Ecological Processes in a Cold Desert Ecosystem: The Abundance and Species Distribution of Algal Mats in Glacial Meltwater Streams in Taylor Valley, Antarctica

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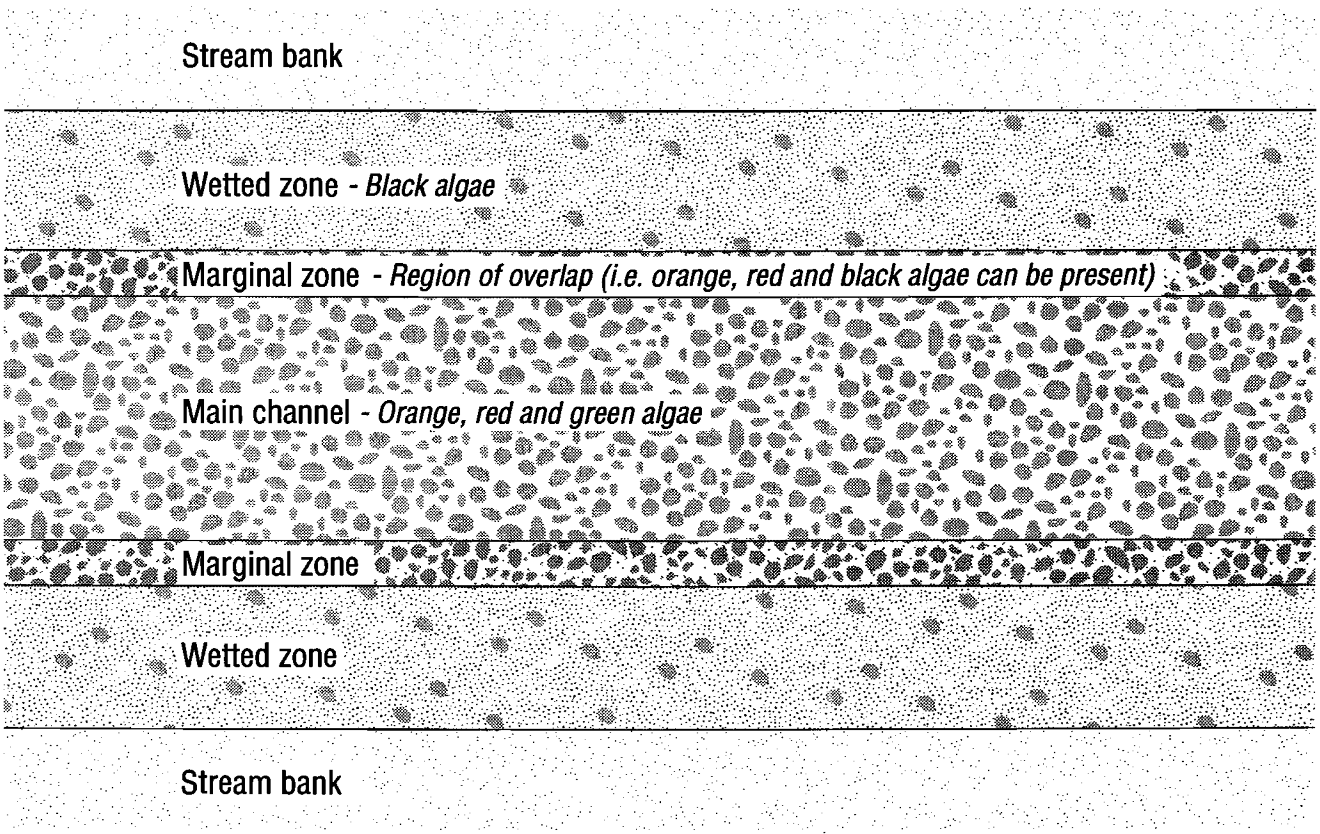

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ECOLOGICAL PROCESSES IN A COLD DESERT ECOSYSTEM: THE ABUNDANCE AND SPECIES DISTRIBUTION OF ALGAL MATS IN GLACIAL MELTWATER STREAMS IN TAYLOR VALLEY, ANTARCTICA

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ABSTRACT

The McMurdo Dry Valleys, located in South Victoria Land, are the largest of the polar desert oases found along the coast of Antarctica. Glacial meltwater streams are an important aquatic habitat in the McMurdo Dry Valleys. This report presents results on the abundance and species distribution of algal mats at 16 stream sites in Taylor Valley.

