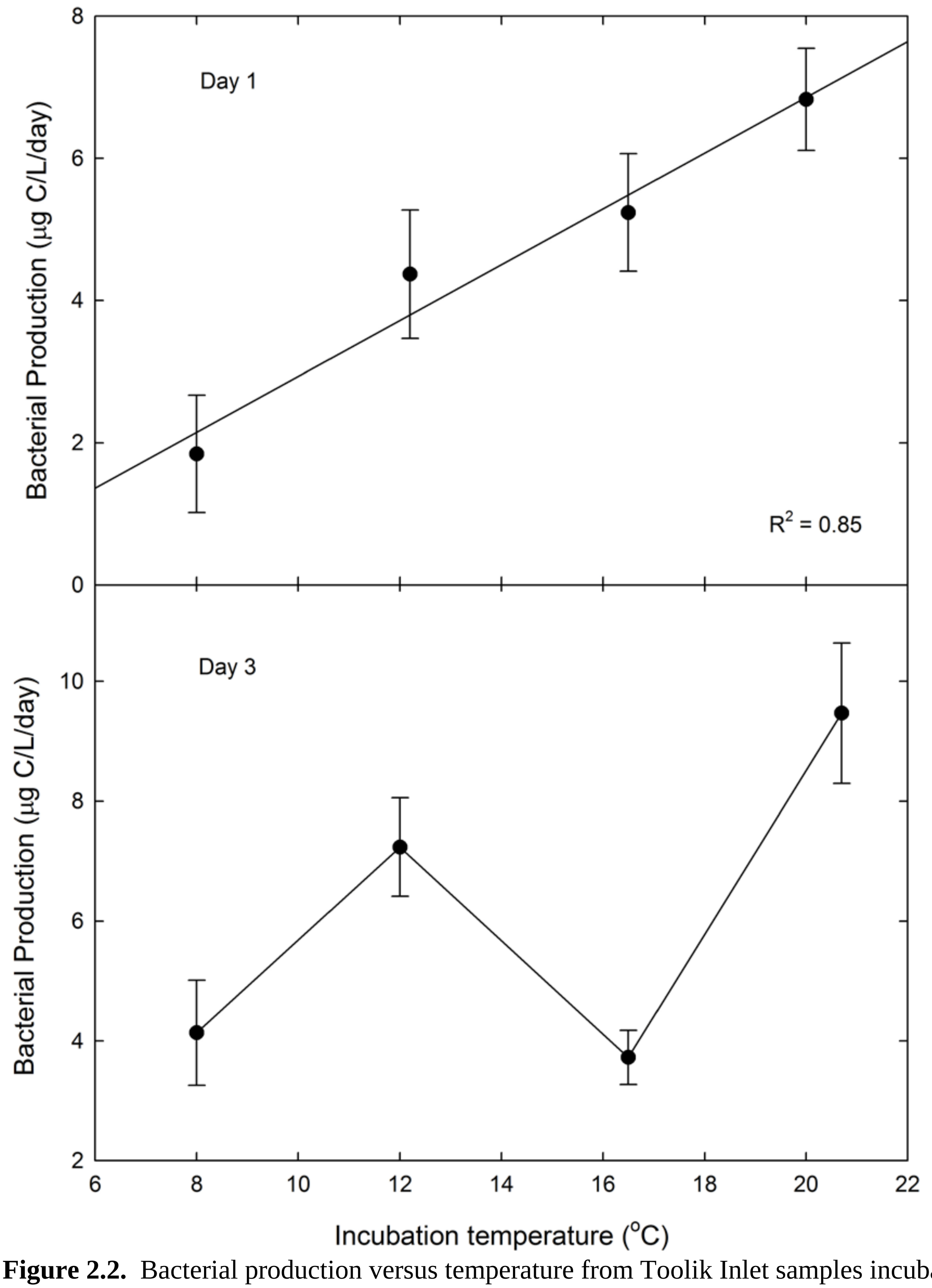


Figure 2.2. Bacterial production versus temperature from Toolik Inlet samples incubated at different temperatures in Experiment A. Bars indicate standard deviation of three replicates of each treatment. Letters indicate significantly different means via independent samples t-tests ($p < 0.05$).

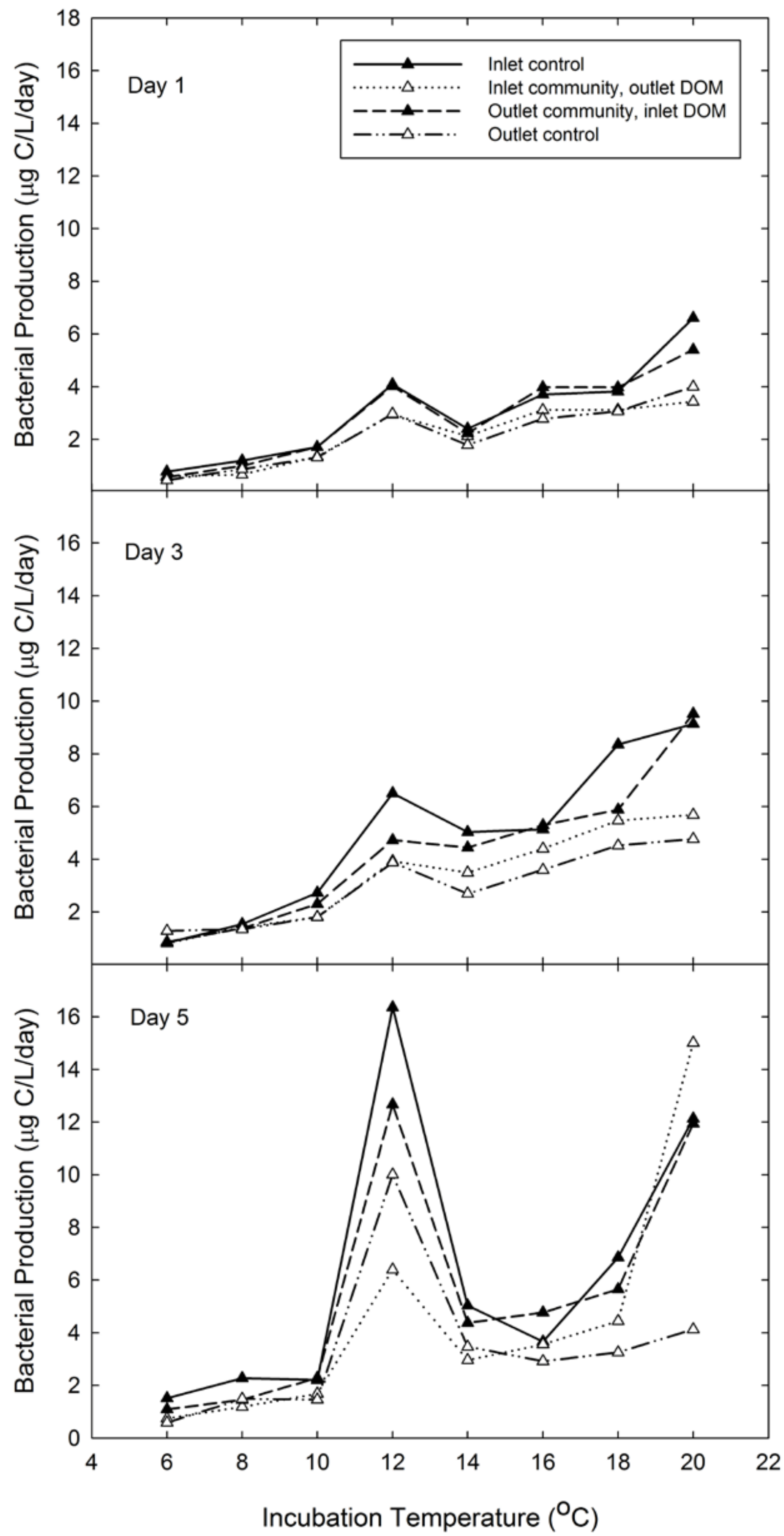


Figure 2.3. Bacterial production versus temperature from Toolik Inlet and Outlet samples incubated at different temperatures in Experiment B. Initial collection temperatures at Toolik Inlet and Outlet were 14.2 and 15.9 °C, respectively, with a daily range 13.3 to 16.7 °C at the inlet.

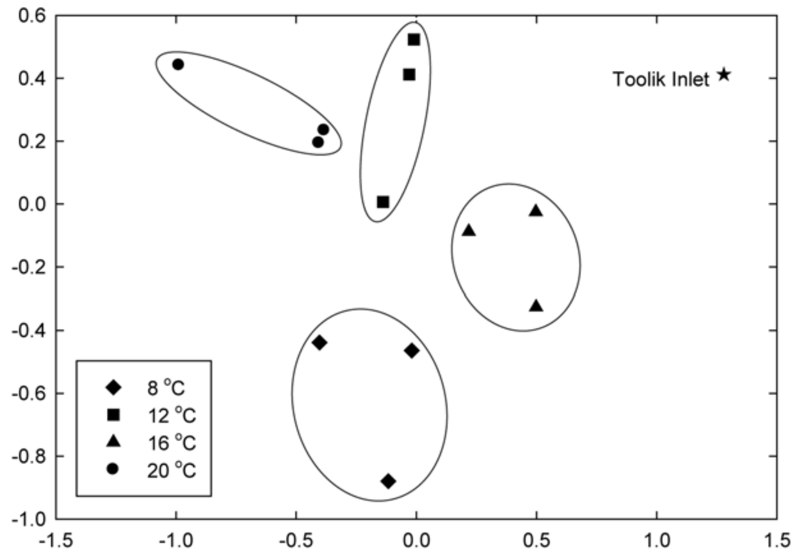


Figure 2.4. Non-metric multi-dimensional scaling (MDS) of Toolik Inlet DGGE community fingerprints from post-incubation samples held at different temperatures from Experiment A. Proximity of samples indicates a higher degree of community similarity as indicated by overlap in OTUs determined by the DGGE banding patterns of PCR amplified products from 16S rRNA genes. Normalized Raw Stress = 0.0265.

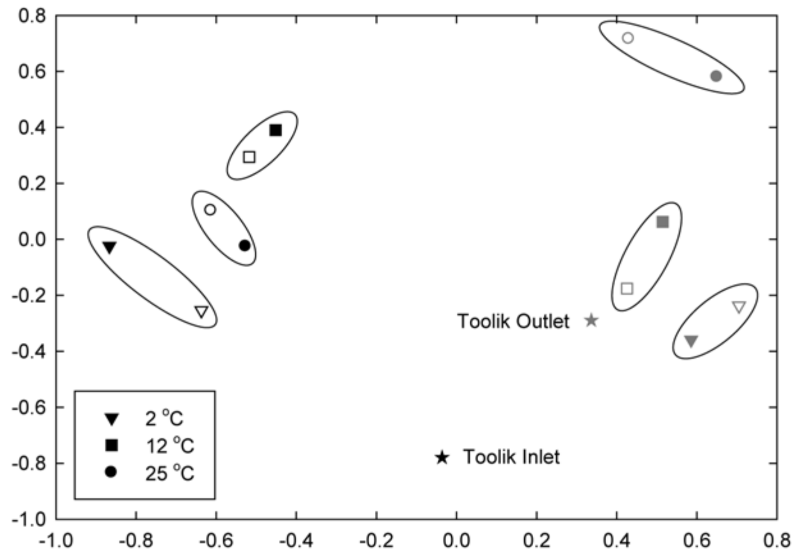


Figure 2.5. Non-metric MDS of DGGE community similarity from Experiment C. Proximity of samples indicates a higher degree of community similarity as indicated by the banding patterns of OTUs. Closed symbols designate samples where bacterial communities were given DOM from their source habitat and open symbols designate samples with a DOM source from the opposite site. Black symbols indicate bacterial communities from Toolik Inlet and grey from Toolik Outlet. Normalized Raw Stress = 0.02054.

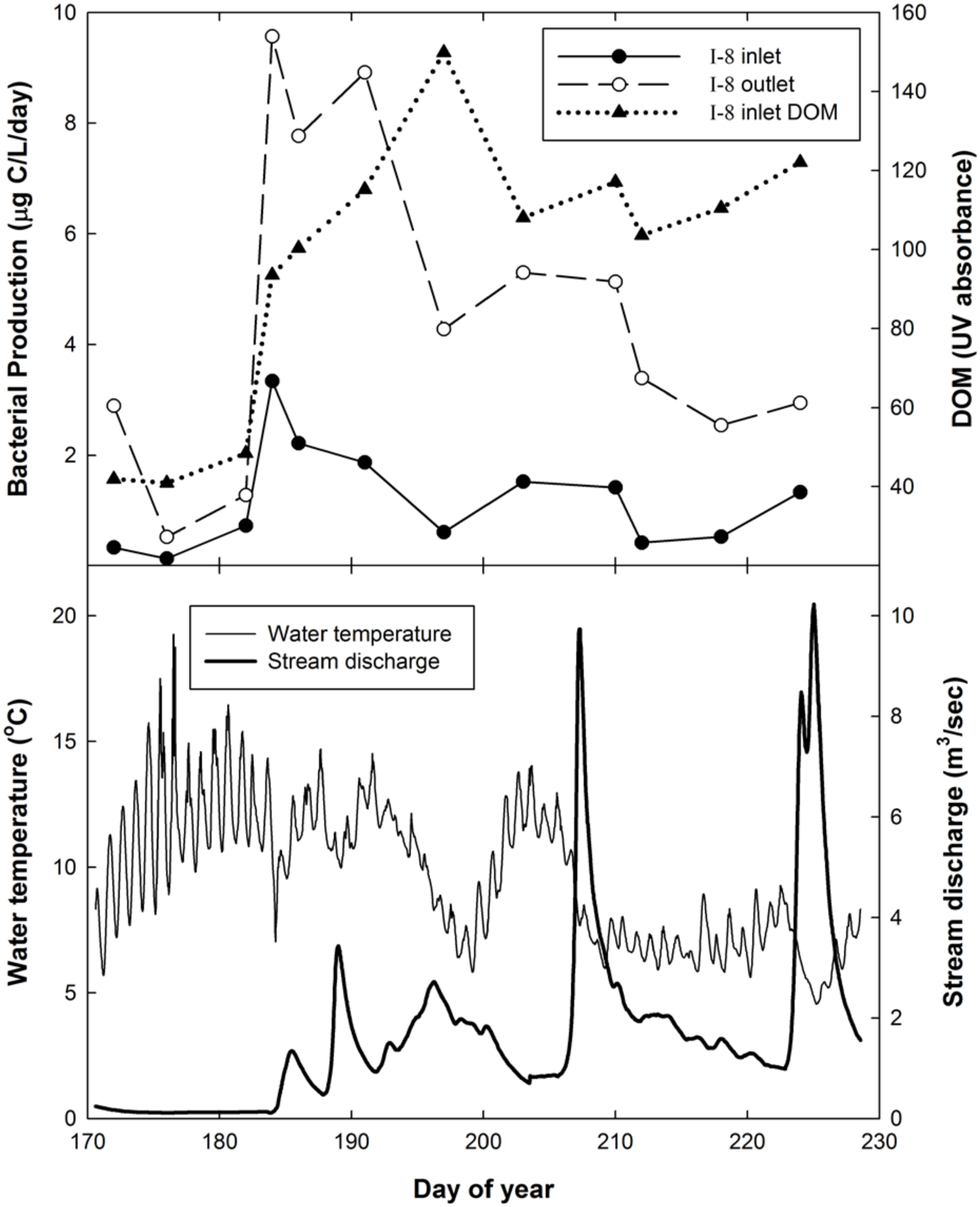


Figure 2.6. Top panel: DOM UV absorbance at I-8 inlet and BP at I-8 inlet and outlet in 2003. Bottom panel: Stream discharge and water temperature at Toolik Inlet in 2003.

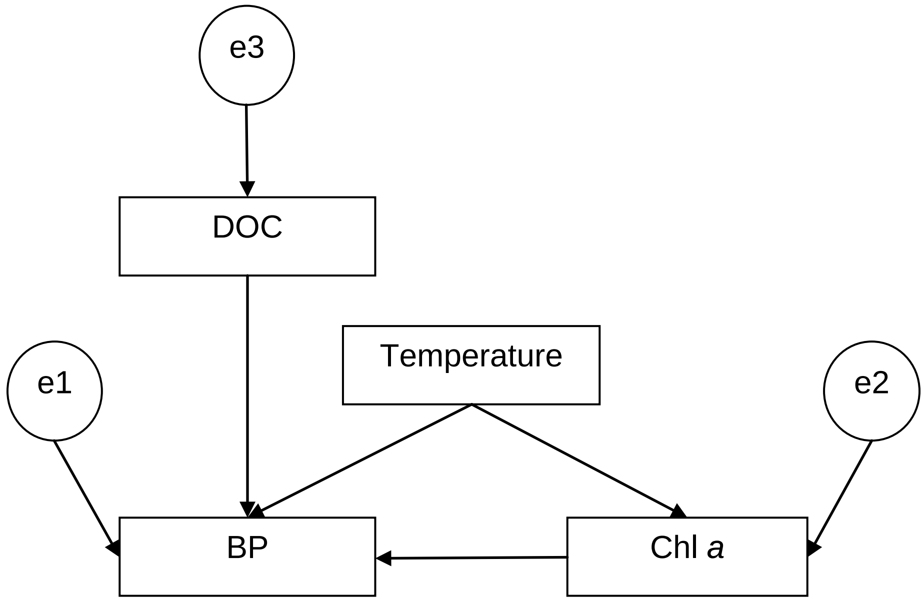
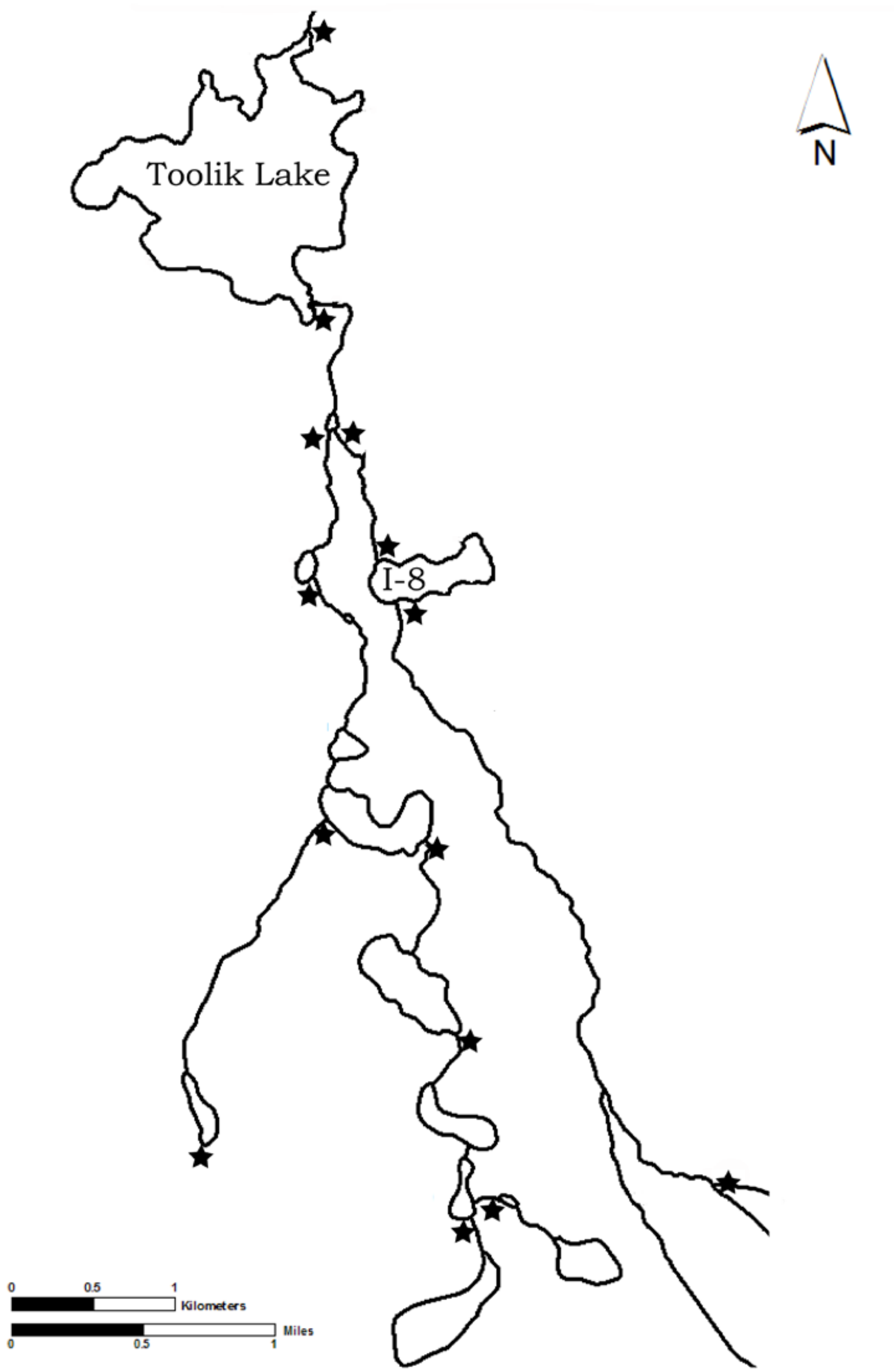


Figure 2.7. Path model for I-series lakes in summers 2003-2006. Boxes indicate variables and circles are error terms associated with endogenous variables. Straight arrows indicate presumed causal relationships.

Appendix



Appendix 2.A. Map of stream sampling locations in the Toolik Lake and I-series catchment in Northern Alaska (modified from (Kling et al. 2000)).

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CHAPTER III

Interactions of temperature, nutrients, and community composition as controls on aquatic bacterial productivity

Abstract

Bacterial growth in aquatic habitats is likely to be nutrient limited where there are low temperatures, poor quality dissolved organic matter, and low nutrient supply. In the Arctic, pulses of nutrients flushed from soils in storm events act as important subsidies to oligotrophic lakes and streams. Bacterial nutrient limitation and the potential response of bacteria to storm events was investigated by manipulating both water temperature and inorganic nutrients in short (up to 4 days) and long duration (up to 2 weeks) laboratory mesocosm experiments with samples collected from several arctic streams. Inorganic N and P additions increased bacterial production (^{14}C-labelled leucine uptake) up to seven times over controls, and warmer incubation temperatures increased the speed of this bacterial response to added nutrients. Bacterial community composition, as indicated by fingerprinting 16S rRNA genes, shifted rapidly in response to changes in incubation temperature and the addition of inorganic nutrients. Bacterial cell number also increased in response to temperature and nutrient manipulations with cell-specific leucine incorporation initially increasing and then declining after two days. While the bacteria in these habitats responded to nutrient pulses with rapid changes in productivity, the water

temperature controlled the speed of metabolic response and affected the resultant change in bacterial community structure.

Introduction

Inorganic nutrient limitation of bacteria can be an important control of productivity in oligotrophic aquatic systems. Inorganic nutrient limitation of bacteria is determined by interactions with other factors including carbon quality, water temperature, and competition with other functional groups, such as primary producers, for shared limiting resources. Bacteria directly compete with primary producers for these nutrients in both organic and inorganic forms in addition to responding to algal C substrates. Cole et al. (1988) concluded that bacterial production in the water column and in sediments is broadly predictable via the supply or standing stock of organic matter. Yet, competition experiments with algae and bacteria show that bacteria can out-compete algae for nutrients at low concentrations (Cole 1982, Currie and Kalff 1984, Cotner and Wetzel 1992). This has led many researchers to assume that bacteria will not be limited by inorganic nutrients *in situ* (e.g., Kirchman 1994). Nevertheless, nutrient limitation of bacteria has been found in a wide variety of aquatic habitats including wetlands, rivers, lakes, and marine habitats (Morris and Lewis 1992, Mohamed et al. 1998, Waiser 2001, Castillo et al. 2003, Kuosa and Kaartokallio 2003).

Within habitats with substantial allochthonous DOM sources, carbon bioavailability is also likely to influence the degree of bacterial mineralization or nutrient competition between bacteria and algae or among bacterial populations (Jarvinen and Salonen 1998, Bernhardt and Likens 2002). For example, algal carbon is very labile, consisting of amino acids, lipids, carbohydrates, and other compounds easily broken down and assimilated into bacterial biomass. Algal compounds are stoichiometrically similar to bacteria, while terrestrially-derived carbon has higher C:N and C:P ratios and is structurally more complex. These compounds require more or different extracellular enzymes to be broken down , particularly phenolics (Findlay 2003). The formation of enzymes is costly to bacteria, both energetically and in terms of N and P requirement. Thus, if the available carbon substrate is complex, bacteria may require inorganic nutrients to make the enzymes necessary to access non-algal carbon sources for energy, provided they possess such a capability (Hessen et al. 1994, Gasol et al. 2009).

Temperature is also limiting to bacteria (White et al. 1991, Panzenbock et al. 2000), and can interact with nutrient limitation. Bacterial response to nutrients has been linked to seasonal variations in temperature (Hall et al. 2009, Hoikkala et al. 2009) with degree of nutrient limitation varying with season and water temperature. Additionally, direct testing of temperature and nutrient effects often indicates co-limitation by these factors (Vrede 2005, Mindl et al. 2007, Sawstrom et al. 2007). Separating the effect of temperature and nutrients from their interactive effect is required to examine the relative effects of these drivers on bacterial activity and composition in natural habitats.

Pulsed nutrient supply can cause bacterial nutrient limitation due to the limited ability of bacteria to retain nutrients (Vadstein 2000). Nutrient pulses often occur during storm events. Storm events decouple temperature and nutrients as well as bring in carbon sources from upstream, making it difficult to predict bacterial response. During cold storm events, water temperatures are reduced but inputs of inorganic nutrients and terrestrially-derived DOM are elevated. Additionally, diurnal water temperature ranges at the study site in the Arctic vary at a magnitude similar to that found over the entire summer season. This high variability of temperature and nutrients diminishes the ability of bacteria to shift to optimal activity for a given resource supply. Examining the effects of temperature and nutrient pulses on the time scale of storm events may allow for a more mechanistic understanding of the interaction of temperature and nutrient limitation, rather than investigation at the seasonal scale used in previous studies.

Bacterial communities contain populations with different metabolic capabilities and thus different potential responses to changing temperature and nutrients. Shifts in community composition occur as populations change in dominance in response to different optimal conditions or differential mortality. For example, several investigators have found correlations between bacterial community composition and resource supply in natural habitats (Pearce 2005, Yannarell and Triplett 2005, Xing and Kong 2007). Previously rare populations can increase in size in response to a new substrate (Szabo et al. 2007) and the new community may have the capability to access different substrates and may have different nutrient requirements, affecting both community structure and function.

What has not yet been determined is the interaction of temperature and nutrients with bacterial community structure in natural habitats. Individually, warmer temperatures and increased nutrients are predicted to increase bacterial productivity and select for communities that can reproduce fastest under those conditions. However, in highly variable environments, bacterial communities would be constrained to a physiological response, particularly if temperature and nutrients select for different bacterial populations, resulting in static community composition. Laboratory manipulations of natural bacterial communities are used here to isolate the response of bacterial activity, growth rates, and community structure to temperature and pulsed nutrient supply.

Methods

Study site

Sites are located on the north slope of the Brooks Range, Alaska, at the Toolik Field Station Arctic LTER. Samples were collected from the inlet and outlet of lakes I-8 and Toolik. Toolik Lake is a multi-basin lake draining a catchment of 66.9 km^2 and has a single outlet. Two kilometers upstream of the main Toolik inlet stream is an 18 ha lake, Lake I-8, which has a large headwater stream inlet, I-8 inlet, and a single outlet, I-8 outlet (**Figure 3.1**) with average water temperatures of 9.4 and 12.3 °C, respectively, for summers 2003-2007. All of the lakes in the Toolik Lake catchment are oligotrophic, with mean primary productivity of 3.23 μmol C/L/day and mean chlorophyll *a* of 1.02 μg/L (Kling et al. 2000). Toolik Inlet water temperature ranges from 4.5 to ~19 °C during the summer season with a mean of 11.3 °C for 2003-2007 (Adams et al. In revision). There are frequently 2-3 storm events during the summer season, post snow-melt.

Field measurements

In order to detect patterns of bacterial response to nutrients and temperature variation *in situ*, bacterial production, DNA, temperature, and inorganic nutrients were sampled weekly at Toolik Inlet and Lake I-8 inlet and outlet from 2003-2006. Temperature was measured with a digital thermometer during sample collection. BP was measured using ^{14}C labeled-leucine uptake following Kirchman (1994) with an isotopic dilution of 1. Each measure was calculated from the incubation with ^{14}C leucine of three unfiltered 10 mL subsamples and one 10 mL trichloroacetic acid (TCA) killed control for approximately three hours before ending with 5% TCA. Samples were filtered onto 0.2 µm nitro-cellulose filters and extracted using ice-cold 5% TCA. Filters were then placed in scintillation vials, dissolved using ethylene glycol monoethyl ether, and Scintisafe scintillation cocktail was added before counting on a liquid scintillation counter (Packard Tri-Carb 2100TR). Stream discharge and temperature were monitored at Toolik Lake inlet using a Stevens PGIII Pulse Generator and a Campbell Scientific Model 247 conductivity and temperature probe connected to a Campbell Scientific CR510 datalogger. Inorganic nutrient samples were filtered through ashed (450 °C) GF/F Whatman filters upon collection and stored at 4 ºC (NH_4 and PO_4) or frozen (NO_3) until analysis. Ammonium concentrations were determined within 48 hours using a fluorometric OPA method (modified from (Holmes et al. 1999) and phosphate concentrations were determined within 48 hours spectrophotometrically using the molybdenum blue assay (Murphy and Riley 1962). Frozen nitrate samples were transported to Ann Arbor, Michigan, where they were analyzed on an Alpkem Flowsystem 3000 Autoanalyzer using flow injection with a cadmium reduction coil method modified from Armstrong et al. (1967).

Mesocosm experiments

Four experiments were conducted to test the impact of inorganic nutrients on bacterial production, growth rate, and community composition. Each experiment was a factorial design of manipulated temperature (12 and 17 °C) and nutrients with an inoculum of natural bacterial communities. Incubation temperatures were determined by summer mean and high water temperatures. The first experiment tested the response of bacteria to low level nutrient additions over a 4 day period, and the other three experiments tested the response of bacteria to higher concentrations of nutrients for up to two weeks. For all experiments, water was collected in the field and filtered into size fractions in the laboratory to exclude grazers and to isolate DOM source. Incubations were set up within 4 hours of collection with 10% 1.0 μm filtered water (bacterial inoculum) and 90% 0.2 μm filtered water (DOM source) collected concurrently. Mesocosms were kept in the dark to ensure exclusion of photosynthesis and were in incubators or water baths set to treatment temperature +/- 1 °C.

The "*short-term experiment*" was conducted on samples from Toolik Inlet, starting on 22 June 2007. Three replicates of each treatment had total starting volumes of 3.2 L in 4 L cubitainers with inorganic nutrients added at a concentration typically observed during a storm event (1.5 μM NH_4NO_3 and 0.25 μM KH_2PO_4, **Fig. 3.2**, **Appendix 3.A**). BP was measured in all replicates and treatments at approximately 0, 2, 4, 6, 8, 10, 14, 21, 26, 32, 39, and 49 hours, and BP was also measured in the 12 °C treatments at 60, 72, 83, and 98 hours. DNA and cell counts were collected at 26 and 49 hours with the 12 °C treatments also collected at 72 and 98 hours.

For the other three experiments, inorganic nutrients were added at a higher concentration (6.4 μM NH_4NO_3 and 0.45 μM KH_2PO_4) and the samples were incubated for longer time periods. The second experiment, the "*longer duration experiment,*" was performed at I-8 inlet with samples collected on 27 June 2006 in order to test the longer term response of the bacteria to temperature and nutrients. Three 3-L replicates of each treatment were incubated in 4 L cubitainers. BP was measured at 2, 4, 6, 9, 11, and 14 days, and samples for DNA and cell counts were collected at 2, 4, 9, and 14 days.

The third experiment included a "*DOM manipulation*" combining bacteria and 0.2 μm-filtered DOM from different sites to test for interactions of carbon source with temperature and nutrient limitation. This experiment was incubated for two weeks with a total volume of 1.25 L in 4L cubitainers. Water was collected from Lake I-8 inlet and outlet on 12 July 2005, with BP measured at 2, 4, 6, 9, 12, and 14 days while DNA and cell counts were measured from samples on day 14. DOM at I-8 inlet was characterized by DOM UV absorbance of 154.3, 705.5 μM DOC, 0.76 mg protein/L, 1.16 μM total phenolics, and 0.09 μg phaeophytin-corrected chl a/L. DOM at I-8 outlet was characterized by DOM UV absorbance of 98.93, 513.9 μM DOC, 0.57 mg protein/L, 0.65 μM total phenolics, and 0.77 μg phaeophytin-corrected chl a/L.

The fourth experiment examined "*community sensitivity*" and was performed on I-8 inlet and outlet water collected on 18 July 2006 to test if communities from different sites were similarly susceptible to temperature or nutrient manipulation. Temperature and nutrients again were manipulated factorially, with three 1 L replicates in acid-washed and 0.2 μm filtered sample rinsed amber HDPE Nalgene bottles for each treatment. DNA and cell counts were collected on day 6 and 11 of the incubations.

Samples for cell counts in all experiments were preserved with 2.5% final concentration of gluteraldehyde and stored at 4 °C until analysis. Samples from 2005 were counted on a FACSCalibur (BD Biosciences) flow cytometer following del Giorgio et al. (1996). Sub-samples were stained with SYBR green in the dark for a minimum of 15 minutes (Marie et al. 1997, Lebaron et al. 1998). The concentration of beads in the standard 1 μm bead solution and concentration of cells in multiple confirmatory samples were measured by epifluorescence microscopy. Samples from 2006 and 2007 were counted on a LSR II flow cytometer (BD Biosciences) as described by Ewart et al. (2008) with data acquired in log mode for at least 60 seconds and until 20,000 events were recorded, with the minimum green fluorescence (channel 200) set as the threshold.

DNA samples were collected from laboratory mesocosms by filtering ~500 mL of sample through a Sterivex-GP 0.2 µm filter. Filters were preserved using a DNA extraction buffer as described by Crump et al. (2003) and stored at -80 °C until extraction. DNA was extracted using a phenol-chloroform extraction, and PCR amplified using 357f with a G-C clamp and 519r universal 16S rDNA Bacterial primers on a Bio-Rad thermocycler (Crump et al. 2003, Crump et al. 2007). DNA was then separated using denaturant gradient gel electrophoresis (DGGE) with an 8% acrylamide gel cast with either a 40 to 60% or 35 to 55% gradient of urea and formamide. Standard lanes for standardizing within and between gels were created using a mixture of previously identified Toolik Lake clone isolates that were PCR amplified using the same primers (Crump et al. 2003). Gels were run on a Bio-rad system for 18 to 24 hours at 75 volts and 65 °C. Imaging was performed with Quantity One software on a Chemi-Doc gel documentation system (Bio-Rad), gel bands were identified using GelComparII software (Bionumerics) to create a presence-absence matrix as described by Crump and Hobbie (2005). Each band represents an operational taxonomic unit (OTU) of bacteria, although occasionally multiple sequences may be present within a band (Crump et al. 2003, Crump et al. 2004) or bacteria may differ in a more variable region of the 16S gene; therefore, changes detected here are considered to be a conservative index of shifts of community composition. Pairwise similarity values were calculated using the Dice equation (SPSS ver. 14, 15) in order to condense presence-absence data into percent community similarities between samples. PROXCAL (SPSS Categories, ver. 14 and 15) was used to create non-metric multi-dimensional scaling (NMDS) graphs of sample similarities. Two-way between-subjects ANOVA was performed using SPSS (ver. 14, 16, and 17). The percent similarity between samples was designated as the dependent variable with categorical dummy variables indicating the same or different treatment types of incubation temperature or nutrient addition as predictors. Both normal distribution of data and homogeneity of variance were verified using a Shapiro-Wilk test (SPSS ver. 17) with data log-transformed where necessary. Two data sets were not able to be transformed to have homogeneity of variance and so the non-parametric Kruskal-Wallace test (SPSS ver. 17) was performed to verify the significance of ANOVA results.

Results

Storm events, nutrients, and bacterial production

During the summer of 2004, there were three large storm events characterized by rain and subsequent increases in stream discharge (> 4 m^3/s) (**Fig. 3.2, top panel**). The events occurred on 9-15 July, 18-24 July, and 30 July- 7 August (two combined events). Ammonium concentrations at Toolik Inlet spiked either before or immediately after each of the three storm events, while phosphate concentrations increased only immediately after the first event and nitrate concentrations were diluted during these events (**Fig. 3.2, middle panel**). At Toolik Inlet, peaks in BP corresponded with the occurrence of the three storm events (**Fig. 3.2, bottom panel**). There was also a small increase of BP at the outlet of the lake after the first storm event. However, several environmental factors that may be driving these responses covaried, requiring direct testing with mesocosm experiments.

Mesocosms - activity

Several laboratory experiments were performed to determine bacterial response to increases in temperature and inorganic nutrients. The *short-term experiment* from Toolik Inlet showed increases in BP with temperature and nutrients, with warmer temperatures having the greatest impact after two days (**Fig. 3.3, top panel**). The largest treatment impact was the effect of temperature in the nutrient additions at 32 hours. In the 17 °C treatment, fertilized BP was 10.8 times greater than the fertilization at 12 °C. Similarly, the 17 °C treatment increased BP without a nutrient addition. After 26 hours, the 17 °C treatment had BP 9.8 times greater than the 12 °C treatment. The nutrient treatment increased BP in the 12 °C treatment to 6.1 times greater activity than the unfertilized 12 °C treatment at 84 hours. However, in the 17 °C treatment, the largest impact of nutrients was only 1.8-fold greater BP than the 12 °C treatment, at approximately 39 hours of incubation.

The number of bacterial cells in the *short-term experiment* also increased in response to temperature and nutrients. Cell counts increased roughly linearly or exponentially (**Fig. 3.3, middle panel**). Cell-specific leucine uptake also increased during the initial hours of the experiment, with increases detected earliest in the higher temperature treatments (**Fig. 3.3, bottom panel**). Maximum cell-specific leucine uptake was detected around 24-48 hours for the 17 °C treatments and 48-72 hours in the 12 °C, corresponding with peaks in BP.

When greater concentrations of nutrients were added in the *longer duration experiments* at the I-8 inlet and outlet, the initial response in BP (within two days) was greater in the nutrient treatments (**Figs. 3.4, 3.5**). Nutrient additions in the 17 °C treatment increased BP to seven times greater than the unfertilized 17 °C treatment after two days. There was a similar response in the 12 °C treatments, but it took four days for fertilized bacteria to reach seven fold greater BP than the unfertilized 12 °C treatment (**Fig. 3.4)**. In contrast to the *short-term experiment*, temperature had less impact over longer durations. The fertilized 17 °C treatment stimulated BP only 2.5 times greater than the fertilized 12 °C treatments and the unfertilized 17 °C treatment only increased BP 1.3 times greater than the unfertilized 12 °C treatment after two days. The difference in temperature effect may be due to community composition or other differences between the habitats used in the experiments.

Bacterial cell counts also increased during the *longer duration experiments*, and were much greater in incubations containing added nutrients regardless of temperature (**Fig. 3.4, middle panel**). Cell-specific leucine uptake decreased sharply in all incubations after two days while cell numbers increased, indicating that cell division predominated over individual cell growth (**Fig. 3.4**).

The initial increase of BP measured in treatments with warmer temperature and added nutrients occurred regardless of DOM source added to the inoculum (**Fig. 3.5**). By four days, the BP of nutrient treatments was similar regardless of incubation temperature in both the *DOM manipulation* and the *longer duration experiment*. In the *DOM manipulation* the greatest BP and cell counts were measured in the high temperature nutrient treatment after 14 days (**Fig. 3.6**).

Mesocosms - communities

Bacterial communities in the mesocosms shifted quickly in response to incubation temperature and nutrient addition. In the *short-term* experiment at Toolik Inlet, detectable shifts occurred within two days. Two-way ANOVAs of percent similarity between bacterial communities in different treatments indicate that both temperature and nutrient addition were statistically significant indicators of percent similarity by day two of the experiment, with greater similarity within treatments than between treatments (**Table 3.1**). Pairwise similarities ranged from 36.4% similarity to 100% similarity throughout the experiment, with an average similarity of 78.9% similarity for day 1, 71.3% similarity for day 2, with 75.6% and 70.8% for days 3 and 4.

In the other experiments, nutrient additions also impacted community composition. When nutrient addition and temperature manipulation was repeated at I-8 inlet with replication during the *longer duration* experiment, the replicates grouped by both nutrients and temperature on the NMDS for days 2, 4, and 9 (Day 2 in **Fig. 3.7**, **Appendix 3.B, top and middle panel**). By day 14, the communities still group by nutrients, but not as clearly by temperature (**Appendix 3.B, bottom panel**). Throughout the experiment both nutrients and temperature are statistically significant predictors of community similarity, but the interaction term of temperature and nutrients ceases to be significant on day 14 (**Table 3.2**). Percent similarity of communities between treatments ranged from 41.8 to 98% for the dates sampled with an average similarity of 77.6% at 2 days, 75.9% at 4 days, 61.7% at 9 days, and 65.8% at 14 days. For the *DOM manipulation* experiment, the starting community was the only statistically significant predictor of community similarity at the end of the experiment (**Table 3.3**) but nutrient addition was nearly significant at the 95% level ($p = 0.058$) and the interaction term between starting community and nutrient addition was statistically significant (p =

0.007). Communities ranged from 36.8 to 90.5% similarity, with a mean of 60.6% similarity between treatments.

To test if either community used in the DOM experiment was more sensitive to nutrients or temperature, the communities at I-8 inlet and outlet were again manipulated with temperature and inorganic nutrients without a manipulation of DOM source, and DNA was sampled at 6 and 11 days. For the *community sensitivity* experiment, a two-way ANOVA for the inlet community indicated that temperature and nutrients were both statistically significant predictors of the similarity of community composition, with no significant interaction terms (**Table 3.4**). A similar analysis of the outlet community similarities indicated that only nutrient addition was a significant predictor of community similarity between samples. For this experiment, community similarities of samples ranged from 27.6 to 100% with an average similarity of 63.8% for the inlet communities on day 6, 69.2% on day 11, 67.3% for outlet communities on day 6, and 62.3% on day 11.

Discussion

Storm Events

Changes in stream discharge, nutrient concentrations, and BP were all synchronous in response to storm events in 2004 at Toolik Inlet (**Fig. 3.2**). Water temperature was inversely related to stream discharge but did not appear to constrain bacterial response to substrate additions washed in from soil water at these temperatures. DOC also increased with peaks in discharge, but after an initial three-fold increase with the first event, concentrations later in the summer varied by only ~20% (**Appendix 3.C**). While bacteria could be sensitive to small variations in DOC supply, the large pulses of ammonium are readily available for bacterial uptake (Harder and Dijkhuizen 1983, Kirchman 1994). The ammonium could also enable the bacteria to access previously unavailable pools of carbon (Gasol et al. 2009). The covariance of discharge, nutrients, and DOC along with an inverse relationship with water temperature during the storm events makes it difficult to identify the main control of bacterial activity in natural systems, requiring the isolation of factors in experiments.

Mesocosms - activity

Both short and long term incubations of high and low nutrient additions indicate severe nutrient limitation of bacterial communities in the Toolik Lake region. Bacterial activity responded rapidly to added nutrients in all experiments. The nutrient treatment had a larger impact than temperature treatment in the high concentration additions. When fewer nutrients were added in the short-term experiment, higher incubation temperatures increased bacterial activity more quickly than did nutrients added at low concentrations. This indicates that nutrient concentrations at the upper range of those found in the environment are required to overcome the impacts of low temperatures on bacteria, with high nutrient treatments at different temperatures reaching similar magnitudes of activity during the incubations. This is in contrast with Vrede's (2005) finding that low temperatures superseded any other control, including P limitation. Temperature controlled the cellular response to added nutrients in all experiments, with higher temperatures increasing the speed at which activity increased. This is likely due to increased speed of biochemical reactions at warmer temperatures; increased response to nutrients at higher temperatures has been observed in other recent studies (Mindl et al. 2007, Sawstrom et al. 2007). The faster response to nutrients at higher temperature occurred regardless of sampling location, initial community composition, or DOM source.

Cell counts for all of the experiments mirrored the corresponding BP measurements in which treatment had the largest impact on activity. The faster uptake of leucine per cell at the warmer temperatures is not surprising as temperature increases biological reactions, and increased growth with increased temperature has been documented in many systems (White et al. 1991, Adams et al. In revision). In contrast, when greater amounts of nutrients were added in the *longer duration* experiment, nutrient treatments resulted in both greater cell counts and higher cell-specific leucine uptake. The cell-specific uptake was particularly high two days into the experiment and rapidly declined afterwards, but cell counts spiked at four days; this sequence suggests that the bacteria reproduced after the initial physiological response to a pulse of nutrients.

Elevated cell-specific leucine uptake in nutrient treatments suggests elongation or growth in size of cells. Bacteria differ in size and shape by community and by growth stage (Lebaron et al. 2002). When nutrients are present, bacteria can delay cell division to take advantage of the resources and increase in size (Shiomi and Margolin 2007). This interpretation is supported by microscopic observations in our experiments which indicated a large number of long, filamentous bacteria in the nutrient addition treatments. It would appear that when large amounts of inorganic nutrients were added, both growth and reproduction of the filamentous portion of the bacterial community were stimulated, regardless of incubation temperature. The nitrate and phosphate concentrations added in these experiments are on the high end of the range of concentrations measured in the field but NH_4 was added at much higher concentrations. This may have preferentially stimulated nitrifying bacteria that are capable of ammonia oxidation such as *Nitrosomonas* or *Nitrosococcus* in addition to the observed filamentous forms. The active fraction of a community can shift in response to nutrients (Van Wambeke et al. 2009) and stimulation of growth in only a subset of the community was reflected in the DGGE profiles of the experiments through shifts in community composition.

Mesocosms – communities

The fast response of bacteria to nutrient inputs was observed also in community dynamics. Both incubation temperature and nutrient addition changed community structure in as little as two days (**Tables 3.1, 3.2, Fig. 3.7**). This shift in structure also continued for the duration of the longer term experiments at I-8 inlet (**Tables 3.2 and 3.4**). At some sites nutrients may be a stronger driver of community structure than temperature. Temperature was not a statistically significant predictor of community similarity when community and DOM source were manipulated along with temperature and nutrients (**Table 3.3**). The results from the DOM manipulation experiment led to the prediction that bacterial communities at I-8 inlet and outlet would respond differentially to temperature and nutrients. I-8 inlet communities were predicted to respond to nutrients more than temperature because the site usually has low nutrients and relatively large amounts of terrestrial carbon inputs in addition to more variable temperature. The bacterial communities at I-8 outlet were predicted to respond to water temperature but not nutrients because the site is less than two meters downstream of the lake where higher nutrient concentrations and algal carbon are found along with more consistent water temperature. The *community sensitivity* experiment indicated that both predictions were incorrect (**Table 3.4**). The communities from I-8 inlet responded to both temperature and nutrient additions consistently in both the *community sensitivity* and *longer duration* experiments, while the I-8 outlet community responded to nutrients but not to temperature. Bertoni et al. (2008) also found community specific shifts in response to nutrient additions which may have reflected the *in situ* temperatures of different seasons. The different response of communities at the I-8 inlet and outlet to nutrient addition supports the hypothesis of community-specific nutrient limitation, but also suggests that natural site variability of temperature and nutrient concentrations are poor predictors of stability of community composition. Community-specific responses to temperature and nutrients are not limited to BP and cell counts, but also influence the stability of the community itself through population level competition.

In the natural environment, competition for nutrients occurs not only between bacterial populations but also with algae, especially for phosphorus. Given a pulse of NH_4 or PO_4 in a large run-off event, heterotrophic bacteria may be inferior competitors to phytoplankton due to a smaller storage capacity (Kirchman 1994, Vadstein 2000). Under conditions of uniform or moderately transient PO_4 supply, heterotrophic bacteria should be the best competitors for PO_4, followed by green algae, and then cyanobacteria (Vadstein 2000). The ability to store nutrients appears to be the most important factor in the outcome of competition; therefore, bacteria are expected to be more limited under conditions of pulsed nutrient supply. However, bacteria can also respond to algal exudates from increased primary production resulting from pulsed nutrient inputs. For example, at Toolik Lake in the summer of 2004, several pulses of BP occurred in the epilimnion; some pulses corresponded with inflowing nutrients from storm events and others followed the algal response to storm events (Evans et al. In prep.).

Water temperature also impacts bacterial response to nutrients, particularly when these two factors are decoupled during storm events. As observed during the mesocosm experiments, colder temperatures can delay or diminish bacterial response to pulsed inorganic nutrients and changing water temperature can shift bacterial communities to different populations than those stimulated by inorganic nutrients. Hall et al. (2009) also suggest that the bacterial response to temperature and nutrients changes seasonally, with summer and winter communities having different nutrient efficiencies relative to water temperature with warm adapted summer communities increasing nutrient use efficiency with warmer temperatures and the opposite pattern in winter communities. The interaction between temperature and response to nutrients must be accounted for when considering the impact of nutrient limitation and storm events on bacterial communities and the rest of the food web.

Conclusions

Aquatic bacteria in Northern Alaska can be nutrient limited, as predicted by the theory that large amounts of allochthonous carbon entering oligotrophic lakes and streams requires more nutrients for enzyme formation. Inorganic nutrient additions and increased temperature both increased bacterial productivity and growth rates rapidly, and habitat-specific shifts in community composition occurred within two days. This fast response of bacteria was also observed in the field following storm events during which discharge, ammonium, and BP peaked synchronously. Bacterial communities in these habitats can respond rapidly to nutrient pulses, particularly at higher temperatures, highlighting the importance of both temperature and community composition to the nutrient limitation of bacteria.

Acknowledgements

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Tables

Table 3.1. Tests of between-subjects effects for the impact of incubation temperature and nutrient addition on the % similarity of bacterial community composition between samples in the *short-term* experiment. Days 3 and 4 are for low temperature treatments only. *Kruskal-Wallace test confirms non-significance with .907 for temperature and .969 for nutrients.

Dependent Variable: Community Similarity

Source	df	Sig.			
		1 day	2 days	3 days	4 days
Corrected Model	3	.051	.000	.001	.020
Intercept	1	.000	.000	.000	.000
Temperature	1	.437*	.002		
Nutrients	1	.747*	.001	.001	.020
Temperature * Nutrients	1	.006	.163		
		df			
Error		62	62	13	13
Total		66	66	15	15
Corrected Total		65	65	14	14

R Squared = .12 (Adjusted R Squared = .08) 1 day
R Squared = .25 (Adjusted R Squared = .21) 2 days
R Squared = .59 (Adjusted R Squared = .56) 3 days
R Squared = .35 (Adjusted R Squared = .30) 4 days

Table 3.2. Tests of between-subjects effects for similarity of bacterial community composition in the longer duration experiment at I-8 inlet.

Dependent Variable: Community Similarity

Source	df	Sig.			
		2 days	4 days	9 days	14 days
Corrected Model	3	.000	.000	.000	.000
Intercept	1	.000	.000	.000	.000
Temperature	1	.000	.022	.000	.002
Nutrients	1	.000	.000	.000	.000
Temperature * Nutrients	1	.001	.001	.003	.210
Error	62				
Total	66				
Corrected Total	65				

R Squared = .63 (Adjusted R Squared = .61) 2 days
R Squared = .62 (Adjusted R Squared = .60) 4 days
R Squared = .53 (Adjusted R Squared = .51) 9 days
R Squared = .41 (Adjusted R Squared = .38) 14 days

Table 3.3. Test of between-subjects effects for similarity of bacterial community composition from day 14 of DOM manipulation experiment.

Dependent Variable: Community Similarity

Source	df	Sig.
Corrected Model	14	0.008
Intercept	1	0.000
Starting community	1	0.000
DOM source	1	0.813
Temperature	1	0.182
Nutrients	1	0.058
Starting community * Nutrients	1	0.007
Error	105	
Total	120	
Corrected Total	119	

R Squared = .24 (Adjusted R Squared = .14)

Table 3.4. Tests of between-subjects effects for DNA from community sensitivity experiment performed at I-8 inlet and outlet. *Kruskal-Wallace test confirms significance with .619 for temperature and .000 for nutrients.

Dependent Variable: Community Similarity

Source	df	Sig.			
		Inlet, 6 days	Outlet, 6 days	Inlet, 11 days	Outlet, 11 days
Corrected Model	3	.000	.000	.000	.049
Intercept	1	.000	.000	.000	.000
Temperature	1	.000	.217*	.001	.088
Nutrients	1	.000	.000*	.000	.037
Temperature * Nutrients	1	.505	.622	.163	.097
		df			
Error		51	42	62	41
Total		55	46	66	45
Corrected Total		54	45	65	44

R Squared = .44 (Adjusted R Squared = .41) Inlet 6 days
R Squared = .66 (Adjusted R Squared = .64) Outlet 6 days
R Squared = .49 (Adjusted R Squared = .46) Inlet 11 days
R Squared = .18 (Adjusted R Squared = .12) Outlet 11 days

Figures

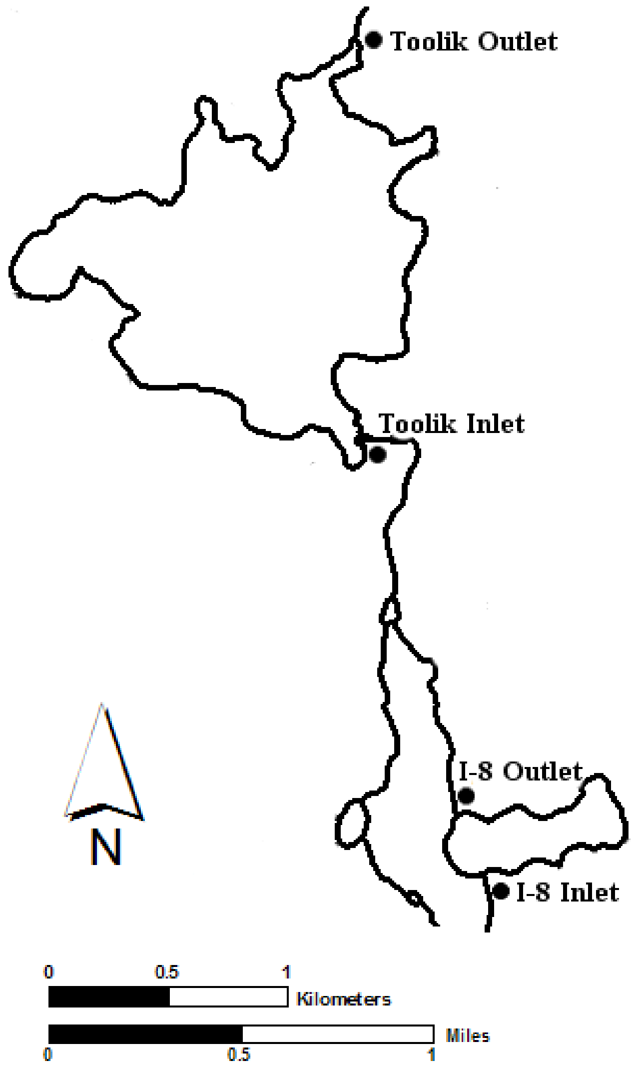


Figure 3.1. Sampling locations at Lake I-8 and Toolik Lake, Alaska.

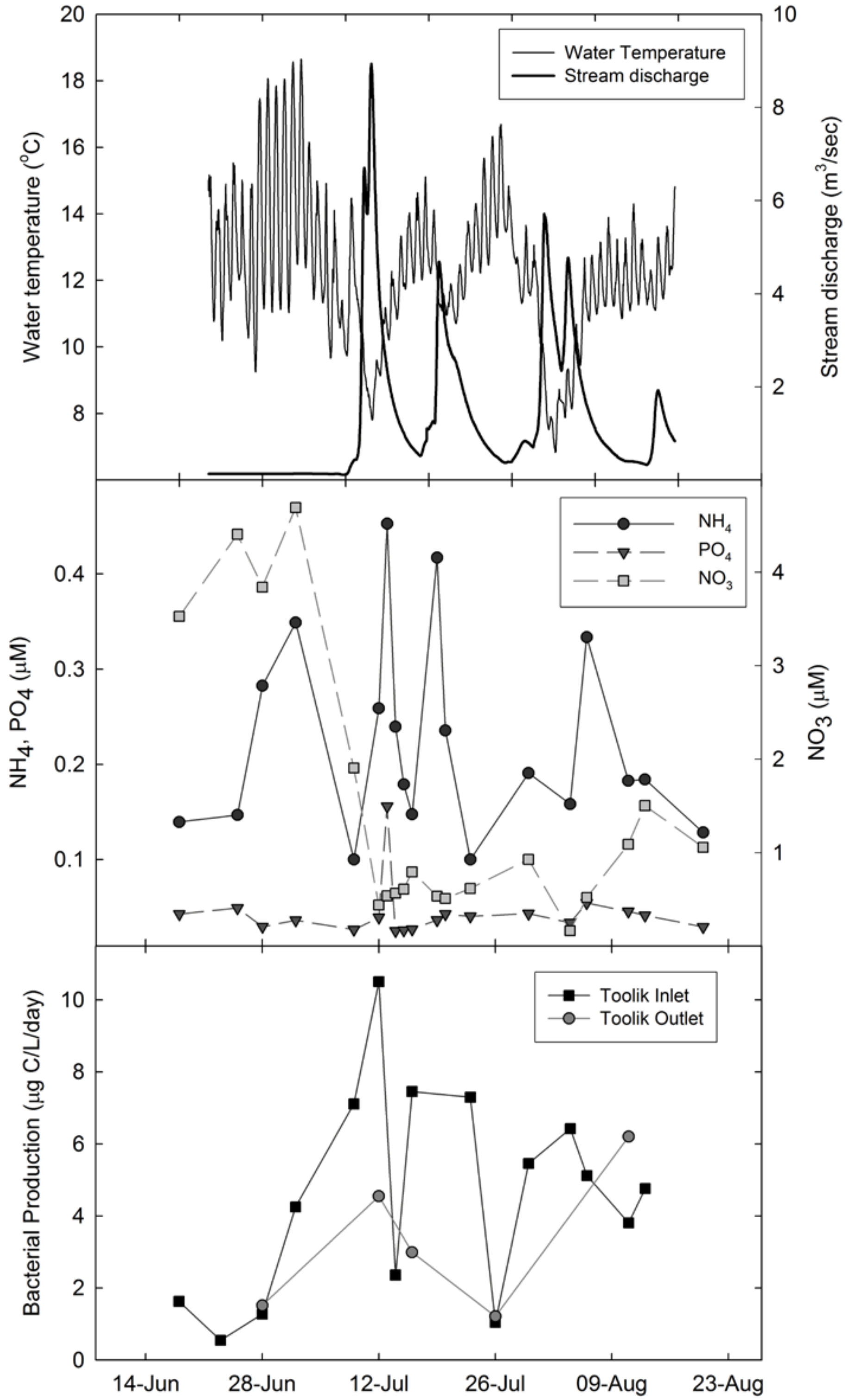


Figure 3.2. Toolik Inlet stream during summer 2004. Top panel: Temperature (thin line) and stream discharge (thick line); center panel: NH_4 (●), PO_4 (▾), and NO_3 (■); bottom panel: BP at Toolik Inlet (■) and Outlet (●).

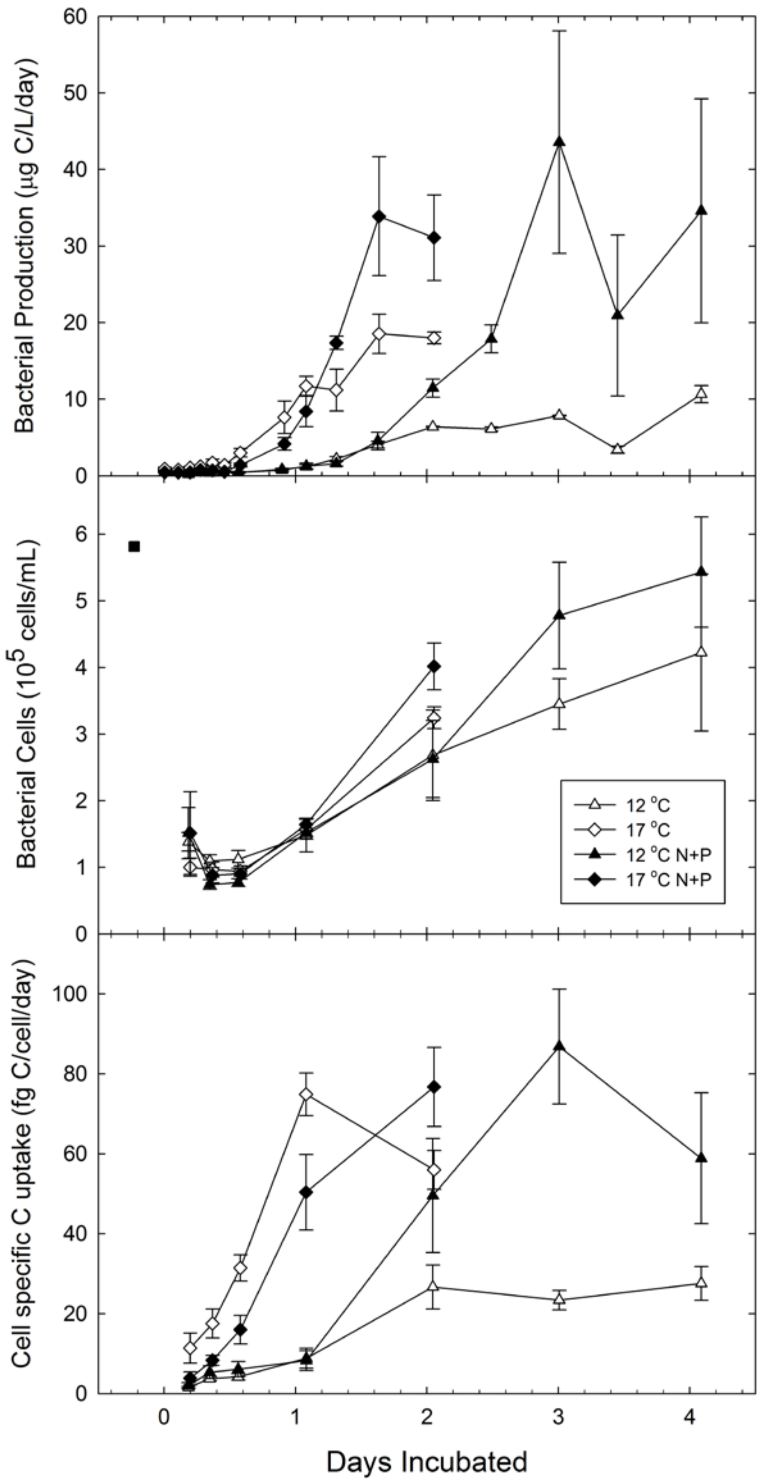


Figure 3.3. Toolik Inlet BP and cell counts from the short-term experiment. Error bars are standard error of the mean. Original sample from Toolik Inlet designated by ■ for number of cells. Top panel: bacterial production, middle panel: cell counts, and bottom panel: cell specific carbon uptake.

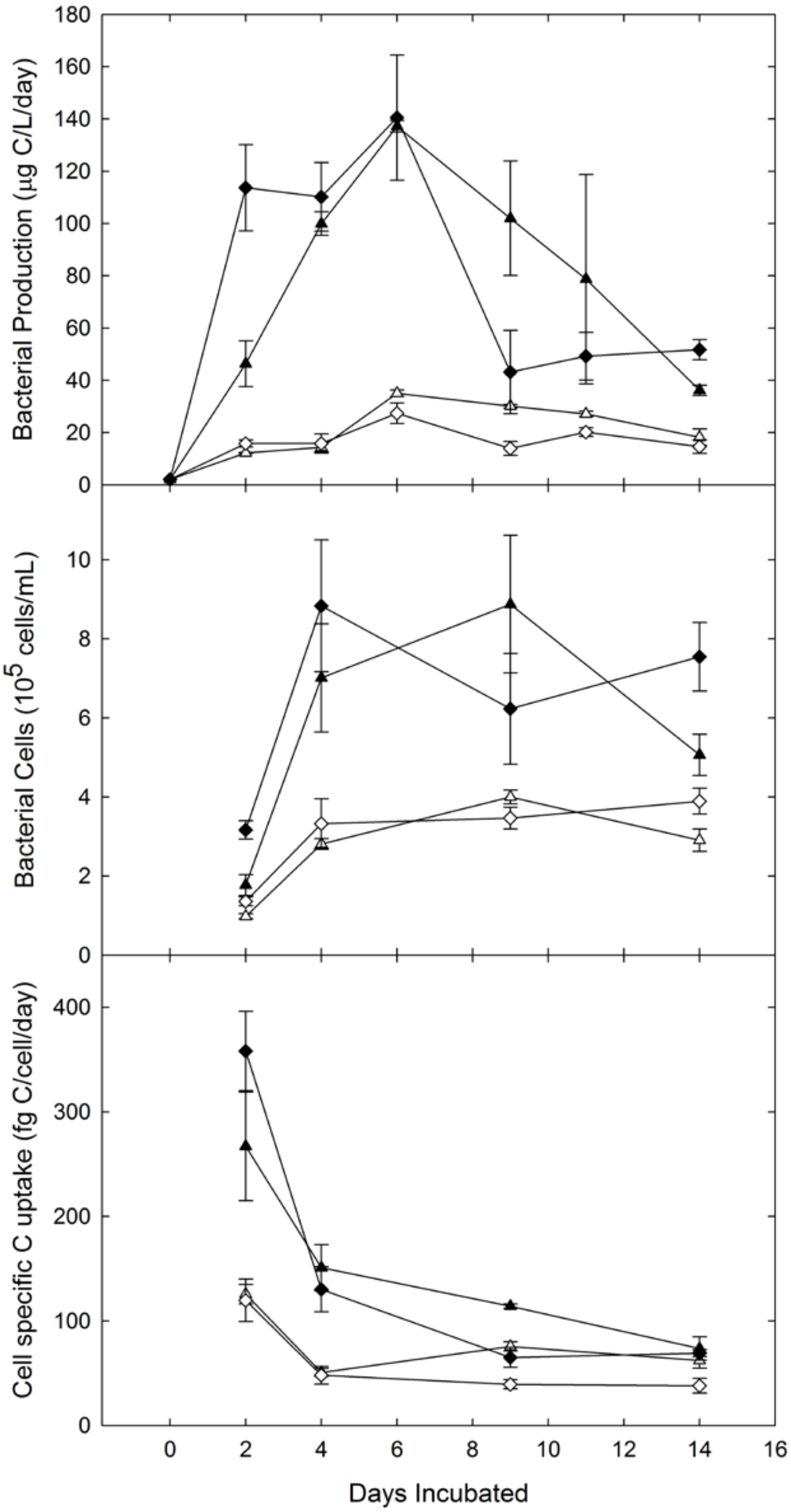


Figure 3.4. Longer duration two week nutrient addition with replication at I-8 inlet. Error bars are standard error of the mean of experimental replicates. Samples are designated by incubation temperature (▲ = 12 °C and ♦ = 17 °C) with open symbols for no nutrients added and closed symbols for nutrients added. Top panel: bacterial production, middle panel: cell counts, bottom panel: cell specific leucine uptake.

