LONG-TERM AND OVER WINTER PHYTOPLANKTON COMMUNITY DYNAMICS IN LAKE BONNEY ANTARCTICA

by

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ABSTRACT

Lake Bonney is a hypersaline permanently ice-covered lake in the Taylor Valley, Antarctica that hosts simplified microbial food-webs. Studied since the 1960s, there are many aspects which are poorly understood. Logistical constraints have prevented sampling during the austral winter, a 4-month period of 24-hour darkness. Our knowledge of how the resident photosynthetic microorganisms respond during this period is limited. With inputs from ephemeral glacial-melt streams the lake level (stage) of Bonney has risen more than 3 m since 2004. With no outflow streams, the only known water loss is via ablation of the permanent ice-cover. A study of the spatial and temporal changes in the phytoplankton community structure during this period of rapid lake level rise is lacking. During the summers (November-January) from 2004-05 to 2014-15 an in situ submersible spectrofluorometer was deployed in Lake Bonney to quantify the chlorophyll-a concentrations (µg L^{-1}) of four functional groups of microalgae (green algae, brown/mixed algae, cryptophytes, cyanobacteria) using known excitation/emission spectra. During the 2013-14 field season this same instrument was mounted on autonomous cable-crawling profilers deployed in both east and west lobes of Lake Bonney, obtaining the first ever daily profiles of chlorophyll-a concentration at an annual scale. Following a summer of rapid lake level rise (2010-11), an increasing trend in depth integrated chlorophyll-a concentration was observed in Lake Bonney. During the same period, the nutrient poor surface water has become increasingly dominated by green algae. Dramatic shifts were also observed in the phytoplankton communities during the polar night. The highest concentrations of mean chlorophyll-a were measured during the 24-hour darkness. Algal spectral groups containing species capable of a mixotrophic metabolism (brown/mixed and cryptophytes) increased in concentration and relative abundance when photosynthetically active radiation was unavailable. This work provides valuable contributions to our knowledge of long-term and year-round phytoplankton community dynamics in Lake Bonney, and improves our understanding of the metabolic strategies employed by organisms in this high latitude permanently ice-covered lake.

CHAPTER ONE

INTRODUCTION

Ecological Significance of the McMurdo Dry Valleys

Antarctica is the highest, driest, and coldest continent on Earth. Seventy percent of the Earth's freshwater is trapped in the frozen ice sheets that blanket the continent (Green & Lyons, 2009). Much of the ice that covers the continent exceeds depths of 2500 m (Lythe & Vaughan, 2001). Located in southern Victoria Land, along the coastline of McMurdo Sound, there is a series of ice-free valleys referred to as the McMurdo Dry Valleys (MDV) that encompass an ice-free area of roughly 4500 km^2 (Levy, 2013). Receiving very little precipitation, extremely low temperatures, and a strong bimodal light regime makes this is one of the most extreme terrestrial environments on our planet (Priscu 1998).

This region supports no vascular plants and no vertebrates (Riffenburgh, 2007). The major ecotypes (exposed soils, glaciers, ephemeral streams, and perennially ice-covered lakes) support simplified microbially dominated food webs. The MDV are often considered the closest earthly analogs to conditions that have previously existed on the planet Mars (Doran, Wharton Jr., Des Marais, & McKay, 1998; McKay et al., 2005). Nestled within the MDV are numerous perennially ice-covered lakes, one of the primary ecotypes in these polar desert landscapes. These lakes, along with subglacial aquatic ecosystems, host the only year-round metabolism known on the entire Antarctic continent and are subject of much scientific inquiry (Bowman et al. 2016; Morgan-Kiss et al. 2016; Priscu et al. 1999).

Food-webs in the MDV lakes are dominated by microalgae, bacteria, and various heterotrophic flagellates. The truncated microbial food-webs found within these lakes have been shown to be driven primarily by bottom-up processes such as photosynthetically active radiation (PAR) and nutrient availability (Dore & Priscu, 2001). The photosynthetic organisms that inhabit the perennially ice-covered lakes are uniquely adapted to cold low-light conditions (Lizotte, Sharp, & Priscu, 1995; Morgan-Kiss, Priscu, Pocock, Gudynaite-Savitch, & Huner, 2006) and primary production from these organisms supports the subsequent trophic levels by providing particulate and dissolved organic matter (Bowman et al., 2016). The flux pathways of organic matter and nutrients are maintained by the microbial-loop (Azam et al., 1983) in these aquatic ecosystems, as the dissolved organic matter (DOM) excreted by photosynthetic organisms is rapidly utilized as an energy source by prokaryotic heterotrophs. The carbon and nutrients not incorporated into new bacterial biomass production are remineralized and again made available to primary producers (chemoautotrophs and photoautotrophs) (Bowman et al., 2016). The permanent ice-covers on the MDV lakes prevent wind-induced mixing and atmospheric gas exchange creating chemically and physically stratified aquatic ecosystems unlike any other lakes found on Earth (Priscu 1997; Spigel and Priscu 1996). A strong understanding of the environmental factors that control phytoplankton community structure and function is paramount to our ability to understand and predict how climate change may affect the microbial communities in the MDV lakes.

An Ecosystem Sensitive to Climate Change

Current climate models suggest global surface temperatures will increase in the coming decades, and polar regions are expected to warm the fastest (IPCC, 2014). Polar regions like the MDV are some of the most sensitive to changes in climate because of the heavy influence of frozen water in these habitats (Fountain et al., 2016). Increased temperature reduces snow and ice-cover, lowering albedo (i.e. reflectiveness) and decreases the amount of solar radiation reflected from Earth's surface. The decreased albedo results in increased energy absorbance causing further retreat of the snow and ice-cover. This feedback system is one of the primary mechanisms that makes polar regions particularly sensitive to climate change (Taylor et al., 2013). Current forecasting models of the MDV region suggest increased warming will thin the permanent lake-ice covers and increase loss in glacial mass through summer melting, leading to increased landscape connectivity (Obryk et al., 2016). The simplified microbial food webs present and the rapid landscape-level responses expected from slight changes in environmental conditions make the MDV an ideal location to study the biological impacts of climate change (Fountain, Levy, Gooseff, & Van Horn, 2014).

History of Exploration and Research in the MDV

Interest in the MDV lakes has existed since their discovery in 1903 when humans first explored this area. During the British-funded Discovery Expedition of the Antarctic continent, Sir Robert Falcon Scott and his team explored the MDV. He noted in his diaries that “we have seen no living thing, not even a moss or lichen; all that we did find, far inland among the moraine heaps, was the skeleton of a Weddell seal, and how that came there is beyond guessing”. Scott’s team made the first limnological measurements of Lake Bonney as they documented their exploration of the valley, recording the lake level and width of the narrows separating the east and west basins (Scott, 1907). It was, however, half a century before the first focused scientific studies would take place. In 1957-58, the International Geophysical Year, 12 nations set out to investigate the geology, climate, and biology of this poorly understood continent. In 1960-61 Armitage and House collected the first water samples from permanently ice-covered lakes with the purpose of studying zooplankton but found none. Instead, they measured general limnological parameters of Lake Bonney and Lake Vanda including temperature, pH, and conductivity (Armitage & House, 1962). Later that year, the Antarctic Treaty was signed, preventing territorial claims by any nation, and promoting scientific research (Green & Lyons, 2009), setting into motion the rigorous scientific research efforts that continue to this day. The preliminary measurements made by Armitage and House (1962) were soon followed by several limnological research investigations. During the summers of 1961-62 and 1962-63 Goldman et al. (1967) investigated the biological and chemical conditions of lakes Vanda and Bonney. They noted seasonal changes in the optical properties of the lake-ice covers, used microscope counts to identify phytoplankton, and measured a maximum photosynthetic rate of 8 mg C m^{-3} d^{-1} about 5 m from the ice-water interface (Goldman, Mason, & Hobbie, 1967). In 1963 expeditions were undertaken to make detailed measurements of physiochemical characteristics of Lake Bonney. Shirtcliffe and Benseman (1964) observed the density, electrical conductivity and chloride content of the water profile, and Hoare et al. (1964) made detailed temperature profiles. Both groups confirmed the water column to be highly stratified and stable and determined that solar radiation was the primary heat source for the observed temperature profiles (Hoare et al., 1964; Shirtcliffe & Benseman, 1964). nResearch efforts continued to increase over the next 30 years and in 1992, the National Science Foundation funded a Long Term Ecological Research (LTER) site to conduct ecosystem studies in this area. The LTER is an interdisciplinary effort to create long-term scientific studies investigating basic ecosystem function and environmental change in a broad array of ecosystem types worldwide. The core research areas of all LTER sites include: quantifying and monitoring primary production, observing changes in populations of organisms, tracking the path and flux of organic and inorganic matter through the ecosystem, and identifying environmental disturbance patterns and the ecosystem response (https://lternet.edu/). The McMurdo LTER (MCM LTER) site is one of 25 currently funded within the LTER network and represents the coldest and driest LTER location currently being studied. Given Antarctica’s influence on global climate and the fact that 14% of the Earth’s biosphere is polar, scientific research in the region provides valuable data on ecosystem processes at the cold limits of life (Priscu and Christner 2004; Singh, Bitz, and Frierson 2016). The MCM LTER, as well as the preceding research efforts, have produced an incredible depth of knowledge of the ecosystem structure and function in the McMurdo Dry Valleys (Bowman et al., 2016). Despite the comprehensive studies of the biogeochemical characteristics of the MDV lakes, long-term study of changes in the phytoplankton community structure in MDV lakes is lacking and was last investigated between 1989-2000 (Tursich, 2003). Further, with few exceptions (e.g. Lizotte et al. 1995, Priscu et al. 1999, Morgan-Kiss et al. 2016), sampling of MDV lakes has been restricted to the austral summer months (November-January) due to logistical constraints. Much of our understanding of winter processes has been inferred from summer and spring sampling efforts. The work presented in this thesis contributes to these current shortcomings in our understanding of phytoplankton community dynamics in Antarctic lakes.

Phytoplankton Physiology and Enumeration

On a global scale, marine phytoplankton are responsible for 50% of primary production despite the relatively low biomass when compared to land plants (Litchman et al., 2015). Phytoplankton drive aquatic food-webs, affect elemental stoichiometry (Redfield 1958), and through their cycling of CO_2, directly affect the global climate (Falkowski 2012). The influence of phytoplankton on aquatic systems is equally as important at local scales (Falkowski & Raven, 2013a). Photoautotrophic and chemoautotrophic organisms are considered primary producers because they utilize CO_2 to synthesize new organic carbon molecules. Chemoautotrophs require chemical sources of energy, while photoautotrophs utilize light energy to produce organic carbon (Madigan, Martinko, Bender, Buckley, & Stahl, 2014). Photoautotrophic organisms are generally considered the most important primary producers in aquatic ecosystems (Wetzel, 2001). Oxygenic photosynthesis, which evolves O_2 as a reaction by-product, is characteristic of cyanobacteria and eukaryotic algae and is based on a chemical reaction between water and CO_2 driven by energy from a narrow band of electromagnetic radiation (400-700 nm) referred to as photosynthetically active radiation (PAR). Photosynthesis occurs within a cell in two stages, commonly referred to as the “light” and “dark” reactions. In the first stage, the “light reactions”, specialized photopigments absorb light energy which is used to transfer electrons from water to $NADP^+$ and also to drive the phosphorylation of ADP to ATP (White, Drummond, & Fuqua, 2012). This process occurs as electrons flow through two distinct photosystems called photosystem I (PSI) and photosystem II (PSII) (Madigan et al., 2014). The photosystems occur as protein complexes integrated into photosynthetic membranes called “thylakoids” (Morgan-Kiss et al., 2006). The thylakoid membranes exist in organelles called “chloroplasts” in eukaryotes and stacks of thylakoid membranes called “phycobilisomes” are found near the cytoplasmic membranes of cyanobacteria (Madigan et al., 2014). Each photosystem contains a chlorophyll-a reaction center surrounded by light-harvesting antenna pigments, which act to absorb light energy and transfer it to the reaction center. The composition of antenna pigments can differ between photosystems and also between phytoplankton species (Falkowski & Raven, 2013b).

Beginning in PSII, when the reaction center absorbs photons passed to it via antenna pigments, an electron is raised to an excited state and then passed through an electron transport chain to PSI. Electrons are replaced as water is oxidized and oxygen is released. Protons are translocated across the thylakoid membrane as electrons are transferred between the photosystems creating a proton motive force capable of driving the phosphorylation of ADP to ATP. As the electrons enter PSI light energy is again used to stimulate the transfer to the final electron acceptor ADP^+ (White et al., 2012). The reactions of the two photosystems operating in series produce energy storage and transport ATP and the reduced intermediate NADPH, which are used to fix CO_2 in downstream metabolic reactions in the second stage of photosynthesis; the “dark reactions.”

The “dark reactions” are characterized by the Benson-Bassham-Calvin Cycle (Calvin cycle), in which the photoassimilation of atmospheric carbon dioxide is converted to complex organic molecules ultimately used to satisfy cellular energy demands (Biel & Fomina, 2015). This process occurs outside of the thylakoid membranes in the chloroplasts of eukaryotes and in the cytosol of bacteria (White et al., 2012). In a series of chemical reactions, the products of the “light reactions” are consumed to reduce CO_2 to 3-carbon sugars and ultimately glucose in the Calvin Cycle. During the "light reactions" not all energy is efficiently transferred to the reaction center, some is emitted from the cell as heat and most unused energy is emitted as light in the form of fluorescence (White et al., 2012). A rate limiting step of energy transfer occurs between PSII and PSI, resulting in most emitted fluorescence to originate in PSII. This allows PSII fluorescence to be exploited as an indicator of photosynthetic potential (Kolber & Falkowski, 1993). The fluorescence emitted from the PSII system is primarily from an evolutionarily conserved chlorophyll-a core and a species dependent composition of peripheral light-harvesting photopigments. The various peripheral antenna pigments are excited by different wavelengths within the PAR spectrum (Beutler, Wiltshire, Luring, & Moldaenke, 2002).

Fluorescence has been used to quantify chlorophyll-a concentrations through a water column since the 1970s (Kiefer, 1973). With recent technological advances, in situ characterization and differentiation of algal communities has become possible. By selectively using different excitation spectra of the antenna pigments associated with PSII chlorophyll-a fluorescence and measuring fluorescence from the PSII reaction center chlorophyll, different phytoplankton groups, each with their own specific compliment of assessor pigments, can be rapidly identified in the water column within seconds (Beutler, Wiltshire, Luring, et al., 2002). These methods to identify phytoplankton have considerable advantages over traditional methods, such as counting and identifying individual cells with optical microscopy (Catherine et al., 2012). One tool which has gained popularity with aquatic scientists, and employs these fluorometric methods is in situ spectrofluorometry (Alexander & Imberger, 2013; Gregor & Maršálek, 2004; Houliez, Lizon, Thyssen, Artigas, & Schmitt, 2012; Kring, Figary, Boyer, Watson, & Twiss, 2014). The bbe Moldaenke Fluoroprobe is one such device (Fig. 1.1). Major phylogenic groups of phytoplankton differ in their fluorescence excitation spectra, because of their unique compositions of antennae pigments, but the emission wavelength of PSII chlorophyll-a fluorescence in intact cells is conserved near 685 nm. The Fluoroprobe selectively excites the photopigments of different algal spectral groups and measures the fluorescence emission response. As the instrument is deployed in the water column a microcontroller rapidly alternates the pulse of five light emitting diodes (LEDs) at a frequency of 5 kHz. The LEDs are tuned to the known excitation spectra of four primary spectral groups of algae as well as chromophoric dissolved organic matter (CDOM). As the LEDs excite algal chlorophyll-a (chl-a) and CDOM, the chl-a fluorescence emission around 685 nm is detected by a photomultiplier and stored by the microcontroller. The data are downloaded from the instrument after deployment and the fluorescence signal for each LED is corrected for the fluorescence from CDOM and transmission of the sample. Using an iterative guassian fit weighted by standard deviations from the algal group norm spectra (calibrated by the manufacturer), algal biomass can be quantified for each group and is reported as µg L^-

^{1} of chl-a (detection limit of 20 ng L^{-1}). During the instrument's operation, pressure is also measured, allowing the depth calculation associated with each sample (Beutler, Wiltshire, Meyer, et al., 2002). A detailed schematic of the instrument as well as a list of the characteristics of the quantifiable algal spectral groups are shown in Figure 1.1 and Table 1.1, respectively.

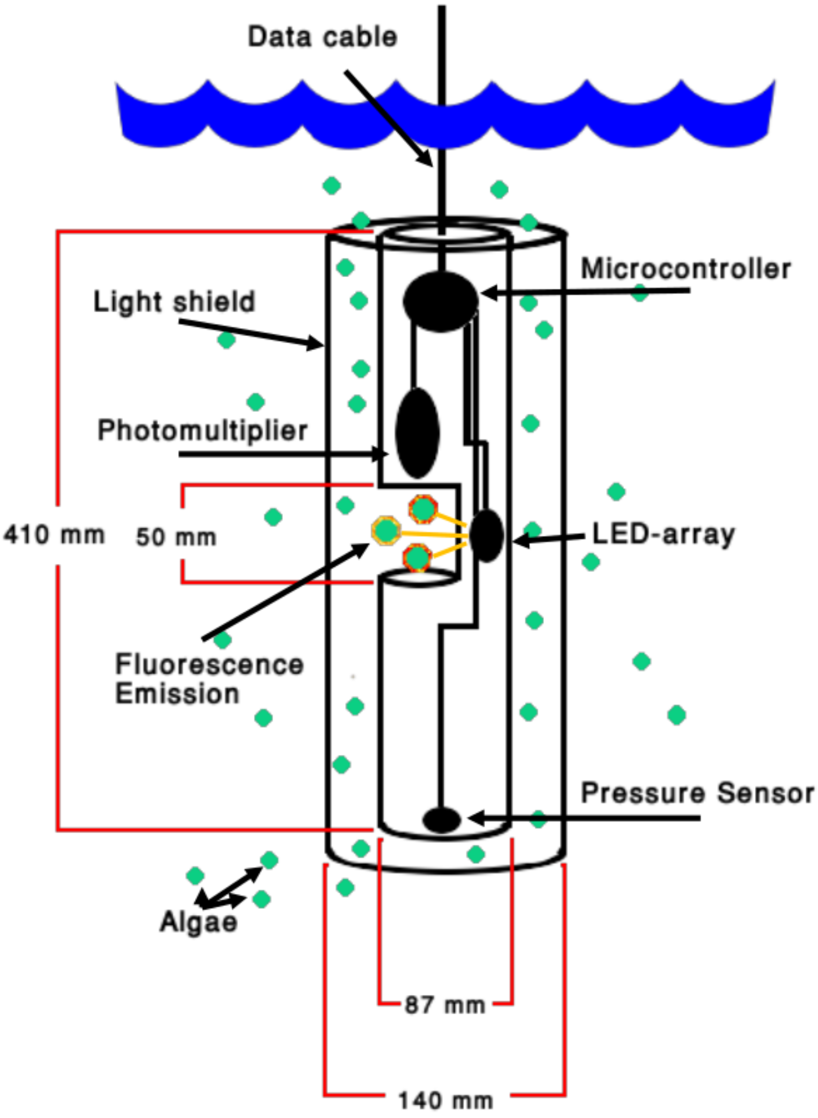

Figure 1.1: Diagram of in situ submersible spectrofluorometer (bbe Moldaenke Fluoroprobe) operation. Adapted from Beutler et al. 2002.

Spectral Group	Photopigment Composition	Excitation Wavelength
Green Algae (Chlorophyta and Euglenophyta)	Chl-a, Chl-b, xanthophyll	470 nm
Brown/Mixed Algae (Haptophyta, Chrysophyceae, Bacillariophyceae, Dinophyceae)	Chl-a, Chl-c, xanthophyll (often fucoxanthin or peridinin)	525 nm
Cryptophytes	Chl-a, Chl-c, with one phycobiliprotein (either pycoerythrin or phycocyanin)	570 nm
Cyanobacteria	Chl-a, phycobilisomes (mainly phycocyanin)	610 nm
CDOM	NA	370 nm

Table 1.1: Algal spectral groups differentiated by the Fluoroprobe. Characteristic photopigment composition and excitation wavelengths are listed for each group. Dissolved organic matter or “yellow substances” abbreviated as CDOM. Adapted from Beutler et al. 2002.

Ecological Application of Spectrofluorometry

The MCM LTER began using a Fluoroprobe for routine limnological sampling in 2004 to examine the biomass and community structure of phytoplankton in the MDV lakes. An autonomous in situ profiling system (ALPS) (Winslow et al., 2014) was deployed in both east and west Lake Bonney in 2013 that included a Fluoroprobe. This allowed the first ever year-long daily profiles of phytoplankton biomass and community composition in a MDV lake. The work presented in this thesis, both the long-term data and the year-round profiles, address the overarching hypothesis that phytoplankton community composition responds dynamically to changing environmental conditions. I hypothesize that the landscape-level effects of climate change (e.g. increased glacial run-off, increasing lake depth, etc.) are influencing the algal community structure in Lake Bonney. Additionally, I hypothesize that during the 24-hour darkness of the austral winter, the Lake Bonney algal community structure shifts in favor of organisms capable of alternative metabolic strategies (i.e. mixotrophy).

Questions Addressed

Long-Term Study

1.) How has increasing lake depth between 2004 and 2015 affected the total integrated chl-a concentration in the trophogenic zone during the summer months?

2.) Has the vertical structure of Lake Bonney phytoplankton communities changed during this period of increasing lake level?

3.) Between 2004 and 2015 were different environmental variables driving the trends of the individual algal group chl-a concentrations?

Over Winter Study

1.) Does the total chl-a concentration decrease during the 24-hour darkness of the austral winter?

2.) How does the diversity of the phytoplankton community respond to the 24-hour darkness of winter?

3.) Does the relative abundance of algal groups capable of mixotrophy increase when PAR is unavailable?

Significance of Research

Our current knowledge of phytoplankton community composition in MDV lakes is limited because quantification and identification of algal cells by microscopy is tedious and often subjective. We know little about the community dynamics during the darkness of winter because of the logistical constraints that prevent sampling. My data are the first to show a long-term (11 year) trend in phytoplankton biomass and community structure through the water column since Tursich's work (2003). The year-round study is the first to show the dynamics of phytoplankton community composition during the polar night.

The work investigating fluorescence based chl-a concentrations is a novel approach for monitoring long-term changes in phytoplankton community structure in an Antarctic lake. The previous long-term synthesis of the temporal and spatial changes in phytoplankton community composition relied on inverted microscope counts from samples collected between 1989 and 2000 (Tursich, 2003). An advantage to the microscopy approach was the increased ability for species-level identification when compared to the spectrofluorometric methods used in this study. While organism identification by the Fluoroprobe is coarser, this instrument provides significant advantages in spatial resolution and efficiency. The Fluoroprobe provides rapid estimates of algal group biomass (µg chl-a L^{-1}) throughout the entire water column, which is not feasible with traditional microscopy methods.

Understanding how algal spectral groups have changed provides an important biological response to climate change. These data will help serve as a guide for future research of ecosystem structure and function in MDV lakes. The data presented in the year-round study will help to fill many gaps that currently exist in the carbon budget for these lakes (Priscu et al. 1999). This work also builds upon the pioneering studies that investigated algal community dynamics during the winter-spring transition (Lizotte et al., 1995), as well as more recent work which sampled MDV lakes during the transition from fall to winter (Morgan-Kiss et al. 2016; Priscu et al. 1999; Vick and Priscu 2012). The methods used for data collection in the year-round study provide us with valuable information on how autonomous tools might be used in the exploration of the icy oceans of worlds in the outer solar system.

Description of Study Site

McMurdo Dry Valleys

Only 0.32 % of the total area of the Antarctic continent is ice-free (Riffenburgh, 2007). The largest of these ice-free regions, the McMurdo Dry Valleys, is positioned between the Ross Sea and the East Antarctic ice-sheet (77-78ºS, 160-164ºE). These valleys were carved by glaciers advancing and retreating through the Transantarctic Mountains, which currently impede the flow of ice from the East Antarctic Ice Sheet (Fountain, Nylen, Monaghan, Basagic, & Bromwich, 2010). The Taylor, Wright, and Beacon Valleys comprise the central portion of the MDV and represent an area of 3000 km^2 (Levy, 2013). This region is characterized by exposed soil, glaciers, ephemeral melt-water streams, and perennially ice-covered lakes. The mean annual temperature ranges from -14.8 to -30 °C and only extends above the freezing point for a few weeks during the summer months (Doran et al., 2002). The extreme southern latitude creates a strong bimodal light regime, with four month periods of 24-hour sunlight and 24-hour darkness, each flanked by two months of twilight. The MDV receive on average less than 50 mm yr^{-1} of precipitation (water equivalents), much of which falls as snow, and strong katabatic winds prevent accumulation (Fountain et al., 2010). These conditions result in the coldest and driest desert environment on our planet. The Taylor Valley is the most heavily studied of the MDV and is home to three major perennially ice-capped closed basin lakes; Bonney, Hoare, and Fryxell (Fig. 1.2). The primary focus of this research is Lake Bonney.

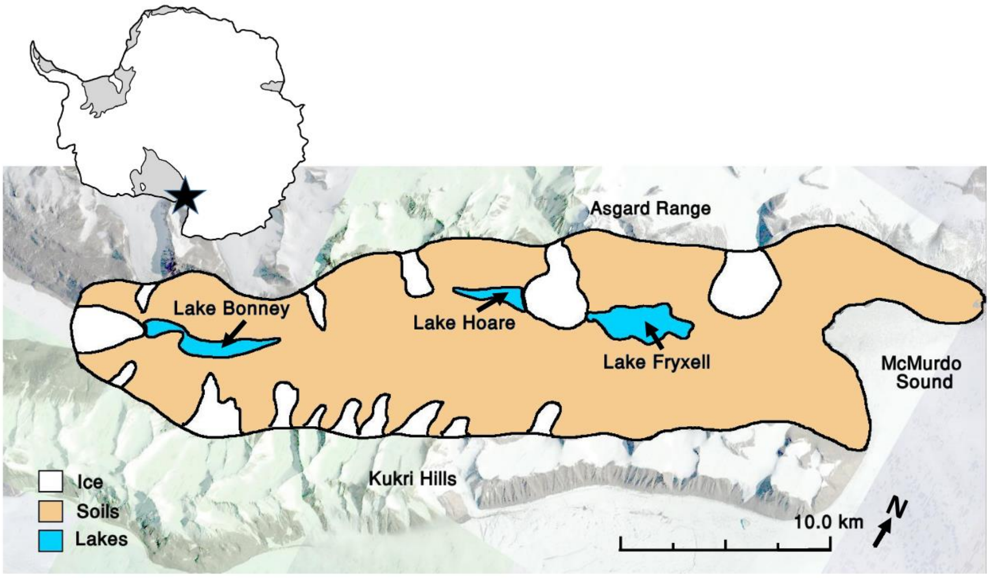

Figure 1.2: Map of the Taylor Valley. Approximate geographic location is represented by the star on the Antarctic continent figure inset. Scale and compass orientation apply only to Taylor Valley map. Adapted from map data provided by: Google, Digital Globe, CNES / Astrium, and U.S. Geological Survey.

Lake Bonney

Lake Bonney is 7 km long and 0.9 km wide located 25 km inland at the western end of the Taylor Valley (-77.72, 162.37). This hypersaline lake is separated into two distinct basins by a narrow sill 50 m wide that forms a channel 17.7 m deep (Winslow et al., 2014). This channel allows advective mixing of surface waters but sub-oxic waters below the chemocline remain isolated and chemically distinct. The lobes (east, west) are recognized as separate lakes due to their individual geological legacies and unique physiochemical characteristics (Poreda, Hunt, Berry Lyons, & Welch, 2004). General characteristics of each lobe are summarized in Table 1.2.

The permanent ice-cover of Lake Bonney averages 4 m thick and prevents wind induced mixing and atmospheric gas exchange. The lack of mixing creates a chemically stratified and stable water column. The water column of east Lake Bonney (ELB) is more transparent than west Lake Bonney (WLB) (average attenuation coefficients of PAR for ELB and WLB = 0.11 and 0.18, respectively). The bottom water of ELB is more saline than the west lobe. Both lobes have a temperature profile with surface waters around 0 ^{o}C reaching a maximum temperature between 10-15 m and then decreasing to less than 0 ^{o}C at the bottom of the water column (Fig. 1.3). Dissolved oxygen concentrations are 250-350% over air saturation in the upper portion of the water column, and drop to suboxic levels below the chemocline (Priscu et al. 1999).

Lobe	Max Length (km)	Max Width (km)	Max Depth (m)	Surface Area (km^2)	Ice Thickness (m)	Temperature (°C)	Max Conductivity (mS cm^{-1})
East	4.8	0.9	41	3.32	3.0-4.5	-2.8 to 7.9	116
West	2.6	0.9	43	0.99	2.8-4.5	-5.4 to 3.2	81

Table 1.2: Summary of the hydrographic properties of the east and west lobes of Lake Bonney (Priscu 1998).

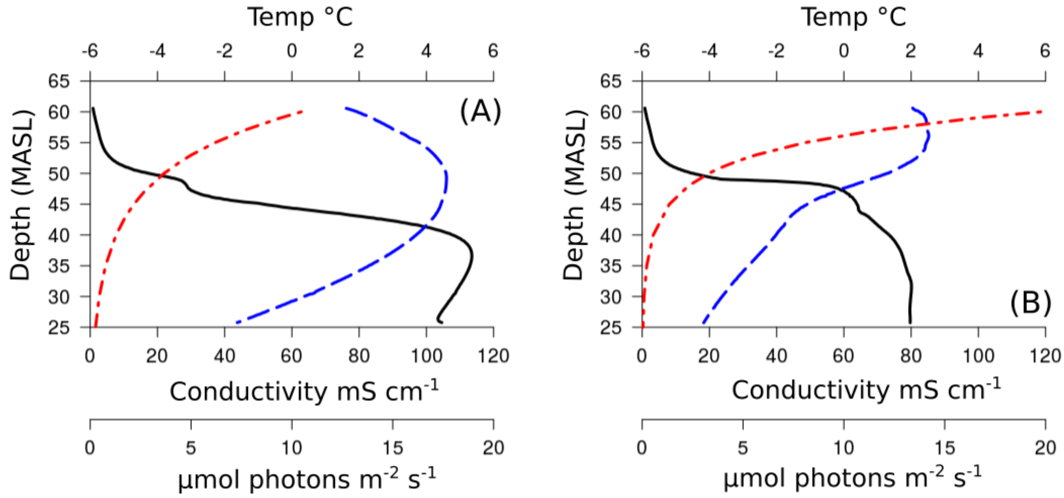

Figure 1.3: Characteristic profiles of east (A) and west (B) lobes of Lake Bonney. Salinity (conductivity) is represented by a solid black line, temperature as the dashed blue line, and underwater PAR as a dot-dash red line. Profile data recorded December 2014.

Depth profiles of nutrients important for phytoplankton growth (e.g. dissolved inorganic nitrogen and phosphorus) highlight the oligotrophic conditions in the surface waters where PAR is available (Fig. 1.4). Increased nutrient concentrations are observed below the strong density gradient of the chemocline in both lakes.

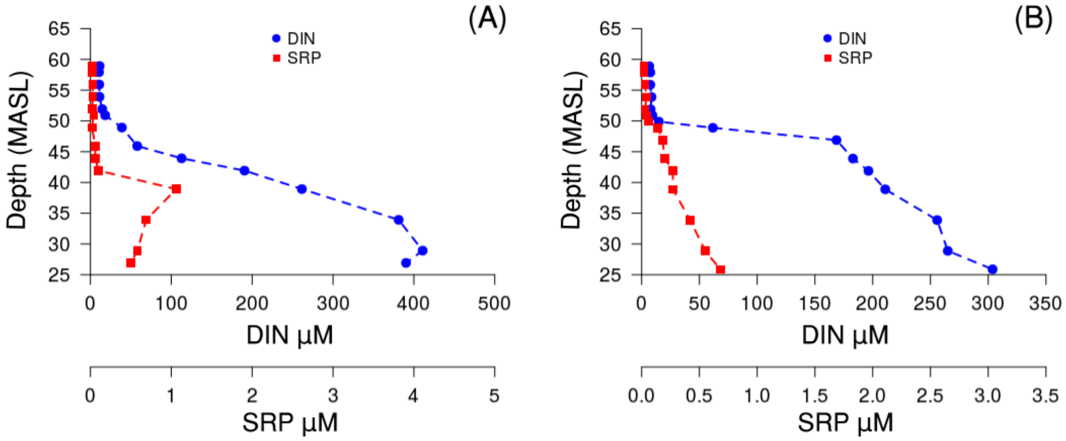

Figure 1.4: Characteristic nutrient profiles for east (A) and west (B) Lake Bonney. Dissolved inorganic nitrogen (DIN = NH_4^+ + NO_3^- + NO_2^-) concentrations show as blue circles and soluble reactive phosphorus (SRP = PO_4^{-3}) represented with red squares. Depth is reported in meters above sea-level (MASL) where higher values equate to shallower depths. Nutrient data recorded December 2009.

Lake Bonney is in a hydrologically closed basin and receives seasonal freshwater inflows from Santa Fe Stream (WLB) and Priscu Stream (ELB). WLB also receives saline rich subglacial outflows from Blood Falls, a unique feature at the terminus of the Taylor Glacier (Mikucki, Foreman, Sattler, Lyons, & Priscu, 2004). Recent work has highlighted the existence of a saline groundwater system extending from below the Taylor Glacier into Lake Bonney (Mikucki et al., 2015). With no outlet streams, the only known loss of lake water is through the ablation of the permanent ice cover (Dugan, Obryk, & Doran, 2013).

Lake Bonney supports no crustaceous zooplankton and no fish, but hosts diverse bacterial and eukaryotic microbial communities (Vick-Majors, Priscu, & Amaral-Zettler, 2014). It has been shown that the phytoplankton grow in discrete layers associated with chemical gradients in the water column, forming deep chlorophyll layers associated with the chemocline (Lizotte & Priscu, 1994). Recent studies focused on phylogenetics and gene expression have helped to identify the abundant phytoplankton species found in lake Bonney (Bielewicz et al., 2011; Kong, Ream, Priscu, & Morgan-Kiss, 2012; Li, Podar, & Morgan-Kiss, 2016). The abundant algal species that likely comprise the spectral groups differentiated by the Fluoroprobe are summarized below (Table 1.3). The abundant stramenopile detected throughout the water column of both lobes by Bielewicz et al. (2011) was most closely related to *Nannochloropsis limnetica*. This organism is likely included in the green algae group detected by the Fluoroprobe, as the absorbance emission profile of *Nannochloropsis limnetica* matches closely to that of the Chlorophyceae class, with a peak excitation near 470 nm (Fietz et al., 2005).