Results indicate that species of filamentous cyanobacteria are the most abundant algae in the dry valley streams. Algal mats were classified on the basis of on apparent color into four mat types. "Black-colored algae" were found in the wetted zone adjacent to the streambed and were primarily composed of *Nostoc*. "Green-colored algae" were found attached to the surface/undersurface of rocks in the main stream channel and were mainly composed of *Prasiola*. "Orange-colored" and "red-colored algae" occurred in the streambed regions with the greatest flow and had a greater diversity of species. The abundance of algal mats is controlled by sediment transport and the characteristics of the streambed. Algal mats were more abundant in streams where the streambed is composed of a stone pavement. In streams with abundant algal mats, the nutrient concentrations are lower than in streams with sparse algal mats.

PREFACE

The U.S. Long-Term Ecological Research (LTER) network is a wonderful gift to humanity, providing a thermometer to our earth's ecosystem health. Through studies that explore ecological phenomena over long temporal and broad spatial scales, the LTER program has substantively increased our understanding of how physical processes affect nutrient supply, population dynamics, and patterns of primary production.

The Institute of Arctic and Alpine Research has a long history in ecoscience surveys. Last year we celebrated 75 years of activities at our Mountain Research Station near Ward, Colorado. The station has engaged in continuous ecological research since 1952, and became one of the original NSF-LTER sites in 1981. INSTAAR scientists have participated strongly in other LTER sites, including Toolik Lake, Alaska. This polar-alpine connection has broadened recently to include LTER investigations in the McMurdo Dry Valleys, Antarctica.

The McMurdo Dry Valleys (MCMLTER) site is truly an end-member, being far drier and colder than any of the other 17 LTER sites. Frozen lakes, ephemeral proglacial streams, salt accumulation and simple ecosystems define the MCMLTER site. Biomass is dominated by algae and bacteria. INSTAAR is proud to include this substantive MCMLTER data report within its Occasional Paper series. We thank the authors for this contribution to science and long-term ecological research.

James P. M. Syvitski
Director, INSTAAR

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INTRODUCTION

Located on the western coast of the Ross Sea, the McMurdo Dry Valleys are the largest ice-free regions of Antarctica. These barren dry valleys are extremely cold, with air temperatures ranging from -45°C during the continually dark winter months to about 5°C during the continually light summer months. The valleys receive less than 10 cm of precipitation per year (Wharton, 1991), most of which typically falls as snow and is lost to sublimation within a matter of hours. The cold temperatures and arid conditions, coupled with catabatic winds descending from the Polar Plateau, make the McMurdo Dry Valleys one of the most extreme deserts in the world. Nevertheless, photosynthetically-based ecosystems exist in glacial meltwater streams. For most of the year, the stream beds are dry, and the algal mats are essentially "freeze dried." However, during the austral summers (from November to January) meltwater streams flow for a period of 6 - 10 weeks. Algal mats are present in the main channels of many of these streams or in rivulets draining the hyporheic zone and become photosynthetically active in as little as 20 minutes after becoming wet (Vincent and Howard-Williams, 1986). The algal mats mainly consist of filamentous cyanobacteria (*Oscillatoria* and *Nostoc*) and chlorophytes (*Prasiola*) while nematodes, tardigrades, and rotifers dominate invertebrate populations associated with the algae. Invertebrate groups common in temperate streams (insects, crustaceans, etc.) are absent.

Annual streamflow is highly variable and can change as much as 10-fold in one day depending upon air temperatures and insulating conditions (von Guerard et al., 1994). The regional summer temperatures in the dry valleys have increased in recent decades (Wharton et al., 1992). Warmer temperatures have resulted in increased streamflow and rising lake levels (Chinn, 1993). As a result, the stream ecosystems may be undergoing directional changes associated with longer periods of flow and greater peak flows (McKnight and Tate, in press).

Compared with most places on continental earth, life in Taylor Valley is very limited. Only a few species of lichen, moss, algae, and invertebrates exsist in the valley. Because of the extreme cold and arid conditions of Antarctica, the ephemeral streams of Taylor Valley are unique habitats. Unlike most temperate streams, annual flow is very limited (approximately 3 months) and can fluctuate immensely within a single 24-hour period. These influences present interesting challenges to living organisms in the streams, and provide a unique habitat for research and comparison.