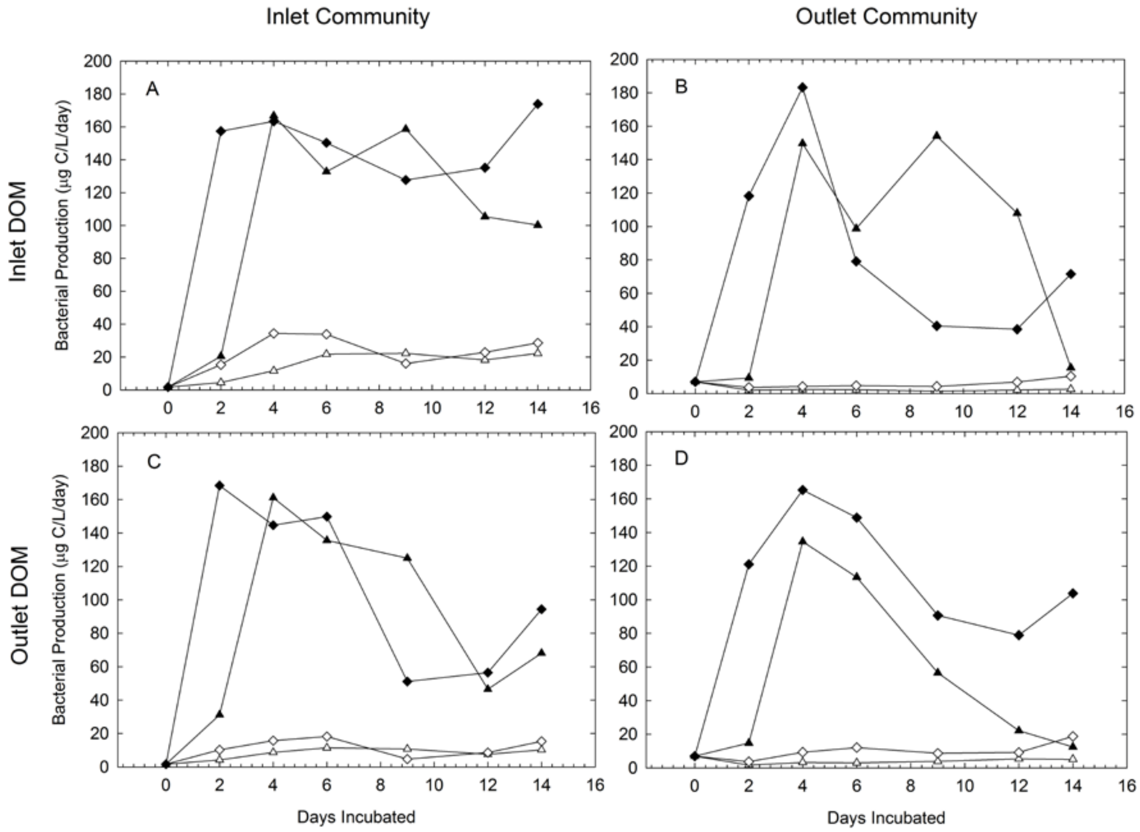


Figure 3.5. BP from the DOM manipulation experiment. 12 °C (▲) and 17 °C (♦) have open symbols to designate no nutrients added and closed symbols designate nutrient addition. Panel A is I-8 inlet community and DOM source, panel B is I-8 outlet community and DOM source, panel C is I-8 inlet community with outlet DOM source, panel D is I-8 outlet community with inlet DOM source. Error bars are standard error of the mean calculated from analytical replicates.

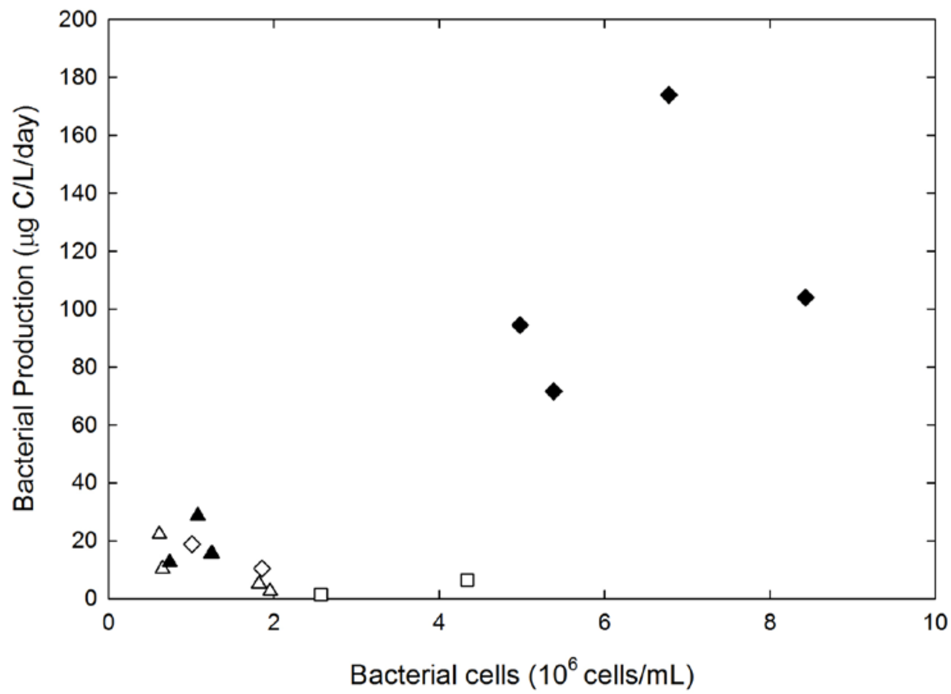


Figure 3.6. Bacterial cell counts versus BP at Day 14 of DOM manipulation experiment. Cell counts collected from original collection sites are designated by ■. Treatments are designated by incubation temperature (▲ = 12 °C and ♦ = 17 °C) with open symbols for no nutrients added and closed symbols for nutrients added. Symbols are grouped with respect to DOM source added.

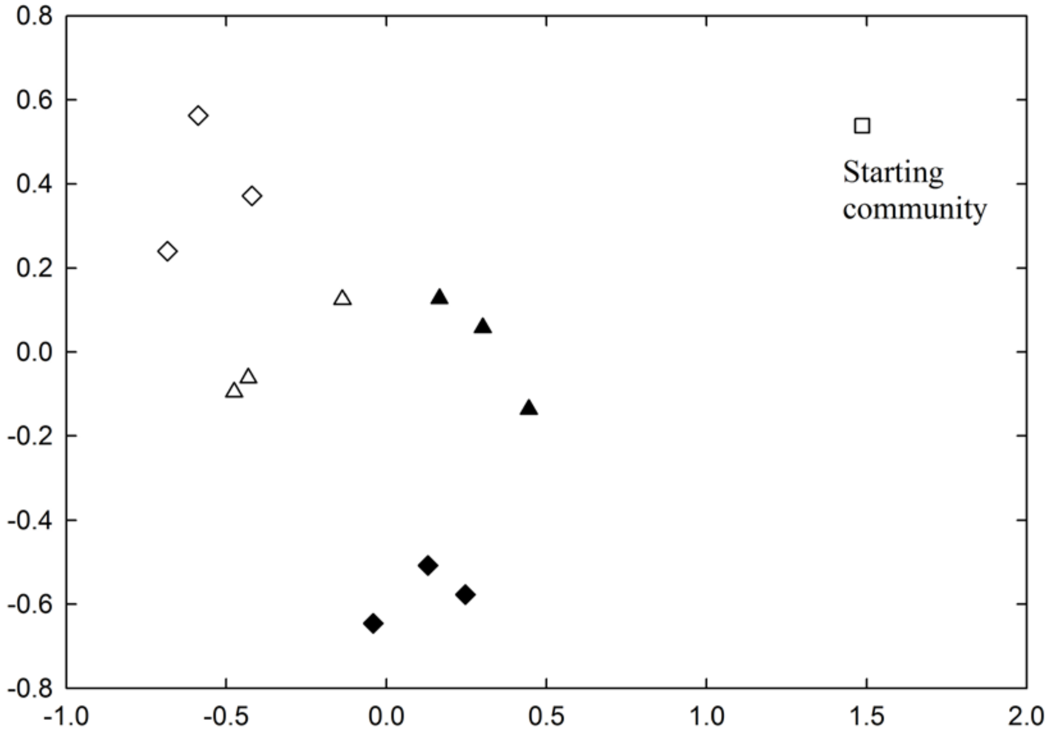
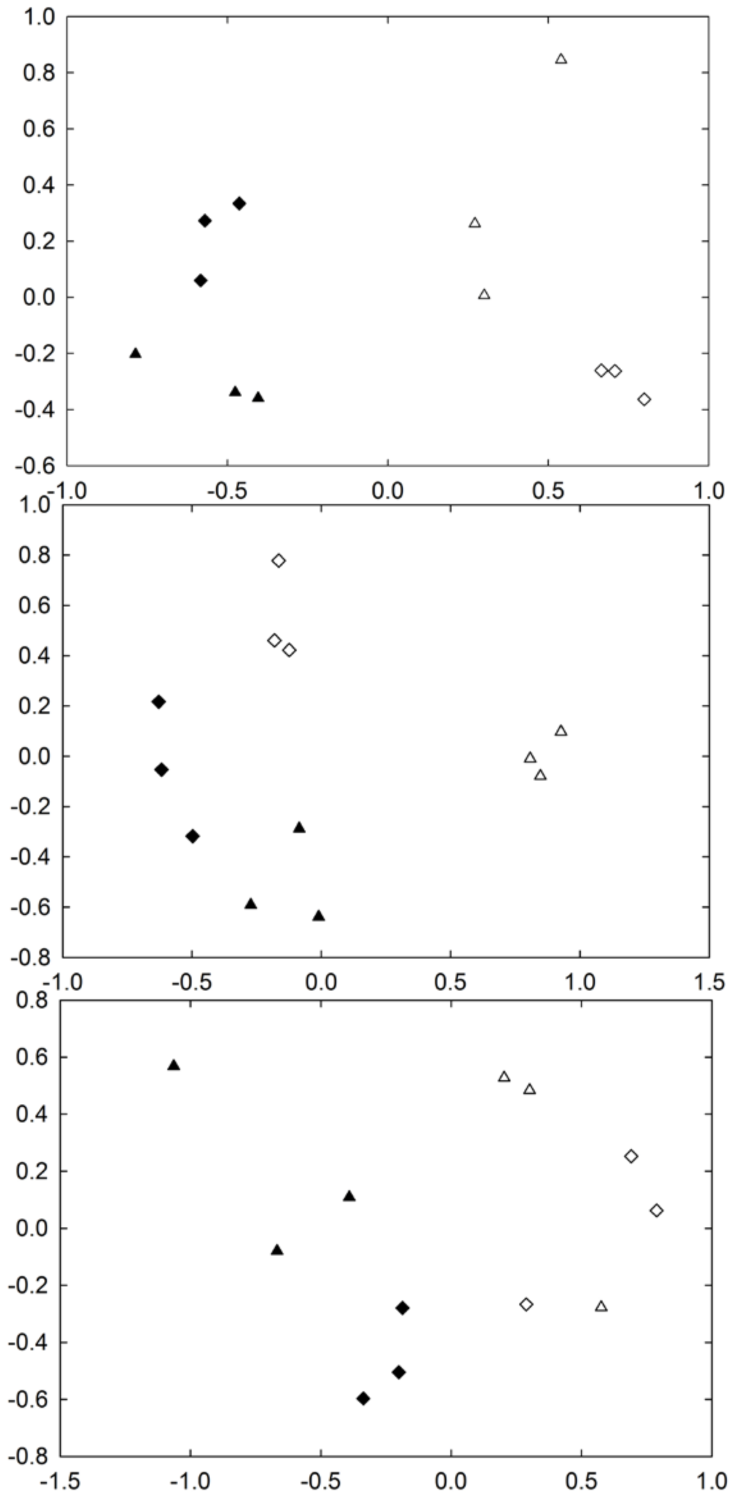


Figure 3.7. NMDS plot of community similarity on collection (day 0) and day 2 for the *short-term* experiment in Figure 3.4. DNA collected from collection site is designated by □. Treatments are designated by incubation temperature (▲ = 12 °C and ♦ = 17 °C) with open symbols for no nutrients added and closed symbols for nutrients added shown here after 2 days incubation, normalized raw stress = 0.017.

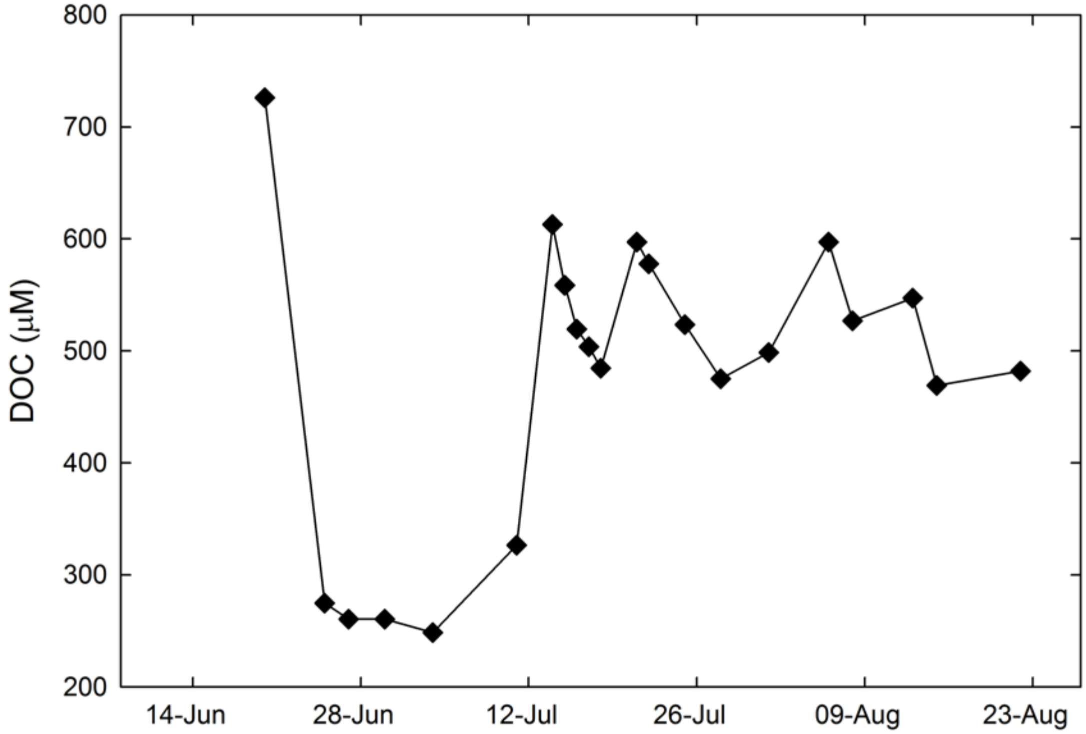
Appendices

Appendix 3.A. Inorganic nutrient concentrations in summers 2003-2007.

site	year	NH4 (μM) min	NH4 (μM) mean	NH4 (μM) max	NO3 (μM) min	NO3 (μM) mean	NO3 (μM) max	PO4 (μM) min	PO4 (μM) mean	PO4 (μM) max
I-8 inlet	2003	0.00	0.41	1.98	0.31	0.88	2.14	0.01	0.07	0.24
	2004	0.01	0.20	0.54	0.27	2.37	5.94	0.02	0.03	0.05
	2005	0.10	0.26	0.65	0.79	4.33	8.55	0.00	0.04	0.07
	2006	0.00	0.23	0.53	0.80	1.75	2.94	0.03	0.05	0.11
	2007	0.00	0.60	3.89	0.95	8.77	19.00	0.02	0.07	0.26
I-8 outlet	2003	0.00	0.24	1.52	0.03	0.26	0.73	0.02	0.07	0.33
	2004	0.12	0.27	0.67	0.12	0.33	0.97	0.02	0.03	0.04
	2005	0.12	0.31	0.49	0.00	0.30	0.70	0.00	0.04	0.06
	2006	0.00	0.16	1.06	0.03	0.25	0.68	0.02	0.04	0.10
	2007	0.00	0.30	0.73	0.07	0.17	0.46	0.03	0.05	0.10
Toolik Inlet	2003	0.00	0.16	0.54	0.41	1.01	3.07	0.01	0.04	0.13
	2004	0.04	0.48	2.42	0.16	1.39	5.33	0.02	0.04	0.16
	2005	0.10	0.16	0.26	0.63	4.44	8.51	0.00	0.08	0.59
	2006	0.00	0.73	3.46	0.15	0.62	1.58	0.02	0.04	0.13
	2007	0.00	0.40	3.04	0.42	3.31	8.62	0.00	0.05	0.20
Toolik Outlet	2004	0.05	0.21	0.66	0.00	0.04	0.16	0.02	0.04	0.10



Appendix 3.B. NMDS for days 4, 9, 14 of longer duration experiment. Top panel is at four days with normalized raw stress = 0.008. Middle panel is at nine days with normalized raw stress = 0.016. Bottom panel is at fourteen days with normalized raw stress = 0.032. Treatments are designated by incubation temperature (▲ = 12 °C and ♦ = 17 °C) with open symbols for no nutrients added and closed symbols for nutrients added.



Appendix 3.C. DOC chemograph of Toolik Inlet in the summer of 2004.

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CHAPTER IV

Metacommunity dynamics of bacteria

Abstract

Metacommunity processes of species sorting and mass effects were investigated at the inlets and outlet of a small 18 ha lake in Northern Alaska. Bacterial communities were generally more stable over time in the lake and lake outlet as measured by high similarity of DNA fingerprinting during the summer season. Outlet and downstream communities were also generally more productive than those in the main lake inlet as measured by ^{14}C-labelled leucine incorporation. Transplant experiments were performed using dialysis tubing to test if inlet bacteria were viable in the lake outlet habitat. All transplants resulted in inlet bacteria maintaining or increasing their productivity at the outlet habitat. Despite the apparent habitat suitability, low similarity of community composition between inlet and outlet communities indicates that either the inlet bacteria are dispersal limited by sequestration in bottom waters or dilution upon entering the lake, or the majority are outcompeted by populations resident in the lake. Transplanting the outlet bacterial community to the headwater stream inlet resulted in depressed productivity, regardless of different environmental conditions in either early or late summer season. This indicates that the bacterial communities that come to dominance

within the lake are less adapted to processing upstream carbon. A spatial survey of the lake and small inlets showed that all inlet communities clustered apart from the lake and outlet communities in a multidimensional plot of community similarity, suggesting that lake communities are distinct from the inlets and well mixed within the lake. The highest community similarity between inlet and outlet bacteria was measured after a very large rain event in 2003, with over 61% similarity (average non-storm similarities were 39%, ± 8%). While mass effects may be important during storm events, species sorting by competition between stream inlet and lake populations appears to be the predominant mechanism structuring bacterial communities within the lake.

Introduction

Because many of the same processes structure plant, animal, and bacterial communities, metacommunity concepts can be applied to explain bacterial community patterns across landscapes. Both dispersal and competition, two mechanisms integral to metacommunity theory, impact the presence and dominance of populations within the community. In aquatic systems, bacterial communities can be dispersed in water that flows from terrestrial soils into lakes and streams, resulting in a mixture of communities and resources that may favor certain populations or alter overall community growth. Dormant and slow-growing bacterial cells can become active when their preferred carbon resource appears, and previously active cells may then be at a competitive disadvantage given the new mix of substrates.

Metacommunity theory contains four main perspectives which include mechanisms that act alone or interact within a habitat: patch dynamics, species sorting, mass effects, and neutral processes (Leibold et al. 2004). The patch dynamic perspective defines habitat patches as identical with local species diversity limited by dispersal or species interactions and requires trade-offs in species traits for regional co-existence to occur (Mouquet et al. 2005). The species sorting perspective emphasizes spatial niche separation where low levels of dispersal allow communities to respond to local conditions (Leibold and Wilbur 1992). Mass effects are in contrast to species sorting; inferior competitors can persist in the community due to high levels of dispersal from other habitats (Urban 2004). The fourth perspective is neutral theory, which is usually applied to long-lived organisms where competitive exclusion happens on very long time scales and species are equivalent in traits such as dispersal and reproduction (Harte et al. 2005). Mass effects and species sorting are the two perspectives most easily applied to bacterial communities in aquatic habitats because bacteria have potentially high rates of immigration and emigration due to dispersal in water flow (Lindstrom and Bergstrom 2004), the environment is very heterogeneous, especially at the microbial scale (Scheffer et al. 2003), the communities can shift at very fast time scales (Judd et al. 2006, Van der Gucht et al. 2007), and bacterial populations differ in their growth rates and metabolic capabilities (Amon and Benner 1996, LaPara et al. 2002, Bertoni et al. 2008, Adams et al. In revision).

Time scale may influence whether mass effects or species sorting is most important in structuring the bacterial community. In lake catchments, the main mode of bacterial dispersal is unidirectional in downstream water flow of variable velocity from upstream soils, hyporheic zones, streams, and lakes, although atmospheric deposition can also disperse bacteria (Jones and McMahon 2009). Cells entrained in flowing water rely on the physical mixing of inflowing water within the new habitat to reach suitable resources which may or may not have flowed in with their source water. In order for bacteria to establish in a new habitat, they must have a sufficient growth rate to both compete with other populations for resources as well as exceed passive emigration due to water flow through a habitat. Alternatively, new members can continually flush in from the upstream habitat. The physiological response of bacteria to new environmental conditions can be quite fast. For example, productivity can respond to changes in temperature within a couple of hours (Kirchman et al. 2005, Bertoni et al. 2008, Adams et al. In revision). Physiological responses may result from temporary responses by populations in the community, whereas community shifts due to species sorting may take longer than the bacterial populations remain in a habitat, particularly during a storm event with high water flow.

The mechanisms of community structuring at work in these habitats have consequences for processing of carbon and other resources across the landscape. Bacterial response to temperature and nutrient limiting conditions may be specific to the community assemblage present at a given time. For example, soil bacterial populations are transported into aquatic systems along with dissolved organic matter. Transported soil populations would mix in the streams, forming a new community which is likely to contain bacteria that are accustomed to processing the allochthonous carbon. However, resident lake communities may not be able to process terrestrial carbon due to a lack of enzymes that function to break down structural carbon. Judd et al. (2006) have shown that substrate "quality" depends on the community composition and its ability to process particular substrates. Compositional shifts of the community will occur in response to the new and different substrates, given enough time. Lake communities are also flushed downstream into new habitats, and Crump et al. (2007) have shown a gradient of decreasing similarity in community structure with movement downstream. However, the implications of this shift in community composition on processing of carbon or other resources are not well known.

In aquatic ecosystems, the persistence of new bacterial populations which immigrate via water inputs will depend on both their ability to outcompete pre-existing populations and the intensity of dispersal into and out of the habitat. Bacterial populations that are best adapted to specific environmental conditions should dominate in habitats with those conditions if competition (species sorting) is the dominant mechanism structuring the community. Thus, when dispersal is low and species sorting dominates, community composition should be dissimilar in habitats with different environmental conditions. However, if dispersal is high and different habitats are linked hydrologically, then mass effects will produce greater similarity in community composition between habitats.

In this chapter I examine the natural variability of habitats and bacterial communities upstream and downstream of a small arctic lake, and determine the role of mass effects and species sorting processes in structuring bacterial communities. Four main questions guide the investigation. First, how do lakes impact habitat characteristics and bacterial communities? This is answered by comparing habitats upstream and downstream of a lake and determining the similarity of communities in these habitats when dispersal is low. Second, can inlet bacteria be active in the outlet (lake) habitat when competition with lake communities is removed? This is tested by transplant experiments using dialysis bags to determine whether mass effects would enable the persistence of inlet bacteria in the outlet habitat. Third, do outlet communities adapted to lake DOM retain the ability to process upstream DOM, or has species sorting resulted in the loss of most bacterial populations with this ability? Lastly, how are bacteria entering in stream flow distributed in the lake? I used transects measuring environmental characteristics and bacterial communities to address this question.

Methods

Study site

Sites are located on the north slope of the Brooks Range, Alaska, at the Arctic LTER. Samples were collected from upstream, downstream, and within Lake I-8, which is located two kilometers upstream of Toolik Lake. Lake I-8 is 18.21 ha in area with a volume of 642,462 m^3 and drains a catchment of 2910.3 ha. It is oligotrophic, with mean primary productivity of 1.45 μmol C/L/day and mean chlorophyll *a* of 0.92 μg/L (Kling et al. 2000). Lake I-8 has a predominant headwater inlet stream, sampled ~5 km upstream of the lake at the site I-8 HW, as well as at the inflow to the lake at site I-8 inlet. There are three smaller inlet streams, (I-8 NE inlet, I-8 SE inlet, and I-8 S inlet) which also flow into the lake, and a single outlet named I-8 outlet. Site I8-I9 is one km downstream of the lake outlet (**Fig. 4.1**). Water temperatures ranged from 3.3 to 18 °C and averaged 10.5 °C for summers 2003-2007 at I-8 inlet, and ranged from 5.8 to 18.4 °C and averaged 12.9 °C at I-8 outlet. There are frequently 2-3 storm events during the summer season, post snow-melt.

Field measurements

Bacterial production, bacterial community composition, temperature, and DOM were sampled weekly at Lake I-8 inlet, I-8 outlet, and at site I8-I9 in the summers of 2003-2007 (**Fig. 4.1a**). The smaller inlets to the lake were also sampled weekly during the summer of 2007. I-8 HW and the lake itself were sampled three times every summer, with weekly sampling of the lake occurring during the summer of 2003 and a more intense spatial sampling at 8 sites across the lake on 4 July 2007 (**Fig. 4.1b**). Stream water samples were collected from mid-stream while avoiding disturbance of bottom surfaces. Lake samples were collected using a Van Dorn, typically at the depths of 1 m (epilimnion) and 7 m (hypolimnion). Temperature was measured with a digital thermometer during sample collection. Conductivity was measured with a model 122 Orion conductivity meter and pH was measured with a model 210A Orion pH meter which was calibrated daily. Stream discharge and temperature were monitored at the sites using dataloggers (Onset StowAways and Hobos) as well as a Marsh-McBirney Flowmate discharge meter. Water residence time (WRT) of the lake was calculated by dividing the lake volume by the mean outlet stream discharge. Epilimnetic WRT was calculated using the lake volume less than 3m, the mean thermocline depth during the summer season. Time series temperature measurements in 2003 were obtained from the I-8 W station with seven Brancker TR 1050 self-contained temperature loggers (thermistors) at depths from 0 to 6 m. Isotherm depths were determined by linear interpolation of readings taken every 15 minutes. The thermistors had an accuracy of 0.002 °C and a time constant of <3 seconds.

Bacterial Production (BP) was measured using ^{14}C labeled-leucine uptake following Kirchman (1992) with an isotopic dilution of 1. Each measure was calculated from incubation with ^{14}C leucine of three unfiltered 10 mL subsamples and one 10 mL trichloroacetic acid (TCA) killed control for approximately three hours before ending by adding TCA to a final concentration of 5% in the sample. Samples were filtered onto 0.2 µm nitro-cellulose filters and extracted using 5 mL of ice-cold 5% TCA. Filters were then dissolved in scintillation vials using ethylene glycol monoethyl ether, and had Scintisafe scintillation cocktail added for counting on a liquid scintillation counter (Packard Tri-Carb 2100TR).

Dissolved organic matter (DOM) samples were filtered in the field through ashed GF/F Whatman filters and stored at 4 ºC until analysis. Protein concentrations were determined within 48 hours using a colorimetric Bradford reagent assay (as modified by Judd 2002) and phenolic concentrations were determined within 48 hours spectrophotometrically using the Folin-Ciocalteu assay (Waterman and Mole 1994). DOC samples were acidified to pH 2 after filtration, and stored in the dark at 4 °C until analysis on a Shimadzu TOC 5000 using platinum-catalyzed high-temperature combustion to CO_2 followed by infrared detection. The chlorophyll *a* (chl) samples were filtered onto Whatman GF/F filters in the field and kept dark until frozen upon returning from the field. After overnight freezing at ~20 °C, filters were extracted for 24 hrs with acetone, read on a Turner Designs 10 AU fluorometer configured with a chlorophyll optical kit (10-037R), and corrected for phaeopigment using acidification with HCl.

Samples for cell counts were preserved with 2.5% final concentration of gluteraldehyde and stored at 4 °C until analysis. Samples from 2005 were counted on a FACSCalibur (BD Biosciences) flow cytometer following del Giorgio et al. (1996). Sub-samples were stained with SYBR green nucleic acid stain in the dark for a minimum of

15 minutes (Marie et al. 1997, Lebaron et al. 1998). The concentration of the standard 1 μm bead solution and multiple confirmatory cell count samples were measured by epifluorescence microscopy. Samples from 2006 and 2007 were counted on a LSR II flow cytometer (BD Biosciences) as described by Ewart et al. (2008) with data acquired in log mode for at least 60 seconds and until 20,000 events were recorded, with the minimum green fluorescence (channel 200) set as the threshold. Cell doubling times were calculated with BP, average cell counts from environmental samples, and an experimentally determined conversion factor (20 fg C/cell) (Lee and Fuhrman 1987).

Bacterial community composition was measured with a fingerprinting technique applied to DNA samples. DNA samples were collected from the field by filtering ~500 mL of sample through a Sterivex 0.2 μm filter. Filters were preserved using a DNA extraction buffer as described by Crump et al. (2003) and stored at -80 °C until extraction. DNA was extracted using a phenol-chloroform extraction and pcr amplified using 357f with a G-C clamp and 519r universal 16S rDNA Bacterial primers on a Bio-Rad thermocycler (Crump et al. 2003, 2007). DNA was then separated using denaturant gradient gel electrophoresis (DGGE) with an 8% acrylamide gel cast with a 30-40% to 50-70% gradient of urea and formamide. Standard lanes were created using a mixture of previously identified Toolik Lake clone isolates (Crump et al. 2003) and used to standardize within and between gels. Gels were run on a Bio-rad system for 18 to 24 hours at 75 volts and 65 °C. Imaging was performed with Quantity One software on a Chemi-Doc gel documentation system (Bio-Rad), gel bands were identified using GelCompar software to create a presence-absence matrix as described by Crump and Hobbie (2005). Each band represents an operational taxonomic unit (OTU) of bacteria.

Dice transformation (SPSS 14.0 through 17.0) was used to condense presence-absence data into percent community similarities between samples. PROXCAL (SPSS Categories, versions 14.0 through 17.0) was used to create non-metric multi-dimensional scaling (NMDS) graphs of sample similarities. Two-tailed paired t-tests (Excel 2003) were used to compare the number of populations (bands) between sites.

Transplant Experiments

Transplantation of bacterial communities was performed to test activity in different habitats. Dialysis bags (Sigma dialysis tubing cellulose membrane, 76 mm flat width) were used to isolate bacterial communities from inputs of new members (Gasol et al. 2002). Substrates smaller than 12,000 M.W. diffuse across the tubing membrane in less than 18 hours, as confirmed with a diffusion test of ^{14}C-labelled leucine (**Appendix 4.A**), allowing exposure of the contained bacteria to ambient temperature and nutrient conditions. Bags were washed and soaked in DI water to remove excess glycerin for a minimum of 12 hours before use, no sections of tubing were used more than once, and nitrile gloves were worn when handling the bags. At each site, three (two in 2005) replicate samples of whole water were collected in acid-washed 1L opaque Nalgene bottles and either transported to another site within 15 minutes or immediately transferred to 45.7 cm sections of tubing and secured with custom wood closures (final volume 640 mL). Grazers were not removed for these experiments due to co-occurrence with particle attached bacteria. Filled bags were then secured to dowels with plastic ties within open-topped plastic covered metal cages of dimensions 70 x 55 x 55 cm. Cages were secured in streams using rebar. There were three replicate bags for each treatment and each bag was allowed to incubate *in situ* for two to four days. Upon collection, each bag's contents were transferred to an acid-washed 1 L opaque Nalgene bottle from which 40 mL was used to measure bacterial production, 180 mL was filtered to measure chl, proteins, phenolics, and DOC, 10-15 mL was preserved for cell counts, and the remainder filtered to collect DNA.

Several transplant experiments were conducted at I-8 inlet and outlet. The first experiment presented here was performed on 18-21 July 2006 and consisted of incubating the I-8 inlet community at both the inlet and outlet sites, to test if the community flowing into the lake would still be viable downstream. The next experiments were conducted in the early part of the summer season on 5-9 July 2005 and 2-4 July 2007 and also included the incubation of the outlet community at both sites to test if the downstream community retained the ability to process carbon from upstream. The third set of experiments was conducted in the later portion of the summer on 26-28 July 2005 and 1-3 August 2006 and also consisted of transplantation of both inlet and outlet communities between sites in addition to controls incubated at their original habitat.

Results

Differences in activity and community composition between sites

Bacterial productivity (BP) was usually greater downstream of Lake I-8 compared to the lake inlet or headwater stream (**Fig. 4.2, Appendix 4.B.**). During the ice-free summer season, BP at I-8 HW in 2003-2007 averaged 4.29 μg C/L/day (SD = 7.57, n = 15). Downstream at I-8 inlet, BP was lowest with an average of 2.12 μg C/L/day (SD = 1.63, n = 56). However, I-8 outlet BP averaged 7.46 μg C/L/day (SD = 3.75, n = 57).

Greater BP was also present ~1 km downstream of Lake I-8 at site I8-I9 which averaged 4.75 μg C/L/day (SD = 3.43, n = 50).

Community composition was also consistently different between sites upstream and downstream of the lake. In 2003, the bacterial community composition at I-8 inlet was generally variable with low similarity between summer samplings, averaging 45% (**Fig. 4.3**). Mid-lake and outlet communities were generally more stable with a similarity during the summer averaging 74 and 63%, respectively. When communities were compared by date, the lake and outlet samples (lake-out in **Fig 4.3**) had a very high similarity to each other with a mean of 79%. The inlet communities were less similar to the other two sites with average similarity by date of about 40%. In 2007, community similarity between sites was not as different, but showed a similar pattern. The lake community again had the highest similarity to the outlet at 66% and the inlet had the lowest similarity to the outlet with 47% (**Fig. 4.4**). The number of OTUs also differed between sites, with 19.6 ± 2.2 bands on average at the inlet and 25.5 ± 3.1 at the outlet in 2003 (p value = 0.003). The inlet also had significantly fewer populations than the outlet in 2007 with 11.7 ± 2.6 bands found at the inlet and 17.9 ± 3.7 at the outlet (p value = 0.01).

Transplant experiments

Bacteria transplanted between sites showed patterns in activity similar to those observed *in situ*. To test if bacteria flowing into the lake have the potential to be active in lake habitats, bacteria from the inlet were held in place or moved to the outlet. Bacteria from the inlet incubated at the inlet had a mean BP of 14.26 μg C/L/day, and those transplanted to the outlet had a greater average BP of 19.63 μg C/L/day but the difference between outlet and inlet was not statistically significant. Equal or greater activity of the inlet community was observed in additional transplants when moved to the outlet in both the early (**Fig. 4.5**) and late (**Fig. 4.6**) summer season. Bacteria were also moved from the outlet to the inlet to test if the communities that developed across the lake can process stream inlet carbon. The outlet bacteria had depressed activity in both early and late summer season (**Figs. 4.5 and 4.6**). In the early season transplants, both inlet and outlet communities had similar activity despite incubation location, but the late season transplants indicated community-specific responses to the inlet habitat with higher activity measured in the incubated inlet community. For all transplant experiments, the outlet habitat had more chl *a,* and generally had warmer temperatures and more proteins and DOC than the inlet habitat (**Table 4.1**).

Lake Inputs

I-8 inlet is the largest contributor of water to the lake, and in 2007 it had the greatest contribution to inflow when total inflow was highest (**Table 4.2**). The other inlets to the lake were either ephemeral (I-8 SE inlet and I-8 E inlet) or had much lower flow compared to the main inlet. I-8 NE inlet did comprise over 36% of water inputs on 4 July 2007, possibly due to rainstorms only in that part of the catchment, but its flow was only 10.2 L/s. During wetter years, it is anticipated that I-8 inlet also comprises the majority of the water inputs due to its large catchment size of 1281 ha, which is 44% of the total catchment for Lake I-8

In order to determine the depth at which I-8 inlet water and bacteria enter the lake, a thermistor chain was deployed at the deep sampling site of the western basin (Lake I-8 W, **Fig. 4.7**). The summer of 2003 was relatively cold and wet with several large storm events (**Table 2.3**, **Fig. 4.8**). During the summer, the lake had periods of stratification until the last week of July, as well as isothermal conditions for most of August and for brief periods earlier in the summer. The dark blue bars (**Fig. 4.7**) indicate the depth of inflows as calculated by density from temperature and conductivity. The depth of inflow varied throughout the summer, with base flow and early season run-off events intruding at the base of the epilimnion. The inflow occasionally entered a well-mixed water column or formed surface overflows. Deep intrusions to the very bottom of the hypolimnion were typically found in August when water temperatures were colder.

The spatial extent of inflow also affects bacterial dispersal into the lake. The degree to which the inflow mixes with the lake will affect the degree of mass effects impacting the bacterial community. Conductivity and pH profiles from the western sampling stations of the lake indicate that after the first small rain event of the season in 2007, the inflow signal intruded at the base of the epilimnion, around 3 m, but only at the southwest station which is closest to I-8 inlet (**Fig. 4.9**).

The length of time inflow persists in the habitat directly affects community dynamics by determining whether bacterial populations can reproduce fast enough to overcome potential dilution and dispersal farther downstream. Epilimnion water retention time averages ~9 days but can vary from <1 to 600 days, depending on stream discharge (**Table 4.3**). Previous estimates of WRT at this site were based on the lake area relationship between Lake I-8 and Toolik Lake (Kling et al. 2000, Crump et al. 2007) instead of direct measurements of discharge presented here. However, even large storm events do not sustain the shortest WRTs for a long period. Bacteria cell doubling times (DT) are also highly variable (**Table 4.3**). The fastest doubling time (0.4 days) is shorter than the fastest WRT (0.8 days), but the wide range of doubling times indicates that WRT can be shorter than DT. The balance of DT compared to WRT affects the persistence of populations within the habitat. The percent of the number of populations unique to the outlet community ranged from 40-76% (mean 62%) in 2003 and 32 to 63% (mean 48%) of inlet populations were detected concurrently at the outlet. Overall community similarity between the inlet and outlet ranged from 29 to 62% (mean 42%) and was greatest after the largest storm event of 2003 (**Figs. 4.3, 4.8**). In 2007, 29 to 79% (mean of 60%) of populations at the outlet were unique to the outlet while 50 to 71% (mean of 59%) of populations in the inlet community were also found at the outlet.

Bacterial communities collected during the spatial sampling after the first small rain event in 2007 show clustering based on lotic or lentic habitat type (**Fig. 4.10**). Lake communities, including I-8 outlet, had a mean similarity to each other of 76.2% with a standard deviation (SD) of 8.7%. Inlet communities had a mean similarity to each other of 32.2% with a standard deviation of 29.9% and had only 27.5% average similarity to the lake communities (SD of 8.6%). The two inlet streams draining catchments south of the lake (I-8 inlet and I-8 S inlet) had two-thirds of their bacterial community members in common, while the I-8 NE inlet had very low similarity to the other two inlet sites (13.3% and 16.7% respectively). The inlet communities had higher similarity to each other when sampled on 18 June and 20 July, ranging from 20.7 to 63.2%. The I-8 inlet bacterial community was also more similar to lake communities at the west station and outlet on 21 June and 11 July with 66.9% and 63.2% mean similarities (SD of 4.5% and 9.1%, respectively) but was more distinct from lake communities when sampled on 8 August with only 23.9% similarity to the lake and outlet (SD of 5.6%).

Discussion

Both greater bacterial productivity and greater stability of community composition were observed at the outlet of Lake I-8 compared to the main inlet (**Figs. 4.3 and 4.4**). The lake has more labile carbon sources from autochthonous production as indicated by higher levels of chl *a* and proteins at the outlet than the inlet (**Table 4.1**). More bioavailable resources for the bacteria can increase production and may explain the consistently higher BP at the outlet. The lake also slows the transport of bacteria down the catchment. Given sufficient time, species sorting processes can dominate the community dynamics, and competition results in a downstream community that is best adapted to available carbon sources (Van der Gucht et al. 2007). Mass effects can disrupt the community composition in the lake when large storm events occur, resulting in similar communities at the inlet and outlet. In fact, after a large (estimated 4500 L/s) storm event in August of 2003, the community similarity of I-8 inlet and I-8 outlet was 61.5% compared to 36.7% similarity before the storm (**Fig. 4.8**).

When transplanted, bacteria from the inlet are viable at the outlet and have equal, if not greater, activity in the new habitat (**Figs. 4.5 and 4.6**). However, less than half of inlet bacterial populations usually persist at the outlet as indicated by the low similarity of inlet and outlet communities (**Figs. 4.3, 4.4, Appendix 4.B**). On the basis of these similarity results, the communities that develop in the lake and are detected at the outlet appear to be dominated by members that process lake carbon rather than the terrestrial carbon flowing in from upstream. Kritzberg et al. (2005) determined that a greater bacterial preference for autochthonous carbon, along with greater growth efficiencies, is likely in habitats with high levels of allochthonous (terrestrial) carbon. When outlet communities were transplanted to the inlet habitat, they were less productive than at their original habitat, and in the late season were less productive than the inlet communities incubated at the same time (**Figs. 4.5, 4.6**). This indicates that the lake communities were no longer optimized to process upstream carbon, and that bacterial populations from the inlet are either outcompeted or diluted to low numbers within the new lake community. Although still viable in the lake, the inlet communities appear to be either poor competitors or potentially limited in their dispersal to the outlet habitat during low flow periods.

The dispersal of inlet communities into the lake is limited by the depth, spatial extent, and volume of stream inflow. While the main inlet does provide the majority of water to the lake (**Table 4.2**), this water may not extend far into the lake due to mixing or insufficient volume of inflow, as observed on 4 Jul 2007 (**Fig. 4.9**), or it may flow directly to the hypolimnion where it becomes isolated until the lake mixes deeply (**Fig. 4.7**). However, during large storm events, the inflow is very high, and concurrent cold conditions can create a well-mixed lake. Large storm events also decrease the WRT and short WRTs have been found in other systems to increase community similarity (Lindstrom and Bergstrom 2004). Both sufficient water volume and inflow penetration into the epilimnion would be required for mass effects to have a large impact on the outlet community, such as occurred around 30 Jul 2003 (**Fig. 4.7, Fig. 4.8**). However, storms of such magnitude are relatively rare, only 13% of summer storm events from 1991-2008 had a similar or greater magnitude (Arctic LTER data).

Bacterial communities are also dispersed to the outlet from smaller inlets and from within the lake itself. The inlets to the lake drain sub-catchments that differ in vegetation and surface geomorphology, both of which impact bacterial communities and therefore the types of populations that can migrate downstream (Judd and Kling 2002). Most populations from the smaller inlets do not appear to persist in the lake, with very low similarities of inlet and lake communities. This is likely due to the small number of inlet bacterial cells becoming diluted within the lake, as seen also in other studies (Lindstrom and Bergstrom 2004). Lower population sizes can result in stochastic extinctions and can decrease the ability of new populations to compete with existing lake populations. Spatial sampling of the lake indicated a relatively well-mixed bacterial community and a high similarity between distant sites within the lake (**Fig. 4.10**). Chemical measures of lake water support this being a well mixed habitat (**Appendix 4.C, 4.D**) with no evidence for a gradient of community composition along an allochthonous gradient such as that found in a much larger reservoir by Simek et al. (2001). This separation of communities in the inlet and lake again supports species sorting as the predominant driver of community dynamics at Lake I-8.

In Lake I-8, there is evidence of a continuum of importance between species sorting and mass effects as mechanisms structuring bacterial community composition, although the dominance of mass effects was rare and limited to large stream inflow events. Transplant experiments showed that although inlet communities can survive in the outlet habitat, outlet communities consist of many members that lack the ability to survive in the inlet habitat, particularly later in the summer season. The analysis of depth, spatial extent, and volume of water inflow determined the potential dispersal of inlet bacteria to the lake. The balance of biological growth rates (DTs) to physical WRT controls the persistence of inlet bacteria in the lake and outlet habitat, provided that water inflow does not become entrained in the hypolimnion. Many members of the inlet populations will be mixed with the lake and outlet populations when WRT is short. WRT, along with environmental conditions, has been found to control the distribution of bacterial groups in other habitats as well (Lindstrom et al. 2005, Crump et al. 2007). If WRT is long, competition and predation will structure the community in the lake, and many inlet populations will not persist. Van der Gucht et al. (2007) suggest fast population growth rates and regular dispersal as a way for bacterial communities to track environmental conditions. In this system, bacteria have a faster average DT than the average WRT, suggesting that species sorting dominates while mass effects may be important only during aperiodic, large summer storm events.

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Tables

Table 4.1. Habitat characteristics during transplant experiments. Transplant experiment collected on 9 Jul 05 was deployed 12 hours after conditions were measured on 5 Jul 05.

Date	**Site**	**Temp (°C)**	**BP (μg C/L/day)**	**Cond (μS)**	**pH**	**Chl a (μg/L)**	**Protein (mg/L)**	**Phenolics (μM)**	**DOC (μM)**
5 Jul 05	I-8 inlet	7	1.25	123.3	7.28	0.21	0.16	0.06	268.2
5 Jul 05	I-8 outlet	12.3	7.19	51.2	6.99	0.39	0.29	0.04	387.4
9 Jul 05	I-8 inlet	7.2	1.69	62.0	6.29	0.18	0.51	0.81	615
9 Jul 05	I-8 outlet	10.6	11.45	62.2	6.61	0.80	0.53	0.99	457.3
26 Jul 05	I-8 inlet	11.2	1.42	117.2	7.12	0.10	0.16	0.29	353.8
26 Jul 05	I-8 outlet	14.6	6.38	67.9	7.61	0.75	0.38	0.78	527.1
28 Jul 05	I-8 inlet	11	1.79	124.3	7.66	0.90	0.16	0.27	350.6
28 Jul 05	I-8 outlet	14.4	10.62	69.5	7.54	0.97	0.34	0.76	521.5
18 Jul 06	I-8 inlet	10.10	0.85	88.5	8.14	0.41	0.30	0.56	462.6
18 Jul 06	I-8 outlet	12.40	2.39	69.6	7.65	2.10	0.59	1.05	574.2
21 Jul 06	I-8 inlet	8.30	1.16	77.7	7.59	0.43	0.47	0.73	527.7
21 Jul 06	I-8 outlet	11.60	7.70	72.5	7.39	1.72	0.59	0.95	563.7
1 Aug 06	I-8 inlet	10.10	0.56	95.9	7.62	10.10	0.45	0.43	475.5
1 Aug 06	I-8 outlet	12.60	3.86	75.4	7.41	12.60	0.59	0.87	592.5
3 Aug 06	I-8 inlet	12.10	2.09	100.4	7.72	0.65	0.47	0.48	456.7
3 Aug 06	I-8 outlet	12.80	10.85	78.4	7.52	2.10	0.62	0.81	576.5
2 Jul 07	I-8 inlet	17.6	7.15	152.2	7.65	0.29	0.12	0.68	402.4
2 Jul 07	I-8 outlet	16.3	15.39	79	7.47	0.48	0.19	0.69	314.6
4 Jul 07	I-8 inlet	13.9	2.69	158	7.5	0.20	0.21	0.23	363.3
4 Jul 07	I-8 outlet	18.4	2.68	74.2	7.25	0.29	0.32	0.03	427.3

Table 4.2. Water contribution to Lake I-8 for summer 2007. Outflow is stream discharge measured at the I-8 outlet. Total inflow is the sum of discharge rates for all lake inlets; inflows for dates 16, 21, and 29 June, and 11 July are based only on discharge measured at I-8 inlet.

	% contribution to lake inflow				***Total inflow (L/s)***	***Outflow (L/s)***
Date	**I-8 NE inlet**	**I-8 S inlet**	**I-8 SE inlet**	**I-8 inlet**		
16-Jun-07					9.8	32.7
18-Jun-07	6.4	5.1	1.0	87.4	24.4	34.4
21-Jun-07					8.5	32.1
29-Jun-07					42.0	41.9
4-Jul-07	36.1	6.4	n/a	57.5	28.3	27.1
11-Jul-07				11.2		17.9
16-Jul-07	14.1	8.8	0.8	76.3	318.8	47.8
20-Jul-07	10.0	8.2	1.2	80.6	134.3	161.7
28-Jul-07	7.7	6.8	1.3	84.2	48.3	50.7
3-Aug-07	5.1	4.0	0.3	90.5	502.1	618.6

Table 4.3. Water residence time (WRT) for Lake I-8 and doubling times (DT) for I-8 inlet and outlet, based on data from 2003-2007.

	Lake WRT (days)			Epilimnetic WRT (days)		
Year	**Slow**	**Mean**	**Fast**	**Slow**	**Mean**	**Fast**
2003	120.3	3.9	1.0	88.9	2.9	0.8
2004	122.4	5.8	1.3	90.5	4.3	1.0
2005	811.1	20.2	1.5	599.8	14.9	1.1
2006	39.0	9.4	2.1	28.9	6.9	1.5
2007	328.0	23.4	2.7	242.6	17.3	2.0
Average	284.1	12.5	1.7	210.1	9.3	1.3

Site	**Longest DT (days)**	**Mean DT (days)**	**Shortest DT (days)**
I-8 inlet	29.8	1.9	0.4
I-8 outlet	12.4	0.9	0.4

Figures

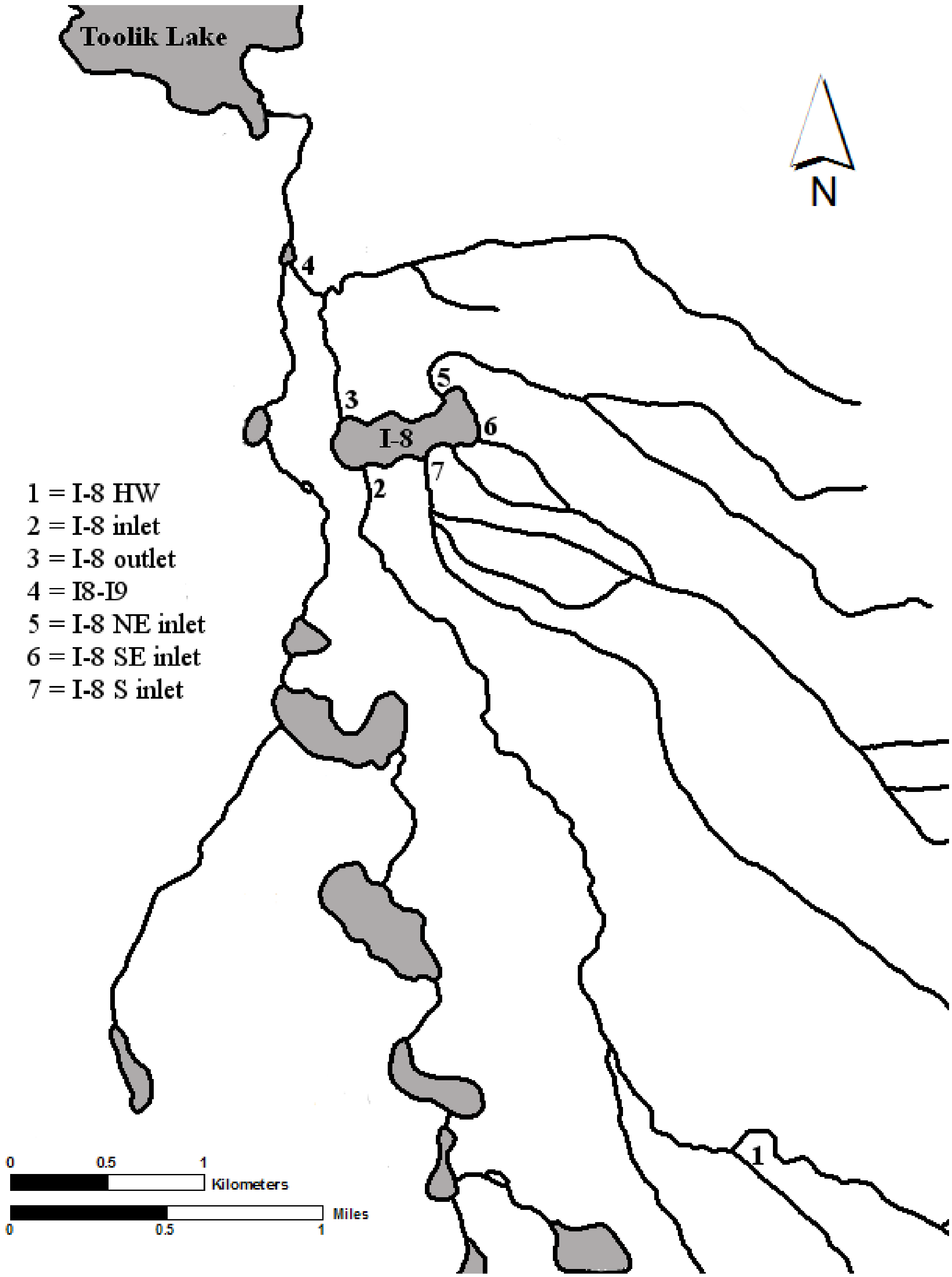


Figure 4.1a. Sampling locations in the I-series catchment to Toolik Lake, Alaska.

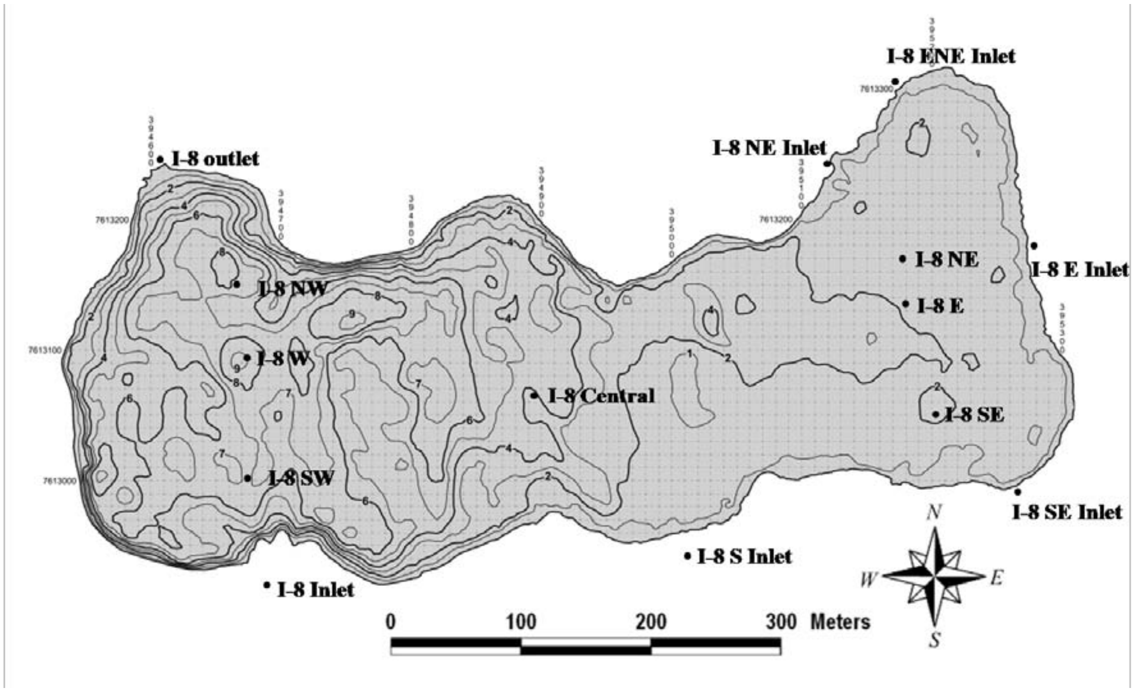


Figure 4.1b. Lake spatial sampling sites at Lake I-8, Northern Alaska. I-8 outlet is located at 394605.858 Easting 7613243.017 Northing on the UTM Zone 6 North, WGS84 coordinate system (149.59 °W, 68.61 °N). Larger inlet stream locations are also shown in Figure 4.1a.

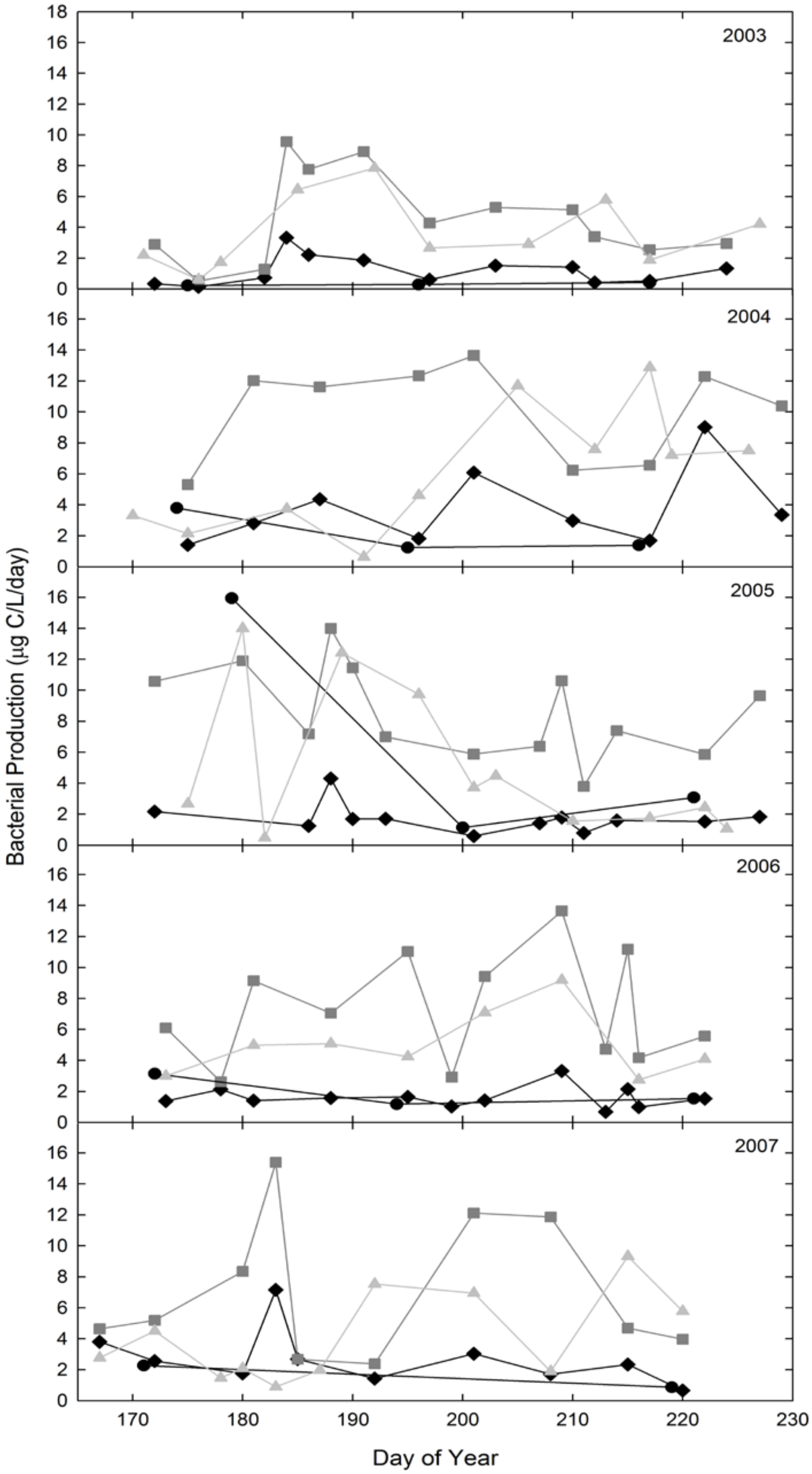


Figure 4.2. Bacterial Production at sites upstream and downstream of Lake I-8 with symbols ● I-8 headwaters, ♦ I-8 inlet, ■ I-8 outlet, and ▲ I-8 to I-9.

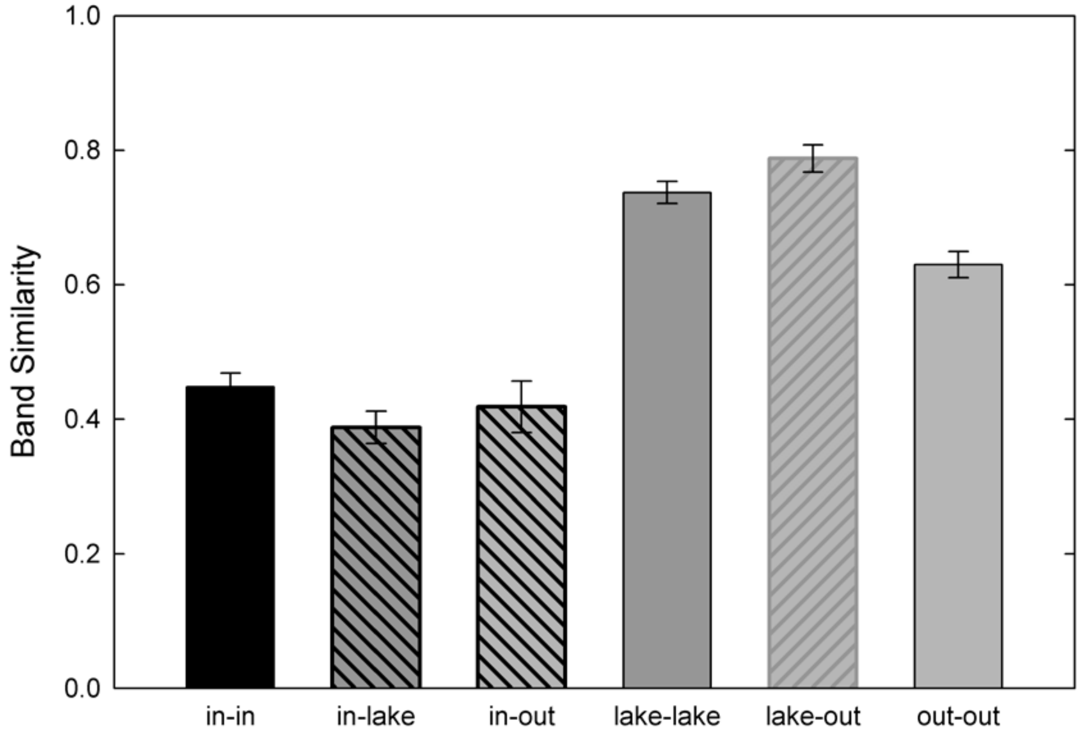


Figure 4.3. Dice similarity of DGGE bands at sites at Lake I-8 in summer 2003. Error bars are standard error of the mean. Similarities at a single site (e.g. in-in) are similarities between sampling dates, whereas similarities between sites (e.g. in-lake) are pair-wise similarities between sites sampled on the same day. "In" designates the I-8 inlet stream, "out" designates the outlet stream, and "lake" designates samples collected from the lake water column at the I-8 West station.

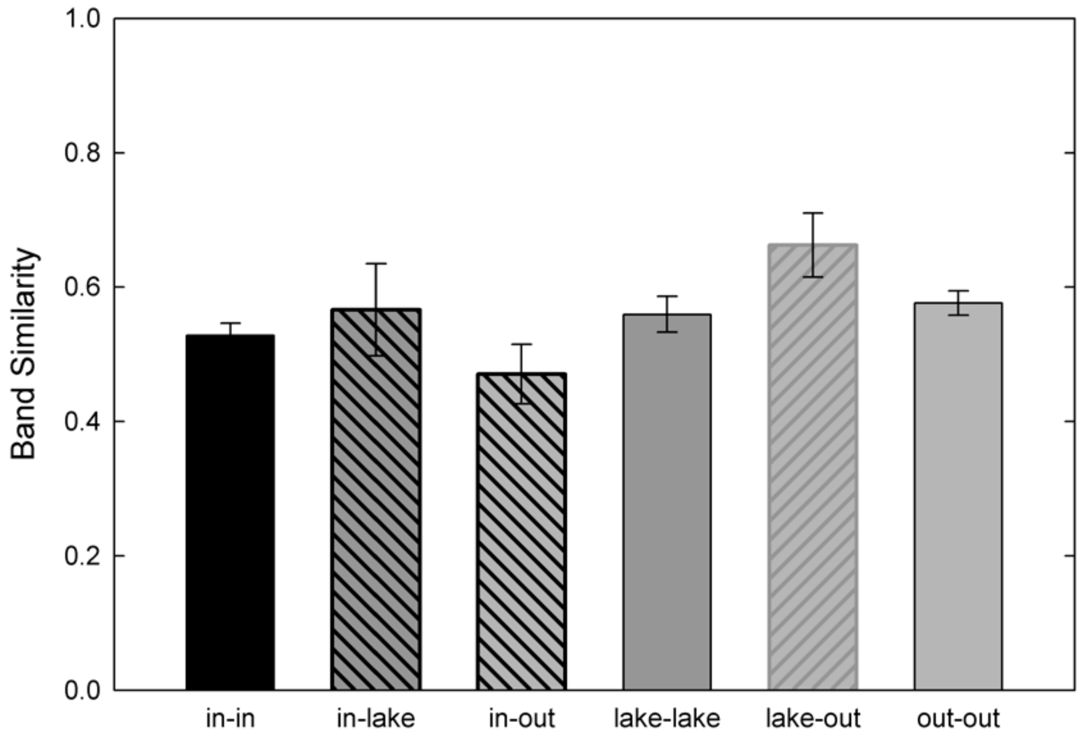


Figure 4.4. Dice similarity of sites at Lake I-8 in summer 2007 (dry year). Error bars are standard error of the mean. Similarities at a single site (e.g. in-in) are similarities between sampling dates, whereas similarities between sites (e.g. in-lake) are pair-wise similarities between sites sampled on the same day.

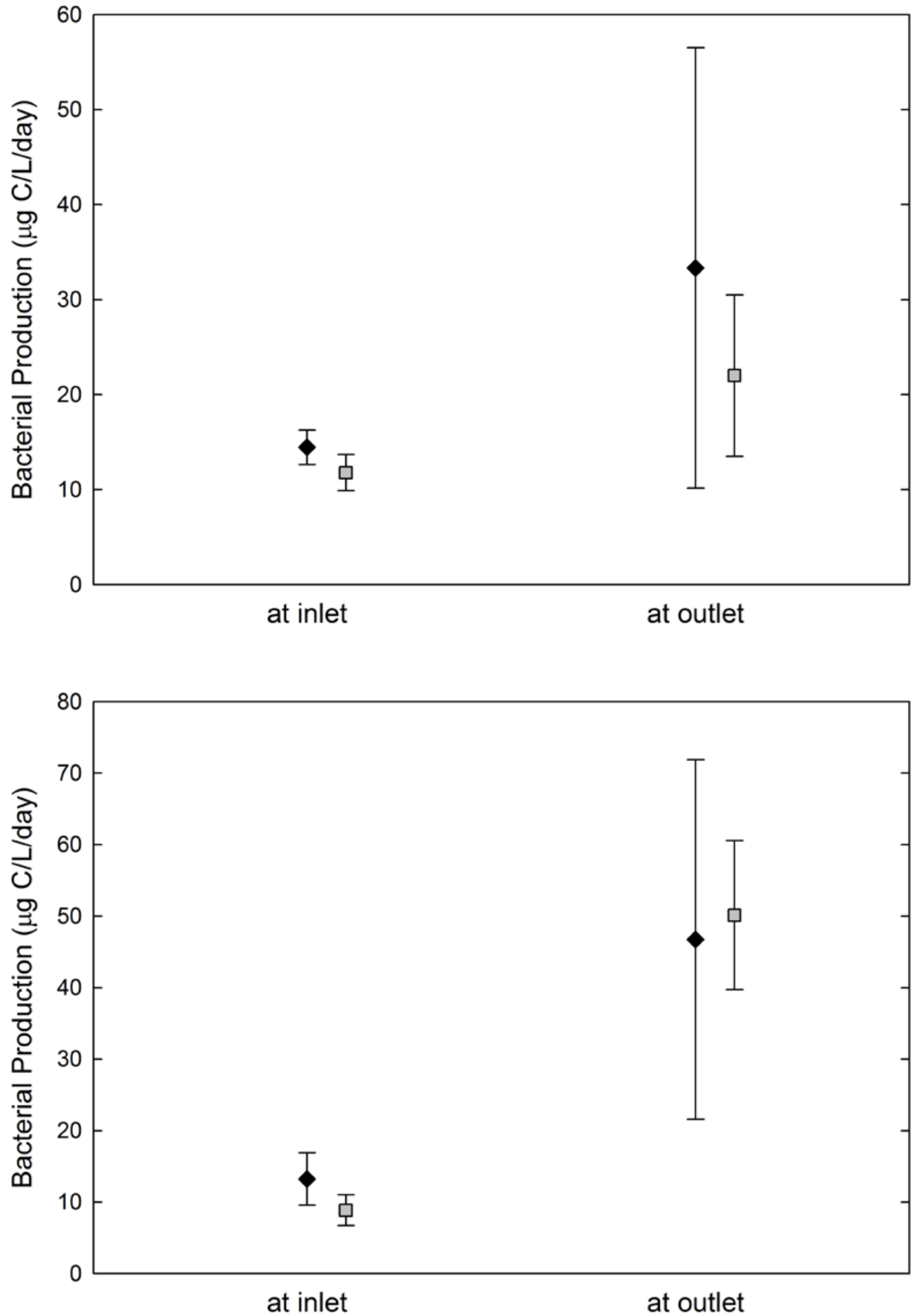


Figure 4.5. Early summer transplants at I-8 inlet and outlet from 5-9 Jul 05 (top) and 2-4 Jul 07 (bottom), ♦ inlet community, ◻ outlet community. Error bars are standard error of the mean.