Spectral Group	Algal Species	Excitation Wavelength
Green Algae	*Chlamydomonas spp.* *Chloromonas sp.* *Chlorella sp.* *Micractinium sp.* *Nannochloropsis sp.*	470 nm
Brown/Mixed Algae	*Isochrysis sp.* *Ochromonas sp*	525 nm
Cryptophytes	*Geminigera sp.*	570 nm
Cyanobacteria	*Nostocales sp.* (WLB only) *Oscillatoriales sp.*	610 nm

Table 1.3: Phytoplankton identified in Lake Bonney that are representative of the algal spectral groups detected by the Fluoroprobe.

CHAPTER TWO

LONG-TERM CHANGES IN ALGAL COMMUNITY COMPOSITION

Introduction

Increased green-house gas emissions from human activities (e.g. the burning of fossil-fuels and industrial processes) have altered the atmospheric composition of our planet. The resulting change in thermal energy balance has affected global climate patterns, ocean circulation, and has been linked with changes in the structure and function of ecosystems (IPCC, 2014). A recent review by Scheffers et al. (2016) determined that greater than 80% of the core ecosystem processes of terrestrial and aquatic ecosystems they identified have been impacted by climate change. These impacts are manifested as physiological changes at the organism-level as well as broad changes in community abundance and distribution (Scheffers et al., 2016). Studies of marine systems have linked climate change to alterations in timing and magnitude of seasonal algal blooms, the spatial structure and distribution of phytoplankton communities, and interactions between organisms (Hays, Richardson, & Robinson, 2005; Paerl & Huisman, 2008; Winder & Sommer, 2012). These changes in algal food-web dynamics extend across trophic levels and impact biogeochemical cycles (Scheffers et al., 2016).

The influences of climate change on freshwater systems have also been identified throughout the world. A detailed study of 52 lakes in eastern Canada, associated a dramatic increase in the abundance of golden-brown algae during the latter part of the twentieth century with the limnological impacts of climate change (Ginn, Rate, Cumming, & Smol, 2010). Increasingly warmer springs observed since the 1960s have affected the timing of seasonal algal blooms in a large temperate lake in Washington, disrupting the trophic link between phytoplankton and zooplankton (Winder & Schindler, 2004). The physiological traits shared within phytoplankton functional groups make each group uniquely sensitive to changes in different environmental conditions (Litchman et al., 2015). The varied response of algal groups (and species within groups) to the effects of climate change will be difficult to predict, and ecosystem structure and function will be differentially impacted.

The MDV ecosystem is particularly sensitive to changes in local climate conditions, and temperatures above freezing can dramatically alter the landscape (Fountain et al., 2014; Lyons et al., 2001). The closed basin and steep bathymetry of Lake Bonney makes it susceptible to rapid changes in lake level over short periods of time. After an Antarctic climate cooling trend was observed between 1986-2000, a record year of summer temperature was recorded during 2001-02, causing drastic increases in glacial melt and flooding across the Taylor Valley landscape (Foreman, Wolf, & Priscu, 2004). Glacial melt is the primary source of new water and allochthonous nutrient inputs into the MDV lakes. In a single summer the lake level decline observed since 1993 was reversed and the lake rose 1.01 meters. This high melt year led to an increase in water turbidity and a 23% decrease in primary production in WLB due to turbid inflow from streams associated with the Taylor Glacier. Following the season of increased stream flow, high nutrient concentrations were observed in the surface waters of both lobes of Lake Bonney resulting in a 149% and 48% increase in depth integrated chl-a concentration in ELB and WLB, respectively (Foreman et al., 2004). Since 2001, lake levels have risen more than 3 m (Fountain et al., 2016). If the temperature increases predicted by current climate models (IPCC, 2014) are observed in the MDV, future decreases in the thickness of the lake's permanent ice-cover and increased glacial run-off are likely (Fountain et al., 2016).

Many studies have investigated the complex interactions between environmental conditions and the phytoplankton communities present in Lake Bonney on annual time scales (Bowman et al., 2016; Fritsen & Priscu, 1999; Kong, Li, Romancova, Prášil, & Morgan-Kiss, 2014; Lizotte & Priscu, 1992). A comprehensive study on how algal communities have changed over the last decade is currently lacking. It has been shown that the stable water columns in the east and west lobes of Lake Bonney support distinct layers of phytoplankton resembling deep chlorophyll maxima (Lizotte & Priscu, 1992). Nutrient and light availability has been shown to regulate phytoplankton production in both lobes (Dore and Priscu 2001; Priscu 1995, Fritsen and Priscu 1999). The permanent ice-cover often limits underwater irradiance to between 1-22% of surface irradiance and biases the wavelengths of light which penetrate the water column to the blue to blue-green portion of the spectrum (Priscu

1998). The phototrophic organisms present are extremely well adapted to low relatively monochromatic light conditions and low temperatures (Morgan-Kiss et al., 2006; Neale & Priscu, 1995). Previous analysis of phytoplankton photopigment distribution has shown a population of cryptophytes in the surface waters just below the ice and that the most productive layers in east and west Bonney are dominated by chrysophytes (brown/mixed algae) and chlorophytes (green algae) (Lizotte & Priscu, 1998; Tursich, 2003). A recent study combining spectrofluorometric data with real-time polymerase chain reaction assays, showed that green algae are distributed throughout the water column and dominated algal biomass of both lobes while brown/mixed algae were of lower abundance and were associated with the deep-chlorophyll layer (Dolhi, Teufel, Kong, & Morgan-Kiss, 2015).

Vertical profiles of Lake Bonney algal populations have been recorded routinely during MCM LTER sampling since 2004 using a submersible spectrofluorometer (bbe Moldaenke Fluoroprobe). Chl-a fluorescence emission following the excitation by specific wavelengths of light allows the Fluoroprobe to distinguish four spectral groups of algae (green algae, brown/mixed algae, cryptophytes, and cyanobacteria) and provides an approximation of biomass (µg chl-a L^{-1}) for each group. In this chapter I present changes in the vertical phytoplankton community structure in the trophogenic zone of ELB (5-22 m) and WLB (5-20 m) between the 2004-05 and 2014-15 austral summer field seasons.

The overarching hypothesis for this chapter is that the landscape-level effects of climate change (e.g. increased glacial run-off, increasing lake depth, etc.) are influencing the algal community structure in Lake Bonney. The specific questions I will address in this chapter are: How has increasing lake depth between 2004 and 2015 affected the total integrated chl-a concentration in the trophogenic zone during the austral summer? Has the vertical structure of Lake Bonney phytoplankton communities changed during this period of increasing lake level? Between 2004 and 2015 were different environmental variables driving the trends of the individual algal group chl-a concentrations?

Methods

Detailed biological and chemical lake sampling has been performed between October and January as part of the MCM LTER. A Jiffy drill was used was used together with a melting probe at each lake to penetrate the perennial ice-cover and gain access to the liquid water column. Two sampling holes were drilled in an area corresponding to the deepest part of the lake. Exact location of the sampling holes varied from year to year based on topological features of the lake ice surface. One hole was drilled within a sampling hut (Polarhaven) and was used for sample collection. The second hole, located ~20 m from the Polarhaven was used for primary productivity incubation experiments and instrument deployment. Sampling in the outside hole was conducted beneath a tarp to prevent artificial increases in water-column solar radiation.

Water samples were collected with a 5 L Niskin bottle suspended on a depth-calibrated steel cable on a hand-winch. During sampling, depths are measured from the piezometric water level down, and here will be reported primarily as meters above sea level (MASL), where higher numbers represent shallower depths (MASL = recorded lake stage (MASL) – measured depth (m)). The stage measurements were obtained from the "Blue Box" daily average dataset available in the MCM LTER database (http://www.mcmlter.org/limnological-data). This study focuses on the trophogenic zone depth ranges which contain the highest rates of primary productivity (5-20 m WLB, 5-22 m ELB). Detailed procedures for all physiochemical parameters can be found in the MCM Limnological Methods Manual (http://montana.edu/priscu); key methods used in my study are detailed below).

Submersible Spectrofluorometer

A submersible spectrofluorometer (bbe Moldaenke Fluoroprobe) was deployed in all MCM LTER lakes beginning in the 2004-2005 field season. This instrument employs five LEDs calibrated to the known excitation spectra of light harvesting antennae pigments of the following specific algal groups: 470 nm = green algae; 525 = brown/mixed algae; 570 nm = cryptophytes; 610 nm = cyanobacteria. An additional LED excited at 370 nm to estimate CDOM, which was used to correct chl-a fluorescence. The Fluoroprobe was connected to a depth calibrated steel cable and lowered by hand-winch at a speed of approximately 20 cm s^{-1} to ~2 m from the lake bottom. After the cast the Fluoroprobe was connected to a laptop computer and data were downloaded using software supplied by the instrument manufacturer.

Primary Productivity Measurements

Sample water was collected at specific depths in each lake (5, 6, 8, 10, 12, 13, 15, 18, 20, 22 m ELB; 5, 6, 8, 10, 12, 13, 14, 15, 17, 20 m WLB). Two light and one dark 125 ml borosilicate bottles were filled with sample water from each depth and inoculated with radiolabeled ^{14}C bicarbonate (final activity 100 to 121 µCi ml^{-1}) based on water column dissolved inorganic carbon concentrations, which was measured on a separate aliquot by infrared spectroscopy of acid sparged samples. Inoculated bottles were suspended by a cable at their respective sample depths and allowed to incubate for 24 hrs. After incubation samples were filtered on 25 mm Whatman GF/F filters, which were placed in 20 ml scintillation vials, acidified with 0.5 ml of 3N HCl, and dried. Activity on the filters was determined using a calibrated liquid scintillation counter

Photosynthetically Active Radiation

During the 24-hour primary productivity incubation experiments, underwater (10 m) and incident PAR were measured using a Licor LI-193SA spherical quantum sensor and a Licor LI-190SA quantum sensor, respectfully. Water column extinction coefficients were calculated and using the Beer-Lambert law, 24-hour mean PAR was computed for the entire water column during each incubation experiment.

Conductivity, Temperature, and Depth Instrument

Water column temperature and conductivity profiles were obtained using a Sea-Bird Electronics SBE 25 CTD. The CTD was deployed using a hand-winch at 1 m s^{-1} to a depth ~2 m from the bottom of the lake. Data were downloaded to a laptop computer using a serial data-cable and the SeaTerm software following the deployment.

Data Analysis

All data analysis and visualizations were done using R statistical software (R Core Team, 2016). Generalized additive models (GAM) were developed with the gam function in the mgcv software package (Wood, 2011). Various functions within the Lubridate and dplyr packages were employed to format and structure data for analysis (Grolemund & Wickham, 2011; Wickham & Francois, 2016). Shannon diversity index was calculated with the diversity function included in the vegan software package (Oksanen et al., 2016). Ecological analysis of the phytoplankton spectral classes was done utilizing data publicly available in the MCM LTER database (http://www.mcmlter.org/limnological-data). Limnological sample collection was routinely preformed at discrete depths within the water column of the east and west lobes of Lake Bonney. To allow for statistical analysis between environmental variables measured at discrete depths (PPR incubation depths) and the continuous measurements of algal group chl-a obtained during a Fluoroprobe cast, a modified Fluoroprobe dataset was constructed. The Fluoroprobe casts were aligned to the discrete sampling depths by taking the mean chl-a concentration between +/- 0.5 m of the corresponding depths sampled in each lobe.

GAM models were constructed for each phytoplankton group using the following ecological parameters as explanatory variables: ice thickness (m), dissolved inorganic carbon (DIC mM), dissolved organic carbon (DOC mM), dissolved inorganic nitrogen (DIN µM (DIN = $NH_4^+ + NO_3^- + NO_2^-$)), soluble reactive phosphorus (SRP µM (PO_4^{-3})), underwater photosynthetically active radiation (PAR µmol photons m^{-2} s^{-1}), depth in meters above sea level (MASL), and the date as a numerical fraction of the year. These variables were chosen because they have been shown to be primary drivers of phytoplankton primary productivity (e.g. PAR and nutrients), represent available carbon sources (e.g. DIC and DOC), and capture the physical changes in environmental conditions between 2004 and 2015 (e.g. ice thickness, depth, time). Final models for each algal group were chosen based on the greatest amount of variance explained by the fewest number of model parameters. Variables were systematically removed from the models using backward elimination beginning with a full model with all parameters included. Akaike's Information Criterion (AIC) was employed with the AIC function in the R base package (R Core Team, 2016) to determine if including additional parameters added explanatory power to the model worth the cost in reduced degrees of freedom.

Filled contour plots visualizing the summer (November-January) spatial distribution of algal spectral class chl-a were created using a bivariate interpolation matrix of chl-a concentration as a function of time and depth (x and y matrix coordinates, respectivel(R Core Team, 2016).

Results

The lake level (stage) of Lake Bonney has risen approximately 3.1 m from December 2004 to December 2015. During years with high stream flow from glacial run-off, lake level can change dramatically. For example, over a three-month period in 2010-11 (01-November to 01-February) the stage of Lake Bonney rose 0.81 m (Fig. 2.1).

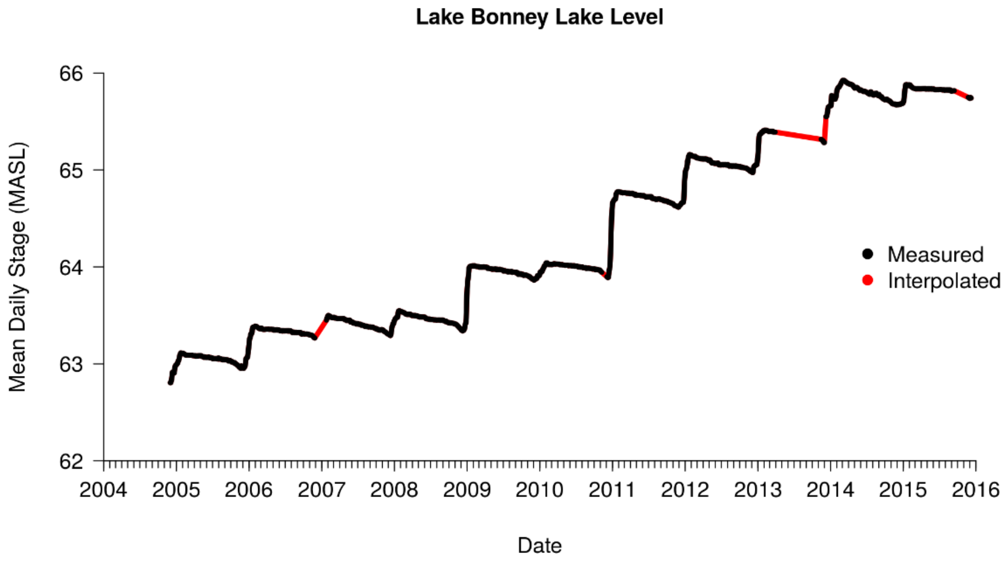

Figure 2.1: Mean daily stage recorded in Lake Bonney between December 2004 and December 2015. Minor x-axis ticks represent months. Lake level (stage) is reported in meters above sea level (MASL). Measured values are recorded by the "Blue Box" pressure sensor. Missing values were linearly interpolated and highlighted in red.

Total chl-a concentrations measured in situ by the Fluoroprobe during the routine LTER summer (November, December, January) limnological sampling runs were integrated over the trophogenic zone (5-20 m WLB; 5-22 m ELB) for each

Fluoroprobe cast. Generalized additive models were then constructed using the integrated values of total chl-a and time. The models provided strong evidence of an increasing trend in integrated total chl-a over the trophogenic zone between November 2004 and January 2016 in both west and east lobes of Lake Bonney (Fig 2.2 and Fig 2.3 respectively).

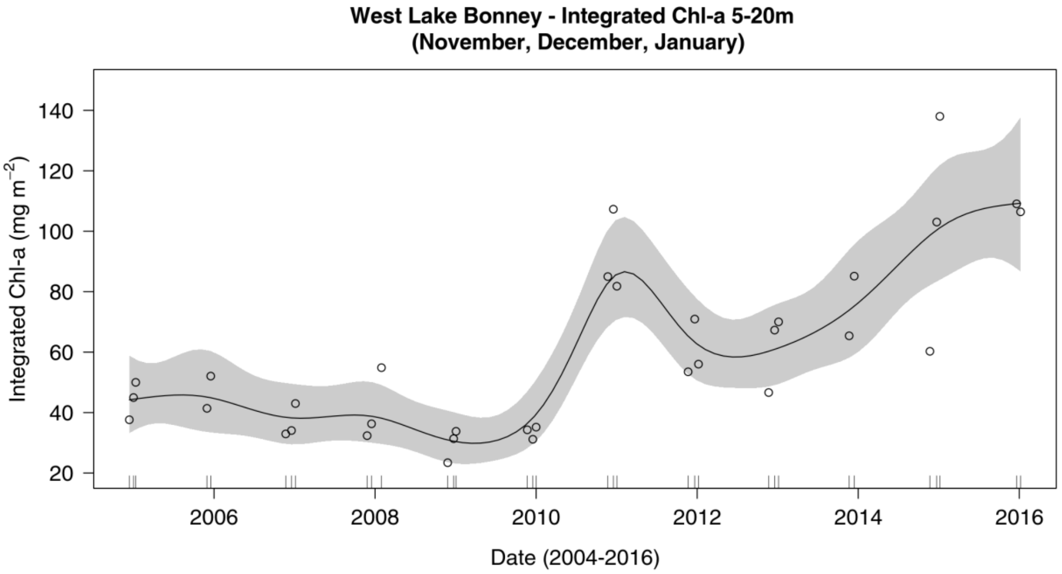

Figure 2.2: Generalized additive model of integrated chl-a over 5-20m in WLB from 2004-16. Data from Fluoroprobe casts made during routine limnological sampling in November, December, and January. Integrated values are represented by open circles and sample dates are denoted by ticks above the x-axis. Depth measurement recorded from the piezometric water level, which is typically ~30 cm.

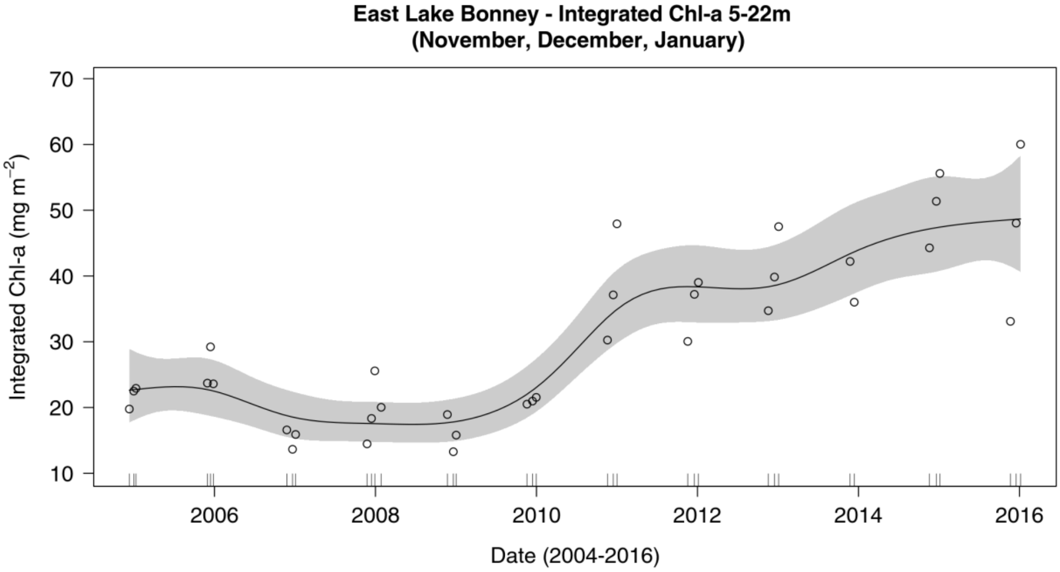

Figure 2.3: Generalized additive model of integrated chl-a over 5-22 m in ELB from 2004-16. Data from Fluoroprobe casts made during routine limnological sampling in November, December, and January. Integrated values are represented by open circles and sample dates are denoted by ticks above the x-axis. Depth measurement recorded from the piezometric water level, which is typically ~30 cm.

A comparison of depth profiles of algal group chl-a concentrations (µg L^{-1}) measured by the Fluoroprobe during December 2004 with those measured in December 2014 highlights several trends in both west and east Lake Bonney (Figures 2.4 and 2.5 respectively). The first observation is that, despite rising lake levels, the position of the chemocline relative to sea level appears to be stable, suggesting that the volume of relatively fresh and oligotrophic water above the chemocline is increasing. The next trend is that the chl-a concentrations of the brown/mixed algae and green algae groups have increased both in the nutrient-poor surface waters and in the deep chlorophyll maxima positioned near the nutrient-rich chemocline. Profiles of the cyanobacteria and cryptophyte groups measured in December 2005 and December 2014, highlight a population of cryptophytes just below the surface of the ice-water interface as well as populations of both groups in the deeper portion of the trophogenic zone. Both cyanobacteria and cryptophyte groups have showed no significant temporal trend of increasing or decreasing chl-a biomass during this period.

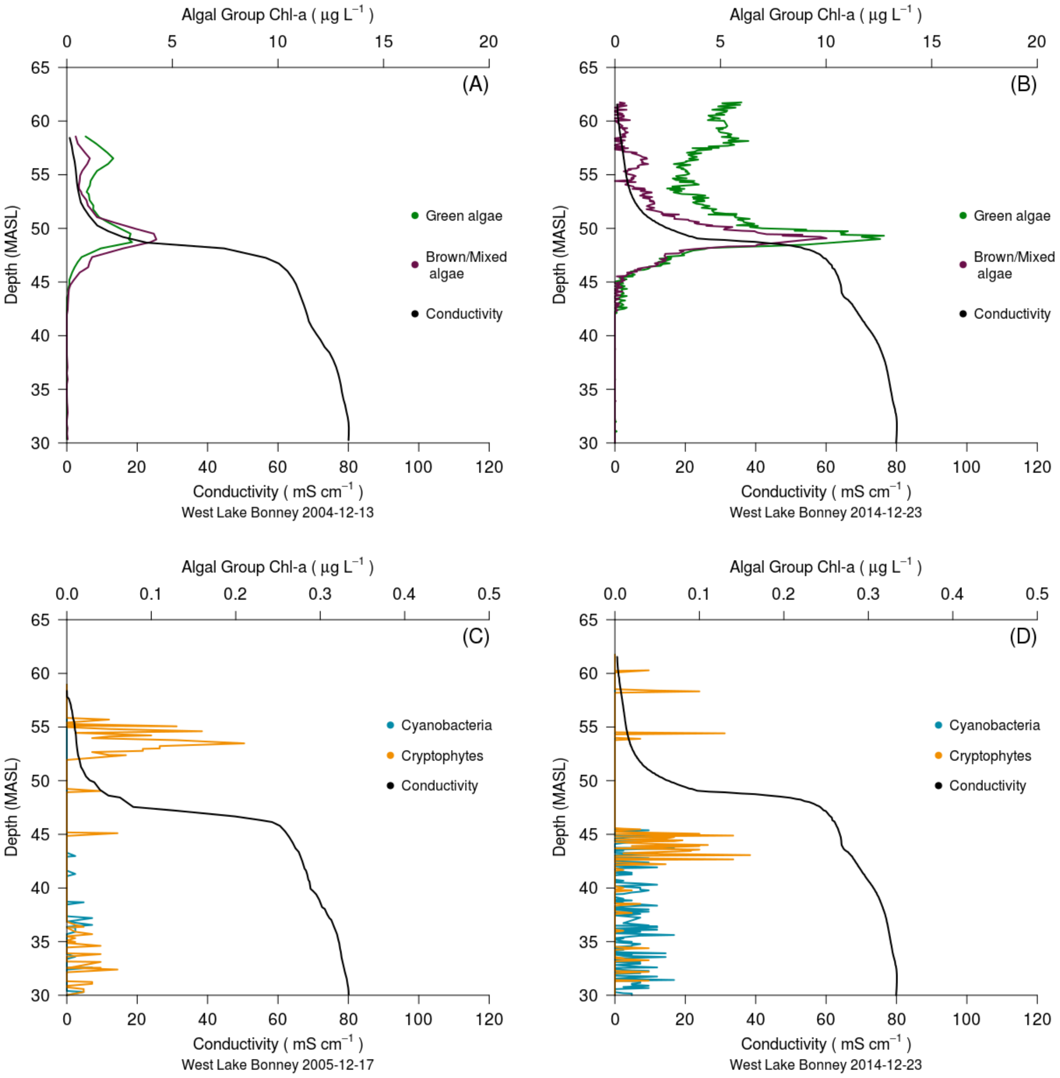

Figure 2.4: Depth profiles of algal group chl-a concentration comparing green algae and brown/mixed algae in December 2004 (A) to December 2014 (B) in WLB. Cryptophyte and cyanobacteria chl-a profiles are compared from December 2005 (C) and December 2014 (D). Displayed algal group concentrations begin 0.5 m below measured ice thickness. The chemoclines are depicted the conductivity profiles (black line).

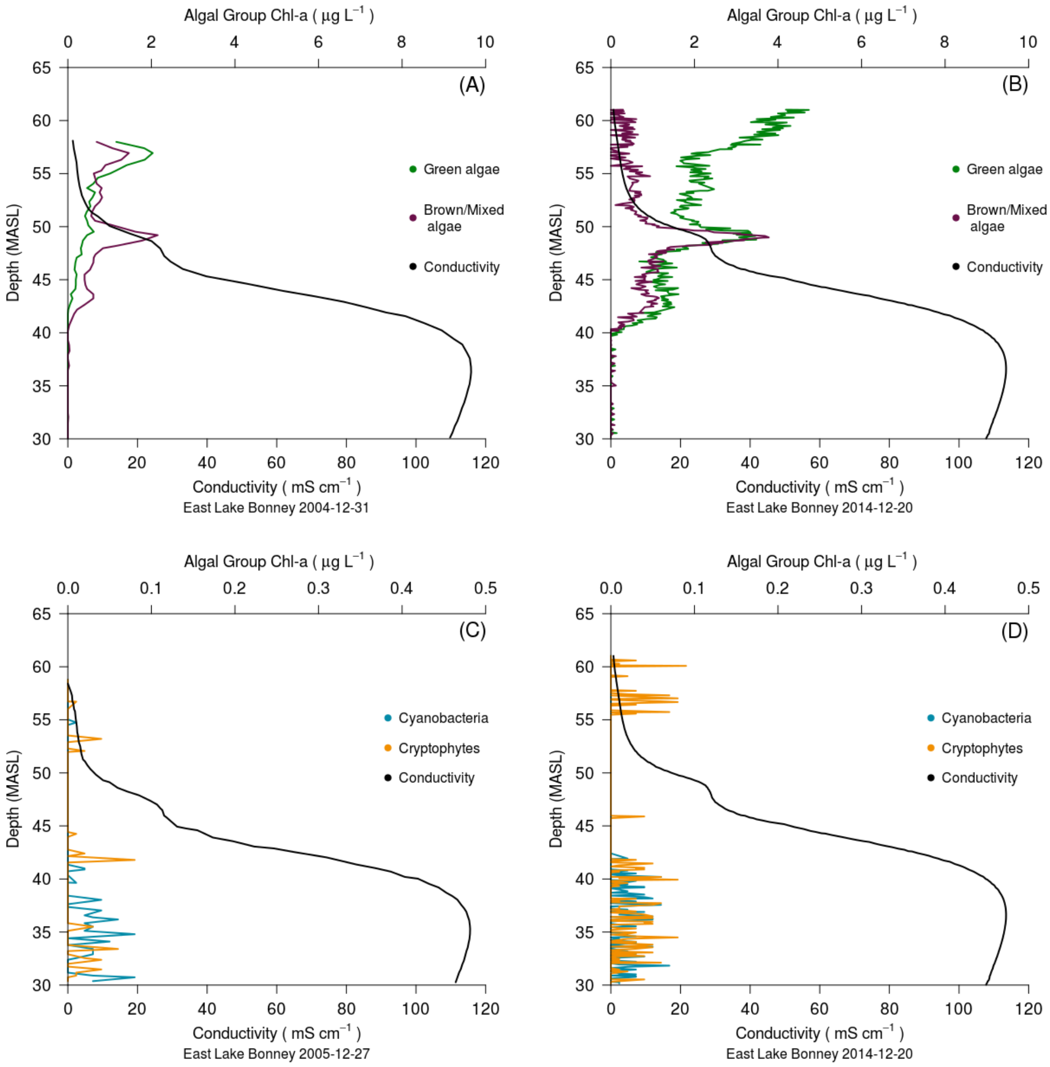

Figure 2.5: Depth profiles of algal group chl-a concentration comparing green algae and brown/mixed algae in December 2004 (A) to December 2014 (B) in ELB. Cryptophyte and cyanobacteria chl-a profiles are compared from December 2005 (C) and December 2014 (D). Displayed algal group concentrations begin 0.5 m below measured ice thickness. The chemoclines are depicted the conductivity profiles (black line).

Water columns of both WLB and ELB have become increasingly dominated by green algae between the 2004-05 and 2014-15 austral summers (November, December, January). Chl-a concentrations were depth-integrated over the trophogenic zone (5-20 m WLB; 5-22 m ELB) for each sampling event and plotted over time (Fig

2.6). The proportion of the green algae chl-a to the total depth integrated chl-a has risen from a summer average of 0.38 in 2004-05 to an average of 0.68 in 2014-15 in WLB. In ELB this proportion has risen from a summer average of 0.44 in 2004-05 to an average of 0.72 in 2014-15. During the 2010-11 summer the average proportion of green algae chl-a to the total chl-a was 0.87 in ELB.

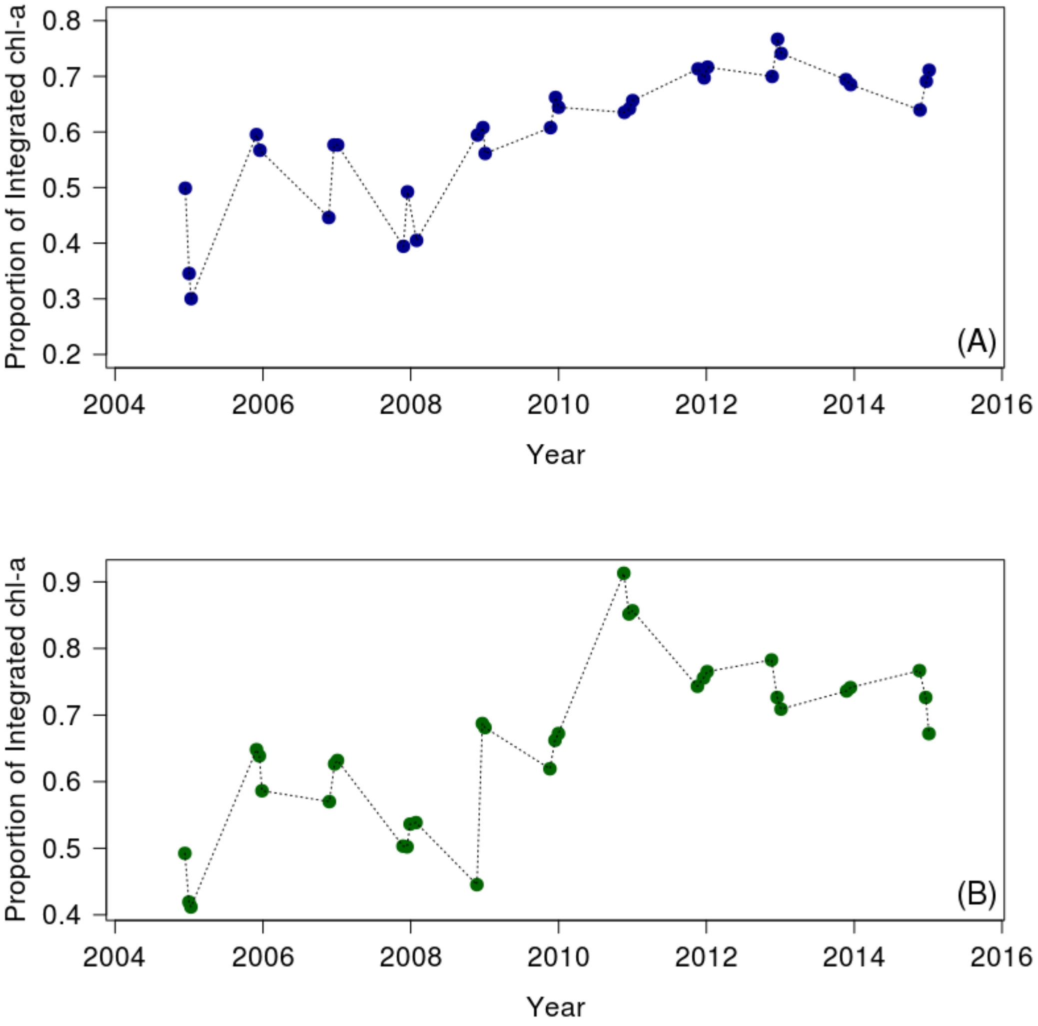

Figure 2.6: Proportion of depth-integrated green algae chl-a (mg m^{-2}) to the total depth-integrated chl-a (mg m^{-2}) in the trophogenic zones (5-20 m WLB; 5-22 m ELB) of WLB (A) and ELB (B) between 2004 and 2015. Data were obtained during MCM LTER summer sampling (November, December, January).

Primary productivity in both lobes of Lake Bonney has been greatest in two distinct zones of the water column between 2004-05 and 2014-15; under the ice surface, where light is least limiting, and above the chemocline (~50 MASL), where nutrients are least limiting. Depth profiles of primary productivity measured during December between 2004 and 2014 highlight the two most productive layers (Fig. 2.7). Depth-integrated primary production values in the trophogenic zone (5-20 m WLB; 5-22 m ELB) have varied around a mean of 21.54 mg C m^{-2} d^{-1} (standard deviation = 9.70) in WLB and a mean of 15.96 mg C m^{-2} d^{-1} (standard deviation = 4.54) in ELB.