Since the late 1950's, numerous short-term research projects (<3 yr) have been conducted in the McMurdo Dry Valleys to investigate stream ecology (Broady, 1982; Howard-Williams et al., 1986; Vincent and Howard-Williams, 1986, 1987, 1989; Vincent, 1988). In 1992, the McMurdo Dry Valleys were selected as a site in the NSF Long-Term Ecological Research (LTER) program, and the first season of field research in Taylor Valley was conducted in 1993/94. The LTER program consists of 18 research sites where long-term ecological studies are conducted in a variety of habitats. As part of the McMurdo (MCM)LTER, past and current information is being integrated into an overall landscape- or ecosystem-level synthesis.

Purpose and Scope

Taylor Valley, located in the McMurdo Dry Valleys, is the focus of the field research of the MCMLTER. The ephemeral streams of Taylor Valley are the links between glaciers and lakes. Twelve Taylor Valley streams were chosen to investigate the spatial distribution of algal species composition and biomass. Most previous ecological studies of streams in Taylor Valley focused primarily on Canada Stream, a stream with extensive algal mats (Broady, 1982; Howard-Williams et al., 1986; Vincent and Howard-Williams, 1986, 1987, 1989; Vincent, 1988). For the MCMLTER project, a range of streams with varying degrees of algal abundance were examined to identify the factors controlling the distribution and abundance of algae. These potential controlling factors include topography, nutrients, major ions, moisture, gradient, and sediment grain size. At each stream, one to three transects were established for long-term monitoring.

The purpose of this report is to present the results of algal species abundance and distribution at these stream transects. Ancillary data on stream channel characteristics, bed-material size distribution, streamflow, and water chemistry are presented as well.

DESCRIPTION OF THE TAYLOR VALLEY SITE

Located on the southern coast of Antarctica, Taylor Valley is found at 78°S latitude and 164°E longitude (Fig. 1). The Asgard Range borders the valley to the north, and the Kukri Hills lie to the south. At the head of the valley lies Taylor Glacier--a terminal glacier from the Polar Plateau. Numerous alpine glaciers exist in the hills surrounding Taylor Valley. The two prominent glaciers that feed several meltwater streams in the lower Taylor Valley are the Canada and Commonwealth glaciers.

During the austral summer, meltwater streams drain the glaciers into the valley's permanently ice-covered lakes. The Taylor Valley contains four lakes--Lake Fryxell, Lake Chad, Lake Hoare, and Lake Bonney. All of the lakes are closed basins, except for Lake Chad, which flows into Lake Hoare. Due to the recent increase in summer runoffs, Lake Chad and Lake Hoare have begun to merge (McKnight and Andrews, 1993). These lakes are permanently ice-covered and the meltwater streams are the primary sources of water, major ions, and nutrients. Thus, the streams are a critical link in the trophic interactions and biogeochemical cycles of Taylor Valley. Twelve streams with significant flow were chosen for the long-term study. Huey Creek, Canada Stream, Bowles Creek, Green Creek, Delta Stream, and Von Guerard Stream were studied in the Lake Fryxell Basin; Andersen Creek, House Creek, and Wharton Creek were studied in the Lake Hoare Basin; Priscu Stream, Lawson Creek, and Bohner Stream were studied in the Lake Bonney Basin. Stream reach varied in length from 0.3 kilometers (Lawson Creek) to 11.2 kilometers (Delta Stream) (Table 1).

Table 1. Stream lengths for Taylor Valley streams.

Stream	Length (km)
Huey Creek	2.1
Canada Stream	1.5
Bowles Creek	0.9
Green Creek	1.2
Delta Stream	11.2
Von Guerard Stream	4.9
Andersen Creek	1.4
House Creek	2.0
Wharton Creek	1.0
Priscu Stream	3.8
Lawson Creek	0.3
Bohner Stream	1.2