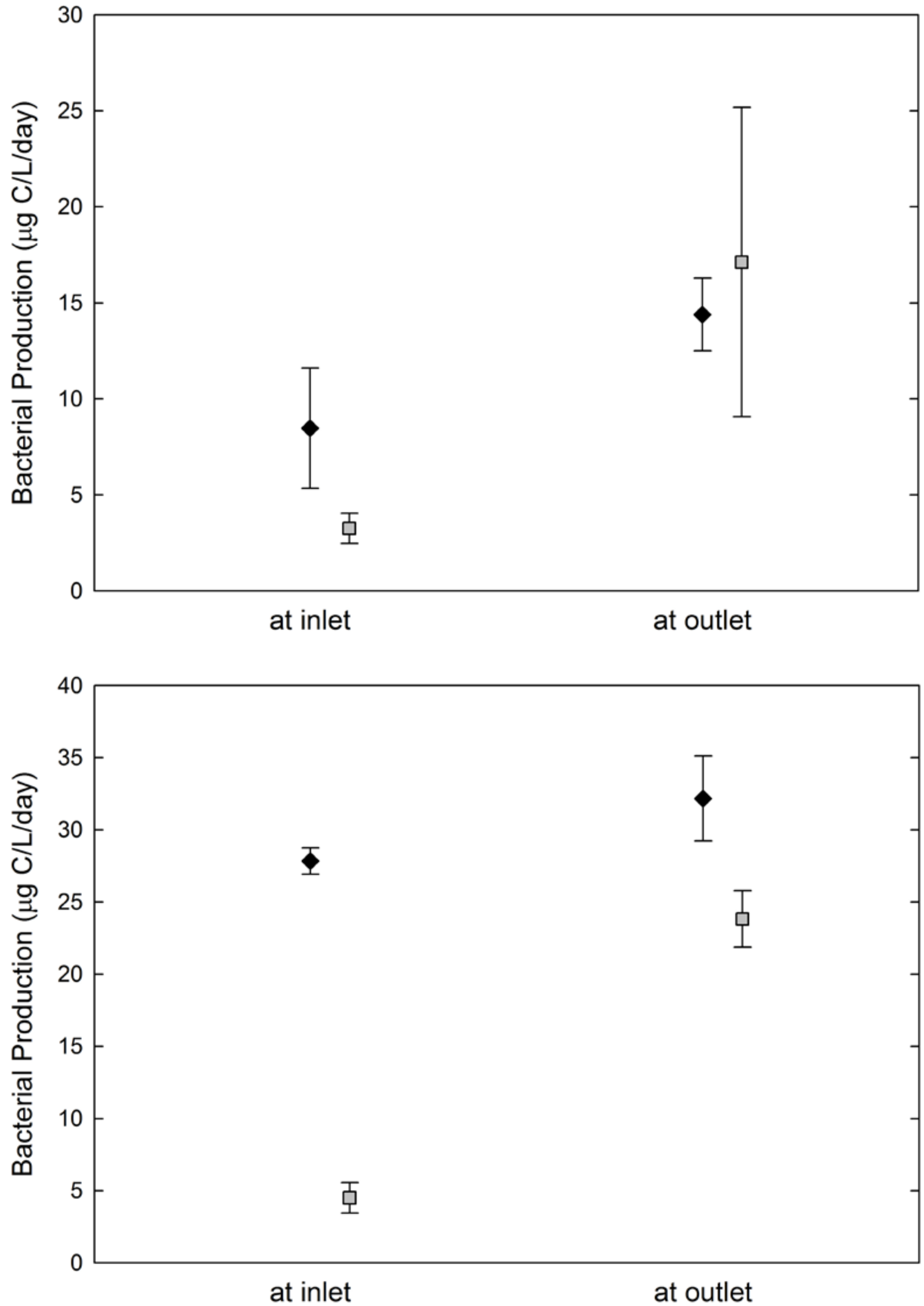


Figure 4.6. Late summer transplants at I-8 inlet and outlet from 26-28 Jul 05 (top) and 1-3 Aug 06 (bottom), ♦ inlet community, ▢ outlet community. Error bars are standard error of the mean.

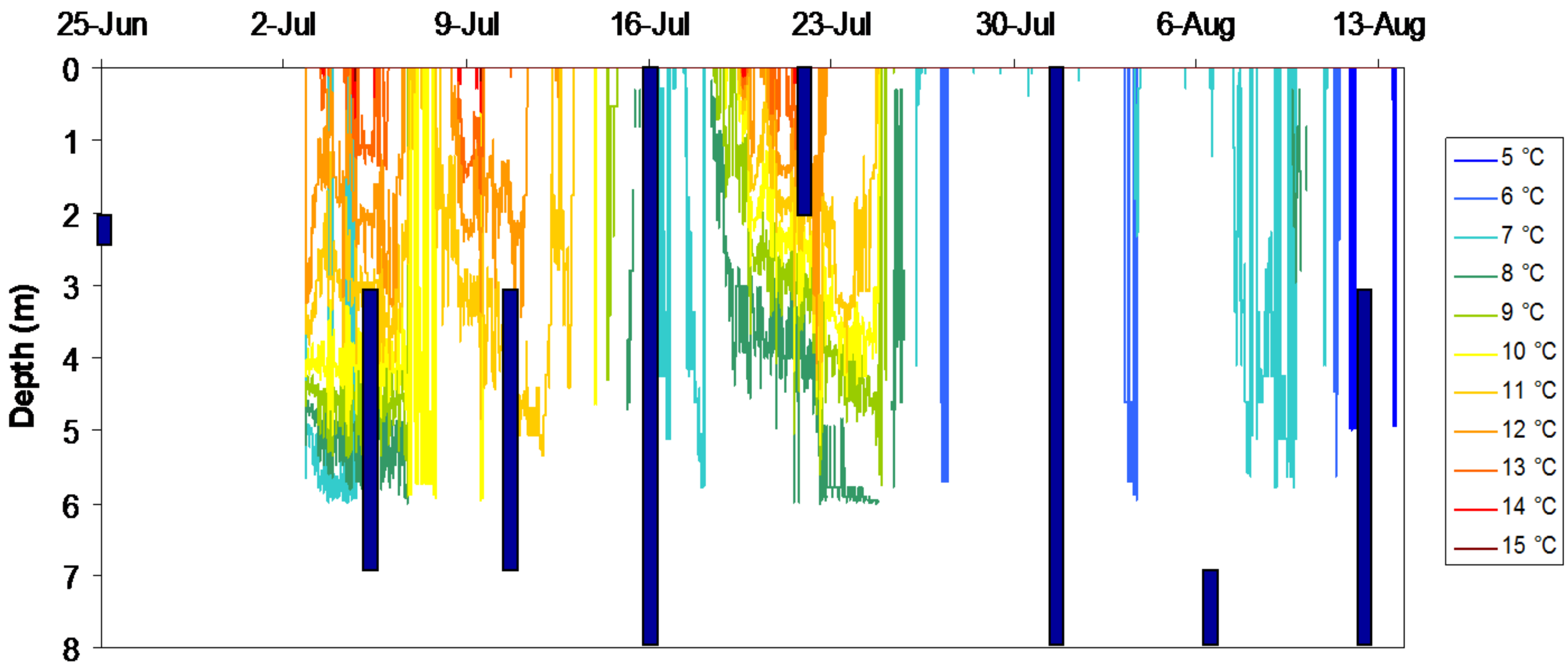


Figure 4.7. Plot of isotherms in Lake I-8 from summer 2003. Bars indicate the depth at which the density of the water from I-8 inlet is the same as the water within the lake.

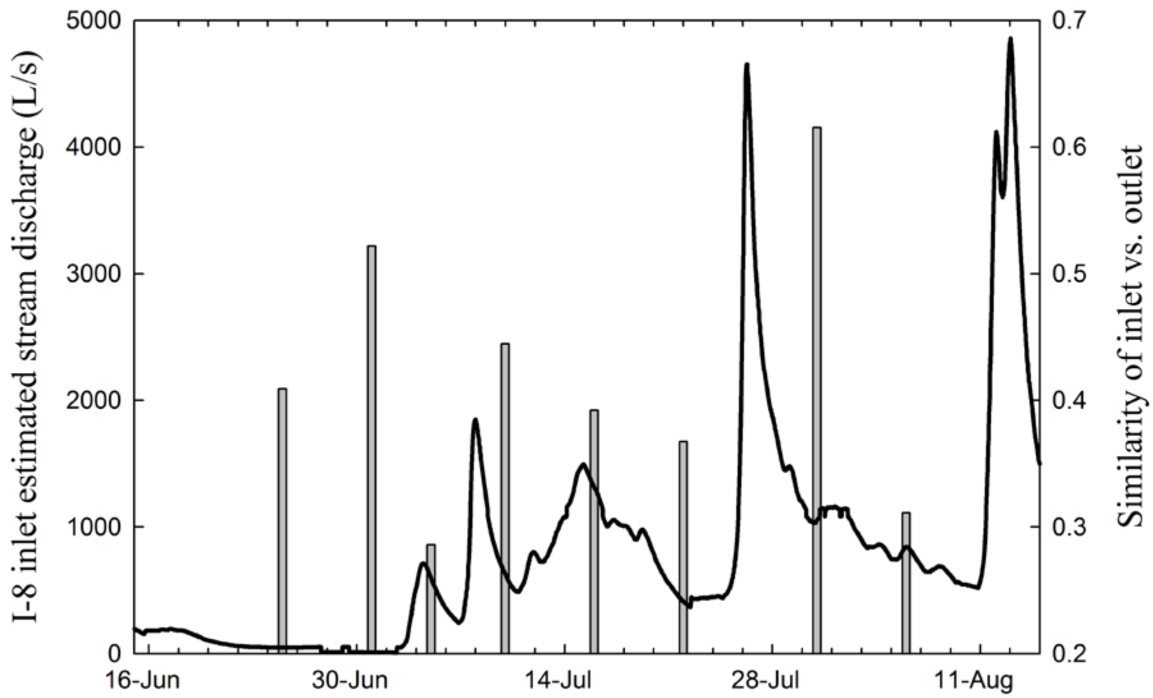


Figure 4.8. Modeled discharge at I-8 inlet (black line) and % similarity of bacterial communities at I-8 inlet and I-8 outlet in the summer of 2003 (gray bars). Discharge was modeled using the relationship of discharge between Toolik Lake inlet and I-8 inlet in 2005-2007. Highest DNA similarity between I-8 inlet and outlet was detected after a large rain event near the end of July.

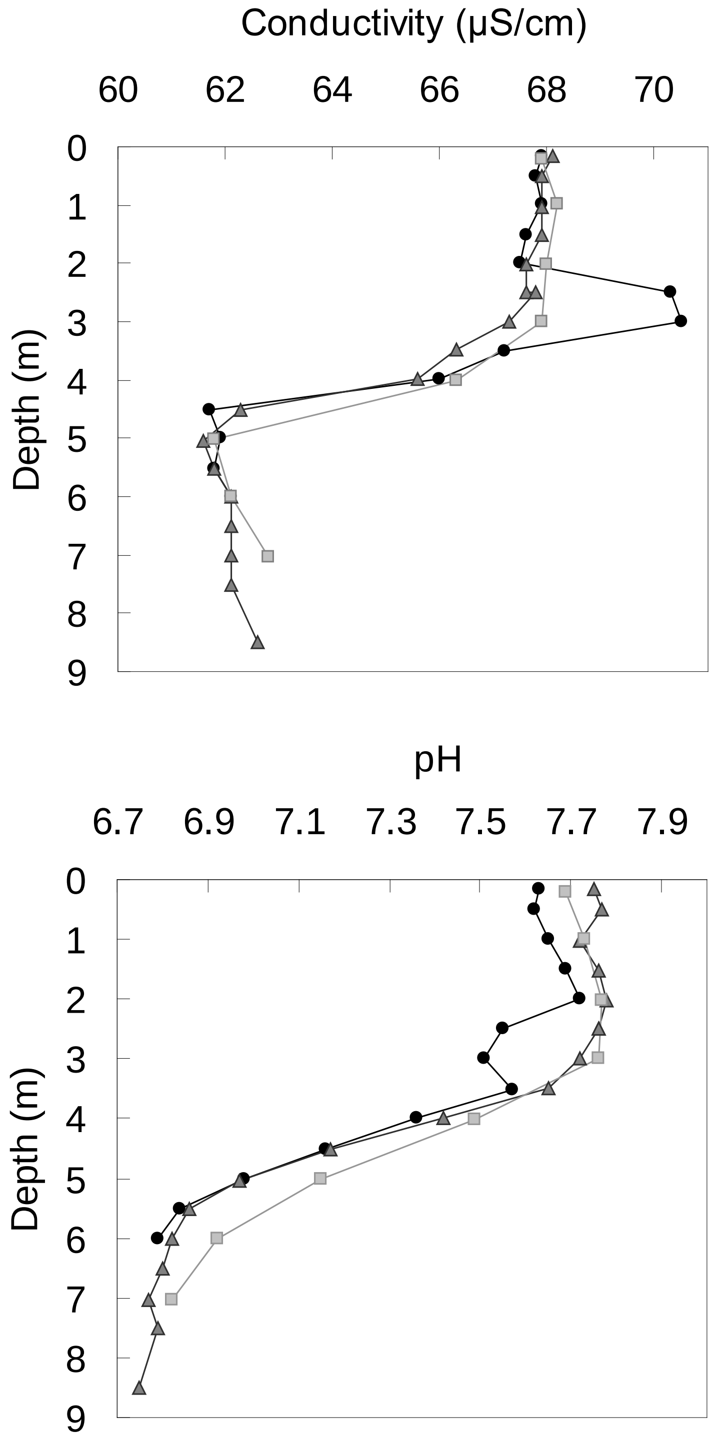


Figure 4.9. Conductivity (top) and pH (bottom) depth profiles for the sampling transect in the western basin of Lake I-8 on 4 Jul 2007. I-8 southwest station (●) clearly shows the influence of the main inlet stream in higher conductivity and lower pH, compared to the west (■) and northwest (▲) stations.

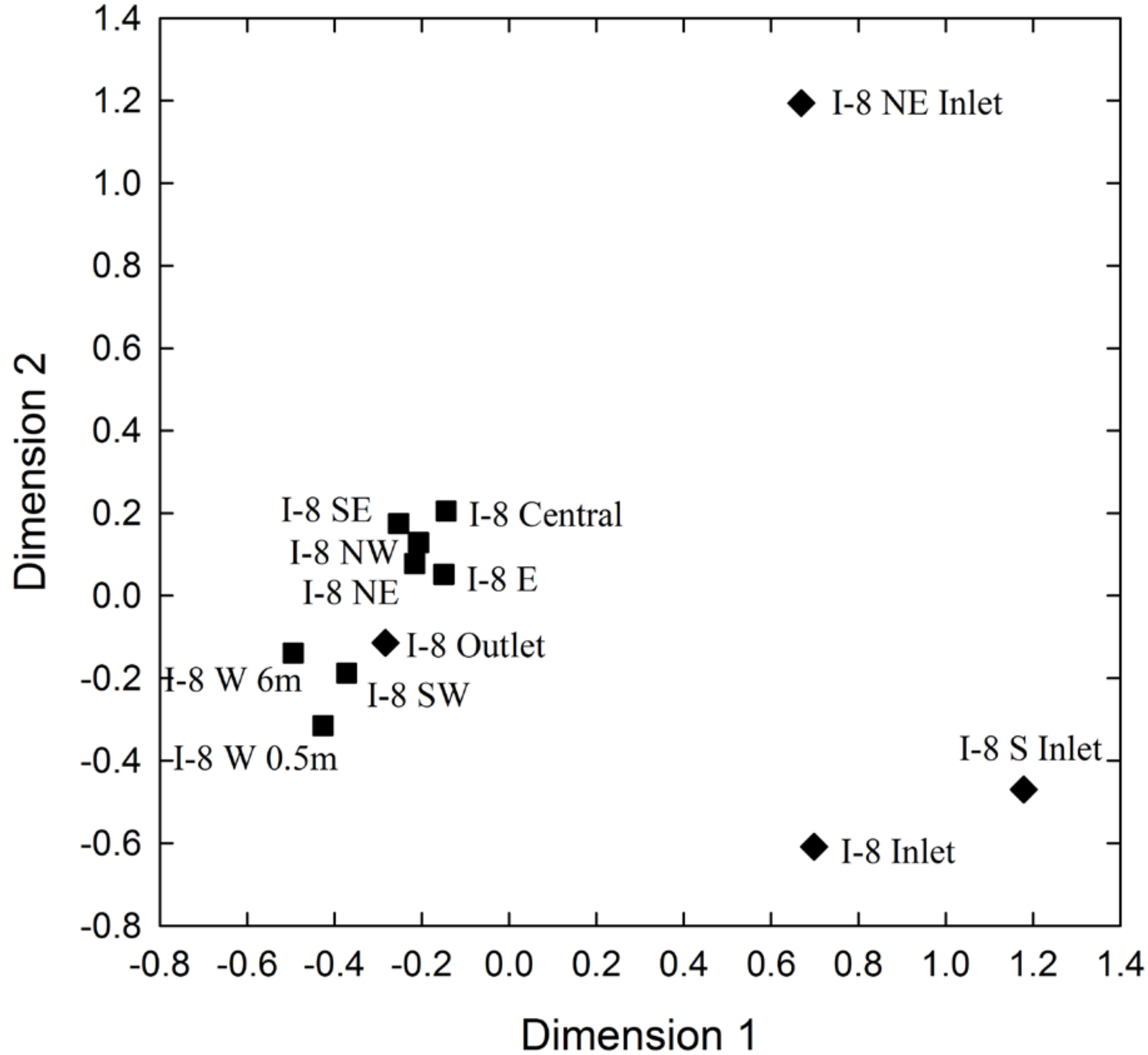
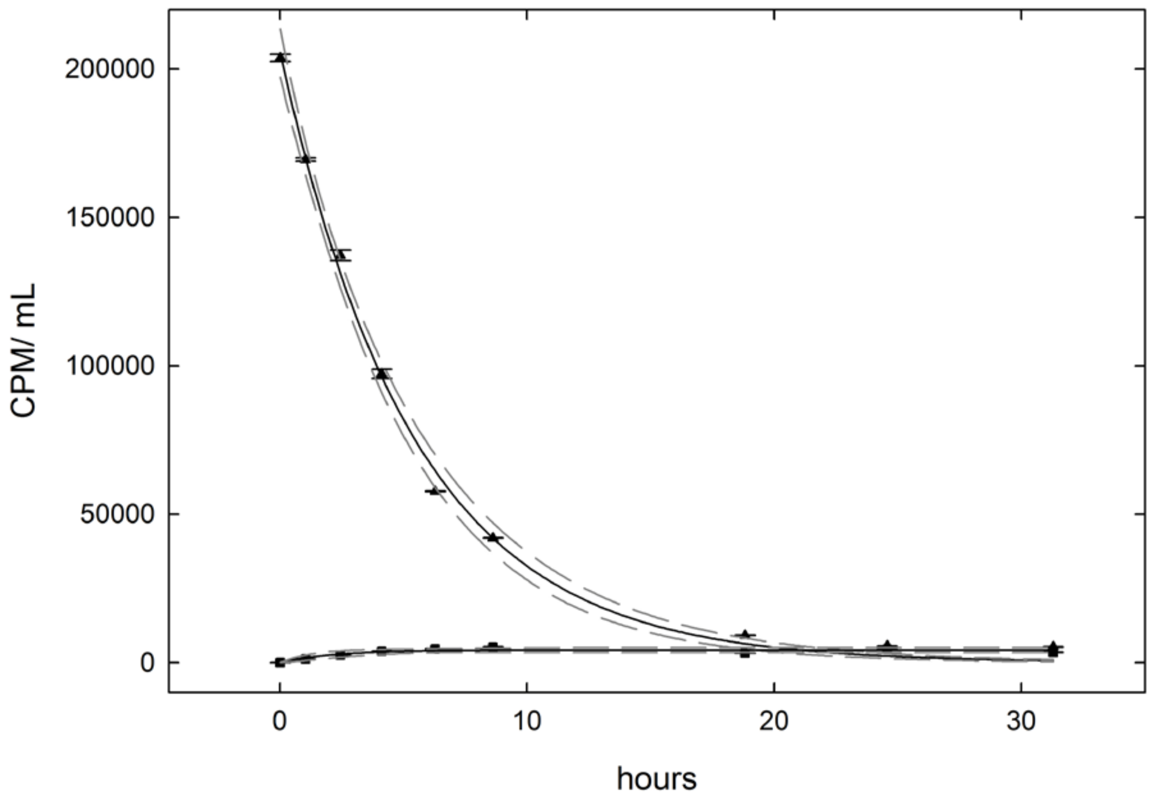


Figure 4.10. NMDS of bacterial communities at Lake I-8 on 4 Jul 07 based on sample similarities. Inlets and outlet samples are indicated by ♦ and lake samples by ■. All samples were collected from surface water (0.01 m for streams, 0.5 m for lake) unless otherwise noted. Normalized raw stress = 0.009.

Appendices



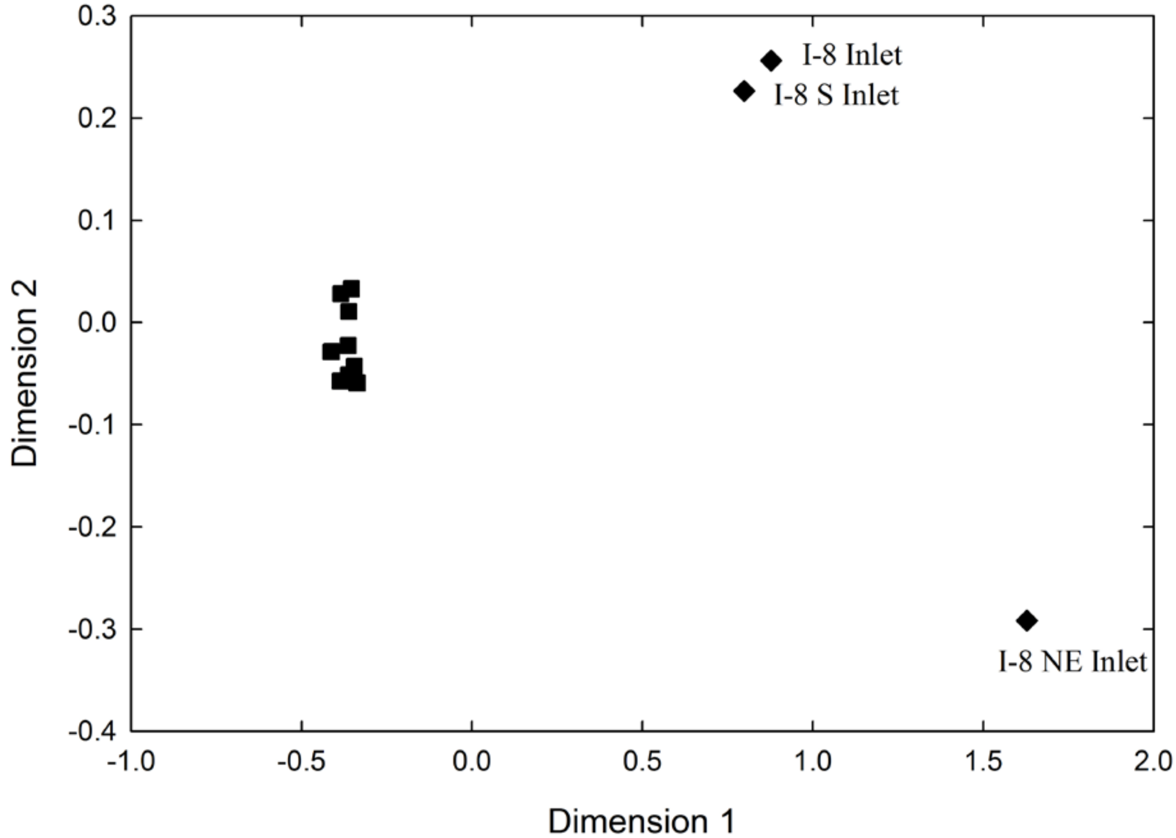
Appendix 4.A. Diffusion of ^{14}C-leucine across dialysis bags. Upper line (▲) is radioactivity of ^{14}C-labeled leucine measured inside a dialysis bag, while the lower line is radioactivity measured in the fluid exterior of the bag (■). Black solid lines are fitted to the curves with exponential equations (decay and increase, R^2 = 0.997 and 0.84), gray dashed lines are 95% confidence intervals. Error bars on data points are standard error of the mean.

Appendix 4.B. DNA similarity (1.0 = identical) between sites during transplant experiments and the impact of location on community composition (average similarity of control compared to location treatment).

Date	Samples compared		Similarity
18 Jul 06	I-8 inlet	I-8 outlet	0.38
18 – 21 Jul 06	In/ in	In/out	0.77
21 Jul 06	I-8 inlet	I-8 outlet	0.56
1 Aug 06	I-8 inlet	I-8 outlet	0.51
1-3 Aug 06	In/in	In/out	0.74
1-3 Aug 06	Out/out	Out/in	0.90
3 Aug 06	I-8 inlet	I-8 outlet	0.55

Appendix 4.C. Limnological variables measured at Lake I-8 during the 4 Jul 07 intensive spatial sampling (see Kling et al. 2000 for methodology).

Site	Time_hr_dst	Depth_m	Temp_C	Cond_uS	pH	Alk_ueqL	DOC_uM	NH4_OPA_uM	PO4_uM	NO3_uM	TDN_uM	TDP_uM	Ca_uM	Mg_uM	Na_uM	K_uM	Si_uM	Oxygen_mgL	Chla_ugL
I8 Inlet	9:55	0.01	13.9	158	7.5	1418	363.3	0.35	0.02	13.82	21.1	0.08	668	146	22.3	5.4	30.5	.	0.23
I8 Inlet Northeast	9:15	0.01	11.3	208	7.53	1898	427.3	0.57	0.06	18.70	24.7	0.06	917	176	30.8	5.7	41.2	.	0.36
I8 Inlet South	14:10	0.01	16.3	143.3	6.93	1379	405.9	0.54	0.07	1.86	13.5	0.11	639	114	20.4	4.4	38.0	.	0.41
I8 Lake Central	11:08	0.5	17.8	68.4	7.57	633.3	447.4	0.26	0.04	0.06	10.8	0.09	308	66.3	12.8	7.4	16.5	8.43	1.01
I8 Lake East	10:32	0.5	17.9	68.7	7.78	650.5	456.4	0.34	0.04	0.12	12.2	0.11	309	66.3	13.4	7.7	15.9	8.74	1.02
I8 Lake Northeast	10:15	0.5	18	68.8	7.85	645	444.1	0.48	0.03	0.21	12.1	0.11	312	67	13.2	7.8	15.8	8.78	0.94
I8 Lake Northwest	12:50	0.5	17.5	68.1	7.73	640.4	405.7	0.27	0.04	0.08	11.3	0.07	305	66.1	12.8	7.4	16.4	8.73	1.05
I8 Lake Southeast	10:44	0.5	18	69	7.8	634.3	429.3	0.44	0.07	0.20	12.5	0.10	311	67.5	27.8	9.2	19.1	8.80	0.65
I8 Lake Southwest	11:38	0.5	17.7	67.8	7.63	616.1	448	0.25	0.04	0.18	11.1	0.12	305	65.8	13.3	7.5	16.4	8.48	1.06
I8 Lake West	12:12	0.5	17.6	67.8	7.76	647.2	391.1	0.28	0.03	0.11	11.7	0.08	305	66.2	12.9	7.4	16.5	8.69	0.97
I8 Lake West	12:12	6	7.76	61.8	6.82	609.9	425.9	0.52	0.05	0.32	11.8	0.14	290	62.6	13.1	8.1	29.7	7.75	1.85
I8 Outlet	11:00	0.01	18.4	74.2	7.25	622.3	393.5	0.67	0.04	0.46	12.1	0.11	316	68.5	13.1	7.5	17.9	.	0.34



Appendix 4.D. NMDS of environmental data taken on 4 Jul 07. Proximities are based on Euclidean distances of temperature, conductivity, pH, alkalinity, DOC, NH4, PO4, NO3, TDN, TDP, Ca, Mg, Na, K, Si, and chl. Normalized raw stress is > 0.001.

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CHAPTER V

Synthesis of controls on bacterial activity

Abstract

Bacterial production has been demonstrated within this dissertation to be controlled by both environmental factors and bacterial community composition. Several Bayesian models were created using five summers of data from lakes and streams in Northern Alaska to measure the relative effects of these drivers. Site identity was found to be an important variable in the models, whereas the importance of other drivers such as temperature, chlorophyll a, total dissolved nitrogen, total dissolved phosphorus, and dissolved organic carbon varied greatly. The removal of site identity increased the strength of relationships between environmental variables and bacterial production, indicating that included variables could mask co-varying unmeasured drivers. Non-zero parameter estimates for an index of community composition indicated that community composition can be included in models of community-level bacterial production in natural systems and may account for differences in production between sites. Discerning the interaction of community composition and environmental variables is integral to understanding the controls on bacterial production in natural habitats.

Introduction

Bacterial production can be controlled by temperature (White et al. 1991), nutrients (Vadstein 2000), organic matter (Findlay et al. 2003), and community composition (Foreman and Covert 2003). Throughout this dissertation, these different controls on bacterial productivity have been examined and their interactions tested both in the field and through experimentation. Here, I develop a predictive model of activity, incorporating empirical data from an arctic lake catchment.

As discussed in Chapter 2, populations within the bacterial community near Toolik Lake, Alaska, have different optimal temperatures, which are detectible when the community is held at different temperatures for as little as 3 days. Immediate responses of the whole community to temperature are roughly linear and Q_{10} (increase in activity with increase in temperature) from different sites and dates is negatively correlated with *in situ* temperature ($r^2 = 0.41$) (Adams et al. In revision).

Stream discharge also affects bacterial activity, but indirectly by transporting upstream nutrients, DOM, and new community members. In general, discharge is inversely correlated with temperature in the Arctic, because summer storms tend to have cooler air temperatures. At Toolik Inlet, both temperature and discharge were significantly related to BP for 2003-2006, even though all four years had very different temperature and storm event frequency and intensity. Path Analysis (Amos software 16.0) indicated that discharge had a larger coefficient ($\beta = 0.45$) than water temperature ($\beta = 0.25$) at Toolik Inlet, although the effect of discharge may be due to drivers of BP that co-vary with discharge such as DOM and nutrients. At Lake I-8 inlet and outlet, path analysis results of discharge, water temperature, and BP were similar to that seen at

Toolik Inlet; there was a strong correlation (β = 0.60) of water temperature and BP, probably related to consistent differences in temperature between the inlet and outlet of the lake.

Bacterial productivity is also limited by inorganic nutrients and DOM which are the basic substrates needed for bacterial growth. Pulsed inorganic nutrient supply, such as that found during storm events, can interact with temperature limitation to affect both BP and bacterial community composition at these sites (Chapter 3). Storm events also bring in DOM from upstream; however, not all portions of the DOM pool are bioavailable (Findlay et al. 2003). For example, BP is better correlated with chlorophyll *a* (chla) concentrations than with DOC at the catchment scale due to the large amounts of terrestrial carbon that enters the aquatic habitat in the study system (path analysis, Chapter 2). Additionally, not all communities are adapted to the same types of DOM. I transplanted upstream inlet bacteria and lake outlet bacteria and determined that in the early season, all communities are more active downstream of the lake (where there is the addition of presumably more labile carbon from lake algae) but later in the summer, the inlet bacteria are equally active at either site. The depressed activity of the outlet bacteria at the inlet indicates that the community formed at the lake outlet cannot process much of the terrestrial carbon from upstream (Chapter 4). Laboratory experiments manipulating temperature, DOM source, and inorganic nutrient supply (Chapters 2 and 3) also indicate the importance of community composition, with populations shifting rapidly in dominance in response to drivers. Communities that have enough time to respond to environmental variables by shifting in composition may then have a different potential BP for changing conditions.

Multiple regression has been frequently used to examine controls on BP in natural habitats, although modeling approaches for bacteria have focused on either modeling the food web (Ducklow 1994, Hopkinson and Vallino 1994, Allen et al. 2002, Polimene et al. 2006) or modeling laboratory responses to variation in substrates (Oneill et al. 1989). Zubkov et al. (2004) developed one of the few models incorporating population level dynamics of different bacterial groups and was based on laboratory experimentation. In multiple regressions, DOC explains BP in some lakes with large amounts of terrestrial carbon inputs (Agren et al. 2008), but BP in other lakes is better explained by chla (Letarte and Pinelalloul 1991) and primary productivity (Chrost and Siuda 2006) or temperature and nutrients (Ameryk et al. 2005). A few investigators have also examined spatial patterns of BP. Shiah et al. (2003) found spatial variation in control of BP by temperature and substrate supply and Truu et al. (1996) found that covariation of environmental variables and spatial structure better explained BP than each alone. Bacterial community composition is rarely included in these models, although when included in a multiple regression in soil systems, community composition has been found to control processes (Balser and Firestone 2005).

Within this dissertation, modeling efforts have focused primarily on path analysis using field measurements of BP, temperature, stream discharge, chla, and DOC concentrations. However, it is also necessary to examine the effect of unmeasured site characteristics as well as community composition in order to understand patterns of community-level processes at larger spatial scales. Bayesian methods are used here to determine the relationship of community composition and environmental factors in determining bacterial productivity.

Methods

Field Data

Data are environmental samples of water temperature (temp), total dissolved nitrogen (TDN), total dissolved phosphorus (TDP), dissolved organic carbon (DOC), chlorophyll a (chla), and bacterial production (BP). Samples were collected weekly during the ice-free summer season at three sites in the Toolik Lake watershed in Northern Alaska from 2003-2007, a headwater stream (I-8 inlet), lake outlet (I-8 outlet), and farther downstream (I8-I9) (**Fig. 5.1**). Measurements were performed as described by Adams (Chapter 4) and Kling et al. (2000). Results from previous step-wise linear multiple regression using SPSS (v. 16.0) and path analysis using AMOS (v. 16.0) were used to narrow down the potential model inputs out of a larger set of biologically relevant drivers.

Bacterial community composition was determined by the comparison of banding patterns of denaturant gradient gel electrophoresis of 16S rRNA genes (Crump et al. 2003, 2007). Coordinates from a PROXCAL (SPSS 14, 17) generated NMDS plot of Dice transformed sample similarities of DNA from I-8 inlet and I-8 outlet in 2003 and 2007 were then used as a proxy for community composition within the relevant model.

Model Development

The basic model (model 1) is a generalized linear model of BP of sample i with the fixed effects (μ_i) of site, temp, TDN, and chla. Site identity and its associated parameter may account for unmeasured differences between sites such as pH, redox potential, or oxygen. The fixed effects are in the form of a multiple linear regression indicated by the likelihood and equation:

$$BP_i \sim \text{Lognormal}(\mu_i, \tau)$$

$$\mu_i = \alpha * site_i + \beta * temp_i + \gamma * TDN_i + \lambda * chla_i$$

Posterior densities of the parameters were calculated using Gibbs sampling, a type of Markov Chain Monte Carlo algorithm (WinBUGs 3.0.3). Missing data for chla were estimated using a prior uniform distribution based on the entire data range. Data for the rest of the chla data set were also estimated but were constrained to a range based on measurement error. Prior gamma distributions were used for parameters known to be positive, while normal or uniform distributions were used for all others.

$$\alpha \sim \text{Normal}(0, 0.0001)$$
$$\beta \sim \text{Normal}(0, 0.0001)$$
$$\gamma \sim \text{Normal}(0, 0.0001)$$
$$\lambda \sim \text{Normal}(0, 0.0001)$$
$$\tau \sim \text{Gamma}(0.01, 0.01)$$

Sites were incorporated as a fixed effect rather than as a random effect because the sites are different in potentially important ways. The three sites are in the same watershed (**Fig. 5.1**), however, the two closest sites, I-8 inlet and I-8 outlet, are most diverse in physical characteristics, BP (**Fig. 5.2**), and bacterial community composition despite proximity, and therefore site is incorporated without a mechanistic function such as distance.

Additional parameters of TDP and DOC were added to the model (model 2) to determine if the predictive power of the model could be improved. Model 2 was also run on each site independently as well as all sites together (alpha parameter and site variables removed) to test if and how the other included parameters were site specific. Community composition (**Figs. 5.3 and 5.4**) was added to the model (model 3) to test if the fixed effect of site could be explained by community composition differences rather than by environmental differences between sites. Coordinates from dimensions 1 and 2 (dim1 and dim2) of NMDS plots of community similarity between sites were used to distinguish bacterial communities in the model. Due to a limited data set, community composition was only modeled for I-8 inlet and I-8 outlet in 2003 and 2007 for a preliminary test of this modeling approach. Prior normal distributions were used for all additional parameters.

Model 2:

$$\mu_i = \alpha * site_i + \beta * temp_i + \gamma * TDN_i + \lambda * chla_i + \delta * TDP_i + \varepsilon * DOC_i$$

$$\delta \sim \text{Normal}\ (0, 0.0001)$$
$$\varepsilon \sim \text{Normal}\ (0, 0.0001)$$

Model 3:

$$\mu_i = \alpha * site_i + \beta * temp_i + \gamma * TDN_i + \lambda * chla_i + \delta * TDP_i + \varepsilon * DOC_i + \iota * Dim1_i + \kappa * Dim2_i$$

$$\iota \sim \text{Normal}\ (0, 0.0001)$$
$$\kappa \sim \text{Normal}\ (0, 0.0001)$$

Model Selection and Validation

Each model was run for a minimum of 20,000 (up to 100,000) iterations with three chains. Parameter convergence was verified by examination of the smoothness of the density curves of parameter estimations as well as the decrease of autocorrelation during the model run. The deviance information criterion (DIC) was used as the comparison of the model fit between different model formulations using the same data set. Site was initially included in the model as a random effect, but the DIC (723.4) did not significantly differ from the model including site as a direct effect (722.9). Log transforms were also tested as variations of the model for chla, DOC, TDN, and TDP, but parameters failed to converge in the smaller data sets (2003 and 2007) and initial parameters were not able to generate for the larger data set (2003-2007). Additional models including the incorporation of Michaelis- Menten dynamics and Monod equations or multivariate normal prior distribution of parameters were tested, but the parameters did not converge, despite running the models for over 1 million iterations. Non-convergence indicates that these mechanistic functions do not fit the community-wide response of BP in the field despite their ability to predict the responses of bacterial populations in laboratory cultures. Their application to mixed populations has long been in question (Wetzel 1994).

Results

The first model is a linear multiple regression which includes temperature, TDN, chla, and site as predictors of BP. Parameter estimates of environmental variables in this model had 95% confidence intervals which overlap with zero although TDN differed from zero by at least 1 standard deviation (SD) (**Table 5.1**). Site parameters were positive and had different values for each site (0.76 to 2.09), indicating that an additional factor not included in the model differed between sites and explains patterns of BP.

The addition of TDP and DOC as fixed effects into the second model improved the parameter estimates. Temperature, TDN, and DOC all had 95% CIs that did not overlap with zero (**Table 5.1**). Chla had parameter estimates different from zero within 1 SD. The site parameter estimates decreased for all three sites (-0.06 to 1.2). As in the previous model, the parameter for I-8 inlet was smallest out of the three and was not different from zero, while I-8 outlet was the largest, reflecting the greatest difference in

BP between the two sites (dif1, **Table 5.1**). The differences in site parameters were significant in both models and the addition of TDP and DOC did not change the parameter difference between I-8 inlet and I8-I9.

The removal of the site variable within the model increased the significance of the environmental parameters, but differences in environmental parameters were found when data sets from each site were run independently (**Table 5.2**). The 95% CI for all environmental parameter estimates were different from zero when the three sites were included without site identity. The parameter estimate for temperature increased (farther away from zero), and both chla and TDP changed from a negative to a positive parameter estimate. When data from each site was run in isolation, the magnitudes of parameters were different between sites. Both temperature and DOC had parameter estimates with a 95% CI that did not include zero and TDN was only different from zero at I-8 outlet (**Table 5.2**).

A subset of data from 2003 and 2007 at I-8 inlet and outlet were used in order to compare model 2 to model 3, with site identity restored as a variable. Focusing the model on one year at two sites yields different parameter estimates. The second model was modified to run on the environmental factors of this smaller data set. Again, the sites had different parameter estimates from each other (**Table 5.3**) but both 95% CI and standard deviation overlap with zero. In fact, for the smaller data sets, only parameter distributions for chla in 2003 and DOC in 2007 have the least overlap with zero.

NMDS dimensions of bacterial community similarity (**Fig. 5.3**) were added to model 3, and tested on the smaller subsets from 2003 and 2007 at I-8 inlet and outlet. Site parameter estimates again had 95% CI which overlapped with zero, although I-8 outlet in 2003 and both sites in 2007 were different from zero within 1 SD (**Table 5.3**). The estimates for the parameters of bacterial community indices were the only environmental variable in 2007 that had parameter estimates different from zero.

Discussion

The multiple regressions of BP, site, chla, temperature, and TDN indicate the importance of site differences for predicting BP. The three sites in model 1, I-8 inlet, I-8 outlet, and I8-I9, are all connected hydrologically, but differ in some way in addition to chla, temperature, and TDN. These differences are significant enough to impact BP, with particularly lower BP at I-8 inlet compared to the downstream sites (**Fig. 5.2**). This observation has been made previously (Chapter 4) but is verified by the differences in the alpha parameters of the model and the non-zero values of dif1, dif2, and dif3, which compare the alpha parameters between sites (**Table 5.1**).

While the parameters used in model 1 were indicated by a previous step-wise multiple regression to have the strongest effect on BP, TDP and DOC are also thought to be biologically important. Model 2 included these parameters which resulted in a decrease in the estimates of site parameters (closer to zero). The addition of TDP and DOC explained some of the variation previously contained within the site variables. In other words, some of the differences in BP between sites can also be explained by differences in TDP and DOC. The addition of more biologically relevant environmental factors such as redox potential or pH may further decrease the site parameters (alphas) and explain more of the variance of BP.

The impact of site identity was also seen when the site variable was removed from the model. All parameter estimates were different from zero, suggesting that unmeasured site differences may be correlated with these variables, inflating the strength of their relationship with BP. When data from each site was run individually, parameter estimates were more similar to those from the full version of model 2 which included site identity. Each site differed in parameter estimates, similar to the variation found in the path analysis of Chapter 2, where strength of drivers varied based on habitat type or year.

Spatial or temporal variation of strength of environmental drivers on BP could be due to differences in bacterial community compositions. Community composition can shift quickly and be very different despite close proximity, as found in Chapters 2-4. Incorporating a composite measure of bacterial community composition was only possible for two years at two sites because samples must be compared on the same NMDS, and therefore the same DGGE comparison. Consequently, model 2 was tested on the smaller data sets of years 2003 and 2007 at I-8 inlet and I-8 outlet for comparison of model parameters with and without community composition. The smaller data set resulted in temperature and TDN parameter estimates closer to zero in both years compared to the models run with all three sites, suggesting that either bacteria at I8-I9 had a stronger relationship with temperature and TDN, or that the controls on BP can vary from year to year. Yearly variation is also evident in the difference of parameter estimates in 2003 compared to 2007. In 2003, lambda (chla) was farther from zero than in 2007, while epsilon (DOC) was farther from zero in 2007 than in 2003. Likewise, dif1, the difference between site parameters, is farther from zero in 2003 than in 2007. This suggests that the overall site difference between I-8 inlet and I-8 outlet varied in some respect more in 2003 than in 2007. Yearly variation in importance of controls has been also indicated by path analysis of BP at the catchment scale (Chapter 2).

When the dimensions of the NMDS of bacterial community similarities were added to the model, the dimensions differed in the magnitude of their parameter estimates. In NMDS, the first dimension should account for the majority of community differences between habitats, and in 2003, dim1 does have a parameter estimate greater than dim2. However, in 2007, the pattern is reversed, and dim2 is farther from zero than dim1, and also differs from zero by at least 1 SD. Interestingly, many of the other environmental parameter estimates became closer to zero in model 3 and their decreased importance may reflect community specific responses to those environmental variables.

Analysis of residuals of the models was performed to determine potential relationships not included in the model. Both models 1 and 2 run with the full data set and by site indicate that residuals have no relationship with BP.h (predicted BP), day of year, nitrate, ammonium, or phosphate. However, both models 2 and 3 run with the smaller data set (2003 and 2007) have residuals that increase in variance compared to predicted BP, indicating potential non-linear relationships. The presence of outliers in some of the environmental data may be responsible for the appearance of a non-linear relationship. Log transformation of data prior to running the models reduced the magnitude of some residuals, but residuals still showed increasing variance with increasing predicted BP. The exclusion of samples with outliers did not remedy the pattern and increased the number of iterations required to converge, if at all. The smaller data sets are limited to 15-17 sampling dates and it is likely that the inclusion of a larger data set would result in more robust parameter estimates and diminish the impact of data outliers.

This modeling investigation of different environmental factors and community composition as controls on BP has highlighted the importance of unmeasured site characteristics as well as community composition across the catchment. Although step-wise multiple regression had previously indicated that temperature, TDN, and chla would be the best predictors of BP, this exploration of modeling highlighted the importance of spatial variation and community composition, as well as verifying the potential for interannual variation in the importance of controls. Non-linear relationships of environmental variables and BP may describe individual bacterial populations, but community-wide responses appear to be better described by multiple regression. Further exploration of community compositional changes in natural habitats may allow for a broader predictive model that merges both community dynamics and a variable habitat.

Conclusions

Throughout this dissertation, the interaction of environmental factors, community composition, and bacterial productivity has been examined through various approaches and at different temporal and spatial scales. Laboratory mesocosm experiments examined the effect of temperature and nutrients and short time scales on both communities and bacterial production. Transplant experiments *in situ* isolated the mechanisms of metacommunity dynamics. Field measurements from the scale of a single site up to an entire lake district have been used to develop both path analysis and Bayesian models. Throughout these investigations, the importance of bacterial community composition has been evident, even at short time scales. The feedback between bacterial productivity and community composition clearly controls the observed impact of environmental drivers on bacterial production, and future efforts to predict or understand bacterial productivity necessitates the consideration of community composition.

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Tables

Table 5.1. Summary of parameter estimates from multiple regression of temperature, TDN, chla, and site identity as fixed effects controlling BP. Model 1 includes data from summers 2003-2007; model 2 also incorporates TDP and DOC.

		Mean ± SD (95% CI)	
Variable	**Parameter**	**Model 1 (2003-2007)**	**Model 2 (2003-2007)**
I-8 inlet	alpha[1]	0.76 ± 0.26 (0.27, 1.27)	-0.06 ± 0.38 (-0.81, 0.67)
I-8 outlet	alpha[2]	2.09 ± 0.32 (1.46, 2.73)	1.20 ± 0.44 (0.33, 2.05)
I8-I9	alpha[3]	1.52 ± 0.31 (0.91, 2.15)	0.70± 0.42 (-0.13, .51)
Temp	beta	0.02 ± 0.02 (-0.02, 0.06)	0.045 ± 0.02 (0.01, 0.08)
TDN	gamma	-0.03 ± 0.01 (0.04, -0.01)	-0.03 ± 0.01 (-0.04, -0.02)
chla	lambda	-0.10 ± 0.12 (-0.33, 0.14)	-0.116 ± 0.11 (-0.33, 0.11)
TDP	delta	n/a	-0.23 ± 0.37 (-0.94, 0.49)
DOC	epsilon	n/a	0.001 ± 4.38E-04 (4.80E-04, 0.002)
dif1	alpha[1]- alpha[2]	-1.32 ± 0.16 (-1.65,-1.00)	-1.26 ± 0.16 (-1.58, -0.95)
dif2	alpha[2]- alpha[3]	0.56 ± 0.14 (0.29, 0.84)	0.50 ± 0.14 (0.23, 0.77)
dif3	alpha[3]- alpha[1]	0.76 ± 0.15 (0.46, 1.06)	0.76 ± 0.15 (0.47, 1.06)
precision	tau	2.07 ± 0.24 (1.63, 2.55)	2.17 ± 0.25 (1.71, 2.70)

Table 5.2. Summary of parameter estimates from multiple regression of temperature, TDN, chla, TDP, and DOC as fixed effects controlling BP at each site (Model 2, 2003-2007).

		Mean ± SD (95% CI)			
Variable	**Parameter**	**I-8 inlet**	**I-8 outlet**	**I8-I9**	**All sites**
Temp	beta	0.12 ± 0.02 (0.08, 0.17)	0.08 ± 0.02 (0.04, 0.11)	0.04 ± 0.02 (0.003, 0.08)	0.08 ± 0.01 (0.06, 0.10)
TDN	gamma	-0.10 ± 0.02 (-0.14, -0.06)	-0.02 ± 0.01 (-0.04, -0.004)	0.03 ± 0.01 (-0.04, -0.01)	-0.03 ± 0.007 (-0.05, -0.02)
chla	lambda	0.13 ± 0.22 (-0.31, 0.55)	-0.27 ± 0.14 (-0.55, 0.02)	0.13 ± 0.27 (-0.40, 0.66)	0.29 ± 0.12 (0.06, 0.51)
TDP	delta	1.15± 2.36 (-3.49, 5.79)	-0.31 ± 0.34 (-0.99, 0.36)	-0.24 ± 3.95 (-8.11, 7.39)	0.20 ± 3.41E-04 (4.54E-04, 0.002)
DOC	epsilon	0.001± 5.38E-04 (3.70E-04, 0.002)	0.003 ± 6.178E-04 (0.002, 0.004)	0.002 ± 6.66E-04 (0.001, 0.004)	0.001 ± 3.41E-04 (4.54E-04, 0.002)
precision	tau	2.56± 0.52 (1.65, 3.68)	2.70± 0.55 (1.74, 3.88)	2.01 ± 0.44 (1.26, 2.96)	1.62 ± 0.19 (1.27, 2.01)

Table 5.3. Summary of parameter estimates from multiple regression of temperature, TDN, TDP, DOC, chla, and site identity as fixed effects controlling BP. Model 3 also adds community composition as reduced to the first two dimensions of NMDS plots of community similarity between sites.

		Mean ± SD (95% CI)			
Variable	**Parameter**	**Model 2 (2003)**	**Model 3 (2003 + DNA)**	**Model 2 (2007)**	**Model 3 (2007 + DNA)**
I-8 inlet	alpha[1]	-0.07 ± 2.27 (-4.98, 4.06)	1.99 ± 2.47 (-2.82, 6.91)	2.05 ± 3.27 (-4.47, 8.5)	7.63 ± 5.00 (-2.97, 17.52)
I-8 outlet	alpha[2]	1.41 ± 2.22 (-3.38, 5.46)	4.02 ± 2.64 (-1.08, 9.25)	3.14 ± 3.71 (-4.25, 10.42)	8.79 ± 5.44 (-2.75, 19.61)
Temp	beta	-0.03 ± 0.08 (-0.19, 0.14)	-0.06 ± 0.11 (-0.29, 0.14)	0.02 ± 0.15 (-0.26, 0.31)	-0.22 ± 0.21 (-0.65, 0.23)
TDN	gamma	-0.014 ± 0.03 (-0.07, 0.04)	-0.02 ± 0.03 (-0.08, -0.04)	0.02 ± 0.09 (-0.15, 0.19)	0.07 ± 0.09 (-0.11, 0.24)
chla	lambda	0.48 ± 0.52 (-0.65, 1.44)	-0.07 ± 0.70 (-1.56, 1.17)	-0.19 ± 0.49 (-1.15, 0.79)	-0.31 ± 0.49 (-1.28, 0.68)
TDP	delta	-3.21 ± 18.69 (-38.82, 34.63)	-12.2 ± 20.61 (-53.32, 29.89)	0.21 ± 0.68 (-1.13, 1.56)	0.22 ± 0.73 (-1.23, 1.67)
DOC	epsilon	4.97E-04 ± 0.002 (-0.003, 0.004)	-3.76E-04 ± 0.002 (-0.004, 0.003)	-0.004 ± 0.004 (-0.01, 0.004)	-0.01 ± 0.01 (-0.02, 0.002)
Dim1	iota	n/a	1.27 ± 1.31 (-1.25, 3.89)	n/a	-0.83 ± 0.87 (-2.56, 0.93)
Dim2	kappa	n/a	0.53 ± 1.44 (-2.39, 3.32)	n/a	1.08 ± 0.77 (-0.49, 2.60)
dif1	alpha[1]- alpha[2]	-1.48 ± 0.58 (-2.65, -0.32)	2.04 ± 1.53 (-5.07, 0.93)	-1.09 ± 1.11 (-3.26, 1.14)	-1.16 ± 1.21 (-3.56, 1.28)
precision	tau	1.12 ± 0.57 (0.34, 2.52)	1.23 ± 0.69 (0.32, 2.83)	2.01 ± 0.95 (0.59, 4.24)	2.40 ± 1.30 (0.56, 5.54)

Figures

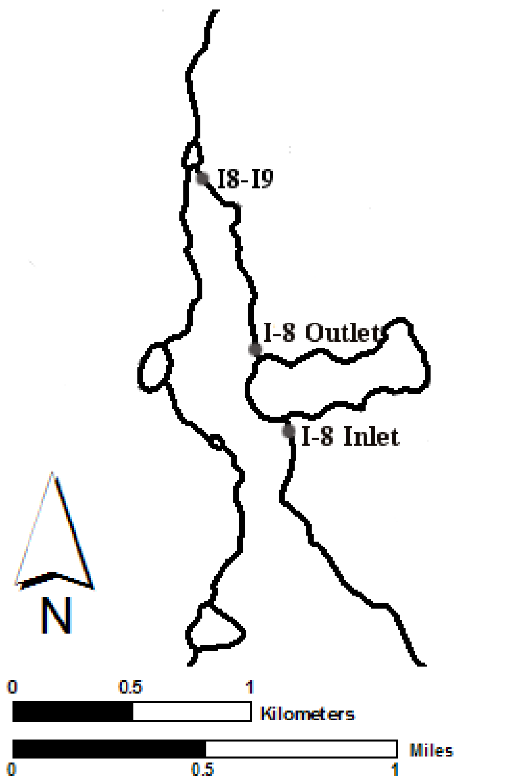

Figure 5.1. Sampling sites in the Lake I-8 catchment, Northern Alaska.

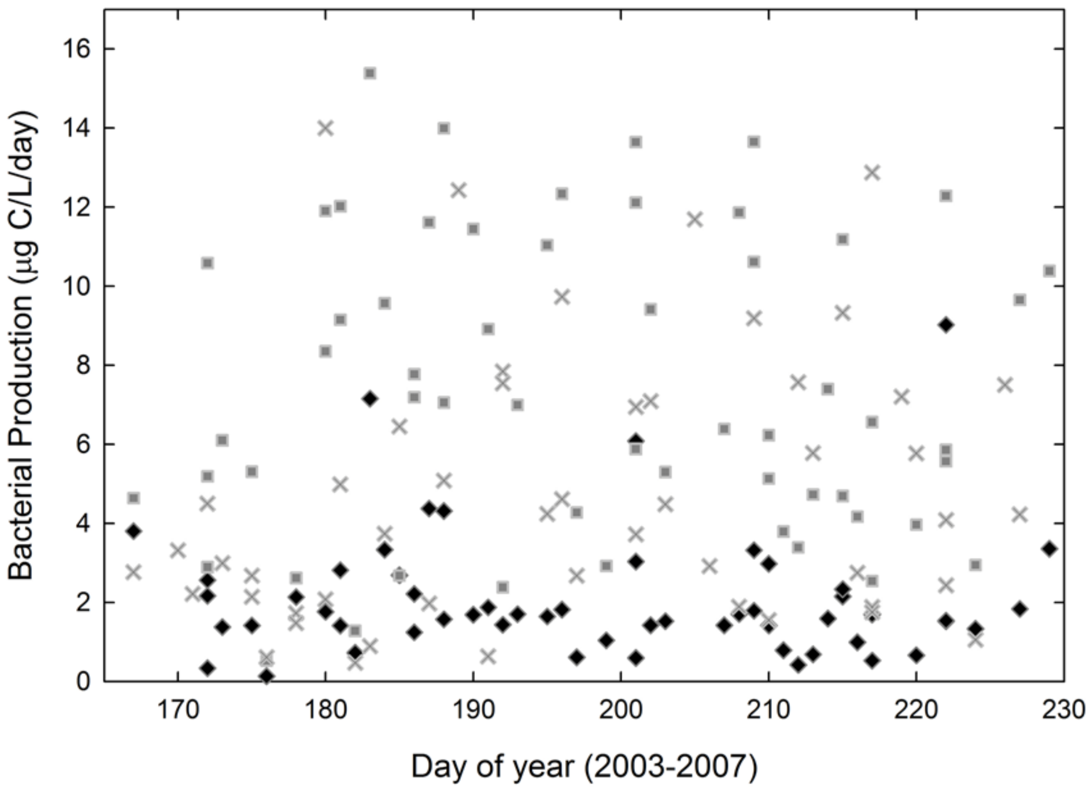

Figure 5.2. BP at three sites downstream from each other during the summer season. Bacterial Production at sites upstream and downstream of Lake I-8. ♦ I-8 inlet, ■ I-8 outlet, and × I-8 to I-9, for summers 2003-2007.

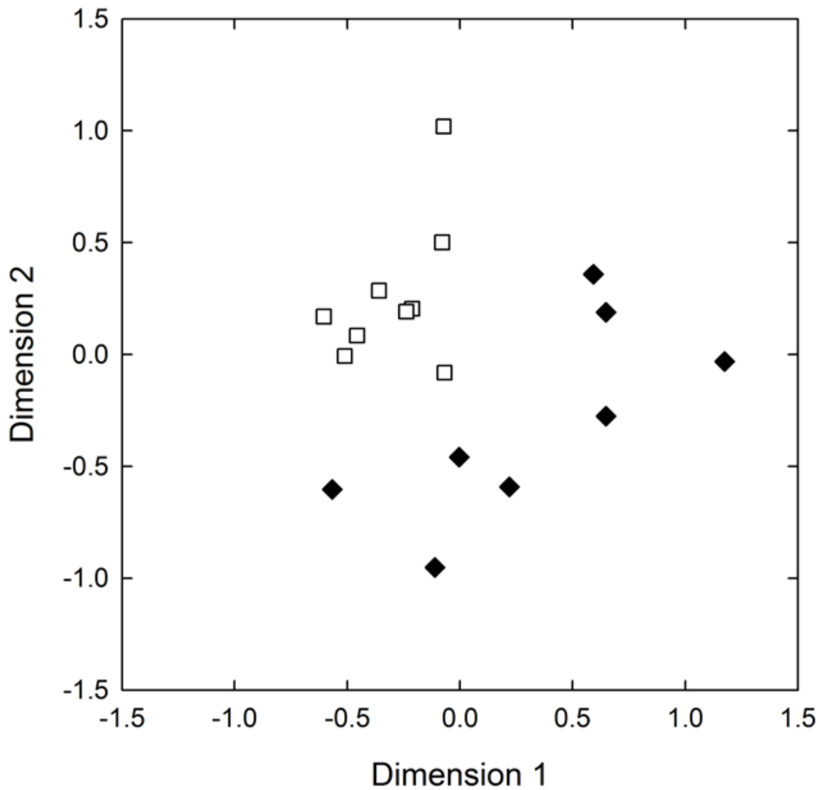

Figure 5.3. NMDS plot of bacterial community similarity in 2003 at I-8 inlet (♦) and outlet (□). Normalized raw stress value = 0.05.

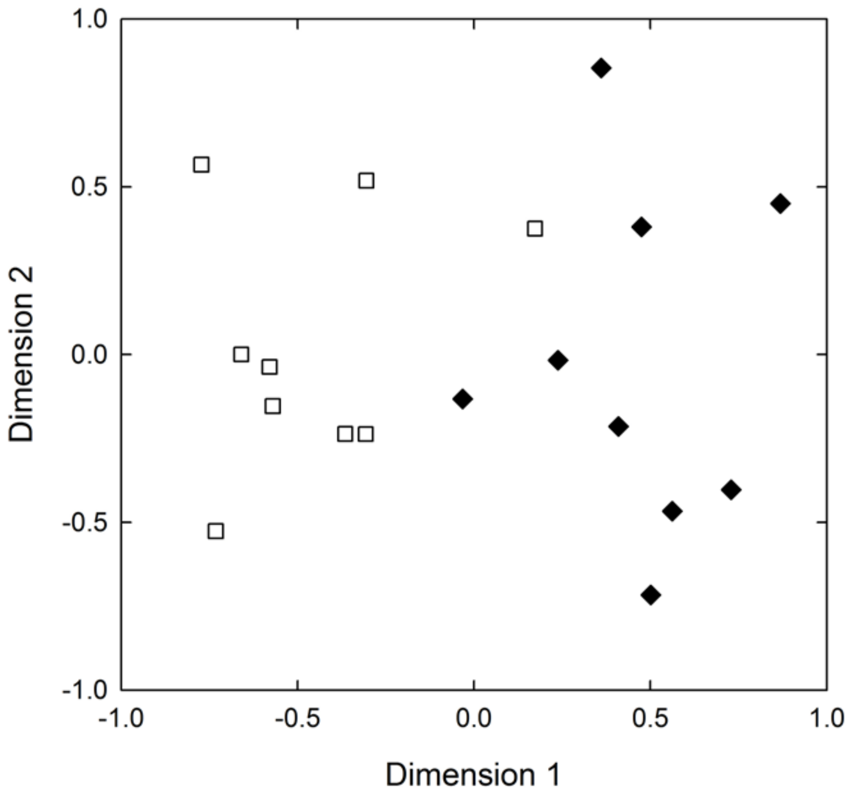

Figure 5.4. NMDS plot of bacterial community similarity at I-8 inlet (♦) and outlet (□) in summer 2007. Normalized raw stress value = 0.04.

Appendix

Appendix 5.A. WinBUGs code.

```
#Linear model of BP with chla (estimated missing values), temperature, TDN, TDP, and DOC and
site as fixed effects, plus coordinates of bacterial community composition NMDS.

model
{
                for( i in 1 : 17) {          # loop number is based on number of samples
                        BP[i]~dlnorm(mu[i],tau) #likelihood
                        mu[i])<-
alpha[Site[i]]+beta*temp[i]+gamma*TDN[i]+lambda*chlaEst[i]+delta*TDP[i]+epsilon*DOC[i]+
iota*Dim1[i]+kappa*Dim2[i]
                        BP.h[i]~dlnorm(mu[i],tau) #predictions
                        residuals[i]<-BP[i]-BP.h[i]

                        chlaEst[i]~dunif(chlalower[i],chlaupper[i])
                }
for (i in 1:2){  #1:3 for models run with all three sites
alpha[i]~dnorm(0,0.0001) # fixed effects
}
beta~dnorm(0,0.0001)
gamma~dnorm(0,0.0001)
lambda~dnorm(0,0.0001)
delta~dnorm(0,0.0001) #not used in model 1
epsilon~dnorm(0,0.0001) #not used in model 1
iota~dnorm(0,0.0001) # used in model 3 only
kappa~dnorm(0,0.0001) # used in model 3 only
dif1<-alpha[1]-alpha[2]
dif2<-alpha[2]-alpha[3] #used for data sets from all three sites
dif3<-alpha[3]-alpha[1] #used for data sets from all three sites
tau~dgamma(0.01,0.01)
        }

#Initial values
list(alpha = c(1,1),  #c(1,1,1) for models run with all three sites
beta = 0,
gamma = 0,
lambda =0,
delta =0, #not used in model 1
epsilon =0, #not used in model 1
iota=0, # used in model 3 only
kappa=0, # used in model 3 only
tau = 1)
```

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Appendix A. Bacterial Production measurements for summers 2002-2007.