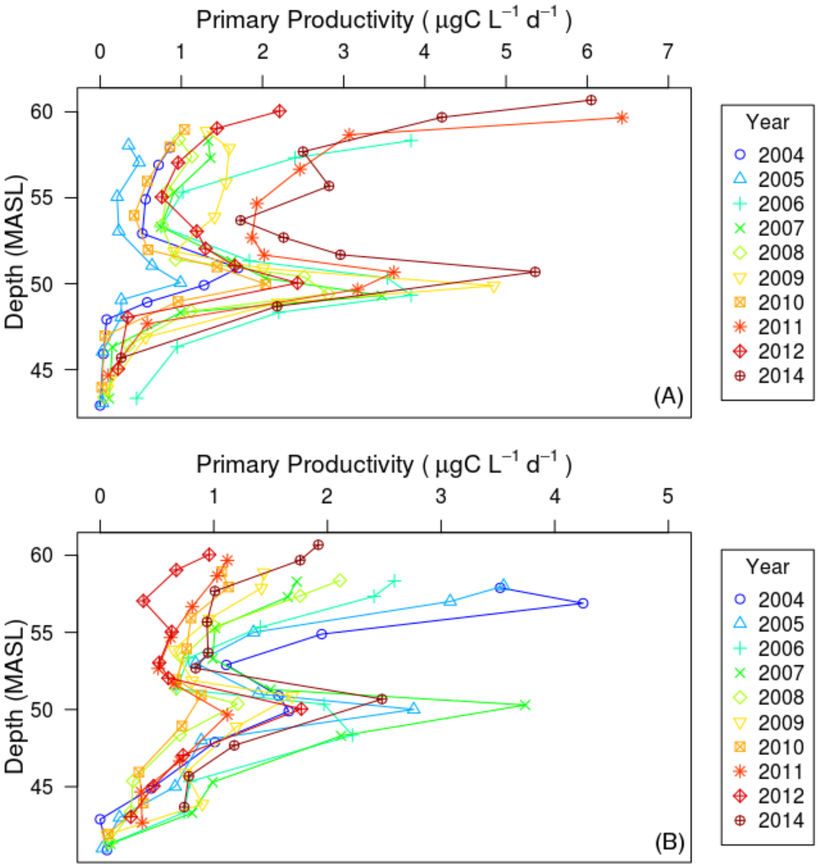

Figure 2.7: Depth profiles of primary productivity rates measured in December from 2004 through 2014 in west (A) and east (B) Lake Bonney. Data from each year are represented by a unique color and symbol indicated in the legend to the right of each plot. Depth is reported as meters above sea level (MASL).

Contour plots showing the relative proportion of chl-a of each algal group to the total chl-a concentration at each depth in Lake Bonney between the summers of 2004-05 and 2014-15 are shown in Fig. 2.8 and Fig. 2.9 for WLB and ELB, respectively.

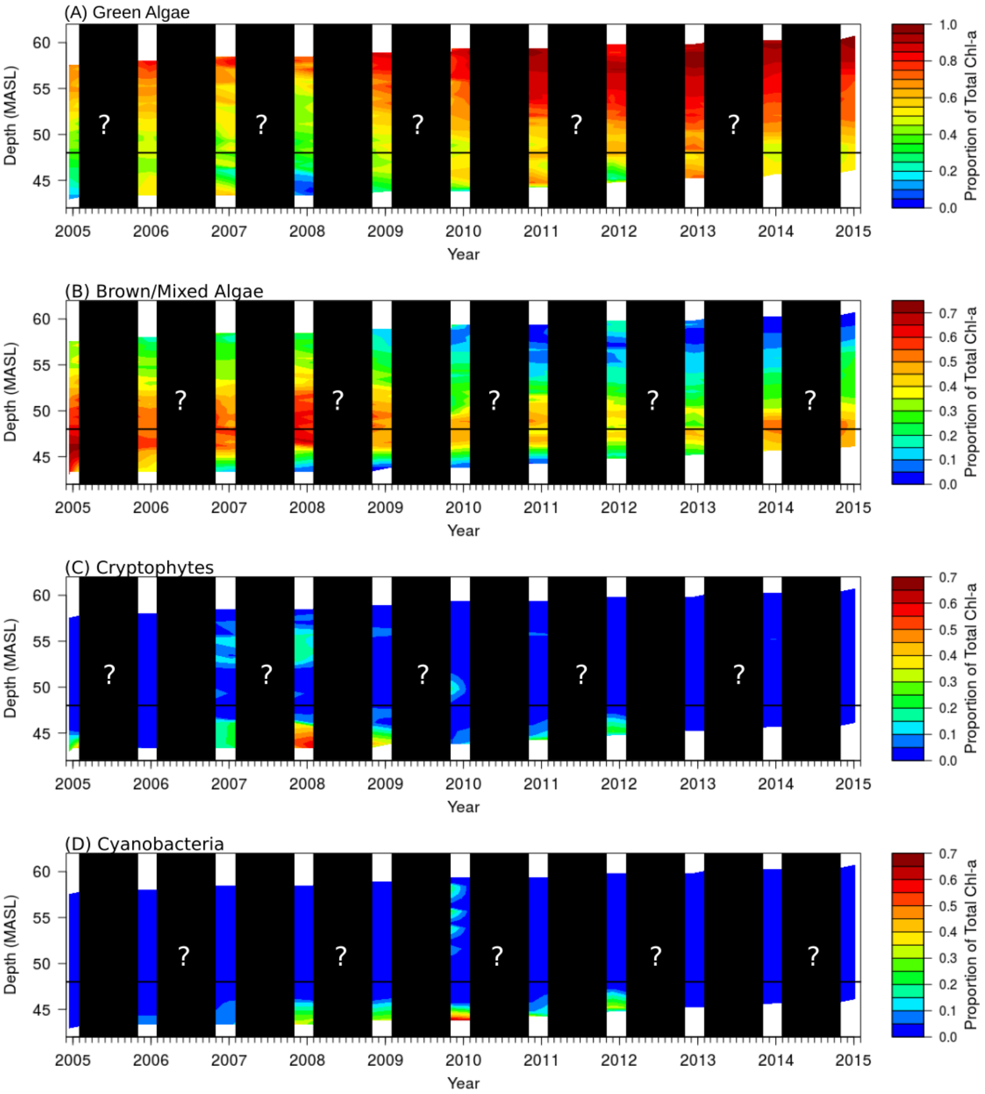

Figure 2.8: WLB algal group proportions of total chl-a concentration in the trophogenic zone (5-20 m) during summer sampling (November, December, January). Green algae (A), brown/mixed algae (B), cryptophytes (C), cyanobacteria (D). Depths are measured from surface down, and reported as meters above sea level (MASL). Chemocline is approximated with black line at 48 MASL. Black boxes represent periods with no data. Color keys are at different scales.

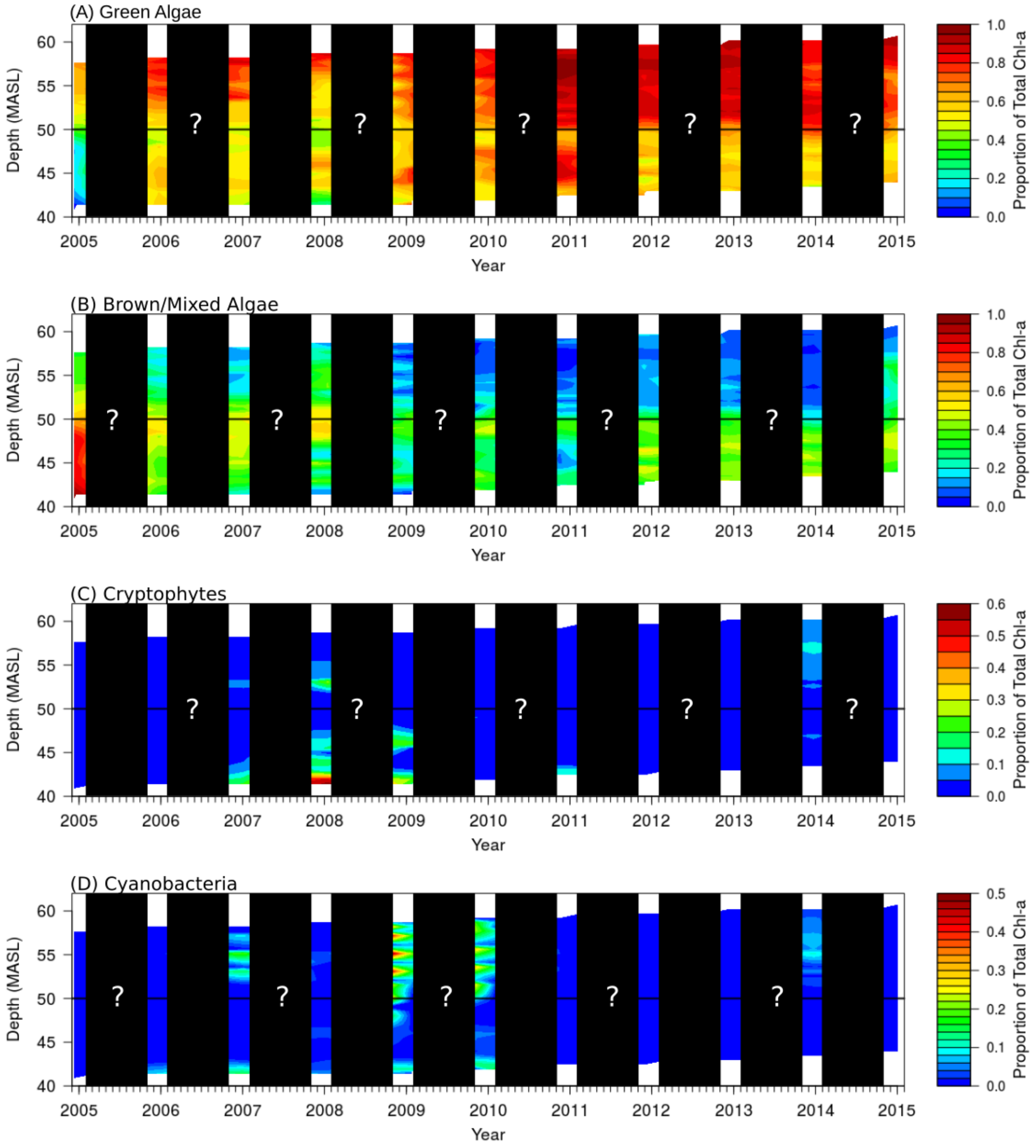

Figure 2.9: ELB algal group proportions of total chl-a concentration in the trophogenic zone (5-22 m) during summer sampling (November, December, January). Green algae (A), brown/mixed algae (B), cryptophytes (C), cyanobacteria (D). Depths are measured from surface down and reported as meters above sea level (MASL). Chemocline is approximated with black line at 50 MASL. Black boxes represent periods with no data. Color keys are at different scales.

The contour plots of the algal group relative abundances (proportion of total chl-a concentration) illustrate several important characteristics of the summer phytoplankton community structure. In both lobes of Lake Bonney, the cyanobacteria and cryptophyte groups contribute between 0-10% to the total chl-a concentration and are most prevalent in the deeper waters near the chemocline. Green algae comprise more than 50% of the total phytoplankton chl-a in the upper water column and increased after the high stream flow in 2010-11. The mid-depths and lower depths coinciding with the layer of highest primary productivity in each lobe are dominated by green algae (~40-50%) and the brown/mixed spectral group (~40-50%).

To determine the environmental variables that best explain the long-term trends in algal group chl-a concentration generalized additive models (GAMs) were employed. One of the strengths of using GAMs to evaluate these relationships is the ability to non-parametrically “let the data speak.” The GAM individually fits a smooth of each model parameter to the response (μg chl-a L^{-1}) and then combines those results “additively” to determine a final curve that is most parsimonious to the data while best describing the overall variance. This allows for complicated multivariate analyses with no need for a priori knowledge of the expected relationships. GAMs also effectively capture relationships that are not strictly positive or negative. The effective degrees of freedom (edf) values included in Table 2.1 and 2.2 are associated with the shape or “wiggle” of the smoothed fit of the explanatory variables to the response. The higher the edf, the greater the amount of “wiggle” in the relationship between the parameter and response. One of the drawbacks to GAMs is because parameters are fit individually, interaction between variables are not well identified. Potential interactions between variables (e.g. depth and PAR or ice thickness and PAR) would not be elucidated by the GAM results. The additive nature of GAM curve fitting makes it difficult to determine the variance explained by individual model parameters, but excels in describing the additive effects of parameters on overall variance.

The difficult nature of sampling MDV lakes results in values periodically missing throughout the dataset for different environmental variables (see Appendix). Rather than significantly reduce the datasets to ensure that all values were simultaneously available for each sampling depth, the gam function selectively dropped missing values as models were ran (Wood, 2011). The GAMs of algal group chl-a concentration showed that there is a strong temporal and spatial component to the trends observed in each group, as time and or depth were statistically significant parameters in explaining the variance in chl-a concentration for all groups (Table 2.1 and Table 2.2).

Underwater PAR in WLB was significantly related to trends in chl-a concentration (p-values ranged from 0.003-0.05). Dissolved inorganic nitrogen (DIN) was also statistically related to trends in concentrations in all groups (p-value = <0.001) except the cyanobacteria. The brown/mixed spectral group was significantly positively related to increasing dissolved organic carbon (DOC) concentrations (p-value = 0.008) (Table 2.1).

West Lake Bonney
Chl-a Concentration Generalized Additive Model Results

Algal Group	Model Parameter	edf	F-statistic	p-value
Green Algae	MASL	3.628	2.315	0.051
	DIN (µM)	1.429	12.045	<0.001
	SRP (µM)	1.000	0.000	0.986
	Time (Decimal Date)	7.372	7.300	<0.001
	PAR (µmol photons m^{-2} s^{-1})	3.909	3.849	0.003
Variance Explained: 63.3%				
Brown/Mixed	MASL	3.916	2.815	0.020
	DIN (µM)	5.112	6.899	<0.001
	PAR (µmol photons m^{-2} s^{-1})	5.982	8.112	<0.001
	DOC (mM)	1.00	7.176	0.008
Variance Explained: 64.5%				
Cryptophytes	DIN (µM)	5.282	4.008	<0.001
	Time (Decimal Date)	6.906	4.773	<0.001
	PAR (µmol photons m^{-2} s^{-1})	3.286	2.471	0.050
Variance Explained: 37.7%				
Cyanobacteria	Ice Thickness (m)	9.000	10.913	<0.001
	Time (Decimal Date)	8.661	12.258	<0.001
	PAR (µmol photons m^{-2} s^{-1})	1.000	8.984	0.003
Variance Explained: 50.0%				

Table 2.1: Results from generalized additive models summarized. WLB algal group chl-a concentration modeled using the modified Fluoroprobe dataset and various environmental variables measured during summer limnological sampling between 2004-05 and 2014-15 (n=310).

This analysis revealed that underwater PAR was a statistically significant parameter in explaining the trends in green algae, cryptophytes, and cyanobacteria (p-values = <0.001), while ice-thickness, which influences PAR, showed a strong statistical association (p-value = <0.001) with the chl-a concentration trends of the brown/mixed algae and the cyanobacteria in ELB. Variance in chl-a concentration of the brown/mixed group in ELB, was partially explained by DOC concentration (p-value = 0.020), displaying a positive relationship (Table 2.2). Soluble reactive phosphorus, a known limiting nutrient (Dore & Priscu, 2001), was positively related to the brown/mixed group chl-a concentration (p-value = 0.002). Cryptophytes showed a positive relationship with DIN concentration and significantly described trends in their chl-a concentration (p-value = 0.013).

East Lake Bonney
Chl-a Concentration Generalized Additive Model Results

Algal Group	Model Parameter	edf	F-statistic	p-value
Green Algae	MASL	4.721	22.943	<0.001
	Time (Decimal Date)	6.108	5.404	<0.001
	PAR (μmol photons m^{-2} s^{-1})	3.640	5.537	<0.001
	Variance Explained: 76.2%			
Brown/Mixed	MASL	4.275	7.341	<0.001
	Ice Thickness (m)	1.000	11.514	<0.001
	SRP (μM)	1.000	10.215	0.002
	DOC (mM)	3.305	2.986	0.020
	DIC (mM)	5.390	2.103	0.051
	Time (Decimal Date)	6.410	6.794	<0.001
	Variance Explained: 51.1%			
Cryptophytes	MASL	3.046	6.803	<0.001
	Ice Thickness (m)	1.671	3.591	0.030
	DIN (μM)	1.000	6.260	0.013
	PAR (μmol photons m^{-2} s^{-1})	5.172	6.330	<0.001
	Variance Explained: 31.2%			
Cyanobacteria	Ice Thickness (m)	8.660	9.812	<0.001
	Time (Decimal Date)	9.000	13.299	<0.001
	PAR (μmol photons m^{-2} s^{-1})	2.133	13.366	<0.001
	Variance Explained: 52.2%			

Table 2.2: Results from generalized additive models summarized. ELB algal group chl-a concentration modeled using the modified Fluoroprobe dataset and various environmental variables measured during summer limnological sampling between 2004-05 and 2014-15 (n=330).

Discussion

The effects of climate change have been associated with changes in phytoplankton community dynamics in marine and freshwater ecosystems worldwide (Winder & Sommer, 2012). The lakes in the MDV harbor phytoplankton communities uniquely adapted to environmental conditions experienced nowhere else in the world. The geographic isolation and low anthropogenic influence make these environments ideal systems to study microbial responses to climate change. Lake levels throughout the MDV have risen annually during the last decade as warmer summers temperatures have been observed (Fountain et al., 2016). I contend that climate-driven changes (e.g. increased lake depth and increased glacial run-off) have affected the phytoplankton communities present in Lake Bonney.

The first question addressed is whether the total integrated chl-a concentration over the trophogenic zone has been affected by the continued lake level rise between 2004-2015. In both lobes of Lake Bonney, the total integrated chl-a concentration in the trophogenic zone (5-22 m ELB; 5-20 m WLB) has increased in concert with lake levels. The summer mean has more than doubled in both lobes during this period from 42.39 to 99.82 mg m^{-2} and 21.06 to 50.22 mg m^{-2} in WLB and ELB, respectively. Glacial run-off provides an important influx of allochthonous nutrients into the surface waters of these lakes (Welch et al., 2010). Pulse events of high stream flow not only introduce nutrients but sediment as well. The increased water turbidity in WLB induced from sediments during the floods of 2001-02, decreased primary production by 23% (Foreman et al., 2004). The high lake level rise (0.81 m) experienced in 2010-11 coincided with spikes of integrated chl-a in both lobes, increasing from a 2009-10 summer mean of 33.0 mg m^{-2} to 90.9 mg m^{-2} in WLB, and from 20.8 mg m^{-2} to 38.3 mg m^{-2} in 2010-11 in ELB. These 2010-11 increases could not be explained simply by an increase in primary productivity, nor could the overall increasing trend in chl-a, as there was no clear temporal correlation. However, both the chl-a spike during 2010-11 and overall increasing trend, coincide with a shift in the phytoplankton community structure.

The answer to second question I intended to address, whether the vertical structure of Lake Bonney phytoplankton communities changed during this period of increasing lake level, is yes. While the phytoplankton groups have remained in highly stratified populations as recently shown (Dolhi et al., 2015), the proportion of green algae chl-a to the total chl-a throughout the trophogenic zone has increased by ~30% in both lakes between 2004 and 2015. This increase in the green algae group was most pronounced during 2010-11, and concentrations remained elevated in the years following. The initial increase might be explained by physiological response to decreased PAR associated with the turbid influx of glacial melt water. It has been shown that as PAR decreased during the summer-winter transition, Lake Bonney phytoplankton increased their chl-a content per cell to compensate for lower light levels (Morgan-Kiss et al., 2016). Another possible explanation could be that the influx of allochthonous nutrients from glacial run-off were efficiently utilized by the green algae surface populations, increasing the group abundance. The dominant green algae (*Chlamydomonas sp.*) are large (>10 µm) organisms (Kong et al., 2014) and are poor prey for heterotrophic grazers (Li et al., 2016). The lack of grazing pressure may allow the green algae to maintain a high abundance, and may in-turn, influence the flow of carbon and nutrients as through the system. This is analogous to the uncoupled trophic interactions observed between phytoplankton and zooplankton in lake Washington (Winder & Schindler, 2004).

The third question I wanted to answer was whether different environmental parameters were driving the trends of the individual algal group chl-a concentrations during this period of annual lake level rise. Phytoplankton groups have been shown to be influenced by different environmental factors based on the physiological traits that they share (Litchman et al., 2015). The use of GAMs to determine which variables best describe group trends elucidated several interesting results, but alone, were not sufficient to fully address my question.

Light availability (PAR) had a strong relationship with all the phytoplankton group chl-a concentration trends, other than the brown/mixed group, through the 2004-05 to 2014-15 austral summers. This supports work by Li et al. (2016) who found that haptophytes (brown/mixed group member) dominating the deep layers near the chemocline were not influenced by light. The brown/mixed algae showed a positive association with DOC concentration (p-values = 0.02 and 0.008; ELB and WLB, respectively) in both lobes of Lake Bonney. This provides support for the idea that some members of this group (*Isochrysis sp.*) may supplement photosynthesis with alternative carbon and energy sources, as has been previously suggested (Li et al., 2016).

The phototrophic green algae populations in both lobes were strongly correlated (p-values = 0.003 and <0.001; WLB and ELB, respectively) with PAR. In ELB 76.2% of the variance in green algae chl-a was explained by PAR, depth, and time. At least one dominant member of this algal group (*Chlamydomonas sp.*) has been shown to be purely photoautotrophic (Li et al., 2016). The dependence on light driven photosynthesis for growth could explain why these organisms increasing in dominance, especially in the upper portion of the water column. Surface populations of green algae (*Chlamydomonas sp.*) have been shown to maintain their position in the water column through phototaxis (Pocock et al., 2004). As lake levels are increasing members of the green algae group maintain their position near the surface where PAR is most available and capitalizing on the influx of nutrients from glacial run-off, while other groups may rely on upward diffusion of nutrients near the chemocline (Kong et al., 2012).

Previous studies have observed cryptophyte populations just below the ice in both lakes (Bielewicz et al., 2011; Priscu, 1998). The depth profiles obtained with the Fluoroprobe support these earlier findings, however, cryptophytes were usually detected in relatively low concentrations (<0.3 µg L^{-1}) if not undetectable (<20 ng L^{-1}) during the austral summer. The generalized additive models show that in both lobes the concentrations of cryptophyte chl-a was negatively correlated with PAR high irradiances, and the greatest concentrations were correlated with depths near the nutrient rich chemocline. The variability in the trends for cryptophyte chl-a concentrations were difficult to model, as only 31.2% and 37.7% of the variance was explained in the west and east lobes, respectively. It is possible that cryptophytes rely heavily on the ability to obtain carbon and nutrients by utilizing a mixotrophic metabolism such as the ingestion of bacteria (Roberts & Laybourn-Parry, 1999). These heterotrophic capabilities may decrease their necessity to produce photopigments in Lake Bonney, and PSII fluorescence may underestimate their abundance.

Measuring chl-a concentrations based on fluorescence has advantages in speed and spatial resolution over many other methods, but PSII fluorescence yield can be influenced by a myriad of factors including: nutrient availability, cell density, photopigment composition, energy transfer within the cell, and also dynamic changes in photochemistry in response to environmental conditions, which can occur on the scale of seconds to minutes (Catherine et al., 2012). The evolutionary adaption of Lake Bonney phytoplankton to low levels of relatively monochromatic light, resulted in organisms highly specialized photochemistries (Morgan-Kiss et al., 2006; Neale & Priscu, 1995). The pigment compositions of algal cultures used by the manufacture to calibrate the Fluoroprobe (Beutler, Wiltshire, Meyer, et al., 2002) may be poorly matched to the highly-adapted organisms in found in these lakes. Not calibrating the instrument to the species present in Lake Bonney may result in over or underestimated chl-a concentrations to for different groups.

Another important point that this study underscores, is the need for a greater frequency of sample collection. With only 3 sampling events each year, representing only the summer months, it was not possible to determine anything but general relationships with environmental variables responsible for long-term trends in algal group chl-a concentration. Phytoplankton are short-lived organisms that respond quickly to their environment, and this study attempted to model 11 years of change with no data for 99% of each year.

Following a season of high stream-flow and dramatic rise in lake level (2010-11) the relative abundance of green algae in both lobes of Lake Bonney, has increased by ~30%. Abrupt environmental changes (e.g. pulse flooding events) as well as continuous environmental change (e.g. increasing lake depth) can push ecosystem stability beyond a threshold level, displaying dramatic trophic responses which may not return to conditions that existed before the state change (Bestelmeyer et al., 2011). The important influence of ice on MDV lake ecosystems, and the sensitivity to increased temperature, have placed them on the threshold of dramatic change (Obryk et al., 2016). If current climate models (IPCC, 2014) accurately predict increased global temperatures, and warmer temperatures continue to be observed in the MDV, increased glacial run-off, continued lake-level rise, and decreases in the thickness of the permanent ice-cover, will likely result. Algal groups that respond favorably (e.g.

green algae) to the changing lake conditions will continue to increase in abundance and the observed trends of increasing total chl-a concentration are likely to continue.

CHAPTER THREE

PHYTOPLANKTON COMMUNITY DYNAMICS DURING THE POLAR WINTER IN LAKE BONNEY, ANTARCTICA AS MEASURED BY AN AUTONOMOUS IN SITU SPECTROFLUOROMETER

Introduction

Seasonal changes in phytoplankton community structure, often referred to as "phytoplankton succession," have long been acknowledged (Hutchinson, 1967). Phytoplankton communities respond to the seasonality of their physical environment, such as changes in temperature and PAR availability, changes in the chemical characteristics of their environment, through competition for nutrient availability, and these responses are further confounded by biotic factors, such as heterotrophic grazing pressure and parasitism (Reynolds, 1984). The vertical community structure and overall species abundances are differentially effected by these complex interactions, based on variations in photosynthetic efficiencies, nutrient uptake kinetics, and sensitivity to losses (predation, parasitism, viruses) (Reynolds, 1984). The seasonal extremes of PAR availability in high latitude lakes like those in the MDV, undoubtedly influence algal succession as photoautotrophic and photoheterotrophic growth is not possible during a four month period (mid-April to mid-August) of the year (McKnight, Howes, Taylor, & Goehringer, 2000).

The logistical constraints that limit access to the MDV lakes during the austral winter, have led to a poor understanding of seasonal phytoplankton community dynamics (Priscu 1999). Several early season sampling efforts have been undertaken during the cold and dark transition periods from winter to spring (August-October; Priscu et al. 1999, Lizotte et al. 1996) and a single study that ended in April measured phytoplankton dynamics as the sun set (Morgan-Kiss et al. 2016). Lizotte et al. (1996) showed that algal photopigments were abundant throughout the photic zone preceding the onset of sunlight and that photosynthetic primary production (PPR) progressed down the water column as PAR increased during spring and summer (Lizotte, Sharp, and Priscu 1995; Priscu et al. 1999). McKnight et al. (2000), used automatic sampling devices to collect and preserve water samples from multiple depths in Lake Fryxell (~16 km east of Lake Bonney) during austral winter. Their data showed that different algal species have different strategies for overwinter survival. Many survived by entering resting states relying on starch reserves or by increasing the thickness of their cell wall and becoming dormant. Several cryptophyte species were more abundant in the winter than in summer suggesting heterotrophic growth by this group during the winter (McKnight et al., 2000). The sampling season of 2007-08 was extended into the transition period from constant sunlight to 24-hour darkness (mid-April). Vick and Priscu (2012) observed physiological changes in the bacterial communities, which were tightly coupled with phytoplankton primary productivity, as carbon excreted by phytoplankton declined with the loss of PAR. They also showed an increase in the relative abundance in mixotrophs during the summer-winter transition period. During the same extended season transition period it was shown that chl-a concentrations were negatively correlated with light and rates of PPR, suggesting an acclimation of algal photochemistry to increase their light harvesting abilities per unit of chlorophyll (Kong et al., 2014). Alternative metabolic strategies by phytoplankton such as mixotrophy (various combinations of photosynthetic and heterotrophic abilities) are also thought to play an important role in Antarctic lakes (Li et al., 2016; Marshall & Laybourn-Parry, 2002; Thurman et al., 2012). Mixotrophy refers to a type of metabolism whereby an organism incorporates both phototrophic and heterotrophic biosynthetic carbon pathways. Facultative mixotrophy allows organisms to fix inorganic carbon (i.e. CO_2) when light is an available energy source, and to phagotrophically ingest food particles at other times (Jones, 1999). Jones et al., (2009) showed in laboratory experiments that mixotrophic organisms could survive periods of up 6 months of darkness if a source of dissolved organic carbon was available. The ability to switch from phototrophy to heterotrophy allows them to metabolically contribute to nutrient cycles in the absence of light, providing a competitive and important ecological advantage to their survival in the dark (Jones et al., 2009). The brown/mixed algae and cryptophyte groups distinguished by the Fluoroprobe contain organisms known to be capable of mixotrophic metabolisms (*Isochrysis sp.* and *Geminigera sp.*, respectively) (Gast, McKie-Krisberg, Fay, Rose, & Sanders, 2014; Li et al., 2016).

In the austral summer of 2013 a suite of autonomous sensors and sampling devices was deployed in the east and west lobes of Lake Bonney. Included in the sensor suite attached to an autonomous cable crawling profiler was a submersible spectrofluorometer (bbe Moldaenke Fluoroprobe). This instrument provided the first profiles of phytoplankton spectral group chl-a concentrations obtained on a daily frequency over a year-long time scale. The instruments were retrieved and redeployed during each of the 2014-15 and 2015-16 seasons. The fluorometry data obtained during the first year of deployment are presented in this chapter, providing the first information on algal community dynamics during a period of the year.

Other than the few logistically challenging sampling missions during seasonal transitions, and the automatic sampling which occurred in Lake Fryxell, very little is known about the algal physiological and community structure changes that are triggered by the darkness of the polar night and the onset of spring sunlight. Carbon budgets and ecosystem models developed from data collected during the summer have been used to infer winter processes (Priscu et al. 1999). The poorly understood winter months are also the portion of the year which has the greatest implications for the search for life in our solar system. Jupiter’s moon Europa and Saturn’s moon Titan thought to harbor oceans beneath thick layers of ice; cold, dark, liquid water environments analogous to the lakes of the MDV, may provide the necessary conditions for life (Domagal-Goldman et al., 2016). Successfully deploying autonomous instrumentation in the MDV lakes, helps provide strategies for future attempts to remotely observe the biogeochemical properties of liquid water held by planetary bodies throughout our solar system.

The overarching hypothesis for this chapter is that during the 24-hour darkness of the austral winter, the Lake Bonney algal community structure shifts in favor of organisms capable of alternative metabolic strategies (i.e. mixotrophy). The specific questions I will address are: Does the total chl-a concentration decrease during the 24-hour darkness of the austral winter? How does the diversity of the phytoplankton community respond to the 24-hour darkness of winter? Does the relative abundance of algal groups capable of mixotrophy increase when PAR is unavailable?

Methods

The permanent ice-cover was initially penetrated with a motorized auger fitted with a 9 cm cutting bit. The borehole was then enlarged to >1 m in diameter using a heated melting coil. A suite of sampling devices and physiochemical and biological sensors were deployed near the center of the east and west lobes of Lake Bonney in December 2013 and described in Winslow et al. (2014). The instrumentation suite was retrieved in November 2014 and re-deployed in December 2014, then retrieved and re-deployed in November and December of 2015. Details of the relevant instrumentation are described below.

Ice Tethered Profiler

A McLane Laboratories ice tethered profiler (ITP) included the following sensors: Sea-Bird SBE 41CP CTD endcap with an integrated SBE 41CPIDO dissolved oxygen (DO) sensor, submersible spectrofluorometer (bbe Moldaenke

Fluoroprobe), two Pro-Oceanus Mini-Pro CO_2 sensors, and Biospherical PAR sensor (Fig 3.1). The stock endcap sensors were modified to accommodate the high salinity and dissolved gas levels present in Lake Bonney. The modifications by Sea-Bird extended the measurable range of conductivity (0-14 S m^{-1}), temperature (-5 to 5 ^{o}C), and dissolved oxygen (>200% saturation). During the profile routine, the CTD with DO and PAR sampled at 1 Hz while the CO_2 sensor and Fluoroprobe sampled at their maximum sampling frequencies (0.5 Hz and 0.25 Hz, respectively). The ITP was programmed to make two sets of measurements each day, once rising through the water column and once diving. These routines were programed to occur at 2:00 and 14:00 (local time), respectively.

Water Sampler

A McLane Laboratories Remote Access Sampler (RAS) was suspended 15.5 m below the piezometric water level (Fig. 3.1). Forty-eight individual 500 mL Tedlar sample bags were autonomously filled over the course of the deployment. Samples were obtained every 9 days with 5 duplicate collection events. The samples were preserved by the addition of 5 mL of a saturated mercuric chloride solution to a final concentration of 1%. The preservative was added to each sample bag before deployment.

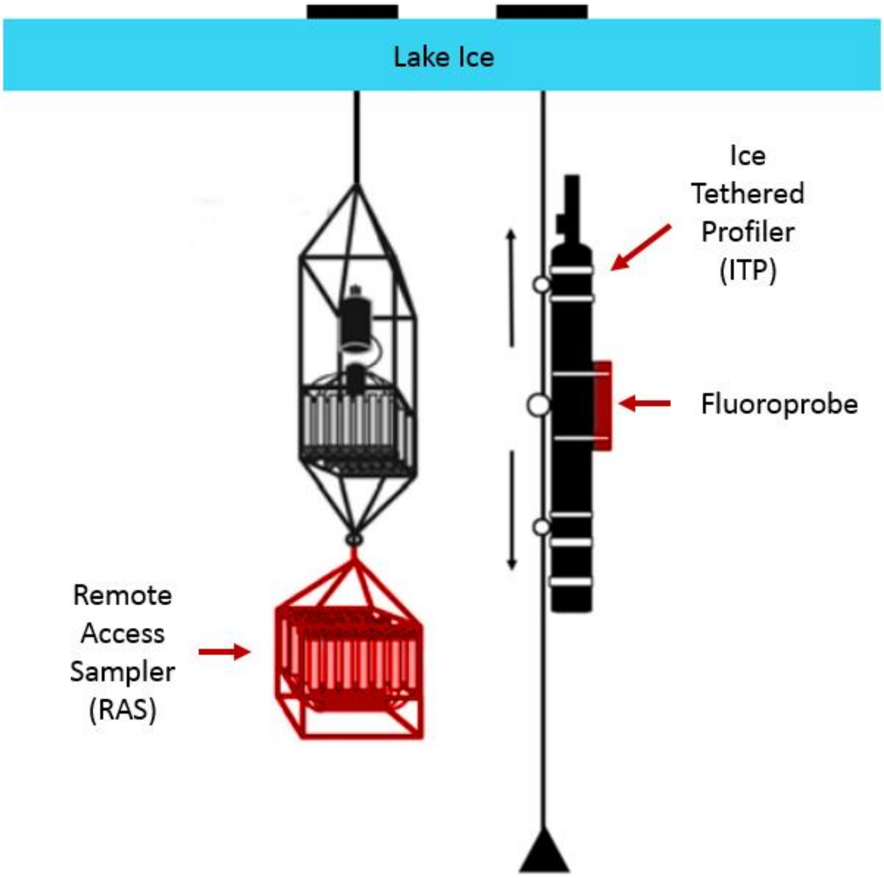

Figure 3.1: Schematic of autonomous sampling devices deployed in each lobe of Lake Bonney (not to scale). RAS, ITP, and Fluoroprobe are indicated with red arrows. Adapted from Winslow et al., 2014.

<u>Particulate Organic Carbon and Nitrogen</u>

Water samples obtained with the Remote Access Sampler (RAS) ranged from 190-497 ml volume in ELB; and from 406-477 ml in WLB. These samples were returned to Montana State University where they were vacuum (~0.3 atm) filtered through combusted (450 ^{o}C for > 4h) 25 mm diameter Whatman GF/F filters. The filters were dried at room temperature (20-25 ^{o}C) for 24 h, acidified over fuming concentrated HCl for 24-48 hours and then dried at 90 ^{o}C for 4-12 hrs. The filters were flash combusted with oxygen at 1800 ^{o}C and combustion products were analyzed using a CE Instruments Flash EA 1112 Flash elemental analyzer gas chromatography. Acetanalide standards and volumes filtered were used to convert the instrument signal to the C and N concentration.