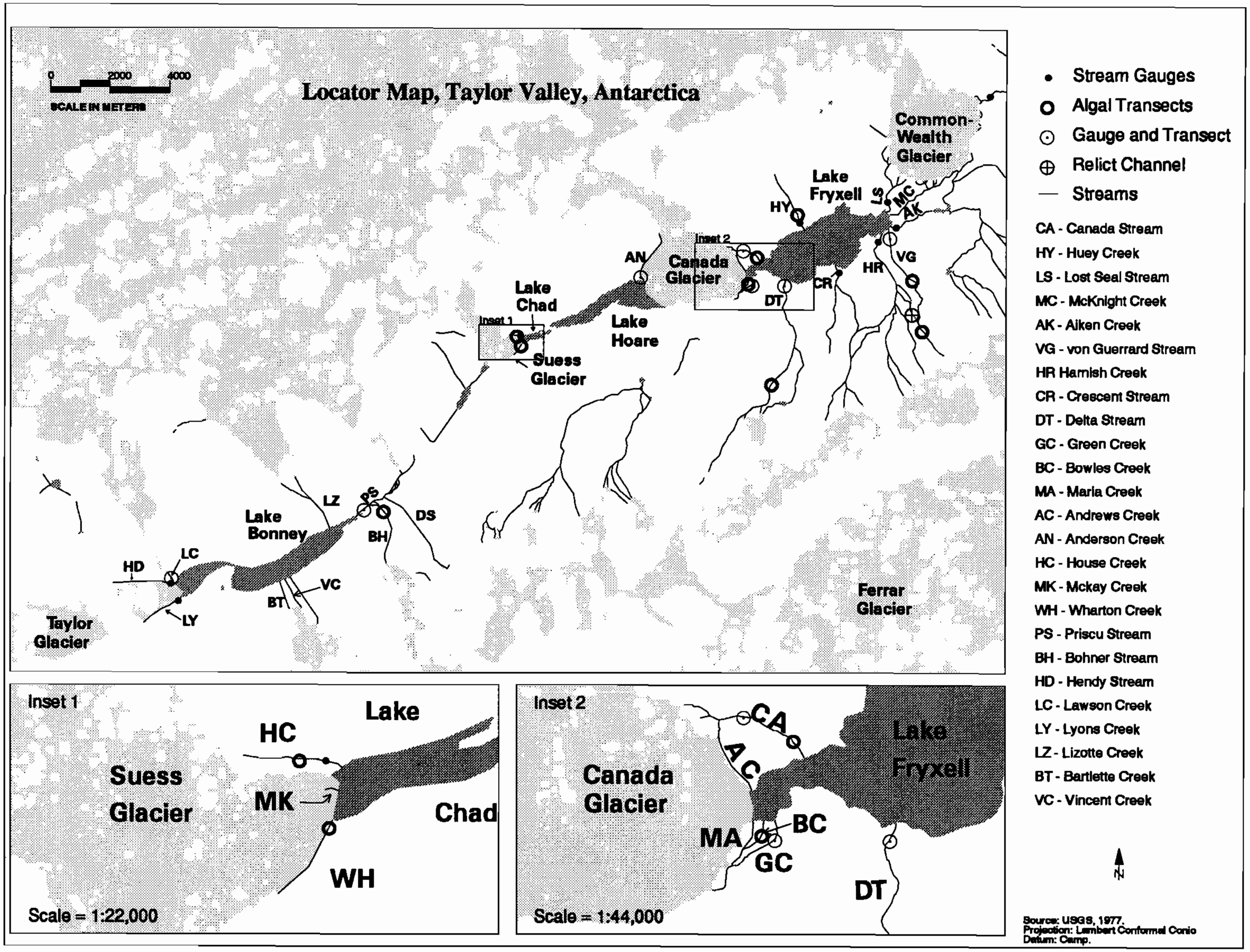

Figure 1. Map of Taylor Valley showing the three lakes and stream transect sites.

In the past 10-20,000 years, water levels in the closed basin lakes were much higher (Doran et al., 1994). Strand lines from past lake shores are evident, and several of the streams in Lake Fryxell basin cut through perched deltas. Preserved algal matter found within these perched deltas has been dated to infer history of lake-level change. Approximately 3,000-1,000 years ago, the lakes completely dried up, after which time they slowly began to refill (Green et al., 1989). Since the early 1900's, lake levels in Taylor Valley have been rising due to increased streamflow associated with longer periods of temperatures above freezing (Chinn, 1993).

Streams

Stream flow varies greatly depending upon air temperatures and insolating conditions. The streambeds are generally sandy and unstable, and during periods of peak flow, large quantities of sediment are moved. As a result, deposition of sediment in shallow reaches can be several centimeters thick during high flow events. As the streamflow proceeds, a moist region adjacent to the stream can be observed which corresponds to the hyporheic zone, or zone of subsurface flow. A tracer study demonstrated the exchange of water between the open channel and the hyporheic zone is rapid compared to other stream systems and the weathering reactions in the hyporheic zone are a source of nutrients and major ions to the streams (McKnight and Andrews, 1993). Because the streams are located in a barren desert valley, they receive no external inputs of organic carbon. The only inputs into the closed basin lakes are the austral streams and the aeolian sediment on the lake ice surface. Thus, the streams serve as the primary linkage between the terrestrial and aquatic systems, providing necessary solutes and nutrients to the lakes.