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	Toolik shore	15-Jun-03		0.01		2.0	13.62
2003-0532	Toolik Main	16-Jun-03		3		2.0	10.14
2003-0536	Toolik Main	16-Jun-03		14		2.0	10.58
2003-0539	Toolik Inlet	17-Jun-03	9:00	0.01		2.0	11.19
2003-0239	Toolik Inlet	20-Jun-03	18:00	0.01		11.0	1.42
2003-0242	I8-I9	20-Jun-03	15:40	0.01	10.5	10.5	2.21
2003-0243	I7-I9	20-Jun-03	16:22	0.01	12.2	12.2	1.33
2003-0568	I8 in	21-Jun-03	14:40	0.01	14.1	14.1	0.34
2003-0569	I8 out	21-Jun-03	15:10	0.01	6.5	14.1	2.89
2003-0573	Toolik	23-Jun-03	9:30	1		2.0	5.62
2003-0574	Toolik	23-Jun-03	10:00	3		2.0	8.43
2003-0575	Toolik	23-Jun-03	10:30	5		2.0	7.89
2003-0576	Toolik	23-Jun-03	11:00	8		2.0	7.78
2003-0577	Toolik	23-Jun-03	11:30	12		2.0	7.32
2003-0578	Toolik	23-Jun-03	12:00	16		2.0	2.52
2003-0288	I2-I3	24-Jun-03	9:30	0.01	14.8	8.0	0.78
2003-0290	I1-I3	24-Jun-03	9:30	0.01	8.0	8.0	0.85
2003-0293	I4-I5 (I5 in)	24-Jun-03	16:00	0.01	12.3	12.3	1.01
2003-0296	I6 HW in	24-Jun-03	15:15	0.01	9.2	9.2	0.36
2003-0299	I6 West in	24-Jun-03	18:00	0.01	8.1	2.0	0.44
2003-0302	I8 Headwaters	24-Jun-03	10:45	0.01	5.9	5.9	0.22
2003-0594	I1	24-Jun-03	12:10	1	5.9	5.4	1.24
2003-0595	I1	24-Jun-03	12:10	3	4.9	5.4	1.72
2003-0596	I2	24-Jun-03	10:45	1	5.4	5.0	0.90
2003-0597	I2	24-Jun-03	10:45	3	4.7	5.0	1.22
2003-0598	I3	24-Jun-03	12:50	1	14.4	14.4	2.83
2003-0599	I3	24-Jun-03	12:50	3	7.4	14.4	5.23
2003-0600	I4	24-Jun-03	13:55	1	10.4	6.6	0.91
2003-0601	I4	24-Jun-03	13:55	3	6.6	6.6	2.16
2003-0603	I5	24-Jun-03	18:00	3	4.8	2.0	1.95
2003-0604	I6 HW	24-Jun-03	15:10	1	6.0	6.0	1.98
2003-0295	I5-I6	25-Jun-03	9:50	0.01	8.0	8.0	1.34
2003-0301	I7-I9	25-Jun-03	16:15	0.01	13.9	13.7	1.99
2003-0303	I8 In	25-Jun-03	14:15	0.01	16.0	16.0	0.14
2003-0304	I8 Out	25-Jun-03	15:20	0.01	14.0	14.0	0.52
2003-0305	I8-I9	25-Jun-03	16:15	0.01	13.8	2.0	0.61
2003-0306	MWL	25-Jun-03	16:30	0.01	8.7	8.7	0.93
2003-0308	Swamp In	25-Jun-03	17:00	0.01	11.9	11.9	0.35
2003-0310	Toolik Inlet	25-Jun-03	16:45	0.01	14.0	6.6	1.41
2003-0611	I6	25-Jun-03	11:45	1	7.1	7.0	1.77
2003-0612	I6	25-Jun-03	11:45	3	6.9	7.0	1.94
2003-0613	I7	25-Jun-03	13:05	1	11.4	8.9	2.23
2003-0614	I7	25-Jun-03	13:05	3	6.4	8.9	0.50
2003-0615	I8	25-Jun-03	15:30	1	13.2	10.2	6.22
2003-0616	I8	25-Jun-03	15:30	3	7.2	10.2	4.64
2003-0617	Iswamp	25-Jun-03	14:50	1	13.4	11.2	1.31
2003-0618	Iswamp	25-Jun-03	14:50	3	9.0	11.2	1.18

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2003-0619	Iminus	25-Jun-03	10:35	1	3.89	3.9	2.03
2003-0620	Iminus	25-Jun-03	10:35	3	3.87	3.9	2.15
2003-0191	Toolik	27-Jun-03		1		4.0	4.22
2003-0192	Toolik	27-Jun-03		3		4.0	4.90
2003-0193	Toolik	27-Jun-03		5		4.0	4.54
2003-0194	Toolik	27-Jun-03		8		4.0	4.71
2003-0195	Toolik	27-Jun-03		12		4.0	4.12
2003-0196	Toolik	27-Jun-03		16		4.0	3.94
2003-0245	Toolik Inlet	27-Jun-03		0.01		4.0	1.53
2003-0248	I8-I9	27-Jun-03		0.01		4.0	1.73
2003-0249	I7-I9	27-Jun-03		0.01		4.0	3.06
2003-0622	I8 in	1-Jul-03		0.01	14.5	14.5	0.73
2003-0623	I8 out	1-Jul-03		0.01	15.2	15.2	1.28
2003-0627	I8 in	3-Jul-03		0.01		6.0	3.34
2003-0627	I8 in	3-Jul-03		0.01		16.0	9.74
2003-0628	I8 out	3-Jul-03		0.01		6.0	9.57
2003-0628	I8 out	3-Jul-03		0.01		16.0	14.67
2003-0198	Toolik	4-Jul-03		1		4.0	7.46
2003-0199	Toolik	4-Jul-03		3		4.0	9.15
2003-0200	Toolik	4-Jul-03		5		4.0	7.35
2003-0201	Toolik	4-Jul-03		8		4.0	8.89
2003-0202	Toolik	4-Jul-03		12		4.0	8.76
2003-0203	Toolik	4-Jul-03		16		4.0	7.77
2003-0251	Toolik Inlet	4-Jul-03		0.01		4.0	10.64
2003-0254	I8-I9	4-Jul-03		0.01		4.0	6.45
2003-0255	I7-I9	4-Jul-03		0.01		4.0	13.95
2003-0647	I8	5-Jul-03		1	13.5	13.5	4.59
2003-0648	I8	5-Jul-03		3	11.8	11.8	7.43
2003-0649	I8	5-Jul-03		7	8.2	8.2	3.87
2003-0650	I8 In	5-Jul-03		0.01	11.8	11.8	2.22
2003-0651	I8 Out	5-Jul-03		0.01	14.4	14.4	7.77
2003-0681	I8 In	10-Jul-03		0.01	11.9	11.9	1.87
2003-0682	I8	10-Jul-03		1	15.4	15.4	2.78
2003-0683	I8	10-Jul-03		3	13.4	13.4	6.69
2003-0684	I8 Out	10-Jul-03		0.01	13.5	13.5	8.91
2003-0205	Toolik	11-Jul-03		1	12.86	12.0	8.01
2003-0205	Toolik	11-Jul-03		1	12.86	12.9	7.33
2003-0206	Toolik	11-Jul-03		3	12.31	12.0	8.83
2003-0207	Toolik	11-Jul-03		5	10.59	12.0	5.33
2003-0207	Toolik	11-Jul-03		5	10.59	10.6	4.36
2003-0208	Toolik	11-Jul-03		8	7.8	6.0	3.74
2003-0209	Toolik	11-Jul-03		12	6.44	6.0	2.95
2003-0210	Toolik	11-Jul-03		16	5.8	6.0	4.30
2003-0210	Toolik	11-Jul-03		16	5.8	5.8	1.83
2003-0257	Toolik Inlet	11-Jul-03		0.01	12.2	13.5	7.29
2003-0260	I8-I9	11-Jul-03		0.01	12.2	13.7	7.85
2003-0261	I7-I9	11-Jul-03		0.01	13	14.2	4.76
2003-0312	I1-I3	15-Jul-03	10:30	0.01	9.3	9.0	1.86

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2003-0314	I2-I3	15-Jul-03	10:30	0.01	7	6.6	0.81
2003-0319	I5-I6	15-Jul-03	17:50	0.01	11.1	11.1	2.67
2003-0320	I6 HW in	15-Jul-03	15:55	0.01	4.5	4.6	0.14
2003-0326	I8 Headwaters	15-Jul-03	10:00	0.01	2.8	3.5	0.29
2003-0793	I2	15-Jul-03	11:45	1		7.9	0.51
2003-0794	I2	15-Jul-03	11:45	13		5.7	0.84
2003-0791	I1	15-Jul-03	13:00	1		8.5	0.62
n/a	I1	15-Jul-03	13:00	8.5		7.1	1.79
2003-0795	I3	15-Jul-03	14:00	1		8.9	3.59
2003-0797	I4	15-Jul-03	15:45	1		8.4	2.22
2003-0801	I6 west HW	15-Jul-03	16:30	1		9.5	1.08
n/a	I6 west HW	15-Jul-03	16:30	5.5		6.8	3.68
2003-0317	I4-I5 (I5 in)	16-Jul-03		0.01			1.47
2003-0323	I6 West in	16-Jul-03	11:15	0.01	4.3	5.5	0.15
2003-0325	I7-I9	16-Jul-03	16:15	0.01	8.6	8.1	1.27
2003-0327	I8 In	16-Jul-03	14:30	0.01	3.8	5.7	0.61
2003-0328	I8 Out	16-Jul-03	15:00	0.01	7.8	7.5	4.27
2003-0329	I8-I9	16-Jul-03	16:15	0.01	8	7.8	2.68
2003-0330	MWL	16-Jul-03	16:30	0.01	6	6.4	0.13
2003-0332	Swamp In	16-Jul-03	17:15	0.01	9.4	9.3	0.93
2003-0334	Toolik Inlet	16-Jul-03	17:00	0.01	7.7	9.3	2.08
2003-0799	I5	16-Jul-03	10:20	1		9.5	2.49
n/a	I5	16-Jul-03	10:20	7.5		9.2	1.37
2003-0805	I6	16-Jul-03	12:20	1		7.5	1.90
n/a	I6	16-Jul-03	12:20	7.5		6.5	1.74
2003-0807	I7	16-Jul-03	14:10	1		7.6	3.06
n/a	I7	16-Jul-03	14:10	9.5		6	1.74
2003-0809	I8	16-Jul-03	15:15	1		6.7	1.07
n/a	I8	16-Jul-03	15:15	7.5		7.1	1.62
2003-0811	Iswamp	16-Jul-03	16:15	1		7.9	2.17
2003-0213	Toolik	18-Jul-03	9:17	3			6.11
2003-0217	Toolik	18-Jul-03	10:00	16			3.47
2003-0779	I8incub in/in	20-Jul-03		0.01	6	6	16.73
2003-0780	I8 incub out/out	20-Jul-03		0.01	6	6	8.23
2003-0781	I8 incub in/out	20-Jul-03		0.01	6	6	6.98
2003-0782	I8 incub out/in	20-Jul-03		0.01	6	6	45.13
2003-0783	I8 incub in/in	20-Jul-03		0.01	16	16	27.15
2003-0784	I8 incub out/out	20-Jul-03		0.01	16	16	24.74
2003-0785	I8 In	22-Jul-03		0.01			1.52
2003-0786	I8	22-Jul-03		1			5.06
2003-0788	I8	22-Jul-03		3			3.20
2003-0789	I8	22-Jul-03		7			4.73
2003-0790	I8 Out	22-Jul-03		0.01			5.30
2003-0220	Toolik	25-Jul-03	9:07	3	11.7	12	6.53
2003-0222	Toolik	25-Jul-03	9:30	8	9.7	9.3	3.40
2003-0224	Toolik	25-Jul-03	9:55	16	6.5	6.5	1.64
2003-0269	Toolik Inlet	25-Jul-03	12:30	0.01	10.1	10.1	2.74
2003-0272	I8-I9	25-Jul-03		0.01	10.6	10.1	2.91

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2003-0273	I7-I9	25-Jul-03		0.01	11.7	12	5.17
2003-0907	I8 In	29-Jul-03		0.01	7.8	7.8	1.42
2003-0908	I8 Out	29-Jul-03		0.01	7.4	7.4	5.13
2003-0911	I8 In	31-Jul-03		0.01	4.8	4.8	0.42
2003-0912	I8	31-Jul-03		1	7.6	7.6	1.81
2003-0913	I8	31-Jul-03		3	6.9	6.9	2.71
2003-0914	I8	31-Jul-03		7	6.9	6.9	2.20
2003-0915	I8 Out	31-Jul-03		0.01	6.4	6.4	3.39
2003-0227	Toolik	1-Aug-03	9:30	3	8.9	8.9	3.95
2003-0231	Toolik	1-Aug-03	10:10	16	6.5	8.1	2.82
2003-0275	Toolik Inlet	1-Aug-03	12:08	0.01	6.9	11.5	3.42
2003-0278	I8-I9	1-Aug-03	9:43	0.01	6.4	10.2	5.78
2003-0279	I7-I9	1-Aug-03	10:08	0.01	7.3	10.2	2.61
2003-0336	I1-I3	5-Aug-03	10:15	0.01	7.9	7.2	0.70
2003-0338	I2-I3	5-Aug-03	10:15	0.01	7.2	7.2	1.25
2003-0343	I5-I6	5-Aug-03	17:50	0.01	9.4	7.3	0.75
2003-0344	I6 HW in	5-Aug-03	17:50	0.01	5.8	6.5	0.02
lakes	I2	5-Aug-03	11:45	1		5.8	1.01
n/a	I2	5-Aug-03	11:45	14		4.2	0.79
lakes	I1	5-Aug-03	13:40	1		7.8	1.08
n/a	I1	5-Aug-03	13:40	8.5		7.8	0.98
lakes	I3	5-Aug-03	14:50	1		7.3	0.81
lakes	I4	5-Aug-03	16:00	1		7.2	1.58
lakes	I6 west HW	5-Aug-03	18:00	1		6.5	1.43
n/a	I6 west HW	5-Aug-03	18:00	6		7.7	1.05
2003-0347	I6 West	5-Aug-03	17:50	0.01	6.1	6.5	0.32
2003-0349	I7-I9	5-Aug-03	17:15	0.01	9.3	9.3	0.68
2003-0350	I8 Headwaters	5-Aug-03	10:05	0.01	4.9	4.9	0.42
2003-0351	I8 In	5-Aug-03	14:30	0.01	6.5	6.5	0.53
2003-0352	I8 Out	5-Aug-03	15:05	0.01	7.7	7.7	2.54
2003-0353	I8-I9	5-Aug-03	17:10	0.01	8.1	8.1	1.89
2003-0354	MWL	5-Aug-03	17:10	0.01	8.6	8.1	1.34
2003-0356	Swamp In	5-Aug-03	14:30	0.01	7.7	7.7	1.15
2003-0358	Toolik Inlet	5-Aug-03	18:15	0.01	9	9	1.77
lakes	I5	6-Aug-03	11:00	1		9.1	2.27
n/a	I5	6-Aug-03	11:00	8		9.1	2.03
lakes	I6	6-Aug-03	13:30	1		11.3	2.09
n/a	I6	6-Aug-03	13:30	7.5		11.3	2.55
lakes	I7	6-Aug-03	15:15	1		10.1	2.46
n/a	I7	6-Aug-03	15:15	10		10.1	3.19
lakes	I8	6-Aug-03	16:10	1		9.3	3.38
n/a	I8	6-Aug-03	16:10	7		8.1	5.20
lakes	Iswamp	6-Aug-03	17:25	1		9.5	2.37
2003-0234	Toolik	8-Aug-03	0:00	3			3.96
2003-0238	Toolik	8-Aug-03	0:00	16			4.22
n/a	I8 incub in/in	8-Aug-03	13:45		12	12	50.73
n/a	I8 incub out/out	8-Aug-03	13:45		12	12	23.26
n/a	I8 incub in/out	8-Aug-03	13:45		12	12	10.92

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	I8 incub out/in	8-Aug-03	13:45	0	12	12.0	22.08
2003-0921	I8 In	12-Aug-03	12:11	0.01	3.3	3.3	1.33
2003-0922	I8	12-Aug-03	11:25	1	6.8	6.8	4.51
2003-0923	I8	12-Aug-03	11:46	3	5.3	5.3	3.66
2003-0925	I8 Out	12-Aug-03	13:01	0.01	5.8	5.8	2.95
n/a	Toolik	15-Aug-03	0:00	3	7.8	7.8	1.70
n/a	Toolik	15-Aug-03	0:00	8	7.6	7.8	1.33
n/a	Toolik	15-Aug-03	0:00	16	7.2	7.2	2.71
n/a	Toolik Inlet	15-Aug-03	0:00	0.01	7.0	7.2	3.54
n/a	I8-I9	15-Aug-03	0:00	0.01	6.1	6.1	4.22
n/a	I7-I9	15-Aug-03	0:00	0.01	8.4	8.4	4.16
2003-1018	I8 incub in/in	17-Aug-03	0:00		12.0	12.0	10.34
2003-1019	I8 incub out/out	17-Aug-03	0:00		12.0	12.0	17.25
2003-1020	I8 incub in/out	17-Aug-03	0:00		12.0	12.0	10.61
2003-1021	I8 incub out/in	17-Aug-03	0:00		12.0	12.0	12.56
2004-0137	Toolik	18-Jun-04	9:16	1	5.5		2.56
2004-0138	Toolik	18-Jun-04	9:30	3	5.5		4.60
2004-0139	Toolik	18-Jun-04	9:45	5	5.4		4.22
2004-0140	Toolik	18-Jun-04	10:00	8	5.3		4.93
2004-0141	Toolik	18-Jun-04	10:10	12	5.3		2.40
2004-0142	Toolik	18-Jun-04	10:30	16	5.2		4.21
2004-0134	I7-I9	18-Jun-04	0:00	0.01	15.0	16.0	3.39
2004-0133	I8-I9	18-Jun-04	0:00	0.01	15.4	16.0	3.31
2004-0130	Toolik Inlet	18-Jun-04	0:00	0.01	14.5	16.0	1.63
2004-0158	I2-I3	22-Jun-04	9:15	0.01	13.5	13.5	7.16
2004-0156	I1-I3	22-Jun-04	9:15	0.01	11.7	11.7	1.20
2004-0170	I8 Headwaters	22-Jun-04	10:20	0.01	10.4	11.7	3.79
2004-0667	I2	22-Jun-04	10:37	1	16.1	16.1	1.35
2004-0665	I1	22-Jun-04	12:15	1	13.2	13.2	2.86
2004-0669	I3	22-Jun-04	13:15	1	16.1	16.1	9.79
2004-0671	I4	22-Jun-04	14:35	1	15.8	16.1	9.86
2004-0162	I5-I6	22-Jun-04	15:45	0.01	14.1	14.2	3.05
2004-0164	I6 HW In	23-Jun-04	15:45	0.01	9.6	9.6	5.25
2004-0167	I6 West	22-Jun-04	15:45	0.01	11.5	13.3	1.71
2004-0677	I6 HW	22-Jun-04	16:10	1	15.6	15.5	0.35
2004-0161	I4-I5	22-Jun-04	17:15	0.01	15.2	16.5	12.01
2004-0673	I5	22-Jun-04	18:25	1		14.2	3.59
2004-0675	I6	23-Jun-04	10:15	1		17.5	1.28
2004-0679	I7	23-Jun-04	11:00	1	17.9	17.5	0.78
2004-0171	I8 In	23-Jun-04	12:00	0.01	13.0	15.1	1.42
2004-0172	I8 Out	23-Jun-04	12:20	0.01	15.6	16.5	5.31
2004-0683	I8	23-Jun-04	12:20	1	15.0	15.1	5.26
2004-0681	I Swamp	23-Jun-04	13:35	1		19.1	2.94
2004-0174	MWL	23-Jun-04	14:45	0.01	10.4	10.4	0.42
2004-0176	Swamp In	23-Jun-04	14:45	0.01	12.7	13.7	1.11
2004-0169	I7-I9	23-Jun-04	14:45	0.01	17.6	17.6	1.93
2004-0173	I8-I9	23-Jun-04	14:45	0.01	17.3	17.6	2.14
2004-0178	Toolik Inlet	23-Jun-04	16:30	0.01	14.5	14.5	0.54

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2004-0186	Toolik	25-Jun-04	9:15	1	12.5	12.5	5.26
2004-0187	Toolik	25-Jun-04	9:30	3	9.6	9.6	5.50
2004-0188	Toolik	25-Jun-04	9:40	5	8.0	8.0	7.62
2004-0189	Toolik	25-Jun-04	9:50	8	6.4	6.5	5.12
2004-0190	Toolik	25-Jun-04	10:10	12	5.4	5.2	3.36
2004-0191	Toolik	25-Jun-04	10:15	16	5.2	5.2	3.55
2004-0686	Toolik Inlet	28-Jun-04	10:05	0.01	14.9	14.5	1.28
2004-0687	Toolik Outlet	28-Jun-04	11:00	0.01	15.2	14.5	1.52
2004-0713	I8 Inlet	29-Jun-04	10:15	0.01	13.4	13.4	2.81
2004-0714	I8 Outlet	29-Jun-04	11:00	0.01	17.5	17.5	12.02
n/a	HEA 25 blue	29-Jun-04	14:00	0.01	n/a	25	2.51
n/a	HEA 25 green	29-Jun-04	14:00	0.01	n/a	25	2.19
n/a	HEA 25 yellow	29-Jun-04	14:00	0.01	n/a	25	1.36
n/a	HEA 25 white	29-Jun-04	14:00	0.01	n/a	25	1.41
n/a	HEA 20 blue	29-Jun-04	14:45	0.01	n/a	20	2.66
n/a	HEA 20 green	29-Jun-04	14:45	0.01	n/a	20	2.77
n/a	HEA 20 yellow	29-Jun-04	14:45	0.01	n/a	20	1.17
n/a	HEA 20 white	29-Jun-04	14:45	0.01	n/a	20	1.08
n/a	HEA 18 blue	29-Jun-04	15:15	0.01	n/a	18	2.78
n/a	HEA 18 green	29-Jun-04	15:15	0.01	n/a	18	1.91
n/a	HEA 18 yellow	29-Jun-04	15:15	0.01	n/a	18	0.78
n/a	HEA 18 white	29-Jun-04	15:15	0.01	n/a	18	0.64
n/a	HEA 14 blue	29-Jun-04	16:10	0.01	n/a	14	1.69
n/a	HEA 14 green	29-Jun-04	16:10	0.01	n/a	14	1.66
n/a	HEA 14 yellow	29-Jun-04	16:10	0.01	n/a	14	0.68
n/a	HEA 14 white	29-Jun-04	16:10	0.01	n/a	14	0.55
n/a	HEA 12 blue	29-Jun-04	16:35	0.01	n/a	12	1.99
n/a	HEA 12 green	29-Jun-04	16:35	0.01	n/a	12	2.50
n/a	HEA 12 yellow	29-Jun-04	16:35	0.01	n/a	12	1.27
n/a	HEA 12 white	29-Jun-04	16:35	0.01	n/a	12	0.68
n/a	HEA 10 blue	29-Jun-04	17:00	0.01	n/a	10	0.79
n/a	HEA 10 green	29-Jun-04	17:00	0.01	n/a	10	0.87
n/a	HEA 10 yellow	29-Jun-04	17:00	0.01	n/a	10	0.19
n/a	HEA 10 white	29-Jun-04	17:00	0.01	n/a	10	0.22
n/a	HEA 8 blue	29-Jun-04	18:10	0.01	n/a	8	0.49
n/a	HEA 8 green	29-Jun-04	18:10	0.01	n/a	8	0.53
n/a	HEA 8 yellow	29-Jun-04	18:10	0.01	n/a	8	0.28
n/a	HEA 8 white	29-Jun-04	18:10	0.01	n/a	8	0.28
n/a	HEA 6 blue	29-Jun-04	18:40	0.01	n/a	6	0.84
n/a	HEA 6 green	29-Jun-04	18:40	0.01	n/a	6	0.97
n/a	HEA 6 yellow	29-Jun-04	18:40	0.01	n/a	6	0.41
n/a	HEA 6 white	29-Jun-04	18:40	0.01	n/a	6	0.31
n/a	HEA 2 blue	29-Jun-04	18:55	0.01	n/a	2	0.08
n/a	HEA 2 green	29-Jun-04	18:55	0.01	n/a	2	0.16
n/a	HEA 2 yellow	29-Jun-04	18:55	0.01	n/a	2	0.09
n/a	HEA 2 white	29-Jun-04	18:55	0.01	n/a	2	0.10
n/a	HEA 6 blue	1-Jul-04	11:30	0.01	n/a	6	2.10
n/a	HEA 6 green	1-Jul-04	11:30	0.01	n/a	6	2.12

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	HEA 6 yellow	1-Jul-04	11:30	0.01	n/a	6	1.77
n/a	HEA 6 white	1-Jul-04	11:30	0.01	n/a	6	1.34
n/a	HEA 12 blue	1-Jul-04	11:55	0.01	n/a	12	2.70
n/a	HEA 12 green	1-Jul-04	11:55	0.01	n/a	12	3.30
n/a	HEA 12 yellow	1-Jul-04	11:55	0.01	n/a	12	3.05
n/a	HEA 12 white	1-Jul-04	11:55	0.01	n/a	12	2.07
n/a	HEA 20 blue	1-Jul-04	12:10	0.01	n/a	20	3.07
n/a	HEA 20 green	1-Jul-04	12:10	0.01	n/a	20	2.98
n/a	HEA 20 yellow	1-Jul-04	12:10	0.01	n/a	20	2.49
n/a	HEA 20 white	1-Jul-04	12:10	0.01	n/a	20	1.64
n/a	HEA 8 blue	1-Jul-04	13:38	0.01	n/a	8	1.13
n/a	HEA 8 green	1-Jul-04	13:38	0.01	n/a	8	1.29
n/a	HEA 8 yellow	1-Jul-04	13:38	0.01	n/a	8	1.61
n/a	HEA 8 white	1-Jul-04	13:38	0.01	n/a	8	1.03
n/a	HEA 14 blue	1-Jul-04	14:20	0.01	n/a	14	2.65
n/a	HEA 14 green	1-Jul-04	14:20	0.01	n/a	14	2.84
n/a	HEA 14 yellow	1-Jul-04	14:20	0.01	n/a	14	2.32
n/a	HEA 14 white	1-Jul-04	14:20	0.01	n/a	14	1.36
n/a	HEA 25 blue	1-Jul-04	13:30	0.01	n/a	25	10.28
n/a	HEA 25 green	1-Jul-04	13:30	0.01	n/a	25	4.23
n/a	HEA 25 yellow	1-Jul-04	13:30	0.01	n/a	25	5.37
n/a	HEA 25 white	1-Jul-04	13:30	0.01	n/a	25	3.67
n/a	HEA 2 blue	1-Jul-04	14:45	0.01	n/a	2	0.37
n/a	HEA 2 green	1-Jul-04	14:45	0.01	n/a	2	0.29
n/a	HEA 2 yellow	1-Jul-04	14:45	0.01	n/a	2	0.13
n/a	HEA 2 white	1-Jul-04	14:45	0.01	n/a	2	0.10
n/a	HEA 10 blue	1-Jul-04	15:35	0.01	n/a	10	1.11
n/a	HEA 10 green	1-Jul-04	15:35	0.01	n/a	10	1.34
n/a	HEA 10 yellow	1-Jul-04	15:35	0.01	n/a	10	1.00
n/a	HEA 10 white	1-Jul-04	15:35	0.01	n/a	10	0.78
n/a	HEA 18 blue	1-Jul-04	15:45	0.01	n/a	18	3.40
n/a	HEA 18 green	1-Jul-04	15:45	0.01	n/a	18	2.59
n/a	HEA 18 yellow	1-Jul-04	15:45	0.01	n/a	18	2.60
n/a	HEA 18 white	1-Jul-04	15:45	0.01	n/a	18	2.44
2004-0245	Toolik	2-Jul-04	9:20	1	15.1	15.1	13.52
2004-0246	Toolik	2-Jul-04	9:35	3	13.2	13.2	13.75
2004-0247	Toolik	2-Jul-04	9:50	5	9.6	9.6	9.26
2004-0248	Toolik	2-Jul-04	10:25	8	6.4	6.0	6.19
2004-0249	Toolik	2-Jul-04	10:45	12	5.6	6.0	7.79
2004-0250	Toolik	2-Jul-04	11:00	16	5.3	6.0	8.27
2004-0242	I7-I9	2-Jul-04	9:57	0.01	9.3	15.9	4.23
2004-0241	I8-I9	2-Jul-04	10:09	0.01	17.0	17.0	3.74
2004-0238	Toolik Inlet	2-Jul-04	11:55	0.01	16.1	16.1	4.25
2004-0734	HEA 25 blue	3-Jul-04	11:45	0.01	n/a	25	21.75
2004-0735	HEA 25 green	3-Jul-04	11:45	0.01	n/a	25	3.59
2004-0736	HEA 25 yellow	3-Jul-04	11:45	0.01	n/a	25	0.74
2004-0737	HEA 25 white	3-Jul-04	11:45	0.01	n/a	25	9.06
2004-0746	HEA 14 blue	3-Jul-04	12:25	0.01	n/a	14	3.42

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2004-0747	HEA 14 green	3-Jul-04	12:25	0.01	n/a	14	3.27
2004-0748	HEA 14 yellow	3-Jul-04	12:25	0.01	n/a	14	1.85
2004-0749	HEA 14 white	3-Jul-04	12:25	0.01	n/a	14	8.31
2004-0758	HEA 8 blue	3-Jul-04	11:55	0.01	n/a	8	31.89
2004-0759	HEA 8 green	3-Jul-04	11:55	0.01	n/a	8	1.63
2004-0760	HEA 8 yellow	3-Jul-04	11:55	0.01	n/a	8	1.72
2004-0761	HEA 8 white	3-Jul-04	11:55	0.01	n/a	8	1.41
2004-0738	HEA 20 blue	3-Jul-04	13:15	0.01	n/a	20	164.29
2004-0739	HEA 20 green	3-Jul-04	13:15	0.01	n/a	20	36.23
2004-0740	HEA 20 yellow	3-Jul-04	13:15	0.01	n/a	20	3.42
2004-0741	HEA 20 white	3-Jul-04	13:15	0.01	n/a	20	7.97
2004-0750	HEA 12 blue	3-Jul-04	13:30	0.01	n/a	12	4.10
2004-0751	HEA 12 green	3-Jul-04	13:30	0.01	n/a	12	4.32
2004-0752	HEA 12 yellow	3-Jul-04	13:30	0.01	n/a	12	3.94
2004-0753	HEA 12 white	3-Jul-04	13:30	0.01	n/a	12	4.00
2004-0762	HEA 6 blue	3-Jul-04	13:48	0.01	n/a	6	1.71
2004-0763	HEA 6 green	3-Jul-04	13:48	0.01	n/a	6	1.45
2004-0764	HEA 6 yellow	3-Jul-04	13:48	0.01	n/a	6	1.00
2004-0765	HEA 6 white	3-Jul-04	13:48	0.01	n/a	6	4.36
2004-0742	HEA 18 blue	3-Jul-04	14:02	0.01	n/a	18	4.76
2004-0743	HEA 18 green	3-Jul-04	14:02	0.01	n/a	18	2.72
2004-0744	HEA 18 yellow	3-Jul-04	14:02	0.01	n/a	18	2.51
2004-0745	HEA 18 white	3-Jul-04	14:02	0.01	n/a	18	2.45
2004-0754	HEA 10 blue	3-Jul-04	14:35	0.01	n/a	10	1.43
2004-0755	HEA 10 green	3-Jul-04	14:35	0.01	n/a	10	0.81
2004-0756	HEA 10 yellow	3-Jul-04	14:35	0.01	n/a	10	0.45
2004-0757	HEA 10 white	3-Jul-04	14:35	0.01	n/a	10	0.72
2004-0766	HEA 2 blue	3-Jul-04	14:55	0.01	n/a	2	0.31
2004-0767	HEA 2 green	3-Jul-04	14:55	0.01	n/a	2	0.25
2004-0768	HEA 2 yellow	3-Jul-04	14:55	0.01	n/a	2	0.23
2004-0769	HEA 2 white	3-Jul-04	14:55	0.01	n/a	2	0.12
2004-0770	I8 Inlet	5-Jul-04	14:10	0.01	12.2	12.7	4.37
2004-0771	I8 Outlet	5-Jul-04	15:00	0.01	17.8	18.2	11.61
n/a	Toolik Inlet (9 mL)	5-Jul-04	16:55	0.01		12	4.91
n/a	RWT- 1 ppm	5-Jul-04	16:52	0.01		12	5.50
n/a	RWT- 100 ppm	5-Jul-04	16:57	0.01		12	4.65
n/a	RWT- 1000 ppm	5-Jul-04	17:01	0.01		12	4.60
n/a	CuCl2- 1M	5-Jul-04	17:12	0.01		12	4.18
n/a	CuCl2- 2M	5-Jul-04	17:12	0.01		12	5.84
n/a	Toolik Inlet (10 mL)	5-Jul-04	17:12	0.01		12	5.35
2004-0303	Toolik	9-Jul-04	11:45	1	13.5	13.5	6.03
2004-0304	Toolik	9-Jul-04	11:02	3	13.5	13.5	7.11
2004-0305	Toolik	9-Jul-04	7:12	5	9.3	9.0	4.23
2004-0306	Toolik	9-Jul-04	17:02	8	8.7	9.0	4.20
2004-0307	Toolik	9-Jul-04	11:02	12	5.5	5.5	3.13
2004-0308	Toolik	9-Jul-04	6:57	16	5.3	5.5	3.22
2004-0300	I7-I9	9-Jul-04	10:45	0.01	11.4	11.4	0.34
2004-0299	I8-I9	9-Jul-04	10:20	0.01	12.6	12.6	0.63

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2004-0296	Toolik Inlet	9-Jul-04	13:00	0.01	10.9	11.4	7.11
n/a	Toolik	10-Jul-04	0:00	1	11.8	11.2	6.82
n/a	Toolik	10-Jul-04	0:00	5	11.2	11.2	4.82
n/a	Toolik	10-Jul-04	0:00	8	8.1	8.0	4.97
2004-0910	Toolik Inlet Bay	11-Jul-04	0:00	1	11.2	11.0	14.13
2004-0911	Toolik Inlet Bay	11-Jul-04	0:00	5	9.0	8.0	12.95
2004-0912	Toolik Inlet Bay	11-Jul-04	0:00	8	7.4	8.0	10.36
2004-0907	Toolik	11-Jul-04	0:00	1	11.8	11.0	11.03
2004-0908	Toolik	11-Jul-04	0:00	5	10.3	11.0	11.97
2004-0909	Toolik	11-Jul-04	0:00	8	8.2	8.0	9.18
2004-0913	Toolik Inlet Bay	12-Jul-04	9:41	1	11.6	11.6	8.96
2004-0915	Toolik Inlet Bay	12-Jul-04	10:15	3	9.5	9.5	10.45
2004-0914	Toolik Inlet Bay	12-Jul-04	10:00	5	10.1	10.1	5.38
2004-0917	Toolik	12-Jul-04	10:30	1	12.2	11.6	6.36
2004-0918	Toolik	12-Jul-04	10:40	3	11.9	11.6	5.37
2004-0919	Toolik	12-Jul-04	10:50	5	10.5	10.1	5.30
2004-0922	Toolik	12-Jul-04	11:00	6	9.7	9.5	9.27
2004-0920	Toolik	12-Jul-04	11:03	8	7.0	7.0	4.38
2004-0921	Toolik	12-Jul-04	11:15	12	5.8	6.0	2.05
2004-0927	Toolik Inlet	12-Jul-04	9:55	0.01	9.9	10.1	10.51
2004-0928	Toolik Outlet	12-Jul-04	10:35	0.01	12.6	12.6	4.55
2004-0324	I2-I3	13-Jul-04	9:20	0.01	10.8	10.8	2.61
2004-0322	I1-I3	13-Jul-04	9:20	0.01	11.9	11.9	2.11
2004-0336	I8 Headwaters	13-Jul-04	10:20	0.01	6.9	7.8	1.25
2004-1135	I2	13-Jul-04	10:20	1	12.5	11.9	1.99
2004-1133	I1	13-Jul-04	11:40	1	12.9	12.7	4.46
2004-1137	I3	13-Jul-04	12:20	1	13.0	12.7	9.64
2004-1139	I4	13-Jul-04	13:35	1	13.2	15.3	8.77
2004-0329	I5-I6	13-Jul-04	15:30	0.01	14.3	14.3	8.79
2004-0333	I6 West	13-Jul-04	15:30	0.01	10.1	10.9	0.95
2004-0330	I6 HW In	13-Jul-04	15:30	0.01	10.6	10.9	1.24
2004-1143	I6 HW	13-Jul-04	15:35	1	13.6	13.6	4.59
2004-0327	I4-I5	13-Jul-04	16:30	0.01	13.5	16.3	52.64
2004-1141	I5	13-Jul-04	18:10	1	13.6	11.2	8.41
2004-1145	I6	14-Jul-04	10:00	1	13.3	13.7	3.50
2004-1147	I7	14-Jul-04	11:05	1	13.1	13.7	5.78
2004-0337	I8 In	14-Jul-04	11:50	0.01	10.4	10.4	1.82
2004-0338	I8 Out	14-Jul-04	12:05	0.01	11.8	12.3	12.34
2004-1149	I8	14-Jul-04	12:45	1	11.2	12.0	14.38
2004-0342	Swamp In	14-Jul-04	13:30	0.01	14.9	14.9	4.22
2004-1151	I Swamp	14-Jul-04	13:50	1	12.8	12.7	8.26
2004-0335	I7-I9	14-Jul-04	14:55	0.01	14.4	14.4	4.10
2004-0339	I8-I9	14-Jul-04	14:50	0.01	12.3	12.3	4.61
2004-0340	MWL	14-Jul-04	15:07	0.01	10.2	10.2	1.15
2004-0344	Toolik Inlet	14-Jul-04	16:10	0.01	13.4	13.5	2.36
2004-0963	Toolik	14-Jul-04	0:00	1	14.3	13.5	6.81
2004-0964	Toolik	14-Jul-04	0:00	3	12.4	12.0	11.64
2004-0965	Toolik	14-Jul-04	0:00	5	11.0	12.0	13.24

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2004-0966	Toolik Inlet Bay	14-Jul-04	0:00	3	12.1	12.0	15.81
2004-1018	Toolik Inlet Bay	16-Jul-04	8:30	1	13.9	13.2	7.71
2004-1019	Toolik Inlet Bay	16-Jul-04	8:40	3	11.8	11.9	11.16
2004-1020	Toolik Inlet Bay	16-Jul-04	9:13	8	7.4	7.5	7.35
2004-0352	Toolik	16-Jul-04	9:35	1	14.2	14.9	9.05
2004-0353	Toolik	16-Jul-04	9:55	3	12.2	13.2	8.80
2004-0354	Toolik	16-Jul-04	10:15	5	10.8	11.9	7.55
2004-0355	Toolik	16-Jul-04	10:26	8	7.1	8.5	2.80
2004-0356	Toolik	16-Jul-04	10:30	12	5.9	7.5	2.59
2004-0345	Toolik Inlet	16-Jul-04	8:30	0.01	12.3	11.9	7.45
n/a	Toolik Outlet	16-Jul-04	8:45	0.01	13.7	13.2	2.99
2004-1086	I8 In	19-Jul-04	11:35	0.01	8.3	8.3	6.08
2004-1087	I8 Out	19-Jul-04	12:30	0.01	11.5	11.5	13.64
2004-1168	Toolik Inlet Bay	23-Jul-04	9:10	1	13.6	13.6	6.54
2004-1169	Toolik Inlet Bay	23-Jul-04	9:20	5	10.6	10.6	8.35
2004-1170	Toolik Inlet Bay	23-Jul-04	9:30	8	7.5	7.5	5.39
2004-0411	Toolik	23-Jul-04	10:00	1	14.3	13.6	6.75
2004-0412	Toolik	23-Jul-04	10:10	3	13.2	13.6	14.36
2004-0413	Toolik	23-Jul-04	10:20	5	12.0	12.0	15.02
2004-0414	Toolik	23-Jul-04	10:30	8	7.4	7.5	3.56
2004-0415	Toolik	23-Jul-04	10:40	12	6.1	6.0	2.57
2004-0416	Toolik	23-Jul-04	10:50	16	5.7	6.0	3.00
2004-0408	I7-I9	23-Jul-04	11:36	0.01	14.7	14.7	8.89
2004-0407	I8-I9	23-Jul-04	10:50	0.01	12.6	12.6	11.70
2004-0404	Toolik Inlet	23-Jul-04	12:33	0.01	13.7	14.7	7.30
2004-1171	Toolik Inlet	26-Jul-04	10:20	0.01	14.1	15.0	1.05
2004-1172	Toolik Outlet	26-Jul-04	9:40	0.01	15.4	15.0	1.21
n/a	HEA 20 blue	27-Jul-04	12:45	0.01	n/a	20.0	6.61
n/a	HEA 20 green	27-Jul-04	12:45	0.01	n/a	20.0	3.43
n/a	HEA 20 yellow	27-Jul-04	12:45	0.01	n/a	20.0	3.99
n/a	HEA 20 white	27-Jul-04	12:45	0.01	n/a	20.0	5.40
n/a	HEA 14 blue	27-Jul-04	13:30	0.01	n/a	14.0	2.41
n/a	HEA 14 green	27-Jul-04	13:30	0.01	n/a	14.0	2.13
n/a	HEA 14 yellow	27-Jul-04	13:30	0.01	n/a	14.0	1.79
n/a	HEA 14 white	27-Jul-04	13:30	0.01	n/a	14.0	2.23
n/a	HEA 8 blue	27-Jul-04	12:55	0.01	n/a	8.0	1.19
n/a	HEA 8 green	27-Jul-04	12:55	0.01	n/a	8.0	0.66
n/a	HEA 8 yellow	27-Jul-04	12:55	0.01	n/a	8.0	0.87
n/a	HEA 8 white	27-Jul-04	12:55	0.01	n/a	8.0	1.00
n/a	HEA 18 blue	27-Jul-04	13:35	0.01	n/a	18.0	3.82
n/a	HEA 18 green	27-Jul-04	13:35	0.01	n/a	18.0	3.12
n/a	HEA 18 yellow	27-Jul-04	13:35	0.01	n/a	18.0	3.07
n/a	HEA 18 white	27-Jul-04	13:35	0.01	n/a	18.0	3.98
n/a	HEA 12 -1L blue	27-Jul-04	14:15	0.01	n/a	12.0	4.78
n/a	HEA 12 -1L green	27-Jul-04	14:15	0.01	n/a	12.0	3.24
n/a	HEA 12 -1L yellow	27-Jul-04	14:15	0.01	n/a	12.0	4.11
n/a	HEA 12 -1L white	27-Jul-04	14:15	0.01	n/a	12.0	4.40
n/a	HEA 12 blue	27-Jul-04	14:18	0.01	n/a	12.0	4.09

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	HEA 12 green	27-Jul-04	14:18	0.01	n/a	12.0	2.94
n/a	HEA 12 yellow	27-Jul-04	14:18	0.01	n/a	12.0	2.97
n/a	HEA 12 white	27-Jul-04	14:18	0.01	n/a	12.0	4.02
n/a	HEA 16 blue	27-Jul-04	15:35	0.01	n/a	16.0	3.71
n/a	HEA 16 green	27-Jul-04	15:35	0.01	n/a	16.0	3.12
n/a	HEA 16 yellow	27-Jul-04	15:35	0.01	n/a	16.0	2.78
n/a	HEA 16 white	27-Jul-04	15:35	0.01	n/a	16.0	3.98
n/a	HEA 10 blue	27-Jul-04	15:45	0.01	n/a	10.0	1.71
n/a	HEA 10 green	27-Jul-04	15:45	0.01	n/a	10.0	1.35
n/a	HEA 10 yellow	27-Jul-04	15:45	0.01	n/a	10.0	1.31
n/a	HEA 10 white	27-Jul-04	15:45	0.01	n/a	10.0	1.72
n/a	HEA 6 blue	27-Jul-04	14:50	0.01	n/a	6.0	0.77
n/a	HEA 6 green	27-Jul-04	14:50	0.01	n/a	6.0	0.60
n/a	HEA 6 yellow	27-Jul-04	14:50	0.01	n/a	6.0	0.45
n/a	HEA 6 white	27-Jul-04	14:50	0.01	n/a	6.0	0.57
2004-1178	I8 Inlet	28-Jul-04	12:00	0.01	9.8	9.9	2.98
2004-1179	I8 Outlet	28-Jul-04	13:00	0.01	13.9	13.4	6.23
n/a	HEA 20 blue	29-Jul-04	11:00	0.01	n/a	20.0	9.14
n/a	HEA 20 green	29-Jul-04	11:00	0.01	n/a	20.0	5.68
n/a	HEA 20 yellow	29-Jul-04	11:00	0.01	n/a	20.0	4.77
n/a	HEA 20 white	29-Jul-04	11:00	0.01	n/a	20.0	9.52
n/a	HEA 14 blue	29-Jul-04	11:55	0.01	n/a	14.0	5.03
n/a	HEA 14 green	29-Jul-04	11:55	0.01	n/a	14.0	3.49
n/a	HEA 14 yellow	29-Jul-04	11:55	0.01	n/a	14.0	2.69
n/a	HEA 14 white	29-Jul-04	11:55	0.01	n/a	14.0	4.44
n/a	HEA 8 blue	29-Jul-04	11:10	0.01	n/a	8.0	1.54
n/a	HEA 8 green	29-Jul-04	11:10	0.01	n/a	8.0	1.41
n/a	HEA 8 yellow	29-Jul-04	11:10	0.01	n/a	8.0	1.34
n/a	HEA 8 white	29-Jul-04	11:10	0.01	n/a	8.0	1.38
n/a	HEA 18 blue	29-Jul-04	12:05	0.01	n/a	18.0	8.36
n/a	HEA 18 green	29-Jul-04	12:05	0.01	n/a	18.0	5.47
n/a	HEA 18 yellow	29-Jul-04	12:05	0.01	n/a	18.0	4.52
n/a	HEA 18 white	29-Jul-04	12:05	0.01	n/a	18.0	5.88
n/a	HEA 12 -1L blue	29-Jul-04	12:55	0.01	n/a	12.0	7.41
n/a	HEA 12 -1L green	29-Jul-04	12:55	0.01	n/a	12.0	4.59
n/a	HEA 12 -1L yellow	29-Jul-04	12:55	0.01	n/a	12.0	4.70
n/a	HEA 12 -1L white	29-Jul-04	12:55	0.01	n/a	12.0	4.15
n/a	HEA 12 blue	29-Jul-04	13:05	0.01	n/a	12.0	6.51
n/a	HEA 12 green	29-Jul-04	13:05	0.01	n/a	12.0	3.93
n/a	HEA 12 yellow	29-Jul-04	13:05	0.01	n/a	12.0	3.88
n/a	HEA 12 white	29-Jul-04	13:05	0.01	n/a	12.0	4.73
n/a	HEA 16 blue	29-Jul-04	13:35	0.01	n/a	16.0	5.13
n/a	HEA 16 green	29-Jul-04	13:35	0.01	n/a	16.0	4.40
n/a	HEA 16 yellow	29-Jul-04	13:35	0.01	n/a	16.0	3.60
n/a	HEA 16 white	29-Jul-04	13:35	0.01	n/a	16.0	5.29
n/a	HEA 10 blue	29-Jul-04	13:40	0.01	n/a	10.0	2.73
n/a	HEA 10 green	29-Jul-04	13:40	0.01	n/a	10.0	1.81
n/a	HEA 10 yellow	29-Jul-04	13:40	0.01	n/a	10.0	1.81

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	HEA 10 white	29-Jul-04	13:40	0.01	n/a	10.0	2.30
n/a	HEA 6 blue	29-Jul-04	13:48	0.01	n/a	6.0	0.83
n/a	HEA 6 green	29-Jul-04	13:48	0.01	n/a	6.0	0.81
n/a	HEA 6 yellow	29-Jul-04	13:48	0.01	n/a	6.0	1.29
n/a	HEA 6 white	29-Jul-04	13:48	0.01	n/a	6.0	0.86
2004-0469	Toolik	30-Jul-04	9:13	1	14.2	14.2	10.26
2004-0470	Toolik	30-Jul-04	9:35	3	14.0	14.2	12.55
2004-0471	Toolik	30-Jul-04	9:47	5	11.6	12.0	9.22
2004-0472	Toolik	30-Jul-04	10:05	8	8.0	8.0	2.94
2004-0473	Toolik	30-Jul-04	10:17	12	6.1	6.1	2.40
2004-0474	Toolik	30-Jul-04	10:25	16	5.7	6.1	2.77
2004-0466	I7-I9	30-Jul-04	0:00	0.01	12.7	12.7	6.03
2004-0465	I8-I9	30-Jul-04	0:00	0.01	12.5	12.5	7.57
2004-0462	Toolik Inlet	30-Jul-04	0:00	0.01	12.1	12.5	5.45
2004-1211	HEA 20 blue	31-Jul-04	10:50	0.01	n/a	20.0	12.13
2004-1212	HEA 20 green	31-Jul-04	10:50	0.01	n/a	20.0	15.01
2004-1213	HEA 20 yellow	31-Jul-04	10:50	0.01	n/a	20.0	4.13
2004-1214	HEA 20 white	31-Jul-04	10:50	0.01	n/a	20.0	11.94
2004-1215	HEA 14 blue	31-Jul-04	11:25	0.01	n/a	14.0	5.04
2004-1216	HEA 14 green	31-Jul-04	11:25	0.01	n/a	14.0	2.96
2004-1217	HEA 14 yellow	31-Jul-04	11:25	0.01	n/a	14.0	3.47
2004-1218	HEA 14 white	31-Jul-04	11:25	0.01	n/a	14.0	4.38
2004-1219	HEA 8 blue	31-Jul-04	10:55	0.01	n/a	8.0	2.28
2004-1220	HEA 8 green	31-Jul-04	10:55	0.01	n/a	8.0	1.19
2004-1221	HEA 8 yellow	31-Jul-04	10:55	0.01	n/a	8.0	1.49
2004-1222	HEA 8 white	31-Jul-04	10:55	0.01	n/a	8.0	1.46
2004-1223	HEA 18 blue	31-Jul-04	11:35	0.01	n/a	18.0	6.86
2004-1224	HEA 18 green	31-Jul-04	11:35	0.01	n/a	18.0	4.45
2004-1225	HEA 18 yellow	31-Jul-04	11:35	0.01	n/a	18.0	3.25
2004-1226	HEA 18 white	31-Jul-04	11:35	0.01	n/a	18.0	5.65
2004-1227	HEA 12 -1L blue	31-Jul-04	11:55	0.01	n/a	12.0	7.49
2004-1228	HEA 12 -1L green	31-Jul-04	11:55	0.01	n/a	12.0	4.71
2004-1229	HEA 12 -1L yellow	31-Jul-04	11:55	0.01	n/a	12.0	5.39
2004-1230	HEA 12 -1L white	31-Jul-04	11:55	0.01	n/a	12.0	5.36
2004-1231	HEA 12 blue	31-Jul-04	12:00	0.01	n/a	12.0	16.36
2004-1232	HEA 12 green	31-Jul-04	12:00	0.01	n/a	12.0	6.40
2004-1233	HEA 12 yellow	31-Jul-04	12:00	0.01	n/a	12.0	10.00
2004-1234	HEA 12 white	31-Jul-04	12:00	0.01	n/a	12.0	12.67
2004-1235	HEA 16 blue	31-Jul-04	12:20	0.01	n/a	16.0	3.66
2004-1236	HEA 16 green	31-Jul-04	12:20	0.01	n/a	16.0	3.56
2004-1237	HEA 16 yellow	31-Jul-04	12:20	0.01	n/a	16.0	2.92
2004-1238	HEA 16 white	31-Jul-04	12:20	0.01	n/a	16.0	4.77
2004-1239	HEA 10 blue	31-Jul-04	12:25	0.01	n/a	10.0	2.21
2004-1240	HEA 10 green	31-Jul-04	12:25	0.01	n/a	10.0	1.68
2004-1241	HEA 10 yellow	31-Jul-04	12:25	0.01	n/a	10.0	1.46
2004-1242	HEA 10 white	31-Jul-04	12:25	0.01	n/a	10.0	2.29
2004-1243	HEA 6 blue	31-Jul-04	12:30	0.01	n/a	6.0	1.52
2004-1244	HEA 6 green	31-Jul-04	12:30	0.01	n/a	6.0	0.75

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2004-1245	HEA 6 yellow	31-Jul-04	12:30	0.01	n/a	6.0	0.59
2004-1246	HEA 6 white	31-Jul-04	12:30	0.01	n/a	6.0	1.09
2004-0490	I2-I3	3-Aug-04	10:50	0.01	9.1	9.1	1.16
2004-0488	I1-I3	3-Aug-04	10:50	0.01	10.3	10.3	1.19
2004-0502	I8 Headwaters	3-Aug-04	11:50	0.01	5.5	5.5	1.39
2004-1356	I2	3-Aug-04	11:50	1	10.7	10.3	3.02
2004-1354	I1	3-Aug-04	13:10	1	11.7	12.2	5.85
2004-1358	I3	3-Aug-04	13:50	1	9.8	9.7	4.88
2004-1360	I4	3-Aug-04	15:10	1	10.6	10.2	8.17
2004-0495	I5-I6	3-Aug-04	16:35	0.01	11.7	12.4	4.47
2004-0499	I6 West	3-Aug-04	16:35	0.01	8.3	7.9	1.06
2004-0496	I6 HW In	3-Aug-04	16:35	0.01	7.9	7.9	0.67
2004-1362	I6 HW	3-Aug-04	16:50	1	11.7	11.7	3.70
2004-0493	I4-I5	3-Aug-04	17:50	0.01	12.7	12.0	11.33
2004-1364	I5	4-Aug-04	10:05	1	11.0	11.1	3.94
2004-1366	I6	4-Aug-04	12:00	1	11.0	12.4	2.75
2004-1368	I7	4-Aug-04	13:10	1	11.4	12.4	4.84
2004-0503	I8 In	4-Aug-04	14:15	0.01	10.5	10.5	1.70
2004-0504	I8 Out	4-Aug-04	14:30	0.01	8.5	8.5	6.56
2004-1370	I8	4-Aug-04	14:40	1	8.4	8.5	7.41
2004-0508	Swamp In	4-Aug-04	16:10	0.01	14.4	14.4	5.33
2004-1372	Iswamp	4-Aug-04	16:00	1	10.9	10.5	5.01
2004-0501	I7-I9	4-Aug-04	17:20	0.01	13.0	19.0	3.07
2004-0505	I8-I9	4-Aug-04	17:25	0.01	9.4	19.0	12.87
2004-0506	MWL	4-Aug-04	17:30	0.01	10.8	10.9	0.91
2004-0510	Toolik Inlet	4-Aug-04	18:05	0.01	10.7	10.9	6.42
2004-0518	Toolik	6-Aug-04	9:15	1	11.7	11.7	7.36
2004-0519	Toolik	6-Aug-04	9:30	3	11.0	10.3	9.09
2004-0520	Toolik	6-Aug-04	9:40	5	10.3	10.3	7.34
2004-0521	Toolik	6-Aug-04	9:50	8	9.1	9.1	6.73
2004-0522	Toolik	6-Aug-04	10:10	12	6.4	5.9	2.44
2004-0523	Toolik	6-Aug-04	10:15	16	5.9	5.9	2.47
2004-0515	I7-I9	6-Aug-04	10:37	0.01	12.6	13.0	5.18
2004-0514	I8-I9	6-Aug-04	10:14	0.01	10.9	10.3	7.21
2004-0511	Toolik Inlet	6-Aug-04	11:57	0.01	13.7	13.0	5.12
2004-1326	I8 Inlet	9-Aug-04	10:55	0.01	11.2	11.4	9.02
2004-1327	I8 Outlet	9-Aug-04	12:00	0.01	11.5	11.8	12.28
2004-1404	Toolik Inlet	11-Aug-04	14:50	0.01	13.9	13.5	3.81
2004-1405	Toolik Outlet	11-Aug-04	14:30	0.01	13.5	13.5	6.20
n/a	HEA 6 blue- A	12-Aug-04	14:25	0.01	n/a	6.3	0.70
n/a	HEA 6 green	12-Aug-04	14:25	0.01	n/a	6.3	-0.74
n/a	HEA 6 yellow	12-Aug-04	14:25	0.01	n/a	6.3	0.43
n/a	HEA 6 white	12-Aug-04	14:25	0.01	n/a	6.3	-0.33
n/a	HEA 6 blue- B	12-Aug-04	14:25	0.01	n/a	6.3	-0.39
n/a	HEA 6 blue- C	12-Aug-04	14:25	0.01	n/a	6.3	0.05
n/a	HEA 12 blue- A	12-Aug-04	15:35	0.01	n/a	12.4	3.31
n/a	HEA 12 green- A	12-Aug-04	15:35	0.01	n/a	12.4	2.30
n/a	HEA 12 yellow- A	12-Aug-04	15:35	0.01	n/a	12.4	0.05

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	HEA 12 white- A	12-Aug-04	15:35	0.01	n/a	12.4	1.75
n/a	HEA 12 blue- B	12-Aug-04	15:35	0.01	n/a	12.4	1.37
n/a	HEA 12 green- B	12-Aug-04	15:35	0.01	n/a	12.4	0.99
n/a	HEA 12 yellow-B	12-Aug-04	15:35	0.01	n/a	12.4	0.16
n/a	HEA 12 white-B	12-Aug-04	15:35	0.01	n/a	12.4	1.37
n/a	HEA 12 blue- C	12-Aug-04	15:35	0.01	n/a	12.4	2.41
n/a	HEA 12 green- C	12-Aug-04	15:35	0.01	n/a	12.4	2.85
n/a	HEA 12 yellow- C	12-Aug-04	15:35	0.01	n/a	12.4	1.11
n/a	HEA 12 white- C	12-Aug-04	15:35	0.01	n/a	12.4	1.60
n/a	HEA 20 blue- A	12-Aug-04	14:35	0.01	n/a	20.1	6.25
n/a	HEA 20 green	12-Aug-04	14:35	0.01	n/a	20.1	2.81
n/a	HEA 20 yellow	12-Aug-04	14:35	0.01	n/a	20.1	1.87
n/a	HEA 20 white	12-Aug-04	14:35	0.01	n/a	20.1	3.28
n/a	HEA 20 blue- B	12-Aug-04	14:35	0.01	n/a	20.1	5.50
n/a	HEA 20 blue- C	12-Aug-04	14:35	0.01	n/a	20.1	5.01
2004-0577	Toolik	13-Aug-04	9:10	1	12.7	12.7	8.84
2004-0578	Toolik	13-Aug-04	9:20	3	12.7	12.7	7.88
2004-0579	Toolik	13-Aug-04	9:30	5	12.6	12.6	6.34
2004-0580	Toolik	13-Aug-04	9:40	8	11.8	12.6	7.48
2004-0581	Toolik	13-Aug-04	9:55	12	6.6	6.6	1.58
2004-0582	Toolik	13-Aug-04	10:05	16	6.1	6.6	2.16
2004-0574	I7-I9	13-Aug-04	0:00	0.01	13.0	13.0	7.35
2004-0573	I8-I9	13-Aug-04	0:00	0.01	12.1	12.1	7.51
2004-0570	Toolik Inlet	13-Aug-04	0:00	0.01	13.1	13.0	4.76
n/a	I8 In benthic water	11-Aug-04	13:00	0.01		12.0	80.02
n/a	I8 In benthic scrubs	11-Aug-04	13:00	0.01		12.0	80.02
n/a	I8 In benthic rock	11-Aug-04	13:00	0.01		12.0	83.53
n/a	I8 In benthic TCA only	11-Aug-04	13:00	0.01		12.0	83.53
n/a	I8 Out benthic water	11-Aug-04	13:00	0.01		12.0	118.90
n/a	I8 Out benthic scrubs	11-Aug-04	13:00	0.01		12.0	118.90
n/a	I8 Out benthic whole rock	11-Aug-04	13:00	0.01		12.0	135.68
n/a	I8 Out benthic TCA only	11-Aug-04	13:00	0.01		12.0	135.68
n/a	I8 In benthic post scrub	11-Aug-04	13:00	0.01		12.0	11.48
n/a	I8 Out benthic post scrub	11-Aug-04	13:00	0.01		12.0	11.48
n/a	HEA 6 blue- A	14-Aug-04	14:05	0.01	n/a	6.3	3.06
n/a	HEA 6 green	14-Aug-04	14:05	0.01	n/a	6.3	6.59
n/a	HEA 6 yellow	14-Aug-04	14:05	0.01	n/a	6.3	2.79
n/a	HEA 6 white	14-Aug-04	14:05	0.01	n/a	6.3	6.61
n/a	HEA 6 blue- B	14-Aug-04	14:05	0.01	n/a	6.3	3.66
n/a	HEA 6 blue- C	14-Aug-04	14:05	0.01	n/a	6.3	4.95
n/a	HEA 12 blue- A	14-Aug-04	15:10	0.01	n/a	11.9	4.99
n/a	HEA 12 green- A	14-Aug-04	15:10	0.01	n/a	11.9	2.57
n/a	HEA 12 yellow- A	14-Aug-04	15:10	0.01	n/a	11.9	2.04
n/a	HEA 12 white- A	14-Aug-04	15:10	0.01	n/a	11.9	2.54
n/a	HEA 12 blue- B	14-Aug-04	15:10	0.01	n/a	11.9	3.80
n/a	HEA 12 green- B	14-Aug-04	15:10	0.01	n/a	11.9	2.49
n/a	HEA 12 yellow-B	14-Aug-04	15:10	0.01	n/a	11.9	1.59
n/a	HEA 12 white-B	14-Aug-04	15:10	0.01	n/a	11.9	2.68

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	HEA 12 blue- C	14-Aug-04	15:10	0.01	n/a	11.9	4.11
n/a	HEA 12 green- C	14-Aug-04	15:10	0.01	n/a	11.9	2.62
n/a	HEA 12 yellow- C	14-Aug-04	15:10	0.01	n/a	11.9	1.68
n/a	HEA 12 white- C	14-Aug-04	15:10	0.01	n/a	11.9	2.46
n/a	HEA 20 blue- A	14-Aug-04	14:15	0.01	n/a	20.4	12.21
n/a	HEA 20 green	14-Aug-04	14:15	0.01	n/a	20.4	5.72
n/a	HEA 20 yellow	14-Aug-04	14:15	0.01	n/a	20.4	4.10
n/a	HEA 20 white	14-Aug-04	14:15	0.01	n/a	20.4	6.79
n/a	HEA 20 blue- B	14-Aug-04	14:15	0.01	n/a	20.4	111.63
n/a	HEA 20 blue- C	14-Aug-04	14:15	0.01	n/a	20.4	9.42
2004-1511	I8 Inlet	16-Aug-04	10:20	0.01	10.4	10.4	3.36
2004-1512	I8 Outlet	16-Aug-04	10:55	0.01	13.0	13.0	10.38
2004-1513	HEA 12 blue- A	16-Aug-04	14:00	0.01	n/a	12.3	5.95
2004-1514	HEA 12 green- A	16-Aug-04	14:00	0.01	n/a	12.3	3.64
2004-1515	HEA 12 yellow- A	16-Aug-04	14:00	0.01	n/a	12.3	2.95
2004-1516	HEA 12 white- A	16-Aug-04	14:00	0.01	n/a	12.3	2.87
2004-1517	HEA 12 blue- B	16-Aug-04	14:00	0.01	n/a	12.3	5.39
2004-1518	HEA 12 green- B	16-Aug-04	14:00	0.01	n/a	12.3	3.24
2004-1519	HEA 12 yellow-B	16-Aug-04	14:00	0.01	n/a	12.3	1.43
2004-1520	HEA 12 white-B	16-Aug-04	14:00	0.01	n/a	12.3	1.86
2004-1521	HEA 12 blue- C	16-Aug-04	14:00	0.01	n/a	12.3	5.92
2004-1522	HEA 12 green- C	16-Aug-04	14:00	0.01	n/a	12.3	2.70
2004-1523	HEA 12 yellow- C	16-Aug-04	14:00	0.01	n/a	12.3	2.16
2004-1524	HEA 12 white- C	16-Aug-04	14:00	0.01	n/a	12.3	3.03
2005-0817	I8-in	21-Jun-05	14:30	0.01	11.3	12.0	2.17
2005-0818	I8-out	21-Jun-05	15:40	0.01	12.4	12.6	10.58
n/a	blue, 12 deg C	23-Jun-05	21:20	0.01	13.0	13.0	6.75
n/a	green, 12 deg C	23-Jun-05	21:20	0.01	13.0	13.0	6.45
n/a	yellow, 12 deg C	23-Jun-05	21:20	0.01	13.0	13.0	14.30
n/a	white, 12 deg C	23-Jun-05	21:20	0.01	13.0	13.0	10.49
n/a	blue, 12 deg C, N+P	23-Jun-05	21:20	0.01	13.0	13.0	131.55
n/a	green, 12 deg C, N+P	23-Jun-05	21:20	0.01	13.0	13.0	111.95
n/a	yellow, 12 deg C, N+P	23-Jun-05	21:20	0.01	13.0	13.0	72.79
n/a	white, 12 deg C, N+P	23-Jun-05	21:20	0.01	13.0	13.0	73.95
n/a	blue, 17 deg C	23-Jun-05	21:20	0.01	17.0	17.0	9.82
n/a	green, 17 deg C	23-Jun-05	21:20	0.01	17.0	17.0	9.17
n/a	yellow, 17 deg C	23-Jun-05	21:20	0.01	17.0	17.0	23.29
n/a	white, 17 deg C	23-Jun-05	21:20	0.01	17.0	17.0	20.51
n/a	blue, 17 deg C, N+P	23-Jun-05	21:20	0.01	17.0	17.0	163.23
n/a	green, 17 deg C, N+P	23-Jun-05	21:20	0.01	17.0	17.0	165.81
n/a	yellow, 17 deg C, N+P	23-Jun-05	21:20	0.01	17.0	17.0	127.75
n/a	white, 17 deg C, N+P	23-Jun-05	21:20	0.01	17.0	17.0	156.38
2005-0233	Toolik Main	24-Jun-05	9:20	1	10.5	10.0	5.61
2005-0234	Toolik Main	24-Jun-05	9:35	3	10.3	10.0	7.13
2005-0235	Toolik Main	24-Jun-05	9:40	5	10.1	10.0	6.46
2005-0236	Toolik Main	24-Jun-05	9:50	8	9.0	9.0	4.86
2005-0237	Toolik Main	24-Jun-05	10:00	12	5.0	5.0	4.18
2005-0238	Toolik Main	24-Jun-05	10:14	16	4.7	5.0	4.59

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2005-0230	I7-I9	24-Jun-05	13:30	0.01	11.2	12.0	4.07
2005-0229	I8-I9	24-Jun-05	13:30	0.01	12.5	12.0	2.68
2005-0226	Toolik Inlet	24-Jun-05	13:30	0.01	11.5	12.0	2.93
n/a	Toolik Inlet, 6 deg C	24-Jun-05	15:08	0.01	11.5	6.0	2.42
n/a	Toolik Inlet, 8 deg C	24-Jun-05	15:08	0.01	11.5	8.0	2.42
n/a	Toolik Inlet, 10 deg C	24-Jun-05	15:08	0.01	11.5	10.0	2.86
n/a	Toolik Inlet, 14 deg C	24-Jun-05	15:08	0.01	11.5	14.0	2.89
n/a	Toolik Inlet, 17 deg C	24-Jun-05	15:08	0.01	11.5	17.0	3.59
n/a	Toolik Inlet, 21 deg C	24-Jun-05	15:08	0.01	11.5	21.0	3.52
2005-0252	I1-I3	28-Jun-05	9:30	0.01	11.4	11.8	4.27
2005-0254	I2-I3	28-Jun-05	9:30	0.01	11.8	11.8	4.64
2005-0266	I8 HW	28-Jun-05	10:50	0.01	13.3	13.3	15.95
2005-0886	I2	28-Jun-05	10:50	1	11.7	11.4	5.02
2005-0884	I1	28-Jun-05	12:00	1	14.7	14.3	5.64
2005-0888	I3	28-Jun-05	12:45	1	16.2	16.4	11.81
2005-0890	I4	28-Jun-05	13:50	1	16.9	16.4	15.53
2005-0259	I5-I6	28-Jun-05	15:15	0.01	16.2	15.7	9.77
2005-0896	I6 HW	28-Jun-05	15:50	1	15.7	15.7	8.41
2005-0257	I4-I5	28-Jun-05	16:45	0.01	17.4	17.5	5.73
2005-0892	I5	28-Jun-05	18:15	1	15.8	16.0	13.09
2005-0894	I6	29-Jun-05	10:00	1	16.1	15.7	11.60
2005-0898	I7	29-Jun-05	11:10	1	17.1	16.9	15.42
2005-0267	I8 in	29-Jun-05	12:15	0.01	18.0	18.4	123.66
2005-0900	I8	29-Jun-05	12:30	1	17.1	18.4	23.29
2005-0268	I8 out	29-Jun-05	12:20	0.01	18.4	18.4	11.90
2005-0272	I swamp in	29-Jun-05	14:10	0.01	17.8	17.8	9.55
2005-0902	I swamp	29-Jun-05	13:50	1	17.5	17.8	18.45
2005-0265	I7-I9	29-Jun-05	15:55	0.01	19.7	20.8	12.25
2005-0269	I8-I9	29-Jun-05	15:55	0.01	20.8	20.8	14.00
2005-0270	MWL	29-Jun-05	15:50	0.01	14.5	14.5	11.99
2005-0274	Toolik Inlet	29-Jun-05	17:00	0.01	19.4	19.4	22.96
2005-0300	Toolik Main	1-Jul-05	9:25	1	15.2	14.0	4.29
2005-0301	Toolik Main	1-Jul-05	9:50	3	14.3	14.0	12.99
2005-0302	Toolik Main	1-Jul-05	10:00	5	11.4	11.4	8.34
2005-0303	Toolik Main	1-Jul-05	10:10	8	9.1	9.1	6.36
2005-0304	Toolik Main	1-Jul-05	10:20	12	5.7	5.7	4.32
2005-0305	Toolik Main	1-Jul-05	10:30	16	4.9	5.7	4.06
2005-0297	I7-I9	1-Jul-05	11:30	0.01	12.5	12.0	1.07
2005-0296	I8-I9	1-Jul-05	11:30	0.01	11.9	12.0	0.48
n/a	Toolik Inlet, 6 deg C	1-Jul-05	11:45	0.01	11.1	5.7	1.31
n/a	Toolik Inlet, 9 deg C	1-Jul-05	11:45	0.01	11.1	9.1	1.09
2005-0293	Toolik Inlet, 12 deg C	1-Jul-05	11:45	0.01	11.1	12.0	2.04
n/a	Toolik Inlet, 14 deg C	1-Jul-05	11:45	0.01	11.1	14.0	2.85
n/a	Toolik Inlet, 17 deg C	1-Jul-05	11:45	0.01	11.1	17.0	2.95
n/a	Toolik Inlet, 20 deg C	1-Jul-05	11:45	0.01	11.1	20.0	3.85
2005-0947	I8 in	5-Jul-05	13:26	0.01	7.0	7.0	1.25
2005-0948	I8 out	5-Jul-05	13:50	0.01	12.3	13.5	7.19
2005-0963	I8 in	7-Jul-05	14:20	0.01	7.3	7.3	4.31

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2005-0964	I8 out	7-Jul-05	17:19	0.01	12.0	12.0	13.99
2005-0965	blue bag rep A	7-Jul-05	14:20	0.01	7.3	7.3	11.52
2005-0966	blue bag rep B	7-Jul-05	14:20	0.01	7.3	7.3	11.04
2005-0967	white bag rep A	7-Jul-05	14:20	0.01	7.3	7.3	4.98
2005-0968	white bag rep B	7-Jul-05	14:20	0.01	7.3	7.3	4.37
2005-0356	Toolik	8-Jul-05	9:28	1	11.1	11.1	6.30
2005-0357	Toolik	8-Jul-05	9:40	3	11.1	11.1	3.04
2005-0358	Toolik	8-Jul-05	9:56	5	11.1	11.1	5.38
2005-0359	Toolik	8-Jul-05	10:06	8	10.3	10.3	6.39
2005-0360	Toolik	8-Jul-05	10:21	12	5.9	5.9	5.43
2005-0361	Toolik	8-Jul-05	10:35	16	5.2	5.9	1.54
2005-0353	I7-I9	8-Jul-05	13:00	0.01	10.7	10.1	4.30
2005-0352	I8-I9	8-Jul-05	13:00	0.01	11.9	11.8	12.43
2005-0349	Toolik Inlet	8-Jul-05	13:30	0.01	10.1	10.1	4.93
2005-0991	I8 in	9-Jul-05	11:30	0.01	7.2	7.2	1.69
2005-0992	I8 out	9-Jul-05	13:30	0.01	10.6	10.6	11.45
2005-0993	blue bag rep A	9-Jul-05	11:30	0.01	7.2	7.2	12.64
2005-0994	blue bag rep B	9-Jul-05	11:30	0.01	7.2	7.2	16.28
2005-0995	green bag rep A	9-Jul-05	13:30	0.01	10.6	10.6	10.16
2005-0996	green bag rep B	9-Jul-05	13:30	0.01	10.6	10.6	56.49
2005-0997	yellow bag rep A	9-Jul-05	13:30	0.01	10.6	10.6	30.50
2005-0998	yellow bag rep B	9-Jul-05	13:30	0.01	10.6	10.6	13.51
2005-0999	white bag rep A	9-Jul-05	11:30	0.01	7.2	7.2	9.90
2005-1000	white bag rep B	9-Jul-05	11:30	0.01	7.2	7.2	13.69
2005-1001	mystery bag	9-Jul-05	13:30	0.01	10.6	10.6	57.33
2005-1050	I8 in	12-Jul-05	10:15	0.01	4.7	4.7	1.70
2005-1051	I8 out	12-Jul-05	10:50	0.01	9.2	9.2	6.99
n/a	blue, 12 deg C	14-Jul-05	20:00	0.01	12.0	12.0	4.53
n/a	green, 12 deg C	14-Jul-05	20:00	0.01	12.0	12.0	4.19
n/a	yellow, 12 deg C	14-Jul-05	20:00	0.01	12.0	12.0	1.96
n/a	white, 12 deg C	14-Jul-05	20:00	0.01	12.0	12.0	1.71
n/a	blue, 12 deg C, N+P	14-Jul-05	20:00	0.01	12.0	12.0	20.47
n/a	green, 12 deg C, N+P	14-Jul-05	20:00	0.01	12.0	12.0	31.22
n/a	yellow, 12 deg C, N+P	14-Jul-05	20:00	0.01	12.0	12.0	9.31
n/a	white, 12 deg C, N+P	14-Jul-05	20:00	0.01	12.0	12.0	14.80
n/a	blue, 17 deg C	14-Jul-05	20:40	0.01	17.0	17.0	15.32
n/a	green, 17 deg C	14-Jul-05	20:40	0.01	17.0	17.0	10.20
n/a	yellow, 17 deg C	14-Jul-05	20:40	0.01	17.0	17.0	3.68
n/a	white, 17 deg C	14-Jul-05	20:40	0.01	17.0	17.0	3.77
n/a	blue, 17 deg C, N+P	14-Jul-05	20:40	0.01	17.0	17.0	157.36
n/a	green, 17 deg C, N+P	14-Jul-05	20:40	0.01	17.0	17.0	168.41
n/a	yellow, 17 deg C, N+P	14-Jul-05	20:40	0.01	17.0	17.0	118.19
n/a	white, 17 deg C, N+P	14-Jul-05	20:40	0.01	17.0	17.0	121.07
2005-0402	Toolik	15-Jul-05	9:10	1	12.1	12.0	4.31
2005-0403	Toolik	15-Jul-05	9:25	3	11.6	12.0	5.37
2005-0404	Toolik	15-Jul-05	9:45	5	10.7	10.1	3.39
2005-0405	Toolik	15-Jul-05	10:00	8	10.1	10.1	6.29
2005-0406	Toolik	15-Jul-05	10:15	12	6.0	6.0	2.83