Data Analysis

Data were analyzed using R statistical software. Visualizations were constructed with the base plotting system (R Core Team, 2016). Chlorophyll-a growth and decay rates during each year were estimated using slopes calculated from linear regression models. The independence assumption of linear models was in violation because of the sequential nature of data collection (i.e. profile every 12 h). There was likely autocorrelation between residuals due to the lack of independence through time. It was decided that this violation could be reasonably ignored because the models were used only to estimate chl-a growth and decay rates. Shannon diversity indices were calculated using the diversity function in the vegan package (Oksanen et al., 2016). Due to the structure of the fluorometric profile data the interp function from the Akima package was used to create evenly spaced bivariate interpolation matrices of algal spectral group chl-a concentration with depth and time as matrix coordinates (y and x, respectively). These processed data were then used to construct contour plots (Akima & Gebhardt, 2015). The depth recorded by the Fluoroprobe in WLB during the 2013-14 deployment was consistently offset by an average of 2.4 m with the depth recorded by the CTD endcap of the ITP. This discrepancy suggested that the

Fluoroprobe was zeroed during calibration differently than the CTD. Depths recorded by the CTD were calibrated using depth marks on the lowering cable and corrected for any off set. Correlations between daily maximum depths recorded by the CTD and the Fluoroprobe were used to adjust the Fluoroprobe depths, to reflect a more accurate measurement. No adjustment was applied to ELB Fluoroprobe depths. The average offset between the CTD and Fluoroprobe depth measurements was reflective of the physical distance between the two instruments (~0.6 m).

Results

East Lake Bonney (2013-14)

The ITP consistently captured daily profiles between the depths of 15 and 21 m in the east lobe of Lake Bonney throughout the 2013-14 deployment. Mean underwater PAR (between 14.5 and 15.5 m) measured by the ITP ranged from 0.34 to 293.60 µmol photons m^{-2} s^{-1}. Mean PAR was plotted on a log scale to accommodate the large range of values, and to clearly highlight the annual trend of underwater irradiance (Fig. 3.2). Between mid-April and late-August mean PAR was less than 1 µmol photons m^{-2} s^{-1} around 15 m.

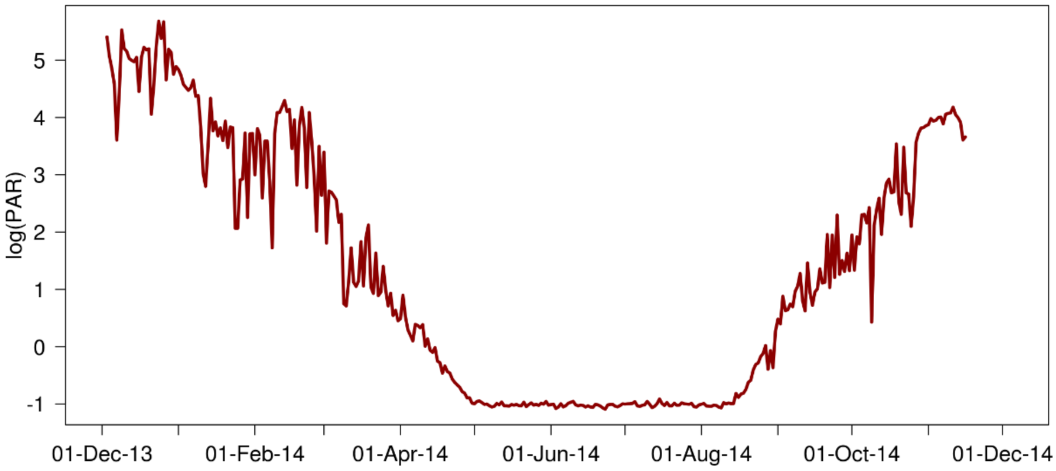

Figure 3.2: Mean underwater PAR (μmol photons m^{-2} s^{-1}) measured in ELB between (14.5 and 15.5 m) during the 2013-14 ITP deployment. PAR values are plotted on a log scale therefore units are not included on the y-axis.

The daily mean total chl-a measured as fluorescence over this depth range was calculated using both the up-cast and down-cast made by the Fluoroprobe. Linear regressions of mean chl-a concentration against sampling date were used to estimate the rate of chl-a gain and loss during specific portions of the year.

Mean chl-a increased at a rate of 0.09 μg L^{-1} d^{-1} ($R^2 = 0.90$) between 04-Dec-2013 and 21-Jan-2014. A loss of 0.05 μg L^{-1} d^{-1} (R^2=0.63) was observed between 12-Feb-2014 and 03-Apr-2014 (Fig 3.2). Mean total chl-a concentrations remained relatively constant at 4.7 +/- 1.3 μg L^{-1} during most of the austral winter (March-July) between 15-21 m depth (Fig 3.2). Mean total chl-a decreased at a rate of 0.03 μg L^{-1} d^{-1} (R^2=0.86) between 20-Jul-2014 and 11-Oct-2014 followed by an increase of 0.07 μg L^{-1} d^{-1} was observed between 17-Oct-2014 and 15-Nov-2014 as sunlight began returning to the valley (Fig. 3.3).

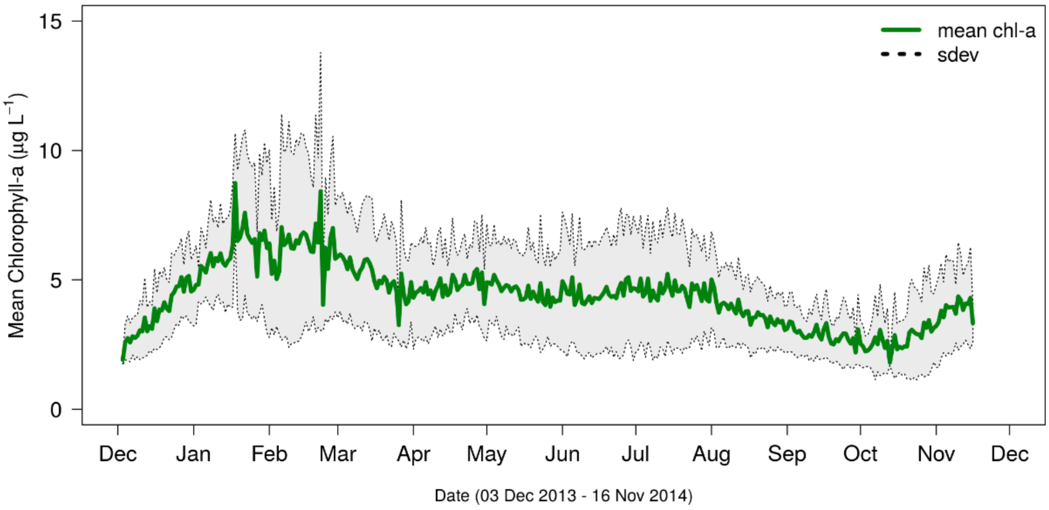

Figure 3.3: Daily mean total chl-a concentration between 15 and 21 m as measured by the ITP's Fluoroprobe in ELB during the 2013-14 ITP deployment. Ticks on x-axis indicate the first day of the month.

Turnover times (d) were calculated by dividing the mean chl-a concentration over a period by the estimated chl-a gain/loss rate during the corresponding interval. It has been estimated that there are 80.11 g C (g chl-a)$^{-1}$ (Sharp, 1993) in this depth range, and using this ratio, gain/loss rates were calculated in terms of carbon and summarized below (Table 3.1). During periods of chl-a increase when PAR was available the turnover time of carbon was about 50 days. Negative turnover times represent the amount of time for phytoplankton chl-a (carbon) to be replenished in the system and positive turnover times signify the time for an equivalent amount of carbon to be lost.

Date Range	**Chl-a Rate** (µg chl-a L^{-1} d^{-1})	**Carbon Rate** (µg C L^{-1} d^{-1})	**Turnover Time (d)**
04-Dec to 20-Jan	0.09	7.3	51
12-Feb to 03-Mar	-0.05	-4.1	-107
20-Jul to 11-Oct	-0.03	-2.2	-123
17-Oct to 15-Nov	0.07	5.2	52

Table 3.1: Summary of estimated mean chl-a and carbon gain/loss rates and associated turnover times (ELB 2013-14). Specific date ranges used were arbitrarily selected from observed periods of chl-a gain/loss.

The ratio of particulate organic carbon (POC) to particulate organic nitrogen (PON) was variable throughout the year but had a mean POC:PON ratio centered around 10 (Figure. 3.4). These observations of the POC to PON ratio were generally greater than the Redfield ratio of 6.6, suggesting the particulate organic matter was of poor quality. POC:PON increased during the summer and into early fall from around 8 to 12, coinciding with an increase in green algae chl-a concentration. The POC:PON ration decreases back to about 8 into May as green algae chl-a decreases. An increase in POC:PON (~13) is again observed as the brown/mixed and cryptophyte groups increase in June and July. The POC:PON decreases to ~10 by November when PAR is again available and diversity has begun to increase.

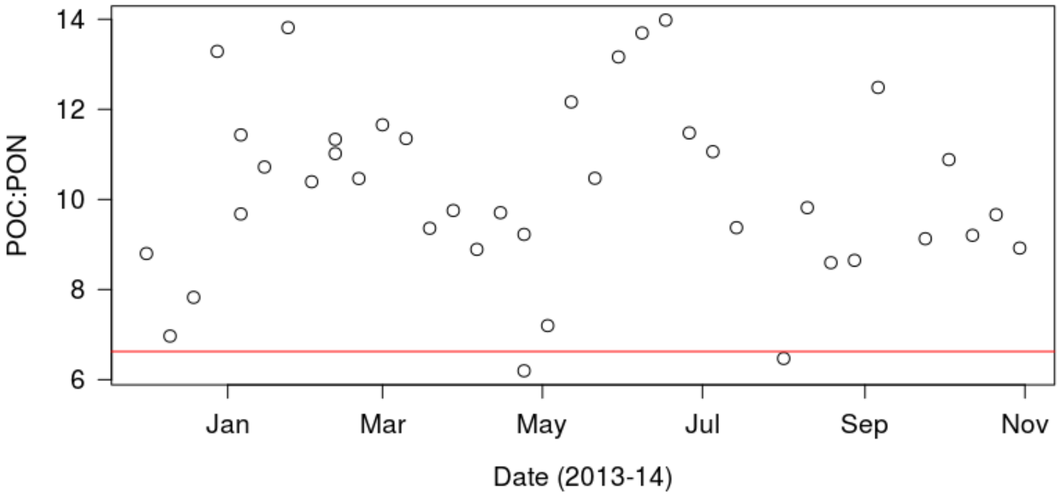

Figure 3.4: Molar ratios of particulate organic carbon (POC) to particulate organic nitrogen (PON) measured in water samples collected at regular intervals by the remote access sampler positioned at a depth of 15 m in ELB. Red line indicates the molar POC:PON ratio for phytoplankton in balanced growth (Redfield ratio (6.6); Redfield 1958). X-axis ticks represent the first day of the month.

The mean Shannon diversity index reached its highest level (1.08) in early December and decreased to ~0.8 during the summer and early fall months as PAR declined. Diversity increased again between in April reaching a Shannon Index of ~0.9 before decreasing steadily during the polar night reaching a low of 0.48 at the end of the period of darkness. Shannon diversity began to increase again as under-ice PAR became measurable in September (Fig. 3.5).

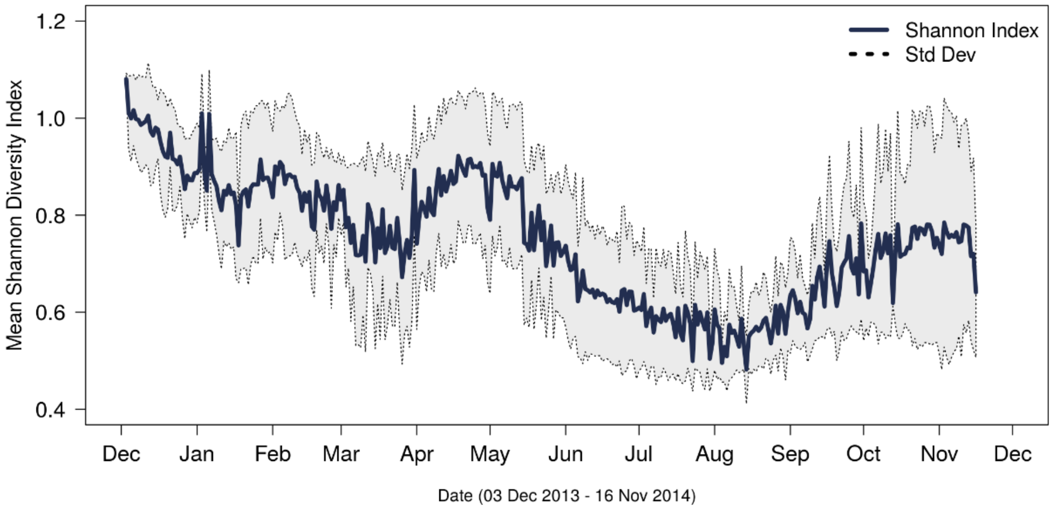

Figure 3.5: Mean daily Shannon diversity index calculated from the measured chl-a concentration of the four spectral classes of phytoplankton (between 15-21 m) in ELB during 2013-14 ITP deployment. Ticks on x-axis indicate first day of the month.

Vertical changes in algal diversity between 15-21 m are highlighted in the contour plot of the Shannon diversity index (Fig. 3.6). Diversity was uniform over the depth range, and the decrease in late January (~1 to 0.8) corresponds with an increase in the green algae group.

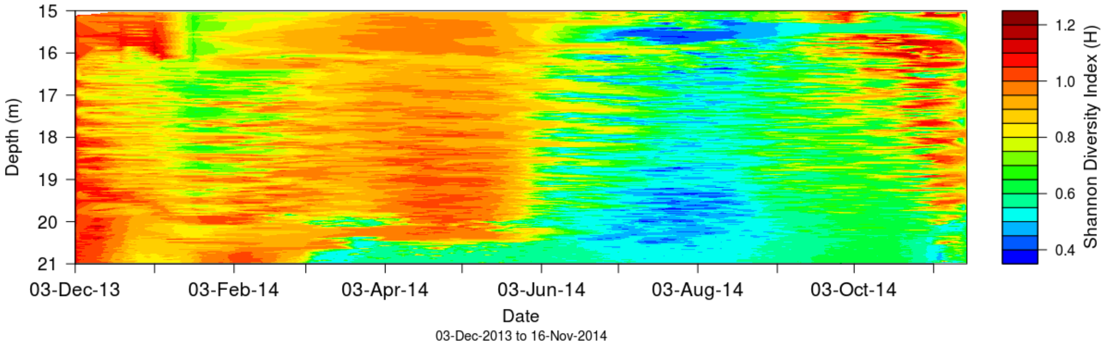

Figure 3.6: Contour plot of Shannon diversity index calculated form algal group chl-a concentrations (between 15-21 m) in ELB during the 2013-14 ITP deployment. X-axis ticks are monthly intervals beginning on the 03-December-2013.

Countour plots provided a visual representation of the algal spectral class concentrations throughout the recorded depth range during the entirety of the ITP deployment (Fig. 3.7). Brown/mixed algae were abundant over the depth range (15-21 m) throughout the year. The greatest concentrations (~9 µg L^{-1}) were observed in February between 15-17 m, during the transition from summer to winter. Their concentration decreased throughout the water column and then during the darkness of winter (June and July) concentrations rose (5-7 µg L^{-1}) between 15-19 m. Between August and October the brown/mixed algae concentration decreased gradually up the water column, to then increase down the water column into November. Green algae were abundant over the depth range during the summer months reaching the highest concentrations (6-8 µg L^{-1}) in January and February. The green algae chl-a then decreased gradually up the water column and by September was <1 µg L^{-1}. In October, the green algae concentration began decreasing down the water column as PAR became available and by November was reaching 4 µg L^{-1}. The cryptophyte group was present over the depth range in low concentration (<0.05 µg L^{-1}) during January, with the greatest concentrations (1.1 µg L^{-1}) between 15-16 m. By March the cryptophyte group was undetectable, but began increasing in concentration again in May during the darkness of winter. Cryptophytes reached concentrations of 2.2 µg L^{-1} above 17 m by mid-August. The cryptophyte group began increasing in concentration down the water column in October and into November (0-2 µg L^{-1}). Cyanobacteria occupied the depth range throughout the year with concentrations <1 µg L^{-1}. The lowest concentrations of cyanobacteria coincided with depths and times when green algae and cryptophytes were most abundant.

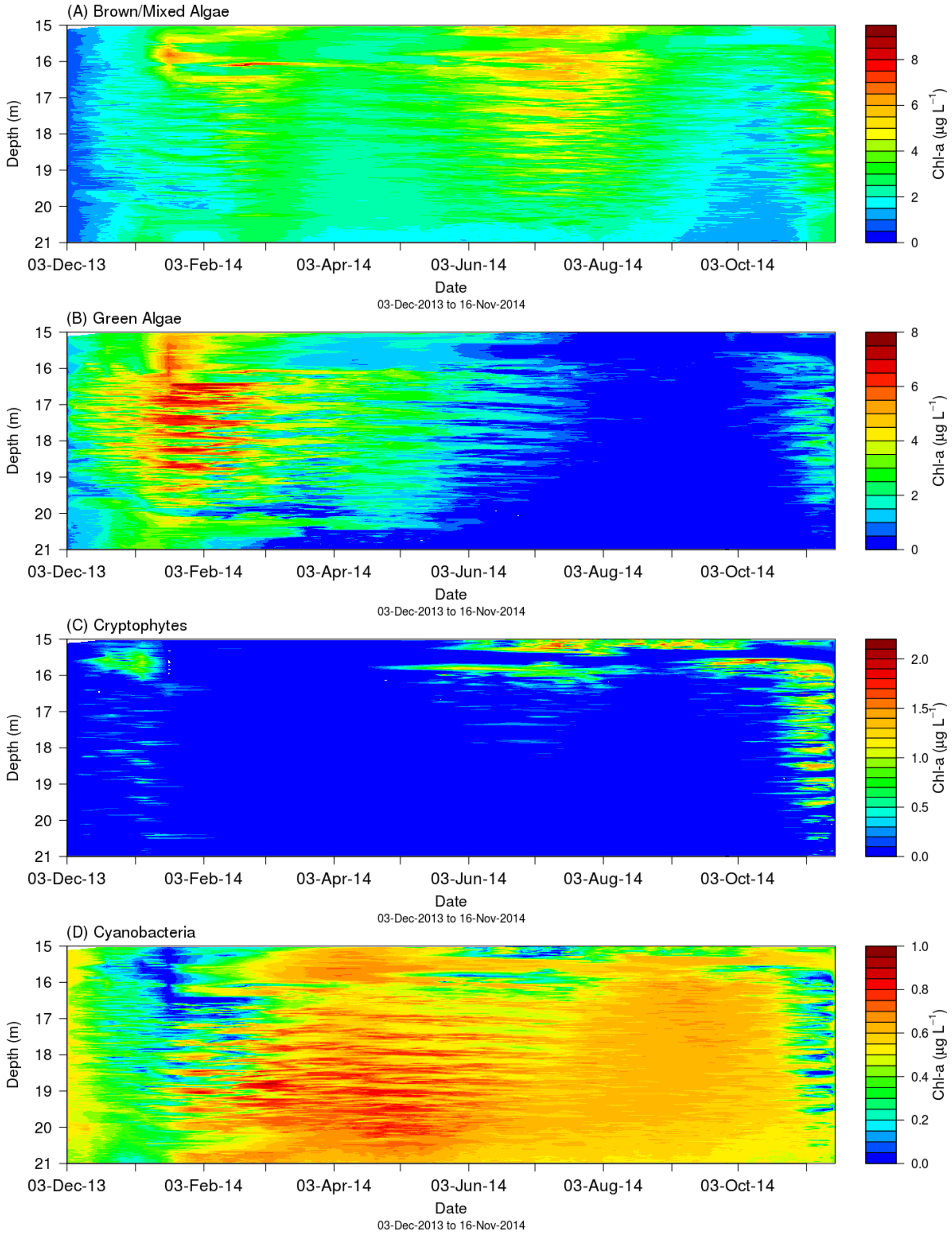

Figure 3.7: Contour plots of algal group chl-a concentrations over depth and time. Brown/mixed algae (A), green algae (B), cryptophytes (C), cyanobacteria (D). Plot was constructed with a bivariate interpolation matrix using depth and date (as a numerical fraction of the year). Color keys are at different scales in each plot.

West Lake Bonney (2013-14)

The ITP obtained daily profiles between the depths of 16-19 m from 06-Dec-2013 to 21-Nov-2014 in the west lobe of Lake Bonney. Total chl-a was averaged over this depth range for each day and included both the down and up-casts for each profile. Linear regression models were used to estimate growth and loss rates of mean total chl-a over this depth range in a manner similar to that used for ELB. Between 02-Apr-2014 and 26-Jul-2014 mean total chl-a increased steadily at 0.06 µg L^{-1} day^{-1} (R^2 = 0.83). In mid-October into mid-November mean total chl-a decreased rapidly at 0.09 µg L^{-1} day^{-1} (R^2 = 0.70). Mean total chl-a then rapidly increased at 0.15 µg L^{-1} day^{-1} (R^2 = 0.60) between 13-Oct-2014 and 17-Nov-2014 (Fig. 3.8).

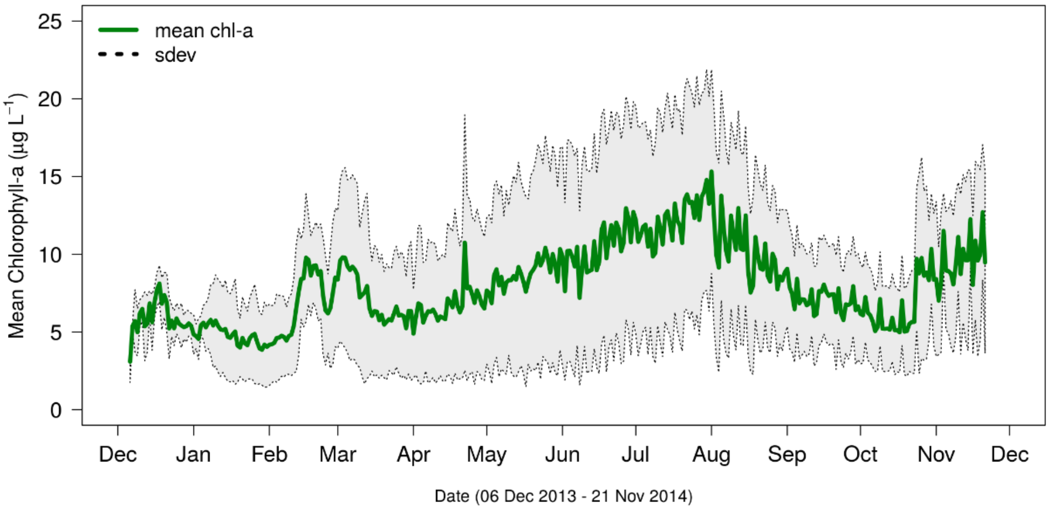

Figure 3.8: Daily mean total chl-a between 16 and 19 m in WLB during the 2013-14 ITP deployment. Ticks on x-axis indicate first day of the month.

Chlorophyll-a and carbon turnover times (d) were calculated (see ELB 2013-14 results) based on the estimated gain/loss rates and are summarized in Table 3.2. As seen in ELB the turnover time during periods of chl-a increase while PAR was available was about 50 days. The increase observed during the austral winter had a turnover time of 158 days.

Date Range	**Chl-a Rate** (µg chl-a L^{-1} d^{-1})	**Carbon Rate** (µg C L^{-1} d^{-1})	**Turnover Time (d)**
02-Apr to 26-Jul	0.06	4.8	158
31-Jul to 06-Oct	-0.09	-7.4	-92
13-Oct to 17-Nov	0.15	12.3	53

Table 3.2: Summary of estimated mean chl-a and carbon gain/loss rates and associated turnover times (WLB 2013-14). Specific date ranges used were arbitrarily selected from observed periods of chl-a gain/loss.

The ratio of POC to PON increased nearly linearly at the depth of 15 m throughout the year. POC:PON ratios of particulate organic matter were greater than the Redfield ratio at each observation, except for a single observation in September. The fixed depth which the RAS collected water was just above the consistent depth range obtained by the ITP in WLB during 2013-14 (Fig 3.9). The increase in POC:PON (~9 to 14) at 15 m during 2013-14 corresponded with a decreasing trend in the mean Shannon diversity index (~1 to 0.6) between 16-19 m.

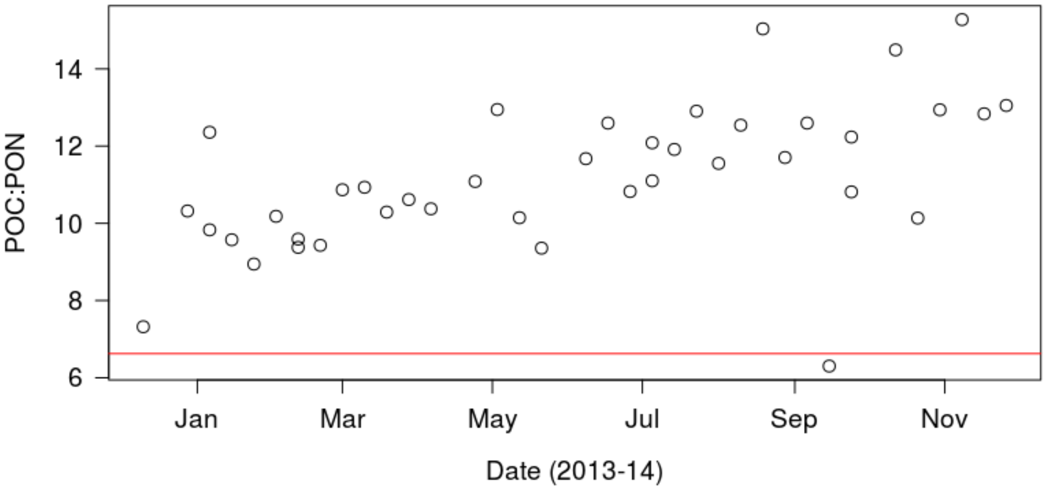

Figure 3.9: Ratio of particulate organic carbon (POC) to particulate organic nitrogen (PON) micromolar concentrations measured form water samples collected at regular intervals by the remote access sampler positioned 15 m depth in WLB. Red line indicates the molar POC:PON ratio for phytoplankton in balanced growth (Redfield ratio (6.6); Redfield 1958). X-axis ticks represent the first day of the month.

The mean Shannon diversity increased during the summer (December to January) when PAR was greatest reaching 1.07, but then decreased rapidly as PAR declined between February and March. The mean Shannon diversity index increased during April and May reaching a winter peak in late May (0.91). After the increase observed in May, the mean Shannon diversity declined steadily into November reaching a low of 0.56 (Fig. 3.10).

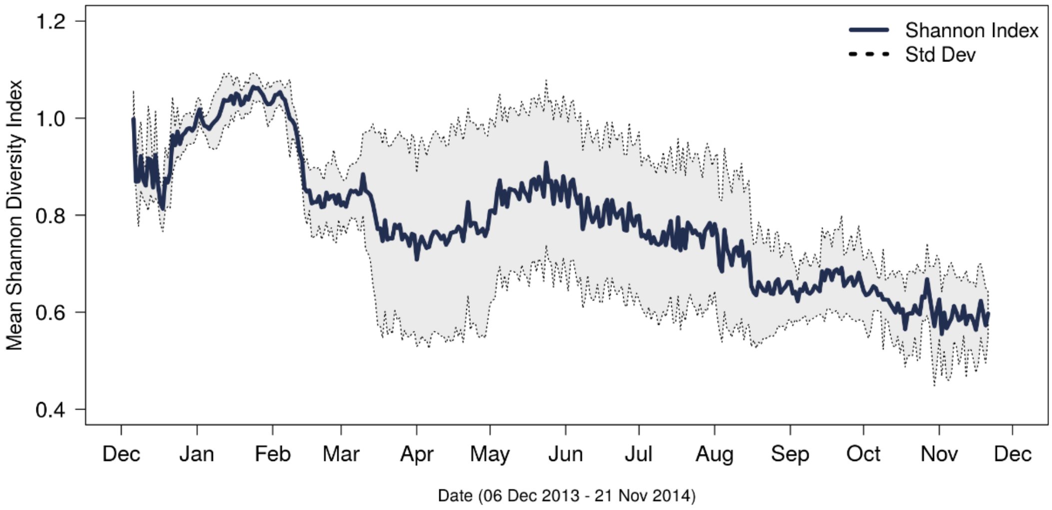

Figure 3.10 Mean daily Shannon diversity index calculated from the measured chl-a concentration of the four spectral classes of phytoplankton in WLB during 2013-14 ITP deployment. Ticks on x-axis indicate first day of the month.

Temporal changes in algal diversity throughout the depth range (16-19 m) are highlighted the contour plot of Shannon diversity index (Fig. 3.11). Diversity increased (0.8 to 1.07) evenly throughout the depth range during the austral summer (December and January). Diversity remained high (~1.0) between 16 and 16.75 m into August, while below this depth diversity began decreasing in February. In June, the diversity of the phytoplankton community began decreasing progressively up the water column.

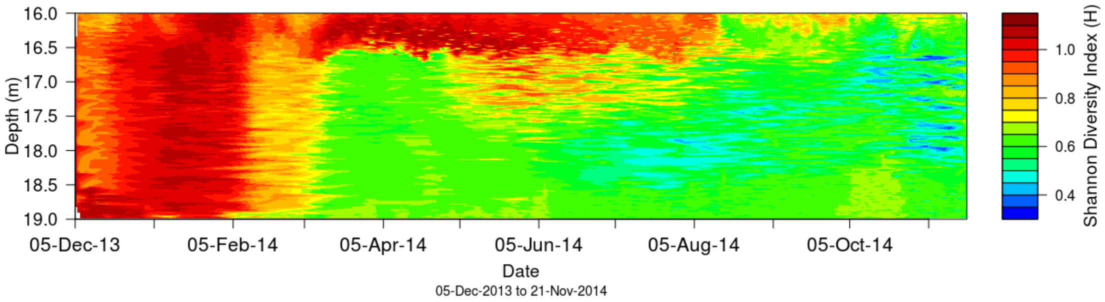

Figure 3.11: Contour plot of Shannon diversity index calculated form algal group chl-a concentrations (between 16-19 m) in WLB during the 2013-14 ITP deployment. Constructed with bivariate interpolation matrix.

Depth contoured data showed that brown/mixed algae were present throughout the depth range all year, but most concentrated above 17 m (Fig. 3.12). The brown/mixed group reached their highest concentrations (~18 µg L^{-1}) during March above 16.5 m. During the darkness of winter (June-August) concentrations were 15-17 µg L^{-1} above 17 m and gradually increased down the water column. (4 to 8 µg L^{-1} at 18.5 m). Green algae occupied the entire depth range (16-19 m) in December, decreasing below 16.5 m through January. The highest concentration (11 µg L^{-1}) was observed in March near the top of the profile. The green algae maintained their concentration into the winter at the upper meter of the profile, but below 17 m, concentration averaged 0.15 µg L^{-1}. In August, the green algae concentration began decreasing at the top of the profile from ~4 µg L^{-1} to an average of 0.7 µg L^{-1} by mid-October. Concentration began increasing down the water column as PAR again became available. Cryptophytes were primarily detected in depths above 17 m throughout the 2013-14 deployment. At depths greater than 17 m, the mean cryptophyte chl-a concentration was below the detection limit (<0.02 µg L^{-1}). This group reached its greatest abundance (1-4 µg L^{-1}) during the darkness of winter (May-August). In September, the cryptophytes began decreasing to a mean of 0.2 µg L^{-1} (between 16 and 17 m) by November. Cyanobacteria maintained a relatively consistent concentration throughout the year with a mean of 0.8 µg L^{-1} over the profile (16-19 m). Cyanobacteria concentrations were lowest (<0.2 µg L^{-1}) in portions of the water column that coincided with highest concentrations of the other algal groups.

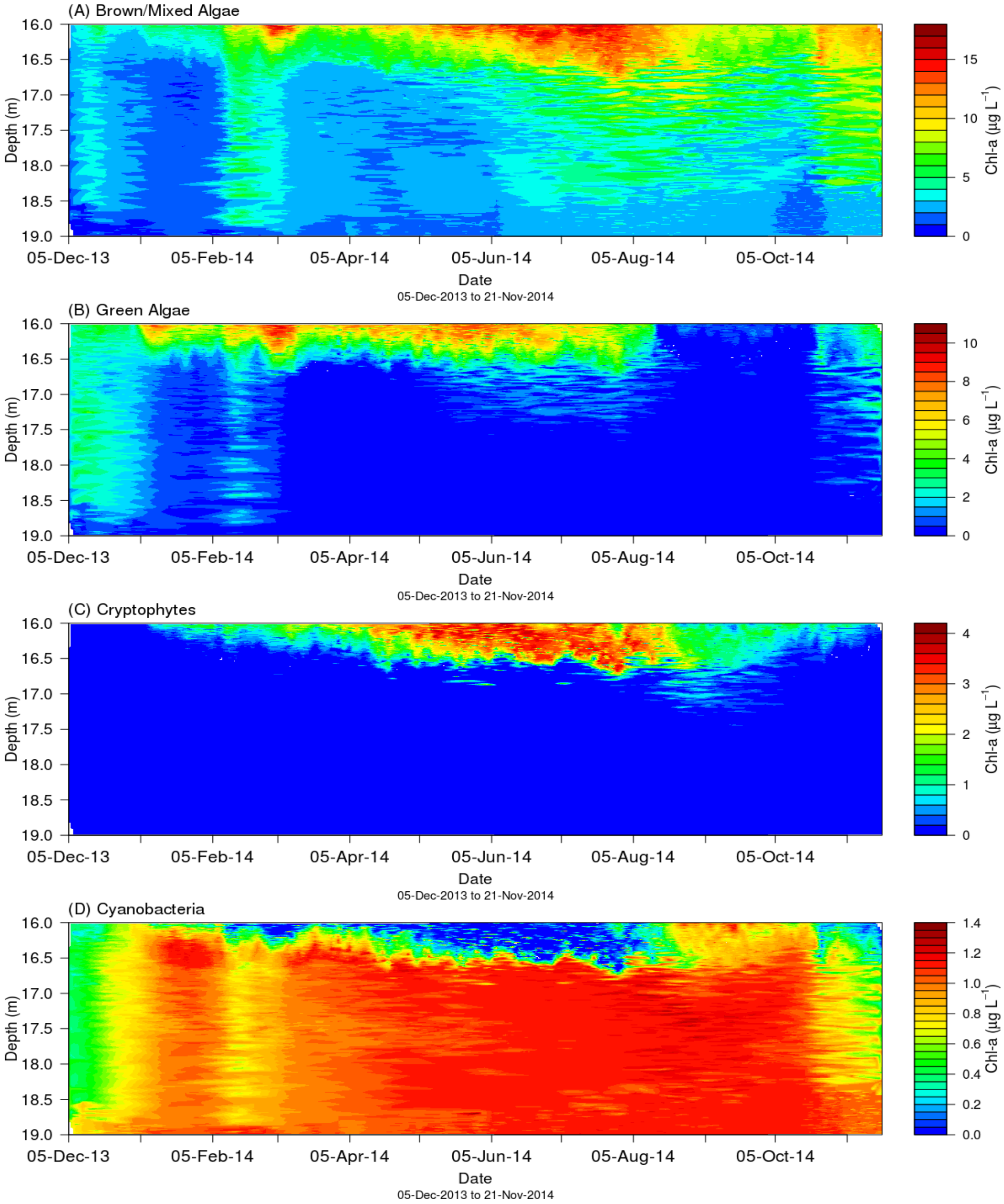

Figure 3.12: Filled contour plots of algal group chl-a concentrations measured by the ITP Fluoroprobe. Brown/mixed algae (A), green algae (B), cryptophytes (C), cyanobacteria (D). Plot was constructed with a bivariate interpolation matrix using depth and date (as a numerical fraction of the year). Color keys are not the same scale in the four plots.