Algae

Although vascular plants are absent in Taylor Valley, the streams contain abundant algae. Algal mats found in these streams primarily consist of cyanobacteria (*Oscillatoria, Phormidium, Nostoc*), chlorophyta (*Prasiola*), and bacillariophyta (diatoms). The algal mats are desiccated and frozen for a majority of the year. The microbial mats, however, begin photosynthesizing in as little as 20 minutes after rehydration (Vincent and Howard-Williams, 1986). Within the algal mats, sheath pigments are concentrated in the upper layer and the chlorophyll *a* was mostly located in the lower layer of the mat, suggesting that most of the photosynthetic biomass is in the lower layer (Vincent et al, 1993). Because streamflow can vary as much as 10-fold in one day, the depth and lateral extent of water over the streambed varies substantially within a few to several hours. Depending on stream gradient and bed-material size, substrate erosion and deposition can dramatically restructure the streambed within a matter of hours. As a result, in some streams algae are limited to the edges of the stream channel or in hyporheic zone seeps. In such locations, the algal mats are protected from the abrasive effects of sediment transport, but the mats are exposed to dessication and continuous sunlight during the summer.

Studies on the algal flora of the Antarctic continent date back to the early 20th century (West and West, 1911; Fritsch, 1912, 1917). Little information, however, concerning algal species distribution across stream sites has been collected. Hirano (1979) examined the algal flora of the Yukidori Zawa stream in Dronning Maud Land and Broady (1982) studied the algal flora of Canada Stream in Taylor Valley. Each of these studies focused on single streams with abundant algal mats. This study examined multiple streams with varying biomass levels in three separate closed basins to identify factors controlling algal species abundance and distribution. [For other studies involving Antarctic algae, see Broady (1979), Seaburg et al. (1979), Howard-Williams, et al. (1986), Howard-Williams and Vincent (1989), and Prescott (1979).]

METHODS OF SAMPLE COLLECTION AND ANALYSIS

Transects were established on Taylor Valley streams during January, 1994 (Table 2). Generally, one transect was established on each stream; however, two to three transects were established for the longer streams with greater biomass in Fryxell Basin (i.e., for Canada, Delta, and Von Guerard streams). Transects ranged in length with a typical transect being approximately 40 meters across.

Table 2. Latitude(S) and longitude(E) measurements of Taylor Valley stream transects.

[Ck.=Creek, and St.=Stream,Guer.=Guerard]

SITE		LATITUDE	LONGITUDE
Huey Ck.	(start)	-77°36′ 7.789″	163° 7′21.849″
near gage	(end)	-77°36′ 6.037″	163° 7′18.106″
Canada St.	(start)	-77°36′47.669″	163° 3′ 9.675″
near gage	(end)	-77°36′48.237″	163° 3′ 2.883″
Canada St.	(start)	-77°36′52.543″	163° 4′11.498″
at delta	(end)	-77°36′53.345″	163° 4′12.421″
Bowles Ck.	(start)	-77°37′23.999″	163° 3′27.354″
near gage	(end)	-77°37′23.164″	163° 3′25.526″
Green Ck.	(start)	-77°37′26.369″	163° 3′30.212″
above gage	(end)	-77°37′27.914″	163° 3′33.528″
Delta St.	(start)	-77°39′11.564″	163° 5′58.855″
at upper site	(end)	-77°39′10.270″	163° 5′51.629″
Delta St.	(start)	-77°37′31.796″	163° 6′38.887″
at gage	(end)	-77°37′33.157″	163° 6′30.297″
Von Guer. St.	(start)	-77°38′ 4.424″	163°18′19.031″
at upper site	(end)	-77°38′ 3.163″	163°18′26.391″
Von Guer St.	(start)	-77°36′33.213″	163°15′19.076″
at gage	(end)	-77°36′34.111″	163°15′10.822″
Von Guer. St.	(start)	-77°37′ 9.483″	163°17′18.526″
at lower site	(end)	-77°37′10.770″	163°17′14.857″
Andersen Ck.	(start)	-77°37′22.503″	162°54′22.696″
near gage	(end)	-77°37′22.761″	162°54′26.687″
House Ck.	(start)	-77°36′ 7.789″	163° 7′21.849″
near gage	(end)	-77°36′ 6.037″	163° 7′18.106″
Wharton Ck.	(start)	-77°38′42.203″	162°44′42.348″
at delta	(end)	-77°38′41.785″	162°44′46.432″
Priscu St.	(start)	-77°41′48.696″	162°32′23.240″
near gage	(end)	-77°41′46.416″	162°32′14.267″
Lawson Ck.	(start)	-77°43′13.298″	162°16′ 7.595″
near gage	(end)	-77°43′14.228″	162°15′59.715″
Bohner St.	(start)	-77°41′49.097″	162°33′50.099″
at lower site	(end)	-77°41′51.735″	162°33′35.765″