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2005-0407	Toolik	15-Jul-05	10:33	16	5.2	6.0	2.46
2005-0399	I7-I9	15-Jul-05	13:20	0.01	12.6	12.0	11.49
2005-0398	I8-I9	15-Jul-05	13:20	0.01	11.3	12.0	9.73
n/a	Toolik Inlet, 6 deg C	15-Jul-05	12:04	0.01	11.8	6.0	1.06
n/a	Toolik Inlet, 8 deg C	15-Jul-05	12:04	0.01	11.8	8.0	0.93
n/a	Toolik Inlet, 10 deg C	15-Jul-05	12:04	0.01	11.8	10.1	1.56
2005-0395	Toolik Inlet, 12 deg C	15-Jul-05	12:04	0.01	11.8	12.0	1.71
n/a	Toolik Inlet, 14 deg C	15-Jul-05	12:04	0.01	11.8	14.0	1.69
n/a	Toolik Inlet, 17 deg C	15-Jul-05	12:04	0.01	11.8	17.0	1.60
n/a	Toolik Inlet, 20 deg C	15-Jul-05	12:04	0.01	11.8	20.0	2.36
n/a	blue, 12 deg C	16-Jul-05	20:10	0.01	12.0	12.0	11.65
n/a	green, 12 deg C	16-Jul-05	20:10	0.01	12.0	12.0	8.75
n/a	yellow, 12 deg C	16-Jul-05	20:10	0.01	12.0	12.0	2.36
n/a	white, 12 deg C	16-Jul-05	20:10	0.01	12.0	12.0	3.25
n/a	blue, 12 deg C, N+P	16-Jul-05	20:10	0.01	12.0	12.0	166.80
n/a	green, 12 deg C, N+P	16-Jul-05	20:10	0.01	12.0	12.0	161.16
n/a	yellow, 12 deg C, N+P	16-Jul-05	20:10	0.01	12.0	12.0	149.67
n/a	white, 12 deg C, N+P	16-Jul-05	20:10	0.01	12.0	12.0	134.64
n/a	blue, 17 deg C	16-Jul-05	20:50	0.01	17.0	17.0	34.36
n/a	green, 17 deg C	16-Jul-05	20:50	0.01	17.0	17.0	15.71
n/a	yellow, 17 deg C	16-Jul-05	20:50	0.01	17.0	17.0	4.23
n/a	white, 17 deg C	16-Jul-05	20:50	0.01	17.0	17.0	9.34
n/a	blue, 17 deg C, N+P	16-Jul-05	20:50	0.01	17.0	17.0	163.35
n/a	green, 17 deg C, N+P	16-Jul-05	20:50	0.01	17.0	17.0	144.68
n/a	yellow, 17 deg C, N+P	16-Jul-05	20:50	0.01	17.0	17.0	183.25
n/a	white, 17 deg C, N+P	16-Jul-05	20:50	0.01	17.0	17.0	165.29
n/a	blue, 12 deg C	18-Jul-05	20:00	0.01	12.0	12.0	21.72
n/a	green, 12 deg C	18-Jul-05	20:00	0.01	12.0	12.0	11.42
n/a	yellow, 12 deg C	18-Jul-05	20:00	0.01	12.0	12.0	2.22
n/a	white, 12 deg C	18-Jul-05	20:00	0.01	12.0	12.0	3.02
n/a	blue, 12 deg C, N+P	18-Jul-05	20:00	0.01	12.0	12.0	132.76
n/a	green, 12 deg C, N+P	18-Jul-05	20:00	0.01	12.0	12.0	135.63
n/a	yellow, 12 deg C, N+P	18-Jul-05	20:00	0.01	12.0	12.0	98.69
n/a	white, 12 deg C, N+P	18-Jul-05	20:00	0.01	12.0	12.0	113.39
n/a	blue, 17 deg C	18-Jul-05	20:40	0.01	17.0	17.0	33.83
n/a	green, 17 deg C	18-Jul-05	20:40	0.01	17.0	17.0	18.28
n/a	yellow, 17 deg C	18-Jul-05	20:40	0.01	17.0	17.0	4.68
n/a	white, 17 deg C	18-Jul-05	20:40	0.01	17.0	17.0	12.09
n/a	blue, 17 deg C, N+P	18-Jul-05	20:40	0.01	17.0	17.0	150.37
n/a	green, 17 deg C, N+P	18-Jul-05	20:40	0.01	17.0	17.0	149.79
n/a	yellow, 17 deg C, N+P	18-Jul-05	20:40	0.01	17.0	17.0	79.02
n/a	white, 17 deg C, N+P	18-Jul-05	20:40	0.01	17.0	17.0	148.84
2005-0421	I1-I3	19-Jul-05	9:00	0.01	11.1	11.1	2.39
2005-0423	I2-I3	19-Jul-05	9:00	0.01	11.5	11.1	2.89
2005-0435	I8 Headwaters	19-Jul-05	9:50	0.01	6.7	6.7	1.13
2005-1150	I2	19-Jul-05	10:10	1	13.7	12.6	2.58
2005-1148	I1	19-Jul-05	12:00	1	13.6	13.7	2.89
2005-1152	I3	19-Jul-05	12:40	1	13.9	13.7	4.35

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2005-1154	I4	19-Jul-05	13:40	1	14.4	13.7	6.52
2005-0428	I5-I6	19-Jul-05	15:10	0.01	14.3	14.6	3.63
2005-0432	I6 West	19-Jul-05	15:10	0.01	9.2	13.7	0.82
2005-0429	I6 HW In	19-Jul-05	15:10	0.01	10.3	13.7	1.77
lakes	I6 HW	19-Jul-05	15:41	1	13.8	14.6	3.97
2005-0426	I4-I5	19-Jul-05	16:43	0.01	15.1	14.0	4.82
lakes	I5	19-Jul-05	18:00	1	14.1	14.0	8.23
lakes	I6	20-Jul-05	10:20	1	13.3	13.6	2.28
lakes	I7	20-Jul-05	11:05	1	13.3	13.6	4.96
2005-0436	I8 In	20-Jul-05	12:20	0.01	10.6	10.6	0.59
lakes	I8	20-Jul-05	12:30	1	12.3	12.6	7.62
2005-0437	I8 Out	20-Jul-05	13:00	0.01	12.6	12.6	5.88
2005-0441	I swamp In	20-Jul-05	14:15	0.01	13.7	13.7	0.47
lakes	I swamp	20-Jul-05	14:10	1	13.2	13.7	6.78
2005-0434	I7-I9	20-Jul-05	15:45	0.01	14.8	14.3	1.78
2005-0438	I8-I9	20-Jul-05	15:45	0.01	14.3	14.3	3.72
2005-0439	MWL	20-Jul-05	15:55	0.01	9.2	9.2	0.60
2005-0443	Toolik Inlet	20-Jul-05	16:35	0.01	13.9	13.9	1.58
n/a	blue, 12 deg C	21-Jul-05	20:15	0.01	12.0	12.0	22.28
n/a	green, 12 deg C	21-Jul-05	20:15	0.01	12.0	12.0	10.75
n/a	yellow, 12 deg C	21-Jul-05	20:15	0.01	12.0	12.0	1.40
n/a	white, 12 deg C	21-Jul-05	20:15	0.01	12.0	12.0	3.92
n/a	blue, 12 deg C, N+P	21-Jul-05	20:15	0.01	12.0	12.0	158.68
n/a	green, 12 deg C, N+P	21-Jul-05	20:15	0.01	12.0	12.0	124.98
n/a	yellow, 12 deg C, N+P	21-Jul-05	20:15	0.01	12.0	12.0	154.08
n/a	white, 12 deg C, N+P	21-Jul-05	20:15	0.01	12.0	12.0	56.57
n/a	blue, 17 deg C	21-Jul-05	20:45	0.01	17.0	17.0	16.04
n/a	green, 17 deg C	21-Jul-05	20:45	0.01	17.0	17.0	4.73
n/a	yellow, 17 deg C	21-Jul-05	20:45	0.01	17.0	17.0	4.25
n/a	white, 17 deg C	21-Jul-05	20:45	0.01	17.0	17.0	8.68
n/a	blue, 17 deg C, N+P	21-Jul-05	20:45	0.01	17.0	17.0	127.65
n/a	green, 17 deg C, N+P	21-Jul-05	20:45	0.01	17.0	17.0	51.20
n/a	yellow, 17 deg C, N+P	21-Jul-05	20:45	0.01	17.0	17.0	40.48
n/a	white, 17 deg C, N+P	21-Jul-05	20:45	0.01	17.0	17.0	90.66
2005-0469	Toolik	22-Jul-05	9:20	1	12.8	12.8	7.38
2005-0470	Toolik	22-Jul-05	9:40	3	12.8	12.8	7.53
2005-0471	Toolik	22-Jul-05	9:57	5	12.7	12.8	6.79
2005-0472	Toolik	22-Jul-05	10:10	8	11.7	12.0	6.66
2005-0473	Toolik	22-Jul-05	10:18	12	6.0	6.0	1.99
2005-0474	Toolik	22-Jul-05	10:30	16	5.5	6.0	2.41
2005-0466	I7-I9	22-Jul-05	13:00	0.01	13.5	14.0	4.74
2005-0465	I8-I9	22-Jul-05	13:00	0.01	12.7	12.0	4.48
n/a	Toolik Inlet, 6 deg C	22-Jul-05	13:00	0.01	12.9	5.5	0.57
n/a	Toolik Inlet, 9 deg C	22-Jul-05	13:00	0.01	12.9	9.0	1.05
2005-0462	Toolik Inlet, 12 deg C	22-Jul-05	13:00	0.01	12.9	12.0	1.32
n/a	Toolik Inlet, 14 deg C	22-Jul-05	13:00	0.01	12.9	14.0	1.13
n/a	Toolik Inlet, 17 deg C	22-Jul-05	13:00	0.01	12.9	17.0	1.32
n/a	Toolik Inlet, 20 deg C	22-Jul-05	13:00	0.01	12.9	20.0	1.37

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	blue, 12 deg C	24-Jul-05	20:30	0.01	12.0	12.0	18.16
n/a	green, 12 deg C	24-Jul-05	20:30	0.01	12.0	12.0	7.55
n/a	yellow, 12 deg C	24-Jul-05	20:30	0.01	12.0	12.0	2.09
n/a	white, 12 deg C	24-Jul-05	20:30	0.01	12.0	12.0	5.39
n/a	blue, 12 deg C, N+P	24-Jul-05	20:30	0.01	12.0	12.0	105.38
n/a	green, 12 deg C, N+P	24-Jul-05	20:30	0.01	12.0	12.0	46.60
n/a	yellow, 12 deg C, N+P	24-Jul-05	20:30	0.01	12.0	12.0	107.86
n/a	white, 12 deg C, N+P	24-Jul-05	20:30	0.01	12.0	12.0	22.17
n/a	blue, 17 deg C	24-Jul-05	21:00	0.01	17.0	17.0	22.83
n/a	green, 17 deg C	24-Jul-05	21:00	0.01	17.0	17.0	8.64
n/a	yellow, 17 deg C	24-Jul-05	21:00	0.01	17.0	17.0	6.93
n/a	white, 17 deg C	24-Jul-05	21:00	0.01	17.0	17.0	9.25
n/a	blue, 17 deg C, N+P	24-Jul-05	21:00	0.01	17.0	17.0	135.12
n/a	green, 17 deg C, N+P	24-Jul-05	21:00	0.01	17.0	17.0	56.45
n/a	yellow, 17 deg C, N+P	24-Jul-05	21:00	0.01	17.0	17.0	38.45
n/a	white, 17 deg C, N+P	24-Jul-05	21:00	0.01	17.0	17.0	78.98
2005-1229	I8 in	26-Jul-05	10:25	0.01	11.2	11.2	1.42
2005-1230	I8 out	26-Jul-05	12:02	0.01	14.6	14.6	6.38
n/a	blue, 12 deg C	26-Jul-05	19:50	0.01	12.0	12.0	22.27
n/a	green, 12 deg C	26-Jul-05	19:50	0.01	12.0	12.0	10.29
n/a	yellow, 12 deg C	26-Jul-05	19:50	0.01	12.0	12.0	2.64
n/a	white, 12 deg C	26-Jul-05	19:50	0.01	12.0	12.0	5.07
n/a	blue, 12 deg C, N+P	26-Jul-05	19:50	0.01	12.0	12.0	100.19
n/a	green, 12 deg C, N+P	26-Jul-05	19:50	0.01	12.0	12.0	68.18
n/a	yellow, 12 deg C, N+P	26-Jul-05	19:50	0.01	12.0	12.0	15.48
n/a	white, 12 deg C, N+P	26-Jul-05	19:50	0.01	12.0	12.0	12.48
n/a	blue, 17 deg C	26-Jul-05	20:30	0.01	17.0	17.0	28.58
n/a	green, 17 deg C	26-Jul-05	20:30	0.01	17.0	17.0	15.38
n/a	yellow, 17 deg C	26-Jul-05	20:30	0.01	17.0	17.0	10.31
n/a	white, 17 deg C	26-Jul-05	20:30	0.01	17.0	17.0	18.75
n/a	blue, 17 deg C, N+P	26-Jul-05	20:30	0.01	17.0	17.0	173.88
n/a	green, 17 deg C, N+P	26-Jul-05	20:30	0.01	17.0	17.0	94.41
n/a	yellow, 17 deg C, N+P	26-Jul-05	20:30	0.01	17.0	17.0	71.48
n/a	white, 17 deg C, N+P	26-Jul-05	20:30	0.01	17.0	17.0	103.83
2005-1231	I8 in	28-Jul-05	10:21	0.01	11.0	11.0	1.79
2005-1232	I8 out	28-Jul-05	12:02	0.01	14.4	14.4	10.62
2005-1235	blue bag rep A	28-Jul-05	10:30	0.01	11.0	11.0	11.61
2005-1236	blue bag rep B	28-Jul-05	10:30	0.01	11.0	11.0	5.35
2005-1239	green bag rep A	28-Jul-05	12:15	0.01	14.4	14.4	12.50
2005-1240	green bag rep B	28-Jul-05	12:15	0.01	14.4	14.4	16.30
2005-1237	yellow bag rep A	28-Jul-05	12:15	0.01	14.4	14.4	9.07
2005-1238	yellow bag rep B	28-Jul-05	12:15	0.01	14.4	14.4	25.18
2005-1233	white bag rep A	28-Jul-05	10:30	0.01	11.0	11.0	4.05
2005-1234	white bag rep B	28-Jul-05	10:30	0.01	11.0	11.0	2.47
2005-0513	Toolik	29-Jul-05	9:30	1	14.5	14.5	5.08
2005-0514	Toolik	29-Jul-05	9:40	3	14.5	14.5	4.05
2005-0515	Toolik	29-Jul-05	9:53	5	13.8	13.8	7.68
2005-0516	Toolik	29-Jul-05	10:05	8	12.5	12.5	5.82

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2005-0517	Toolik	29-Jul-05	10:20	12	7.6	7.6	1.80
2005-0518	Toolik	29-Jul-05	10:30	16	6.7	6.1	1.66
2005-0510	I7-I9	29-Jul-05	10:00	0.01	11.5	11.0	1.94
2005-0509	I8-I9	29-Jul-05	10:30	0.01	10.5	11.0	1.55
2005-0506	Toolik Inlet	29-Jul-05	13:30	0.01	11.1	11.0	0.92
2005-1262	I8 in	30-Jul-05	11:00	0.01	8.0	8.0	0.79
2005-1263	I8 out	30-Jul-05	13:30	0.01	13.7	13.7	3.79
2005-1266	blue bag rep A	30-Jul-05	11:00	0.01	8.0	8.0	0.45
2005-1267	blue bag rep B	30-Jul-05	11:00	0.01	8.0	8.0	0.57
2005-1270	green bag rep A	30-Jul-05	13:30	0.01	13.7	13.7	0.64
2005-1271	green bag rep B	30-Jul-05	13:30	0.01	13.7	13.7	0.44
2005-1268	yellow bag rep A	30-Jul-05	13:30	0.01	13.7	13.7	0.72
2005-1269	yellow bag rep B	30-Jul-05	13:30	0.01	13.7	13.7	1.84
2005-1264	white bag rep A	30-Jul-05	11:00	0.01	8.0	8.0	0.68
2005-1265	white bag rep B	30-Jul-05	11:00	0.01	8.0	8.0	0.68
2005-1327	I8 in	2-Aug-05	10:15	0.01	9.0	9.0	1.59
2005-1328	I8 out	2-Aug-05	12:00	0.01	13.2	13.2	7.39
2005-1331	blue bag rep A	2-Aug-05	10:15	0.01	9.0	9.0	12.68
2005-1332	blue bag rep B	2-Aug-05	10:15	0.01	9.0	9.0	8.56
2005-1333	green bag rep A	2-Aug-05	12:00	0.01	13.2	13.2	8.82
2005-1334	green bag rep B	2-Aug-05	12:00	0.01	13.2	13.2	14.24
2005-1335	yellow bag rep A	2-Aug-05	12:00	0.01	13.2	13.2	12.11
2005-1336	yellow bag rep B	2-Aug-05	12:00	0.01	13.2	13.2	8.98
2005-1329	white bag rep A	2-Aug-05	10:15	0.01	9.0	9.0	16.70
2005-1330	white bag rep B	2-Aug-05	10:15	0.01	9.0	9.0	3.50
n/a	BCF 1	3-Aug-05	9:00	0.01	8.3	12.0	0.84
n/a	BCF 2	3-Aug-05	11:05	0.01	n/a	12.0	0.90
n/a	BCF 3	3-Aug-05	13:07	0.01	n/a	12.0	1.48
n/a	BCF 4	3-Aug-05	15:04	0.01	n/a	12.0	1.89
n/a	BCF 5	3-Aug-05	17:05	0.01	n/a	12.0	2.75
n/a	BCF 6	3-Aug-05	19:04	0.01	n/a	12.0	3.48
n/a	BCF 7	3-Aug-05	22:04	0.01	n/a	12.0	5.86
n/a	BCF 8	4-Aug-05	1:02	0.01	n/a	12.0	9.23
n/a	BCF 9	4-Aug-05	4:05	0.01	n/a	12.0	16.16
n/a	BCF 10	4-Aug-05	7:03	0.01	n/a	12.0	22.57
n/a	BCF 11	4-Aug-05	9:02	0.01	n/a	12.0	28.31
2005-0571	Toolik	5-Aug-05	9:25	1	13.2	13.2	5.56
2005-0572	Toolik	5-Aug-05	9:33	3	13.2	13.2	8.07
2005-0573	Toolik	5-Aug-05	9:44	5	13.1	13.2	8.06
2005-0574	Toolik	5-Aug-05	10:00	8	12.6	12.3	6.97
2005-0575	Toolik	5-Aug-05	10:10	12	6.4	6.4	2.13
2005-0576	Toolik	5-Aug-05	10:20	16	5.7	6.4	2.24
2005-0568	I7-I9	5-Aug-05	12:30	0.01	11.2	12.0	3.26
2005-0567	I8-I9	5-Aug-05	12:30	0.01	10.9	12.0	1.76
n/a	Toolik Inlet, 6 deg C	5-Aug-05	13:00	0.01	11.7	5.7	1.11
n/a	Toolik Inlet, 9 deg C	5-Aug-05	13:00	0.01	11.7	9.0	1.65
2005-0564	Toolik Inlet, 12 deg C	5-Aug-05	13:00	0.01	11.7	12.0	1.68
n/a	Toolik Inlet, 14 deg C	5-Aug-05	13:00	0.01	11.7	14.0	2.42

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	Toolik Inlet, 17 deg C	5-Aug-05	13:00	0.01	11.7	17.0	2.54
n/a	Toolik Inlet, 20 deg C	5-Aug-05	13:00	0.01	11.7	20.0	3.12
2005-0578	I1-I3	9-Aug-05	9:10	0.01	9.9	9.9	3.56
2005-0580	I2-I3	9-Aug-05	9:10	0.01	9.7	9.9	2.72
2005-0592	I8 Headwaters	9-Aug-05	10:20	0.01	10.4	12.6	3.08
lakes	I2	9-Aug-05	10:10	1	11.6	12.6	2.35
lakes	I1	9-Aug-05	11:30	1	12.6	14.7	4.36
lakes	I3	9-Aug-05	12:10	1	12.8	12.3	8.32
lakes	I4	9-Aug-05	13:15	1	13.2	12.6	9.04
2005-0585	I5-I6	9-Aug-05	14:50	0.01	14.5	14.1	1.28
2005-0586	I6 HW In	9-Aug-05	14:50	0.01	11.3	11.3	5.32
lakes	I6 HW	9-Aug-05	14:50	1	13.4	14.1	3.43
2005-0583	I4-I5	9-Aug-05	16:05	0.01	15.0	15.0	3.06
lakes	I5	9-Aug-05	17:00	1	13.7	15.0	7.91
lakes	I6	10-Aug-05	9:45	1	13.6	13.3	4.12
lakes	I7	10-Aug-05	10:45	1	13.6	13.3	5.61
2005-0593	I8 In	10-Aug-05	11:50	0.01	13.3	13.3	1.52
lakes	I8	10-Aug-05	12:00	1	13.8	13.3	5.14
2005-0594	I8 Out	10-Aug-05	12:00	0.01	16.3	16.3	5.85
2005-0598	I swamp In	10-Aug-05	13:15	0.01	14.4	14.4	1.51
lakes	I swamp	10-Aug-05	13:15	1	14.2	14.4	4.93
2005-0591	I7-I9	10-Aug-05	14:40	0.01	16.7	16.7	3.39
2005-0595	I8-I9	10-Aug-05	14:45	0.01	17.4	16.7	2.44
2005-0596	MWL	10-Aug-05	14:45	0.01	11.6	11.6	0.76
2005-0600	Toolik Inlet	10-Aug-05	15:20	0.01	17.5	17.5	6.12
2005-0626	Toolik	12-Aug-05	9:30	1	14.3	14.3	5.68
2005-0627	Toolik	12-Aug-05	9:40	3	13.6	13.6	4.05
2005-0628	Toolik	12-Aug-05	9:45	5	13.0	13.0	6.91
2005-0629	Toolik	12-Aug-05	9:55	8	12.6	13.0	5.49
2005-0630	Toolik	12-Aug-05	10:10	12	7.3	7.3	1.78
2005-0631	Toolik	12-Aug-05	10:25	16	5.9	5.9	1.67
2005-0623	I7-I9	12-Aug-05	12:30	0.01	12.9	13.0	4.47
2005-0622	I8-I9	12-Aug-05	12:30	0.01	12.4	12.0	1.06
2005-0619	Toolik Inlet	12-Aug-05	12:30	0.01	12.1	12.0	5.47
2005-1431	I8 in	15-Aug-05	10:15	0.01	9.8	9.8	1.84
2005-1432	I8 out	15-Aug-05	11:00	0.01	15.1	15.1	9.65
2005-0682	Toolik	18-Aug-05	9:30	1	13.3	13.3	6.06
2005-0683	Toolik	18-Aug-05	9:40	3	13.3	13.3	7.54
2005-0684	Toolik	18-Aug-05	9:55	5	13.2	13.3	7.59
2005-0685	Toolik	18-Aug-05	10:10	8	12.6	12.6	4.47
2005-0686	Toolik	18-Aug-05	10:25	12	6.7	6.7	1.85
2005-0687	Toolik	18-Aug-05	10:35	16	5.8	5.8	1.81
2005-0675	Toolik Inlet	18-Aug-05	11:20	0.01	8.3	8.3	2.79
2006-0110	I1 into I3	21-Jun-06	11:20	0.01	8.4	7.3	2.89
2006-0112	I2 into I3	21-Jun-06	11:45	0.01	11.6	11.2	3.24
2006-0124	I8 Headwaters	21-Jun-06	10:00	0.01	7.0	7.0	3.14
2006-0693	I2	21-Jun-06	0:00	1	4.8	7.0	3.01
2006-0691	I1	21-Jun-06	0:00	1	6.1	9.2	3.90

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2006-0695	I3	21-Jun-06	0:00	1	11.4	11.5	7.69
2006-0697	I4	21-Jun-06	0:00	1	5.0	12.5	0.53
2006-0117	I5 into I6	21-Jun-06	14:00	0.01	8.9	9.9	2.22
2006-0121	I6 Inlet West	21-Jun-06	14:30	0.01	9.9	9.9	0.64
2006-0703	I6 HW	21-Jun-06	0:00	1	9.1	9.9	2.65
2006-0118	I6 HW Inlet	21-Jun-06	15:15	0.01	9.8	9.9	0.57
2006-0115	I4 into I5	21-Jun-06	13:05	0.01	9.6	9.0	4.81
2006-0699	I5	21-Jun-06	0:00	1	9.9	9.0	4.76
2006-0701	I6	22-Jun-06	0:00	1	8.8	10.3	2.67
2006-0705	I7	22-Jun-06	0:00	1	9.2	10.4	1.58
2006-0125	I8 Inlet	22-Jun-06	9:45	0.01	9.3	10.7	1.38
2006-0677	I8	22-Jun-06	0:00	1	10.5	10.7	9.28
2006-0126	I8 Outlet	22-Jun-06	10:00	0.01	10.8	10.7	6.10
2006-0130	I Swamp Inlet	22-Jun-06	10:30	0.01	10.3	13.1	2.22
2006-0679	I Swamp	22-Jun-06	0:00	1	11.3	13.1	3.06
2006-0123	I7 into I9	22-Jun-06	11:15	0.01	11.6	12.0	3.25
2006-0127	I8 into I9	22-Jun-06	11:30	0.01	11.9	12.0	2.99
2006-0128	Milkyway Lower	22-Jun-06	11:50	0.01	8.1	10.1	1.13
2006-0132	Toolik Inlet	22-Jun-06	13:41	0.01	12.2	12.1	3.62
2006-0144	Toolik	23-Jun-06	9:15	1	7.0	7.0	1.92
2006-0146	Toolik	23-Jun-06	9:30	3	5.9	5.9	3.20
2006-0147	Toolik	23-Jun-06	9:45	5	5.2	5.9	3.08
2006-0148	Toolik	23-Jun-06	9:55	8	4.0	4.0	2.40
2006-0149	Toolik	23-Jun-06	10:05	12	3.7	4.0	2.59
2006-0150	Toolik	23-Jun-06	10:10	16	3.4	4.0	2.45
2006-0720	I8 Inlet	27-Jun-06	11:00	0.01	7.8	7.8	2.14
2006-0721	I8 Outlet	27-Jun-06	10:15	0.01	11.6	11.6	2.62
n/a	b 12C	29-Jun-06	21:32	0.01	12.0	12.0	11.88
n/a	g 12C	29-Jun-06	21:32	0.01	12.0	12.0	12.50
n/a	y12C	29-Jun-06	21:32	0.01	12.0	12.0	12.21
n/a	b NP 12C	29-Jun-06	21:45	0.01	12.0	12.0	62.12
n/a	g NP 12C	29-Jun-06	21:45	0.01	12.0	12.0	44.79
n/a	y NP 12C	29-Jun-06	21:45	0.01	12.0	12.0	32.06
n/a	b 17C	29-Jun-06	22:14	0.01	17.0	17.0	14.14
n/a	g 17C	29-Jun-06	22:14	0.01	17.0	17.0	18.57
n/a	y 17C	29-Jun-06	22:14	0.01	17.0	17.0	14.79
n/a	b NP 17C	29-Jun-06	22:14	0.01	17.0	17.0	145.80
n/a	g NP 17C	29-Jun-06	22:14	0.01	17.0	17.0	104.06
n/a	y NP17C	29-Jun-06	22:14	0.01	17.0	17.0	91.14
2006-0184	I8 Inlet	30-Jun-06	10:45	0.01	9.0	9.0	1.41
2006-0185	I8 Outlet	30-Jun-06	11:10	0.01	11.6	11.6	9.15
2006-0183	I7 into I9	30-Jun-06	11:45	0.01	12.6	12.6	4.49
2006-0182	I8 into I9	30-Jun-06	12:00	0.01	11.9	11.9	4.99
2006-0178	Toolik Inlet	30-Jun-06	14:20	0.01	12.0	0.0	2.96
2006-0190	Toolik	30-Jun-06	0:00	1	10.9	10.0	3.94
2006-0191	Toolik	30-Jun-06	0:00	3	10.0	10.0	5.44
2006-0192	Toolik	30-Jun-06	0:00	5	8.3	8.3	5.14
2006-0193	Toolik	30-Jun-06	0:00	8	5.3	8.0	5.65

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2006-0194	Toolik	30-Jun-06	0:00	12	4.5	8.0	5.54
2006-0195	Toolik	30-Jun-06	0:00	16	4.1	8.0	4.77
n/a	b 12C	1-Jul-06	21:02	0.01	12.0	12.0	11.05
n/a	g 12C	1-Jul-06	21:02	0.01	12.0	12.0	16.88
n/a	y12C	1-Jul-06	21:02	0.01	12.0	12.0	15.11
n/a	b NP 12C	1-Jul-06	21:02	0.01	12.0	12.0	103.75
n/a	g NP 12C	1-Jul-06	21:02	0.01	12.0	12.0	105.05
n/a	y NP 12C	1-Jul-06	21:02	0.01	12.0	12.0	91.01
n/a	b 17C	1-Jul-06	21:32	0.01	17.0	17.0	22.23
n/a	g 17C	1-Jul-06	21:32	0.01	17.0	17.0	9.45
n/a	y 17C	1-Jul-06	21:32	0.01	17.0	17.0	15.77
n/a	b NP 17C	1-Jul-06	21:32	0.01	17.0	17.0	124.42
n/a	g NP 17C	1-Jul-06	21:32	0.01	17.0	17.0	83.99
n/a	y NP17C	1-Jul-06	21:32	0.01	17.0	17.0	122.30
n/a	b 12C	3-Jul-06	21:13	0.01	12.0	12.0	35.28
n/a	g 12C	3-Jul-06	21:13	0.01	12.0	12.0	37.19
n/a	y12C	3-Jul-06	21:13	0.01	12.0	12.0	32.75
n/a	b NP 12C	3-Jul-06	21:13	0.01	12.0	12.0	138.39
n/a	g NP 12C	3-Jul-06	21:13	0.01	12.0	12.0	140.25
n/a	y NP 12C	3-Jul-06	21:13	0.01	12.0	12.0	133.09
n/a	b 17C	3-Jul-06	21:42	0.01	17.0	17.0	31.93
n/a	g 17C	3-Jul-06	21:42	0.01	17.0	17.0	19.46
n/a	y 17C	3-Jul-06	21:42	0.01	17.0	17.0	30.75
n/a	b NP 17C	3-Jul-06	21:42	0.01	17.0	17.0	170.67
n/a	g NP 17C	3-Jul-06	21:42	0.01	17.0	17.0	93.20
n/a	y NP17C	3-Jul-06	21:42	0.01	17.0	17.0	157.71
n/a	b 12C	6-Jul-06	21:08	0.01	12.0	12.0	30.18
n/a	g 12C	6-Jul-06	21:08	0.01	12.0	12.0	31.16
n/a	y12C	6-Jul-06	21:08	0.01	12.0	12.0	28.93
n/a	b NP 12C	6-Jul-06	21:08	0.01	12.0	12.0	145.53
n/a	g NP 12C	6-Jul-06	21:08	0.01	12.0	12.0	84.44
n/a	y NP 12C	6-Jul-06	21:08	0.01	12.0	12.0	76.09
n/a	b 17C	6-Jul-06	21:40	0.01	17.0	17.0	12.22
n/a	g 17C	6-Jul-06	21:40	0.01	17.0	17.0	10.33
n/a	y 17C	6-Jul-06	21:40	0.01	17.0	17.0	19.17
n/a	b NP 17C	6-Jul-06	21:40	0.01	17.0	17.0	22.80
n/a	g NP 17C	6-Jul-06	21:40	0.01	17.0	17.0	32.14
n/a	y NP17C	6-Jul-06	21:40	0.01	17.0	17.0	74.52
2006-0233	I8 Inlet	7-Jul-06	10:20	0.01	7.8	7.8	1.57
2006-0234	I8 Outlet	7-Jul-06	10:54	0.01	10.7	10.7	7.05
2006-0232	I7 into I9	7-Jul-06	11:35	0.01	10.7	10.7	3.32
2006-0231	I8 into I9	7-Jul-06	11:50	0.01			5.08
2006-0227	Toolik Inlet	7-Jul-06	12:15	0.01		10.5	4.91
2006-0239	Toolik	7-Jul-06	0:00	1			8.37
2006-0240	Toolik	7-Jul-06	0:00	3			8.81
2006-0241	Toolik	7-Jul-06	0:00	5			6.95
2006-0242	Toolik	7-Jul-06	0:00	8			3.24
2006-0243	Toolik	7-Jul-06	0:00	12			4.79

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2006-0244	Toolik	7-Jul-06	0:00	16			4.78
n/a	b 12C	8-Jul-06	20:58	0.01	12.0	12.0	26.43
n/a	g 12C	8-Jul-06	20:58	0.01	12.0	12.0	29.14
n/a	y12C	8-Jul-06	20:58	0.01	12.0	12.0	25.84
n/a	b NP 12C	8-Jul-06	20:58	0.01	12.0	12.0	158.81
n/a	g NP 12C	8-Jul-06	20:58	0.01	12.0	12.0	38.56
n/a	y NP 12C	8-Jul-06	20:58	0.01	12.0	12.0	38.70
n/a	b 17C	8-Jul-06	21:27	0.01	17.0	17.0	17.79
n/a	g 17C	8-Jul-06	21:27	0.01	17.0	17.0	19.51
n/a	y 17C	8-Jul-06	21:27	0.01	17.0	17.0	23.29
n/a	b NP 17C	8-Jul-06	21:27	0.01	17.0	17.0	38.18
n/a	g NP 17C	8-Jul-06	21:27	0.01	17.0	17.0	42.16
n/a	y NP17C	8-Jul-06	21:27	0.01	17.0	17.0	67.35
n/a	b 12C	11-Jul-06	21:33	0.01	12.0	12.0	12.53
n/a	g 12C	11-Jul-06	21:33	0.01	12.0	12.0	23.37
n/a	y12C	11-Jul-06	21:33	0.01	12.0	12.0	18.77
n/a	b NP 12C	11-Jul-06	21:33	0.01	12.0	12.0	38.87
n/a	g NP 12C	11-Jul-06	21:33	0.01	12.0	12.0	37.27
n/a	y NP 12C	11-Jul-06	21:33	0.01	12.0	12.0	32.34
n/a	b 17C	11-Jul-06	22:05	0.01	17.0	17.0	15.98
n/a	g 17C	11-Jul-06	22:05	0.01	17.0	17.0	9.70
n/a	y 17C	11-Jul-06	22:05	0.01	17.0	17.0	18.22
n/a	b NP 17C	11-Jul-06	22:05	0.01	17.0	17.0	49.55
n/a	g NP 17C	11-Jul-06	22:05	0.01	17.0	17.0	46.38
n/a	y NP17C	11-Jul-06	22:05	0.01	17.0	17.0	59.22
2006-0284	Toolik	12-Jul-06	0:00	1	12.9	11.4	7.15
2006-0285	Toolik	12-Jul-06	0:00	3	11.4	11.4	8.57
2006-0286	Toolik	12-Jul-06	0:00	5	10.4	6.2	5.26
2006-0287	Toolik	12-Jul-06	0:00	8	6.2	6.2	4.61
2006-0288	Toolik	12-Jul-06	0:00	12	5.0	4.6	2.42
2006-0289	Toolik	12-Jul-06	0:00	16	4.6	4.6	2.72
2006-0291	I1 into I3	13-Jul-06	8:55	0.01	11.6	11.6	2.91
2006-0293	I2 into I3	13-Jul-06	8:55	0.01	12.4	11.6	6.69
2006-0305	I8 Headwaters	13-Jul-06	9:50	0.01	7.6	7.6	1.17
2006-0881	I2	13-Jul-06	9:50	1	12.7	12.4	2.62
2006-0879	I1	13-Jul-06	11:15	1	13.0	14.0	3.71
2006-0883	I3	13-Jul-06	11:50	1	13.6	14.0	8.69
2006-0885	I4	13-Jul-06	12:55	1	13.6	13.9	11.55
2006-0298	I5 into I6	13-Jul-06	14:19	0.01	13.7	13.8	2.03
2006-0302	I6 Inlet West	13-Jul-06	14:19	0.01	9.0	9.8	0.50
2006-0299	I6 HW Inlet	13-Jul-06	14:19	1	9.8	9.8	1.69
2006-0891	I6 HW	13-Jul-06	14:19	0.01	13.6	13.8	3.60
2006-0296	I4 into I5	13-Jul-06	15:40	0.01	14.8	14.0	4.17
2006-0887	I5	13-Jul-06	16:50	1	13.1	14.0	7.29
2006-0889	I6	14-Jul-06	10:30	1	13.1	14.1	4.47
2006-0893	I7	14-Jul-06	11:20	1	13.4	14.1	5.09
2006-0306	I8 Inlet	14-Jul-06	12:00	0.01	9.7	9.7	1.64
2006-0895	I8	14-Jul-06	12:35	1	12.5	13.1	7.49

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2006-0307	I8 Outlet	14-Jul-06	12:20	0.01	13.1	13.1	11.03
2006-0311	I Swamp Inlet	14-Jul-06	13:15	0.01	12.2	12.2	3.43
2006-0897	I Swamp	14-Jul-06	13:20	1	13.1	12.2	6.16
2006-0304	I7 into I9	14-Jul-06	14:00	0.01	13.8	13.8	4.13
2006-0308	I8 into I9	14-Jul-06	14:00	0.01	13.4	13.8	4.24
2006-0309	Milkyway Lower	14-Jul-06	14:00	0.01	8.7	8.7	2.47
2006-0313	Toolik Inlet	14-Jul-06	15:00	0.01	13.0	13.0	3.96
2006-0899	I8 Inlet	18-Jul-06	9:38	0.01	10.1	10.1	1.04
2006-0900	I8 Outlet	18-Jul-06	10:32	0.01	12.4	12.4	2.92
2006-0354	I8 Inlet	21-Jul-06	9:38	0.01	8.3	8.5	1.42
2006-0355	I8 Outlet	21-Jul-06	10:15	0.01	11.6	12.0	9.41
2006-0353	I7 into I9	21-Jul-06	10:40	0.01	10.9	12.0	5.83
2006-0352	I8 into I9	21-Jul-06	10:55	0.01	11.0	12.0	7.09
2006-0348	Toolik Inlet	21-Jul-06	11:20	0.01	0.0	12.0	4.97
2006-0913	inlet A	21-Jul-06	9:50	0.01	8.3	8.5	15.63
2006-0914	inlet B	21-Jul-06	9:50	0.01	8.3	8.5	8.15
2006-0915	inlet C	21-Jul-06	9:50	0.01	8.3	8.5	19.00
2006-0916	outlet A	21-Jul-06	10:15	0.01	11.6	12.0	27.90
2006-0917	outlet B	21-Jul-06	10:15	0.01	11.6	12.0	15.32
2006-0918	outlet C	21-Jul-06	10:15	0.01	11.6	12.0	15.67
2006-0360	Toolik	21-Jul-06	0:00	1	12.1	12.0	8.64
2006-0361	Toolik	21-Jul-06	0:00	3	12.1	12.0	6.22
2006-0362	Toolik	21-Jul-06	0:00	5	12.1	12.0	4.99
2006-0363	Toolik	21-Jul-06	0:00	8	9.2	6.9	3.20
2006-0364	Toolik	21-Jul-06	0:00	12	5.4	6.9	2.76
2006-0365	Toolik	21-Jul-06	0:00	16	4.9	6.9	1.72
2006-1014	Toolik Inlet	26-Jul-06	9:10	0.01	12.1	12.0	4.07
n/a	8C A	27-Jul-06	16:04	0.01	7.0	8.0	1.56
n/a	8C B	27-Jul-06	16:04	0.01	7.0	8.0	1.20
n/a	8C C	27-Jul-06	16:04	0.01	7.0	8.0	2.77
n/a	8C D	27-Jul-06	16:04	0.01	7.0	8.0	0.56
n/a	12C A	27-Jul-06	15:34	0.01	12.2	12.2	4.78
n/a	12C B	27-Jul-06	15:34	0.01	12.2	12.2	4.99
n/a	12C C	27-Jul-06	15:34	0.01	12.2	12.2	3.33
n/a	12C D	27-Jul-06	15:34	0.01	12.2	12.2	0.67
n/a	16C A	27-Jul-06	16:29	0.01	16.6	16.5	4.33
n/a	16C B	27-Jul-06	16:29	0.01	16.6	16.5	5.94
n/a	16C C	27-Jul-06	16:29	0.01	16.6	16.5	5.44
n/a	16C D	27-Jul-06	16:29	0.01	16.6	16.5	2.89
n/a	20C A	27-Jul-06	15:48	0.01	17.6	20.0	6.00
n/a	20C B	27-Jul-06	15:48	0.01	17.6	20.0	7.22
n/a	20C C	27-Jul-06	15:48	0.01	17.6	20.0	7.26
n/a	20C D	27-Jul-06	15:48	0.01	17.6	20.0	3.30
2006-0399	I8 Inlet	28-Jul-06	10:30	0.01	11.0	12.0	3.32
2006-0400	I8 Outlet	28-Jul-06	11:10	0.01	13.7	14.0	13.65
2006-0398	I7 into I9	28-Jul-06	11:35	0.01	15.0	14.0	4.88
2006-0397	I8 into I9	28-Jul-06	11:50	0.01	14.5	14.0	9.19
2006-0393	Toolik Inlet	28-Jul-06	12:10	0.01	0.0	14.0	7.01

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2006-0404	Toolik	28-Jul-06	0:00	1	13.9	13.9	8.70
2006-0406	Toolik	28-Jul-06	0:00	3	13.0	13.9	8.68
2006-0407	Toolik	28-Jul-06	0:00	5	11.7	12.0	8.37
2006-0408	Toolik	28-Jul-06	0:00	8	9.0	12.0	7.02
2006-0409	Toolik	28-Jul-06	0:00	12	5.6	5.1	2.28
2006-0410	Toolik	28-Jul-06	0:00	16	5.1	5.1	3.24
n/a	8C A	29-Jul-06	15:16	0.01	8.0	8.0	3.22
n/a	8C B	29-Jul-06	15:16	0.01	8.0	8.0	4.96
n/a	8C C	29-Jul-06	15:16	0.01	8.0	8.0	4.23
n/a	8C D	29-Jul-06	15:16	0.01	8.0	8.0	1.01
n/a	12C A	29-Jul-06	14:29	0.01	12.0	12.0	8.15
n/a	12C B	29-Jul-06	14:29	0.01	12.0	12.0	7.00
n/a	12C C	29-Jul-06	14:29	0.01	12.0	12.0	6.56
n/a	12C D	29-Jul-06	14:29	0.01	12.0	12.0	2.77
n/a	16C A	29-Jul-06	15:39	0.01	16.5	16.5	3.28
n/a	16C B	29-Jul-06	15:39	0.01	16.5	16.5	3.71
n/a	16C C	29-Jul-06	15:39	0.01	16.5	16.5	4.18
n/a	16C D	29-Jul-06	15:39	0.01	16.5	16.5	1.66
n/a	20C A	29-Jul-06	14:52	0.01	20.7	20.7	10.69
n/a	20C B	29-Jul-06	14:52	0.01	20.7	20.7	9.36
n/a	20C C	29-Jul-06	14:52	0.01	20.7	20.7	8.35
n/a	20C D	29-Jul-06	14:52	0.01	20.7	20.7	6.07
n/a	8C A	31-Jul-06	17:25	0.01	7.5	8.0	2.24
n/a	8C B	31-Jul-06	17:25	0.01	7.5	8.0	1.15
n/a	8C C	31-Jul-06	17:25	0.01	7.5	8.0	2.08
n/a	8C D	31-Jul-06	17:25	0.01	7.5	8.0	2.96
n/a	12C A	31-Jul-06	16:53	0.01	12.0	12.0	6.32
n/a	12C B	31-Jul-06	16:53	0.01	12.0	12.0	4.71
n/a	12C C	31-Jul-06	16:53	0.01	12.0	12.0	3.26
n/a	12C D	31-Jul-06	16:53	0.01	12.0	12.0	2.62
n/a	16C A	31-Jul-06	17:47	0.01	16.5	16.5	2.01
n/a	16C B	31-Jul-06	17:47	0.01	16.5	16.5	3.36
n/a	16C C	31-Jul-06	17:47	0.01	16.5	16.5	4.07
n/a	16C D	31-Jul-06	17:47	0.01	16.5	16.5	1.25
n/a	20C A	31-Jul-06	17:04	0.01	19.5	19.5	5.32
n/a	20C B	31-Jul-06	17:04	0.01	19.5	19.5	5.22
n/a	20C C	31-Jul-06	17:04	0.01	19.5	19.5	3.41
n/a	20C D	31-Jul-06	17:04	0.01	19.5	19.5	3.76
2006-1023	I8 Inlet	1-Aug-06	13:40	0.01	10.1	10.1	0.68
2006-1024	I8 Outlet	1-Aug-06	15:20	0.01	12.6	12.6	4.72
2006-1050	I8 Inlet	3-Aug-06	14:15	0.01	12.1	12.0	2.15
2006-1051	I8 Outlet	3-Aug-06	15:06	0.01	12.8	12.0	11.18
2006-1052	in/in A	3-Aug-06	14:45	0.01	12.1	12.0	29.67
2006-1053	in/in B	3-Aug-06	14:45	0.01	12.1	12.0	27.02
2006-1054	in/in C	3-Aug-06	14:45	0.01	12.1	12.0	26.83
2006-1055	in/out A	3-Aug-06	15:30	0.01	12.8	12.0	27.93
2006-1056	in/out B	3-Aug-06	15:30	0.01	12.8	12.0	37.83
2006-1057	in/out C	3-Aug-06	15:30	0.01	12.8	12.0	30.74

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2006-1058	out/out A	3-Aug-06	15:25	0.01	12.8	12.0	20.22
2006-1059	out/out B	3-Aug-06	15:25	0.01	12.8	12.0	24.31
2006-1060	out/out C	3-Aug-06	15:25	0.01	12.8	12.0	26.94
2006-1061	out/in A	3-Aug-06	14:30	0.01	12.1	12.0	5.94
2006-1062	out/in B	3-Aug-06	14:30	0.01	12.1	12.0	2.45
2006-1063	out/in C	3-Aug-06	14:30	0.01	12.1	12.0	5.15
2006-0448	I8 Inlet	4-Aug-06	10:02	0.01	9.2	12.0	0.99
2006-0449	I8 Outlet	4-Aug-06	10:50	0.01	13.2	12.0	4.17
2006-0447	I7 into I9	4-Aug-06	11:33	0.01	13.2	12.0	1.78
2006-0446	I8 into I9	4-Aug-06	12:00	0.01	13.2	12.0	2.75
2006-0442	Toolik Inlet	4-Aug-06	14:16	0.01	13.5	12.0	3.81
2006-0454	Toolik	4-Aug-06	9:40	1	13.5	12.0	3.29
2006-0455	Toolik	4-Aug-06	9:40	3	13.5	12.0	3.09
2006-0456	Toolik	4-Aug-06	9:46	5	13.1	12.0	1.78
2006-0457	Toolik	4-Aug-06	9:55	8	8.0	12.0	1.23
2006-0458	Toolik	4-Aug-06	10:12	12	5.8	5.5	1.50
2006-0459	Toolik	4-Aug-06	10:20	16	5.3	5.5	1.70
2006-0523	Toolik	8-Aug-06	0:00	1			2.63
2006-0524	Toolik	8-Aug-06	0:00	3			2.64
2006-0525	Toolik	8-Aug-06	0:00	5			3.46
2006-0526	Toolik	8-Aug-06	0:00	8			3.34
2006-0527	Toolik	8-Aug-06	0:00	12			2.78
2006-0528	Toolik	8-Aug-06	0:00	16			1.95
2006-0488	I1 into I3	9-Aug-06	9:30	0.01	9.0	9.0	1.34
2006-0490	I2 into I3	9-Aug-06	9:30	0.01	7.3	7.3	1.75
2006-0502	I8 Headwaters	9-Aug-06	10:40	0.01	3.7	3.7	1.53
2006-1115	I2	9-Aug-06	10:40	1	11.9	12.6	1.34
2006-1113	I1	9-Aug-06	11:40	1	12.1	12.6	2.53
2006-1117	I3	9-Aug-06	12:20	1	11.3	12.6	4.50
2006-1119	I4	9-Aug-06	13:25	1	11.9	12.5	3.92
2006-0495	I5 into I6	9-Aug-06	14:40	0.01	13.1	12.8	3.86
2006-0499	I6 Inlet West	9-Aug-06	14:40	0.01	7.8	7.8	1.80
2006-0496	I6 HW Inlet	9-Aug-06	14:40	0.01	9.1	7.8	13.39
2006-1125	I6 HW	9-Aug-06	14:45	1	12.2	12.8	1.87
2006-0493	I4 into I5	9-Aug-06	15:45	0.01		12.5	6.90
2006-1121	I5	9-Aug-06	17:00	1	12.4	12.5	3.38
2006-1123	I6	10-Aug-06	10:00	1	12.0	12.5	2.05
2006-1127	I7	10-Aug-06	10:35	1	11.9	12.5	2.11
2006-0504	I8 Inlet	10-Aug-06	10:45	0.01	8.5	8.5	1.54
2006-1129	I8	10-Aug-06	12:00	1	10.6	10.8	5.73
2006-0503	I8 Outlet	10-Aug-06	12:00	0.01	10.8	10.8	5.57
2006-0508	I Swamp Inlet	10-Aug-06	13:00	0.01	11.0	11.0	2.70
2006-1131	I Swamp	10-Aug-06	13:10	1	10.3	11.0	2.49
2006-0501	I7 into I9	10-Aug-06	14:10	0.01	10.8	10.8	1.59
2006-0505	I8 into I9	10-Aug-06	14:10	0.01	10.7	10.8	4.09
2006-0506	Milkyway Lower	10-Aug-06	14:10	0.01	7.5	7.5	3.11
2006-0510	Toolik Inlet	10-Aug-06	14:50	0.01	10.7	10.7	5.00
2007-0105	I8 inlet	16-Jun-07	16:54	0.01	14.0	14.0	3.81

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2007-0106	I8 outlet	16-Jun-07	17:57	0.01	11.7	11.7	4.64
2007-0104	I7-I9	16-Jun-07	18:50	0.01	13.9	13.9	2.51
2007-0103	I8-I9	16-Jun-07	18:50	0.01	13.9	13.9	2.77
2007-0100	Toolik Inlet	16-Jun-07	19:48	0.01	13.4	13.4	3.46
2007-0134	I1-I3	20-Jun-07	9:08	0.01	11.3	11.3	2.14
2007-0136	I2-I3	20-Jun-07	9:08	0.01	12.3	12.3	2.39
lakes	I2	20-Jun-07	9:45	1	9.9	16.1	0.92
lakes	I1	20-Jun-07	11:10	1	12.4	13.5	1.46
lakes	I3	20-Jun-07	11:50	1	12.4	13.2	2.70
2007-0148	I8 HW	20-Jun-07	11:58	0.01	9.5	9.9	2.27
lakes	I4	20-Jun-07	13:00	1	15.4	15.4	2.83
2007-0142	I6 HW in	20-Jun-07	14:46	0.01	8.8	8.8	1.07
lakes	I6 HW	20-Jun-07	14:46	1	14.3	14.3	1.77
lakes	I5	20-Jun-07	17:00	1	13.0	19.7	7.45
2007-0139	I4-I5	20-Jun-07	19:23	0.01	15.4	16.5	2.67
2007-0145	I6 west inlet	21-Jun-07	8:34	0.01	10.5	10.5	2.55
2007-0141	I5-I6	21-Jun-07	9:17	0.01	9.6	9.7	1.28
lakes	I6	21-Jun-07	9:45	1	12.9	16.0	2.20
lakes	I7	21-Jun-07	10:37	1	15.3	16.0	5.66
2007-0149	I8 inlet	21-Jun-07	11:27	0.01	13.5	13.5	2.56
2007-0150	I8 outlet	21-Jun-07	12:30	0.01	15.9	15.9	5.19
lakes	I8	21-Jun-07	12:52	1	15.3	16.8	4.88
2007-0154	I swamp in	21-Jun-07	13:33	0.01	14.0	14.0	1.93
lakes	I swamp	21-Jun-07	14:17	1	16.5	17.0	3.06
2007-0147	I7-I9	21-Jun-07	15:01	0.01	17.8	17.8	6.84
2007-0151	I8-I9	21-Jun-07	15:03	0.01	17.8	17.8	4.50
2007-0152	MWL	21-Jun-07	15:35	0.01	11.2	11.2	2.98
2007-0156	Toolik Inlet	21-Jun-07	16:09	0.01	16.5	16.5	5.41
n/a	12C A	22-Jun-07	11:58	0.01	12.0	12.0	0.47
n/a	12C B	22-Jun-07	11:58	0.01	12.0	12.0	0.45
n/a	12C C	22-Jun-07	11:58	0.01	12.0	12.0	0.53
n/a	12C NP A	22-Jun-07	11:58	0.01	12.0	12.0	0.66
n/a	12C NP B	22-Jun-07	11:58	0.01	12.0	12.0	0.86
n/a	12C NP C	22-Jun-07	11:58	0.01	12.0	12.0	0.63
n/a	17C A	22-Jun-07	12:14	0.01	17.0	17.0	1.22
n/a	17C B	22-Jun-07	12:14	0.01	17.0	17.0	0.51
n/a	17C C	22-Jun-07	12:14	0.01	17.0	17.0	1.03
n/a	17C NP A	22-Jun-07	12:14	0.01	17.0	17.0	0.51
n/a	17C NP B	22-Jun-07	12:14	0.01	17.0	17.0	0.41
n/a	17C NP C	22-Jun-07	12:14	0.01	17.0	17.0	0.47
n/a	12C A	22-Jun-07	14:13	0.01	12.0	12.0	0.63
n/a	12C B	22-Jun-07	14:13	0.01	12.0	12.0	0.34
n/a	12C C	22-Jun-07	14:13	0.01	12.0	12.0	0.45
n/a	12C NP A	22-Jun-07	14:13	0.01	12.0	12.0	0.19
n/a	12C NP B	22-Jun-07	14:13	0.01	12.0	12.0	0.52
n/a	12C NP C	22-Jun-07	14:13	0.01	12.0	12.0	0.55
n/a	17C A	22-Jun-07	14:43	0.01	17.0	17.0	0.88
n/a	17C B	22-Jun-07	14:43	0.01	17.0	17.0	0.59

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	17C C	22-Jun-07	14:43	0.01	17.0	17.0	0.96
n/a	17C NP A	22-Jun-07	14:43	0.01	17.0	17.0	0.53
n/a	17C NP B	22-Jun-07	14:43	0.01	17.0	17.0	0.31
n/a	17C NP C	22-Jun-07	14:43	0.01	17.0	17.0	0.48
n/a	12C A	22-Jun-07	16:17	0.01	12.0	12.0	0.17
n/a	12C B	22-Jun-07	16:17	0.01	12.0	12.0	0.26
n/a	12C C	22-Jun-07	16:17	0.01	12.0	12.0	0.21
n/a	12C NP A	22-Jun-07	16:17	0.01	12.0	12.0	0.06
n/a	12C NP B	22-Jun-07	16:17	0.01	12.0	12.0	0.33
n/a	12C NP C	22-Jun-07	16:17	0.01	12.0	12.0	0.62
n/a	17C NP A	22-Jun-07	16:51	0.01	17.0	17.0	0.41
n/a	17C NP B	22-Jun-07	16:51	0.01	17.0	17.0	0.22
n/a	17C NP C	22-Jun-07	16:51	0.01	17.0	17.0	0.74
n/a	17C A	22-Jun-07	16:51	0.01	17.0	17.0	1.02
n/a	17C B	22-Jun-07	16:51	0.01	17.0	17.0	0.74
n/a	17C C	22-Jun-07	16:51	0.01	17.0	17.0	1.38
n/a	12C A	22-Jun-07	18:25	0.01	12.0	12.0	0.58
n/a	12C B	22-Jun-07	18:25	0.01	12.0	12.0	0.40
n/a	12C C	22-Jun-07	18:25	0.01	12.0	12.0	0.46
n/a	12C NP A	22-Jun-07	18:25	0.01	12.0	12.0	0.52
n/a	12C NP B	22-Jun-07	18:25	0.01	12.0	12.0	0.68
n/a	12C NP C	22-Jun-07	18:25	0.01	12.0	12.0	0.05
n/a	17C A	22-Jun-07	18:45	0.01	17.0	17.0	1.33
n/a	17C B	22-Jun-07	18:45	0.01	17.0	17.0	0.79
n/a	17C C	22-Jun-07	18:45	0.01	17.0	17.0	1.56
n/a	17C NP A	22-Jun-07	18:45	0.01	17.0	17.0	0.88
n/a	17C NP B	22-Jun-07	18:45	0.01	17.0	17.0	0.63
n/a	17C NP C	22-Jun-07	18:45	0.01	17.0	17.0	0.82
n/a	12C A	22-Jun-07	20:10	0.01	12.0	12.0	0.59
n/a	12C B	22-Jun-07	20:10	0.01	12.0	12.0	0.30
n/a	12C C	22-Jun-07	20:10	0.01	12.0	12.0	0.37
n/a	12C NP A	22-Jun-07	20:10	0.01	12.0	12.0	0.19
n/a	12C NP B	22-Jun-07	20:10	0.01	12.0	12.0	0.44
n/a	12C NP C	22-Jun-07	20:10	0.01	12.0	12.0	0.48
n/a	17C A	22-Jun-07	20:55	0.01	17.0	17.0	1.77
n/a	17C B	22-Jun-07	20:55	0.01	17.0	17.0	0.91
n/a	17C C	22-Jun-07	20:55	0.01	17.0	17.0	2.48
n/a	17C NP A	22-Jun-07	20:55	0.01	17.0	17.0	0.80
n/a	17C NP B	22-Jun-07	20:55	0.01	17.0	17.0	0.64
n/a	17C NP C	22-Jun-07	20:55	0.01	17.0	17.0	0.70
n/a	12C A	22-Jun-07	22:38	0.01	12.0	12.0	0.49
n/a	12C B	22-Jun-07	22:38	0.01	12.0	12.0	0.48
n/a	12C C	22-Jun-07	22:38	0.01	12.0	12.0	0.46
n/a	12C NP A	22-Jun-07	22:38	0.01	12.0	12.0	0.27
n/a	12C NP B	22-Jun-07	22:38	0.01	12.0	12.0	0.60
n/a	12C NP C	22-Jun-07	22:38	0.01	12.0	12.0	0.63
n/a	17C A	22-Jun-07	23:10	0.01	17.0	17.0	1.39
n/a	17C B	22-Jun-07	23:10	0.01	17.0	17.0	0.82

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	17C C	22-Jun-07	23:10	0.01	17.0	17.0	1.99
n/a	17C NP A	22-Jun-07	23:10	0.01	17.0	17.0	0.69
n/a	17C NP B	22-Jun-07	23:10	0.01	17.0	17.0	0.41
n/a	17C NP C	22-Jun-07	23:10	0.01	17.0	17.0	0.57
n/a	12C A	23-Jun-07	1:23	0.01	12.0	12.0	0.38
n/a	12C B	23-Jun-07	1:23	0.01	12.0	12.0	0.47
n/a	12C C	23-Jun-07	1:23	0.01	12.0	12.0	0.50
n/a	12C NP A	23-Jun-07	1:23	0.01	12.0	12.0	0.20
n/a	12C NP B	23-Jun-07	1:23	0.01	12.0	12.0	0.54
n/a	12C NP C	23-Jun-07	1:23	0.01	12.0	12.0	0.61
n/a	17C A	23-Jun-07	2:02	0.01	17.0	17.0	2.70
n/a	17C B	23-Jun-07	2:02	0.01	17.0	17.0	2.25
n/a	17C C	23-Jun-07	2:02	0.01	17.0	17.0	4.09
n/a	17C NP A	23-Jun-07	2:02	0.01	17.0	17.0	1.60
n/a	17C NP B	23-Jun-07	2:02	0.01	17.0	17.0	0.92
n/a	17C NP C	23-Jun-07	2:02	0.01	17.0	17.0	1.70
n/a	12C A	23-Jun-07	9:23	0.01	12.0	12.0	0.68
n/a	12C B	23-Jun-07	9:23	0.01	12.0	12.0	0.95
n/a	12C C	23-Jun-07	9:23	0.01	12.0	12.0	0.91
n/a	12C NP A	23-Jun-07	9:23	0.01	12.0	12.0	0.35
n/a	12C NP B	23-Jun-07	9:23	0.01	12.0	12.0	1.02
n/a	12C NP C	23-Jun-07	9:23	0.01	12.0	12.0	0.93
n/a	17C A	23-Jun-07	10:05	0.01	17.0	17.0	5.09
n/a	17C B	23-Jun-07	10:05	0.01	17.0	17.0	5.95
n/a	17C C	23-Jun-07	10:05	0.01	17.0	17.0	11.86
n/a	17C NP A	23-Jun-07	10:05	0.01	17.0	17.0	5.23
n/a	17C NP B	23-Jun-07	10:05	0.01	17.0	17.0	2.53
n/a	17C NP C	23-Jun-07	10:05	0.01	17.0	17.0	4.79
n/a	12C A	23-Jun-07	13:49	0.01	12.0	12.0	0.75
n/a	12C B	23-Jun-07	13:49	0.01	12.0	12.0	1.21
n/a	12C C	23-Jun-07	13:49	0.01	12.0	12.0	1.66
n/a	12C NP A	23-Jun-07	13:49	0.01	12.0	12.0	0.51
n/a	12C NP B	23-Jun-07	13:49	0.01	12.0	12.0	1.87
n/a	12C NP C	23-Jun-07	13:49	0.01	12.0	12.0	1.42
n/a	17C A	23-Jun-07	14:02	0.01	17.0	17.0	9.79
n/a	17C B	23-Jun-07	14:02	0.01	17.0	17.0	11.32
n/a	17C C	23-Jun-07	14:02	0.01	17.0	17.0	14.06
n/a	17C NP A	23-Jun-07	14:18	0.01	17.0	17.0	12.40
n/a	17C NP B	23-Jun-07	14:18	0.01	17.0	17.0	6.75
n/a	17C NP C	23-Jun-07	14:18	0.01	17.0	17.0	6.06
n/a	12C A	23-Jun-07	19:17	0.01	12.0	12.0	1.74
n/a	12C B	23-Jun-07	19:17	0.01	12.0	12.0	2.74
n/a	12C C	23-Jun-07	19:17	0.01	12.0	12.0	2.19
n/a	12C NP A	23-Jun-07	19:17	0.01	12.0	12.0	0.91
n/a	12C NP B	23-Jun-07	19:17	0.01	12.0	12.0	1.94
n/a	12C NP C	23-Jun-07	19:17	0.01	12.0	12.0	2.00
n/a	17C A	23-Jun-07	19:34	0.01	17.0	17.0	8.00
n/a	17C B	23-Jun-07	19:34	0.01	17.0	17.0	8.95

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	17C C	23-Jun-07	19:34	0.01	17.0	17.0	16.64
n/a	17C NP A	23-Jun-07	19:34	0.01	17.0	17.0	18.96
n/a	17C NP B	23-Jun-07	19:34	0.01	17.0	17.0	15.94
n/a	17C NP C	23-Jun-07	19:34	0.01	17.0	17.0	17.16
n/a	12C A	24-Jun-07	2:52	0.01	12.0	12.0	3.21
n/a	12C B	24-Jun-07	2:52	0.01	12.0	12.0	4.42
n/a	12C C	24-Jun-07	2:52	0.01	12.0	12.0	4.60
n/a	12C NP A	24-Jun-07	2:52	0.01	12.0	12.0	2.48
n/a	12C NP B	24-Jun-07	2:52	0.01	12.0	12.0	6.49
n/a	12C NP C	24-Jun-07	2:52	0.01	12.0	12.0	4.68
n/a	17C A	24-Jun-07	3:20	0.01	17.0	17.0	13.95
n/a	17C B	24-Jun-07	3:20	0.01	17.0	17.0	18.85
n/a	17C C	24-Jun-07	3:20	0.01	17.0	17.0	22.81
n/a	17C NP A	24-Jun-07	3:20	0.01	17.0	17.0	18.55
n/a	17C NP B	24-Jun-07	3:20	0.01	17.0	17.0	43.54
n/a	17C NP C	24-Jun-07	3:20	0.01	17.0	17.0	39.56
n/a	12C A	24-Jun-07	12:55	0.01	12.0	12.0	6.34
n/a	12C B	24-Jun-07	12:55	0.01	12.0	12.0	6.44
n/a	12C C	24-Jun-07	12:55	0.01	12.0	12.0	6.46
n/a	12C NP A	24-Jun-07	12:55	0.01	12.0	12.0	9.70
n/a	12C NP B	24-Jun-07	12:55	0.01	12.0	12.0	10.95
n/a	12C NP C	24-Jun-07	12:55	0.01	12.0	12.0	13.72
n/a	17C A	24-Jun-07	13:25	0.01	17.0	17.0	16.62
n/a	17C B	24-Jun-07	13:25	0.01	17.0	17.0	19.30
n/a	17C C	24-Jun-07	13:25	0.01	17.0	17.0	18.09
n/a	17C NP A	24-Jun-07	13:25	0.01	17.0	17.0	21.43
n/a	17C NP B	24-Jun-07	13:25	0.01	17.0	17.0	40.77
n/a	17C NP C	24-Jun-07	13:25	0.01	17.0	17.0	31.05
n/a	12C A	24-Jun-07	23:35	0.01	12.0	12.0	5.88
n/a	12C B	24-Jun-07	23:35	0.01	12.0	12.0	6.66
n/a	12C C	24-Jun-07	23:35	0.01	12.0	12.0	5.83
n/a	12C NP A	24-Jun-07	23:35	0.01	12.0	12.0	16.33
n/a	12C NP B	24-Jun-07	23:35	0.01	12.0	12.0	21.51
n/a	12C NP C	24-Jun-07	23:35	0.01	12.0	12.0	15.78
n/a	17C A	24-Jun-07	0:08	0.01	17.0	17.0	16.07
n/a	17C B	24-Jun-07	0:08	0.01	17.0	17.0	14.58
n/a	17C C	24-Jun-07	0:08	0.01	17.0	17.0	16.04
n/a	17C NP A	24-Jun-07	0:08	0.01	17.0	17.0	20.53
n/a	17C NP B	24-Jun-07	0:08	0.01	17.0	17.0	32.76
n/a	17C NP C	24-Jun-07	0:08	0.01	17.0	17.0	23.46
n/a	12C A	25-Jun-07	12:00	0.01	12.0	12.0	7.79
n/a	12C B	25-Jun-07	12:00	0.01	12.0	12.0	7.84
n/a	12C C	25-Jun-07	12:00	0.01	12.0	12.0	7.99
n/a	12C NP A	25-Jun-07	12:00	0.01	12.0	12.0	72.48
n/a	12C NP B	25-Jun-07	12:00	0.01	12.0	12.0	26.64
n/a	12C NP C	25-Jun-07	12:00	0.01	12.0	12.0	31.60
n/a	17C A	25-Jun-07	12:40	0.01	17.0	17.0	16.24
n/a	17C B	25-Jun-07	12:40	0.01	17.0	17.0	15.37