Discussion

Phytoplankton biomass and community structure in Lake Bonney respond dramatically to the strong bimodal light regime characteristic of the high latitude in which they occur. Fluoroprobe profiles during the 2013-14 deployment indicated that mean chl-a concentration near the chemocline of WLB reached a peak at the end of July (15 µg L^{-1}; sd = 6.6), while ELB mean chl-a remained relatively constant (~4 µg L^{-1}; sd = 1.9) during the 24-hour darkness of winter. These results provide insight for first question I set to answer; does the total chl-a concentration decrease during the 24-hour darkness of the austral winter? During most of the austral winter (mid-April to late-July), no, total chl-a does not decrease, in fact WLB concentrations steadily increased (0.06 µg L^{-1} d^{-1}) with an estimated turnover time of 158 d. Differences in total chl-a trends were observed between the two lobes through July, however both lobes showed losses between August and October. It has been shown previously that phytoplankton in Lake Bonney respond to low light levels by increasing their cellular concentration of photopigments (Morgan-Kiss et al., 2016; Neale & Priscu, 1995). This physiological response could help explain the chl-a increases observed during the transition from summer to winter. The highest single chl-a observations for the brown/mixed and green algae groups were in February (9 and 7 µg L^{-1}; ELB, respectively) and March (18 and 11 µg L^{-1}; WLB, respectively). It is likely phytoplankton were adjusting their photochemistry to maximize light harvesting during the transition period, especially the increases observed in obligately phototrophic green algae (Morgan-Kiss et al., 2016). Another possible explanation for the late summer increases, could be an influx of nutrients and cyanobacteria released from the permanent ice-cover (Paerl & Priscu, 1998; Priscu et al., 1998; Vick-Majors et al., 2014). The physiological response of increased photopigments as well as fallout from ice are not enough to explain the sustained (and increasing) trends observed during the period when PAR was unavailable.

By answering the second question I posed; how does the diversity of the phytoplankton community respond to the 24-hour darkness of winter, I can begin to shed light on possible explanations for the observed winter trends. Calculating diversity indices is flexible and can be done with any type of community data, for example, in this study chl-a concentrations estimated by PSII fluorescence were used. Having only four spectral groups of phytoplankton in the community of interest, and using fluorescence emission signals to quantify abundance, it doesn't make sense to compare these metrics with other lakes, or even with diversity metrics calculated previously in Lake Bonney (Shade, 2016). While not directly comparable to diversity indices calculated from other methods (e.g. phylogenetics, direct cell counts, etc.), these data provide valuable insights into the observed community trends.

Shannon diversity indices, which account for both species richness and species evenness, showed that average water column diversity of these deep phytoplankton communities decreased during the transition from summer to winter. In ELB during 2013-14, the mean algal diversity was lowest in August and in WLB, during the same deployment, mean algal diversity was lowest in November (2014). The periods of low diversity were associated with higher POC:PON ratios than periods with greater diversity. The high POC:PON values (12 and 14; ELB and WLB respectively), well above the Redfield ratio (6.6), suggest that algal growth was unbalanced with less diverse assemblages. In both lobes, community diversity was high (~1) throughout the profile in December, coinciding with POC:PON ratios closer to Redfield (8 ELB; 9 WLB), supporting the idea that growth is more balanced with diverse communities. Diversity decreased during the summer-winter transition in both lobes, however in WLB, diversity persisted (~1) between 16 and 16.5 m into August while below this depth diversity dropped to ~0.6 by March. The diversity in ELB was more homogeneous over the profile (15-21 m) than WLB (16-19 m) as green algae and brown/mixed persisted over a greater depth range. Despite differences in algal distribution over the profile, the periods of low diversity during the darkness of winter, were both associated with elevated concentrations of the brown/mixed and cryptophyte groups. The potential alternative metabolic capabilities (e.g. phagotrophy) of members included in these groups allow them to obtain nutrients below the levels needed for balanced growth by directly ingesting bacteria (Mitra et al., 2014). This idea would support the high POC:PON observations, because these systems are known to be nutrient limited (Priscu, 1995), and nutritional quality of bacteria would likely be insufficient (Mitra et al., 2014).

The increased chl-a concentrations of the brown/mixed algae and cryptophyte groups during the darkness of winter answers my third question; does the relative abundance of algal groups capable of mixotrophy increase when PAR is unavailable- yes. These data clearly demonstrate the importance of mixotrophic metabolism in the flow of carbon and nutrients through the food-webs of these unique lake systems. Providing support for other work that has recognized this essential over winter strategy (Laybourn-Parry, 2002; Li et al., 2016; McKnight et al., 2000; J. C. Priscu et al., 1999; Vick-Majors et al., 2014). The basis for my first question (does total chl-a decrease) was the assumption that without PAR, phytoplankton would not spend energy producing chl-a, however this was not the case. Under the physiological stress of low temperatures and low light it is likely a competitive strategy to maintain a photochemical apparatus in a down-regulated state, even if it is not actively being used by the organism, a similar strategy used by overwintering evergreen trees (Morgan-Kiss et al., 2006). If chl-a is maintained within the cell, when PAR becomes available in the spring, these organisms can efficiently resume photosynthetic metabolism, without need of synthesizing the photosynthetic apparatus de novo. This may explain the observed increases in chl-a from the brown/mixed algae and cryptophytes during a period when photosynthesis would not be possible.

During late winter (August-October), both lobes showed a decrease in mean chl-a (-0.09 and -0.03 $\mu g\ L^{-1}\ d^{-1}$; WLB and ELB, respectively) with turnover times of -92 and -123 d (WLB and ELB, respectively). Contour plots highlight that this decrease is experienced progressively up the water column for the dominant algal groups (brown/mixed and green algae), though in ELB the green algae decline begins in June. One possible explanation for the late winter losses, is that these organisms are moving up the water column, where low levels of PAR are becoming available. The profiles captured algal dynamics in the deep chl-a layers, but little is known about what happens above 15 m during this time. Cyanobacteria persisted in low concentrations throughout the year, with little overlap in their vertical position, with other groups present in high concentrations. During this “window” of decline, the cyanobacteria begin to occupy this space in the water column, where competition is now low. Another possible explanation for the late winter decline is that almost monospecific composition of the algal community increased the susceptibility to infections from fungi or viruses. Recent work has highlighted the important, yet poorly understood, role that fungi play in aquatic food-webs (Grossart & Rojas-Jimenez, 2016). The influence of fungi on MDV lakes is just beginning to be investigated, however, fungal species (*Chrytridiomycota* and *Cryptomycota*) known to parasitize various phytoplankton species have been identified (Priscu, unpublished data). Recent studies have also shown that dominant members of the green algae (*Chlamydomonas sp.*) are subject to parasitism from a heterotrophic nanoflagellate (*Pirsonia sp.*), while the dominant member of the brown/mixed algae (*Isochrysis sp.*) is likely prey of a heterotrophic bacteria (*Pteridomonas sp.*) (Li et al., 2016). These food-web relationships may also help explain winter losses of chl-a.

Despite complications obtaining a full depth profile of the trophogenic zone during a single season, my data clearly demonstrate the ecological advantage of mixotrophic metabolism, as concentrations of the brown/mixed and cryptophyte groups increased during the darkness of winter. The ability of mixotrophic organisms to use both phototrophic and heterotrophic metabolic pathways has significant implications for carbon and nutrient cycling in Lake Bonney.

CHAPTER FOUR

GENERAL CONCLUSIONS

The overarching hypothesis for this thesis was that phytoplankton community composition responds dynamically to changing environmental conditions. I accept this hypothesis after completing two separate studies. The first study, I analyzed data that were collected during the austral summers (November, December, January) between 2004-05 and 2014-15, with a goal of characterizing long-term changes in the phytoplankton community structure. I hypothesized that the landscape-level effects of climate change (e.g. increased glacial run-off, increasing lake depth, etc.) are influencing the algal community structure in Lake Bonney. I accepted this hypothesis after addressing three specific questions. I showed that the total integrated chl-a concentrations in the trophogenic zone of each lake has more than doubled during this period (42.39 to 99.82 mg m^{-2} and 21.06 to 50.22 mg m^{-2} in WLB and ELB, respectively). I showed that the increase followed a summer (2010-11) of high stream flow when lake levels rose 0.8 m. This pulse event of rapid lake level rise in 2010-11 coincided with a shift in the algal community composition. Following that event, the proportion that green algae contribute to the total chl-a concentration has increased by around 30% in both lobes. I attempted to determine which environmental drivers were most strongly influencing the trends of individual spectral groups, but with the method employed, I was only able to make general conclusions supporting the nutrient and light limited conditions these organisms experience. These results underpin the value that extensive year-round sampling would provide to the MCM LTER.

In the second study, I analyzed data collected by autonomous sampling devices throughout a year-long (2013-14) deployment, with a goal of characterizing the seasonal variation in phytoplankton community structure, particularly during the poorly understood winter months. I hypothesized that during the 24-hour darkness of winter, the Lake Bonney algal community structure shifts in favor of organisms capable of alternative metabolic strategies (i.e. mixotrophy). I accepted this hypothesis after answering the questions I posed. My data showed that the mean chl-a concentration does not rapidly decline once PAR was unavailable, but increased steadily (0.06 $\mu g\ L^{-1}\ d^{-1}$) in WLB, and remain relatively constant (~4 $\mu g\ L^{-1}$) in ELB until August. I showed that the diversity of the phytoplankton community decreased over the winter and that periods of low diversity were associated with less balanced growth. I was also able to clearly show that mixotrophic metabolism is an important component to flux of carbon and energy in Lake Bonney. The spectral groups containing organisms identified with the capacity for mixotrophic growth (*Isochrysis sp.* – brown/mixed algae; *Geminigera sp.* – cryptophytes) increased in concentration during the darkness of winter. During the same period a significant decrease of the obligately phototrophic green algae was observed, as these organisms likely attempted to wait-out the darkness relying on lipid reserves. Cyanobacteria, the least abundant algal group in Lake Bonney, where able to maintain their chl-a concentrations throughout the winter suggesting an evolutionary adaptation allowing them to enter dormant states and simply persist during the dark winter months.

This work has helped to fill in a knowledge gap that has existed for over 30 years in our understanding of the response of the photosynthetic algal community to a 4-month period of total darkness. The observed changes in algal community structure will allow us to better understand the flux pathways of carbon in Lake Bonney year-round, and highlights the importance of heterotrophic winter growth when calculating carbon budgets. Successfully deploying autonomous samplers in Lake Bonney provides insights applicable to the quest for life throughout our solar system, lending strategies to remotely survey liquid water environments trapped beneath a permanent ice-cover.

The potential weaknesses of using in situ fluorescence, such as the low algal group resolution and variability in fluorescence emission (e.g. increased fluorescence under nutrient stress, changes in cellular concentration of photopigments, etc.) are out-weighed by the benefits provided in rapid spatial and temporal estimations of phytoplankton communities. Future research can allow the calibration of the Fluoroprobe to the unique spectral signatures of the organism present in the MDV lakes, providing increased accuracy in obtaining cellular densities and algal biomass measurements, based simply on assessor pigment absorption characteristics and associated PSII fluorescence. Using traditional phytoplankton enumeration methods (e.g. microscopy, HPLC pigment analysis, etc.) to achieve the same goal would have been costly and provided a decreased spatial resolution (see for example Tursich, 2003). The fluorometric methods used here, allowed us to remotely observe phytoplankton community changes during the darkness of winter at a temporal and spatial resolution never achieved. This research contributes significantly to our understanding of phytoplankton community dynamics in the perennially ice-covered lakes of the McMurdo Dry Valleys, Antarctica.

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APPENDIX A

LONG-TERM COMMUNITY ANALYSIS DATA

WLB Community Analysis Data Set

Sample ID (run_depth)	Cyanobacteria (µg chl-a L^{-1})	Cryptophytes (µg chl-a L^{-1})	Brown/Mixed Algae (µg chl-a L^{-1})	Green Algae (µg chl-a L^{-1})	Ice Thickness (m)	Depth (m)	Date (YYYY-MM-DD)	Conductivity (mS/cm)	DIC (mM)	DOC (mM)	NH$_4$ (µM)	SRP (µM)	NO$_2$ (µM)	NO$_3$ (µM)	Decimal Date	DIN (µM)	MASL0(m)	Underwater PAR (µmol photons m^{-2} s^{-1})
WB0405L2_05	0.000	0.000	0.520	1.390	3.65	5	2004-12-13	1.389	0.60	0.04	0.42	0.05	0.11	3.36	2004.948	3.89	57.91	7.21
WB0405L2_06	0.000	0.000	0.975	2.060	3.65	6	2004-12-13	1.750	1.00	0.05	0.68	0.05	0.17	5.15	2004.948	6.00	56.91	5.98
WB0405L2_08	0.000	0.000	0.657	1.280	3.65	8	2004-12-13	2.683	1.90	0.06	0.43	0.05	0.14	6.41	2004.948	6.98	54.91	4.11
WB0405L2_10	0.000	0.000	0.773	1.020	3.65	10	2004-12-13	3.728	2.70	0.07	1.10	0.05	0.14	6.53	2004.948	7.77	52.91	2.83
WB0405L2_12	0.000	0.000	1.845	1.755	3.65	12	2004-12-13	6.351	5.20	0.10	1.18	0.13	0.36	7.08	2004.948	8.62	50.91	1.94
WB0405L2_13	0.000	0.000	3.695	2.790	3.65	13	2004-12-13	10.216	6.60	0.26	2.15	0.05	0.39	8.24	2004.948	10.78	49.91	1.61
WB0405L2_14	0.000	0.000	4.100	3.015	3.65	14	2004-12-13	19.297	21.80	0.42	41.22	0.05	0.00	12.68	2004.948	53.90	48.91	1.34
WB0405L2_15	0.000	0.000	2.670	1.610	3.65	15	2004-12-13	44.684	42.30	0.68	133.30	0.09	0.00	12.14	2004.948	145.44	47.91	1.11
WB0405L2_17	0.000	0.000	0.810	0.310	3.65	17	2004-12-13	62.675	49.20	0.77	169.62	0.05	3.75	9.33	2004.948	182.70	45.91	0.76
WB0405L2_20	0.000	0.020	0.050	0.010	3.65	20	2004-12-13	67.327	53.60	0.76	186.92	0.04	0.00	11.93	2004.948	198.85	42.91	0.44
WB0405L3_05	0.000	0.000	1.140	1.180	3.65	5	2005-01-01	1.306	NA	0.03	0.32	0.06	0.19	5.86	2005.000	6.37	57.99	NA
WB0405L3_06	0.000	0.000	1.890	1.645	3.65	6	2005-01-01	1.769	NA	0.04	0.21	0.09	0.17	7.09	2005.000	7.47	56.99	NA
WB0405L3_08	0.000	0.000	1.300	1.215	3.65	8	2005-01-01	2.653	NA	0.04	0.00	0.07	0.13	6.39	2005.000	6.52	54.99	NA
WB0405L3_10	0.000	0.000	1.360	0.955	3.65	10	2005-01-01	3.817	NA	0.05	0.95	0.05	0.12	5.18	2005.000	6.25	52.99	NA
WB0405L3_12	0.000	0.000	3.635	1.690	3.65	12	2005-01-01	6.539	NA	0.08	0.37	0.05	0.26	9.21	2005.000	9.84	50.99	NA
WB0405L3_13	0.000	0.000	6.770	2.520	3.65	13	2005-01-01	10.918	NA	0.13	1.47	0.05	0.51	11.77	2005.000	13.75	49.99	NA
WB0405L3_14	0.000	0.000	5.350	2.075	3.65	14	2005-01-01	23.578	NA	0.15	18.95	0.06	0.00	15.96	2005.000	34.91	48.99	NA
WB0405L3_15	0.000	0.000	1.435	0.595	3.65	15	2005-01-01	51.305	NA	0.55	111.92	0.09	0.00	14.59	2005.000	126.51	47.99	NA

WB0405L3_17	0.000	0.000	0.470	0.070	3.65	17	2005-01-01	63.162	NA	0.65	137.72	0.11	4.44	9.85	2005.000	152.01	45.99	NA
WB0405L3_20	0.000	0.010	0.000	0.000	3.65	20	2005-01-01	67.600	NA	0.74	155.53	0.13	4.06	9.84	2005.000	169.43	42.99	NA
WB0405L4_05	0.000	0.000	2.280	1.810	3.65	5	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	58.03	NA
WB0405L4_06	0.000	0.020	2.570	1.820	3.65	6	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	57.03	NA
WB0405L4_08	0.000	0.040	1.590	1.040	3.65	8	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	55.03	NA
WB0405L4_10	0.000	0.000	1.730	1.080	3.65	10	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	53.03	NA
WB0405L4_12	0.000	0.000	4.025	1.485	3.65	12	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	51.03	NA
WB0405L4_13	0.000	0.000	7.420	2.050	3.65	13	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	50.03	NA
WB0405L4_14	0.000	0.000	5.840	1.620	3.65	14	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	49.03	NA
WB0405L4_15	0.000	0.000	1.810	0.930	3.65	15	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	48.03	NA
WB0405L4_17	0.000	0.000	0.730	0.210	3.65	17	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	46.03	NA
WB0405L4_20	0.000	0.020	0.000	0.000	3.65	20	2005-01-11	NA	NA	NA	NA	NA	NA	NA	2005.027	NA	43.03	NA
WB0506L1_05	0.000	0.000	0.838	4.901	3.59	5	2005-11-30	1.035	1.30	0.10	1.79	0.03	0.20	7.62	2005.912	9.61	57.96	16.72
WB0506L1_06	0.000	0.000	0.891	3.080	3.59	6	2005-11-30	1.172	1.60	0.09	1.57	0.08	0.18	8.32	2005.912	10.07	56.96	14.22
WB0506L1_08	0.000	0.020	0.570	1.467	3.59	8	2005-11-30	2.271	1.90	0.08	0.52	0.03	0.15	9.25	2005.912	9.92	54.96	10.28
WB0506L1_10	0.000	0.072	0.799	1.549	3.59	10	2005-11-30	2.940	2.60	0.09	0.66	0.01	0.14	9.69	2005.912	10.49	52.96	7.43
WB0506L1_12	0.000	0.021	1.693	2.503	3.59	12	2005-11-30	4.898	4.00	0.11	0.35	0.02	0.21	10.53	2005.912	11.09	50.96	5.37
WB0506L1_13	0.000	0.097	3.181	2.939	3.59	13	2005-11-30	6.721	6.90	0.30	2.54	0.03	0.45	13.08	2005.912	16.07	49.96	4.57
WB0506L1_14	0.000	0.000	2.946	2.802	3.59	14	2005-11-30	9.968	14.40	0.32	29.79	0.04	0.00	19.65	2005.912	49.44	48.96	3.88
WB0506L1_15	0.000	0.000	1.609	1.483	3.59	15	2005-11-30	16.275	40.80	0.77	140.62	0.07	0.00	17.56	2005.912	158.18	47.96	3.30
WB0506L1_17	0.000	0.002	0.194	0.187	3.59	17	2005-11-30	59.248	42.70	0.84	177.89	0.07	2.68	13.97	2005.912	194.54	45.96	2.39
WB0506L1_20	0.011	0.000	0.012	0.003	3.59	20	2005-11-30	66.004	54.50	0.86	193.42	0.08	0.00	14.33	2005.912	207.75	42.96	1.47
WB0506L2_05	0.000	0.000	0.654	3.168	3.59	5	2005-12-17	0.232	0.70	0.04	0.49	0.06	0.11	5.45	2005.959	6.05	58.06	3.94

WB0506L2_06	0.000	0.000	1.070	3.406	3.59	6	2005-12-17	1.204	1.20	0.04	0.78	0.02	0.14	8.03	2005.959	8.95	57.06	3.23
WB0506L2_08	0.000	0.049	0.834	1.523	3.59	8	2005-12-17	2.227	1.90	0.06	0.42	0.01	0.14	9.35	2005.959	9.91	55.06	2.18
WB0506L2_10	0.000	0.107	1.082	1.618	3.59	10	2005-12-17	2.899	2.50	0.06	0.91	0.01	0.12	9.62	2005.959	10.65	53.06	1.46
WB0506L2_12	0.000	0.000	4.548	4.787	3.59	12	2005-12-17	4.338	2.80	0.08	0.22	0.03	0.17	10.00	2005.959	10.39	51.06	0.99
WB0506L2_13	0.000	0.000	6.066	5.466	3.59	13	2005-12-17	6.588	5.40	0.09	0.00	0.01	0.29	11.26	2005.959	11.55	50.06	0.81
WB0506L2_14	0.000	0.006	3.783	3.384	3.59	14	2005-12-17	10.627	9.90	0.25	13.69	0.05	0.00	17.87	2005.959	31.56	49.06	0.66
WB0506L2_15	0.000	0.000	1.060	1.084	3.59	15	2005-12-17	15.093	38.50	0.62	139.70	0.16	0.00	17.76	2005.959	157.46	48.06	0.54
WB0506L2_17	0.000	0.000	0.320	0.236	3.59	17	2005-12-17	57.976	47.10	0.69	176.69	0.10	2.31	13.48	2005.959	192.48	46.06	0.37
WB0506L2_20	0.002	0.000	0.007	0.010	3.59	20	2005-12-17	65.896	52.80	0.77	195.02	0.13	2.68	11.77	2005.959	209.47	43.06	0.20
WB0607L1_05	0.000	0.045	0.871	2.795	3.55	5	2006-11-22	1.420	1.00	0.04	1.28	0.03	0.17	6.48	2006.890	7.93	58.27	13.91
WB0607L1_06	0.000	0.135	0.710	1.643	3.55	6	2006-11-22	1.968	1.30	0.04	0.99	0.10	0.18	7.34	2006.890	8.51	57.27	11.79
WB0607L1_08	0.000	0.273	0.640	1.051	3.55	8	2006-11-22	2.806	2.00	0.06	0.33	0.14	0.18	8.42	2006.890	8.93	55.27	8.46
WB0607L1_10	0.000	0.352	0.827	1.059	3.55	10	2006-11-22	3.816	2.20	0.07	0.98	0.14	0.15	8.85	2006.890	9.98	53.27	6.07
WB0607L1_12	0.000	0.023	2.430	1.923	3.55	12	2006-11-22	8.102	3.40	0.10	1.06	0.09	0.20	9.51	2006.890	10.77	51.27	4.36
WB0607L1_13	0.000	0.163	3.054	2.006	3.55	13	2006-11-22	11.724	7.00	0.31	0.53	0.09	0.26	11.07	2006.890	11.86	50.27	3.70
WB0607L1_14	0.000	0.603	2.604	1.203	3.55	14	2006-11-22	17.758	15.20	0.32	9.49	0.04	0.32	20.81	2006.890	30.62	49.27	3.13
WB0607L1_15	0.000	0.017	0.933	0.573	3.55	15	2006-11-22	48.432	106.70	0.80	113.43	0.71	0.75	18.50	2006.890	132.68	48.27	2.65
WB0607L1_17	0.013	0.085	0.306	0.115	3.55	17	2006-11-22	62.491	162.70	0.92	165.90	0.73	1.55	14.81	2006.890	182.26	46.27	1.90
WB0607L1_20	0.040	0.070	0.011	0.006	3.55	20	2006-11-22	67.723	208.20	0.97	175.55	0.85	1.25	13.96	2006.890	190.76	43.27	1.16
WB0607L2_05	0.000	0.000	0.460	2.486	3.55	5	2006-12-18	1.340	0.80	0.03	0.92	0.00	0.15	5.17	2006.962	6.24	58.33	13.75
WB0607L2_06	0.000	0.020	0.518	1.894	3.55	6	2006-12-18	1.946	1.20	0.04	0.83	0.01	0.15	6.34	2006.962	7.32	57.33	11.19
WB0607L2_08	0.000	0.030	0.505	1.130	3.55	8	2006-12-18	2.771	1.90	0.05	0.41	0.10	0.16	8.33	2006.962	8.90	55.33	7.42
WB0607L2_10	0.000	0.123	0.702	1.282	3.55	10	2006-12-18	3.956	2.20	0.06	0.66	0.09	0.14	8.86	2006.962	9.66	53.33	4.92

WB0607L2_12	0.000	0.000	1.947	2.433	3.55	12	2006-12-18	7.575	3.00	0.07	0.30	0.08	0.18	9.26	2006.962	9.74	51.33	3.26
WB0607L2_13	0.000	0.000	2.719	2.963	3.55	13	2006-12-18	11.091	5.40	0.20	0.72	0.08	0.22	10.51	2006.962	11.45	50.33	2.65
WB0607L2_14	0.000	0.197	2.640	2.323	3.55	14	2006-12-18	22.740	13.60	0.28	12.49	0.19	0.33	19.47	2006.962	32.29	49.33	2.16
WB0607L2_15	0.000	0.000	0.709	0.843	3.55	15	2006-12-18	53.806	95.70	0.73	114.52	1.16	0.78	17.30	2006.962	132.60	48.33	1.76
WB0607L2_17	0.000	0.011	0.474	0.336	3.55	17	2006-12-18	62.831	139.10	0.86	161.74	0.83	1.56	14.69	2006.962	177.99	46.33	1.17
WB0607L2_20	0.010	0.020	0.023	0.139	3.55	20	2006-12-18	67.705	170.00	0.90	177.49	1.25	1.31	14.26	2006.962	193.06	43.33	0.63
WB0607L3_05	0.000	0.000	0.525	2.685	3.55	5	2007-01-05	1.495	NA	0.04	1.21	0.06	0.43	6.57	2007.011	8.21	58.39	NA
WB0607L3_06	0.000	0.012	0.528	2.105	3.55	6	2007-01-05	1.891	NA	0.05	1.31	0.12	0.45	7.01	2007.011	8.77	57.39	NA
WB0607L3_08	0.000	0.067	0.494	1.180	3.55	8	2007-01-05	2.758	NA	0.06	0.37	0.07	0.21	8.63	2007.011	9.21	55.39	NA
WB0607L3_10	0.000	0.093	0.852	1.592	3.55	10	2007-01-05	3.932	NA	0.07	0.78	0.13	0.18	8.71	2007.011	9.67	53.39	NA
WB0607L3_12	0.000	0.000	3.260	3.913	3.55	12	2007-01-05	7.685	NA	0.09	0.78	0.09	0.22	8.66	2007.011	9.66	51.39	NA
WB0607L3_13	0.000	0.000	3.643	4.287	3.55	13	2007-01-05	13.101	NA	0.44	0.97	0.11	0.31	11.13	2007.011	12.41	50.39	NA
WB0607L3_14	0.000	0.038	2.828	2.944	3.55	14	2007-01-05	19.539	NA	0.55	19.23	0.25	0.41	20.25	2007.011	39.89	49.39	NA
WB0607L3_15	0.000	0.000	1.121	1.318	3.55	15	2007-01-05	45.105	NA	1.10	127.12	0.68	0.92	17.41	2007.011	145.45	48.39	NA
WB0607L3_17	0.001	0.024	0.444	0.500	3.55	17	2007-01-05	63.419	NA	1.07	152.40	0.86	1.39	13.48	2007.011	167.27	46.39	NA
WB0607L3_20	0.035	0.094	0.049	0.275	3.55	20	2007-01-05	67.663	NA	1.10	173.21	0.98	1.32	14.43	2007.011	188.96	43.39	NA
WB0708L1_05	0.000	0.000	0.615	2.618	3.43	5	2007-11-26	1.504	0.90	0.04	0.78	0.05	0.18	5.30	2007.901	6.26	58.31	14.84
WB0708L1_06	0.000	0.031	0.686	1.817	3.43	6	2007-11-26	1.978	1.10	0.05	0.53	0.07	0.20	6.86	2007.901	7.59	57.31	12.57
WB0708L1_08	0.000	0.373	0.569	0.703	3.43	8	2007-11-26	2.861	1.80	0.06	0.57	0.11	0.21	8.60	2007.901	9.38	55.31	9.02
WB0708L1_10	0.000	0.500	0.544	0.589	3.43	10	2007-11-26	4.177	2.40	0.06	1.94	0.04	0.20	8.82	2007.901	10.96	53.31	6.47
WB0708L1_12	0.000	0.000	2.443	1.785	3.43	12	2007-11-26	7.289	3.00	0.07	1.37	0.04	0.97	9.40	2007.901	11.74	51.31	4.64
WB0708L1_13	0.000	0.201	3.720	2.183	3.43	13	2007-11-26	11.317	5.80	NA	1.02	0.05	1.10	11.59	2007.901	13.71	50.31	3.93
WB0708L1_14	0.000	0.754	3.596	1.150	3.43	14	2007-11-26	17.108	11.00	NA	15.51	0.08	1.20	21.07	2007.901	37.78	49.31	3.33

WB0708L1_15	0.000	0.000	1.174	0.654	3.43	15	2007-11-26	42.581	36.20	0.81	120.83	0.19	2.12	17.91	2007.901	140.86	48.31	2.82
WB0708L1_17	0.018	0.136	0.162	0.068	3.43	17	2007-11-26	62.153	45.90	1.12	168.69	0.30	3.22	13.18	2007.901	185.09	46.31	2.03
WB0708L1_20	0.061	0.039	0.002	0.002	3.43	20	2007-11-26	66.995	50.10	0.98	185.04	0.16	2.92	13.02	2007.901	200.98	43.31	1.23
WB0708L2_05	0.000	0.000	0.426	2.365	3.26	5	2007-12-16	1.152	1.10	0.05	0.67	0.05	0.26	6.26	2007.956	7.19	58.32	11.97
WB0708L2_06	0.000	0.000	0.560	2.212	3.26	6	2007-12-16	1.827	1.30	0.04	0.88	0.06	0.23	7.11	2007.956	8.22	57.32	9.97
WB0708L2_08	0.000	0.247	0.521	1.009	3.26	8	2007-12-16	2.845	2.00	0.06	0.70	0.09	0.23	8.77	2007.956	9.70	55.32	6.91
WB0708L2_10	0.000	0.231	0.599	0.779	3.26	10	2007-12-16	3.850	2.50	0.06	1.44	0.05	0.20	8.82	2007.956	10.46	53.32	4.79
WB0708L2_12	0.000	0.000	2.046	1.996	3.26	12	2007-12-16	6.930	3.30	0.07	1.19	0.06	0.92	9.12	2007.956	11.23	51.32	3.32
WB0708L2_13	0.000	0.003	3.392	2.412	3.26	13	2007-12-16	10.612	4.50	NA	0.80	0.06	1.04	10.06	2007.956	11.90	50.32	2.76
WB0708L2_14	0.000	0.153	3.825	2.730	3.26	14	2007-12-16	17.225	9.50	NA	6.36	0.08	1.03	18.52	2007.956	25.91	49.32	2.30
WB0708L2_15	0.000	0.000	1.453	1.132	3.26	15	2007-12-16	43.484	42.20	0.69	115.47	0.29	2.00	17.91	2007.956	135.38	48.32	1.91
WB0708L2_17	0.000	0.070	0.549	0.330	3.26	17	2007-12-16	62.127	52.10	0.90	164.23	0.25	2.66	13.70	2007.956	180.59	46.32	1.33
WB0708L2_20	0.052	0.120	0.015	0.018	3.26	20	2007-12-16	67.241	58.90	0.94	179.09	0.25	2.78	12.94	2007.956	194.81	43.32	0.77
WB0708L4_05	0.000	0.095	0.617	1.275	2.9	5	2008-01-30	0.858	1.00	0.04	0.20	0.03	0.19	4.21	2008.079	4.60	58.55	NA
WB0708L4_06	0.000	0.304	0.893	1.721	2.9	6	2008-01-30	1.680	1.10	0.04	0.31	0.03	0.17	5.23	2008.079	5.71	57.55	NA
WB0708L4_08	0.000	0.485	1.035	1.263	2.9	8	2008-01-30	2.609	2.10	0.06	0.17	0.05	0.15	7.20	2008.079	7.52	55.55	NA
WB0708L4_10	0.000	0.625	1.651	1.533	2.9	10	2008-01-30	3.926	2.50	0.06	1.56	0.05	0.14	8.29	2008.079	9.99	53.55	NA
WB0708L4_12	0.000	0.000	5.081	3.576	2.9	12	2008-01-30	6.893	3.20	0.07	1.86	0.05	0.16	8.41	2008.079	10.43	51.55	NA
WB0708L4_13	0.000	0.000	4.541	3.317	2.9	13	2008-01-30	10.544	5.10	0.21	0.96	0.06	0.40	8.36	2008.079	9.72	50.55	NA
WB0708L4_14	0.000	0.012	5.603	3.030	2.9	14	2008-01-30	16.251	10.40	0.27	3.03	0.08	0.34	17.47	2008.079	20.84	49.55	NA
WB0708L4_15	0.000	0.000	2.202	1.240	2.9	15	2008-01-30	39.690	41.90	0.57	84.16	0.18	0.59	18.66	2008.079	103.41	48.55	NA
WB0708L4_17	0.009	0.064	0.611	0.233	2.9	17	2008-01-30	61.653	58.50	0.76	158.60	0.21	1.36	13.48	2008.079	173.44	46.55	NA
WB0708L4_20	0.058	0.103	0.007	0.000	2.9	20	2008-01-30	66.472	63.90	0.89	174.16	0.34	1.25	12.85	2008.079	188.26	43.55	NA