Within each transect, algal mats were visually identified as either orange, red, black, or green. Not all types of algal mats were found within every transect. A maximum of five algal samples of each color were collected from each transect using a #13 cork borer (diameter = 17 mm, area = 227 mm^2). The exact location of sample collection was mapped on small-scale stream contour maps. Algal samples were preserved in 10% formalin for laboratory identifications. In all, 141 algal samples were collected from 12 streams. A maximum of five additional algal samples of each color were collected for chlorophyll and ash-free dry mass (AFDM) analyses. Moss samples were also collected for identification, chlorophyll and AFDM analysis using the same method as for algae samples.

Streamflow was measured at the time of sample collection using a pygmy current meter. Measurements were made at the narrowest point in the stream within the mapped area. Therefore, velocities represent maximum velocities occurring in the reach for the discharge at the time of mapping. Water samples were collected in polyethylene bottles for nutrient and major ion analyses. Pebble counts were made by a random walk approach (Wolman, 1954). The intermediate axis (i.e., b-axis) of the bed particles were measured. The smallest particles sampled were 1.4 cm. At sites with abundant algal mats, pebble counts were done in reaches immediately above and below the mapped reach to minimize disturbance. In reaches where the rocks were imbedded in a stone pavement, the rocks were not picked up, but were measured in place.

Preserved algal samples were examined in the laboratory to determine species composition and relative abundance using a Nikon Diaphot phase contrast microscope. Samples were well mixed to attain an even (random) sampling of mat (some small "clumps" of algae were still present, but these did not affect the objectives of this study), and then subsamples of 2 ml were withdrawn. Each subsample was placed in a 2-ml settling chamber with a 26 mm diameter (Utermöhl, 1958) and examined at x400 magnification. To get a representative count of relative species abundance, seven random fields (a total area of 0.44 mm^2) needed to be examined per subsample. Within each field, algae were identified to genus and species where possible (excluding diatoms, which were counted but not identified.) [For a discussion on the diatoms of Lake Hoare see Spaulding et al. (1996). Note, however, that the diatom flora of Taylor Valley streams differs from the diatoms sampled in Lake Hoare (Spaulding, personal contact). It is suggested that these stream diatom flora deserve more detailed investigation.] Percent cover was determined in each field by measuring the length and width of all specimens using an ocular micrometer. Cell "depth" was also measured in order to estimate biovolume. All seven fields were then tallied, and the percentage of the total algal biomass was determined for each taxa. Taxonomic identifications were primarily based on classical Antarctic literature such as Fritsch (1912) and West and West (1911). Other related studies include Broady (1982, 1991), Hirano (1979, 1983), and Vincent and Howard-Williams (1987, 1989). Invertebrates were estimated by examining the entire slide at low power and assigning a subjective scale of rare (1-2 organisms), moderate (2-10 organisms), and abundant (10-50 organisms).

Samples for chlorophyll and AFDM measurements were filtered through GF/C glass fiber filters and frozen. Chlorophyll was extracted in buffered acetone and analyzed spectrophotometrically using the trichromatic method (Strickland and Parson, 1968). AFDM samples were dried (100°C) for 24 hours, weighed, ashed (450°C) for 4 hours, rehydrated with water, dried for 24 hours, and reweighed. Nutrient data (NH_4, PO_4, NO_2, NO_3, and DIC) was obtained from two separate tests. Frozen, filtered samples were analyzed in McMurdo during February, 1994 using standard colorimetric methods adapted for 10-ml samples. The samples were then refrozen and reanalyzed in July-August, 1994 using a Lachat Quickchem AE. Water samples for major element chemistry were filtered on 0.4-μm membrane filters and analyzed using a Dionex ion chromatography instrument (Welch et al., 1996).