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
n/a	17C C	25-Jun-07	12:40	0.01	17.0	17.0	17.84
n/a	17C NP A	25-Jun-07	12:40	0.01	17.0	17.0	20.06
n/a	17C NP B	25-Jun-07	12:40	0.01	17.0	17.0	32.48
n/a	17C NP C	25-Jun-07	12:40	0.01	17.0	17.0	24.46
n/a	12C A	25-Jun-07	22:39	0.01	12.0	12.0	4.27
n/a	12C B	25-Jun-07	22:39	0.01	12.0	12.0	2.60
n/a	12C C	25-Jun-07	22:39	0.01	12.0	12.0	3.40
n/a	12C NP A	25-Jun-07	22:39	0.01	12.0	12.0	41.92
n/a	12C NP B	25-Jun-07	22:39	0.01	12.0	12.0	11.28
n/a	12C NP C	25-Jun-07	22:39	0.01	12.0	12.0	9.61
n/a	17C A	25-Jun-07	23:08	0.01	17.0	17.0	9.99
n/a	17C B	25-Jun-07	23:08	0.01	17.0	17.0	6.41
n/a	17C C	25-Jun-07	23:08	0.01	17.0	17.0	6.69
n/a	17C NP A	25-Jun-07	23:08	0.01	17.0	17.0	9.47
n/a	17C NP B	25-Jun-07	23:08	0.01	17.0	17.0	20.03
n/a	17C NP C	25-Jun-07	23:08	0.01	17.0	17.0	20.11
n/a	12C A	26-Jun-07	13:56	0.01	12.0	12.0	12.73
n/a	12C B	26-Jun-07	13:56	0.01	12.0	12.0	10.39
n/a	12C C	26-Jun-07	13:56	0.01	12.0	12.0	8.91
n/a	12C NP A	26-Jun-07	13:56	0.01	12.0	12.0	63.35
n/a	12C NP B	26-Jun-07	13:56	0.01	12.0	12.0	15.70
n/a	12C NP C	26-Jun-07	13:56	0.01	12.0	12.0	24.71
n/a	17C A	26-Jun-07	14:35	0.01	17.0	17.0	10.93
n/a	17C B	26-Jun-07	14:35	0.01	17.0	17.0	8.14
n/a	17C C	26-Jun-07	14:35	0.01	17.0	17.0	10.05
n/a	17C NP A	26-Jun-07	14:35	0.01	17.0	17.0	22.67
n/a	17C NP B	26-Jun-07	14:35	0.01	17.0	17.0	32.85
n/a	17C NP C	26-Jun-07	14:35	0.01	17.0	17.0	21.35
2007-0158	Toolik Main	22-Jun-07	15:29	1	11.1	11.1	4.20
2007-0159	Toolik Main	22-Jun-07	15:52	3	10.9	10.9	4.07
2007-0160	Toolik Main	22-Jun-07	15:59	5	7.5	7.5	3.22
2007-0161	Toolik Main	22-Jun-07	16:19	8	5.9	5.9	2.91
2007-0162	Toolik Main	22-Jun-07	16:37	12	5.3	5.3	5.03
2007-0163	Toolik Main	22-Jun-07	16:58	16	4.8	5.3	2.79
2007-0709	I7-I9	27-Jun-07	14:05	0.01	13.9	13.9	2.87
2007-0710	I8-I9	27-Jun-07	14:30	0.01	13.2	13.2	1.48
2007-0328	I8 inlet	29-Jun-07	10:45	0.01	13.3	13.3	1.77
2007-0329	I8 outlet	29-Jun-07	11:15	0.01	15.7	15.7	8.35
2007-0327	I7-I9	29-Jun-07	13:30	0.01	14.9	15.0	2.89
2007-0326	I8-I9	29-Jun-07	12:20	0.01	15.4	15.0	2.08
2007-0323	Toolik Inlet	29-Jun-07	14:30	0.01	.	15.0	4.26
2007-0718	transplant I8-I9 A	29-Jun-07	10:10	0.01	15.4	15.0	1.48
2007-0719	transplant I8-I9 B	29-Jun-07	10:10	0.01	15.4	15.0	7.41
2007-0720	transplant I8-I9 C	29-Jun-07	10:10	0.01	15.4	15.0	22.19
2007-0721	transplant I7-I9 @ I8-I9 A	29-Jun-07	10:10	0.01	15.4	15.0	0.96
2007-0722	transplant I7-I9 @ I8-I9 B	29-Jun-07	10:10	0.01	15.4	15.0	8.77
2007-0332	Toolik Main	29-Jun-07	10:00	1	12.9	12.9	8.34
2007-0333	Toolik Main	29-Jun-07	10:14	3	12.5	12.9	7.20

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2007-0334	Toolik Main	29-Jun-07	10:28	5	10.5	10.5	4.32
2007-0335	Toolik Main	29-Jun-07	10:32	8	7.3	10.5	1.66
2007-0336	Toolik Main	29-Jun-07	10:43	12	6.5	6.5	1.52
2007-0337	Toolik Main	29-Jun-07	10:59	16	6.5	6.5	2.22
2007-0730	I7-I9	2-Jul-07	12:05	0.01	14.8	14.8	1.53
2007-0712	transplant I7-I9 A	2-Jul-07	12:05	0.01	14.8	14.8	74.57
2007-0713	transplant I7-I9 B	2-Jul-07	12:05	0.01	14.8	14.8	26.22
2007-0714	transplant I7-I9 C	2-Jul-07	12:05	0.01	14.8	14.8	17.30
2007-0715	transplant I8-I9 @ I7-I9 A	2-Jul-07	12:05	0.01	14.8	14.8	51.82
2007-0716	transplant I8-I9 @ I7-I9 B	2-Jul-07	12:05	0.01	14.8	14.8	62.61
2007-0717	transplant I8-I9 @ I7-I9 C	2-Jul-07	12:05	0.01	14.8	14.8	16.16
2007-0731	I8-I9	2-Jul-07	13:00	0.01	16.3	14.8	0.89
2007-0725	transplant I8-I9 A	2-Jul-07	13:00	0.01	16.3	16.3	78.34
2007-0726	transplant I8-I9 B	2-Jul-07	13:00	0.01	16.3	16.3	86.88
2007-0727	transplant I8-I9 C	2-Jul-07	13:00	0.01	16.3	16.3	20.26
2007-0728	transplant I7-I9 @ I8-I9 A	2-Jul-07	13:00	0.01	16.3	16.3	46.10
2007-0729	transplant I7-I9 @ I8-I9 B	2-Jul-07	13:00	0.01	16.3	16.3	19.51
2007-0723	transplant I7-I9 @ I8-I9 C	2-Jul-07	13:00	0.01	16.3	16.3	34.01
2007-0732	I8 inlet	2-Jul-07	15:55	0.01	17.6	17.0	7.15
2007-0733	I8 outlet	2-Jul-07	17:23	0.01	16.8	17.0	15.39
2007-0751	I8 inlet	4-Jul-07	9:55	0.01	13.9	13.9	2.69
2007-0753	transplant I8-in/in A	4-Jul-07	10:15	0.01	13.9	13.9	20.57
2007-0754	transplant I8-in B	4-Jul-07	10:15	0.01	13.9	13.9	9.28
2007-0755	transplant I8-in C	4-Jul-07	10:15	0.01	13.9	13.9	9.91
2007-0762	transplant I8-out at in A	4-Jul-07	10:15	0.01	13.9	13.9	12.98
2007-0763	transplant I8-out at in B	4-Jul-07	10:15	0.01	13.9	13.9	7.86
2007-0764	transplant I8-out at in C	4-Jul-07	10:15	0.01	13.9	13.9	5.73
2007-0752	I8 outlet	4-Jul-07	11:00	0.01	18.4	13.9	2.68
2007-0759	transplant I8-out A	4-Jul-07	11:20	0.01	18.4	18.4	41.51
2007-0760	transplant I8-out B	4-Jul-07	11:20	0.01	18.4	18.4	38.00
2007-0761	transplant I8-out C	4-Jul-07	11:20	0.01	18.4	18.4	70.85
2007-0756	transplant I8-in at out A	4-Jul-07	11:20	0.01	18.4	18.4	96.99
2007-0757	transplant I8-in at out B	4-Jul-07	11:20	0.01	18.4	18.4	23.17
2007-0758	transplant I8-in at out C	4-Jul-07	11:20	0.01	18.4	18.4	20.04
2007-0384	I7-I9	6-Jul-07	10:10	0.01	15.9	15.9	2.68
2007-0383	I8-I9	6-Jul-07	10:30	0.01	16.2	15.9	1.97
2007-0380	Toolik Inlet	6-Jul-07	13:22	0.01	15.5	15.5	4.13
2007-0389	Toolik Main	6-Jul-07	9:50	1	17.4	17.4	12.23
2007-0390	Toolik Main	6-Jul-07	10:26	3	16.1	17.4	18.21
2007-0391	Toolik Main	6-Jul-07	10:37	5	11.0	13.5	6.10
2007-0392	Toolik Main	6-Jul-07	10:47	8	6.5	13.5	5.22
2007-0393	Toolik Main	6-Jul-07	10:58	12	5.2	7.6	2.85
2007-0394	Toolik Main	6-Jul-07	11:04	16	5.2	7.6	5.53
2007-0401	I1-I3	10-Jul-07	8:40	0.01	11.1	10.6	55.86
2007-0399	I2-I3	10-Jul-07	8:40	0.01	10.6	10.6	6.13
lakes	I2	10-Jul-07	9:47	1	17.9	18.4	1.03
2007-0413	I8 HW	10-Jul-07	10:25	0.01	12.8	12.8	27.87
lakes	I1	10-Jul-07	11:02	1	18.3	18.5	4.71

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
lakes	I3	10-Jul-07	12:39	1	18.5	19.2	5.41
lakes	I4	11-Jul-07	9:24	1	18.1	18.5	5.80
2007-0407	I6 HW in	11-Jul-07	10:05	0.01	6.8	7.4	0.55
2007-0404	I4-I5	11-Jul-07	10:30	0.01	14.2	15.7	10.76
lakes	I5	11-Jul-07	10:30	1	17.7	15.7	2.29
2007-0406	I5-I6	11-Jul-07	12:49	0.01	13.5	13.5	6.04
lakes	I6 HW	11-Jul-07	12:49	1	17.7	18.5	4.50
2007-0410	I6 W in	11-Jul-07	12:49	0.01	13.2	13.5	7.34
lakes	I6	11-Jul-07	13:20	1	17.6	18.5	4.21
lakes	I7	11-Jul-07	14:06	1	17.7	18.1	7.77
2007-0414	I8 inlet	11-Jul-07	15:10	0.01	14.8	14.8	1.44
lakes	I8	11-Jul-07	15:20	1	17.9	18.5	10.90
2007-0419	I swamp in	11-Jul-07	15:55	0.01	16.0	16.0	4.88
lakes	I swamp	11-Jul-07	16:03	1	17.9	18.3	10.55
2007-0415	I8 outlet	11-Jul-07	16:45	0.01	18.2	18.3	2.38
2007-0412	I7-I9	11-Jul-07	16:52	0.01	17.9	16.0	5.39
2007-0416	I8-I9	11-Jul-07	16:59	0.01	19.8	18.5	7.54
2007-0417	MWL	11-Jul-07	17:28	0.01	13.5	13.5	1.41
2007-0421	Toolik Inlet	11-Jul-07	17:50	0.01	16.1	16.1	3.97
2007-0425	Toolik Main	13-Jul-07	10:05	1	17.3	17.3	10.44
2007-0426	Toolik Main	13-Jul-07	10:31	3	17.0	17.3	9.22
2007-0427	Toolik Main	13-Jul-07	10:50	5	11.2	11.2	4.78
2007-0428	Toolik Main	13-Jul-07	11:00	8	7.2	7.2	1.65
2007-0429	Toolik Main	13-Jul-07	11:09	12	5.8	5.8	0.73
2007-0430	Toolik Main	13-Jul-07	11:15	16	5.2	5.8	0.70
2007-0830	I8 NE inlet	20-Jul-07	9:20	0.01	6.8	6.8	1.09
2007-0829	I8 SE inlet	20-Jul-07	9:54	0.01	10.1	9.2	1.30
2007-0828	I8 S Inlet	20-Jul-07	10:14	0.01	9.2	9.2	0.97
2007-0473	I8 inlet	20-Jul-07	10:57	0.01	13.5	13.5	3.03
2007-0474	I8 outlet	20-Jul-07	11:44	0.01	16.9	16.9	12.11
2007-0472	I7 into I9	20-Jul-07	12:23	0.01	15.8	17.8	5.29
2007-0471	I8 into I9	20-Jul-07	12:26	0.01	17.8	17.8	6.95
2007-0468	Toolik Inlet	20-Jul-07	13:37	0.01	16.5	16.5	0.34
2007-0477	Toolik Main	20-Jul-07	10:25	1	17.4	17.4	0.66
2007-0478	Toolik Main	20-Jul-07	10:35	3	17.3	17.4	6.74
2007-0479	Toolik Main	20-Jul-07	10:47	5	13.1	13.1	4.69
2007-0480	Toolik Main	20-Jul-07	10:57	8	7.5	7.5	2.17
2007-0481	Toolik Main	20-Jul-07	11:08	12	5.8	5.3	1.03
2007-0482	Toolik Main	20-Jul-07	11:25	16	5.3	5.3	0.87
2007-0517	I8 inlet	27-Jul-07	10:05	0.01	11.9	11.9	1.71
2007-0518	I8 outlet	27-Jul-07	10:50	0.01	16.9	16.9	11.86
2007-0516	I7 into I9	27-Jul-07	11:40	0.01	14.4	11.9	3.00
2007-0515	I8 into I9	27-Jul-07	11:40	0.01	14.8	16.9	1.89
2007-0512	Toolik Inlet	27-Jul-07	13:07	0.01	14.9	15.4	3.57
2007-0521	Toolik Main	27-Jul-07	9:40	1	17.0	16.9	2.45
2007-0522	Toolik Main	27-Jul-07	10:08	3	16.9	16.9	4.39
2007-0523	Toolik Main	27-Jul-07	10:22	5	14.8	14.8	1.80
2007-0524	Toolik Main	27-Jul-07	10:39	8	7.5	7.5	2.84

sortchem	Site	Date	Time received	Depth	Water temp.	Incubation temp.	Bacterial Production
			(hr)	(m)	(deg C)	(deg C)	(ug C L/day)
2007-0525	Toolik Main	27-Jul-07	10:52	12	5.6	5.3	1.68
2007-0526	Toolik Main	27-Jul-07	10:59	16	5.3	5.3	1.73
2007-0302	Toolik Inlet	2-Aug-07	11:45	0.5	14.0	14.0	8.61
2007-0559	I8 outlet	3-Aug-07	10:20	0.01	15.1	15.1	4.69
2007-0908	I8 NE inlet	3-Aug-07	11:12	0.01	7.6	7.6	1.50
2007-0909	I8 SE inlet	3-Aug-07	11:58	0.01	10.8	10.8	2.50
2007-0910	I8 S inlet	3-Aug-07	12:37	0.01	9.8	9.8	1.21
2007-0558	I8 inlet	3-Aug-07	13:00	0.01	10.8	9.4	2.33
2007-0557	I7 into I9	3-Aug-07	13:45	0.01	16.1	16.1	16.48
2007-0556	I8 into I9	3-Aug-07	13:45	0.01	15.6	16.1	9.33
2007-0553	Toolik Inlet	3-Aug-07	15:55	0.01	15.3	15.3	8.56
2007-0562	Toolik Main	3-Aug-07	10:11	1	15.7	16.0	5.46
2007-0563	Toolik Main	3-Aug-07	10:19	3	15.6	16.0	5.76
2007-0564	Toolik Main	3-Aug-07	10:25	5	15.2	10.0	5.21
2007-0565	Toolik Main	3-Aug-07	10:36	8	7.7	10.0	3.47
2007-0566	Toolik Main	3-Aug-07	10:42	12	5.8	5.2	2.25
2007-0567	Toolik Main	3-Aug-07	10:49	16	5.2	5.2	3.11
2007-0581	I1 into I3	7-Aug-07	9:45	0.01	11.7	11.7	1.62
2007-0583	I2 into I3	7-Aug-07	9:45	0.01	9.1	11.7	1.29
lakes	I2	7-Aug-07	10:30	1	13.7	13.8	0.98
2007-0595	I8 HW	7-Aug-07	11:40	0.01	4.9	4.9	0.86
lakes	I1	7-Aug-07	11:40	1	14.2	14.5	2.63
lakes	I3	7-Aug-07	12:30	1	13.3	13.8	4.87
lakes	I4	7-Aug-07	13:30	1	13.8	13.8	6.72
lakes	I6 HW	7-Aug-07	15:00	1	13.7	13.7	3.09
2007-0586	I4 into I5	7-Aug-07	16:00	0.01	13.0	13.7	8.90
lakes	I5	7-Aug-07	17:25	1	14.3	16.0	4.99
2007-0589	I6 HW inlet	7-Aug-07	17:25	0.01	8.7	8.5	1.68
lakes	I6	8-Aug-07	9:20	1	0.0	0.0	3.15
2007-0588	I5 into I6	8-Aug-07	10:05	0.01	11.1	11.1	2.90
2007-0592	I6 west inlet	8-Aug-07	10:05	0.01	5.8	5.8	0.90
lakes	I7	8-Aug-07	10:30	1	13.3	13.3	3.91
2007-0596	I8 inlet	8-Aug-07	11:50	0.01	7.8	7.8	0.66
lakes	I8	8-Aug-07	12:32	1	10.6	10.4	3.88
2007-0597	I8 outlet	8-Aug-07	12:32	0.01	10.4	10.4	3.97
2007-0601	I swamp inlet	8-Aug-07	13:25	0.01	12.3	11.2	2.13
lakes	I swamp	8-Aug-07	13:25	1	11.1	11.1	4.71
2007-0594	I7 into I9	8-Aug-07	14:50	0.01	12.0	12.0	4.81
2007-0598	I8 into I9	8-Aug-07	14:50	0.01	11.4	12.0	5.77
2007-0599	Milky Way Lower	8-Aug-07	15:31	0.01	8.5	8.5	3.17
2007-0603	Toolik Inlet	8-Aug-07	16:09	0.01	11.9	11.9	6.20
2007-0607	Toolik Main	9-Aug-07	14:35	1	14.2	14.2	5.29
2007-0608	Toolik Main	9-Aug-07	14:46	3	14.0	14.2	6.25
2007-0609	Toolik Main	9-Aug-07	15:00	5	13.3	13.3	7.27
2007-0610	Toolik Main	9-Aug-07	15:12	8	7.9	7.9	2.83
2007-0611	Toolik Main	9-Aug-07	15:29	12	5.8	5.8	1.72
2007-0612	Toolik Main	9-Aug-07	15:40	16	5.4	5.4	2.00

Appendix B. Dissolved Organic Matter for summers 2004-2007

Sortchem	Site	Date	Time	Temperature (deg C)	DOM (UV abs)	DOC (uM)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)	Activity Phenol Oxidase (umol/h/mL)	Activity Peroxidase (umol/h/mL)
2004-0649	I8 Inlet	15-Jun-04	10:30	14.30	41.3	260.8	0.05	0.83	0.16	0.002	0.002
2004-0650	I8 Outlet	15-Jun-04	12:00	10.60	59.6	302.3	0.29	0.86	2.02	0.001	0.000
2004-0134	I7-I9	18-Jun-04	14:03	15.00	57.7	339.1	0.31	0.86	0.40	0.001	0.000
2004-0133	I8-I9	18-Jun-04	14:42	15.40	51.8	284.1	0.21	0.87	0.37	0.002	0.000
2004-0130	Toolik Inlet	18-Jun-04	16:40	14.50	44.5	723.4	0.17	0.84	0.51	0.001	0.000
2004-0169	I7-I9	23-Jun-04	14:45	17.60	59.3	351	0.29	0.88	0.28	0.002	0.000
2004-0173	I8-I9	23-Jun-04	14:45	17.30	44.0	286.3	0.16	0.84	0.42	0.002	0.000
2004-0178	Toolik Inlet	23-Jun-04	16:30	14.50	42.2	272	0.11	0.82	0.29	0.002	0.001
2004-0183	I7-I9	25-Jun-04		15.00	56.4	342.5	0.23	0.88	0.23	0.006	0.004
2004-0182	I8-I9	25-Jun-04		14.10	40.3	262	0.17	0.82	0.45	0.006	-0.002
2004-0179	Toolik Inlet	25-Jun-04		14.80	39.7	257.7	0.16	0.83	0.25	0.002	0.003
2004-0686	Toolik Inlet	28-Jun-04	10:05	14.90	40.5	257.9	0.17	0.84	1.48	0.022	0.018
2004-0687	Toolik Outlet	28-Jun-04	11:00	15.20	68.4	384.4	0.16	0.96	0.68	0.002	0.000
2004-0713	I8 Inlet	29-Jun-04	10:15	13.40	40.1	296.1	0.01	0.85	0.56	0.001	0.000
2004-0714	I8 Outlet	29-Jun-04	11:00	17.50	53.8	321.2	0.31	0.84	0.42	0.001	0.000
2004-0242	I7-I9	2-Jul-04	9:57	9.30	58.7	359.4	0.15	0.84	0.42	0.002	0.000
2004-0241	I8-I9	2-Jul-04	10:09	17.00	41.7	259.5	0.14	0.77	0.66	0.002	0.000
2004-0238	Toolik Inlet	2-Jul-04	11:55	16.10	35.3	245.9	0.11	0.77	0.50	0.001	0.000
2004-0770	I8 Inlet	5-Jul-04	14:10	12.20	32.8	266.3	0.02	0.76	0.17	0.002	-0.001
2004-0771	I8 Outlet	5-Jul-04	15:00	17.80	52.9	316	0.22	0.82	0.51	0.002	0.000
2004-0300	I7-I9	9-Jul-04	10:45	11.40	67.1	391.8	0.36	0.88	0.69	0.002	0.000
2004-0299	I8-I9	9-Jul-04	10:20	12.60	54.0	316.8	0.22	0.83	1.52	0.001	0.000
2004-0296	Toolik Inlet	9-Jul-04	13:00	10.90	53.9	323.8	0.27	0.84	1.34	0.002	0.001
2004-0337	I8 In	14-Jul-04	11:50	10.40	113.1	551.3	0.44	1.01	0.06	0.003	0.000
2004-0338	I8 Out	14-Jul-04	12:05	11.80	140.1	627.3	0.56	1.13	0.26	0.002	0.000
2004-0335	I7-I9	14-Jul-04	14:55	14.40	89.3	491.3	0.41	0.96	0.23	0.001	0.000
2004-0339	I8-I9	14-Jul-04	14:50	12.30	133.2	614.6	0.57	1.12	0.37	0.002	0.000
2004-0344	Toolik Inlet	14-Jul-04	16:10	13.40	108.3	516.6	0.37	1.01	0.49	0.001	0.000
2004-1086	I8 In	19-Jul-04	11:35	8.30	155.9	707.9	0.68	0.95	0.31	0.002	0.000
2004-1087	I8 Out	19-Jul-04	12:30	11.50	127.2	601.9	0.77	0.85	1.40	0.002	0.000
2004-1118	Toolik Outlet	22-Jul-04		15.00	83.7	445.4	0.60	0.71		0.001	0.000
2004-0408	I7-I9	23-Jul-04	11:36	14.70	101.5	499.4	0.65	0.75	0.28	0.001	0.000
2004-0407	I8-I9	23-Jul-04	10:50	12.60	120.9	972.1	0.90	0.81	0.42	0.001	0.000
2004-0404	Toolik Inlet	23-Jul-04	12:33	13.70	91.1	520.7	0.74	0.77	0.25	0.001	0.000
2004-1171	Toolik Inlet	26-Jul-04	10:20	14.20	89.7	474	0.61	0.71		0.001	0.000
2004-1172	Toolik Outlet	26-Jul-04	9:40	15.90	80.2	434.4	0.65	0.70		0.001	0.000
2004-1178	I8 Inlet	28-Jul-04	12:00	9.80	83.5	456.4	0.65	0.69	0.29	0.001	0.000
2004-1179	I8 Outlet	28-Jul-04	13:00	13.90	112.3	550.2	0.73	0.82	0.62	0.001	0.000
2004-0466	I7-I9	30-Jul-04		12.70	91.4	509.6	0.70	0.72	0.23	0.001	0.000
2004-0465	I8-I9	30-Jul-04		12.50	105.6	536	0.73	0.76	0.39	0.001	0.000
2004-0462	Toolik Inlet	30-Jul-04		12.10	93.6	496	0.42	0.76	0.26	0.002	0.000
2004-0503	I8 In	4-Aug-04	14:15	10.50	141.6	656.5	0.60	0.92	0.06	0.003	0.000

Sortchem	Site	Date	Time	Temperature (deg C)	DOM (UV abs)	DOC (uM)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)	Activity Phenol Oxidase (umol/h/mL)	Activity Peroxidase (umol/h/mL)
2004-0504	I8 Out	4-Aug-04	14:30	8.50	135.6	635.4	0.64	0.90	0.48	0.001	0.000
2004-0501	I7-I9	4-Aug-04	17:20	13.00	122.3	601.7	0.67	0.86	0.56	0.001	0.000
2004-0505	I8-I9	4-Aug-04	17:25	9.40	134.1	622.9	0.60	0.91	0.36	0.000	0.000
2004-0510	Toolik Inlet	4-Aug-04	18:05	10.70	123.3	594.3	0.52	0.92	0.39	0.001	0.000
2004-0515	I7-I9	6-Aug-04	10:37	12.60	100.7	517.6	0.61	0.62	0.56	0.001	0.000
2004-0514	I8-I9	6-Aug-04	10:14	10.90	122.1	572.4	0.80	0.66	0.37	0.001	0.000
2004-0511	Toolik Inlet	6-Aug-04	11:57	13.70	106.7	524	0.72	0.63	0.55	0.001	0.000
2004-1326	I8 Inlet	9-Aug-04	10:55	11.20	94.0	563.9	0.55	0.57	0.13	0.001	0.000
2004-1327	I8 Outlet	9-Aug-04	12:00	11.50	123.3	640.9	0.71	0.67	0.56	0.001	0.000
2004-1404	Toolik Inlet	11-Aug-04	14:50	13.90	95.6	541.3	0.59	0.59	0.48	0.001	0.000
2004-1405	Toolik Outlet	11-Aug-04	14:30	13.50	88.7	519.5	0.46	0.59	0.97	0.001	0.000
2004-1379	Toolik Outlet	12-Aug-04		0.00	84.5	551.5	0.57	0.56	1.29	0.001	0.000
2004-0574	I7-I9	13-Aug-04		13.00	93.5	476	0.57	0.66	0.54	0.001	0.000
2004-0573	I8-I9	13-Aug-04		12.10	106.0		0.49	0.61	0.79	0.001	0.000
2004-0570	Toolik Inlet	13-Aug-04		13.10	88.0	466.5	0.52	0.55	0.54	0.001	0.000
2004-1511	I8 Inlet	16-Aug-04		.	113.7	714.8	0.60	0.60	0.16	0.002	0.000
2004-1512	I8 Outlet	16-Aug-04		.	112.2	684.3	0.62	0.63	1.04	0.001	0.000

Sortchem	Site	Date	Time	DOM (UV abs)	abs@440nm	DOC (uM)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)
2005-0817	I8-in	21-Jun-05	14:30	46.0	0.049	314.1	0.582	0.32	0.1817
2005-0818	I8-out	21-Jun-05	15:40	75.6	0.045	396.9	0.809	0.48	1.7999
2005-0230	I7-I9	24-Jun-05	13:30	61.7	0.054	349.4	0.544	0.48	
2005-0229	I8-I9	24-Jun-05	13:30	53.5	0.049	299.6	0.771	0.30	
2005-0226	Toolik Inlet	24-Jun-05	13:30	48.0	0.022	297.2	0.647	0.32	
2005-0266	I8 HW	28-Jun-05	10:50	51.1	0.045	333.7	0.527	0.28	0.1505
2005-0267	I8 in	29-Jun-05	12:15	38.6	0.019	295.6	0.500	0.19	0.1794
2005-0268	I8 out	29-Jun-05	12:20	68.6	0.044	399.2	0.345	0.07	0.1979
2005-0265	I7-I9	29-Jun-05	15:55	66.8		390.5	0.597	0.62	0.0483
2005-0269	I8-I9	29-Jun-05	15:55	50.2		293.6	0.425	0.34	1.4505
2005-0274	Toolik Inlet	29-Jun-05	17:00	38.6		263.8	0.525	0.30	0.1674
2005-0297	I7-I9	1-Jul-05	11:30	65.6		367.7	0.680	0.03	
2005-0296	I8-I9	1-Jul-05	11:30	49.1		286.3	0.401	0.03	
2005-0293	Toolik Inlet	1-Jul-05	11:45	40.1		256.3	0.443	-0.01	
2005-0947	I8 in	5-Jul-05	13:26	37.1		268.2	0.156	0.06	0.2144
2005-0948	I8 out	5-Jul-05	13:50	67.6		387.4	0.290	0.04	0.3924
2005-0963	I8 in	7-Jul-05	14:20	153.3	0.032	756.3	0.793	1.44	0.1089
2005-0964	I8 out	7-Jul-05	17:19	81.6	0.033	394.8	0.683	0.44	0.5374
2005-0965	blue bag rep A	7-Jul-05	14:20	83.9	0.024	353.1	0.405	0.06	0.2585
2005-0966	blue bag rep B	7-Jul-05	14:20	43.9	0.018	335.4	0.232	0.15	
2005-0967	white bag rep A	7-Jul-05	14:20	72.0	0.043	451	0.571	0.31	0.5514
2005-0968	white bag rep B	7-Jul-05	14:20	73.2		467.7	0.457	0.47	
2005-0353	I7-I9	8-Jul-05	13:00	89.3		475.9	0.586	0.59	
2005-0352	I8-I9	8-Jul-05	13:00	70.2		393.8	0.385	0.44	
2005-0349	Toolik Inlet	8-Jul-05	13:30	71.5		394.65	0.382	0.43	
2005-0991	I8 in	9-Jul-05	11:30	124.2		615	0.509	0.81	0.1847
2005-0992	I8 out	9-Jul-05	13:30	82.7		457.3	0.526	0.99	0.7978
2005-0993	blue bag rep A	9-Jul-05	11:30	52.1		384.5	0.242	0.22	0.1516
2005-0994	blue bag rep B	9-Jul-05	11:30	50.5		372.6	0.159	0.15	0.2414
2005-0995	green bag rep A	9-Jul-05	13:30	48.7	0.015	370.1	0.256	0.32	1.0259
2005-0996	green bag rep B	9-Jul-05	13:30	49.1	0.042	360.4	0.244	0.33	1.6925
2005-0997	yellow bag rep A	9-Jul-05	13:30	69.4		440.2	0.446	0.42	0.8721
2005-0998	yellow bag rep B	9-Jul-05	13:30	66.6		430.5	0.253	0.57	0.4285
2005-0999	white bag rep A	9-Jul-05	11:30	71.5		477	0.401	0.56	0.385
2005-1000	white bag rep B	9-Jul-05	11:30	75.1		478.1	0.359	0.40	0.3619
2005-1001	mystery bag	9-Jul-05	13:30	69.3		442.7	0.225	0.54	0.9109
2005-1050	I8 in	12-Jul-05	10:15	154.3		705.5	0.758	1.16	0.0894
2005-1051	I8 out	12-Jul-05	10:50	98.9		513.9	0.565	0.65	0.7681
2005-0399	I7-I9	15-Jul-05	13:20	92.2		518.7	0.479	0.64	
2005-0398	I8-I9	15-Jul-05	13:20	116.7	0.034	570.6	0.615	0.85	
2005-0395	Toolik Inlet	15-Jul-05	12:04	99.6	0.028	510.7	0.542	0.73	
2005-0436	I8 In	20-Jul-05	12:20	78.9	0.019	431	0.454	0.58	0.0611

Sortchem	Site	Date	Time	DOM (UV abs)	abs@440nm	DOC (uM)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)
2005-0437	I8 Out	20-Jul-05	13:00	111.0	0.014	546.2	0.639	1.07	0.5234
2005-0434	I7-I9	20-Jul-05	15:45	79.9	0.037	437.3	0.469	0.89	0.168
2005-0438	I8-I9	20-Jul-05	15:45	102.0	0.036	514.8	0.526	1.05	0.5152
2005-0443	Toolik Inlet	20-Jul-05	16:35	82.9	0.026	456.8	0.400	0.81	0.544
2005-0466	I7-I9	22-Jul-05	13:00	75.5	0.018	427.8	0.404	0.82	
2005-0465	I8-I9	22-Jul-05	13:00	97.2	0.036	496.9	0.490	1.18	
2005-0462	Toolik Inlet, 12 deg C	22-Jul-05	13:00	77.1	0.025	430.7	0.348	0.91	
2005-1229	I8 in	26-Jul-05	10:25	56.0	0.014	353.8	0.164	0.29	0.0961
2005-1230	I8 out	26-Jul-05	12:02	103.4	0.01	527.1	0.377	0.78	0.7542
2005-1231	I8 in	28-Jul-05	10:21	52.5	0.034	350.6	0.159	0.27	0.9025
2005-1232	I8 out	28-Jul-05	12:02	100.8	0.044	521.5	0.336	0.76	0.9684
2005-1235	blue bag rep A	28-Jul-05	10:30	52.3		409.3	0.237	0.32	0.0991
2005-1236	blue bag rep B	28-Jul-05	10:30	52.3		387.2	0.272	0.32	0.035
2005-1239	green bag rep A	28-Jul-05	12:15	63.1		677.1	0.146	0.38	0.1132
2005-1240	green bag rep B	28-Jul-05	12:15	64.0		613.5	0.252	0.47	0.0876
2005-1237	yellow bag rep A	28-Jul-05	12:15	105.8		631.2	0.337	0.92	1.0003
2005-1238	yellow bag rep B	28-Jul-05	12:15	106.0		861.2	0.363	0.87	1.09
2005-1233	white bag rep A	28-Jul-05	10:30	95.0		541.9	0.245	0.68	0.8593
2005-1234	white bag rep B	28-Jul-05	10:30	93.1		577.3	0.247	0.70	0.7869
2005-0510	I7-I9	29-Jul-05	10:00	71.5	0.032	408.2	0.259	0.46	
2005-0509	I8-I9	29-Jul-05	10:30	80.5	0.033	448.8	0.308	0.59	
2005-0506	Toolik Inlet	29-Jul-05	13:30	59.4	0.024	365.05	0.219	0.34	
2005-1262	I8 in	30-Jul-05	11:00	48.3	0.018	335	0.041	0.31	0.1427
2005-1263	I8 out	30-Jul-05	13:30	99.8	0.043	523.6	0.223	0.65	1.2156
2005-1266	blue bag rep A	30-Jul-05	11:00	55.0		460.2	0.051	0.39	0.0824
2005-1267	blue bag rep B	30-Jul-05	11:00	56.9		544.3	0.063	0.53	0.1145
2005-1270	green bag rep A	30-Jul-05	13:30	70.7		562.1	0.156	0.61	0.1734
2005-1271	green bag rep B	30-Jul-05	13:30	67.4		502.2	0.013	0.72	0.0696
2005-1268	yellow bag rep A	30-Jul-05	13:30	103.5		603.6	0.291	0.94	1.7053
2005-1269	yellow bag rep B	30-Jul-05	13:30	101.3		562.8	0.395	0.73	1.8207
2005-1264	white bag rep A	30-Jul-05	11:00	84.1		488.6	0.123	0.60	1.1797
2005-1265	white bag rep B	30-Jul-05	11:00	84.0		511.9	0.247	0.67	1.0618
2005-1327	I8 in	2-Aug-05	10:15	44.1	0.015	313.6	0.114	0.27	0.277
2005-1328	I8 out	2-Aug-05	12:00	97.9	0.042	512	0.344	0.71	1.0755
2005-1331	blue bag rep A	2-Aug-05	10:15	50.2		346.4	0.182	0.42	0.2401
2005-1332	blue bag rep B	2-Aug-05	10:15	49.6		363.7	0.330	0.45	0.3221
2005-1333	green bag rep A	2-Aug-05	12:00	72.9		486.8	0.349	0.82	0.5644
2005-1334	green bag rep B	2-Aug-05	12:00	68.5		461.3	0.267	0.58	1.0644
2005-1335	yellow bag rep A	2-Aug-05	12:00	96.6		621.3	0.488	0.85	1.9104
2005-1336	yellow bag rep B	2-Aug-05	12:00	97.0		531	0.440	0.90	2.0386
2005-1329	white bag rep A	2-Aug-05	10:15	72.7		434.7	0.220	0.50	2.0386
2005-1330	white bag rep B	2-Aug-05	10:15	82.9		449.7	0.300	0.54	1.4233

Sortchem	Site	Date	Time	DOM (UV abs)	abs@440nm	DOC (uM)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)
2005-0568	I7-I9	5-Aug-05	12:30	71.8	0.034	382.9	0.364	0.53	
2005-0567	I8-I9	5-Aug-05	12:30	73.5	0.028	416.9	0.291	0.60	
2005-0564	Toolik Inlet	5-Aug-05	13:00	51.1	0.019	333.9	0.186	0.47	
2005-0593	I8 in	10-Aug-05	11:50	39.1	0.014	288.2	0.073	0.25	0.1649
2005-0594	I8 out	10-Aug-05	12:00	94.0	0.037	503.3	0.392	0.72	0.6141
2005-0591	I7-I9	10-Aug-05	14:40	72.8	0.036	373.6	0.409	0.44	0.1855
2005-0595	I8-I9	10-Aug-05	14:45	69.7	0.026	411.2	0.251	0.39	0.4781
2005-0600	Toolik Inlet	10-Aug-05	15:20	48.2	0.018	319.2	0.158	0.29	1.1332
2005-0623	I7-I9	12-Aug-05	12:30	74.7	0.036	374.1	0.377	0.35	
2005-0622	I8-I9	12-Aug-05	12:30	67.8	0.025	404.4	0.225	0.45	
2005-0619	Toolik Inlet	12-Aug-05	12:30	45.3	0.014	311.55	0.073	0.29	
2005-1431	I8 in	15-Aug-05	10:15	36.8	0.01	300	0.074	0.17	0.305
2005-1432	I8 out	15-Aug-05	11:00	90.0	0.034	501.9	0.325	0.51	0.9767

Sortchem	Site	Date	Time	Temperature (deg C)	DOM (UV abs)	abs@254nm	abs@280nm	abs@440nm	DOC (uM)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)	Sugars (uM)
2006-0125	I8 Inlet	22-Jun-06	12:30	11.1	111.6	1.21	0.84	0.03	697.5	0.56	1.27	0.22	17.76
2006-0126	I8 Outlet	22-Jun-06	12:45	10.7	112.6	1.22	0.85	0.04	709.9	0.91	1.42	1.64	15.24
2006-0123	I7 into I9	22-Jun-06	15:00	12.6	95.0	1.04	0.72	0.03	607.8	0.65	1.03	0.43	17.81
2006-0127	I8 into I9	22-Jun-06	15:10	11.9	108.9	1.18	0.83	0.03	670	0.92	1.31	1.55	20.63
2006-0132	Toolik Inlet	22-Jun-06	15:45	12.2	97.8	1.06	0.74	0.03	606.4	0.81	1.19	0.90	15.81
2006-0720	I8 Inlet	27-Jun-06	11:00	7.8	132.6	1.42	0.99	0.04	777.4	1.10	1.70	0.36	15.12
2006-0721	I8 Outlet	27-Jun-06	10:15	11.6	114.7	1.24	0.87	0.04	696	0.97	1.44	2.49	10.99
2006-0184	I8 Inlet	30-Jun-06	10:45	9.0	103.1	1.11	0.78	0.04	618.2	0.77	0.98	0.81	12.45
2006-0185	I8 Outlet	30-Jun-06	11:10	11.6	112.6	1.22	0.85	0.04	687.9	0.99	1.38	2.35	9.09
2006-0183	I7 into I9	30-Jun-06	11:45	12.6	70.4	0.78	0.53	0.02	491.5	0.68	0.54	0.32	8.60
2006-0182	I8 into I9	30-Jun-06	12:00	11.9	107.3	1.17	0.81	0.03	664.5	0.88	1.21	1.34	10.70
2006-0178	Toolik Inlet	30-Jun-06	14:20	12.0	91.2	0.99	0.69	0.03	569.75	0.87	0.91	0.77	13.17
2006-0233	I8 Inlet	7-Jul-06	10:20	7.8	88.0	0.96	0.66	0.02	559.6	0.70	0.81	0.32	7.88
2006-0234	I8 Outlet	7-Jul-06	10:54	10.7	106.1	1.16	0.80	0.03	647.7	0.83	1.22	0.86	10.10
2006-0232	I7 into I9	7-Jul-06	11:35	10.7	76.9	0.85	0.58	0.02	544.6	0.59	0.73	0.34	15.64
2006-0231	I8 into I9	7-Jul-06	11:50	7.8	99.9	1.09	0.76	0.03	640.3	0.84	1.12	0.88	12.59
2006-0227	Toolik Inlet	7-Jul-06	12:15	10.4	87.6	0.96	0.66	0.03	579.8	0.74	0.87	0.70	8.91
2006-0306	I8 Inlet	14-Jul-06	12:00	9.7	87.2	0.95	0.66	0.02	556.3	0.73	0.90	0.41	13.67
2006-0307	I8 Outlet	14-Jul-06	12:20	13.1	96.0	1.05	0.73	0.03	598	0.77	1.08	1.33	11.03
2006-0304	I7 into I9	14-Jul-06	14:00	13.8	68.7	0.76	0.52	0.02	467.9	0.70	0.63	0.30	10.11
2006-0308	I8 into I9	14-Jul-06	14:00	13.4	91.7	1.01	0.70	0.02	576.5	0.76	1.00	0.82	11.66
2006-0313	Toolik Inlet	14-Jul-06	15:00	13.0	80.1	0.88	0.61	0.02	518.2	0.77	0.89	0.77	9.10
2006-0899	I8 Inlet	18-Jul-06	9:38	10.1	68.8	0.75	0.52	0.02	462.6	0.30	0.56	0.41	4.19
2006-0900	I8 Outlet	18-Jul-06	10:32	12.4	94.4	1.03	0.72	0.03	574.2	0.59	1.05	2.10	11.36
2006-0354	I8 Inlet	21-Jul-06	9:38	8.3	82.1	0.89	0.62	0.02	527.7	0.47	0.73	0.43	12.05
2006-0355	I8 Outlet	21-Jul-06	10:15	11.6	88.0	0.97	0.67	0.02	563.7	0.59	0.95	1.72	13.70
2006-0353	I7 into I9	21-Jul-06	10:40	10.9	74.3	0.82	0.56	0.02	511.7	0.48	0.74	2.04	6.15
2006-0352	I8 into I9	21-Jul-06	10:55	11.0	85.6	0.94	0.65	0.02	547.1	0.54	0.88	1.67	4.36
2006-0348	Toolik Inlet	21-Jul-06	11:20	10.5	80.6	0.61	0.61	0.02	512.6	0.46	0.78	1.01	3.87
2006-0913	inlet A	21-Jul-06	9:50	8.3	71.1	0.76	0.53	0.02	452.7	0.45	0.61	0.35	.
2006-0914	inlet B	21-Jul-06	9:50	8.3	71.7	0.77	0.54	0.02	460.6	0.44	0.60	0.29	.
2006-0915	inlet C	21-Jul-06	9:50	8.3	71.2	0.77	0.53	0.02	456.6	0.46	0.83	0.97	.
2006-0916	outlet A	21-Jul-06	10:15	11.6	77.3	0.84	0.58	0.02	484.6	0.46	0.71	0.93	.
2006-0917	outlet B	21-Jul-06	10:15	11.6	80.5	0.87	0.60	0.02	502	0.51	0.86	1.59	.
2006-0918	outlet C	21-Jul-06	10:15	11.6	76.2	0.83	0.58	0.02	484.4	0.44	0.84	2.38	.
2006-1014	Toolik Inlet	26-Jul-06	9:10	12.1	89.8	0.98	0.68	0.03	552.2	0.77	1.09	0.50	6.04
2006-0399	I8 Inlet	28-Jul-06	10:30	11.0	85.8	0.94	0.65	0.02	543.8	0.56	1.07	0.28	1.44
2006-0400	I8 Outlet	28-Jul-06	11:10	13.7	97.5	1.07	0.74	0.03	603.4	0.72	1.39	0.80	4.85
2006-0398	I7 into I9	28-Jul-06	11:35	15.0	78.5	0.87	0.60	0.02	518.7	0.67	0.91	0.46	1.42
2006-0397	I8 into I9	28-Jul-06	11:50	14.5	94.4	1.04	0.72	0.03	575.7	0.52	1.08	1.12	5.23
2006-0393	Toolik Inlet	28-Jul-06	12:10	14.4	84.2	0.93	0.64	0.02	540.5	0.63	0.97	0.70	4.10
2006-1023	I8 Inlet	1-Aug-06	13:40	10.1	72.4	0.79	0.55	0.02	475.5	0.45	0.43	0.91	1.07

Sortchem	Site	Date	Time	Temperature (deg C)	DOM (UV abs)	abs@254nm	abs@280nm	abs@440nm	DOC (uM)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)	Sugars (uM)
2006-1024	I8 Outlet	1-Aug-06	15:20	12.6	93.0	1.02	0.71	0.03	592.5	0.59	0.87	1.52	4.24
2006-1050	I8 Inlet	3-Aug-06	14:15	12.1	69.9	0.80	0.54	0.02	456.7	0.47	0.48	0.65	8.67
2006-1051	I8 Outlet	3-Aug-06	15:06	12.8	86.4	0.98	0.67	0.02	576.5	0.62	0.81	2.10	2.60
2006-1052	in/in A	3-Aug-06	14:45	12.1	67.7	0.77	0.53	0.02	559.1	0.56	0.49	0.47	.
2006-1053	in/in B	3-Aug-06	14:45	12.1	71.3	0.80	0.55	0.03	564.8	0.50	0.55	0.30	.
2006-1054	in/in C	3-Aug-06	14:45	12.1	67.0	0.77	0.52	0.02	567.8	0.36	0.50	0.29	.
2006-1055	in/out A	3-Aug-06	15:30	12.8	71.4	0.82	0.56	0.03	572.8	0.51	0.54	0.41	.
2006-1056	in/out B	3-Aug-06	15:30	12.8	74.7	0.85	0.58	0.04	611.1	0.53	0.60	0.69	.
2006-1057	in/out C	3-Aug-06	15:30	12.8	71.7	0.82	0.56	0.03	594.4	0.46	0.57	0.36	.
2006-1058	out/out A	3-Aug-06	15:25	12.8	90.6	1.03	0.70	0.03	719.5	0.65	0.96	1.89	.
2006-1059	out/out B	3-Aug-06	15:25	12.8	90.9	1.03	0.70	0.03	718.6	0.63	0.96	1.67	.
2006-1060	out/out C	3-Aug-06	15:25	12.8	91.0	1.03	0.71	0.04	728.9	0.74	0.98	1.71	.
2006-1061	out/in A	3-Aug-06	14:30	12.1	92.9	1.02	0.70	0.03	690.8	0.65	0.97	1.85	.
2006-1062	out/in B	3-Aug-06	14:30	12.1	95.5	1.04	0.72	0.03	640.1	0.61	0.91	1.80	.
2006-1063	out/in C	3-Aug-06	14:30	12.1	92.3	1.00	0.70	0.03	653.8	0.78	0.88	2.74	.
2006-0448	I8 Inlet	4-Aug-06	10:02	9.2	75.0	0.81	0.56	0.04	471	0.58	0.46	0.14	6.57
2006-0449	I8 Outlet	4-Aug-06	10:50	13.2	93.8	1.02	0.71	0.03	571.5	0.72	0.88	0.90	7.03
2006-0447	I7 into I9	4-Aug-06	11:33	13.2	70.7	0.78	0.54	0.02	486.1	0.62	0.53	0.16	1.67
2006-0446	I8 into I9	4-Aug-06	12:00	13.2	86.3	0.95	0.66	0.02	546.3	0.61	0.76	0.62	5.33
2006-0442	Toolik Inlet	4-Aug-06	14:16	13.5	72.9	0.80	0.55	0.02	487.2	0.57	0.59	0.40	7.35
2006-0504	I8 Inlet	10-Aug-06		8.5	90.4	0.99	0.68	0.04	591.2	0.87	0.91	1.83	9.88
2006-0503	I8 Outlet	10-Aug-06		10.8	85.0	0.93	0.65	0.04	564.8	0.95	0.88	0.54	9.11
2006-0501	I7 into I9	10-Aug-06		10.8	84.4	0.94	0.64	0.03	584.4	0.82	0.89	0.33	7.07
2006-0505	I8 into I9	10-Aug-06		10.7	82.8	0.91	0.63	0.02	552	0.85	0.84	1.31	8.07
2006-0510	Toolik Inlet	10-Aug-06		10.7	82.7	0.90	0.63	0.02	545.3	0.92	0.81	1.12	11.21

Sortchem	Site	Date	Time	Temperature (deg C)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)
2007-0105	I8 in	16-Jun-07	16:54	14	0.17	0.123	0.20
2007-0106	I8 out	16-Jun-07	18:00	11.7	0.50	0.234	1.94
2007-0104	I7-I9	16-Jun-07	18:50	13.9	0.38	0.222	0.10
2007-0103	I8-I9	16-Jun-07	19:20	13.9	0.25	0.150	1.07
2007-0100	Toolik Inlet	16-Jun-07	20:42	13.4	0.25	0.156	0.18
2007-0704	I8 in	18-Jun-07	16:24	17.3	0.23	0.117	0.20
2007-0705	I8 out	18-Jun-07	17:03	14	0.36	0.231	1.23
2007-0706	I8 in Northeast	18-Jun-07	14:03	14.8	0.42	0.081	0.16
2007-0707	I8 in Southeast	18-Jun-07	14:52	14.2	0.22	0.216	0.46
2007-0708	I8 in South	18-Jun-07	15:36	14.2	0.20	0.156	0.13
2007-0148	I8 HW	20-Jun-07	9:50	9.5	0.18	0.162	0.08
2007-0149	I8 in	21-Jun-07	11:27	13.5	0.00	0.078	0.08
2007-0150	I8 out	21-Jun-07	12:39	15.9	0.30	0.195	0.95
2007-0147	I7-I9	21-Jun-07	14:01	17.8	0.36	0.204	0.08
2007-0151	I8-I9	21-Jun-07	14:22	17.8	0.30	0.138	0.08
2007-0156	Toolik Inlet	21-Jun-07	16:10	16.5	0.17	0.144	0.22
2007-0711	Toolik Inlet	22-Jun-07	6:20	10.5	0.17	0.117	0.16
2007-0709	I7-I9	27-Jun-07	14:05	13.9	0.30	0.195	0.20
2007-0710	I8-I9	27-Jun-07	14:40	13.2	0.16	0.108	0.47
2007-0328	I8 in	29-Jun-07	10:46	13.3	0.18	0.066	0.26
2007-0329	I8 out	29-Jun-07	11:15	15.7	0.25	0.054	0.82
2007-0721	Transplant I7-I9 at I8-I9 A	29-Jun-07	10:10	15.4	0.32	0.042	0.20
2007-0722	Transplant I7-I9 at I8-I9 B	29-Jun-07	10:10	15.4	0.37	-0.013	0.22
2007-0718	Transplant I8-I9 A	29-Jun-07	10:10	15.4	0.21	-0.016	0.28
2007-0719	Transplant I8-I9 B	29-Jun-07	10:10	15.4	0.18	-0.025	0.17
2007-0720	Transplant I8-I9 C	29-Jun-07	10:10	15.4	0.36	-0.040	1.56
2007-0327	I7-I9	29-Jun-07	12:50	14.9	0.37	0.033	0.06
2007-0326	I8-I9	29-Jun-07	12:28	15.4	0.27	-0.016	0.15
2007-0323	Toolik Inlet	29-Jun-07	16:30	.	0.16	0.033	0.22
2007-0730	I7-I9	2-Jul-07	12:05	14.8	0.37	0.698	0.14
2007-0731	I8-I9	2-Jul-07	13:00	16.3	0.23	0.671	0.18
2007-0712	Transplant I7-I9 A	2-Jul-07	12:05	14.8	0.55	0.060	0.14
2007-0728	Transplant I7-I9 at I8-I9 A	2-Jul-07	13:00	16.3	0.29	0.584	0.18
2007-0729	Transplant I7-I9 at I8-I9 B	2-Jul-07	13:00	16.3	0.34	0.746	0.10
2007-0723	Transplant I7-I9 at I8-I9 C	2-Jul-07	13:00	16.3	0.39	-0.019	0.20
2007-0713	Transplant I7-I9 B	2-Jul-07	12:05	14.8	0.00	0.081	0.09
2007-0714	Transplant I7-I9 C	2-Jul-07	12:05	14.8	0.32	0.048	0.13
2007-0725	Transplant I8-I9 A	2-Jul-07	13:00	16.3	0.19	-0.052	0.21
2007-0715	Transplant I8-I9 at I7-I9 A	2-Jul-07	12:05	14.8	0.55	0.020	0.19
2007-0716	Transplant I8-I9 at I7-I9 B	2-Jul-07	12:05	14.8	0.23	-0.046	0.16
2007-0717	Transplant I8-I9 at I7-I9 C	2-Jul-07	12:05	14.8	0.18	-0.040	0.13

Sortchem	Site	Date	Time	Temperature (deg C)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)
2007-0726	Transplant I8-I9 B	2-Jul-07	13:00	16.3	0.16	0.011	0.11
2007-0727	Transplant I8-I9 C	2-Jul-07	13:00	16.3	0.22	-0.040	0.53
2007-0732	I8 in	2-Jul-07	15:55	14.8	0.12	0.683	0.29
2007-0733	I8 out	2-Jul-07	17:23	16.3	0.19	0.692	0.48
2007-0751	I8 in	4-Jul-07	9:55	13.9	0.21	0.231	0.20
2007-0752	I8 out	4-Jul-07	11:00	18.4	0.32	0.027	0.29
2007-0753	Transplant I8 in A	4-Jul-07	10:15	13.9	0.14	0.662	0.10
2007-0754	Transplant I8 in B	4-Jul-07	10:15	13.9	0.37	-0.046	0.12
2007-0755	Transplant I8 in C	4-Jul-07	10:15	13.9	0.36	-0.034	0.14
2007-0756	Transplant I8 in at I8 out A	4-Jul-07	10:15	18.4	0.36	-0.007	0.09
2007-0757	Transplant I8 in at I8 out B	4-Jul-07	10:15	18.4	0.21	0.005	0.06
2007-0758	Transplant I8 in at I8 out C	4-Jul-07	10:15	18.4	0.34	-0.025	0.10
2007-0759	Transplant I8 out A	4-Jul-07	11:20	18.4	0.40	0.048	0.35
2007-0760	Transplant I8 out B	4-Jul-07	11:20	18.4	0.51	0.084	0.35
2007-0761	Transplant I8 out C	4-Jul-07	11:20	18.4	0.66	0.054	0.88
2007-0762	Transplant I8 out at I8 in A	4-Jul-07	11:20	13.9	0.50	0.048	0.29
2007-0763	Transplant I8 out at I8 in B	4-Jul-07	11:20	13.9	0.26	0.057	0.27
2007-0764	Transplant I8 out at I8 in C	4-Jul-07	11:20	13.9	0.28	0.072	0.26
2007-0765	I8 in Northeast	4-Jul-07	9:15		0.26	0.252	0.31
2007-0767	I8 in South	4-Jul-07	14:10		0.48	0.213	0.35
2007-0768	I8 Lake Northeast	4-Jul-07	10:15		0.54	0.084	0.82
2007-0769	I8 Lake East	4-Jul-07	10:32		0.55	0.153	0.88
2007-0770	I8 Lake Southeast	4-Jul-07	10:44		0.57	0.123	0.56
2007-0771	I8 Lake Central	4-Jul-07	11:08		0.51	0.123	0.87
2007-0772	I8 Lake Southwest	4-Jul-07	11:38		0.52	0.234	0.92
2007-0773	I8 Lake West	4-Jul-07	12:12		0.67	0.240	0.84
2007-0774	I8 Lake West	4-Jul-07	12:12		0.54	0.162	1.60
2007-0775	I8 Lake Northwest	4-Jul-07	12:50		0.51	0.195	0.90
2007-0384	I7-I9	6-Jul-07	10:00				0.04
2007-0383	I8-I9	6-Jul-07	10:30				0.27
2007-0380	Toolik Inlet	6-Jul-07	13:23				0.22
2007-0413	I8 HW	10-Jul-07	8:50		-0.03		1.19
2007-0414	I8 in	11-Jul-07	13:52		-0.13	0.756	0.17
2007-0415	I8 out	11-Jul-07	15:49		0.09	0.645	1.75
2007-0412	I7-I9	11-Jul-07	17:00		0.20	0.496	0.84
2007-0416	I8-I9	11-Jul-07	16:29		-0.05	0.332	0.20
2007-0421	Toolik Inlet	11-Jul-07	18:30		-0.09	0.173	0.27
2007-0783	I8 in	16-Jul-07	10:45		0.12	0.176	0.51
2007-0784	I8 out	16-Jul-07	11:17		0.13	0.260	0.94
2007-0785	I8 in Northeast	16-Jul-07	13:30		0.32	0.620	0.62
2007-0786	I8 in South	16-Jul-07	12:35		0.12	0.648	0.21

Sortchem	Site	Date	Time	Temperature (deg C)	Total Proteins (mg/L)	Total Phenolics (uM)	Phaeophytin corrected chl a (ug chl a/L)
2007-0787	I8 in Southeast	16-Jul-07	12:56		0.03	0.350	0.31
2007-0796	Toolik Inlet	16-Jul-07	18:30		0.03	0.170	0.28
2007-0473	I8 in	20-Jul-07			0.17	0.340	0.50
2007-0474	I8 out	20-Jul-07			0.23	0.335	0.87
2007-0830	I8 in NE	20-Jul-07			0.20	0.292	-0.10
2007-0828	I8 in S	20-Jul-07			0.24	0.344	-0.16
2007-0829	I8 in SE	20-Jul-07			0.28	0.368	0.23
2007-0472	I7-I9	20-Jul-07			0.31	0.373	0.16
2007-0471	I8-I9	20-Jul-07			0.21	0.302	0.55
2007-0468	Toolik Inlet	20-Jul-07			0.03	0.349	0.44
2007-0844	I8 in	23-Jul-07			0.10	0.373	0.45
2007-0845	I8 out	23-Jul-07			0.52	0.323	0.08
2007-0846	I8 in South	23-Jul-07			0.21	0.358	0.06
2007-0847	I8 in Southeast	23-Jul-07			0.27	0.358	0.40
2007-0848	I8 in Northeast	23-Jul-07			0.15	0.194	0.09
2007-0849	I8 HW	23-Jul-07			0.32	0.293	
2007-0517	I8 in	27-Jul-07	10:18				0.03
2007-0518	I8 out	27-Jul-07	11:02				1.78
2007-0516	I7-I9	27-Jul-07	11:36				0.18
2007-0515	I8-I9	27-Jul-07	11:57				0.29
2007-0512	Toolik Inlet	27-Jul-07	14:26				0.19
2007-0869	I8 in	28-Jul-07			0.11	0.197	0.18
2007-0868	I8 out	28-Jul-07			0.08	0.274	0.84
2007-0870	I8 in Northeast	28-Jul-07			0.17	0.168	0.19
2007-0871	I8 in Southeast	28-Jul-07			0.23	0.312	0.57
2007-0872	I8 in South	28-Jul-07			0.20	0.264	0.07
2007-0873	I8 Lake	28-Jul-07			0.20	0.259	1.08
2007-0558	I8 in	3-Aug-07			0.51	0.54	0.11
2007-0559	I8 out	3-Aug-07			0.26	0.26	0.95
2007-0908	I8 in Northeast	3-Aug-07			0.30	0.25	0.26
2007-0909	I8 in Southeast	3-Aug-07			0.34	0.28	0.24
2007-0910	I8 in South	3-Aug-07			0.37	0.29	0.08

Appendix C. Cell counts for select experiments.					
Sample	Date	Time	Sample type	HDNA Cells/mL	Total Cells/mL
blue repB	7-Jul-05		transplant	7095500	8591870
white repB	7-Jul-05		transplant	2671183	4796878
I8 in	9-Jul-05		transplant	1110676	5284983
I8 out	9-Jul-05		transplant	2157387	5671333
blue repA	9-Jul-05		transplant	1969367	2815011
blue repB	9-Jul-05		transplant	1877939	2839213
green repA	9-Jul-05		transplant	2200321	3058598
green repB	9-Jul-05		transplant	3638154	4451896
yellow repA	9-Jul-05		transplant	4328938	5913028
yellow repB	9-Jul-05		transplant	3879564	5216519
white repA	9-Jul-05		transplant	2286156	3745043
white repB	9-Jul-05		transplant	2660490	4129934
I8 in	26-Jul-05		nut expt	618798	2569831
I8 out	26-Jul-05		nut expt	1594933	4337050
blue 12C	26-Jul-05		nut expt	349734	615195
green 12C	26-Jul-05		nut expt	373128	652448
yellow 12C	26-Jul-05		nut expt	1117430	1954067
white 12C	26-Jul-05		nut expt	1066580	1819659
y12NP	26-Jul-05		nut expt	583391	1250524
w12NP	26-Jul-05		nut expt	477167	736233
blue 17C	26-Jul-05		nut expt	699691	1077638
green 17C	26-Jul-05		nut expt	888716	1240849
yellow 17C	26-Jul-05		nut expt	1114562	1858901
white 17C	26-Jul-05		nut expt	624906	1008360
b17NP	26-Jul-05		nut expt	5724409	6781369
g17NP	26-Jul-05		nut expt	3027506	4981309
y17NP	26-Jul-05		nut expt	1802005	5384990
w17NP	26-Jul-05		nut expt	5503160	8430825
I8 in	28-Jul-05		transplant	975800	3184325
I8 out	28-Jul-05		transplant	2417963	4953355
blue A	28-Jul-05		transplant	2282585	3176430
blue B	28-Jul-05		transplant	2436214	4225400
green A	28-Jul-05		transplant	3303301	4527971
green B	28-Jul-05		transplant	3646718	4998036
yellow A	28-Jul-05		transplant	2908290	4056464
yellow B	28-Jul-05		transplant	3631100	4623029
white A	28-Jul-05		transplant	2694287	3420275
white B	28-Jul-05		transplant	2115020	2916835
I8 in	30-Jul-05		transplant	568635	1680673
I8 out	30-Jul-05		transplant	2184258	4715170
blue A	30-Jul-05		transplant	2170265	2920629
blue B	30-Jul-05		transplant	2028865	2927049
green A	30-Jul-05		transplant	3229053	4244331
green B	30-Jul-05		transplant	2524826	3649447
yellow A	30-Jul-05		transplant	3212744	4291281
yellow B	30-Jul-05		transplant	3212042	4381264
white A	30-Jul-05		transplant	2441509	3272024
white B	30-Jul-05		transplant	2781889	3504648
I8 in	2-Aug-05		transplant	591669	1856724
I8 out	2-Aug-05		transplant	1864564	3835618
blue A	2-Aug-05		transplant	2066707	2810222
blue B	2-Aug-05		transplant	2049483	2800538

Sample	Date	Time	Sample type	HDNA Cells/mL	Total Cells/mL
green A	2-Aug-05		transplant	4198908	5278398
green B	2-Aug-05		transplant	4577302	5659559
yellow A	2-Aug-05		transplant	2231195	3353909
yellow B	2-Aug-05		transplant	2106243	3169719
white A	2-Aug-05		transplant	4504089	5245466
white B	2-Aug-05		transplant	2841792	3511703
BCF 1	3-Aug-05	9:00	BCF	232046	504347
BCF 2	3-Aug-05	11:05	BCF	168182	482993
BCF 3	3-Aug-05	13:07	BCF	222226	550138
BCF 4	3-Aug-05	15:04	BCF	272775	620292
BCF 5	3-Aug-05	17:05	BCF	260838	592170
BCF 6	3-Aug-05	19:04	BCF	315059	683699
BCF 7	3-Aug-05	22:04	BCF	293939	632965
BCF 8	4-Aug-05	1:02	BCF	396768	762549
BCF 9	4-Aug-05	4:05	BCF	523523	850050
BCF 10	4-Aug-05	7:03	BCF	614492	944348
BCF 11	4-Aug-05	9:02	BCF	809532	1380886

Sample	Date	Time	Sample type	Conservative Cells/mL	Liberal Cells/mL
b 12C	29-Jun-06	21:32	nut expt	5618	106342
g 12C	29-Jun-06	21:32	nut expt	5531	102519
y 12C	29-Jun-06	21:32	nut expt	5879	85150
b NP 12C	29-Jun-06	21:45	nut expt	7293	168421
g NP 12C	29-Jun-06	21:45	nut expt	14088	226294
y NP 12C	29-Jun-06	21:45	nut expt	8069	136623
b 17C	29-Jun-06	22:14	nut expt	6767	155737
g 17C	29-Jun-06	22:14	nut expt	3090	116797
y 17C	29-Jun-06	22:14	nut expt	2640	135333
b NP 17C	29-Jun-06	22:14	nut expt	4381	354992
g NP 17C	29-Jun-06	22:14	nut expt	5360	274301
y NP 17C	29-Jun-06	22:14	nut expt	7319	320441
b 12C	1-Jul-06	21:02	nut expt	6816	255553
g 12C	1-Jul-06	21:02	nut expt	8137	301695
y 12C	1-Jul-06	21:02	nut expt	10939	285864
b NP 12C	1-Jul-06	21:02	nut expt	70134	969976
g NP 12C	1-Jul-06	21:02	nut expt	18800	612270
y NP 12C	1-Jul-06	21:02	nut expt	16390	521766
b 17C	1-Jul-06	21:32	nut expt	10548	344562
g 17C	1-Jul-06	21:32	nut expt	6651	218770
y 17C	1-Jul-06	21:32	nut expt	60549	434761
b NP 17C	1-Jul-06	21:32	nut expt	120938	723529
g NP 17C	1-Jul-06	21:32	nut expt	435691	709373
y NP 17C	1-Jul-06	21:32	nut expt	514458	1217899
b 12C	6-Jul-06	21:08	nut expt	48703	429818
g 12C	6-Jul-06	21:08	nut expt	18380	368999
y 12C	6-Jul-06	21:08	nut expt	42922	401238
b NP 12C	6-Jul-06	21:08	nut expt	295179	1231584
g NP 12C	6-Jul-06	21:08	nut expt	413110	761136
y NP 12C	6-Jul-06	21:08	nut expt	357270	670426
b 17C	6-Jul-06	21:40	nut expt	21205	326136