WB0809L1_05	0.000	0.000	0.268	2.112	3.48	5	2008-11-26	1.460	1.10	0.06	0.65	0.04	0.14	5.02	2008.902	5.81	58.37	14.63
WB0809L1_06	0.000	0.000	0.287	1.453	3.48	6	2008-11-26	1.960	1.50	0.08	0.59	0.07	0.15	6.09	2008.902	6.83	57.37	12.37
WB0809L1_08	0.000	0.010	0.342	0.978	3.48	8	2008-11-26	2.852	2.10	0.06	0.46	0.06	0.17	7.83	2008.902	8.46	55.37	8.83
WB0809L1_10	0.003	0.002	0.400	0.955	3.48	10	2008-11-26	4.028	2.40	0.06	0.72	0.03	0.14	7.82	2008.902	8.68	53.37	6.30
WB0809L1_12	0.000	0.000	0.563	0.988	3.48	12	2008-11-26	7.504	3.20	0.08	1.03	0.07	0.14	8.22	2008.902	9.39	51.37	4.50
WB0809L1_13	0.000	0.000	1.148	1.472	3.48	13	2008-11-26	12.562	4.20	0.39	0.86	0.06	0.21	8.34	2008.902	9.41	50.37	3.80
WB0809L1_14	0.000	0.000	2.553	1.778	3.48	14	2008-11-26	21.414	7.90	0.42	3.28	0.05	0.29	13.28	2008.902	16.85	49.37	3.21
WB0809L1_15	0.000	0.000	1.632	1.238	3.48	15	2008-11-26	50.112	44.00	0.88	95.70	0.15	0.57	18.82	2008.902	115.09	48.37	2.72
WB0809L1_17	0.000	0.014	0.482	0.490	3.48	17	2008-11-26	62.448	60.10	1.06	162.13	0.24	1.54	13.56	2008.902	177.23	46.37	1.94
WB0809L1_20	0.020	0.022	0.002	0.036	3.48	20	2008-11-26	67.343	68.40	1.06	182.52	0.31	1.13	14.33	2008.902	197.98	43.37	1.17
WB0809L2_05	0.000	0.000	0.253	2.020	3.19	5	2008-12-23	1.306	1.00	0.04	0.69	0.00	0.13	6.50	2008.975	7.32	58.41	10.16
WB0809L2_06	0.000	0.000	0.240	1.543	3.19	6	2008-12-23	1.818	1.10	0.04	0.62	0.00	0.13	6.06	2008.975	6.81	57.41	8.54
WB0809L2_08	0.000	0.030	0.299	1.163	3.19	8	2008-12-23	2.751	1.70	0.06	0.46	0.00	0.14	7.34	2008.975	7.94	55.41	6.04
WB0809L2_10	0.000	0.000	0.416	1.115	3.19	10	2008-12-23	3.897	2.20	0.06	0.83	0.02	0.13	8.01	2008.975	8.97	53.41	4.27
WB0809L2_12	0.000	0.000	0.801	1.341	3.19	12	2008-12-23	7.050	2.80	0.07	1.16	0.03	0.50	6.65	2008.975	8.31	51.41	3.01
WB0809L2_13	0.000	0.000	1.875	2.281	3.19	13	2008-12-23	10.744	4.70	0.23	0.93	0.01	0.19	7.92	2008.975	9.04	50.41	2.53
WB0809L2_14	0.000	0.000	3.290	3.156	3.19	14	2008-12-23	17.006	9.30	0.29	3.84	0.01	0.49	15.37	2008.975	19.70	49.41	2.13
WB0809L2_15	0.000	0.000	1.427	1.592	3.19	15	2008-12-23	41.492	43.20	0.75	103.67	0.07	0.89	16.49	2008.975	121.05	48.41	1.79
WB0809L2_17	0.000	0.000	0.845	0.733	3.19	17	2008-12-23	61.736	57.20	0.89	153.32	0.04	1.42	11.24	2008.975	165.98	46.41	1.27
WB0809L2_20	0.053	0.003	0.032	0.106	3.19	20	2008-12-23	67.187	65.00	0.98	167.53	0.11	1.58	12.59	2008.975	181.70	43.41	0.75
WB0809L3_05	0.000	0.030	0.312	1.280	3.04	5	2009-01-03	1.237	NA	0.04	0.38	0.02	0.15	7.16	2009.005	7.69	58.85	NA
WB0809L3_06	0.000	0.082	0.265	1.210	3.04	6	2009-01-03	1.620	NA	0.04	0.51	0.02	0.13	6.41	2009.005	7.05	57.85	NA
WB0809L3_08	0.000	0.147	0.383	1.092	3.04	8	2009-01-03	2.628	NA	0.06	0.31	0.03	0.14	8.03	2009.005	8.48	55.85	NA

WB0809L3_10	0.000	0.012	0.613	1.233	3.04	10	2009-01-03	3.574	NA	0.05	0.84	0.03	0.13	8.21	2009.005	9.18	53.85	NA
WB0809L3_12	0.000	0.000	1.562	1.845	3.04	12	2009-01-03	5.881	NA	0.06	0.50	0.02	0.13	8.04	2009.005	8.67	51.85	NA
WB0809L3_13	0.000	0.000	3.289	2.993	3.04	13	2009-01-03	8.969	NA	0.25	1.42	0.03	0.10	7.86	2009.005	9.38	50.85	NA
WB0809L3_14	0.000	0.000	3.862	3.510	3.04	14	2009-01-03	14.095	NA	0.36	2.88	0.02	0.28	18.19	2009.005	21.35	49.85	NA
WB0809L3_15	0.000	0.050	1.700	1.897	3.04	15	2009-01-03	28.351	NA	0.61	46.80	0.05	0.41	21.32	2009.005	68.53	48.85	NA
WB0809L3_17	0.003	0.057	0.208	0.202	3.04	17	2009-01-03	60.916	NA	0.95	160.65	0.10	1.34	12.40	2009.005	174.39	46.85	NA
WB0809L3_20	0.045	0.060	0.004	0.041	3.04	20	2009-01-03	66.824	NA	0.94	172.90	0.17	1.33	13.62	2009.005	187.85	43.85	NA
WB0910L1_05	0.616	0.000	0.160	2.826	3.27	5	2009-11-22	1.271	1.10	0.04	0.86	0.05	0.31	13.78	2009.890	14.95	58.88	15.70
WB0910L1_06	0.640	0.000	0.175	2.627	3.27	6	2009-11-22	1.750	1.20	0.04	0.68	0.05	0.21	10.01	2009.890	10.90	57.88	13.15
WB0910L1_08	0.680	0.000	0.382	1.718	3.27	8	2009-11-22	2.735	1.70	0.04	0.45	0.05	0.14	8.42	2009.890	9.01	55.88	9.23
WB0910L1_10	0.480	0.066	0.492	1.772	3.27	10	2009-11-22	3.716	2.20	0.05	0.38	0.07	0.13	9.10	2009.890	9.61	53.88	6.47
WB0910L1_12	0.267	0.073	0.596	1.484	3.27	12	2009-11-22	6.548	2.70	0.09	0.69	0.07	0.20	9.32	2009.890	10.21	51.88	4.54
WB0910L1_13	0.120	0.203	0.455	1.417	3.27	13	2009-11-22	9.635	3.50	0.13	1.20	0.08	0.24	9.60	2009.890	11.04	50.88	3.80
WB0910L1_14	0.007	0.470	0.718	1.385	3.27	14	2009-11-22	15.277	5.40	0.18	0.28	0.11	0.29	12.22	2009.890	12.79	49.88	3.19
WB0910L1_15	0.000	0.311	2.137	1.857	3.27	15	2009-11-22	36.178	20.80	0.47	40.05	0.23	0.43	20.42	2009.890	60.90	48.88	2.67
WB0910L1_17	0.002	0.000	0.700	0.720	3.27	17	2009-11-22	61.390	49.70	0.81	149.55	0.41	1.24	14.01	2009.890	164.80	46.88	1.87
WB0910L1_20	0.042	0.000	0.010	0.024	3.27	20	2009-11-22	66.929	55.30	0.95	168.71	0.28	1.20	14.30	2009.890	184.21	43.88	1.10
WB0910L2_05	0.000	0.004	0.134	1.639	3.08	5	2009-12-17	1.236	0.60	0.05	0.67	0.02	0.14	5.84	2009.959	6.65	58.88	14.62
WB0910L2_06	0.000	0.000	0.215	1.865	3.08	6	2009-12-17	1.667	1.10	0.06	0.34	0.02	0.17	6.96	2009.959	7.47	57.88	12.33
WB0910L2_08	0.007	0.111	0.304	1.356	3.08	8	2009-12-17	2.587	1.60	0.06	0.27	0.03	0.14	7.06	2009.959	7.47	55.88	8.77
WB0910L2_10	0.001	0.133	0.439	1.527	3.08	10	2009-12-17	3.679	2.00	0.06	0.49	0.04	0.14	7.92	2009.959	8.55	53.88	6.24
WB0910L2_12	0.024	0.069	0.560	1.460	3.08	12	2009-12-17	6.312	1.90	0.06	0.45	0.03	0.20	7.16	2009.959	7.81	51.88	4.44
WB0910L2_13	0.008	0.024	0.611	1.578	3.08	13	2009-12-17	9.716	3.50	0.17	0.82	0.04	0.08	8.43	2009.959	9.33	50.88	3.74

WB0910L2_14	0.000	0.000	1.455	2.139	3.08	14	2009-12-17	14.654	7.30	0.22	0.72	0.06	0.39	13.82	2009.959	14.93	49.88	3.16
WB0910L2_15	0.000	0.052	2.478	2.339	3.08	15	2009-12-17	30.221	21.30	0.43	43.55	0.14	0.47	17.62	2009.959	61.64	48.88	2.66
WB0910L2_17	0.000	0.000	0.986	1.025	3.08	17	2009-12-17	61.378	49.10	0.86	155.62	0.18	1.29	11.77	2009.959	168.68	46.88	1.89
WB0910L2_20	0.113	0.008	0.012	0.028	3.08	20	2009-12-17	66.938	55.30	0.94	169.55	0.20	1.47	11.89	2009.959	182.91	43.88	1.14
WB0910L3_05	0.000	0.001	0.166	1.467	3.1	5	2010-01-01	1.192	NA	0.03	0.63	0.03	0.42	7.09	2010.000	8.14	58.93	NA
WB0910L3_06	0.001	0.010	0.274	1.736	3.1	6	2010-01-01	1.621	NA	0.03	0.71	0.02	0.22	6.23	2010.000	7.16	57.93	NA
WB0910L3_08	0.003	0.051	0.371	1.736	3.1	8	2010-01-01	2.576	NA	0.04	0.57	0.02	0.17	7.01	2010.000	7.75	55.93	NA
WB0910L3_10	0.000	0.028	0.755	1.793	3.1	10	2010-01-01	3.605	NA	NA	0.59	0.03	0.16	8.43	2010.000	9.18	53.93	NA
WB0910L3_12	0.000	0.048	0.853	1.747	3.1	12	2010-01-01	6.026	NA	0.09	0.95	0.03	0.38	8.56	2010.000	9.89	51.93	NA
WB0910L3_13	0.000	0.000	1.328	2.173	3.1	13	2010-01-01	8.866	NA	0.10	0.49	0.07	0.30	8.84	2010.000	9.63	50.93	NA
WB0910L3_14	0.000	0.000	2.474	2.839	3.1	14	2010-01-01	13.782	NA	0.16	0.48	0.04	0.43	13.21	2010.000	14.12	49.93	NA
WB0910L3_15	0.000	0.110	2.189	2.080	3.1	15	2010-01-01	28.127	NA	0.10	30.02	0.11	0.56	17.72	2010.000	48.30	48.93	NA
WB0910L3_17	0.000	0.000	0.767	0.806	3.1	17	2010-01-01	60.705	NA	0.72	159.17	0.13	1.69	11.76	2010.000	172.62	46.93	NA
WB0910L3_20	0.092	0.010	0.007	0.065	3.1	20	2010-01-01	66.703	NA	0.81	176.26	0.15	1.44	13.38	2010.000	191.08	43.93	NA
WB1011L1_05	0.009	0.033	0.090	4.660	3.42	5	2010-11-22	1.337	1.40	0.04	0.82	0.03	0.20	8.71	2010.890	9.73	58.92	20.78
WB1011L1_06	0.031	0.106	0.069	3.443	3.42	6	2010-11-22	1.740	1.60	0.04	1.17	0.00	0.15	6.37	2010.890	7.69	57.92	16.24
WB1011L1_08	0.000	0.227	0.142	2.912	3.42	8	2010-11-22	2.664	1.70	0.05	0.76	0.04	0.15	7.14	2010.890	8.05	55.92	9.92
WB1011L1_10	0.000	0.033	0.456	3.383	3.42	10	2010-11-22	3.725	2.30	0.06	0.60	0.03	0.16	7.63	2010.890	8.39	53.92	6.05
WB1011L1_12	0.000	0.004	0.909	3.556	3.42	12	2010-11-22	6.389	3.40	0.08	0.00	0.03	0.33	8.52	2010.890	8.85	51.92	3.70
WB1011L1_13	0.000	0.000	1.601	3.533	3.42	13	2010-11-22	9.502	4.50	0.15	0.32	0.03	0.15	8.62	2010.890	9.09	50.92	2.89
WB1011L1_14	0.000	0.000	5.190	6.396	3.42	14	2010-11-22	14.937	6.40	0.18	0.86	0.04	0.36	10.20	2010.890	11.42	49.92	2.26
WB1011L1_15	0.000	0.000	10.794	9.799	3.42	15	2010-11-22	30.262	20.10	0.52	36.40	0.14	0.87	16.21	2010.890	53.48	48.92	1.76
WB1011L1_17	0.000	0.000	2.502	2.314	3.42	17	2010-11-22	60.976	50.20	0.93	154.66	0.21	1.71	10.79	2010.890	167.16	46.92	1.08

WB1011L1_20	0.050	0.037	0.003	0.000	3.42	20	2010-11-22	66.655	55.20	0.98	169.33	0.30	1.11	11.08	2010.890	181.52	43.92	0.51
WB1011L2_05	0.000	0.000	0.149	3.249	3.26	5	2010-12-17	1.335	0.90	0.04	0.60	0.02	0.16	6.76	2010.959	7.52	58.98	4.79
WB1011L2_06	0.000	0.000	0.152	3.554	3.26	6	2010-12-17	1.673	1.00	0.03	0.58	0.01	0.12	6.15	2010.959	6.85	57.98	3.80
WB1011L2_08	0.000	0.000	0.324	3.159	3.26	8	2010-12-17	2.593	1.60	0.05	0.74	0.03	0.14	6.92	2010.959	7.80	55.98	2.40
WB1011L2_10	0.000	0.000	0.689	3.673	3.26	10	2010-12-17	3.607	2.00	0.06	0.68	0.12	0.16	7.66	2010.959	8.50	53.98	1.51
WB1011L2_12	0.000	0.000	1.543	4.715	3.26	12	2010-12-17	6.123	2.60	0.07	1.38	0.03	0.36	8.29	2010.959	10.03	51.98	0.95
WB1011L2_13	0.000	0.000	5.554	8.898	3.26	13	2010-12-17	8.938	3.70	0.16	1.19	0.04	0.23	8.26	2010.959	9.68	50.98	0.76
WB1011L2_14	0.000	0.000	14.431	16.458	3.26	14	2010-12-17	13.838	6.60	0.21	0.77	0.04	0.60	11.06	2010.959	12.43	49.98	0.60
WB1011L2_15	0.000	0.000	9.174	10.584	3.26	15	2010-12-17	25.673	16.10	0.36	28.05	0.13	1.13	18.28	2010.959	47.46	48.98	0.48
WB1011L2_17	0.000	0.000	1.354	1.323	3.26	17	2010-12-17	60.762	44.30	0.84	160.78	0.25	1.42	11.90	2010.959	174.10	46.98	0.30
WB1011L2_20	0.031	0.061	0.000	0.031	3.26	20	2010-12-17	66.679	50.40	0.93	180.47	0.28	1.46	12.96	2010.959	194.89	43.98	0.15
WB1011L3_05	0.042	0.041	0.019	1.609	2.99	5	2011-01-02	1.192	NA	0.04	0.60	0.03	0.18	12.87	2011.003	13.65	59.66	NA
WB1011L3_06	0.001	0.003	0.076	1.949	2.99	6	2011-01-02	1.417	NA	0.05	0.62	0.04	0.23	10.27	2011.003	11.12	58.66	NA
WB1011L3_08	0.000	0.005	0.255	2.259	2.99	8	2011-01-02	2.295	NA	0.05	0.83	0.04	0.14	6.35	2011.003	7.32	56.66	NA
WB1011L3_10	0.001	0.000	0.409	2.697	2.99	10	2011-01-02	3.199	NA	0.06	0.46	0.03	0.11	7.29	2011.003	7.86	54.66	NA
WB1011L3_12	0.000	0.000	1.588	4.382	2.99	12	2011-01-02	4.892	NA	0.07	0.28	0.03	0.11	7.85	2011.003	8.24	52.66	NA
WB1011L3_13	0.000	0.000	3.594	6.120	2.99	13	2011-01-02	6.771	NA	0.19	0.24	0.07	0.10	9.23	2011.003	9.57	51.66	NA
WB1011L3_14	0.000	0.000	7.879	9.753	2.99	14	2011-01-02	10.258	NA	0.20	0.46	0.04	0.28	7.81	2011.003	8.55	50.66	NA
WB1011L3_15	0.000	0.000	9.254	11.341	2.99	15	2011-01-02	15.593	NA	0.25	0.90	0.02	0.17	13.13	2011.003	14.20	49.66	NA
WB1011L3_17	0.005	0.000	0.668	1.227	2.99	17	2011-01-02	57.257	NA	0.89	139.60	0.18	1.32	13.30	2011.003	154.22	47.66	NA
WB1011L3_20	0.043	0.046	0.029	0.321	2.99	20	2011-01-02	65.566	NA	NA	NA	0.05	NA	NA	2011.003	NA	44.66	NA
WB1112L1_05	0.000	0.000	0.668	5.293	3.34	5	2011-11-21	1.120	0.80	0.04	0.99	0.00	0.41	12.86	2011.888	14.26	59.62	10.12
WB1112L1_06	0.000	0.017	0.572	3.658	3.34	6	2011-11-21	1.488	1.10	0.05	0.83	0.02	0.33	10.47	2011.888	11.63	58.62	8.50

WB1112L1_08	0.000	0.015	0.367	3.334	3.34	8	2011-11-21	2.361	1.40	0.05	1.28	0.00	0.28	8.73	2011.888	10.29	56.62	5.99
WB1112L1_10	0.000	0.000	0.740	2.865	3.34	10	2011-11-21	3.232	1.80	0.06	1.01	0.05	0.20	8.49	2011.888	9.70	54.62	4.22
WB1112L1_12	0.000	0.006	1.061	2.671	3.34	12	2011-11-21	5.015	2.20	0.06	0.90	0.00	0.22	8.26	2011.888	9.38	52.62	2.98
WB1112L1_13	0.000	0.000	1.151	2.437	3.34	13	2011-11-21	7.146	2.60	0.11	0.76	0.02	0.23	8.14	2011.888	9.13	51.62	2.50
WB1112L1_14	0.000	0.000	1.253	2.368	3.34	14	2011-11-21	10.663	4.20	0.11	1.05	0.02	0.29	7.97	2011.888	9.31	50.62	2.10
WB1112L1_15	0.000	0.000	2.153	3.073	3.34	15	2011-11-21	16.783	8.10	0.19	9.92	0.04	0.37	16.38	2011.888	26.67	49.62	1.76
WB1112L1_17	0.000	0.000	1.321	1.549	3.34	17	2011-11-21	57.075	43.40	0.71	146.14	0.15	1.49	14.09	2011.888	161.72	47.62	1.24
WB1112L1_20	0.002	0.018	0.171	0.291	3.34	20	2011-11-21	65.279	52.10	0.88	161.70	0.10	1.97	11.52	2011.888	175.19	44.62	0.74
WB1112L2_05	0.000	0.000	0.342	2.440	3.17	5	2011-12-21	1.209	0.80	0.05	0.77	0.03	0.32	10.66	2011.970	11.75	59.66	17.53
WB1112L2_06	0.000	0.000	0.466	2.110	3.17	6	2011-12-21	1.515	1.20	0.06	0.86	0.02	0.26	8.98	2011.970	10.10	58.66	14.14
WB1112L2_08	0.000	0.000	0.539	3.868	3.17	8	2011-12-21	2.337	1.50	0.06	1.04	0.02	0.22	7.52	2011.970	8.78	56.66	9.20
WB1112L2_10	0.000	0.000	0.760	4.054	3.17	10	2011-12-21	3.287	1.90	0.06	1.23	0.02	0.21	7.79	2011.970	9.23	54.66	5.98
WB1112L2_12	0.000	0.000	1.210	4.578	3.17	12	2011-12-21	5.181	2.40	0.08	0.90	0.03	0.20	8.08	2011.970	9.18	52.66	3.89
WB1112L2_13	0.000	0.000	1.525	4.731	3.17	13	2011-12-21	7.141	2.90	0.07	0.60	0.02	0.26	8.07	2011.970	8.93	51.66	3.14
WB1112L2_14	0.000	0.000	2.351	4.069	3.17	14	2011-12-21	10.622	4.60	0.12	2.84	0.04	0.30	8.01	2011.970	11.15	50.66	2.53
WB1112L2_15	0.000	0.000	4.424	4.922	3.17	15	2011-12-21	17.389	7.60	0.17	10.31	0.04	0.40	15.20	2011.970	25.91	49.66	2.04
WB1112L2_17	0.000	0.000	1.889	2.096	3.17	17	2011-12-21	58.217	42.70	0.88	142.94	NA	1.34	14.68	2011.970	158.96	47.66	1.33
WB1112L2_20	0.015	0.033	0.078	0.195	3.17	20	2011-12-21	65.293	51.30	0.96	168.53	NA	1.69	10.60	2011.970	180.82	44.66	0.70
WB1112L3_05	0.000	0.062	0.772	2.613	3	5	2012-01-07	1.004	NA	0.04	0.43	0.02	0.30	9.12	2012.016	9.85	60.01	NA
WB1112L3_06	0.000	0.108	0.679	2.308	3	6	2012-01-07	1.408	NA	0.05	0.55	0.04	0.27	8.72	2012.016	9.54	59.01	NA
WB1112L3_08	0.000	0.061	0.072	2.609	3	8	2012-01-07	2.198	NA	0.05	0.88	0.01	0.20	7.05	2012.016	8.13	57.01	NA
WB1112L3_10	0.000	0.069	0.311	2.829	3	10	2012-01-07	3.106	NA	0.06	0.94	0.03	0.21	7.50	2012.016	8.65	55.01	NA
WB1112L3_12	0.000	0.028	0.769	3.126	3	12	2012-01-07	4.620	NA	0.06	0.84	0.02	0.19	7.92	2012.016	8.95	53.01	NA

WB1112L3_13	0.000	0.004	1.041	3.180	3	13	2012-01-07	6.364	NA	0.07	0.37	0.02	0.26	7.75	2012.016	8.38	52.01	NA
WB1112L3_14	0.000	0.000	2.003	3.588	3	14	2012-01-07	9.535	NA	0.12	1.11	0.01	0.30	8.06	2012.016	9.47	51.01	NA
WB1112L3_15	0.000	0.000	3.572	5.267	3	15	2012-01-07	14.993	NA	0.13	4.91	0.01	0.34	10.36	2012.016	15.61	50.01	NA
WB1112L3_17	0.000	0.023	0.777	1.599	3	17	2012-01-07	56.226	NA	0.94	124.69	NA	1.17	15.51	2012.016	141.37	48.01	NA
WB1112L3_20	0.062	0.047	0.024	0.033	3	20	2012-01-07	65.240	NA	1.00	165.09	NA	1.56	9.08	2012.016	175.73	45.01	NA
WB1213L1_05	0.000	0.000	0.132	2.635	3.34	5	2012-11-21	0.924	0.90	0.05	2.28	0.01	0.22	8.87	2012.888	11.38	59.99	18.15
WB1213L1_06	0.000	0.000	0.067	2.403	3.34	6	2012-11-21	1.388	1.30	0.05	2.80	0.01	0.20	7.45	2012.888	10.45	58.99	15.45
WB1213L1_08	0.000	0.000	0.169	1.788	3.34	8	2012-11-21	2.278	1.50	0.05	3.28	0.02	0.10	6.93	2012.888	10.32	56.99	11.19
WB1213L1_10	0.000	0.000	0.146	1.549	3.34	10	2012-11-21	3.156	2.10	0.06	2.35	0.01	0.15	6.67	2012.888	9.17	54.99	8.10
WB1213L1_12	0.000	0.000	0.454	2.403	3.34	12	2012-11-21	4.673	2.40	0.07	2.71	0.01	0.15	6.95	2012.888	9.82	52.99	5.87
WB1213L1_13	0.000	0.000	0.498	2.665	3.34	13	2012-11-21	6.313	2.80	0.03	3.48	0.01	0.19	7.45	2012.888	11.13	51.99	4.99
WB1213L1_14	0.000	0.000	0.588	2.632	3.34	14	2012-11-21	9.255	4.20	0.11	NA	NA	NA	NA	2012.888	NA	50.99	4.25
WB1213L1_15	0.000	0.000	1.448	2.745	3.34	15	2012-11-21	14.422	6.60	NA	2.17	0.18	0.52	9.16	2012.888	11.85	49.99	3.62
WB1213L1_17	0.000	0.000	2.890	2.759	3.34	17	2012-11-21	54.431	38.50	0.74	NA	0.42	1.27	12.60	2012.888	NA	47.99	2.62
WB1213L1_20	0.000	0.001	0.127	0.583	3.34	20	2012-11-21	65.281	49.60	0.92	NA	0.75	1.49	7.78	2012.888	NA	44.99	1.61
WB1213L2_05	0.000	0.000	0.147	3.639	3.1	5	2012-12-18	0.857	0.70	NA	1.91	0.02	0.16	7.69	2012.962	9.76	60.05	10.99
WB1213L2_06	0.000	0.000	0.093	3.316	3.1	6	2012-12-18	1.319	1.00	0.02	1.81	0.01	0.13	7.90	2012.962	9.85	59.05	9.37
WB1213L2_08	0.000	0.000	0.189	2.476	3.1	8	2012-12-18	2.152	1.60	0.02	2.40	0.01	0.12	6.90	2012.962	9.41	57.05	6.80
WB1213L2_10	0.000	0.000	0.162	2.454	3.1	10	2012-12-18	3.069	2.00	0.04	2.90	0.01	0.07	7.24	2012.962	10.20	55.05	4.94
WB1213L2_12	0.000	0.000	0.949	3.962	3.1	12	2012-12-18	4.508	2.40	0.05	1.81	0.01	0.14	7.23	2012.962	9.19	53.05	3.59
WB1213L2_13	0.000	0.000	1.039	4.379	3.1	13	2012-12-18	5.995	2.60	NA	1.82	0.01	0.26	7.29	2012.962	9.38	52.05	3.06
WB1213L2_14	0.000	0.000	1.531	5.127	3.1	14	2012-12-18	8.448	3.40	NA	1.60	0.05	0.24	8.04	2012.962	9.89	51.05	2.60
WB1213L2_15	0.000	0.000	3.581	6.903	3.1	15	2012-12-18	13.710	6.00	NA	2.38	0.17	0.69	9.20	2012.962	12.26	50.05	2.22

WB1213L2_17	0.000	0.000	1.298	2.299	3.1	17	2012-12-18	51.002	38.40	0.58	NA	0.36	1.49	11.14	2012.962	NA	48.05	1.61
WB1213L2_20	0.000	0.001	0.029	0.452	3.1	20	2012-12-18	64.898	45.60	NA	NA	0.76	1.59	5.45	2012.962	NA	45.05	1.00
WB1213L3_05	0.000	0.000	0.625	3.374	2.91	5	2013-01-05	0.804	NA	0.02	0.94	0.02	0.22	7.63	2013.011	8.80	60.29	NA
WB1213L3_06	0.000	0.000	0.374	2.952	2.91	6	2013-01-05	1.191	NA	0.04	1.82	0.02	0.22	7.99	2013.011	10.04	59.29	NA
WB1213L3_08	0.000	0.000	0.046	2.830	2.91	8	2013-01-05	2.073	NA	0.05	3.04	0.01	0.16	6.73	2013.011	9.93	57.29	NA
WB1213L3_10	0.000	0.000	0.298	2.241	2.91	10	2013-01-05	2.969	NA	0.06	2.93	0.01	0.16	6.97	2013.011	10.06	55.29	NA
WB1213L3_12	0.000	0.000	1.007	3.950	2.91	12	2013-01-05	4.178	NA	0.06	2.49	0.01	0.27	7.34	2013.011	10.10	53.29	NA
WB1213L3_13	0.000	0.000	1.277	4.133	2.91	13	2013-01-05	5.533	NA	NA	1.49	0.01	0.20	7.72	2013.011	9.41	52.29	NA
WB1213L3_14	0.000	0.000	2.332	5.157	2.91	14	2013-01-05	7.782	NA	0.10	1.49	0.10	0.18	7.50	2013.011	9.17	51.29	NA
WB1213L3_15	0.000	0.000	3.991	7.075	2.91	15	2013-01-05	11.879	NA	NA	2.49	0.21	0.26	9.86	2013.011	12.61	50.29	NA
WB1213L3_17	0.000	0.000	1.373	3.888	2.91	17	2013-01-05	47.025	NA	0.61	NA	0.22	1.57	13.31	2013.011	NA	48.29	NA
WB1213L3_20	0.002	0.011	0.104	0.312	2.91	20	2013-01-05	64.477	NA	0.59	NA	0.76	1.47	4.93	2013.011	NA	45.29	NA
WB1314L1_05	0.136	0.046	0.042	3.577	3.45	5	2013-11-21	0.827	0.80	0.03	NA	0.07	0.22	8.67	2013.888	NA	60.31	16.16
WB1314L1_06	0.075	0.125	0.027	4.500	3.45	6	2013-11-21	1.242	1.00	0.03	NA	0.04	0.22	9.06	2013.888	NA	59.31	13.72
WB1314L1_08	0.097	0.137	0.261	3.131	3.45	8	2013-11-21	2.114	1.30	0.03	NA	0.09	0.13	8.09	2013.888	NA	57.31	9.89
WB1314L1_10	0.005	0.175	0.304	2.597	3.45	10	2013-11-21	3.027	2.10	0.04	NA	0.04	0.12	7.54	2013.888	NA	55.31	7.13
WB1314L1_12	0.000	0.095	0.789	2.585	3.45	12	2013-11-21	4.342	2.30	0.05	NA	0.07	0.15	7.85	2013.888	NA	53.31	5.14
WB1314L1_13	0.000	0.051	1.198	2.741	3.45	13	2013-11-21	5.761	2.80	0.07	NA	0.08	0.17	8.16	2013.888	NA	52.31	4.36
WB1314L1_14	0.000	0.002	1.388	3.097	3.45	14	2013-11-21	7.850	3.20	0.07	NA	0.10	0.23	8.10	2013.888	NA	51.31	3.70
WB1314L1_15	0.000	0.000	1.760	3.397	3.45	15	2013-11-21	12.298	6.10	0.13	NA	0.30	0.46	9.31	2013.888	NA	50.31	3.14
WB1314L1_17	0.000	0.000	4.885	4.318	3.45	17	2013-11-21	46.802	36.10	0.59	NA	0.61	1.08	14.98	2013.888	NA	48.31	2.27
WB1314L1_20	0.026	0.038	0.146	0.422	3.45	20	2013-11-21	63.436	48.50	0.70	NA	0.89	1.52	3.84	2013.888	NA	45.31	1.39
WB1314L2_05	0.000	0.000	0.235	4.962	3.28	5	2013-12-14	0.842	NA	0.03	NA	0.01	0.18	9.71	2013.951	NA	60.57	NA

WB1314L2_06	0.000	0.000	0.211	5.339	3.28	6	2013-12-14	1.225	NA	0.03	NA	0.01	0.19	9.63	2013.951	NA	59.57	NA
WB1314L2_08	0.000	0.024	0.356	3.142	3.28	8	2013-12-14	2.091	NA	0.03	NA	0.01	0.15	7.78	2013.951	NA	57.57	NA
WB1314L2_10	0.000	0.024	0.544	2.863	3.28	10	2013-12-14	3.002	NA	0.04	NA	0.01	0.14	7.46	2013.951	NA	55.57	NA
WB1314L2_12	0.000	0.000	1.431	4.131	3.28	12	2013-12-14	4.352	NA	0.05	NA	0.02	0.18	7.94	2013.951	NA	53.57	NA
WB1314L2_13	0.000	0.000	1.649	4.511	3.28	13	2013-12-14	5.793	NA	0.06	NA	0.05	0.18	8.27	2013.951	NA	52.57	NA
WB1314L2_14	0.000	0.000	1.775	4.688	3.28	14	2013-12-14	8.050	NA	0.07	NA	0.09	0.35	8.23	2013.951	NA	51.57	NA
WB1314L2_15	0.000	0.000	2.285	4.928	3.28	15	2013-12-14	12.670	NA	0.11	NA	0.25	0.35	9.15	2013.951	NA	50.57	NA
WB1314L2_17	0.000	0.000	5.990	4.911	3.28	17	2013-12-14	49.242	NA	0.53	NA	0.66	1.25	16.64	2013.951	NA	48.57	NA
WB1314L2_20	0.010	0.046	0.371	0.499	3.28	20	2013-12-14	62.652	NA	0.69	NA	0.92	1.63	2.69	2013.951	NA	45.57	NA
WB1415L1_05	0.000	0.028	0.123	2.975	3.51	5	2014-11-22	NA	0.90	0.05	NA	0.02	0.15	8.49	2014.890	NA	60.68	22.46
WB1415L1_06	0.000	0.086	0.112	3.021	3.51	6	2014-11-22	NA	1.00	0.04	NA	0.03	0.21	8.96	2014.890	NA	59.68	19.02
WB1415L1_08	0.002	0.095	0.260	2.766	3.51	8	2014-11-22	NA	1.30	0.05	NA	0.00	0.20	8.02	2014.890	NA	57.68	13.65
WB1415L1_10	0.000	0.024	0.398	1.888	3.51	10	2014-11-22	NA	1.90	0.05	NA	0.01	0.26	7.27	2014.890	NA	55.68	9.79
WB1415L1_12	0.000	0.022	0.590	2.165	3.51	12	2014-11-22	NA	2.30	0.06	NA	0.03	0.07	7.46	2014.890	NA	53.68	7.03
WB1415L1_13	0.000	0.007	0.841	2.253	3.51	13	2014-11-22	NA	2.60	0.14	NA	0.05	0.19	7.66	2014.890	NA	52.68	5.95
WB1415L1_14	0.000	0.005	0.999	2.298	3.51	14	2014-11-22	NA	2.90	0.12	NA	0.07	0.30	7.91	2014.890	NA	51.68	5.04
WB1415L1_15	0.000	0.000	1.636	2.607	3.51	15	2014-11-22	NA	4.50	0.14	NA	0.14	0.27	8.27	2014.890	NA	50.68	4.27
WB1415L1_17	0.000	0.000	6.869	4.855	3.51	17	2014-11-22	NA	27.10	0.57	NA	0.61	0.89	16.62	2014.890	NA	48.68	3.07
WB1415L1_20	0.004	0.005	0.316	0.417	3.51	20	2014-11-22	NA	48.10	0.88	NA	1.49	1.66	2.22	2014.890	NA	45.68	1.86
WB1415L2_05	0.000	0.004	0.186	4.895	3.44	5	2014-12-23	NA	0.70	0.05	NA	0.03	0.13	7.03	2014.975	NA	60.68	19.76
WB1415L2_06	0.000	0.000	0.386	4.990	3.44	6	2014-12-23	NA	1.00	0.04	NA	0.05	0.14	8.88	2014.975	NA	59.68	16.52
WB1415L2_08	0.000	0.000	0.230	4.985	3.44	8	2014-12-23	NA	1.40	0.04	NA	0.00	0.11	7.79	2014.975	NA	57.68	11.55
WB1415L2_10	0.000	0.000	0.965	3.209	3.44	10	2014-12-23	NA	1.80	0.05	NA	0.02	0.08	7.61	2014.975	NA	55.68	8.07