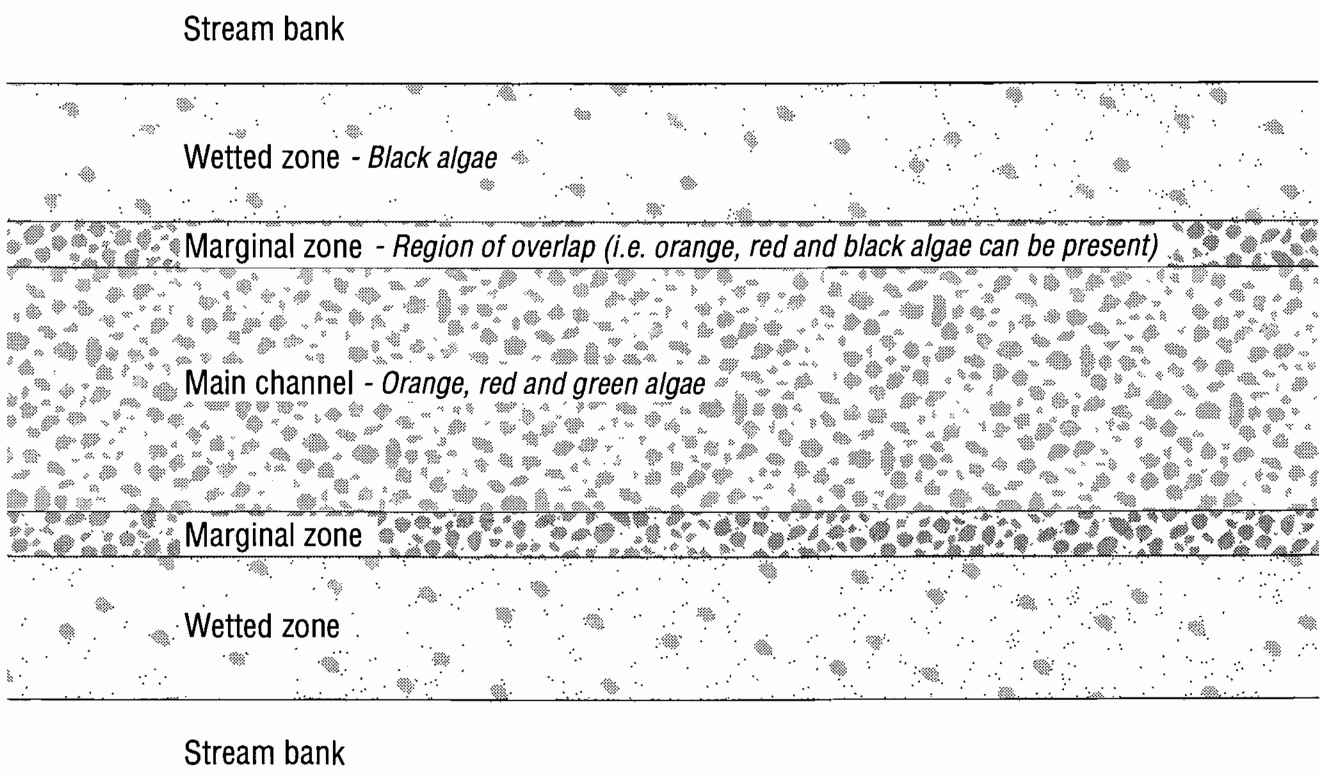

Figure 2. General algal species distribution across a Taylor Valley stream reach.

Table 3. List of algal taxa from Taylor Valley streams.

[Categories are abbreviated as follows: O, orange; B, black; G, green; R, red. Streams are abbreviated as follows: HY, Huey Creek; CA, Canada Stream; BC, Bowles Creek; GC, Green Creek; DT Delta Stream; VG, Von Guerard Stream; AN, Andersen Creek; HC, House Creek; WH, Wharton Creek; PS, Priscu Stream; LC, Lawson Creek; BH, Bohnner Stream.]