Sample	Date	Time	Sample type	Conservative Cells/mL	Liberal Cells/mL
g 17C	6-Jul-06	21:40	nut expt	16333	312199
y 17C	6-Jul-06	21:40	nut expt	29793	401438
b NP 17C	6-Jul-06	21:40	nut expt	204249	456728
g NP 17C	6-Jul-06	21:40	nut expt	206914	510922
y NP 17C	6-Jul-06	21:40	nut expt	497280	902088
b 12C	11-Jul-06	21:33	nut expt	22528	262786
g 12C	11-Jul-06	21:33	nut expt	32362	347913
y 12C	11-Jul-06	21:33	nut expt	16077	260909
b NP 12C	11-Jul-06	21:33	nut expt	167142	405818
g NP 12C	11-Jul-06	21:33	nut expt	204179	579797
y NP 12C	11-Jul-06	21:33	nut expt	211682	533324
b 17C	11-Jul-06	22:05	nut expt	28764	329121
g 17C	11-Jul-06	22:05	nut expt	49055	397759
y 17C	11-Jul-06	22:05	nut expt	36802	441531
b NP 17C	11-Jul-06	22:05	nut expt	327404	738072
g NP 17C	11-Jul-06	22:05	nut expt	274743	614087
y NP 17C	11-Jul-06	22:05	nut expt	500710	913044
in/in A	21-Jul-06		transplant	217912	313313
in/in B	21-Jul-06		transplant	370675	466143
in/in C	21-Jul-06		transplant	459828	542592
in/out A	21-Jul-06		transplant	438079	534567
in/out B	21-Jul-06		transplant	367718	489736
in/out C	21-Jul-06		transplant	413618	558241
inlet 12C D	24-Jul-06		in vs out DNA	110872	222796
inlet NP 12C D	24-Jul-06		in vs out DNA	241108	338295
inlet 17C D	24-Jul-06		in vs out DNA	53985	137911
inlet NP 17C D	24-Jul-06		in vs out DNA	282144	372723
outlet 12C D	24-Jul-06		in vs out DNA	183379	305944
outlet NP 12C D	24-Jul-06		in vs out DNA	82657	193888
outlet 17C D	24-Jul-06		in vs out DNA	30960	113102
outlet NP 17C D	24-Jul-06		in vs out DNA	348491	598987
inlet 12C D	29-Jul-06		in vs out DNA	84371	139184
inlet NP 12C D	29-Jul-06		in vs out DNA	467613	502060
inlet 17C D	29-Jul-06		in vs out DNA	144547	206126
inlet NP 17C D	29-Jul-06		in vs out DNA	502204	602971
outlet 12C D	29-Jul-06		in vs out DNA	66046	118533
outlet NP 12C D	29-Jul-06		in vs out DNA	291412	517191
outlet 17C D	29-Jul-06		in vs out DNA	103592	222303
outlet NP 17C D	29-Jul-06		in vs out DNA	1083032	1498116
inlet 12C A	29-Jul-06		in vs out DNA	106569	219078
inlet NP 12C A	29-Jul-06		in vs out DNA	463753	547789
inlet 17C A	29-Jul-06		in vs out DNA	131448	209881
inlet NP 17C A	29-Jul-06		in vs out DNA	518291	577507
outlet 12C A	29-Jul-06		in vs out DNA	128740	328548
outlet NP 12C A	29-Jul-06		in vs out DNA	251220	405655
outlet 17C A	29-Jul-06		in vs out DNA	135483	393412
outlet NP 17C A	29-Jul-06		in vs out DNA	507987	706961
in/in A	3-Aug-06	14:45	transplant	327382	450219
in/in B	3-Aug-06	14:45	transplant	380593	513297
in/in C	3-Aug-06	14:45	transplant	389992	528837
in/out A	3-Aug-06	15:30	transplant	320049	500876
in/out B	3-Aug-06	15:30	transplant	229729	418845
in/out C	3-Aug-06	15:30	transplant	423352	502925

Sample	Date	Time	Sample type	Conservative Cells/mL	Liberal Cells/mL
out/in A	3-Aug-06	14:30	transplant	578319	809484
out/in B	3-Aug-06	14:30	transplant	578009	827424
out/out A	3-Aug-06	15:25	transplant	487064	958839
out/out B	3-Aug-06	15:25	transplant	540315	998444
out/out C	3-Aug-06	15:25	transplant	499934	911491
12C A	22-Jun-07	16:17	nut expt	136131	154640
12C B	22-Jun-07	16:17	nut expt	123282	149922
12C C	22-Jun-07	16:17	nut expt	101783	110500
12C NP A	22-Jun-07	16:17	nut expt	93685	105463
12C NP B	22-Jun-07	16:17	nut expt	109812	120742
12C NP C	22-Jun-07	16:17	nut expt	183860	227948
17C NP A	22-Jun-07	16:51	nut expt	187781	274419
17C NP B	22-Jun-07	16:51	nut expt	68862	74409
17C NP C	22-Jun-07	16:51	nut expt	96844	105918
17C A	22-Jun-07	16:51	nut expt	106278	119143
17C B	22-Jun-07	16:51	nut expt	89730	108254
17C C	22-Jun-07	16:51	nut expt	62356	73574
12C A	22-Jun-07	20:10	nut expt	120430	127723
12C B	22-Jun-07	20:10	nut expt	98176	103478
12C C	22-Jun-07	20:10	nut expt	88184	97998
12C NP A	22-Jun-07	20:10	nut expt	77198	88347
12C NP B	22-Jun-07	20:10	nut expt	63691	68557
12C NP C	22-Jun-07	20:10	nut expt	58128	65479
17C A	22-Jun-07	20:55	nut expt	75941	82662
17C B	22-Jun-07	20:55	nut expt	78985	88046
17C C	22-Jun-07	20:55	nut expt	110927	118669
17C NP A	22-Jun-07	20:55	nut expt	94057	100892
17C NP B	22-Jun-07	20:55	nut expt	90814	98824
17C NP C	22-Jun-07	20:55	nut expt	58640	65067
Toolik Inlet	22-Jun-07	6:23	nut expt	543999	581442
12C A	23-Jun-07	1:23	nut expt	128840	135280
12C B	23-Jun-07	1:23	nut expt	105057	111292
12C C	23-Jun-07	1:23	nut expt	84900	89754
12C NP A	23-Jun-07	1:23	nut expt	80884	87906
12C NP B	23-Jun-07	1:23	nut expt	63685	68943
12C NP C	23-Jun-07	1:23	nut expt	66565	74190
17C A	23-Jun-07	2:02	nut expt	87115	95395
17C B	23-Jun-07	2:02	nut expt	75194	80351
17C C	23-Jun-07	2:02	nut expt	100290	107461
17C NP A	23-Jun-07	2:02	nut expt	96419	102981
17C NP B	23-Jun-07	2:02	nut expt	86507	92293
17C NP C	23-Jun-07	2:02	nut expt	70494	75925
12C A	23-Jun-07	13:49	nut expt	164855	191545
12C B	23-Jun-07	13:49	nut expt	99096	105117
12C C	23-Jun-07	13:49	nut expt	133537	147602
12C NP A	23-Jun-07	13:49	nut expt	106032	150470
12C NP B	23-Jun-07	13:49	nut expt	123643	164052
12C NP C	23-Jun-07	13:49	nut expt	102716	142519
17C A	23-Jun-07	14:02	nut expt	141600	150110
17C B	23-Jun-07	14:02	nut expt	129241	135240
17C C	23-Jun-07	14:02	nut expt	177527	185778
17C NP A	23-Jun-07	14:18	nut expt	172197	178889
17C NP B	23-Jun-07	14:18	nut expt	160818	166793

Sample	Date	Time	Sample type	Conservative Cells/mL	Liberal Cells/mL
17C NP C	23-Jun-07	14:18	nut expt	139222	146571
12C A	24-Jun-07	12:55	nut expt	394509	404042
12C B	24-Jun-07	12:55	nut expt	189682	196716
12C C	24-Jun-07	12:55	nut expt	195679	204330
12C NP A	24-Jun-07	12:55	nut expt	363603	374540
12C NP B	24-Jun-07	12:55	nut expt	221466	230527
12C NP C	24-Jun-07	12:55	nut expt	174980	182349
17C A	24-Jun-07	13:25	nut expt	346606	357320
17C B	24-Jun-07	13:25	nut expt	300100	307521
17C C	24-Jun-07	13:25	nut expt	297978	308521
17C NP A	24-Jun-07	13:25	nut expt	368226	376034
17C NP B	24-Jun-07	13:25	nut expt	462803	470738
17C NP C	24-Jun-07	13:25	nut expt	349436	358439
12C A	25-Jun-07	12:00	nut expt	409975	419204
12C B	25-Jun-07	12:00	nut expt	285549	293604
12C C	25-Jun-07	12:00	nut expt	309861	322251
12C NP A	25-Jun-07	12:00	nut expt	629611	637340
12C NP B	25-Jun-07	12:00	nut expt	403960	411954
12C NP C	25-Jun-07	12:00	nut expt	377803	384849
17C A	25-Jun-07	12:40	nut expt	456868	468623
17C B	25-Jun-07	12:40	nut expt	377419	388230
17C C	25-Jun-07	12:40	nut expt	406499	417729
17C NP A	25-Jun-07	12:40	nut expt	500301	513625
17C NP B	25-Jun-07	12:40	nut expt	609041	622801
17C NP C	25-Jun-07	12:40	nut expt	464842	474359
12C A	26-Jun-07	13:56	nut expt	645768	658291
12C B	26-Jun-07	13:56	nut expt	282075	312966
12C C	26-Jun-07	13:56	nut expt	263981	296020
12C NP A	26-Jun-07	13:56	nut expt	666659	694045
12C NP B	26-Jun-07	13:56	nut expt	376683	408463
12C NP C	26-Jun-07	13:56	nut expt	508372	526750
17C A	26-Jun-07	14:35	nut expt	356660	376815
17C B	26-Jun-07	14:35	nut expt	304633	331439
17C C	26-Jun-07	14:35	nut expt	397274	417347
17C NP A	26-Jun-07	14:35	nut expt	461244	482812
17C NP B	26-Jun-07	14:35	nut expt	575666	599856
17C NP C	26-Jun-07	14:35	nut expt	497847	519551
transplant I7-I9 A	2-Jul-07	12:05	transplant	927998	1081205
transplant I7-I9 B	2-Jul-07	12:05	transplant	578750	748805
transplant I7-I9 C	2-Jul-07	12:05	transplant	492070	656857
transplant I8-I9 at I7-I9 A	2-Jul-07	12:05	transplant	826747	917671
transplant I8-I9 at I7-I9 B	2-Jul-07	12:05	transplant	612690	649458
transplant I8-I9 at I7-I9 C	2-Jul-07	12:05	transplant	299824	351656
transplant I8-I9 A	2-Jul-07	13:00	transplant	551383	582175
transplant I8-I9 B	2-Jul-07	13:00	transplant	386993	417471
transplant I8-I9 C	2-Jul-07	13:00	transplant	344393	379713
transplant I7-I9 at I8-I9 A	2-Jul-07	13:00	transplant	1222420	1284100
transplant I7-I9 at I8-I9 B	2-Jul-07	13:00	transplant	615872	664725
transplant I7-I9 at I8-I9 C	2-Jul-07	13:00	transplant	1085569	1137607
transplant I8-in A	4-Jul-07		transplant	1068071	1093760
transplant I8-in B	4-Jul-07		transplant	1310043	1396105
transplant I8-in C	4-Jul-07		transplant	986810	1010090
transplant I8-out at in A	4-Jul-07		transplant	1230972	1273265

Sample	Date	Time	Sample type	Conservative Cells/mL	Liberal Cells/mL
transplant I8-out at in B	4-Jul-07		transplant	952812	988376
transplant I8-out at in C	4-Jul-07		transplant	1268014	1313155
transplant I8-out A	4-Jul-07		transplant	1395359	1446512
transplant I8-out B	4-Jul-07		transplant	1342998	1397757
transplant I8-out C	4-Jul-07		transplant	1877341	1942828
transplant I8-in at out A	4-Jul-07		transplant	1821658	1847767
transplant I8-in at out B	4-Jul-07		transplant	1037980	1085295
transplant I8-in at out C	4-Jul-07		transplant	1113793	1140730

Appendix D. Data input for Chapter 2 path analysis

Sortchem	Site	Date	Season	Year	water type	BP (ug C/L/d)	chla (ug/L)	Temp (deg C)	DOC (uM)	ln (BP)	ln(Chla)
2003-0288	I2-I3	24-Jun-03	early	2003	S	0.781	0.49	14.8	584.554	-0.25	-0.71
2003-0290	I1-I3	24-Jun-03	early	2003	S	0.851	0.48	8	440.06	-0.16	-0.73
2003-0293	I4-I5	24-Jun-03	early	2003	S	1.006	0.18	12.3	452.106	0.01	-1.7
2003-0296	I6 HW in	24-Jun-03	early	2003	S	0.356	0.3	9.2	334.138	-1.03	-1.2
2003-0299	I6 West in	24-Jun-03	early	2003	S	0.441	0.13	8.1	371.152	-0.82	-2.04
2003-0302	I8 Headwaters	24-Jun-03	early	2003	S	0.22	0.12	5.9	351.927	-1.52	-2.16
2003-0594	I1	24-Jun-03	early	2003	L	1.237	1.3	5.3	415.038	0.21	0.27
2003-0596	I2	24-Jun-03	early	2003	L	0.895	2.2	5.4	503.124	-0.11	0.79
2003-0598	I3	24-Jun-03	early	2003	L	2.833	0.7	14.4	406.637	1.04	-0.36
2003-0600	I4	24-Jun-03	early	2003	L	0.907	1.81	10.4	443.144	-0.1	0.59
2003-0603	I5	24-Jun-03	early	2003	L	1.947	2.69	4.8	535.059	0.67	0.99
2003-0604	I6 HW	24-Jun-03	early	2003	L	1.985	0.8	6	380.879	0.69	-0.22
2003-0301	I7-I9	25-Jun-03	early	2003	S	1.989	0.23	13.9	453.604	0.69	-1.48
2003-0303	I8 In	25-Jun-03	early	2003	S	0.135	0.17	11.9	523.074	-2	-1.77
2003-0304	I8 Out	25-Jun-03	early	2003	S	0.524	1.64	13.2	459.846	-0.65	0.49
2003-0305	I8-I9	25-Jun-03	early	2003	S	0.61	0.31	13.8	706.829	-0.49	-1.18
2003-0306	MWL	25-Jun-03	early	2003	S	0.927	0.25	8.7	331.772	-0.08	-1.4
2003-0308	Swamp In	25-Jun-03	early	2003	S	0.351	0.24	11.9	416.154	-1.05	-1.41
2003-0310	Toolik Inlet	25-Jun-03	early	2003	S	1.413	0.19	14	440.497	0.35	-1.64
2003-0611	I6	25-Jun-03	early	2003	L	1.767	2.72	7.1	472.979	0.57	1
2003-0613	I7	25-Jun-03	early	2003	L	2.23	1.66	11.4	508.992	0.8	0.51
2003-0615	I8	25-Jun-03	early	2003	L	6.219	7.31	13.2	382.67	1.83	1.99
2003-0617	I Swamp	25-Jun-03	early	2003	L	1.306	0.86	13.4	457.29	0.27	-0.15
2003-0312	I1-I3	15-Jul-03	mid	2003	S	1.863	0.18	9.3	412.596	0.62	-1.71
2003-0314	I2-I3	15-Jul-03	mid	2003	S	0.805	0.21	7	658.081	-0.22	-1.57
2003-0317	I4-I5	15-Jul-03	mid	2003	S	1.466	0.56	11	546.855	0.38	-0.57
2003-0319	I5-I6	15-Jul-03	mid	2003	S	2.669	0.5	11.1	514.96	0.98	-0.69
2003-0320	I6 HW in	15-Jul-03	mid	2003	S	0.138	0.03	4.5	535.557	-1.98	-3.66
2003-0326	I8 Headwaters	15-Jul-03	mid	2003	S	0.29	0.13	2.8	689.789	-1.24	-2.05
2003-0791	I1	15-Jul-03	mid	2003	L	0.615	1.05	8.5	698.698	-0.49	0.05
2003-0793	I2	15-Jul-03	mid	2003	L	0.514	1.13	7.9	769.449	-0.67	0.13
2003-0795	I3	15-Jul-03	mid	2003	L	3.591	0.72	8.9	524.894	1.28	-0.33
2003-0797	I4	15-Jul-03	mid	2003	L	2.22	1.34	8.4	733.112	0.8	0.3
2003-0801	I6 west HW	15-Jul-03	mid	2003	L	1.075	0.76	9.5	409.858	0.07	-0.27
2003-0323	I6 West in	16-Jul-03	mid	2003	S	0.146	0.02	4.3	623.44	-1.92	-3.7
2003-0325	I7-I9	16-Jul-03	mid	2003	S	1.273	0.18	8.6	560.025	0.24	-1.72
2003-0327	I8 In	16-Jul-03	mid	2003	S	0.612	0.06	3.8	622.941	-0.49	-2.85
2003-0328	I8 Out	16-Jul-03	mid	2003	S	4.274	0.5	7.8	559.83	1.45	-0.69
2003-0329	I8-I9	16-Jul-03	mid	2003	S	2.678	0.06	8	564.401	0.99	-2.81
2003-0330	MWL	16-Jul-03	mid	2003	S	0.128	0.07	6	527.411	-2.06	-2.7
2003-0332	Swamp In	16-Jul-03	mid	2003	S	0.934	0.18	9.4	486.446	-0.07	-1.71
2003-0334	Toolik Inlet	16-Jul-03	mid	2003	S	2.085	0.42	7.7	585.526	0.73	-0.87
2003-0799	I5	16-Jul-03	mid	2003	L	2.486	0.81	9.5	522.651	0.91	-0.21
2003-0805	I6	16-Jul-03	mid	2003	L	1.902	0.75	7.5	493.427	0.64	-0.29
2003-0807	I7	16-Jul-03	mid	2003	L	3.062	0.83	7.6	498.875	1.12	-0.19
2003-0809	I8	16-Jul-03	mid	2003	L	1.071	0.96	6.7	583.213	0.07	-0.04

Sortchem	Site	Date	Season	Year	water type	BP (ug C/L/d)	chla (ug/L)	Temp (deg C)	DOC (uM)	ln (BP)	ln(Chla)
2003-0811	Iswamp	16-Jul-03	mid	2003	L	2.17	0.41	7.9	536.301	0.77	-0.89
2003-0336	I1-I3	5-Aug-03	late	2003	S	0.704	0.2	8.2	419.856	-0.35	-1.63
2003-0338	I2-I3	5-Aug-03	late	2003	S	1.249	0.01	6.8	599.857	0.22	-5.03
2003-0343	I5-I6	5-Aug-03	late	2003	S	0.746	0.35	9.4	547.908	-0.29	-1.04
2003-0344	I6 HW in	5-Aug-03	late	2003	S	0.016	0.03	5.8	480.886	-4.12	-3.49
2003-0347	I6 West	5-Aug-03	late	2003	S	0.324	0.08	6.1	540.248	-1.13	-2.59
2003-0927	I1	5-Aug-03	late	2003	L	1.083	0.83	7.8	447.477	0.08	-0.19
2003-0929	I2	5-Aug-03	late	2003	L	1.01	0.75	5.8	579.176	0.01	-0.28
2003-0931	I3	5-Aug-03	late	2003	L	0.812	0.4	7.3	547.965	-0.21	-0.91
2003-0933	I4	5-Aug-03	late	2003	L	1.575	0.89	7.2	601.35	0.45	-0.12
2003-0937	I6 west HW	5-Aug-03	late	2003	L	1.434	0.49	6.5	431.071	0.36	-0.71
2003-0349	I7-I9	6-Aug-03	late	2003	S	0.682	0.15	8.6	508.807	-0.38	-1.88
2003-0350	I8 Headwaters	6-Aug-03	late	2003	S	0.418	0.11	4.7	509.424	-0.87	-2.2
2003-0351	I8 In	6-Aug-03	late	2003	S	0.527	0.1	4.6	.	-0.64	-2.28
2003-0352	I8 Out	6-Aug-03	late	2003	S	2.54	0.22	6.7	540.001	0.93	-1.51
2003-0353	I8-I9	6-Aug-03	late	2003	S	1.886	0.17	7.8	554.455	0.63	-1.79
2003-0354	MWL	6-Aug-03	late	2003	S	1.339	0.43	6.7	523.129	0.29	-0.86
2003-0356	Swamp In	6-Aug-03	late	2003	S	1.153	0.16	7.5	637.414	0.14	-1.83
2003-0358	Toolik Inlet	6-Aug-03	late	2003	S	1.766	0.2	8.2	501.248	0.57	-1.6
2003-0935	I5	6-Aug-03	late	2003	L	2.27	0.84	9.1	552.195	0.82	-0.17
2003-0939	I6	6-Aug-03	late	2003	L	2.088	0.86	11.3	514.384	0.74	-0.15
2003-0941	I7	6-Aug-03	late	2003	L	2.456	0.78	10.1	507.847	0.9	-0.25
2003-0943	I8	6-Aug-03	late	2003	L	3.384	0.12	9.3	542.646	1.22	-2.11
2003-0945	Iswamp	6-Aug-03	late	2003	L	2.367	0.13	9.5	513.23	0.86	-2.04
2004-0158	I2-I3	22-Jun-04	early	2004	S	0.594	1.1	13.5	579.2	-0.52	0.09
2004-0156	I1-I3	22-Jun-04	early	2004	S	0.5	1.12	11.7	391.4	-0.69	0.11
2004-0170	I8 Headwaters	22-Jun-04	early	2004	S	0.238	0.48	10.4	324.8	-1.43	-0.74
2004-0667	I2	22-Jun-04	early	2004	L	0.144	1.05	16.1	490.7	-1.94	0.05
2004-0665	I1	22-Jun-04	early	2004	L	1.024	1.12	13.2	370.3	0.02	0.11
2004-0669	I3	22-Jun-04	early	2004	L	1.338	1.18	16.1	361.6	0.29	0.17
2004-0671	I4	22-Jun-04	early	2004	L	2.313	1.25	15.8	402.3	0.84	0.22
2004-0162	I5-I6	22-Jun-04	early	2004	S	0.277	0.58	14.1	473.1	-1.28	-0.55
2004-0164	I6 HW In	23-Jun-04	early	2004	S	1.875	0.98	9.6	340.3	0.63	-0.02
2004-0167	I6 West	22-Jun-04	early	2004	S	0.159	0.11	11.5	373.8	-1.84	-2.18
2004-0677	I6 HW	22-Jun-04	early	2004	L	0.104	0.73	15.6	344.8	-2.27	-0.31
2004-0161	I4-I5	22-Jun-04	early	2004	S	2.673	0.43	15.2	428.4	0.98	-0.85
2004-0673	I5	22-Jun-04	early	2004	L	0.586	1.34	14	487.9	-0.53	0.29
2004-0675	I6	23-Jun-04	early	2004	L	0.153	1.3	13.6	434.4	-1.88	0.26
2004-0679	I7	23-Jun-04	early	2004	L	0.43	0.8	17.9	426	-0.84	-0.23
2004-0171	I8 In	23-Jun-04	early	2004	S	0.22	0.34	13	325.3	-1.51	-1.09
2004-0172	I8 Out	23-Jun-04	early	2004	S	0.678	1.9	15.6	342.6	-0.39	0.64
2004-0683	I8	23-Jun-04	early	2004	L	2.193	2.49	15	322.4	0.79	0.91
2004-0681	I Swamp	23-Jun-04	early	2004	L	0.552	0.87	16.2	343	-0.59	-0.14
2004-0174	MWL	23-Jun-04	early	2004	S	0.044	0.22	10.4	314.1	-3.12	-1.51
2004-0176	Swamp In	23-Jun-04	early	2004	S	0.193	0.28	12.7	360.9	-1.65	-1.26
2004-0169	I7-I9	23-Jun-04	early	2004	S	0.45	0.42	17.6	353.7	-0.8	-0.87
2004-0173	I8-I9	23-Jun-04	early	2004	S	0.368	0.57	17.3	288.9	-1	-0.56
2004-0178	Toolik Inlet	23-Jun-04	early	2004	S	0.022	0.36	14.5	274.6	-3.83	-1.03

Sortchem	Site	Date	Season	Year	water type	BP (ug C/L/d)	chla (ug/L)	Temp (deg C)	DOC (uM)	ln (BP)	ln(Chla)
2004-0324	I2-I3	13-Jul-04	mid	2004	S	0.148	0.46	10.8	584	-1.91	-0.78
2004-0322	I1-I3	13-Jul-04	mid	2004	S	0.059	0.51	11.9	389.2	-2.82	-0.68
2004-0336	I8 Headwaters	13-Jul-04	mid	2004	S	0.122	0.05	6.9	584.1	-2.1	-3.01
2004-1135	I2	13-Jul-04	mid	2004	L	0.501	0.81	12.5	539.7	-0.69	-0.21
2004-1133	I1	13-Jul-04	mid	2004	L	0.208	0.74	12.9	413.7	-1.57	-0.31
2004-1137	I3	13-Jul-04	mid	2004	L	0.158	0.62	13	591.5	-1.84	-0.48
2004-1139	I4	13-Jul-04	mid	2004	L	0.339	1.09	13.2	521.4	-1.08	0.08
2004-0329	I5-I6	13-Jul-04	mid	2004	S	0.313	0.33	14.3	495.3	-1.16	-1.11
2004-0333	I6 West	13-Jul-04	mid	2004	S	0.028	0.1	10.1	611.3	-3.57	-2.28
2004-0330	I6 HW In	13-Jul-04	mid	2004	S	0.18	0.09	10.6	514.4	-1.71	-2.4
2004-1143	I6 HW	13-Jul-04	mid	2004	L	1.249	0.47	13.6	377.5	0.22	-0.75
2004-0327	I4-I5	13-Jul-04	mid	2004	S	1.95	0.4	13.5	524.1	0.67	-0.91
2004-1141	I5	13-Jul-04	mid	2004	L	0.511	0.85	13.6	490.6	-0.67	-0.16
2004-1145	I6	14-Jul-04	mid	2004	L	0.137	0.81	13.3	465.4	-1.99	-0.22
2004-1147	I7	14-Jul-04	mid	2004	L	0.76	0.98	13.1	459.2	-0.27	-0.02
2004-0337	I8 In	14-Jul-04	mid	2004	S	0.118	0.08	10.4	554.1	-2.13	-2.55
2004-0338	I8 Out	14-Jul-04	mid	2004	S	1.307	0.29	11.8	630.1	0.27	-1.23
2004-1149	I8	14-Jul-04	mid	2004	L	0.677	1.8	11.2	629.5	-0.39	0.59
2004-0342	Swamp In	14-Jul-04	mid	2004	S	0.405	0.27	14.9	458.1	-0.9	-1.33
2004-1151	I Swamp	14-Jul-04	mid	2004	L	0.362	0.87	12.8	477.4	-1.02	-0.15
2004-0335	I7-I9	14-Jul-04	mid	2004	S	0.157	0.29	14.4	494.1	-1.85	-1.24
2004-0339	I8-I9	14-Jul-04	mid	2004	S	0.21	0.43	12.3	617.4	-1.56	-0.85
2004-0340	MWL	14-Jul-04	mid	2004	S	0.124	0.06	10.2	507.6	-2.09	-2.83
2004-0344	Toolik Inlet	14-Jul-04	mid	2004	S	0.277	0.54	13.4	519.5	-1.28	-0.61
2004-0490	I2-I3	3-Aug-04	late	2004	S	0.44	0.44	9.1	670.9	-0.82	-0.82
2004-0488	I1-I3	3-Aug-04	late	2004	S	0.488	0.26	10.3	444.6	-0.72	-1.34
2004-0502	I8 Headwaters	3-Aug-04	late	2004	S	0.107	0.26	5.5	669.7	-2.24	-1.35
2004-1356	I2	3-Aug-04	late	2004	L	0.908	1.12	10.7	658.1	-0.1	0.12
2004-1354	I1	3-Aug-04	late	2004	L	0.556	1.17	11.7	525.7	-0.59	0.16
2004-1358	I3	3-Aug-04	late	2004	L	0.174	0.78	9.8	668	-1.75	-0.25
2004-1360	I4	3-Aug-04	late	2004	L	0.712	0.69	10.6	561.1	-0.34	-0.37
2004-0495	I5-I6	3-Aug-04	late	2004	S	0.834	1.09	11.7	567.9	-0.18	0.08
2004-0499	I6 West	3-Aug-04	late	2004	S	0.459	0.06	8.3	701.4	-0.78	-2.78
2004-0496	I6 HW In	3-Aug-04	late	2004	S	0.141	0.12	7.9	543.8	-1.96	-2.12
2004-1362	I6 HW	3-Aug-04	late	2004	L	0.451	1.68	11.7	672.1	-0.8	0.52
2004-0493	I4-I5	3-Aug-04	late	2004	S	4.08	1.5	12.7	677	1.41	0.4
2004-1364	I5	4-Aug-04	late	2004	L	0.333	1.18	11	627.2	-1.1	0.17
2004-1366	I6	4-Aug-04	late	2004	L	0.197	1.22	11	606.2	-1.62	0.2
2004-1368	I7	4-Aug-04	late	2004	L	0.485	1.37	11.4	587	-0.72	0.32
2004-0503	I8 In	4-Aug-04	late	2004	S	0.068	0.1	10.5	659.3	-2.68	-2.28
2004-0504	I8 Out	4-Aug-04	late	2004	S	1.44	0.65	8.5	638.2	0.36	-0.43
2004-1370	I8	4-Aug-04	late	2004	L	0.519	0.65	8.4	733.2	-0.66	-0.43
2004-0508	Swamp In	4-Aug-04	late	2004	S	0.486	1.04	14.4	502.4	-0.72	0.04
2004-1372	Iswamp	4-Aug-04	late	2004	L	0.482	0.83	10.9	658.7	-0.73	-0.18
2004-0501	I7-I9	4-Aug-04	late	2004	S	0.11	0.75	13	604.5	-2.21	-0.29
2004-0505	I8-I9	4-Aug-04	late	2004	S	3.015	0.49	9.4	625.7	1.1	-0.71
2004-0506	MWL	4-Aug-04	late	2004	S	0.143	0.18	10.8	512.3	-1.95	-1.73
2004-0510	Toolik Inlet	4-Aug-04	late	2004	S	0.441	0.5	10.7	597.2	-0.82	-0.69

Sortchem	Site	Date	Season	Year	water type	BP (ug C/L/d)	chla (ug/L)	Temp (deg C)	DOC (uM)	ln (BP)	ln(Chla)
2005-0252	I1-I3	28-Jun-05	early	2005	S	0.704	0.23	11.4	358	-0.35	-1.45
2005-0254	I2-I3	28-Jun-05	early	2005	S	0.385	0.32	11.8	503.2	-0.95	-1.14
2005-0266	I8 HW	28-Jun-05	early	2005	S	1.458	0.26	13.3	334.5	0.38	-1.34
2005-0886	I2	28-Jun-05	early	2005	L	0.404	0.57	11.7	500.6	-0.91	-0.56
2005-0884	I1	28-Jun-05	early	2005	L	0.621	0.53	14.7	387.9	-0.48	-0.63
2005-0888	I3	28-Jun-05	early	2005	L	0.797	0.74	16.2	452.7	-0.23	-0.3
2005-0890	I4	28-Jun-05	early	2005	L	1.241	0.98	16.9	485.5	0.22	-0.02
2005-0259	I5-I6	28-Jun-05	early	2005	S	0.612	1.76	16.2	447.6	-0.49	0.56
2005-0896	I6 HW	28-Jun-05	early	2005	L	0.505	0.47	15.7	375.9	-0.68	-0.76
2005-0257	I4-I5	28-Jun-05	early	2005	S	0.505	0.82	17.4	445.8	-0.68	-0.2
2005-0892	I5	28-Jun-05	early	2005	L	0.437	0.65	15.8	502.2	-0.83	-0.43
2005-0894	I6	29-Jun-05	early	2005	L	1.298	0.45	16.1	439.1	0.26	-0.8
2005-0898	I7	29-Jun-05	early	2005	L	1.096	0.47	17.1	429.7	0.09	-0.76
2005-0267	I8 in	29-Jun-05	early	2005	S	21.977	0.25	18	296.4	3.09	-1.4
2005-0900	I8	29-Jun-05	early	2005	L	3.485	0.98	17.1	409.6	1.25	-0.02
2005-0268	I8 out	29-Jun-05	early	2005	S	2.384	0.41	18.4	400	0.87	-0.88
2005-0272	I swamp in	29-Jun-05	early	2005	S	0.099	0.13	17.8	382	-2.31	-2.04
2005-0902	I swamp	29-Jun-05	early	2005	L	0.707	0.73	17.5	377.7	-0.35	-0.31
2005-0265	I7-I9	29-Jun-05	early	2005	S	1.497	0.12	19.7	391.3	0.4	-2.11
2005-0269	I8-I9	29-Jun-05	early	2005	S	1.063	1.65	20.8	294.5	0.06	0.5
2005-0270	MWL	29-Jun-05	early	2005	S	0.337	0.36	14.5	275	-1.09	-1.03
2005-0274	Toolik Inlet	29-Jun-05	early	2005	S	3.172	0.26	19.4	264.6	1.15	-1.36
2005-0421	I1-I3	19-Jul-05	mid	2005	S	0.112	0.49	11.1	381.4	-2.19	-0.71
2005-0423	I2-I3	19-Jul-05	mid	2005	S	0.309	0.73	11.5	565.8	-1.18	-0.31
2005-0435	I8 Headwaters	19-Jul-05	mid	2005	S	0.19	0.18	6.7	473.2	-1.66	-1.72
2005-1150	I2	19-Jul-05	mid	2005	L	0.288	0.63	13.7	526.8	-1.24	-0.46
2005-1148	I1	19-Jul-05	mid	2005	L	0.113	0.54	13.6	399.6	-2.18	-0.62
2005-1152	I3	19-Jul-05	mid	2005	L	1.367	0.61	13.9	515.1	0.31	-0.49
2005-1154	I4	19-Jul-05	mid	2005	L	0.237	1.05	14.4	593.5	-1.44	0.05
2005-0428	I5-I6	19-Jul-05	mid	2005	S	0.169	0.36	14.3	498.5	-1.78	-1.01
2005-0432	I6 West	19-Jul-05	mid	2005	S	0.199	0.14	9.2	474.9	-1.62	-1.98
2005-0429	I6 HW In	19-Jul-05	mid	2005	S	0.033	0.32	10.3	467.9	-3.41	-1.15
2005-1587	I6 HW	19-Jul-05	mid	2005	L	0.313	0.54	13.8	427.5	-1.16	-0.62
2005-0426	I4-I5	19-Jul-05	mid	2005	S	1.229	0.65	15.1	536.6	0.21	-0.43
2005-1157	I5	19-Jul-05	mid	2005	L	2.087	0.74	14.1	500.1	0.74	-0.3
2005-1403	I6	20-Jul-05	mid	2005	L	1.178	0.45	13.3	460.6	0.16	-0.8
2005-1405	I7	20-Jul-05	mid	2005	L	0.802	0.9	13.3	445.9	-0.22	-0.11
2005-0436	I8 In	20-Jul-05	mid	2005	S	0.188	0.16	10.6	432.3	-1.67	-1.86
2005-1407	I8	20-Jul-05	mid	2005	L	0.101	1.3	12.3	550.7	-2.29	0.26
2005-0437	I8 Out	20-Jul-05	mid	2005	S	2.459	0.78	12.6	547.5	0.9	-0.24
2005-0441	I swamp In	20-Jul-05	mid	2005	S	0.114	0.25	13.7	420.3	-2.17	-1.39
2005-1409	I swamp	20-Jul-05	mid	2005	L	0.972	0.79	13.2	440.7	-0.03	-0.24
2005-0434	I7-I9	20-Jul-05	mid	2005	S	0.161	0.25	14.8	438.6	-1.83	-1.38
2005-0438	I8-I9	20-Jul-05	mid	2005	S	0.389	0.72	14.3	516.1	-0.94	-0.33
2005-0439	MWL	20-Jul-05	mid	2005	S	0.083	0.55	9.2	373.8	-2.49	-0.6
2005-0443	Toolik Inlet	20-Jul-05	mid	2005	S	0.163	0.75	13.9	458.1	-1.81	-0.29
2005-0578	I1-I3	9-Aug-05	late	2005	S	0.406	1.04	9.9	334.5	-0.9	0.04
2005-0580	I2-I3	9-Aug-05	late	2005	S	0.038	2.08	9.7	515.3	-3.26	0.73

Sortchem	Site	Date	Season	Year	water type	BP (ug C/L/d)	chla (ug/L)	Temp (deg C)	DOC (uM)	ln (BP)	ln(Chla)
2005-0592	I8 Headwaters	9-Aug-05	late	2005	S	0.189	0.5	10.4	308.6	-1.66	-0.7
2005-1417	I2	9-Aug-05	late	2005	L	0.3	0.95	11.6	522.6	-1.21	-0.05
2005-1415	I1	9-Aug-05	late	2005	L	0.906	0.99	12.6	397.7	-0.1	-0.01
2005-1419	I3	9-Aug-05	late	2005	L	0.621	1.35	12.8	519.6	-0.48	0.3
2005-1421	I4	9-Aug-05	late	2005	L	0.542	1.73	13.2	552.8	-0.61	0.55
2005-0585	I5-I6	9-Aug-05	late	2005	S	0.143	0.38	14.5	438.9	-1.95	-0.96
2005-0586	I6 HW In	9-Aug-05	late	2005	S	2.857	0.15	11.3	422.8	1.05	-1.88
2005-1413	I6 HW	9-Aug-05	late	2005	L	0.042	0.65	13.4	382.3	-3.18	-0.43
2005-0583	I4-I5	9-Aug-05	late	2005	S	0.255	1.24	15	486.5	-1.37	0.22
2005-1584	I5	9-Aug-05	late	2005	L	2.517	1.25	13.7	524.5	0.92	0.22
2005-1452	I6	10-Aug-05	late	2005	L	1.839	1.25	13.6	462	0.61	0.22
2005-1469	I7	10-Aug-05	late	2005	L	0.188	1.39	13.6	432.4	-1.67	0.33
2005-0593	I8 In	10-Aug-05	late	2005	S	0.381	0.25	13.3	288.7	-0.97	-1.39
2005-1471	I8	10-Aug-05	late	2005	L	3.426	1.74	13.8	503.6	1.23	0.55
2005-0594	I8 Out	10-Aug-05	late	2005	S	0.602	0.91	16.3	503.9	-0.51	-0.1
2005-0598	I swamp In	10-Aug-05	late	2005	S	0.41	0.26	14.4	319.5	-0.89	-1.34
2005-1473	I swamp	10-Aug-05	late	2005	L	1.573	1.54	14.2	394.5	0.45	0.43
2005-0591	I7-I9	10-Aug-05	late	2005	S	0.193	0.33	16.7	374.1	-1.64	-1.1
2005-0595	I8-I9	10-Aug-05	late	2005	S	0.772	0.63	17.4	411.8	-0.26	-0.46
2005-0596	MWL	10-Aug-05	late	2005	S	0.143	0.69	11.6	286.9	-1.94	-0.37
2005-0600	Toolik Inlet	10-Aug-05	late	2005	S	0.32	1.26	17.5	319.7	-1.14	0.23
2006-0110	I1 into I3	21-Jun-06	early	2006	S	0.418	0.69	7.3	425.8	-0.87	-0.37
2006-0112	I2 into I3	21-Jun-06	early	2006	S	0.213	0.47	11.2	531.8	-1.55	-0.75
2006-0124	I8 Headwaters	21-Jun-06	early	2006	S	0.393	0.15	7	737.6	-0.93	-1.88
2006-0693	I2	21-Jun-06	early	2006	L	0.169	0.95	4.8	523.8	-1.78	-0.05
2006-0691	I1	21-Jun-06	early	2006	L	0.122	0.91	6.1	384.1	-2.1	-0.09
2006-0695	I3	21-Jun-06	early	2006	L	0.667	0.95	11.4	543.9	-0.4	-0.05
2006-0697	I4	21-Jun-06	early	2006	L	0.173	4.23	10.3	572.1	-1.75	1.44
2006-0117	I5 into I6	21-Jun-06	early	2006	S	1.433	1.25	8.9	543.8	0.36	0.23
2006-0121	I6 Inlet West	21-Jun-06	early	2006	S	0.228	0.19	9.9	701.4	-1.48	-1.64
2006-0703	I6 HW	21-Jun-06	early	2006	L	1.074	1.46	9.1	429	0.07	0.38
2006-0118	I6 HW Inlet	21-Jun-06	early	2006	S	0.158	0.1	9.8	553.7	-1.84	-2.29
2006-0115	I4 into I5	21-Jun-06	early	2006	S	0.687	2.48	9.6	589	-0.38	0.91
2006-0699	I5	21-Jun-06	early	2006	L	1.289	4.07	7.7	533.1	0.25	1.4
2006-0701	I6	22-Jun-06	early	2006	L	0.204	1.26	8.8	754.3	-1.59	0.23
2006-0705	I7	22-Jun-06	early	2006	L	0.529	1.09	9.2	762.4	-0.64	0.09
2006-0125	I8 Inlet	22-Jun-06	early	2006	S	0.25	0.22	11.1	699.1	-1.39	-1.5
2006-0677	I8	22-Jun-06	early	2006	L	0.624	1.99	10.5	1011.7	-0.47	0.69
2006-0126	I8 Outlet	22-Jun-06	early	2006	S	2.201	1.64	10.7	711.5	0.79	0.5
2006-0130	I Swamp Inlet	22-Jun-06	early	2006	S	0.416	0.52	13.1	488.3	-0.88	-0.65
2006-0679	I Swamp	22-Jun-06	early	2006	L	1.655	0.52	11.3	822.1	0.5	-0.65
2006-0123	I7 into I9	22-Jun-06	early	2006	S	0.394	0.43	12.6	609.4	-0.93	-0.85
2006-0127	I8 into I9	22-Jun-06	early	2006	S	2.484	1.55	11.9	671.7	0.91	0.44
2006-0128	MWL	22-Jun-06	early	2006	S	0.095	0.31	10.1	579	-2.35	-1.17
2006-0132	Toolik Inlet	22-Jun-06	early	2006	S	1.131	3.18	12.2	608.1	0.12	1.16
2006-0291	I1 into I3	13-Jul-06	mid	2006	S	0.347	0.86	11.6	424.3	-1.06	-0.15
2006-0293	I2 into I3	13-Jul-06	mid	2006	S	0.465	0.63	12.4	581.9	-0.76	-0.46
2006-0305	I8 Headwaters	13-Jul-06	mid	2006	S	0.21	0.23	7.6	596.7	-1.56	-1.47

Sortchem	Site	Date	Season	Year	water type	BP (ug C/L/d)	chla (ug/L)	Temp (deg C)	DOC (uM)	ln (BP)	ln(Chla)
2006-0881	I2	13-Jul-06	mid	2006	L	0.056	0	12.7	553.4	-2.88	.
2006-0879	I1	13-Jul-06	mid	2006	L	1.076	0.88	13	416.5	0.07	-0.13
2006-0883	I3	13-Jul-06	mid	2006	L	0.882	0.82	13.6	525.4	-0.13	-0.2
2006-0885	I4	13-Jul-06	mid	2006	L	0.485	0.81	13.6	593.9	-0.72	-0.21
2006-0298	I5 into I6	13-Jul-06	mid	2006	S	1.215	0.47	13.7	532.4	0.19	-0.76
2006-0302	I6 Inlet West	13-Jul-06	mid	2006	S	0.106	1.11	9	495.3	-2.24	0.1
2006-0299	I6 HW Inlet	13-Jul-06	mid	2006	S	0.351	5.69	9.8	562.3	-1.05	1.74
2006-0891	I6 HW	13-Jul-06	mid	2006	L	0.8	1.11	13.6	443.4	-0.22	0.1
2006-0296	I4 into I5	13-Jul-06	mid	2006	S	0.783	0.65	14.8	603.6	-0.24	-0.44
2006-0887	I5	13-Jul-06	mid	2006	L	1.741	0.57	13.1	391.4	0.55	-0.56
2006-0889	I6	14-Jul-06	mid	2006	L	0.797	0.99	13.1	511.6	-0.23	-0.01
2006-0893	I7	14-Jul-06	mid	2006	L	0.366	0.96	13.4	553.6	-1	-0.04
2006-0306	I8 Inlet	14-Jul-06	mid	2006	S	0.206	0.41	9.7	557.9	-1.58	-0.89
2006-0895	I8	14-Jul-06	mid	2006	L	2.309	1.28	12.5	607.7	0.84	0.25
2006-0307	I8 Outlet	14-Jul-06	mid	2006	S	1.336	1.33	13.1	599.7	0.29	0.28
2006-0311	I Swamp Inlet	14-Jul-06	mid	2006	S	0.633	0.26	12.2	442.3	-0.46	-1.35
2006-0897	I Swamp	14-Jul-06	mid	2006	L	1.26	1.06	13.1	473.8	0.23	0.06
2006-0304	I7 into I9	14-Jul-06	mid	2006	S	0.91	0.3	13.8	469.6	-0.09	-1.2
2006-0308	I8 into I9	14-Jul-06	mid	2006	S	0.604	0.82	13.4	578.2	-0.5	-0.2
2006-0309	MWL	14-Jul-06	mid	2006	S	1.137	0.37	8.7	403.7	0.13	-0.99
2006-0313	Toolik Inlet	14-Jul-06	mid	2006	S	1.012	0.77	13	519.8	0.01	-0.26
2006-0488	I1 into I3	9-Aug-06	late	2006	S	0.578	1.13	9	435.1	-0.55	0.12
2006-0490	I2 into I3	9-Aug-06	late	2006	S	0.54	0.46	7.3	689.8	-0.62	-0.77
2006-0502	I8 Headwaters	9-Aug-06	late	2006	S	0.206	0.16	3.7	679.3	-1.58	-1.81
2006-1115	I2	9-Aug-06	late	2006	L	0.124	0.95	11.9	588.85	-2.09	-0.05
2006-1113	I1	9-Aug-06	late	2006	L	0.766	0.59	12.1	439.45	-0.27	-0.53
2006-1117	I3	9-Aug-06	late	2006	L	0.23	0.7	11.3	567.5	-1.47	-0.36
2006-1119	I4	9-Aug-06	late	2006	L	1.576	0.99	11.9	612	0.45	-0.01
2006-0495	I5 into I6	9-Aug-06	late	2006	S	0.568	1.04	13.1	573.4	-0.56	0.04
2006-0499	I6 Inlet West	9-Aug-06	late	2006	S	1.033	0.26	7.8	618.1	0.03	-1.36
2006-0496	I6 HW Inlet	9-Aug-06	late	2006	S	2.098	0.25	9.1	573.3	0.74	-1.38
2006-1125	I6 HW	9-Aug-06	late	2006	L	1.109	0.69	12.2	460	0.1	-0.37
2006-0493	I4 into I5	9-Aug-06	late	2006	S	1.789	2.23	11.8	646.9	0.58	0.8
2006-1121	I5	9-Aug-06	late	2006	L	2.384	0.65	12.4	561.25	0.87	-0.43
2006-1123	I6	10-Aug-06	late	2006	L	0.805	1.22	12	532.75	-0.22	0.2
2006-1127	I7	10-Aug-06	late	2006	L	0.527	1.2	11.9	517.8	-0.64	0.18
2006-0504	I8 Inlet	10-Aug-06	late	2006	S	0.283	1.83	8.5	592.4	-1.26	0.61
2006-1129	I8	10-Aug-06	late	2006	L	1.837	0.55	10.6	569.7	0.61	-0.6
2006-0503	I8 Outlet	10-Aug-06	late	2006	S	0.995	0.54	10.8	565.9	-0.01	-0.61
2006-0508	I Swamp Inlet	10-Aug-06	late	2006	S	0.661	0.59	11	484.6	-0.41	-0.53
2006-1131	I Swamp	10-Aug-06	late	2006	L	0.444	1.35	10.3	594.9	-0.81	0.3
2006-0501	I7 into I9	10-Aug-06	late	2006	S	0.207	0.33	10.8	585.6	-1.57	-1.1
2006-0505	I8 into I9	10-Aug-06	late	2006	S	1.188	1.31	10.7	553.2	0.17	0.27
2006-0506	MWL	10-Aug-06	late	2006	S	1.257	0.47	7.5	423.2	0.23	-0.75
2006-0510	Toolik Inlet	10-Aug-06	late	2006	S	1.689	1.12	10.7	546.4	0.52	0.12

Appendix E. Data for Chapter 5 model.

Date	order	Site[]	temp[]	BP[]	TDN[]	chlalower[]	chlaupper[]	TDP[]	DOC[]	chla[]	NO3[]	NH4[]	PO4[]
21-Jun-03	1	1	14.1	0.34	22.2	0.001	2.5	0.07	407.8	NA	1.36	0	0.24
25-Jun-03	2	1	16	0.14	41.3	0.13	0.15	0.11	524.5	0.14	1.42	0.24	0.01
1-Jul-03	3	1	14.5	0.73	28.6	0.001	2.5	0.10	362.3	NA	2.14	0.32	0.07
5-Jul-03	4	1	11.8	2.22	27.9	0.001	2.5	0.10	590.6	NA	0.83	0.05	0.04
10-Jul-03	5	1	11.9	1.87	23.6	0.001	2.5	0.14	576	NA	0.99	0.99	0.06
16-Jul-03	6	1	3.8	0.61	19.5	0.07	0.09	0.08	624.4	0.08	0.33	0.09	0.02
22-Jul-03	7	1	13	1.52	22.3	0.001	2.5	0.08	485	NA	0.34	0.19	0.04
29-Jul-03	8	1	7.8	1.42	18.7	0.001	2.5	*0.09*	573.2	NA	NA	NA	.
31-Jul-03	9	1	4.8	0.42	23.6	0.001	2.5	0.10	544.7	NA	0.55	0.13	0.04
5-Aug-03	10	1	6.5	0.53	29.3	0.08	0.1	0.07	1296.7	0.09	0.5	0.16	0.07
12-Aug-03	11	1	3.3	1.33	16.9	0.001	2.5	0.09	642.9	NA	0.31	1.98	0.10
23-Jun-04	12	1	13	1.42	16.3	0.26	0.28	0.05	325.3	0.27	4.6	0.08	0.02
29-Jun-04	13	1	13.4	2.81	14	0.55	0.57	0.04	298.8	0.56	4.48	0.09	0.04
5-Jul-04	14	1	12.2	4.37	13.6	0.16	0.18	0.02	267.8	0.17	5.94	0.01	0.02
14-Jul-04	15	1	10.4	1.82	12.4	0.05	0.07	0.08	554.1	0.06	1.02	0.15	0.04
19-Jul-04	16	1	8.3	6.08	17.9	0.3	0.32	0.09	709.1	0.31	0.27	0.41	0.04
28-Jul-04	17	1	9.8	2.98	15.8	0.28	0.3	0.06	457.4	0.29	0.93	0.19	0.03
4-Aug-04	18	1	10.5	1.7	12.6	0.05	0.07	0.06	659.3	0.06	0.27	0.24	0.05
9-Aug-04	19	1	11.2	9.02	11.7	0.12	0.14	0.06	567.2	0.13	0.76	0.13	0.03
16-Aug-04	20	1	10.4	3.36	14.4	0.15	0.17	0.06	720.4	0.16	0.53	0.54	0.04
21-Jun-05	21	1	11.3	2.17	12.8	0.17	0.19	0.10	314.8	0.18	5.16	0.05	0.04
5-Jul-05	22	1	7	1.25	14.1	0.2	0.22	0.09	268.6	0.21	7.15	0.05	0.04
7-Jul-05	23	1	7.3	4.31	19.8	0.001	2.5	0.20	757.8	NA	1.94	0.23	0.04
9-Jul-05	24	1	7.2	1.69	16.7	0.17	0.19	0.16	616.6	0.18	2.01	0.25	0.02
12-Jul-05	25	1	4.7	1.7	17.7	0.08	0.1	0.17	707.1	0.09	0.79	0.65	0.04
20-Jul-05	26	1	10.6	0.59	13.4	0.05	0.07	0.11	432.3	0.06	1.58	0.25	0.05
26-Jul-05	27	1	11.2	1.42	12	0.09	0.11	0.10	354.6	0.1	3.33	0.09	0.05
28-Jul-05	28	1	11	1.79	13	0.89	0.91	0.11	351.4	0.9	3.57	0.39	0.04
30-Jul-05	29	1	8	0.79	11.8	0.13	0.15	0.06	335.8	0.14	3.88	0.07	0.04
2-Aug-05	30	1	9	1.59	11.3	0.27	0.29	0.13	314.5	0.28	4.75	0.11	0.04
10-Aug-05	31	1	13.3	1.52	16.4	0.15	0.17	0.08	288.7	0.16	6.51	0.44	0.00
15-Aug-05	32	1	9.8	1.84	14.9	0.3	0.32	0.07	300.7	0.31	7.1	0.34	0.07
22-Jun-06	33	1	9.3	1.38	18	0.21	0.23	0.13	699.1	0.22	1.18	0	0.04
27-Jun-06	34	1	7.8	2.14	18.8	0.35	0.37	0.12	778.7	0.36	0.83	0.53	0.03
30-Jun-06	35	1	9	1.41	16.6	0.8	0.82	0.15	619.9	0.81	1.45	0.22	0.03
7-Jul-06	36	1	7.8	1.57	15.2	0.31	0.33	0.10	561.3	0.32	1.35	0	0.04
14-Jul-06	37	1	9.7	1.64	16.5	0.4	0.42	0.09	557.9	0.41	1.39	0	0.04
18-Jul-06	38	1	10.1	1.04	14.1	0.4	0.42	0.15	463.8	0.41	2.54	0.47	0.04
21-Jul-06	39	1	8.3	1.42	17.1	0.42	0.44	0.13	529.4	0.43	1.88	0.09	0.11
28-Jul-06	40	1	11	3.32	16.9	0.27	0.29	0.14	545.4	0.28	1.83	0.32	0.03
1-Aug-06	41	1	10.1	0.68	15.1	0.9	0.92	0.08	473.15	0.91	2.71	0	0.03
3-Aug-06	42	1	12.1	2.15	15.5	0.64	0.66	0.07	458.05	0.65	2.94	0.29	0.04
4-Aug-06	43	1	9.2	0.99	17.6	0.13	0.15	0.15	472.1	0.14	2.49	0.09	0.10
10-Aug-06	44	1	8.5	1.54	16.6	1.82	1.84	0.13	592.4	1.83	1.59	0.47	0.04
16-Jun-07	45	1	14	3.81	16.1	0.23	0.25	0.15	332.2	0.24	7.62	0.61	0.26
21-Jun-07	46	1	13.5	2.56	20.6	0.08	0.1	0.09	441.9	0.09	11.73	0.11	0.05
29-Jun-07	47	1	13.3	1.77	24.9	0.3	0.32	0.08	474.8	0.31	19	0	0.05

Date	order	Site[]	temp[]	BP[]	TDN[]	chlalower[]	chlaupper[]	TDP[]	DOC[]	chla[]	NO3[]	NH4[]	PO4[]
2-Jul-07	48	1	17.6	7.15	22.7	0.33	0.35	0.08	402.4	0.34	14.34	3.89	0.12
4-Jul-07	49	1	13.9	2.69	21.1	0.22	0.24	0.08	363.3	0.23	13.82	0.35	0.02
11-Jul-07	50	1	14.8	1.44	16.1	0.19	0.21	0.05	414.7	0.2	10.68	0.06	0.05
20-Jul-07	51	1	13.5	3.03	15.4	0.57	0.59	0.12	431.9	0.58	4.25	0	0.06
27-Jul-07	52	1	11.9	1.71	14.5	0.03	0.05	0.07	461.1	0.04	5.94	0.54	0.02
3-Aug-07	53	1	10.8	2.33	17.3	0.12	0.14	0.15	630.2	0.13	1.42	0.69	0.07
8-Aug-07	54	1	7.8	0.66	16.4	0.21	0.23	0.12	690.2	0.22	0.95	0.62	0.04
21-Jun-03	55	2	6.5	2.89	78.8	0.001	2.5	0.16	635.2	NA	0.73	0	0.33
25-Jun-03	56	2	14	0.52	31.1	1.43	1.45	0.12	461.3	1.44	0.12	0	0.02
1-Jul-03	57	2	15.2	1.28	22.4	0.001	2.5	0.13	389.9	NA	0.04	0.38	0.04
5-Jul-03	58	2	14.4	7.77	24.6	0.001	2.5	0.10	495.8	NA	0.05	0.03	0.02
10-Jul-03	59	2	13.5	8.91	25.1	0.001	2.5	0.10	543.7	NA	0.03	0.07	0.06
16-Jul-03	60	2	7.8	4.27	21.6	0.001	0.01	0.10	561.3	0	0.2	0.09	0.04
22-Jul-03	61	2	14.7	5.3	16.3	0.001	2.5	0.08	528.7	NA	0.13	0.16	0.02
29-Jul-03	62	2	7.4	5.13	19	0.001	2.5	*0.08*	593.2	NA	NA	NA	.
31-Jul-03	63	2	6.4	3.39	19.2	0.001	2.5	0.08	577	NA	0.44	0.07	0.06
5-Aug-03	64	2	7.7	2.54	28.9	0.23	0.25	0.08	541.5	0.24	0.45	0.08	0.04
12-Aug-03	65	2	5.8	2.95	14	0.001	2.5	0.08	565	NA	0.4	1.52	0.08
23-Jun-04	66	2	15.6	5.31	11.1	1.38	1.4	0.08	342.6	1.39	0.42	0.26	0.02
29-Jun-04	67	2	17.5	12.02	11.1	0.41	0.43	0.06	323.9	0.42	0.27	0.3	0.04
5-Jul-04	68	2	17.8	11.61	12.3	0.5	0.52	0.05	317.5	0.51	0.97	0.67	0.04
14-Jul-04	69	2	11.8	12.34	11.4	0.25	0.27	0.08	630.1	0.26	0.23	0.14	0.03
19-Jul-04	70	2	11.5	13.64	15.2	1.39	1.41	0.06	603.1	1.4	0.31	0.43	0.03
28-Jul-04	71	2	13.9	6.23	16.1	0.61	0.63	0.06	551.1	0.62	0.12	0.14	0.02
4-Aug-04	72	2	8.5	6.56	13.6	0.47	0.49	0.88	638.2	0.48	0.26	0.18	0.04
9-Aug-04	73	2	11.5	12.28	13.6	0.55	0.57	0.06	644.2	0.56	0.23	0.12	0.03
16-Aug-04	74	2	13	10.38	12.8	1.03	1.05	0.05	690	1.04	0.18	0.23	0.04
21-Jun-05	75	2	12.4	10.58	10.6	1.79	1.81	0.15	397.6	1.8	0.32	0.3	0.05
29-Jun-05	76	2	18.4	11.9	11.4	0.19	0.21	0.14	400	0.2	0.43	0.48	0.03
5-Jul-05	77	2	12.3	7.19	13.7	0.38	0.4	0.12	388.7	0.39	0.52	0.49	0.04
7-Jul-05	78	2	12	13.99	10.7	0.53	0.55	0.11	396.3	0.54	0.28	0.12	0.04
9-Jul-05	79	2	10.6	11.45	12.2	0.79	0.81	0.16	458.8	0.8	0.51	0.25	0.03
12-Jul-05	80	2	9.2	6.99	13.2	0.76	0.78	0.12	515.4	0.77	0.7	0.37	0.02
20-Jul-05	81	2	12.6	5.88	16.9	0.51	0.53	0.12	547.5	0.52	0.24	0.14	0.05
26-Jul-05	82	2	14.6	6.38	12.3	0.74	0.76	0.11	527.9	0.75	0.16	0.2	0.04
28-Jul-05	83	2	14.4	10.62	12.9	0.96	0.98	0.14	522.4	0.97	0.14	0.48	0.05
30-Jul-05	84	2	13.7	3.79	13.1	1.21	1.23	0.10	524.5	1.22	0.16	0.19	0.04
2-Aug-05	85	2	13.2	7.39	12.1	1.07	1.09	0.15	512.9	1.08	0	0.42	0.06
10-Aug-05	86	2	16.3	5.85	16.4	0.6	0.62	0.13	503.9	0.61	0.2	0.28	0.00
15-Aug-05	87	2	15.1	9.65	12.6	0.001	2.5	0.12	502.5	NA	0.23	0.26	0.06
22-Jun-06	88	2	10.8	6.1	16.9	1.63	1.65	0.17	711.5	1.64	0.07	0	0.03
27-Jun-06	89	2	11.6	2.62	15.6	2.48	2.5	0.11	697.3	2.49	0.15	NA	0.03
30-Jun-06	90	2	11.6	9.15	16.7	2.34	2.36	0.17	689.6	2.35	0.05	0	0.02
7-Jul-06	91	2	10.7	7.05	15.7	0.85	0.87	0.12	649.4	0.86	0.13	0	0.03
14-Jul-06	92	2	13.1	11.03	15.2	1.32	1.34	0.11	599.7	1.33	0.03	0	0.04
18-Jul-06	93	2	12.4	2.92	12.9	2.09	2.11	0.13	575.4	2.1	0.06	0.26	0.02
21-Jul-06	94	2	11.6	9.41	14.7	1.71	1.73	0.12	565.4	1.72	0.32	0.02	0.09
28-Jul-06	95	2	13.7	13.65	15.4	0.79	0.81	0.13	605	0.8	0.27	0.32	0.03

Date	order	Site[]	temp[]	BP[]	TDN[]	chlalower[]	chlaupper[]	TDP[]	DOC[]	chla[]	NO3[]	NH4[]	PO4[]
1-Aug-06	96	2	12.6	4.72	14	1.51	1.53	0.09	586.75	1.52	0.34	0.12	0.02
3-Aug-06	97	2	12.8	11.18	15.2	2.09	2.11	0.07	574.2	2.1	0.29	0	0.03
4-Aug-06	98	2	13.2	4.17	14.9	0.89	0.91	0.12	572.7	0.9	0.14	0.02	0.07
10-Aug-06	99	2	10.8	5.57	14.9	0.53	0.55	0.12	565.9	0.54	0.43	0.21	0.10
16-Jun-07	100	2	11.7	4.64	11.9	2.23	2.25	0.16	451.2	2.24	0.16	0.19	0.10
21-Jun-07	101	2	15.9	5.19	12.8	1.09	1.11	0.13	420.5	1.1	0.08	0.22	0.05
29-Jun-07	102	2	15.7	8.35	11.4	0.93	0.95	0.11	398.4	0.94	0.11	0.05	0.04
2-Jul-07	103	2	16.8	15.39	14	0.55	0.57	0.11	442.4	0.56	0.27	0.06	0.10
4-Jul-07	104	2	18.4	2.68	12.1	0.33	0.35	0.11	393.5	0.34	0.46	0.67	0.04
11-Jul-07	105	2	18.2	2.38	14.7	2.01	2.03	0.08	452.2	2.02	0.09	0.04	0.08
20-Jul-07	106	2	16.9	12.11	10.7	1	1.02	0.10	444.7	1.01	0.11	0	0.05
27-Jul-07	107	2	16.9	11.86	10.8	2.05	2.07	0.10	463.7	2.06	0.08	0.34	0.03
3-Aug-07	108	2	15.1	4.69	13.2	1.09	1.11	0.13	459.6	1.1	0.07	0.73	0.03
8-Aug-07	109	2	10.4	3.97	14.4	0.73	0.75	1.83	605.9	0.74	0.29	0.29	0.03
20-Jun-03	110	3	10.5	2.21	32.9	0.001	2.5	0.11	427.4	NA	1.07	0	0.03
25-Jun-03	111	3	13.8	0.61	101.6	0.25	0.27	0.10	708.4	0.26	1.92	0	0.02
27-Jun-03	112	3	15.4	1.73	15.9	0.001	2.5	0.07	322.7	NA	2.39	0.29	0.02
4-Jul-03	113	3	12.4	6.45	15.6	0.001	2.5	0.10	371.9	NA	0.55	0.1	0.04
11-Jul-03	114	3	12.2	7.85	21.9	0.001	2.5	0.16	523.4	NA	0.43	0.27	0.06
16-Jul-03	115	3	8	2.68	22.6	0.3	0.32	0.14	565.9	0.31	0.3	0.15	0.03
25-Jul-03	116	3	10.6	2.91	20.2	0.001	2.5	0.07	503.1	NA	0.79	0.07	0.05
1-Aug-03	117	3	6.4	5.78	0	0.001	2.5	0.06	49.5	NA	0.63	0.08	0.04
5-Aug-03	118	3	8.1	1.89	21.2	0.27	0.29	0.08	555.9	0.28	0.56	0.03	0.06
15-Aug-03	119	3	6.1	4.22	23.6	0.001	2.5	0.12	564.4	NA	0.66	0.09	0.06
18-Jun-04	120	3	15.4	3.31	10.4	0.36	0.38	0.05	286.7	0.37	2.71	0.15	0.04
23-Jun-04	121	3	17.3	2.14	10.5	0.41	0.43	0.04	288.9	0.42	3.62	0.07	0.02
2-Jul-04	122	3	17	3.74	11.6	0.65	0.67	0.04	262.1	0.66	3.79	0.2	0.03
9-Jul-04	123	3	12.6	0.63	9.6	1.51	1.53	0.07	319.5	1.52	0.68	0.09	0.03
14-Jul-04	124	3	12.3	4.61	12.8	0.36	0.38	0.10	617.4	0.37	0.34	0.12	0.06
23-Jul-04	125	3	12.6	11.7	12.3	0.001	2.5	0.06	974.9	NA	0.58	0.11	0.04
30-Jul-04	126	3	12.5	7.57	10.5	0.38	0.4	0.06	538.8	0.39	0.53	0.18	0.03
4-Aug-04	127	3	9.4	12.87	13.5	0.35	0.37	0.06	625.7	0.36	0.28	0.16	0.04
6-Aug-04	128	3	10.9	7.21	11.3	0.36	0.38	0.08	575.2	0.37	0.39	0.34	0.06
13-Aug-04	129	3	12.1	7.51	19.3	0.78	0.8	0.07	521.6	0.79	1.14	0.17	0.04
24-Jun-05	130	3	12.5	2.68	14.9	0.001	2.5	0.10	300.2	NA	7.86	0.1	0.06
29-Jun-05	131	3	20.8	14	18.8	1.44	1.46	0.09	294.5	1.45	12.04	0.38	0.04
1-Jul-05	132	3	11.9	0.48	17.5	0.001	2.5	0.09	287.1	NA	11	0.16	0.05
8-Jul-05	133	3	11.9	12.43	10.5	0.001	2.5	0.13	394.6	NA	0.46	0.17	0.09
15-Jul-05	134	3	11.3	9.73	14.8	0.001	2.5	0.12	571.9	NA	0.41	0.2	0.00
20-Jul-05	135	3	14.3	3.72	14.1	0.51	0.53	0.11	516.1	0.52	1.15	0.12	0.04
22-Jul-05	136	3	12.7	4.48	14.5	0.001	2.5	0.12	498.2	NA	1.67	0.17	0.05
29-Jul-05	137	3	10.5	1.55	14.7	0.001	2.5	0.11	450.1	NA	3.06	0.19	0.05
5-Aug-05	138	3	10.9	1.76	12.1	0.001	2.5	0.09	417.5	NA	2.89	0.26	0.05
10-Aug-05	139	3	17.4	2.44	12.1	0.47	0.49	0.13	411.8	0.48	3.31	0.06	0.00
12-Aug-05	140	3	12.4	1.06	13	0.001	2.5	0.10	405	NA	2.69	0.18	0.03
22-Jun-06	141	3	11.9	2.99	15	1.54	1.56	0.14	671.7	1.55	0.21	0	0.03
30-Jun-06	142	3	11.9	4.99	16.4	1.33	1.35	0.13	666.1	1.34	0.36	0.15	0.03
7-Jul-06	143	3	10.7	5.08	15.5	0.87	0.89	0.11	642	0.88	0.53	0	0.03

Date	order	Site[]	temp[]	BP[]	TDN[]	chlalower[]	chlaupper[]	TDP[]	DOC[]	chla[]	NO3[]	NH4[]	PO4[]
14-Jul-06	144	3	13.4	4.24	14.3	0.81	0.83	0.10	578.2	0.82	0.54	0	0.03
21-Jul-06	145	3	11	7.09	15.2	1.66	1.68	0.12	548.8	1.67	0.69	0.03	0.13
28-Jul-06	146	3	14.5	9.19	15.4	1.11	1.13	0.14	577.3	1.12	0.74	0.18	0.04
4-Aug-06	147	3	13.2	2.75	18.8	0.61	0.63	0.13	547.4	0.62	1.13	0.22	0.03
10-Aug-06	148	3	10.7	4.09	14.8	1.3	1.32	0.11	553.2	1.31	0.75	0.18	0.04
16-Jun-07	149	3	13.9	2.77	14.8	1.23	1.25	0.17	353	1.24	6.2	0.44	0.04
21-Jun-07	150	3	17.8	4.5	17.6	0.09	0.11	0.11	332.5	0.1	9.41	0.45	0.11
27-Jun-07	151	3	13.2	1.48	15.6	0.54	0.56	0.10	367.7	0.55	7.22	0.18	0.03
29-Jun-07	152	3	15.4	2.08	15.6	0.17	0.19	0.06	357.9	0.18	5.99	0.11	0.04
2-Jul-07	153	3	16.3	0.89	15.9	0.2	0.22	0.07	314.6	0.21	8.09	0.34	0.09
6-Jul-07	154	3	16.2	1.97	17.7	0.3	0.32	0.05	300.4	0.31	11.68	0.5	0.08
11-Jul-07	155	3	19.8	7.54	19	0.23	0.25	0.05	307.4	0.24	12.63	0.28	0.08
20-Jul-07	156	3	17.8	6.95	12.4	0.63	0.65	0.11	460	0.64	0.91	0	0.04
27-Jul-07	157	3	14.8	1.89	11.3	0.34	0.36	0.10	409.5	0.35	3.7	0	0.02
3-Aug-07	158	3	15.6	9.33	11.1	0.97	0.99	0.10	439.2	0.98	0.25	0.39	0.02
8-Aug-07	159	3	11.4	5.77	14.3	0.49	0.51	0.08	548.1	0.5	0.39	0.63	0.02