WB1415L2_12	0.000	0.003	1.145	3.038	3.44	12	2014-12-23	NA	2.30	0.07	NA	0.03	0.09	7.49	2014.975	NA	53.68	5.64
WB1415L2_13	0.000	0.000	1.610	4.003	3.44	13	2014-12-23	NA	2.60	0.16	NA	0.05	0.18	7.83	2014.975	NA	52.68	4.72
WB1415L2_14	0.000	0.000	1.985	4.753	3.44	14	2014-12-23	NA	3.00	0.17	NA	0.09	0.21	8.21	2014.975	NA	51.68	3.94
WB1415L2_15	0.000	0.000	3.603	6.122	3.44	15	2014-12-23	NA	4.90	0.11	NA	0.15	0.39	8.56	2014.975	NA	50.68	3.30
WB1415L2_17	0.000	0.000	7.640	9.532	3.44	17	2014-12-23	NA	26.70	0.63	NA	0.65	1.14	16.49	2014.975	NA	48.68	2.30
WB1415L2_20	0.004	0.004	0.618	0.754	3.44	20	2014-12-23	NA	48.30	0.86	NA	1.51	1.49	2.44	2014.975	NA	45.68	1.35
WB1415L3_05	0.000	0.000	0.131	5.890	3.33	5	2015-01-06	NA	NA	0.03	NA	0.02	0.24	7.91	2015.014	NA	60.75	NA
WB1415L3_06	0.000	0.000	0.275	7.548	3.33	6	2015-01-06	NA	NA	0.04	NA	0.02	0.14	8.77	2015.014	NA	59.75	NA
WB1415L3_08	0.000	0.000	0.874	7.958	3.33	8	2015-01-06	NA	NA	0.04	NA	0.00	0.27	7.36	2015.014	NA	57.75	NA
WB1415L3_10	0.000	0.000	1.715	4.959	3.33	10	2015-01-06	NA	NA	0.05	NA	0.00	0.17	7.41	2015.014	NA	55.75	NA
WB1415L3_12	0.000	0.000	2.360	5.730	3.33	12	2015-01-06	NA	NA	0.05	NA	0.02	0.11	7.75	2015.014	NA	53.75	NA
WB1415L3_13	0.000	0.000	2.524	6.272	3.33	13	2015-01-06	NA	NA	0.10	NA	0.04	0.12	7.96	2015.014	NA	52.75	NA
WB1415L3_14	0.000	0.000	2.641	7.078	3.33	14	2015-01-06	NA	NA	0.17	NA	0.08	0.21	8.15	2015.014	NA	51.75	NA
WB1415L3_15	0.000	0.000	4.857	9.188	3.33	15	2015-01-06	NA	NA	0.13	NA	0.15	0.31	8.71	2015.014	NA	50.75	NA
WB1415L3_17	0.000	0.000	8.638	10.023	3.33	17	2015-01-06	NA	NA	0.55	NA	0.55	0.85	18.65	2015.014	NA	48.75	NA
WB1415L3_20	0.000	0.023	0.561	0.618	3.33	20	2015-01-06	NA	NA	0.79	NA	1.49	1.53	1.30	2015.014	NA	45.75	NA

ELB Community Analysis Data Set

Sample ID (run_depth)	Cyanobacteria (µg chl-a L^{-1})	Cryptophytes (µg chl-a L^{-1})	Brown/Mixed Algae (µg chl-a L^{-1})	Green Algae (µg chl-a L^{-1})	Ice Thickness (m)	Depth (m)	Date (YYYY-MM-DD)	Conductivity (mS/cm)	DIC (mM)	DOC (mM)	NH$_4$ (µM)	SRP (µM)	NO$_2$ (µM)	NO$_3$ (µM)	Decimal Date	DIN (µM)	MASL (m)	Underwater PAR (µmol photons m^{-2} s^{-1})
EB0405L2_05	0.000	0.000	3.315	8.440	4.27	5	2004-12-11	1.429	1.90	0.04	0.53	0.04	0.23	10.83	2004.943	11.59	57.91	8.07
EB0405L2_06	0.000	0.000	1.430	2.393	4.27	6	2004-12-11	1.989	1.90	0.04	0.57	0.04	0.24	10.50	2004.943	11.31	56.91	7.13
EB0405L2_08	0.000	0.000	0.547	0.997	4.27	8	2004-12-11	2.798	2.30	0.07	0.38	0.04	0.19	11.27	2004.943	11.84	54.91	5.56
EB0405L2_10	0.000	0.000	0.477	0.573	4.27	10	2004-12-11	3.921	3.20	0.04	0.79	0.04	0.17	11.74	2004.943	12.70	52.91	4.34
EB0405L2_12	0.000	0.000	0.410	0.370	4.27	12	2004-12-11	8.691	5.50	0.08	1.56	0.04	0.36	22.28	2004.943	24.20	50.91	3.39
EB0405L2_13	0.000	0.000	0.583	0.350	4.27	13	2004-12-11	13.150	7.60	0.16	2.00	0.04	0.50	29.94	2004.943	32.44	49.91	2.99
EB0405L2_15	0.000	0.000	0.717	0.120	4.27	15	2004-12-11	26.192	13.60	0.21	11.70	0.04	0.80	48.49	2004.943	60.99	47.91	2.33
EB0405L2_18	0.000	0.000	0.350	0.070	4.27	18	2004-12-11	46.722	12.90	0.38	23.16	0.05	2.20	82.31	2004.943	107.67	44.91	1.61
EB0405L2_20	0.000	0.000	0.390	0.067	4.27	20	2004-12-11	76.527	21.20	0.92	110.65	0.06	4.91	131.64	2004.943	247.20	42.91	1.26
EB0405L2_22	0.000	0.000	0.023	0.000	4.27	22	2004-12-11	103.410	20.50	1.40	97.50	0.35	8.32	172.29	2004.943	278.11	40.91	0.98
EB0405L3_05	0.000	0.000	0.690	1.160	4.27	5	2004-12-31	1.420	NA	0.05	0.93	0.04	0.16	11.05	2004.997	12.14	57.99	NA
EB0405L3_06	0.000	0.000	1.265	1.930	4.27	6	2004-12-31	1.941	NA	0.05	0.90	0.05	0.25	20.31	2004.997	21.46	56.99	NA
EB0405L3_08	0.000	0.000	0.690	0.960	4.27	8	2004-12-31	2.824	NA	0.05	0.70	0.06	0.11	12.86	2004.997	13.67	54.99	NA

EB0405L3_10	0.000	0.000	0.790	0.620	4.27	10	2004-12-31	4.034	NA	0.06	0.75	0.05	0.15	14.84	2004.997	15.74	52.99	NA
EB0405L3_12	0.000	0.000	0.597	0.440	4.27	12	2004-12-31	7.838	NA	0.17	1.91	0.04	0.32	25.73	2004.997	27.96	50.99	NA
EB0405L3_13	0.000	0.000	1.350	0.555	4.27	13	2004-12-31	12.014	NA	0.12	3.82	0.04	0.49	36.92	2004.997	41.23	49.99	NA
EB0405L3_15	0.000	0.000	1.005	0.320	4.27	15	2004-12-31	26.560	NA	0.17	10.01	0.07	0.81	52.96	2004.997	63.78	47.99	NA
EB0405L3_18	0.000	0.000	0.407	0.197	4.27	18	2004-12-31	45.521	NA	0.44	21.74	0.04	1.78	95.64	2004.997	119.16	44.99	NA
EB0405L3_20	0.000	0.000	0.510	0.080	4.27	20	2004-12-31	75.070	NA	0.93	71.30	0.06	4.10	155.49	2004.997	230.89	42.99	NA
EB0405L3_22	0.000	0.000	0.030	0.000	4.27	22	2004-12-31	102.460	NA	1.60	99.13	0.29	8.37	218.57	2004.997	326.07	40.99	NA
EB0405L4_05	0.000	0.000	0.540	1.030	4.27	5	2005-01-10	1.182	NA	NA	NA	NA	NA	NA	2005.025	NA	58.03	NA
EB0405L4_06	0.000	0.000	1.160	1.715	4.27	6	2005-01-10	1.823	NA	NA	NA	NA	NA	NA	2005.025	NA	57.03	NA
EB0405L4_08	0.000	0.000	0.740	1.030	4.27	8	2005-01-10	2.743	NA	NA	NA	NA	NA	NA	2005.025	NA	55.03	NA
EB0405L4_10	0.000	0.000	0.830	0.610	4.27	10	2005-01-10	3.883	NA	NA	NA	NA	NA	NA	2005.025	NA	53.03	NA
EB0405L4_12	0.000	0.000	0.835	0.495	4.27	12	2005-01-10	7.688	NA	NA	NA	NA	NA	NA	2005.025	NA	51.03	NA
EB0405L4_13	0.000	0.000	1.300	0.585	4.27	13	2005-01-10	13.237	NA	NA	NA	NA	NA	NA	2005.025	NA	50.03	NA
EB0405L4_15	0.000	0.000	1.090	0.355	4.27	15	2005-01-10	26.251	NA	NA	NA	NA	NA	NA	2005.025	NA	48.03	NA
EB0405L4_18	0.000	0.000	0.345	0.190	4.27	18	2005-01-10	42.546	NA	NA	NA	NA	NA	NA	2005.025	NA	45.03	NA
EB0405L4_20	0.000	0.000	0.370	0.105	4.27	20	2005-01-10	73.223	NA	NA	NA	NA	NA	NA	2005.025	NA	43.03	NA
EB0405L4_22	0.000	0.000	0.105	0.000	4.27	22	2005-01-10	101.133	NA	NA	NA	NA	NA	NA	2005.025	NA	41.03	NA
EB0506L1_05	0.000	0.007	0.465	2.550	4.11	5	2005-11-30	1.148	1.70	0.06	1.64	0.03	0.31	10.58	2005.912	12.53	57.96	13.26

EB0506L1_06	0.004	0.014	0.303	1.860	4.11	6	2005-11-30	1.296	1.60	0.05	1.52	0.04	0.33	9.68	2005.912	11.53	56.96	11.79
EB0506L1_08	0.016	0.039	0.189	1.131	4.11	8	2005-11-30	2.141	2.10	0.06	1.18	0.13	0.29	10.43	2005.912	11.90	54.96	9.33
EB0506L1_10	0.013	0.046	0.230	0.752	4.11	10	2005-11-30	2.955	2.30	0.06	0.74	0.06	0.20	10.65	2005.912	11.59	52.96	7.38
EB0506L1_12	0.000	0.000	0.364	0.783	4.11	12	2005-11-30	4.807	3.70	0.08	1.85	0.12	0.31	15.52	2005.912	17.68	50.96	5.84
EB0506L1_13	0.000	0.000	1.082	1.136	4.11	13	2005-11-30	7.123	5.50	0.25	1.92	0.05	0.49	21.36	2005.912	23.77	49.96	5.20
EB0506L1_15	0.000	0.000	0.773	0.823	4.11	15	2005-11-30	18.079	11.80	0.23	12.77	0.04	0.99	31.58	2005.912	45.34	47.96	4.11
EB0506L1_18	0.000	0.000	0.429	0.701	4.11	18	2005-11-30	31.455	11.60	0.46	24.75	0.10	1.95	55.16	2005.912	81.86	44.96	2.90
EB0506L1_20	0.000	0.000	0.509	0.627	4.11	20	2005-11-30	55.587	16.70	1.07	66.52	0.14	4.53	77.69	2005.912	148.74	42.96	2.29
EB0506L1_22	0.000	0.000	0.012	0.019	4.11	22	2005-11-30	88.186	19.20	1.91	111.60	0.66	8.74	110.56	2005.912	230.90	40.96	1.81
EB0506L2_05	0.000	0.000	0.506	2.928	3.68	5	2005-12-14	0.829	0.80	0.02	1.42	0.12	0.15	7.93	2005.951	9.50	58.01	8.21
EB0506L2_06	0.000	0.000	0.703	2.717	3.68	6	2005-12-14	1.531	1.20	0.04	0.86	0.03	0.15	7.46	2005.951	8.47	57.01	7.19
EB0506L2_08	0.000	0.000	0.363	1.263	3.68	8	2005-12-14	2.326	1.90	0.04	0.78	0.04	0.15	10.39	2005.951	11.32	55.01	5.51
EB0506L2_10	0.000	0.000	0.362	0.835	3.68	10	2005-12-14	3.182	2.10	0.03	0.60	0.04	0.13	10.58	2005.951	11.31	53.01	4.23
EB0506L2_12	0.000	0.000	0.666	0.983	3.68	12	2005-12-14	5.611	3.50	0.05	2.05	0.03	0.24	15.93	2005.951	18.22	51.01	3.24
EB0506L2_13	0.000	0.000	1.820	1.734	3.68	13	2005-12-14	8.172	5.20	NA	2.18	0.07	0.38	20.80	2005.951	23.36	50.01	2.84
EB0506L2_15	0.000	0.000	0.674	0.926	3.68	15	2005-12-14	21.422	11.10	-0.03	32.86	0.07	0.52	25.93	2005.951	59.31	48.01	2.18
EB0506L2_18	0.000	0.000	0.444	0.644	3.68	18	2005-12-14	33.465	10.00	0.18	25.00	0.06	1.56	56.15	2005.951	82.71	45.01	1.46

EB0506L2_20	0.000	0.000	0.395	0.523	3.68	20	2005-12-14	63.692	15.70	0.81	68.43	0.04	3.91	80.18	2005.951	152.52	43.01	1.12
EB0506L2_22	0.000	0.000	0.045	0.003	3.68	22	2005-12-14	93.266	17.70	2.21	115.35	0.35	7.91	110.81	2005.951	234.07	41.01	0.86
EB0506L3_05	0.000	0.000	0.280	1.300	3.68	5	2005-12-27	0.348	NA	0.08	1.56	0.03	0.20	7.74	2005.986	9.50	58.11	NA
EB0506L3_06	0.000	0.003	0.513	1.648	3.68	6	2005-12-27	1.251	NA	0.08	1.00	0.06	0.19	10.00	2005.986	11.19	57.11	NA
EB0506L3_08	0.003	0.000	0.313	0.838	3.68	8	2005-12-27	2.361	NA	0.06	0.37	1.30	0.13	8.34	2005.986	8.84	55.11	NA
EB0506L3_10	0.000	0.010	0.323	0.745	3.68	10	2005-12-27	3.005	NA	0.07	0.53	0.02	0.14	8.50	2005.986	9.17	53.11	NA
EB0506L3_12	0.000	0.000	0.680	0.766	3.68	12	2005-12-27	4.951	NA	0.09	2.44	0.05	0.25	17.18	2005.986	19.87	51.11	NA
EB0506L3_13	0.000	0.000	1.413	1.233	3.68	13	2005-12-27	7.251	NA	0.25	1.73	0.05	0.44	21.22	2005.986	23.39	50.11	NA
EB0506L3_15	0.000	0.000	1.028	0.750	3.68	15	2005-12-27	17.256	NA	0.30	9.11	0.51	0.82	31.80	2005.986	41.73	48.11	NA
EB0506L3_18	0.000	0.000	0.338	0.568	3.68	18	2005-12-27	31.620	NA	0.42	19.69	0.07	1.75	55.80	2005.986	77.24	45.11	NA
EB0506L3_20	0.000	0.000	0.330	0.510	3.68	20	2005-12-27	53.329	NA	1.77	62.93	0.15	3.87	78.53	2005.986	145.33	43.11	NA
EB0506L3_22	0.008	0.000	0.026	0.048	3.68	22	2005-12-27	87.949	NA	1.83	98.77	0.34	7.68	108.35	2005.986	214.80	41.11	NA
EB0607L1_05	0.100	0.031	0.286	2.138	3.44	5	2006-11-25	1.293	1.30	0.05	1.27	0.02	0.19	7.48	2006.899	8.94	58.27	22.97
EB0607L1_06	0.165	0.090	0.161	1.308	3.44	6	2006-11-25	1.920	1.40	0.03	1.08	0.11	0.19	8.87	2006.899	10.14	57.27	20.49
EB0607L1_08	0.218	0.001	0.126	0.688	3.44	8	2006-11-25	2.877	1.90	0.04	0.41	0.07	0.19	9.79	2006.899	10.39	55.27	16.31
EB0607L1_10	0.140	0.084	0.146	0.537	3.44	10	2006-11-25	4.269	2.10	0.06	0.44	0.08	0.14	10.36	2006.899	10.94	53.27	12.98
EB0607L1_12	0.012	0.058	0.181	0.375	3.44	12	2006-11-25	9.131	3.00	0.07	2.25	0.02	0.23	13.89	2006.899	16.37	51.27	10.33
EB0607L1_13	0.000	0.015	0.504	0.490	3.44	13	2006-11-25	13.285	5.60	0.11	1.51	0.27	0.29	20.57	2006.899	22.37	50.27	9.22

EB0607L1_15	0.000	0.000	0.658	0.569	3.44	15	2006-11-25	26.832	15.50	0.31	9.57	0.12	0.50	31.10	2006.899	41.17	48.27	7.33
EB0607L1_18	0.000	0.000	0.358	0.350	3.44	18	2006-11-25	40.596	14.90	0.46	17.81	0.16	1.24	54.00	2006.899	73.05	45.27	5.21
EB0607L1_20	0.004	0.017	0.440	0.545	3.44	20	2006-11-25	74.364	30.70	0.97	51.97	0.36	4.02	75.26	2006.899	131.25	43.27	4.14
EB0607L1_22	0.010	0.063	0.036	0.045	3.44	22	2006-11-25	100.444	66.20	1.37	159.55	0.81	9.57	110.30	2006.899	279.42	41.27	3.30
EB0607L2_05	0.004	0.006	0.300	1.191	3.44	5	2006-12-21	1.262	0.60	0.03	0.81	0.39	0.10	3.64	2006.970	4.55	58.34	21.43
EB0607L2_06	0.003	0.000	0.172	0.847	3.44	6	2006-12-21	1.909	1.30	0.04	0.64	0.07	0.14	8.23	2006.970	9.01	57.34	18.34
EB0607L2_08	0.018	0.021	0.205	0.484	3.44	8	2006-12-21	2.790	1.90	0.05	0.43	0.08	0.15	9.83	2006.970	10.41	55.34	13.43
EB0607L2_10	0.006	0.017	0.116	0.450	3.44	10	2006-12-21	3.947	2.10	0.05	0.55	0.11	0.14	10.29	2006.970	10.98	53.34	9.83
EB0607L2_12	0.000	0.007	0.184	0.370	3.44	12	2006-12-21	8.490	2.80	0.06	1.60	0.07	0.18	13.07	2006.970	14.85	51.34	7.20
EB0607L2_13	0.000	0.000	0.732	0.767	3.44	13	2006-12-21	13.285	4.80	0.08	3.11	0.07	0.25	18.10	2006.970	21.46	50.34	6.16
EB0607L2_15	0.000	0.000	0.531	0.535	3.44	15	2006-12-21	26.708	14.90	0.15	6.98	0.13	0.30	28.74	2006.970	36.02	48.34	4.51
EB0607L2_18	0.000	0.003	0.261	0.289	3.44	18	2006-12-21	44.062	15.50	0.42	16.26	0.23	0.92	53.53	2006.970	70.71	45.34	2.83
EB0607L2_20	0.000	0.033	0.179	0.390	3.44	20	2006-12-21	75.882	30.30	0.97	53.46	0.37	3.61	76.67	2006.970	133.74	43.34	2.07
EB0607L2_22	0.016	0.000	0.016	0.120	3.44	22	2006-12-21	100.826	55.40	1.63	186.14	0.59	8.37	110.46	2006.970	304.97	41.34	1.52
EB0607L3_05	0.000	0.000	0.128	1.454	3.44	5	2007-01-04	1.460	NA	0.07	0.48	0.18	0.21	8.90	2007.008	9.59	58.39	NA
EB0607L3_06	0.000	0.000	0.099	1.041	3.44	6	2007-01-04	1.860	NA	0.07	0.36	0.08	0.19	10.22	2007.008	10.77	57.39	NA
EB0607L3_08	0.000	0.000	0.213	0.636	3.44	8	2007-01-04	3.060	NA	0.07	0.03	0.05	0.27	10.81	2007.008	11.11	55.39	NA
EB0607L3_10	0.000	0.000	0.099	0.521	3.44	10	2007-01-04	4.288	NA	0.07	0.46	0.06	0.25	10.45	2007.008	11.16	53.39	NA

EB0607L3_12	0.000	0.004	0.371	0.461	3.44	12	2007-01-04	8.812	NA	0.08	1.46	0.09	0.23	14.37	2007.008	16.06	51.39	NA
EB0607L3_13	0.000	0.000	1.433	1.307	3.44	13	2007-01-04	13.900	NA	0.11	1.19	0.04	0.35	22.19	2007.008	23.73	50.39	NA
EB0607L3_15	0.000	0.000	0.450	0.501	3.44	15	2007-01-04	27.027	NA	0.38	7.76	0.12	0.52	32.88	2007.008	41.16	48.39	NA
EB0607L3_18	0.001	0.006	0.206	0.249	3.44	18	2007-01-04	48.671	NA	0.60	20.72	0.14	1.47	60.51	2007.008	82.70	45.39	NA
EB0607L3_20	0.004	0.030	0.159	0.284	3.44	20	2007-01-04	79.151	NA	1.11	56.27	0.22	4.46	82.12	2007.008	142.85	43.39	NA
EB0607L3_22	0.017	0.023	0.021	0.050	3.44	22	2007-01-04	103.240	NA	1.88	192.88	0.56	9.01	116.94	2007.008	318.83	41.39	NA
EB0708L1_05	0.003	0.030	0.397	1.393	3.25	5	2007-11-24	1.407	1.10	0.05	1.15	0.12	0.15	7.10	2007.896	8.40	58.32	16.76
EB0708L1_06	0.000	0.038	0.278	1.110	3.25	6	2007-11-24	2.026	1.30	0.05	1.16	0.18	0.15	8.90	2007.896	10.21	57.32	14.88
EB0708L1_08	0.000	0.061	0.196	0.497	3.25	8	2007-11-24	2.936	1.90	0.06	0.64	0.13	0.15	10.50	2007.896	11.29	55.32	11.71
EB0708L1_10	0.007	0.118	0.223	0.337	3.25	10	2007-11-24	4.351	2.20	0.06	0.85	0.03	0.14	10.50	2007.896	11.49	53.32	9.22
EB0708L1_12	0.001	0.039	0.319	0.251	3.25	12	2007-11-24	8.174	3.30	0.07	1.93	0.03	0.22	15.20	2007.896	17.35	51.32	7.26
EB0708L1_13	0.000	0.110	0.681	0.438	3.25	13	2007-11-24	12.824	6.20	0.11	2.08	0.03	0.33	22.90	2007.896	25.31	50.32	6.44
EB0708L1_15	0.000	0.008	0.621	0.409	3.25	15	2007-11-24	27.199	11.70	NA	12.12	0.05	0.71	33.40	2007.896	46.23	48.32	5.07
EB0708L1_18	0.002	0.028	0.330	0.204	3.25	18	2007-11-24	45.349	10.70	0.44	20.33	0.12	1.47	53.30	2007.896	75.10	45.32	3.55
EB0708L1_20	0.005	0.040	0.375	0.302	3.25	20	2007-11-24	75.798	16.30	0.95	66.03	0.16	4.01	80.50	2007.896	150.54	43.32	2.79
EB0708L1_22	0.021	0.052	0.028	0.000	3.25	22	2007-11-24	99.680	19.00	1.74	222.10	0.34	8.84	117.60	2007.896	348.54	41.32	2.20
EB0708L2_05	0.004	0.024	0.284	1.554	3.13	5	2007-12-14	1.551	1.80	0.04	0.76	0.09	0.22	8.90	2007.951	9.88	58.30	16.92
EB0708L2_06	0.001	0.037	0.307	1.059	3.13	6	2007-12-14	2.101	1.70	0.04	0.99	0.08	0.22	8.60	2007.951	9.81	57.30	15.03

EB0708L2_08	0.033	0.065	0.342	0.442	3.13	8	2007-12-14	2.972	2.10	0.05	0.55	0.12	0.21	10.70	2007.951	11.46	55.30	11.85
EB0708L2_10	0.003	0.230	0.134	0.396	3.13	10	2007-12-14	4.375	2.70	0.06	0.76	0.03	0.17	11.00	2007.951	11.93	53.30	9.35
EB0708L2_12	0.012	0.036	0.394	0.356	3.13	12	2007-12-14	8.436	4.70	0.08	2.31	0.03	0.30	17.40	2007.951	20.01	51.30	7.37
EB0708L2_13	0.000	0.000	1.198	0.968	3.13	13	2007-12-14	13.685	6.10	0.11	2.05	0.05	0.35	21.90	2007.951	24.30	50.30	6.55
EB0708L2_15	0.000	0.000	0.807	0.611	3.13	15	2007-12-14	27.238	13.40	NA	10.72	0.06	1.02	34.30	2007.951	46.04	48.30	5.17
EB0708L2_18	0.000	0.000	0.398	0.404	3.13	18	2007-12-14	45.984	12.60	0.41	20.11	0.14	1.75	58.60	2007.951	80.46	45.30	3.62
EB0708L2_20	0.005	0.008	0.403	0.392	3.13	20	2007-12-14	77.562	17.10	0.91	60.46	0.23	4.15	79.50	2007.951	144.11	43.30	2.85
EB0708L2_22	0.037	0.115	0.013	0.040	3.13	22	2007-12-14	100.501	21.70	1.73	252.01	0.38	9.49	115.50	2007.951	377.00	41.30	2.25
EB0708L3_05	0.000	0.000	0.383	2.019	3.13	5	2007-12-29	0.544	NA	0.04	0.69	0.09	0.27	7.80	2007.992	8.76	58.42	NA
EB0708L3_06	0.000	0.000	0.401	1.548	3.13	6	2007-12-29	1.395	NA	0.04	0.68	0.09	0.22	9.50	2007.992	10.40	57.42	NA
EB0708L3_08	0.000	0.003	0.752	0.944	3.13	8	2007-12-29	2.735	NA	0.06	0.20	0.15	0.23	10.90	2007.992	11.33	55.42	NA
EB0708L3_10	0.000	0.048	0.448	0.608	3.13	10	2007-12-29	3.893	NA	0.05	0.62	0.03	0.21	10.60	2007.992	11.43	53.42	NA
EB0708L3_12	0.000	0.005	0.529	0.618	3.13	12	2007-12-29	7.660	NA	0.06	1.64	0.03	0.30	14.60	2007.992	16.54	51.42	NA
EB0708L3_13	0.000	0.000	1.751	1.614	3.13	13	2007-12-29	11.150	NA	0.09	2.45	0.04	0.40	19.20	2007.992	22.05	50.42	NA
EB0708L3_15	0.000	0.003	1.002	0.840	3.13	15	2007-12-29	25.984	NA	NA	8.59	0.10	1.13	31.70	2007.992	41.42	48.42	NA
EB0708L3_18	0.003	0.108	0.259	0.326	3.13	18	2007-12-29	40.959	NA	NA	17.56	0.16	1.90	55.00	2007.992	74.46	45.42	NA
EB0708L3_20	0.004	0.097	0.278	0.429	3.13	20	2007-12-29	73.561	NA	0.92	61.42	0.20	4.26	80.30	2007.992	145.98	43.42	NA
EB0708L3_22	0.015	0.174	0.039	0.068	3.13	22	2007-12-29	97.631	NA	1.51	241.54	0.31	9.82	112.70	2007.992	364.06	41.42	NA

EB0708L4_05	0.000	0.000	0.270	1.158	2.66	5	2008-01-27	1.137	0.90	0.03	0.51	0.01	0.11	4.10	2008.071	4.72	58.55	NA
EB0708L4_06	0.000	0.000	0.515	1.144	2.66	6	2008-01-27	1.665	1.40	0.04	0.34	0.02	0.13	7.00	2008.071	7.47	57.55	NA
EB0708L4_08	0.000	0.034	0.327	0.479	2.66	8	2008-01-27	2.810	2.20	0.06	0.18	0.03	0.13	9.60	2008.071	9.91	55.55	NA
EB0708L4_10	0.009	0.050	0.311	0.386	2.66	10	2008-01-27	4.065	2.40	0.05	0.31	0.03	0.11	8.20	2008.071	8.62	53.55	NA
EB0708L4_12	0.000	0.000	0.431	0.579	2.66	12	2008-01-27	7.535	3.30	0.06	1.21	0.03	0.15	12.40	2008.071	13.76	51.55	NA
EB0708L4_13	0.000	0.000	1.721	1.380	2.66	13	2008-01-27	10.602	5.20	0.10	1.95	0.04	0.23	18.40	2008.071	20.58	50.55	NA
EB0708L4_15	0.000	0.038	0.683	0.485	2.66	15	2008-01-27	25.621	12.00	0.26	9.05	0.06	0.51	31.10	2008.071	40.66	48.55	NA
EB0708L4_18	0.022	0.102	0.038	0.465	2.66	18	2008-01-27	42.180	12.00	0.24	15.12	0.09	0.87	49.10	2008.071	65.09	45.55	NA
EB0708L4_20	0.012	0.182	0.090	0.430	2.66	20	2008-01-27	74.122	15.40	0.72	54.71	0.18	2.84	69.80	2008.071	127.35	43.55	NA
EB0708L4_22	0.014	0.226	0.018	0.096	2.66	22	2008-01-27	95.873	20.50	1.91	173.56	0.26	8.07	100.60	2008.071	282.23	41.55	NA
EB0809L1_05	1.160	0.000	0.000	1.173	3.295	5	2008-11-23	1.388	1.60	0.07	0.57	0.02	0.14	8.29	2008.893	9.00	58.37	13.13
EB0809L1_06	1.126	0.000	0.000	0.943	3.295	6	2008-11-23	1.967	1.70	0.07	0.90	0.02	0.14	9.22	2008.893	10.26	57.37	11.59
EB0809L1_08	1.111	0.000	0.000	0.597	3.295	8	2008-11-23	2.964	2.10	0.08	0.27	0.03	0.14	10.07	2008.893	10.48	55.37	9.03
EB0809L1_10	0.917	0.000	0.000	0.620	3.295	10	2008-11-23	4.374	2.60	0.08	0.34	0.04	0.12	10.03	2008.893	10.49	53.37	7.04
EB0809L1_12	0.663	0.000	0.000	0.540	3.295	12	2008-11-23	8.227	3.30	0.08	1.16	0.03	0.16	13.56	2008.893	14.88	51.37	5.48
EB0809L1_13	0.504	0.000	0.091	0.624	3.295	13	2008-11-23	12.401	5.70	0.10	1.76	0.04	0.23	19.00	2008.893	20.99	50.37	4.84
EB0809L1_15	0.203	0.044	0.305	0.484	3.295	15	2008-11-23	27.231	13.10	0.45	7.86	0.03	0.47	29.02	2008.893	37.35	48.37	3.77
EB0809L1_18	0.016	0.044	0.133	0.177	3.295	18	2008-11-23	41.894	12.20	0.52	15.37	0.08	0.70	53.40	2008.893	69.47	45.37	2.59

EB0809L1_20	0.000	0.000	0.183	0.237	3.295	20	2008-11-23	77.155	18.70	1.00	53.99	0.10	2.97	73.72	2008.893	130.68	43.37	2.02
EB0809L1_22	0.008	0.041	0.011	0.069	3.295	22	2008-11-23	98.871	23.20	1.85	117.30	0.22	7.44	105.27	2008.893	230.01	41.37	1.57
EB0809L2_05	0.173	0.013	0.058	1.275	3.11	5	2008-12-20	1.421	1.20	0.04	0.99	0.07	0.19	7.43	2008.967	8.61	58.38	11.73
EB0809L2_06	0.197	0.055	0.012	0.950	3.11	6	2008-12-20	1.944	1.40	0.04	0.43	0.01	0.17	8.38	2008.967	8.98	57.38	10.37
EB0809L2_08	0.210	0.006	0.094	0.704	3.11	8	2008-12-20	2.913	1.90	0.05	0.34	0.02	0.19	9.64	2008.967	10.17	55.38	8.09
EB0809L2_10	0.138	0.028	0.037	0.622	3.11	10	2008-12-20	4.263	2.20	0.06	0.46	0.02	0.16	9.93	2008.967	10.55	53.38	6.32
EB0809L2_12	0.020	0.045	0.086	0.535	3.11	12	2008-12-20	8.259	2.70	0.06	1.16	0.04	0.20	12.75	2008.967	14.11	51.38	4.94
EB0809L2_13	0.000	0.000	0.542	0.762	3.11	13	2008-12-20	12.768	4.10	0.09	1.79	0.01	0.23	17.02	2008.967	19.04	50.38	4.36
EB0809L2_15	0.000	0.000	0.247	0.430	3.11	15	2008-12-20	26.785	11.30	0.26	7.97	0.02	0.26	30.87	2008.967	39.10	48.38	3.41
EB0809L2_18	0.000	0.000	0.053	0.315	3.11	18	2008-12-20	42.733	10.50	0.35	15.08	0.06	1.04	50.78	2008.967	66.90	45.38	2.35
EB0809L2_20	0.000	0.003	0.120	0.227	3.11	20	2008-12-20	73.273	15.60	0.89	54.18	0.09	3.14	72.53	2008.967	129.85	43.38	1.84
EB0809L2_22	0.002	0.018	0.000	0.076	3.11	22	2008-12-20	99.258	19.40	1.55	NA	0.20	8.10	105.47	2008.967	NA	41.38	1.43
EB0809L3_05	0.000	0.007	0.273	1.617	2.86	5	2009-01-02	1.250	NA	0.05	0.72	0.04	0.33	7.74	2009.003	8.79	58.81	NA
EB0809L3_06	0.000	0.010	0.277	1.258	2.86	6	2009-01-02	1.713	NA	0.05	0.38	0.05	0.19	8.71	2009.003	9.28	57.81	NA
EB0809L3_08	0.000	0.006	0.227	0.843	2.86	8	2009-01-02	2.739	NA	0.06	0.69	0.08	0.25	9.91	2009.003	10.85	55.81	NA
EB0809L3_10	0.000	0.012	0.182	0.737	2.86	10	2009-01-02	3.931	NA	0.05	0.34	0.04	0.26	9.67	2009.003	10.27	53.81	NA
EB0809L3_12	0.014	0.000	0.263	0.631	2.86	12	2009-01-02	7.158	NA	0.07	1.43	0.02	0.23	12.92	2009.003	14.58	51.81	NA
EB0809L3_13	0.000	0.000	0.666	0.866	2.86	13	2009-01-02	10.502	NA	0.10	2.17	0.04	0.31	20.00	2009.003	22.48	50.81	NA

EB0809L3_15	0.000	0.006	0.384	0.596	2.86	15	2009-01-02	25.100	NA	0.39	9.26	0.04	0.45	30.32	2009.003	40.03	48.81	NA
EB0809L3_18	0.008	0.112	0.048	0.240	2.86	18	2009-01-02	37.882	NA	0.43	14.62	0.08	1.08	51.98	2009.003	67.68	45.81	NA
EB0809L3_20	0.005	0.008	0.083	0.322	2.86	20	2009-01-02	65.956	NA	0.88	49.60	0.13	2.99	73.77	2009.003	126.36	43.81	NA
EB0809L3_22	0.027	0.053	0.015	0.090	2.86	22	2009-01-02	95.350	NA	1.59	100.62	0.24	6.73	102.37	2009.003	209.72	41.81	NA
EB0910L1_05	0.502	0.000	0.108	2.298	3.28	5	2009-11-19	1.269	1.20	0.05	1.12	0.03	0.33	12.51	2009.882	13.96	58.88	12.19
EB0910L1_06	0.548	0.000	0.105	1.740	3.28	6	2009-11-19	1.660	1.30	0.04	1.04	0.04	0.22	10.08	2009.882	11.34	57.88	10.92
EB0910L1_08	0.536	0.000	0.086	1.124	3.28	8	2009-11-19	2.679	1.90	0.05	0.86	0.05	0.14	9.47	2009.882	10.47	55.88	8.77
EB0910L1_10	0.454	0.000	0.118	0.804	3.28	10	2009-11-19	3.821	2.10	0.05	0.41	0.06	0.11	9.50	2009.882	10.02	53.88	7.04
EB0910L1_12	0.328	0.000	0.052	0.792	3.28	12	2009-11-19	6.698	2.60	0.05	0.93	0.03	0.12	11.67	2009.882	12.72	51.88	5.66
EB0910L1_13	0.228	0.008	0.147	0.728	3.28	13	2009-11-19	9.854	3.40	0.07	1.66	0.05	0.18	14.82	2009.882	16.66	50.88	5.07
EB0910L1_15	0.048	0.154	0.442	0.580	3.28	15	2009-11-19	24.727	9.90	0.22	5.77	0.10	0.44	28.25	2009.882	34.46	48.88	4.07
EB0910L1_18	0.023	0.015	0.177	0.307	3.28	18	2009-11-19	37.973	10.10	0.33	11.89	0.17	0.92	47.26	2009.882	60.07	45.88	2.93
EB0910L1_20	0.012	0.012	0.340	0.385	3.28	20	2009-11-19	66.022	13.30	0.71	43.71	0.33	2.06	66.78	2009.882	112.55	43.88	2.35
EB0910L1_22	0.008	0.000	0.112	0.135	3.28	22	2009-11-19	94.980	18.30	1.45	86.12	0.37	5.71	100.34	2009.882	192.17	41.88	1.89
EB0910L2_05	0.210	0.003	0.143	1.916	3.17	5	2009-12-14	1.278	1.10	0.05	0.71	0.03	0.22	11.13	2009.951	12.06	58.88	10.19
EB0910L2_06	0.263	0.012	0.160	1.512	3.17	6	2009-12-14	1.696	1.50	0.05	0.41	0.04	0.16	9.08	2009.951	9.65	57.88	9.14
EB0910L2_08	0.257	0.000	0.107	0.968	3.17	8	2009-12-14	2.715	1.80	0.05	0.29	0.03	0.12	9.37	2009.951	9.78	55.88	7.34
EB0910L2_10	0.173	0.000	0.083	0.777	3.17	10	2009-12-14	3.939	2.10	0.06	0.36	0.03	0.13	9.67	2009.951	10.16	53.88	5.89

EB0910L2_12	0.037	0.037	0.136	0.729	3.17	12	2009-12-14	7.087	2.90	0.06	1.25	0.03	0.15	13.00	2009.951	14.40	51.88	4.74
EB0910L2_13	0.002	0.000	0.360	0.756	3.17	13	2009-12-14	11.171	4.20	0.08	2.01	0.03	0.20	16.91	2009.951	19.12	50.88	4.24
EB0910L2_15	0.000	0.010	0.884	0.716	3.17	15	2009-12-14	25.458	11.50	0.26	7.51	0.04	0.43	30.57	2009.951	38.51	48.88	3.41
EB0910L2_18	0.020	0.003	0.225	0.617	3.17	18	2009-12-14	38.058	10.30	0.45	10.94	0.05	0.61	44.34	2009.951	55.89	45.88	2.45
EB0910L2_20	0.012	0.005	0.442	0.570	3.17	20	2009-12-14	66.989	13.60	0.94	42.62	0.11	2.24	66.60	2009.951	111.46	43.88	1.97
EB0910L2_22	0.044	0.037	0.164	0.286	3.17	22	2009-12-14	94.980	18.40	1.32	81.17	0.13	5.69	97.88	2009.951	184.74	41.88	1.58
EB0910L3_05	0.002	0.015	0.250	1.587	3.14	5	2009-12-31	1.283	NA	0.04	2.52	0.02	0.19	8.68	2009.997	11.39	58.92	NA
EB0910L3_06	0.010	0.022	0.212	1.450	3.14	6	2009-12-31	1.672	NA	0.04	1.15	0.02	0.23	9.24	2009.997	10.62	57.92	NA
EB0910L3_08	0.032	0.050	0.092	1.058	3.14	8	2009-12-31	2.661	NA	0.05	0.80	0.03	0.31	9.83	2009.997	10.94	55.92	NA
EB0910L3_10	0.020	0.058	0.192	0.860	3.14	10	2009-12-31	3.873	NA	0.05	1.00	0.03	0.25	9.96	2009.997	11.21	53.92	NA
EB0910L3_12	0.000	0.000	0.335	0.850	3.14	12	2009-12-31	7.029	NA	0.06	1.29	0.02	0.17	13.14	2009.997	14.60	51.92	NA
EB0910L3_13	0.007	0.000	0.561	0.861	3.14	13	2009-12-31	10.665	NA	0.07	1.87	0.04	0.26	16.06	2009.997	18.19	50.92	NA
EB0910L3_15	0.000	0.000	1.100	1.048	3.14	15	2009-12-31	25.078	NA	0.23	7.83	0.02	0.66	30.41	2009.997	38.90	48.92	NA
EB0910L3_18	0.034	0.014	0.200	0.449	3.14	18	2009-12-31	36.983	NA	0.31	11.25	0.06	0.98	45.66	2009.997	57.89	45.92	NA
EB0910L3_20	0.038	0.039	0.265	0.555	3.14	20	2009-12-31	66.942	NA	0.68	42.96	0.06	2.40	67.36	2009.997	112.72	43.92	NA
EB0910L3_22	0.116	0.000	0.176	0.307	3.14	22	2009-12-31	94.634	NA	1.25	84.44	0.10	6.15	99.99	2009.997	190.58	41.92	NA
EB1011L1_05	0.004	0.002	0.091	3.735	3.53	5	2010-11-19	1.362	1.50	0.05	0.98	0.03	0.30	12.51	2010.882	13.79	58.93	NA
EB1011L1_06	0.002	0.003	0.020	3.853	3.53	6	2010-11-19	1.720	1.50	0.05	0.46	0.01	0.30	10.63	2010.882	11.39	57.93	NA

EB1011L1_08	0.040	0.004	0.033	2.678	3.53	8	2010-11-19	2.689	1.80	0.05	0.37	0.02	0.24	9.36	2010.882	9.97	55.93	NA
EB1011L1_10	0.041	0.024	0.061	2.219	3.53	10	2010-11-19	3.965	2.20	0.06	0.33	0.03	0.23	9.81	2010.882	10.37	53.93	NA
EB1011L1_12	0.012	0.019	0.054	1.992	3.53	12	2010-11-19	6.781	2.80	0.06	1.09	0.02	0.25	12.38	2010.882	13.72	51.93	NA
EB1011L1_13	0.000	0.010	0.144	1.498	3.53	13	2010-11-19	10.274	3.90	0.08	2.73	0.02	0.57	16.46	2010.882	19.76	50.93	NA
EB1011L1_15	0.000	0.009	0.600	1.069	3.53	15	2010-11-19	24.834	10.80	0.24	6.22	0.05	0.43	29.58	2010.882	36.23	48.93	NA
EB1011L1_18	0.006	0.005	0.059	0.584	3.53	18	2010-11-19	37.512	10.90	0.29	12.30	0.08	1.27	46.83	2010.882	60.40	45.93	NA
EB1011L1_20	0.000	0.000	0.120	0.373	3.53	20	2010-11-19	63.789	14.30	0.73	6.84	0.08	1.44	29.53	2010.882	37.81	43.93	NA
EB1011L1_22	0.000	0.000	0.034	0.179	3.53	22	2010-11-19	92.882	18.80	1.53	45.18	0.10	2.96	66.99	2010.882	115.13	41.93	NA
EB1011L2_05	0.000	0.000	0.209	3.441	3.37	5	2010-12-15	1.319	1.20	0.05	0.50	0.05	0.20	10.30	2010.953	11.00	58.96	11.22
EB1011L2_06	0.000	0.000	0.109	3.563	3.37	6	2010-12-15	1.633	1.30	0.05	0.38	0.05	0.13	8.52	2010.953	9.03	57.96	10.16
EB1011L2_08	0.000	0.000	0.121	2.929	3.37	8	2010-12-15	2.601	1.70	0.06	0.19	0.08	0.13	9.11	2010.953	9.43	55.96	8.34
EB1011L2_10	0.000	0.000	0.314	2.252	3.37	10	2010-12-15	3.804	1.90	0.06	0.13	0.05	0.11	9.30	2010.953	9.54	53.96	6.84
EB1011L2_12	0.000	0.000	0.167	1.942	3.37	12	2010-12-15	6.428	2.60	0.06	0.90	0.06	0.11	11.84	2010.953	12.85	51.96	5.61
EB1011L2_13	0.000	0.000	0.249	2.063	3.37	13	2010-12-15	9.397	3.90	0.08	1.73	0.03	0.28	16.41	2010.953	18.42	50.96	5.08
EB1011L2_15	0.000	0.000	0.948	1.769	3.37	15	2010-12-15	24.231	11.00	0.28	7.63	0.08	0.39	30.53	2010.953	38.55	48.96	4.17
EB1011L2_18	0.000	0.012	0.228	0.795	3.37	18	2010-12-15	36.392	10.00	0.32	10.88	0.19	1.30	40.35	2010.953	52.53	45.96	3.09
EB1011L2_20	0.000	0.005	0.249	0.866	3.37	20	2010-12-15	63.418	13.20	0.77	42.28	0.24	2.59	58.26	2010.953	103.13	43.96	2.54
EB1011L2_22	0.008	0.034	0.070	0.974	3.37	22	2010-12-15	92.095	17.50	1.64	81.79	0.28	5.60	96.10	2010.953	183.49	41.96	2.08

EB1011L3_05	0.000	0.000	0.892	4.649	3.11	5	2011-01-01	1.241	NA	0.04	0.92	0.04	0.19	11.67	2011.000	12.78	59.64	NA
EB1011L3_06	0.000	0.000	0.543	4.046	3.11	6	2011-01-01	1.395	NA	0.05	0.58	0.02	0.23	13.16	2011.000	13.97	58.64	NA
EB1011L3_08	0.000	0.000	0.119	4.335	3.11	8	2011-01-01	2.305	NA	0.05	0.25	0.03	0.11	9.05	2011.000	9.41	56.64	NA
EB1011L3_10	0.000	0.000	0.340	3.068	3.11	10	2011-01-01	3.355	NA	0.06	0.07	0.03	0.11	9.38	2011.000	9.56	54.64	NA
EB1011L3_12	0.000	0.000	0.526	2.697	3.11	12	2011-01-01	5.292	NA	0.06	0.44	0.03	0.12	10.99	2011.000	11.55	52.64	NA
EB1011L3_13	0.000	0.000	0.646	2.777	3.11	13	2011-01-01	7.509	NA	0.08	2.04	0.03	0.26	15.93	2011.000	18.23	51.64	NA
EB1011L3_15	0.000	0.000	1.309	2.257	3.11	15	2011-01-01	18.416	NA	0.22	2.31	0.05	0.54	25.67	2011.000	28.52	49.64	NA
EB1011L3_18	0.001	0.005	0.126	0.858	3.11	18	2011-01-01	31.457	NA	0.28	9.41	0.11	0.69	40.35	2011.000	50.45	46.64	NA
EB1011L3_20	0.004	0.009	0.096	1.154	3.11	20	2011-01-01	54.959	NA	0.63	26.62	0.11	1.33	58.26	2011.000	86.21	44.64	NA
EB1011L3_22	0.000	0.075	0.108	0.239	3.11	22	2011-01-01	84.621	NA	1.28	66.94	0.13	4.22	82.23	2011.000	153.39	42.64	NA
EB1112L1_05	0.000	0.000	0.761	3.215	3.48	5	2011-11-18	1.142	0.90	0.03	1.28	0.02	0.38	12.53	2011.879	14.19	59.63	12.32
EB1112L1_06	0.000	0.000	0.411	2.984	3.48	6	2011-11-18	1.452	1.00	0.04	1.26	0.01	0.36	12.01	2011.879	13.63	58.63	11.05
EB1112L1_08	0.000	0.000	0.439	2.353	3.48	8	2011-11-18	2.300	1.30	0.05	0.93	0.02	0.31	10.13	2011.879	11.37	56.63	8.89
EB1112L1_10	0.000	0.039	0.274	1.917	3.48	10	2011-11-18	3.339	1.90	0.06	0.95	0.02	0.24	8.86	2011.879	10.05	54.63	7.14
EB1112L1_12	0.000	0.032	0.234	1.547	3.48	12	2011-11-18	5.329	2.50	0.06	1.58	0.01	0.25	12.52	2011.879	14.35	52.63	5.74
EB1112L1_13	0.000	0.010	0.263	1.424	3.48	13	2011-11-18	7.531	3.00	0.07	2.04	0.01	0.28	14.17	2011.879	16.49	51.63	5.15
EB1112L1_15	0.012	0.026	0.610	0.784	3.48	15	2011-11-18	18.232	8.00	0.17	13.76	0.01	0.49	26.41	2011.879	40.66	49.63	4.14
EB1112L1_18	0.000	0.012	0.480	0.340	3.48	18	2011-11-18	31.382	10.20	0.24	7.98	0.04	0.81	41.87	2011.879	50.66	46.63	2.99

EB1112L1_20	0.000	0.041	0.344	0.228	3.48	20	2011-11-18	54.411	10.90	0.47	35.23	0.07	1.48	60.40	2011.879	97.11	44.63	2.40
EB1112L1_22	0.000	0.001	0.531	0.378	3.48	22	2011-11-18	83.649	15.80	1.37	35.23	0.01	4.94	87.32	2011.879	127.49	42.63	1.93
EB1112L2_05	0.000	0.000	0.598	2.962	3.38	5	2011-12-18	1.160	0.90	0.04	1.10	0.07	0.31	11.42	2011.962	12.83	59.66	10.42
EB1112L2_06	0.000	0.000	0.427	2.836	3.38	6	2011-12-18	1.487	1.10	0.04	0.97	0.01	0.30	11.51	2011.962	12.78	58.66	9.24
EB1112L2_08	0.000	0.008	0.211	2.415	3.38	8	2011-12-18	2.315	1.30	0.05	0.88	0.02	0.27	9.67	2011.962	10.82	56.66	7.27
EB1112L2_10	0.000	0.014	0.415	1.863	3.38	10	2011-12-18	3.323	1.70	0.06	1.16	0.01	0.25	9.38	2011.962	10.79	54.66	5.72
EB1112L2_12	0.000	0.006	0.211	2.048	3.38	12	2011-12-18	5.441	2.10	0.07	1.40	0.01	0.24	10.95	2011.962	12.59	52.66	4.50
EB1112L2_13	0.000	0.019	0.179	1.878	3.38	13	2011-12-18	7.477	2.70	0.08	1.83	0.02	0.21	13.51	2011.962	15.55	51.66	3.99
EB1112L2_15	0.000	0.000	0.942	1.486	3.38	15	2011-12-18	18.632	7.90	0.23	15.37	0.01	0.46	26.47	2011.962	42.30	49.66	3.14
EB1112L2_18	0.000	0.000	0.799	0.759	3.38	18	2011-12-18	31.736	10.30	0.23	12.26	0.02	0.70	40.35	2011.962	53.31	46.66	2.19
EB1112L2_20	0.000	0.003	0.455	0.583	3.38	20	2011-12-18	53.320	11.10	0.63	29.36	NA	1.45	62.83	2011.962	93.64	44.66	1.73
EB1112L2_22	0.000	0.000	0.988	1.189	3.38	22	2011-12-18	82.916	16.00	1.62	35.23	NA	5.12	85.70	2011.962	126.05	42.66	1.36
EB1112L3_05	0.000	0.000	0.278	2.919	3.18	5	2012-01-05	1.039	NA	0.04	2.58	0.01	0.41	13.94	2012.011	16.93	60.00	NA
EB1112L3_06	0.000	0.000	0.288	2.846	3.18	6	2012-01-05	1.414	NA	0.06	1.62	0.01	0.34	11.00	2012.011	12.96	59.00	NA
EB1112L3_08	0.000	0.002	0.154	2.255	3.18	8	2012-01-05	2.260	NA	0.05	1.00	0.00	0.28	8.50	2012.011	9.78	57.00	NA
EB1112L3_10	0.000	0.001	0.326	1.776	3.18	10	2012-01-05	3.210	NA	0.07	1.88	0.02	0.28	9.51	2012.011	11.67	55.00	NA
EB1112L3_12	0.000	0.004	0.222	1.478	3.18	12	2012-01-05	5.119	NA	0.06	1.68	0.03	0.26	10.76	2012.011	12.70	53.00	NA
EB1112L3_13	0.002	0.006	0.193	1.472	3.18	13	2012-01-05	7.098	NA	0.07	1.71	0.04	0.28	12.74	2012.011	14.73	52.00	NA

EB1112L3_15	0.000	0.000	1.170	2.138	3.18	15	2012-01-05	16.939	NA	0.08	7.98	0.01	0.51	23.76	2012.011	32.25	50.00	NA
EB1112L3_18	0.000	0.000	0.636	1.135	3.18	18	2012-01-05	30.721	NA	0.13	13.76	0.04	0.78	39.22	2012.011	53.76	47.00	NA
EB1112L3_20	0.010	0.017	0.394	0.828	3.18	20	2012-01-05	50.711	NA	0.43	41.10	NA	1.81	65.21	2012.011	108.12	45.00	NA
EB1112L3_22	0.000	0.002	0.688	1.136	3.18	22	2012-01-05	81.359	NA	1.38	41.10	NA	4.96	91.58	2012.011	137.64	43.00	NA
EB1213L1_05	0.000	0.002	0.390	3.380	3.61	5	2012-11-18	0.971	1.00	0.05	3.09	0.01	0.23	10.74	2012.880	14.06	60.00	10.81
EB1213L1_06	0.000	0.001	0.351	2.821	3.61	6	2012-11-18	1.433	1.20	0.05	3.58	0.01	0.21	9.83	2012.880	13.62	59.00	9.78
EB1213L1_08	0.000	0.015	0.288	1.658	3.61	8	2012-11-18	2.235	1.50	0.06	4.10	0.01	0.15	6.96	2012.880	11.20	57.00	8.00
EB1213L1_10	0.000	0.008	0.160	2.140	3.61	10	2012-11-18	3.247	1.80	0.07	1.60	0.01	0.15	8.51	2012.880	10.26	55.00	6.54
EB1213L1_12	0.000	0.002	0.120	2.146	3.61	12	2012-11-18	5.048	2.10	0.06	2.44	0.02	0.14	18.93	2012.880	21.50	53.00	5.35
EB1213L1_13	0.000	0.000	0.151	2.141	3.61	13	2012-11-18	6.961	2.30	0.06	3.38	0.01	0.15	9.00	2012.880	12.54	52.00	4.84
EB1213L1_15	0.000	0.000	0.692	1.540	3.61	15	2012-11-18	16.309	6.60	0.14	4.21	0.17	0.41	16.02	2012.880	20.63	50.00	3.96
EB1213L1_18	0.000	0.000	0.611	0.715	3.61	18	2012-11-18	30.214	10.50	0.25	NA	0.69	0.68	35.60	2012.880	NA	47.00	2.93
EB1213L1_20	0.000	0.000	0.366	0.488	3.61	20	2012-11-18	49.793	10.60	0.31	NA	1.04	1.19	54.54	2012.880	NA	45.00	2.39
EB1213L1_22	0.000	0.000	0.874	0.919	3.61	22	2012-11-18	80.727	15.70	0.94	NA	1.30	3.12	72.08	2012.880	NA	43.00	1.96
EB1213L2_05	0.000	0.001	0.242	3.219	3.35	5	2012-12-16	0.927	1.00	0.05	1.66	0.01	0.22	11.95	2012.956	13.83	60.04	9.39
EB1213L2_06	0.000	0.000	0.269	2.244	3.35	6	2012-12-16	1.355	1.20	0.04	3.60	0.01	0.20	9.41	2012.956	13.20	59.04	8.46
EB1213L2_08	0.000	0.000	0.151	1.560	3.35	8	2012-12-16	2.217	1.60	0.06	2.31	0.01	0.14	8.32	2012.956	10.77	57.04	6.88
EB1213L2_10	0.000	0.000	0.183	1.674	3.35	10	2012-12-16	3.236	2.00	0.07	3.84	0.01	0.16	8.67	2012.956	12.67	55.04	5.59

EB1213L2_12	0.000	0.000	0.108	2.192	3.35	12	2012-12-16	4.940	2.30	0.07	3.32	0.01	0.11	9.54	2012.956	12.97	53.04	4.54
EB1213L2_13	0.000	0.000	0.151	2.040	3.35	13	2012-12-16	7.044	2.60	0.08	3.52	0.01	0.17	11.19	2012.956	14.89	52.04	4.09
EB1213L2_15	0.000	0.000	1.272	2.021	3.35	15	2012-12-16	15.691	6.10	0.16	2.90	0.01	0.19	11.11	2012.956	14.20	50.04	3.32
EB1213L2_18	0.000	0.000	1.003	0.988	3.35	18	2012-12-16	30.244	11.10	0.27	NA	0.64	0.93	36.74	2012.956	NA	47.04	2.43
EB1213L2_20	0.000	0.000	0.610	0.836	3.35	20	2012-12-16	48.762	10.50	0.34	NA	0.88	1.43	51.77	2012.956	NA	45.04	1.98
EB1213L2_22	0.000	0.000	1.270	1.151	3.35	22	2012-12-16	78.300	14.70	0.92	NA	1.25	3.11	73.24	2012.956	NA	43.04	1.61
EB1213L3_05	0.000	0.000	0.169	2.287	3.23	5	2013-01-04	0.814	NA	0.03	2.05	0.02	0.38	11.45	2013.008	13.87	60.26	NA
EB1213L3_06	0.000	0.003	0.222	2.358	3.23	6	2013-01-04	1.206	NA	0.04	1.27	0.01	0.31	10.27	2013.008	11.85	59.26	NA
EB1213L3_08	0.000	0.000	0.092	1.823	3.23	8	2013-01-04	2.110	NA	0.06	2.05	0.01	0.19	8.42	2013.008	10.66	57.26	NA
EB1213L3_10	0.000	0.000	0.267	1.743	3.23	10	2013-01-04	3.069	NA	0.05	1.93	0.01	0.17	8.88	2013.008	10.98	55.26	NA
EB1213L3_12	0.000	0.000	0.623	2.512	3.23	12	2013-01-04	4.605	NA	0.06	1.05	0.01	0.23	10.74	2013.008	12.02	53.26	NA
EB1213L3_13	0.000	0.000	0.485	2.239	3.23	13	2013-01-04	6.220	NA	0.05	2.05	0.01	0.26	12.00	2013.008	14.30	52.26	NA
EB1213L3_15	0.000	0.000	1.888	3.286	3.23	15	2013-01-04	14.071	NA	NA	2.22	0.18	0.64	19.21	2013.008	22.07	50.26	NA
EB1213L3_18	0.000	0.000	0.934	1.188	3.23	18	2013-01-04	29.513	NA	NA	NA	0.59	0.67	34.00	2013.008	NA	47.26	NA
EB1213L3_20	0.000	0.000	0.351	0.679	3.23	20	2013-01-04	45.090	NA	0.45	NA	1.00	1.02	50.01	2013.008	NA	45.26	NA
EB1213L3_22	0.000	0.000	0.439	0.680	3.23	22	2013-01-04	74.141	NA	0.40	NA	1.17	2.70	67.36	2013.008	NA	43.26	NA
EB1314L1_05	0.139	0.585	0.458	4.251	3.81	5	2013-11-24	0.920	1.00	0.03	NA	0.06	0.26	11.30	2013.896	NA	60.30	6.96
EB1314L1_06	0.223	0.487	0.238	3.766	3.81	6	2013-11-24	1.259	1.10	0.03	NA	0.06	0.26	11.03	2013.896	NA	59.30	6.29

EB1314L1_08	0.255	0.447	0.150	2.181	3.81	8	2013-11-24	2.107	1.40	0.03	NA	0.11	0.15	9.46	2013.896	NA	57.30	5.15
EB1314L1_10	0.294	0.206	0.209	1.852	3.81	10	2013-11-24	3.108	1.90	0.04	NA	0.11	0.15	4.96	2013.896	NA	55.30	4.21
EB1314L1_12	0.197	0.111	0.195	2.067	3.81	12	2013-11-24	4.670	2.20	0.05	NA	0.28	0.25	9.63	2013.896	NA	53.30	3.44
EB1314L1_13	0.110	0.122	0.090	2.220	3.81	13	2013-11-24	6.425	2.40	0.05	NA	0.30	0.17	10.64	2013.896	NA	52.30	3.12
EB1314L1_15	0.004	0.091	0.444	2.532	3.81	15	2013-11-24	14.635	5.60	NA	NA	0.25	0.41	20.34	2013.896	NA	50.30	2.55
EB1314L1_18	0.018	0.078	0.340	0.789	3.81	18	2013-11-24	29.468	11.40	NA	NA	0.43	0.45	31.27	2013.896	NA	47.30	1.89
EB1314L1_20	0.017	0.020	0.338	0.546	3.81	20	2013-11-24	44.984	10.40	NA	NA	0.52	1.13	51.46	2013.896	NA	45.30	1.54
EB1314L1_22	0.000	0.034	0.209	0.097	3.81	22	2013-11-24	75.234	15.00	0.71	NA	1.05	2.32	71.45	2013.896	NA	43.30	1.26
EB1314L2_05	0.022	0.297	0.220	5.283	3.74	5	2013-12-13	0.907	NA	0.03	NA	0.01	0.30	12.79	2013.948	NA	60.56	NA
EB1314L2_06	0.102	0.255	0.125	2.892	3.74	6	2013-12-13	1.270	NA	0.04	NA	0.01	0.19	10.80	2013.948	NA	59.56	NA
EB1314L2_08	0.118	0.226	0.073	1.810	3.74	8	2013-12-13	2.164	NA	0.03	NA	0.01	0.16	8.49	2013.948	NA	57.56	NA
EB1314L2_10	0.127	0.154	0.121	1.662	3.74	10	2013-12-13	3.136	NA	0.04	NA	0.01	0.20	8.90	2013.948	NA	55.56	NA
EB1314L2_12	0.036	0.169	0.065	1.895	3.74	12	2013-12-13	4.816	NA	0.04	NA	0.05	0.18	10.16	2013.948	NA	53.56	NA
EB1314L2_13	0.019	0.130	0.099	1.856	3.74	13	2013-12-13	6.420	NA	0.05	NA	0.02	0.22	5.71	2013.948	NA	52.56	NA
EB1314L2_15	0.001	0.023	0.451	1.880	3.74	15	2013-12-13	14.768	NA	NA	NA	0.27	0.51	21.25	2013.948	NA	50.56	NA
EB1314L2_18	0.000	0.014	0.684	0.720	3.74	18	2013-12-13	29.770	NA	NA	NA	0.42	0.50	29.90	2013.948	NA	47.56	NA
EB1314L2_20	0.001	0.045	0.562	0.533	3.74	20	2013-12-13	45.942	NA	NA	NA	0.62	0.81	52.04	2013.948	NA	45.56	NA
EB1314L2_22	0.010	0.016	0.540	0.613	3.74	22	2013-12-13	75.264	NA	0.70	NA	0.93	2.46	67.18	2013.948	NA	43.56	NA

EB1415L1_05	0.000	0.000	0.584	6.387	4.27	5	2014-11-19	NA	0.90	0.04	NA	0.05	0.22	8.20	2014.882	NA	60.68	4.98
EB1415L1_06	0.000	0.008	0.496	5.403	4.27	6	2014-11-19	NA	1.00	0.04	NA	0.03	0.20	9.26	2014.882	NA	59.68	4.50
EB1415L1_08	0.000	0.023	0.561	3.117	4.27	8	2014-11-19	NA	1.30	0.04	NA	0.00	0.14	8.83	2014.882	NA	57.68	3.66
EB1415L1_10	0.000	0.016	0.276	2.060	4.27	10	2014-11-19	NA	1.80	0.05	NA	0.00	0.19	8.19	2014.882	NA	55.68	2.99
EB1415L1_12	0.000	0.011	0.436	1.954	4.27	12	2014-11-19	NA	2.10	0.08	NA	0.03	0.15	8.86	2014.882	NA	53.68	2.43
EB1415L1_13	0.000	0.008	0.352	1.802	4.27	13	2014-11-19	NA	2.40	0.08	NA	0.04	0.18	10.58	2014.882	NA	52.68	2.20
EB1415L1_15	0.000	0.006	0.315	1.433	4.27	15	2014-11-19	NA	4.90	0.12	NA	0.15	0.21	18.15	2014.882	NA	50.68	1.79
EB1415L1_18	0.000	0.010	0.769	0.640	4.27	18	2014-11-19	NA	12.00	0.19	NA	0.36	0.60	30.24	2014.882	NA	47.68	1.32
EB1415L1_20	0.000	0.000	0.574	0.586	4.27	20	2014-11-19	NA	10.10	0.27	NA	0.56	0.90	48.43	2014.882	NA	45.68	1.07
EB1415L1_22	0.000	0.002	0.548	0.759	4.27	22	2014-11-19	NA	13.80	0.64	NA	1.74	2.66	65.16	2014.882	NA	43.68	0.88
EB1415L2_05	0.000	0.004	0.196	4.212	4.12	5	2014-12-20	NA	0.70	0.04	NA	0.04	0.21	6.18	2014.967	NA	60.68	10.46
EB1415L2_06	0.000	0.006	0.369	3.856	4.12	6	2014-12-20	NA	1.00	0.04	NA	0.04	0.22	8.48	2014.967	NA	59.68	9.42
EB1415L2_08	0.000	0.010	0.274	3.047	4.12	8	2014-12-20	NA	1.40	0.04	NA	0.00	0.21	8.54	2014.967	NA	57.68	7.64
EB1415L2_10	0.000	0.010	0.428	1.974	4.12	10	2014-12-20	NA	1.80	0.05	NA	0.01	0.20	8.23	2014.967	NA	55.68	6.19
EB1415L2_12	0.000	0.000	0.517	2.180	4.12	12	2014-12-20	NA	2.30	0.05	NA	0.04	0.14	9.24	2014.967	NA	53.68	5.02
EB1415L2_13	0.000	0.000	0.587	1.840	4.12	13	2014-12-20	NA	2.50	0.06	NA	0.05	0.17	11.06	2014.967	NA	52.68	4.52
EB1415L2_15	0.000	0.000	0.794	1.840	4.12	15	2014-12-20	NA	5.20	0.17	NA	0.18	0.46	18.73	2014.967	NA	50.68	3.66
EB1415L2_18	0.000	0.000	1.239	1.425	4.12	18	2014-12-20	NA	12.70	0.22	NA	0.38	0.85	30.26	2014.967	NA	47.68	2.67

EB1415L2_20	0.000	0.004	0.907	1.193	4.12	20	2014-12-20	NA	10.30	0.36	NA	0.59	0.92	48.66	2014.967	NA	45.68	2.17
EB1415L2_22	0.000	0.000	0.897	1.328	4.12	22	2014-12-20	NA	14.10	0.75	NA	1.52	2.62	64.16	2014.967	NA	43.68	1.76
EB1415L3_05	0.000	0.003	0.279	3.452	4.08	5	2015-01-05	NA	NA	0.04	NA	0.02	0.34	9.09	2015.011	NA	60.73	NA
EB1415L3_06	0.000	0.003	0.341	3.290	4.08	6	2015-01-05	NA	NA	0.04	NA	0.02	0.23	10.42	2015.011	NA	59.73	NA
EB1415L3_08	0.000	0.000	0.416	2.459	4.08	8	2015-01-05	NA	NA	0.05	NA	0.00	0.22	8.19	2015.011	NA	57.73	NA
EB1415L3_10	0.000	0.000	1.302	2.159	4.08	10	2015-01-05	NA	NA	0.06	NA	0.00	0.22	8.08	2015.011	NA	55.73	NA
EB1415L3_12	0.000	0.000	0.618	2.044	4.08	12	2015-01-05	NA	NA	0.06	NA	0.02	0.12	9.09	2015.011	NA	53.73	NA
EB1415L3_13	0.000	0.000	0.551	1.921	4.08	13	2015-01-05	NA	NA	0.07	NA	0.03	0.23	11.11	2015.011	NA	52.73	NA
EB1415L3_15	0.000	0.000	1.206	2.256	4.08	15	2015-01-05	NA	NA	0.17	NA	0.15	0.36	20.11	2015.011	NA	50.73	NA
EB1415L3_18	0.000	0.000	1.283	1.338	4.08	18	2015-01-05	NA	NA	0.30	NA	0.32	0.69	31.43	2015.011	NA	47.73	NA
EB1415L3_20	0.000	0.007	0.701	0.929	4.08	20	2015-01-05	NA	NA	0.34	NA	0.54	1.35	50.66	2015.011	NA	45.73	NA
EB1415L3_22	0.000	0.024	0.608	1.343	4.08	22	2015-01-05	NA	NA	0.89	NA	1.58	2.79	64.94	2015.011	NA	43.73	NA