Appendix F. Community Fingerprinting presence-absence data

	I8 1m 6 Aug 03	I8 out 6 Aug 03	I8 out 21 Jun 03	I8 in 25 Jun 03	I8 out 25 Jun 03	I8 in 1 Jul 03	I8 out 1 Jul 03	I8 1m 6 Aug 03	I8 in 5 Jul 03	I8 1m 5 Jul 03	I8 3m 5 Jul 03	I8 7m 5 Jul 03	I8 out 5 Jul 03	I8 in 10 Jul 03	I8 1m 6 Aug 03	I8 out 10 Jul 03	I8 in 16 Jul 03	I8 out 16 Jul 03	I8 in 22 Jul 03	I8 3m 22 Jul 03	I8 7m 22 Jul 03	I8 1m 6 Aug 03	I8 out 22 Jul 03	I8 in 31 Jul 03	I8 out 31 Jul 03	I8 in 6 Aug 03	I8 1m 12 Aug 03	I8 7m 14 Aug 03	I8 1m 6 Aug 03
dgge:14.7	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
dgge:15.4	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	1	1	0
dgge:16.6	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
dgge:18.0	1	1	0	1	0	1	1	1	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0	1
dgge:20.2	0	1	1	0	1	0	1	0	0	1	1	1	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0
dgge:21.2	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0
dgge:22.0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	1	0	0
dgge:23.3	1	1	0	1	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0
dgge:24.2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:25.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
dgge:26.2	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1
dgge:27.5	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
dgge:29.4	1	1	0	0	0	0	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
dgge:30.9	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	0	0
dgge:31.6	0	0	0	1	1	1	1	0	0	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0
dgge:32.9	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
dgge:34.4	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1
dgge:35.1 *	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0
dgge:35.5	0	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
dgge:36.7	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
dgge:37.6	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:38.5	1	1	0	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1
dgge:39.7	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:40.2 *	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:40.7 *	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:41.5	0	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	0
dgge:42.4	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:43.2	1	0	0	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0
dgge:44.3	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	0	1	1	1
dgge:45.7	0	0	1	0	1	1	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1	0	0	0	0	1	0	0	1
dgge:47.1	1	1	0	1	0	1	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1	1
dgge:48.0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	0	0	1	0	1	1	0	0	1	1	1	1	0	1	0
dgge:48.8	0	1	0	0	1	0	1	1	0	1	1	1	0	0	1	1	0	1	0	1	1	1	1	0	1	0	1	1	1
dgge:49.9	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	0	0	0	0	1	1	0
dgge:50.7	1	1	0	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
dgge:51.9	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:53.3	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:55.3	1	1	1	0	1	0	0	1	1	1	1	1	0	1	1	0	1	0	0	1	1	1	1	1	1	0	1	1	1
dgge:56.2	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0
dgge:57.2	0	0	0	0	1	0	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1	1	1	0	1	1	1	0
dgge:57.9	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:58.5	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	1	0	1	0	0	0	1
dgge:59.3	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	1	1	1	1	0	1	1	0	1	1	1	0
dgge:60.3	1	1	1	0	0	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	1	1	0	1	0	1	1	1
dgge:62.1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1
dgge:64.4	1	0	0	0	0	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
dgge:65.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0
dgge:67.3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
dgge:68.2 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:68.6	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1	0	1	1	0
dgge:69.1	1	1	0	0	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	1	1	1	1	0	1	0	1	1	1

	I8 1m 6 Aug 03	I8 out 6 Aug 03	I8 out 21 Jun 03	I8 in 25 Jun 03	I8 out 25 Jun 03	I8 in 1 Jul 03	I8 out 1 Jul 03	I8 1m 6 Aug 03	I8 in 5 Jul 03	I8 1m 5 Jul 03	I8 3m 5 Jul 03	I8 7m 5 Jul 03	I8 out 5 Jul 03	I8 in 10 Jul 03	I8 1m 6 Aug 03	I8 out 10 Jul 03	I8 in 16 Jul 03	I8 out 16 Jul 03	I8 in 22 Jul 03	I8 3m 22 Jul 03	I8 7m 22 Jul 03	I8 1m 6 Aug 03	I8 out 22 Jul 03	I8 in 31 Jul 03	I8 out 31 Jul 03	I8 in 6 Aug 03	I8 1m 12 Aug 03	I8 7m 14 Aug 03	I8 1m 6 Aug 03
dgge:70.3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:71.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0
dgge:72.2 *	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:73.2	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	0	1	1	0	0
dgge:74.0 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
dgge:75.2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
dgge:76.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0
dgge:78.3	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:79.1	0	0	1	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	I8 D	I8 in 3 Jul 03	I8 out 3 Jul 03	I8 A	I8 B	I8 C	I8 E	I8 D	I8 F	I8 in 29 Jul 03	I8 out 29 Jul 03	I8 G	I8 H	I8 I	I8 J	I8 D
dgge:10.6	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	1
dgge:12.4	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
dgge:13.8	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1
dgge:15.7	0	0	1	0	1	0	0	1	0	1	1	0	0	1	0	0
dgge:16.7	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
dgge:18.0	0	1	1	0	0	1	0	0	1	0	0	0	1	0	0	0
dgge:20.1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
dgge:21.3	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
dgge:23.2	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0
dgge:23.8 *	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:24.2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:25.0 *	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0
dgge:25.4	0	1	1	1	1	0	1	0	0	0	0	0	0	0	1	0
dgge:27.0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
dgge:28.0	1	0	1	0	1	0	0	1	0	1	0	0	1	0	1	1
dgge:29.1 *	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:29.9	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0
dgge:31.3	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	0
dgge:32.8	1	1	0	1	1	1	1	1	1	0	0	1	0	0	0	1
dgge:34.0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0
dgge:35.2	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
dgge:36.3	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1
dgge:37.1	0	0	1	0	0	0	1	0	0	0	1	1	1	0	1	0
dgge:38.6	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0
dgge:39.6 *	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0
dgge:40.0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
dgge:40.3 *	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0
dgge:41.3 *	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
dgge:41.9	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0
dgge:43.8	0	1	0	1	0	0	0	0	0	1	1	0	1	1	0	0
dgge:44.9	1	0	1	0	1	1	0	1	0	1	0	0	0	0	0	1
dgge:45.7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
dgge:46.6	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0
dgge:47.4 *	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
dgge:47.8	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0
dgge:49.6	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
dgge:49.9 *	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
dgge:50.8	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0
dgge:51.3 *	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
dgge:53.0 *	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
dgge:53.5	0	1	0	0	0	1	0	0	0	0	0	1	0	1	1	0
dgge:54.7	0	1	0	1	0	0	1	0	1	0	0	1	1	1	1	0
dgge:55.3 *	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:56.5	0	1	0	0	0	0	0	0	1	0	0	0	1	1	1	0
dgge:57.5	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0
dgge:58.8	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0

	I8 D	I8 in 3 Jul 03	I8 out 3 Jul 03	I8 A	I8 B	I8 C	I8 E	I8 D	I8 F	I8 in 29 Jul 03	I8 out 29 Jul 03	I8 G	I8 H	I8 I	I8 J	I8 D
dgge:61.2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
dgge:62.3 *	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:62.8	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0
dgge:64.1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
dgge:65.4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:67.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:68.6	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0

	I7-I9 4 Jul 03	I7-I9 20 Jun 03	I8-I9 20 Jun 03	I7-I9 25 Jun 03	Toolik Inlet 25 Jun 03	I7-I9 27 Jun 03	I8-I9 27 Jun 03	I7-I9 4 Jul 03	Toolik Inlet 27 Jun 03	Toolik Inlet 4 Jul 03	I7-I9 11 Jul 03	I8-I9 11 Jul 03	I7-I9 16 Jul 03	Toolik Inlet 16 Jul 03	I7-I9 4 Jul 03	I7-I9 25 Jul 03	Toolik Inlet 25 Jul 03	I7-I9 1 Aug 03	I8-I9 1 Aug 03	I7-I9 6 Aug 03	I8-I9 6 Aug 03	I7-I9 4 Jul 03	Toolik Inlet 6 Aug 03	Toolik Inlet 14 Aug 03	I7-I9 15 Aug 03	I8-I9 15 Aug 03	Toolik Inlet 15 Aug 03	Toolik Inlet 14 Jul 03	I7-I9 4 Jul 03
dgge:13.4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:14.2	0	0	1	0	1	1	1	0	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1
dgge:15.3	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
dgge:17.6	0	1	0	1	1	1	0	1	0	1	0	0	0	1	1	1	1	0	1	1	0	0	1	1	1	0	0	1	0
dgge:18.8	0	0	1	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	0	0	0	1	1
dgge:19.5 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
dgge:20.2	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	0	1	1	0	1
dgge:21.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
dgge:22.8	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:23.9	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
dgge:25.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:26.2	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:27.7	0	1	0	0	1	1	1	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0	0	0	0	1	0	1	0
dgge:28.9	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1
dgge:29.5 *	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:30.5	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:31.4	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:32.2	0	0	0	0	0	0	1	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0
dgge:32.9	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:33.7	0	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	1	0
dgge:34.5 *	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:35.2	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
dgge:36.0	0	1	0	0	0	1	1	1	0	1	0	0	1	0	0	1	0	0	1	1	1	1	0	0	0	1	1	1	1
dgge:36.6	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
dgge:38.2	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0
dgge:39.0	1	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	1	1
dgge:39.8 *	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:40.4	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	1	0	1	0	0	0	0
dgge:41.3	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	1	1
dgge:41.9	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	0	1	1	1
dgge:42.9	0	1	0	0	0	1	0	0	0	1	1	1	1	1	0	1	1	1	0	1	0	0	1	1	1	0	0	1	0
dgge:43.8	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	0
dgge:45.2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	0	1
dgge:46.1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0
dgge:47.0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	1	1	0	1	1
dgge:47.8	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1
dgge:48.6	0	1	0	1	1	0	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1
dgge:49.6	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
dgge:50.3 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:51.4	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:51.9 *	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:52.9	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
dgge:53.6	0	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1
dgge:55.1	0	0	0	0	0	1	0	1	1	1	0	0	1	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0
dgge:56.1	1	0	0	0	1	0	1	0	1	1	1	1	0	1	1	0	1	0	1	0	0	1	1	0	0	1	1	1	1
dgge:57.1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	0	0	0	0	1	1
dgge:57.4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	1	0	0
dgge:58.4	0	1	0	1	0	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1
dgge:60.1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:60.7 *	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	I7-I9 4 Jul 03	I7-I9 20 Jun 03	I8-I9 20 Jun 03	I7-I9 25 Jun 03	Toolik Inlet 25 Jun 03	I7-I9 27 Jun 03	I8-I9 27 Jun 03	I7-I9 4 Jul 03	Toolik Inlet 27 Jun 03	Toolik Inlet 4 Jul 03	I7-I9 11 Jul 03	I8-I9 11 Jul 03	I7-I9 16 Jul 03	Toolik Inlet 16 Jul 03	I7-I9 4 Jul 03	I7-I9 25 Jul 03	Toolik Inlet 25 Jul 03	I7-I9 1 Aug 03	I8-I9 1 Aug 03	I7-I9 6 Aug 03	I8-I9 6 Aug 03	I7-I9 4 Jul 03	Toolik Inlet 6 Aug 03	Toolik Inlet 14 Aug 03	I7-I9 15 Aug 03	I8-I9 15 Aug 03	Toolik Inlet 15 Aug 03	Toolik Inlet 14 Jul 03	I7-I9 4 Jul 03
dgge:61.7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
dgge:62.5	0	0	0	1	1	1	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0
dgge:63.7	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:64.6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
dgge:65.4	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
dgge:66.6	0	1	0	1	1	0	1	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
dgge:67.1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:67.9	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
dgge:68.5	0	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0
dgge:69.4	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:70.2	0	0	0	0	0	1	1	1	1	0	1	0	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
dgge:71.2	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0
dgge:72.8	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0	1	0	0	1	0	1
dgge:73.3	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	0	0	0	0	1	0	1	0	1	1	0
dgge:74.5	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0
dgge:75.3	0	0	0	0	1	0	0	0	1	1	1	0	1	0	0	0	1	0	1	0	0	1	0	0	1	0	0	1	1
dgge:77.2	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
dgge:79.2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
dgge:80.6	0	0	0	0	1	0	1	0	0	1	1	1	0	1	0	1	1	0	1	0	1	1	1	0	0	1	1	1	1
dgge:81.1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	0	0	1	1
dgge:82.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:84.8	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:86.1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0

	B 2C 3 Jul 04	TLM ladder	TLM ladder	G 2C 3 Jul 04	Y 2C 3 Jul 04	W 2C 3 Jul 04	B 12C 3 Jul 04	G 12C 3 Jul 04	TLM ladder	Y 12C 3 Jul 04	W 12C 3 Jul 04	B 25C 3 Jul 04	G 25C 3 Jul 04	Y 25C 3 Jul 04	TLM ladder	W 25C 3 Jul 04	B 12C 31 Jul 04	G 12 C 31 Jul 04	Y 12C 31 Jul 04	W 12C 31 Jul 04	TLM ladder	12C 7-21 Aug 04	25C 7-21 Aug 04	T. inlet 28 Jun 04	T. outlet 28 Jun 04	T. inlet 26 Jul 04	TLM ladder	TLM ladder	T. outlet 26 Jul 04
dgge:6.6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
dgge:8.2	1	0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	1	1	0	0	0	1	1	0	0	1	0	0	0
dgge:9.7	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	1	1	0	0	0	0	0	0
dgge:11.1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	0	1	1	0	1	0	0	0	0
dgge:11.9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
dgge:13.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
dgge:13.8	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	0	0	0
dgge:14.9 *	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
dgge:15.8	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0
dgge:17.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	1	1	0	0	0	0	1	0	0
dgge:18.6	0	0	0	0	1	1	0	0	1	1	1	0	0	1	0	0	1	1	1	1	1	1	1	0	1	0	0	0	1
dgge:19.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
dgge:20.7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	1	0
dgge:21.3	1	1	1	1	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	1	0
dgge:22.6	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	1	1	1	0	0	1	0	1	0	0
dgge:23.4	1	1	1	1	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	1	1	0	0	0	0	1	1	1	1
dgge:23.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
dgge:24.1	0	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0
dgge:25.0 *	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
dgge:25.6	1	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1	1	0	0	1	1	1	1	1
dgge:26.3	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1	0	1	1	1	1	1	0	0	1
dgge:26.7	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0
dgge:28.0	1	1	0	1	0	0	0	1	1	0	0	1	1	1	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0
dgge:28.9	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:29.8	0	0	1	0	1	1	0	0	0	0	1	0	0	0	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1
dgge:30.5	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
dgge:31.4	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:32.3	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	0	0	1	1	0
dgge:33.2	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	1	0
dgge:33.9	0	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:34.5	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1
dgge:35.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:36.1	0	0	1	0	0	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:36.7	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	1	1	0
dgge:37.1 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
dgge:37.8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:38.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0
dgge:39.4	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	1	1
dgge:40.3	0	1	1	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	1	1	0
dgge:41.5	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	0
dgge:42.1	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	1	1	1	0	1	0	1	1	0	1	1	0	0	0
dgge:42.5 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0

	B 2C 3 Jul 04	TLM ladder	TLM ladder	G 2C 3 Jul 04	Y 2C 3 Jul 04	W 2C 3 Jul 04	B 12C 3 Jul 04	G 12C 3 Jul 04	TLM ladder	Y 12C 3 Jul 04	W 12C 3 Jul 04	B 25C 3 Jul 04	G 25C 3 Jul 04	Y 25C 3 Jul 04	TLM ladder	W 25C 3 Jul 04	B 12C 31 Jul 04	G 12 C 31 Jul 04	Y 12C 31 Jul 04	W 12C 31 Jul 04	TLM ladder	12C 7-21 Aug 04	25C 7-21 Aug 04	T. inlet 28 Jun 04	T. outlet 28 Jun 04	T. inlet 26 Jul 04	TLM ladder	TLM ladder	T. outlet 26 Jul 04
dgge:43.1	0	1	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	1	0	1	1	0
dgge:44.1	0	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
dgge:45.1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1
dgge:45.7	0	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	0	0	0	0	1	1	0	0	1	0	1	1	0
dgge:46.6	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	1	0
dgge:47.4 *	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0
dgge:47.9	1	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
dgge:48.7	0	0	0	0	1	1	0	0	0	1	1	0	0	1	0	1	0	0	1	1	0	1	0	0	1	1	0	0	1
dgge:49.9	1	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	1	1	0	1	0	1	1	1	0
dgge:50.2 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
dgge:50.7	0	1	1	0	1	0	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1
dgge:51.4	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	1	1	0	1	0	0	0	0	0
dgge:52.4	0	0	1	1	1	1	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	0	1	0	1	0	0	0	0
dgge:53.4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0	1	1	1	0
dgge:54.4	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
dgge:54.9 *	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
dgge:55.5	1	1	1	1	0	0	1	1	1	0	0	1	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0
dgge:56.4	0	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
dgge:57.3	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:58.7	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
dgge:59.8	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
dgge:60.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:61.3	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:62.2	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	1	0	1	1	0	1	1	1	1	0	0	0	0
dgge:63.0	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0
dgge:63.8	1	0	1	1	0	0	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	1	1	1	1	0	0	0	1
dgge:64.9	0	1	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1
dgge:65.6 *	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:66.2	0	1	1	0	1	1	1	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:67.7	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0	0	1	1	0	1	1	1	0	1	0	0	0
dgge:68.5	0	1	1	0	1	1	0	0	1	1	1	0	0	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1
dgge:69.9	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0
dgge:70.6	0	1	1	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	1	1	1	1	0	0	1	0	1	1	0
dgge:71.6	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	1	1	1	1	0	0	1	0	0	0	0	0	0
dgge:72.0 *	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
dgge:72.5	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:73.3	0	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	1	1	1	1	0	0	1	1	1	1	1
dgge:74.1	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1
dgge:75.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0
dgge:75.7 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:77.4	0	1	1	0	0	0	0	0	1	1	0	0	0	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	0
dgge:78.6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0

	B 2C 3 Jul 04	TLM ladder	TLM ladder	G 2C 3 Jul 04	Y 2C 3 Jul 04	W 2C 3 Jul 04	B 12C 3 Jul 04	G 12C 3 Jul 04	TLM ladder	Y 12C 3 Jul 04	W 12C 3 Jul 04	B 25C 3 Jul 04	G 25C 3 Jul 04	Y 25C 3 Jul 04	TLM ladder	W 25C 3 Jul 04	B 12C 31 Jul 04	G 12 C 31 Jul 04	Y 12C 31 Jul 04	W 12C 31 Jul 04	TLM ladder	12C 7-21 Aug 04	25C 7-21 Aug 04	T. inlet 28 Jun 04	T. outlet 28 Jun 04	T. inlet 26 Jul 04	TLM ladder	TLM ladder	T. outlet 26 Jul 04
dgge:79.2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
dgge:81.5	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0
dgge:84.6	0	0	0	0	1	1	0	0	0	1	1	0	0	1	0	1	0	0	1	1	0	1	1	1	1	1	0	0	1
dgge:88.7	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	0	1	1	1	1	1	0	0	0

	TLM ladder	T. inlet 18 Jun 04	T. inlet 23 Jun 04	T. inlet 28 Jun 04	T. outlet 28 Jun 04	T. inlet 1 Jul 04	T. inlet 9 Jul 04	TLM ladder	T. inlet 12 Jul 04	T. outlet 12 Jul 04	T. inlet 14 Jul 04	T. inlet 16 Jul 04	T. outlet 16 Jul 04	T. inlet 23 Jul 04	TLM ladder	T. inlet 26 Jul 04	T. outlet 26 Jul 04	T. inlet 30 Jul 04	T. inlet 4 Aug 04	T. inlet 11 Aug 04	T. outlet 11 Aug 04	TLM ladder	T. inlet 13 Aug 04	TLM ladder	TLM ladder
dgge:8.1	1	0	0	0	0	0	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	1	0	1	1
dgge:11.2	1	1	1	1	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:12.3	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
dgge:13.7	1	1	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:14.8	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	1	1	1	1	0	0	1	0	0
dgge:15.7	0	0	0	0	0	1	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:16.6	1	1	1	0	0	0	0	1	0	0	1	0	1	0	1	1	0	1	1	0	0	1	1	1	1
dgge:17.2	1	0	0	0	0	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	1	0	1	1
dgge:18.3	1	1	1	1	0	1	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1	1
dgge:19.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1
dgge:19.8	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	0	1	1	1	1	0	1	1	1	1
dgge:20.4	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	0	0	1	0	1	0
dgge:21.2 *	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:21.8	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	1
dgge:23.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:24.0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	1	0	1
dgge:24.8 *	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	1	0	0
dgge:25.6 *	1	1	1	1	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0
dgge:26.8	1	1	1	0	0	0	0	1	1	0	1	1	0	0	1	0	1	0	0	0	1	1	1	1	1
dgge:27.5	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	0	0	1	1	1	0	0	1	0	0
dgge:28.6	1	0	0	1	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	1	1	1	1
dgge:29.7	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:31.0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1
dgge:32.0	1	1	1	0	1	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	1	0	1	1
dgge:32.9	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:33.6	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:34.6	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0
dgge:35.5	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1
dgge:36.6	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:37.2 *	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:37.6	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	0	0
dgge:38.2 *	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:38.6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
dgge:39.5	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1
dgge:40.3	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1
dgge:41.6	1	1	1	1	0	1	1	1	1	0	1	1	0	0	1	0	0	1	0	0	0	1	0	1	1
dgge:42.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
dgge:43.6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
dgge:44.7	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:45.7	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
dgge:46.7	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:47.5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
dgge:48.4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
dgge:49.2	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1
dgge:50.0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
dgge:51.1	1	1	0	1	0	0	0	1	0	0	1	1	1	1	1	1	0	1	0	0	0	1	1	1	1
dgge:52.8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:53.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
dgge:54.2	0	0	0	0	0	0	1	0	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	0
dgge:54.9	1	1	1	0	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1
dgge:56.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

	TLM ladder	T. inlet 18 Jun 04	T. inlet 23 Jun 04	T. inlet 28 Jun 04	T. outlet 28 Jun 04	T. inlet 1 Jul 04	T. inlet 9 Jul 04	TLM ladder	T. inlet 12 Jul 04	T. outlet 12 Jul 04	T. inlet 14 Jul 04	T. inlet 16 Jul 04	T. outlet 16 Jul 04	T. inlet 23 Jul 04	TLM ladder	T. inlet 26 Jul 04	T. outlet 26 Jul 04	T. inlet 30 Jul 04	T. inlet 4 Aug 04	T. inlet 11 Aug 04	T. outlet 11 Aug 04	TLM ladder	T. inlet 13 Aug 04	TLM ladder	TLM ladder
dgge:57.1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1
dgge:58.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0
dgge:59.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:60.2	1	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:60.9	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
dgge:62.9	0	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:64.5	1	0	0	0	1	0	1	1	1	0	1	1	0	0	1	1	0	1	0	0	0	1	1	1	1
dgge:73.0 *	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:78.8	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	0

	TLM1	blue 12C	green 12C	yellow 12C	blue 12C NP	green 12C NP	TLM2	white 12C	yellow 12 NP	white 12C NP	blue 17C	green 17C	yellow 17C	white 17C	TLM3	blue 17C NP	green 17C NP	yellow 17C NP	white 17C NP	TLM4	I8 in 12 Jul 05	I8 out 12 Jul 05	I8 in 26 Jul 05	I8 out 26 Jul 05	TLM5
dgge:26.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:31.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:35.9	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1
dgge:39.1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	1	0	0	0	0	1
dgge:40.7	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:42.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
dgge:44.2	0	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0
dgge:45.0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1	0	1
dgge:46.1	1	1	0	1	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	1	1	0	0	0	1
dgge:47.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1
dgge:47.9	1	0	0	0	0	0	1	0	0	1	1	0	0	1	1	1	1	0	0	1	1	1	0	0	1
dgge:48.6	1	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1
dgge:49.2	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1	0	1
dgge:50.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:51.1	1	0	0	0	0	0	1	0	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1
dgge:52.4	0	1	1	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0
dgge:53.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1
dgge:53.7	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0
dgge:55.1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	1	1	0
dgge:55.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
dgge:56.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:57.3 *	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0
dgge:57.7	1	0	1	0	1	0	1	0	0	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	1
dgge:58.6	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0	1	0
dgge:59.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:60.6	1	0	0	0	0	0	1	1	1	1	1	0	1	0	1	0	0	0	0	1	0	1	0	0	1
dgge:60.9	0	1	1	1	1	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1
dgge:61.9	1	0	0	0	0	1	1	0	1	1	1	1	0	0	1	1	0	0	0	1	0	0	1	0	1
dgge:63.1	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	1	0	0	0	1	0	0	0
dgge:64.2	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	0	0	0	0	0	0
dgge:64.8	1	0	0	0	0	1	1	0	0	0	0	1	0	1	1	1	1	0	0	1	0	1	0	0	1
dgge:65.5	1	0	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:66.2	1	0	0	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	0	1	0	1	1
dgge:67.6	0	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0
dgge:68.7	1	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1
dgge:69.5	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	1	0
dgge:70.4	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	1	0	0	1	0	0	0
dgge:71.4	1	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0
dgge:72.3	1	0	0	1	1	0	1	1	1	1	0	0	1	1	1	0	0	0	0	1	0	1	0	0	1
dgge:72.8 *	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
dgge:73.6	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	0	1	0	1	0	0	1
dgge:74.3	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:75.5	1	1	0	0	0	1	1	0	1	0	0	0	1	1	1	1	0	1	1	1	0	1	0	0	1
dgge:76.8	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	1	1	0	1	0	0	1
dgge:77.8	1	0	0	0	0	1	1	0	1	0	0	0	0	1	1	1	0	0	0	1	0	1	0	0	1
dgge:79.1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1
dgge:80.8	1	1	0	1	0	1	1	1	1	1	0	0	0	1	1	1	0	1	1	1	0	1	0	0	1
dgge:82.6	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	1	0	1	0	0	0	0	1
dgge:84.5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:85.5	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1
dgge:87.3	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
dgge:88.7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0

	TLM ladder 1	I8-in 18 Jul 06	IN 12A 24 Jul 06	IN 12B 24 Jul 06	IN 12C 24 Jul 06	TLM ladder 2	IN 12D 24 Jul 06	IN 12NPA 24 Jul 06	IN 12NPB 24 Jul 06	IN 12NPC 24 Jul 06	TLM ladder 3	IN 12NPD 24 Jul 06	IN 17A 24 Jul 06	IN 17B 24 Jul 06	IN 17D 24 Jul 06	TLM ladder 4	IN 17NPA 24 Jul 06	IN 17NPB 24 Jul 06	IN 17NPC 24 Jul 06	IN 17NPD 24 Jul 06	TLM ladder 5
dgge:31.0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:36.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
dgge:37.5	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:40.6	1	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:41.3	1	1	0	1	0	1	0	0	0	1	1	0	0	1	0	1	1	1	1	0	1
dgge:43.8	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:45.6	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:46.8	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:47.7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:49.7	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:50.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
dgge:52.4	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:53.2	0	1	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0
dgge:54.1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	0
dgge:55.1	1	0	1	1	1	1	0	1	0	1	0	0	1	1	0	1	1	1	1	0	1
dgge:56.1	0	0	1	1	1	0	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0
dgge:57.4	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0
dgge:58.6	0	0	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1
dgge:59.7	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
dgge:60.8	0	1	0	1	1	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0
dgge:61.9	0	0	1	1	1	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0
dgge:62.8	1	0	1	0	0	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1
dgge:64.0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0
dgge:65.1	0	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	1	0	0
dgge:66.5	0	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	0	1
dgge:68.2	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1
dgge:69.0 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0
dgge:69.9	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	1	1	0
dgge:71.3	1	1	0	1	0	0	0	1	1	0	0	0	0	0	1	1	0	1	0	1	1
dgge:72.1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	0	0	0	1	1	1	0
dgge:73.2	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	0	0	0	0
dgge:75.7	0	1	0	0	0	0	0	1	1	1	0	1	0	0	0	1	1	1	1	1	1
dgge:77.1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
dgge:77.7 *	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1
dgge:78.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
dgge:79.7	0	0	1	1	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0
dgge:80.4	1	1	0	0	0	0	1	0	0	0	1	1	1	1	1	1	0	0	0	0	1
dgge:81.8	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	TLM ladder 1	I8-out 18 Jul 06	out 12A 24 Jul 06	out 12B 24 Jul 06	out 12D 24Jul 06	TLM ladder 2	out 12NPA 24 Jul 06	out 12NPB 24 Jul 06	out 12NPC 24 Jul 06	out 12NPD 24 Jul 06	TLM ladder 3	out 17A 24 Jul 06	out 17B 24 Jul 06	out 17D 24 Jul 06	TLM ladder 4	out 17NPA 24 Jul 06	out 17NPB 24 Jul 06	out 17NPC 24 Jul 06	out 17NPD 24 Jul 06	TLM ladder 5
dgge:31.1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:35.6	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1	0	0
dgge:37.6	0	1	1	1	0	1	0	0	0	0	1	1	1	0	1	0	0	0	0	1
dgge:40.6	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:41.2	1	1	0	0	0	1	0	1	0	0	1	0	0	0	1	1	1	1	0	0
dgge:43.3	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:43.9	0	1	1	1	0	0	0	1	1	1	0	1	1	0	1	1	1	1	0	1
dgge:46.3	0	0	0	0	1	0	1	1	1	1	0	0	0	1	0	0	0	0	1	0
dgge:47.0	1	1	1	1	0	1	0	0	0	0	1	1	1	0	1	0	0	0	0	1
dgge:48.0	0	1	0	0	1	0	1	1	1	1	0	1	0	1	0	0	0	0	1	0
dgge:49.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:50.8	1	1	0	0	0	1	1	0	0	0	1	0	1	0	1	0	0	0	0	1
dgge:53.0	1	0	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
dgge:54.2	1	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0
dgge:55.2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1
dgge:56.0 *	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
dgge:56.9	0	1	1	1	0	0	1	1	1	1	0	1	1	0	0	1	1	1	0	0
dgge:58.3	1	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1
dgge:59.3	1	1	0	0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1
dgge:60.3	1	1	1	1	0	0	1	1	1	1	0	1	1	0	0	1	1	1	1	1
dgge:61.4	0	0	1	1	0	0	0	1	1	0	0	1	1	1	0	1	1	1	0	0
dgge:62.8	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1
dgge:63.4	0	1	1	1	0	0	0	1	1	0	0	1	1	1	0	1	1	1	1	0
dgge:64.2	0	1	1	1	0	0	1	0	1	1	0	1	1	0	0	0	0	0	0	0
dgge:65.3	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:66.3	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1
dgge:68.1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1
dgge:68.9	1	1	1	1	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	1
dgge:70.0	0	1	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1
dgge:70.9	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1
dgge:72.3	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	1
dgge:73.6	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
dgge:74.6	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:75.6	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
dgge:77.1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0
dgge:77.8 *	1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0

	TLM ladder 1	in 12A 29 Jul 06	in 12B 29 Jul 06	in 12C 29 Jul 06	in 12D 29 Jul 06	TLM ladder 2	in 12NPA 29 Jul 06	in 12NPB 29 Jul 06	in 12NPC 29 Jul 06	in 12NPD 29 Jul 06	TLM ladder 3	in 17A 29 Jul 06	in 17B 29 Jul 06	in 17C 29 Jul 06	in 17D 29 Jul 06	TLM ladder 4	in 17NPA 29 Jul 06	in 17NPB 29 Jul 06	in 17NPC 29 Jul 06	in 17NPD 29 Jul 06	TLM ladder 5
dgge:27.3	0	1	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0
dgge:31.3	1	0	0	0	0	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0	1
dgge:34.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0
dgge:36.5	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	0	1
dgge:38.0	1	1	1	1	0	1	0	0	0	0	1	1	1	1	0	1	0	0	0	0	1
dgge:39.2	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
dgge:40.5	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	0	1
dgge:41.2	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	0	0	1	0	1
dgge:41.6	0	1	1	1	1	0	0	1	1	0	0	1	1	1	1	0	1	1	1	1	0
dgge:43.1	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
dgge:43.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:45.4	0	1	0	0	1	1	0	0	0	0	1	1	1	1	1	1	0	0	1	0	1
dgge:47.1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:48.0 *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:48.9	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	1	1	1	0	0
dgge:49.6 *	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:50.3	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	1	0
dgge:52.4 *	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:53.0	0	1	1	0	0	0	1	1	1	1	0	0	0	1	1	0	1	0	1	1	0
dgge:54.1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:55.0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:55.6	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0	1
dgge:56.9	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0
dgge:57.8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
dgge:58.6	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
dgge:59.3	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:60.1	0	1	1	1	1	0	1	1	1	0	0	1	0	1	1	0	1	1	1	0	0
dgge:61.8	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0
dgge:62.9	1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
dgge:64.0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	0	1	1	0
dgge:65.1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0
dgge:65.8 *	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:66.4	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:67.4	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1
dgge:68.0	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1	1	0	0	1	0	1
dgge:68.9	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
dgge:69.8	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1	1	0
dgge:70.7	1	1	0	1	1	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1
dgge:71.7	0	1	0	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	0	1	0
dgge:72.5	0	1	1	1	1	0	1	1	1	1	0	0	1	1	1	0	1	1	1	1	1
dgge:73.5	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1
dgge:74.5	1	0	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	0	1	0	1
dgge:75.2	1	0	1	0	0	1	1	1	1	1	1	0	0	0	0	0	1	0	0	0	1
dgge:76.2	0	0	0	1	0	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	0
dgge:76.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1

	TLM ladder 1	in 12A 29 Jul 06	in 12B 29 Jul 06	in 12C 29 Jul 06	in 12D 29 Jul 06	TLM ladder 2	in 12NPA 29 Jul 06	in 12NPB 29 Jul 06	in 12NPC 29 Jul 06	in 12NPD 29 Jul 06	TLM ladder 3	in 17A 29 Jul 06	in 17B 29 Jul 06	in 17C 29 Jul 06	in 17D 29 Jul 06	TLM ladder 4	in 17NPA 29 Jul 06	in 17NPB 29 Jul 06	in 17NPC 29 Jul 06	in 17NPD 29 Jul 06	TLM ladder 5
dgge:77.7	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	0	1	0	0
dgge:78.5	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1
dgge:79.5	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0
dgge:80.9	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1
dgge:82.2	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	TLM ladder 1	out 12A 29 Jul 06	out 12B 29 Jul 06	out 12D 29 Jul 06	TLM ladder 2	out 12NPA 29 Jul 06	out 12NPB 29 Jul 06	out 12NPC 29 Jul 06	out 12NPD 29 Jul 06	TLM ladder 3	out 17A 29 Jul 06	out 17B 29 Jul 06	out 17D 29 Jul 06	TLM ladder 4	out 17NPA 29 Jul 06	out 17NPB 29 Jul 06	out 17NPC 29 Jul 06	out 17NPD 29 Jul 06	TLM ladder 5
dgge:31.1	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:33.2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:35.6	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0
dgge:37.5	1	1	1	0	1	0	0	0	0	1	1	1	0	1	0	1	0	0	1
dgge:40.6	1	0	0	0	1	1	0	0	1	1	0	0	0	1	1	1	1	0	1
dgge:41.1	1	1	1	0	1	0	1	0	0	1	1	1	0	1	1	0	0	1	1
dgge:42.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
dgge:43.1	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:43.9	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:44.9	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:46.0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1
dgge:46.9	1	1	1	0	1	0	0	0	0	1	1	1	0	1	1	1	1	0	1
dgge:47.8	0	1	1	1	0	1	1	0	1	0	1	1	1	0	0	1	1	1	0
dgge:48.8	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0
dgge:49.8	1	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:50.7	1	0	1	1	1	0	0	0	0	1	0	0	1	1	1	0	1	0	1
dgge:51.3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
dgge:52.8	1	0	0	1	1	1	0	0	1	1	0	0	1	1	0	0	0	1	1
dgge:53.6	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
dgge:54.4	1	0	0	1	1	0	0	0	0	1	0	0	1	1	1	1	1	0	1
dgge:55.2	1	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	1
dgge:56.1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
dgge:57.0	0	1	1	1	0	1	1	1	0	0	1	1	1	0	1	1	1	0	0
dgge:58.4	1	1	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	1
dgge:59.2	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1
dgge:60.2	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1
dgge:61.5	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
dgge:62.7	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	0	1	0	1
dgge:63.3	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	0	1	0
dgge:64.2	0	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1
dgge:65.1	1	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0	0
dgge:66.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:68.0	1	1	1	0	1	0	0	0	0	0	1	1	0	1	1	1	1	1	1
dgge:69.0	1	1	1	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	1
dgge:70.8	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:71.9	1	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	1	1	1
dgge:73.0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
dgge:73.6	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1
dgge:76.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:78.0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:79.5	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0
dgge:80.6	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0

	TLM ladder	I8-in 27 Jun 06	12A 29 Jun 06	12B 29 Jun 06	12C 29 Jun 06	TLM ladder	12 NPA 29 Jun 06	12 NPB 29 Jun 06	12 NPC 29 Jun 06	TLM ladder	17A 29 Jun 06	17B 29 Jun 06	17C 29 Jun 06	TLM ladder	17 NPA 29 Jun 06	17 NPB 29 Jun 06	17 NPC 29 Jun 06	TLM ladder
dgge:6.6	0	0	1	1	1	0	0	1	1	0	0	1	0	0	0	0	0	0
dgge:7.5	0	1	1	1	1	0	1	1	1	0	0	1	0	0	1	0	1	0
dgge:10.7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1
dgge:14.7	0	0	0	0	1	0	1	1	1	0	0	0	0	0	1	1	1	0
dgge:16.5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
dgge:18.0	1	1	0	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1
dgge:19.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
dgge:22.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:23.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
dgge:26.1	1	1	0	0	0	1	0	0	1	1	0	0	0	1	1	0	1	1
dgge:27.5	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
dgge:29.4	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	1
dgge:30.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:33.2	1	1	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1
dgge:34.3	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:35.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:36.8	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:38.0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:39.0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1	0
dgge:41.1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:43.0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:44.4	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:45.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:47.4	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	1
dgge:48.3	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1
dgge:48.9	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0
dgge:50.2	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	0	1	0
dgge:51.6	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:52.7	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:53.4	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:54.7	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0
dgge:56.0	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0
dgge:57.1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:57.9	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
dgge:58.5	0	0	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1	0
dgge:59.5	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	0
dgge:60.1	0	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0
dgge:60.6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
dgge:61.6	1	1	0	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0
dgge:63.2	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0
dgge:63.8	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:65.2	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	0	0	0
dgge:66.0 *	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
dgge:67.6	1	1	0	0	0	1	1	0	1	1	0	0	1	1	1	1	1	1
dgge:69.0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1
dgge:69.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:70.4	1	1	0	0	0	1	1	0	1	1	0	0	0	1	0	1	0	1
dgge:71.6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:72.5	0	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
dgge:74.0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0
dgge:75.4	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:76.6	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1

	TLM ladder	I8-in 27 Jun 06	12A 29 Jun 06	12B 29 Jun 06	12C 29 Jun 06	TLM ladder	12 NPA 29 Jun 06	12 NPB 29 Jun 06	12 NPC 29 Jun 06	TLM ladder	17A 29 Jun 06	17B 29 Jun 06	17C 29 Jun 06	TLM ladder	17 NPA 29 Jun 06	17 NPB 29 Jun 06	17 NPC 29 Jun 06	TLM ladder
dgge:77.0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
dgge:79.9	1	0	1	1	1	1	0	0	0	1	1	1	1	1	0	0	0	1
dgge:81.7	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0
dgge:84.6	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0
dgge:85.7	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:88.4	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1

	TLM ladder	12A 1 Jul 06	12B 1 Jul 06	12C 1 Jul 06	TLM ladder	12 NPA 1 Jul 06	12 NPB 1 Jul 06	12 NPC 1 Jul 06	TLM ladder	17A 1 Jul 06	17B 1 Jul 06	17C 1 Jul 06	TLM ladder	17 NPA 1 Jul 06	17 NPB 1 Jul 06	17 NPC 1 Jul 06	TLM ladder
dgge:14.3	0	1	1	0	0	0	1	1	0	1	1	1	0	0	1	0	0
dgge:16.5	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
dgge:17.6	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
dgge:22.5	0	1	1	0	0	1	1	1	0	1	1	1	0	1	1	1	0
dgge:23.5	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0
dgge:26.0	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	0	1
dgge:27.4	0	1	1	0	0	1	0	1	0	1	1	1	0	0	0	0	0
dgge:29.6	1	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	1
dgge:30.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:31.5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
dgge:33.0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:34.7	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1
dgge:36.0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1
dgge:36.9	0	1	1	1	0	1	1	1	1	0	0	0	0	1	1	1	0
dgge:38.7	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1
dgge:41.1	1	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	1
dgge:42.5	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
dgge:43.2	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:44.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:45.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:47.3	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:48.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:50.1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
dgge:51.5	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:52.7	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1
dgge:53.5	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:54.8	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0
dgge:56.0	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0
dgge:57.2	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
dgge:58.6	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	0
dgge:59.4	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	0
dgge:60.0	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0
dgge:61.6	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
dgge:64.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:67.1	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0
dgge:68.1	1	0	1	0	0	1	1	1	1	0	0	0	1	1	1	1	1
dgge:69.3	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
dgge:70.5	1	0	0	0	1	0	1	1	1	0	0	0	1	0	1	0	1
dgge:72.8	1	0	0	0	0	1	0	0	1	0	0	0	1	1	1	1	0
dgge:75.7	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0
dgge:77.0	1	0	0	0	0	1	1	1	0	1	0	0	1	0	0	0	0
dgge:78.3	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0
dgge:79.9	0	0	0	0	1	0	0	0	1	0	1	0	0	1	1	0	1
dgge:81.5	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1
dgge:82.9	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
dgge:83.8	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
dgge:85.0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:86.3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:87.8	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1
dgge:90.1	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	0
dgge:93.3	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1

	TLM ladder	12A 6 Jul 06	12B 6 Jul 06	12C 6 Jul 06	12NPA 6 Jul 06	12 NPB 6 JUL 06	12 NPC 6 Jul 06	TLM ladder	17A 6 Jul 06	17B 6 Jul 06	17C 6 Jul 06	17 NPA 6 Jul 06	17 NPB 6 Jul 06	17 NPC 6 Jul 06	TLM ladder	12A 11 Jul 06	12B 11 Jul 06	12C 11 Jul 06	12 NPA 11 Jul 06	12 NPB 11 Jul 06	12 NPC 11 Jul 06	TLM ladder	17A 11 Jul 06	17B 11 Jul 06	17C 11 Jul 06	17 NPA 11 Jul 06	17 NPB 11 Jul 06	17 NPC 11 Jul 06	TLM ladder
dgge:17.6	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	0	1	1	0	0	0	1
dgge:19.1	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:20.4	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
dgge:22.2	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	0
dgge:23.8	0	1	1	1	1	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:25.8	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
dgge:27.2	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
dgge:28.1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
dgge:29.6	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	1	0	1
dgge:30.7	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:33.2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
dgge:33.8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
dgge:35.4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:36.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:36.9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:37.9	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1
dgge:39.0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:39.8	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	0
dgge:41.3	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	1
dgge:43.2	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:44.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
dgge:45.9	0	0	0	0	1	1	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1	1	0	0	1	1	1	1
dgge:47.3	1	0	0	0	0	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	1	1	1	1	1	1	0	1	1
dgge:48.6	0	1	1	1	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	0	0	0	0
dgge:50.4	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	0	1	0	0	1	1	1	0
dgge:51.5	0	1	1	1	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
dgge:52.5	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	1
dgge:53.4	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
dgge:54.6	0	1	1	1	0	0	1	0	1	1	1	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0
dgge:55.7	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
dgge:57.0	0	1	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1
dgge:57.9	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
dgge:59.0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0
dgge:60.0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
dgge:61.7	0	0	0	0	1	0	1	1	0	0	0	1	1	1	1	0	0	0	1	1	1	1	0	0	0	1	1	1	1
dgge:63.4	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
dgge:64.0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0
dgge:65.1	0	1	1	1	0	0	0	1	0	0	0	1	1	0	0	1	1	1	1	1	1	0	1	0	0	1	1	0	0
dgge:66.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	1	1	0
dgge:68.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	1	1	0	1
dgge:69.4	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	1	1	1	1	1
dgge:70.5	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
dgge:71.9	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0
dgge:73.3	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	0	0	0	1	0	0	0	0	0	0
dgge:75.1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1	0
dgge:76.6	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
dgge:79.2	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	0	0	1	0	1
dgge:81.5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0
dgge:83.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
dgge:84.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0
dgge:86.0	0	0	1	1	1	1	1	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	1	0
dgge:87.9	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:89.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1	1	0	0	0	0

	TLM ladder1	T. inlet 26 Jul 06	8A	8B	8C	8D	TLM ladder2	12A	12B	12C	12D	TLM ladder3	16A	16B	16C	16D	TLM ladder4	20A	20B	20C	20D	TLM ladder5
dgge:10.6	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:12.2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:18.7	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:20.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:22.2	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:23.4	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	0	0	0	0	1
dgge:24.4	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0
dgge:25.8	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:27.0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:29.0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	1	0	1
dgge:30.6	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:31.6	0	1	0	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	1	0	0	0
dgge:32.9	0	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0
dgge:33.9	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:34.9	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	0	1	1	1	1	0	1
dgge:35.6	0	1	0	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0
dgge:36.8	1	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1
dgge:38.4	1	1	0	0	0	0	1	1	1	1	0	1	1	0	1	0	1	1	1	1	0	1
dgge:40.0	1	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:40.6	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:42.9	0	1	1	1	0	0	0	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0
dgge:44.7	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:45.6	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	0	1	1	1	1	0	1
dgge:46.3	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
dgge:47.2	0	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0
dgge:48.1	0	1	0	1	1	0	0	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0
dgge:49.8	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:50.4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:51.6	0	1	1	1	1	0	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0
dgge:53.8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
dgge:54.4	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1
dgge:55.8	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0
dgge:56.6	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:57.9	0	1	1	0	1	0	0	1	1	0	0	0	1	1	1	0	0	1	1	0	0	1
dgge:59.0	1	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	0	1
dgge:61.2	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:62.8	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	0
dgge:63.7	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:66.5	1	1	0	0	0	0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1
dgge:69.4	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1
dgge:70.7	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
dgge:72.5	0	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
dgge:73.8	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1
dgge:74.6	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	1	0	0
dgge:77.5	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
dgge:87.8	1	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
dgge:89.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	TLM ladder 1	I8-in 1 Aug 06	I8-out 1 Aug 06	in/in A 3 Aug 06	in/in B 3 Aug 06	TLM ladder 2	in/in C 3 Aug 06	in/out A 3 Aug 06	in/out B 3 Aug 06	in/out C 3 Aug 06	TLM ladder 3	out/out A 3 Aug 06	out/out B 3 Aug 06	out/out C 3 Aug 06	out/in A 3 Aug 06	TLM ladder 4	out/in B 3 Aug 06	I8-in 3 Aug 06	I8-out 3 Aug 06	TLM ladder 5
dgge:3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
dgge:7.1	1	0	1	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1
dgge:10.5	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1
dgge:11.2	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1	0	1
dgge:13.6	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1
dgge:14.3	1	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	1	1
dgge:14.9	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0
dgge:16.7	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
dgge:18.3	1	1	1	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1
dgge:19.3	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	0	1	0
dgge:20.7	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	0	0
dgge:21.2 *	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1
dgge:22.1	1	0	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0
dgge:22.9	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0
dgge:24.1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1
dgge:24.6 *	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:25.3	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1
dgge:26.9	1	0	1	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1
dgge:27.7	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1	0	1
dgge:28.4	0	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
dgge:29.6	0	0	0	1	1	0	1	0	0	0	0	1	1	1	1	0	1	1	0	0
dgge:30.8	0	0	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0
dgge:31.5	1	1	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	0	1
dgge:32.3	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1
dgge:33.6	0	1	1	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	1	0
dgge:34.3 *	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
dgge:35.2 *	0	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0
dgge:36.1	1	0	1	0	0	1	0	0	0	0	1	1	1	1	1	1	1	0	1	1
dgge:37.9	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0
dgge:38.9	0	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0
dgge:40.4	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
dgge:40.8	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0
dgge:42.3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:43.6	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0
dgge:44.6	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	1	0
dgge:46.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:47.2	1	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0
dgge:48.5	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:49.8	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:50.7	1	1	1	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1
dgge:51.9	1	1	1	0	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0
dgge:53.1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
dgge:54.0	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1
dgge:56.4	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
dgge:58.4	0	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0
dgge:61.5	1	0	1	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1
dgge:63.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
dgge:63.6	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0
dgge:64.2	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0
dgge:65.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
dgge:67.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	TLM ladder 1	I8-in 1 Aug 06	I8-out 1 Aug 06	in/in A 3 Aug 06	in/in B 3 Aug 06	TLM ladder 2	in/in C 3 Aug 06	in/out A 3 Aug 06	in/out B 3 Aug 06	in/out C 3 Aug 06	TLM ladder 3	out/out A 3 Aug 06	out/out B 3 Aug 06	out/out C 3 Aug 06	out/in A 3 Aug 06	TLM ladder 4	out/in B 3 Aug 06	I8-in 3 Aug 06	I8-out 3 Aug 06	TLM ladder 5
dgge:76.1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	1	0
dgge:77.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
dgge:84.4	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0
dgge:86.0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0
dgge:87.0	1	1	1	0	0	1	1	1	0	0	0	1	1	1	1	0	1	1	1	0
dgge:90.4	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
dgge:92.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:94.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:98.8	0	0	1	0	0	0	0	1	0	0	0	1	1	1	1	0	1	0	1	0

	TLM ladder 1	18-in 18 Jul 06	I8-out 18 Jul 06	TLM ladder 2	IN/IN A 21 Jul 06	IN/IN B 21 Jul 06	IN/IN C 21 Jul 06	TLM ladder 3	IN/OUT A 21 Jul 06	IN/OUT B 21 Jul 06	IN/OUT C 21 Jul 06	TLM ladder 4	I8-in 21 Jul 06	I8-out 21 Jul 06	TLM ladder 5
dgge:19.2	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1
dgge:22.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:28.4	1	0	1	1	0	0	0	1	0	0	0	1	0	1	1
dgge:32.4	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1
dgge:33.4	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:35.8	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1
dgge:37.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:39.9	1	0	0	1	1	1	1	1	1	1	1	1	0	0	1
dgge:41.6	1	0	1	1	0	0	0	1	0	0	0	1	0	1	1
dgge:42.9	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0
dgge:43.9	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
dgge:45.4	1	0	0	1	0	0	0	1	0	0	0	1	0	1	1
dgge:46.1	1	0	1	1	0	0	0	1	1	1	1	1	0	1	1
dgge:46.9	0	0	1	0	1	1	1	0	1	1	1	0	1	1	0
dgge:48.7	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
dgge:49.4	0	1	1	0	1	1	1	0	1	1	1	0	0	1	0
dgge:50.4	1	0	0	1	1	1	1	1	0	0	0	1	0	0	1
dgge:51.8	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1
dgge:52.8	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1
dgge:53.9	0	0	1	0	1	1	1	0	1	1	1	0	1	0	0
dgge:55.4	0	0	1	0	1	0	1	0	1	0	0	0	1	1	0
dgge:57.2	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0
dgge:58.5	1	1	1	0	1	0	1	1	1	0	0	1	1	1	0
dgge:59.7	1	1	0	1	0	0	0	1	1	1	1	1	0	1	1
dgge:60.9	0	0	1	0	1	1	1	0	0	1	1	1	1	1	0
dgge:62.1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1
dgge:63.5	1	0	1	1	0	0	0	1	0	0	0	0	0	1	1
dgge:65.2	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0
dgge:66.2	0	1	1	0	1	1	1	0	1	1	0	0	0	1	0
dgge:68.0	0	1	1	0	1	1	1	0	1	1	1	0	1	0	0
dgge:71.2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
dgge:72.2	0	0	0	0	0	0	1	0	0	0	1	0	1	1	1
dgge:73.4	1	0	0	1	1	1	0	1	1	1	0	1	0	0	1
dgge:75.2	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
dgge:77.2	1	0	1	1	0	0	0	1	1	1	1	1	0	1	1
dgge:78.2	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
dgge:81.4	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0
dgge:82.7	0	0	1	0	1	1	1	0	1	1	1	0	1	1	0
dgge:84.9	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
dgge:88.8	0	0	0	0	1	1	1	0	1	1	1	0	0	1	0
dgge:90.3	1	0	1	1	0	0	0	1	0	0	0	1	0	1	0
dgge:95.5	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0

	TLM ladder	I8-in 16 Jun 07	I8-out 16 Jun 07	I8-in 18 Jun 07	I8-out 18 Jun 07	I8-NE inlet 18 Jun 07	I8-SE inlet 18 Jun 07	TLM ladder	I8-S inlet 18 Jun 07	I8-in 29 Jun 07	I8-out 29 Jun 07	I8-in 4 Jul 07	I8-out 4 Jul 07	I8-NE inlet 4 Jul 07	TLM ladder	I8-S inlet 4 Jul 07	I8-NE 4 Jul 07	I8-E 4 Jul 07	I8-SE 4 Jul 07	I8-Cen 4 Jul 07	I8-NW 4 Jul 07	TLM ladder	I8-W 0.5m 4 Jul 07
dgge:13.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
dgge:19.1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
dgge:22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0
dgge:24.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:26.2	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	1	1	1	1	1	1
dgge:29.4	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0
dgge:30.3	1	1	1	1	1	1	0	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1
dgge:31.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	0
dgge:32.6	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0
dgge:33.3	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:34.9	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0
dgge:36.1	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	1	1	1	0	0
dgge:36.8	0	0	0	1	0	0	0	1	0	0	1	1	1	0	1	0	1	1	1	1	1	1	1
dgge:38.2	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0
dgge:39.6	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0	1	1	1	1	1	1	1
dgge:40.7	1	0	1	0	1	1	0	1	0	0	1	0	1	0	1	0	1	1	1	1	1	1	0
dgge:41.9	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1
dgge:43.1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0
dgge:44.1	1	0	1	0	1	0	1	1	1	0	1	0	1	0	1	0	1	1	1	1	1	1	0
dgge:44.6	0	1	0	1	0	1	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0
dgge:45.2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
dgge:46.4	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	1	1	1	1	0	1
dgge:47.1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:48.1	1	1	0	1	0	0	0	1	0	1	0	1	0	0	1	1	0	1	0	1	1	1	0
dgge:49.0	1	0	1	0	1	1	0	1	0	0	1	0	1	0	1	0	1	1	1	1	1	1	1
dgge:49.8	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0
dgge:50.7	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0
dgge:51.6	0	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0
dgge:52.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
dgge:52.8	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1	1	1
dgge:54.2	0	1	1	1	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	0	1
dgge:55.9	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:56.7	1	0	1	0	1	1	1	1	0	0	0	0	0	1	1	0	1	1	1	1	1	1	0
dgge:57.7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:58.5	1	0	1	0	1	1	1	1	1	0	1	0	1	0	1	0	1	1	1	1	1	1	1
dgge:60.6	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:61.4	1	0	0	0	1	1	0	1	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1
dgge:63.2	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	1	0	1	0	1
dgge:64.4	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
dgge:65.8	1	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0
dgge:67.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:69.1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
dgge:70.0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1
dgge:70.6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	0	0
dgge:71.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:72.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:73.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:75.4	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	1	1	1	1	1	0
dgge:79.5	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
dgge:81.1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

	I8-W 6m 4 Jul 07	I8-SW 4 Jul 07	I8-in 20 Jul 07	I8-out 20 Jul 07	I8-NE inlet 20 Jul 07	TLM ladder	TLM ladder	I8-out 2 Jul 07	I8-in 2 Jul 07	I8 in/out C 4 Jul 07	I8 in/out B 4 Jul 07	I8 in/out A 4 Jul 07	I8 out/out C 4 Jul 07	TLM ladder	I8 in/in C 4 Jul 07	I8 in/in B 4 Jul 07	nut expt 12A 25 Jun 07	Toolik Inlet 22 Jun 07	I8 NE inlet 18 Jun 07	TLM ladder	I8 out 8 Aug 07	I8 7m 8 Aug 07	I8 1m 8 Aug 07
dgge:13.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:19.1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
dgge:22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:24.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:26.2	1	1	0	1	0	1	1	1	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1
dgge:29.4	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
dgge:30.3	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	1
dgge:31.1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:32.6	1	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
dgge:33.3	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
dgge:34.9	0	0	1	0	0	1	1	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0
dgge:36.1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
dgge:36.8	1	1	0	1	0	1	1	0	1	1	0	0	1	1	1	1	0	1	0	1	0	0	0
dgge:38.2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
dgge:39.6	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0
dgge:40.7	0	0	0	1	0	1	1	1	1	0	0	0	1	1	0	0	0	0	0	1	1	1	1
dgge:41.9	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	1	0	1
dgge:43.1	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
dgge:44.1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0
dgge:44.6	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:45.2	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0
dgge:46.4	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	0
dgge:47.1	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:48.1	0	0	1	0	0	1	0	0	1	1	0	0	0	1	1	1	0	1	0	1	0	0	0
dgge:49.0	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1
dgge:49.8	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:50.7	0	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1	1
dgge:51.6	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
dgge:52.1	0	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0
dgge:52.8	1	1	0	1	0	1	1	0	0	0	0	1	1	1	1	1	0	0	1	1	1	1	1
dgge:54.2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
dgge:55.9	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0
dgge:56.7	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0
dgge:57.7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1
dgge:58.5	1	1	1	1	0	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	1	1	1
dgge:60.6	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	1	1
dgge:61.4	1	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0
dgge:63.2	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:64.4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
dgge:65.8	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
dgge:67.6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:69.1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
dgge:70.0	1	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
dgge:70.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1
dgge:71.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:72.9	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:73.9	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
dgge:75.4	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1
dgge:79.5	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
dgge:81.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	I8 in 8 Aug 07	I8 out 11 Jul 07	I8 7m 11 Jul 07	I8 1m 11 Jul 07	TLM ladder	I8 in 11 Jul 07	I8 out 21 Jun 07	I8 6.5m 21 Jun 07	I8 1m 21 Jun 07	I8 in 21 Jun 07	I8 S inlet 20 Jul 07	TLM ladder
dgge:13.6	0	0	0	0	0	0	0	0	0	0	0	0
dgge:19.1	0	0	0	0	1	0	0	0	0	0	0	1
dgge:22.4	0	0	0	0	0	0	0	0	0	0	0	0
dgge:24.3	0	0	0	0	0	0	0	0	0	0	0	0
dgge:26.2	0	0	0	1	1	0	0	0	0	0	0	1
dgge:29.4	0	1	0	0	1	0	0	0	0	0	0	1
dgge:30.3	1	1	1	1	1	1	0	0	1	1	0	1
dgge:31.1	0	0	0	0	0	0	0	1	0	1	0	0
dgge:32.6	0	0	1	0	1	0	0	0	0	0	0	1
dgge:33.3	1	1	1	1	1	1	1	1	1	1	0	1
dgge:34.9	1	1	0	0	1	0	1	1	0	0	0	1
dgge:36.1	0	0	1	1	0	0	0	0	0	0	0	0
dgge:36.8	0	0	0	1	1	1	1	1	0	1	0	1
dgge:38.2	0	0	0	0	0	0	0	0	0	0	0	0
dgge:39.6	1	1	1	1	1	1	0	0	0	0	0	1
dgge:40.7	0	1	1	1	1	1	1	1	1	1	1	1
dgge:41.9	0	1	1	1	0	1	0	0	1	1	0	0
dgge:43.1	0	0	1	0	1	0	1	1	0	1	0	1
dgge:44.1	0	0	1	1	1	1	0	0	1	0	0	1
dgge:44.6	0	0	0	0	0	0	1	1	0	0	0	0
dgge:45.2	0	0	1	1	0	0	0	0	0	0	1	0
dgge:46.4	1	0	0	1	0	1	0	0	0	0	1	0
dgge:47.1	0	0	0	1	0	1	0	0	0	0	1	0
dgge:48.1	1	0	0	1	1	1	1	0	0	1	0	1
dgge:49.0	0	0	1	1	1	1	0	1	0	0	0	1
dgge:49.8	0	1	1	1	1	1	1	1	1	1	0	1
dgge:50.7	0	1	1	1	0	1	0	1	0	0	1	0
dgge:51.6	1	1	0	0	1	0	1	0	0	1	1	0
dgge:52.1	1	0	0	0	0	0	0	0	0	0	0	0
dgge:52.8	0	0	1	1	1	1	1	1	1	1	0	1
dgge:54.2	1	1	1	1	0	1	1	1	1	1	1	1
dgge:55.9	1	0	0	0	0	0	0	0	0	0	1	0
dgge:56.7	0	0	1	0	1	0	0	0	0	0	0	1
dgge:57.7	1	0	0	0	0	0	0	0	0	0	1	0
dgge:58.5	0	0	1	1	1	0	1	1	1	1	0	1
dgge:60.6	0	1	0	1	0	0	1	1	1	0	0	0
dgge:61.4	0	0	0	0	1	0	0	1	1	0	0	1
dgge:63.2	0	1	0	1	0	0	0	0	0	0	0	0
dgge:64.4	0	0	0	0	0	0	0	0	0	0	0	0
dgge:65.8	0	0	0	0	1	0	0	0	0	0	0	1
dgge:67.6	0	0	0	0	0	0	0	0	0	0	0	0
dgge:69.1	0	0	0	0	0	1	0	0	0	0	0	0
dgge:70.0	0	0	0	1	1	0	1	1	1	0	0	1
dgge:70.6	0	0	1	0	0	0	0	0	0	0	0	0
dgge:71.4	0	0	0	0	0	0	0	0	0	0	0	0
dgge:72.9	0	0	0	0	0	0	0	0	0	0	0	0
dgge:73.9	0	0	0	1	0	0	0	0	0	0	0	0
dgge:75.4	0	1	0	1	1	0	0	0	0	0	0	1
dgge:79.5	0	0	0	0	1	0	0	0	0	0	0	1
dgge:81.1	0	0	0	0	0	0	0	0	0	0	0	0

	TLM ladder	I8-in 16 Jun 07	I8-out 16 Jun 07	I8-in 18 Jun 07	I8-out 18 Jun 07	I8-NE inlet 18 Jun 07	I8-SE inlet 18 Jun 07	TLM ladder	I8-S inlet 18 Jun 07	I8-in 29 Jun 07	I8-out 29 Jun 07	I8-in 4 Jul 07	I8-out 4 Jul 07	I8-NE inlet 4 Jul 07	TLM ladder	I8-S inlet 4 Jul 07	I8-NE 4 Jul 07	I8-E 4 Jul 07	I8-SE 4 Jul 07	I8-Cen 4 Jul 07	I8-NW 4 Jul 07	TLM ladder	I8-W 0.5m 4 Jul 07
dgge:82.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:83.2	0	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
dgge:84.6	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	0	0	0	1	1	1
dgge:85.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
dgge:88.4	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
dgge:90.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:96.2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0

	I8-W 6m 4 Jul 07	I8-SW 4 Jul 07	I8-in 20 Jul 07	I8-out 20 Jul 07	I8-NE inlet 20 Jul 07	TLM ladder	TLM ladder	I8-out 2 Jul 07	I8-in 2 Jul 07	I8 in/out C 4 Jul 07	I8 in/out B 4 Jul 07	I8 in/out A 4 Jul 07	I8 out/out C 4 Jul 07	TLM ladder	I8 in/in C 4 Jul 07	I8 in/in B 4 Jul 07	nut expt 12A 25 Jun 07	Toolik Inlet 22 Jun 07	I8 NE inlet 18 Jun 07	TLM ladder	I8 out 8 Aug 07	I8 7m 8 Aug 07	I8 1m 8 Aug 07
dgge:82.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
dgge:83.2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
dgge:84.6	0	1	0	1	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	1	0
dgge:85.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
dgge:88.4	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1
dgge:90.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
dgge:96.2	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0

	I8 in 8 Aug 07	I8 out 11 Jul 07	I8 7m 11 Jul 07	I8 1m 11 Jul 07	TLM ladder	I8 in 11 Jul 07	I8 out 21 Jun 07	I8 6.5m 21 Jun 07	I8 1m 21 Jun 07	I8 in 21 Jun 07	I8 S inlet 20 Jul 07	TLM ladder
dgge:82.1	0	0	0	0	0	0	0	0	0	0	0	0
dgge:83.2	1	0	0	0	0	0	0	1	1	1	0	0
dgge:84.6	0	0	0	1	1	0	0	1	0	0	0	1
dgge:85.3	0	0	0	0	0	0	0	0	0	0	0	0
dgge:88.4	0	0	0	0	1	0	0	0	0	0	0	1
dgge:90.7	0	0	0	1	0	0	0	0	0	0	0	0
dgge:96.2	0	0	0	0	1	0	0	0	0	0	0	1

	TLM ladder	Toolik Inlet 22 Jun 07	12A 23 Jun 07	12B 23 Jun 07	12C 23 Jun 07	12NPA 23 Jun 07	12NPB 23 Jun 07	12NPC 23 Jun 07	17A 23 Jun 07	17B 23 Jun 07	TLM ladder	17C 23 Jun 07	17NPA 23 Jun 07	17NPB 23 Jun 07	17NPC 23 Jun 07	12A 24 Jun 07	12B 24 Jun 07	12C 24 Jun 07	12NPA 24 Jun 07	TLM ladder	12NPB 24 Jun 07	12NPC 24 Jun 07	17A 24 Jun 07	17B 24 Jun 07	17C 24 Jun 07
dgge:13.8	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:17.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:21.1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:24.4	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:25.5	1	1	1	1	1	1	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:27.9	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:28.8	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1
dgge:29.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
dgge:30.3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:32.0	1	1	1	1	1	1	1	0	0	0	1	0	1	1	1	1	1	1	0	1	0	0	0	1	1
dgge:33.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:34.8	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:37.1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:38.5	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:39.9	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:41.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:42.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
dgge:44.3	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:45.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:45.8	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:47.1	0	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	0	1	0	1	1	0	0	0
dgge:48.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
dgge:50.5	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:52.8	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
dgge:54.8	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1
dgge:57.6	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:61.3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:62.5	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
dgge:68.6	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:73.5	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:75.8	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:76.6	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1
dgge:77.1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:81.8	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:83.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:84.3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
dgge:86.9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:88.4	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0
dgge:89.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:93.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:95.3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0

	17NPA 24 Jun 07	17NPB 24 Jun 07	17NPC 24 Jun 07	TLM ladder	TLM ladder	12A 25 Jun 07	12B 25 Jun 07	12C 25 Jun 07	12NPA 25 Jun 07	12NPB 25 Jun 07	12NPC 25 Jun 07	12A 26 Jun 07	12B 26 Jun 07	TLM ladder	12C 26 Jun 07	12NPA 26 Jun 07	12NPB 26 Jun 07	12NPC 26 Jun 07	TLM ladder	TLM ladder	12A 25 Jun 07	Toolik Inlet 22 Jun 07	TLM ladder
dgge:13.8	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:17.3	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
dgge:21.1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1
dgge:24.4	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:25.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
dgge:27.9	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:28.8	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1
dgge:29.6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:30.3	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:32.0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1
dgge:33.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
dgge:34.8	0	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1	0	0	1
dgge:37.1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1
dgge:38.5	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	1	1	0	0	1
dgge:39.9	1	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	1	1	0	1	1
dgge:41.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
dgge:42.8	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0
dgge:44.3	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	1	1
dgge:45.1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1
dgge:45.8	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1
dgge:47.1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	1	0
dgge:48.6	1	1	1	0	0	0	0	0	1	1	1	1	1	0	1	1	1	0	0	0	0	0	0
dgge:50.5	1	1	0	1	1	0	0	0	0	1	1	0	0	1	0	0	1	1	1	1	0	1	1
dgge:52.8	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0
dgge:54.8	1	1	1	0	0	0	1	1	0	0	0	1	1	0	1	0	1	1	0	0	1	1	0
dgge:57.6	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:61.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:62.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
dgge:68.6	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:73.5	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:75.8	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:76.6	1	0	0	1	0	0	0	0	0	0	1	1	1	0	1	0	0	1	1	1	0	0	0
dgge:77.1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
dgge:81.8	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:83.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
dgge:84.3	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
dgge:86.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dgge:88.4	0	0	0	1	1	1	1	1	0	0	0	1	1	1	1	0	0	0	1	1	0	0	1
dgge:89.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
dgge:93.5	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0	0	0
dgge:95.3	0	0	0	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0