TAXA	CATEGORY	LOCATION
CYANOPHYTA		
Oscillatoria subproboscidea W. & G.S. West		
morph. A	O,B,G,R	HY, CA, BC, GC, DT, VG, AN, HC, WH, PS, LC, BH
morph. B	O,B,G,R	CA, BC, DT, VG, WH, BH
Oscillatoria irrigua Kützing		
morph. C	O,B,G,R	HY, CA, BC, GC, DT, VG, AN, PS, BH
morph. D	O,B,G,R	HY, CA, BC, GC, DT, VG, AN, WH, LC
Phormidium crouani Gomont		
morph. E	O,B,G,R	HY, CA, BC, GC, VG,
Oscillatoria koettlitzi Fritsch		
morph. F	O,B,G,R	CA, GC, DT, VG, WH, PS
morph. G	O,B,G,R	CA, DT, VG, WH, PS
morph. H	O,B,G,R	HY, CA, BC, GC, DT, VG, AN, WH, BH
Phormidium autumnale (Agardh) Gomont		
morph. I	O,B,G,R	CA, TC, GC, DT, VG, WH, PS, LC
morph. J	O,B,G,R	CA, GC, DT, VG
morph. K	O,B	HY, GC, WH
P. frigidum Gomont & *O. deflexa* W. & G.S. West		
morph. L	O,B,G,R	HY, CA, BC, GC, DT, VG, AN, HC, WH, PS, LC, BH
Microcoleus vaginatus (Vaucher) Gomont		
morph. M	O,B,R	CA, DT, VG, WH
Calothrix intricata Fritsch	O,G,R	CA, DT
Chroococcus minutus (Kützing) Nägeli	O,B,G	HY, CA, BC, GC, DT, VG, WH
Gleocapsa kuetzingiana Nägeli	O,B,G,R	HY, CA, GC, DT, AN, PS, LC
Gleocapsa sp.	O	HY
Nodularia harveyana Thuret	O,B,G,R	CA, DT
Nostoc spp.	O,B,G,R	HY, CA, BC, GC, DT, VG, WH, LC

[Categories are abbreviated as follows: O, orange; B, black; G, green; R, red. Streams are abbreviated as follows: HY, Huey Creek; CA, Canada Stream; BC, Bowles Creek; GC, Green Creek; DT Delta Stream; VG, Von Guerard Stream; AN, Andersen Creek; HC, House Creek; WH, Wharton Creek; PS, Priscu Stream; LC, Lawson Creek; BH, Bohnner Stream.]

TAXA	CATEGORY	LOCATION
CHLOROPHYTA		
Actinotaenium cucurbita (Brébisson) Teil	O,B,G,R	CA
Asterococcus sp.	B	GC
Binuclearia tectorum (Kützing) Beger	O,B,G,R	HY, CA, BC, GC, DT, VG, PS, LC
Chlorella sp.	O,B,G	HY, GC, DT, VG
Desmid sp.	B	CA
Indeterminate unicells	O,B,G,R	HY, CA, BC, DT, VG, HC, WH, PS, LC
Indeterminate branched filament	G	CA
Indeterminate colony	B	DT
Prasiola calophylla (Carmichael) Meneghini	O,B,G	VG, AN, BH
Prasiola crispa (Lightfoot) Meneghini	G	CA, DT
BACILLARIOPHYTA		
Diatom spp.	O,B,G,R	HY, CA, BC, GC, DT, VG, AN, HC, WH, PS, LC, BH
Marine diatom fragment	O	VG
CHRYSOPHYTA		
Chrysophyte cysts	O,B,R	HY, CA, BC, DT
EUGLENOPHYTA		
Euglena sp.	B,G	GC, CA

RESULTS

Algal Taxa

In all, over thirty taxa of algae were identified in Taylor Valley streams. Table 3 lists the types of mats (orange, red, green, or black) in which these taxa occurred and identifies the streams where these taxa were found. Detailed descriptions of these taxa are listed in Table 15 in the "Supplemental Data" section. Species belonging to the family Oscillatoriaceae were divided into thirteen distinct morphotypes to allow for finer distinctions to be made concerning physical characteristics. These morphotypes were defined based on the following characteristics described by Broady (1991): trichome width, cell length, presence or absence of a calyptra (thickened membrane on the terminal cell), occurrence or otherwise of numerous trichomes within a common sheath, and shape of the apical cell. Each morphotype was then assigned to the species that most closely matched its description (Table 4). In many cases, more than one morphotype was assigned to a single species. Morphotype L consisted of trichomes less than 2.5 μm in width, making them very difficult to distinguish at x400 magnification. As a result, two species of Oscillatoriales (*Phormidium frigidum* and *Oscillatoria deflexa*) were assigned to this particular morphotype.

Table 4. Species list for Oscillatoriaceae morphotypes found in Taylor Valley streams.

[Analyses by U.S. Geological Survey; O.=Oscillatoria; P.=Phormidium; M.=Microcoleus. Table adapted from Broady and Kibblewhite, 1991. References are based on classical Antarctic literature.]

Morphotype	Species	Reference
A B	*O. subproboscidea*	West and West (1911)
C D	*O. irrigua*	West (1927)
E	*P. crouani*	Hirano (1983)
F G H	*O. koettlitzi*	Fritsch (1912)
I J K	*P. autumnale*	West and West (1911)
L	*P. frigidum* & *O. deflexa*	Fritsch (1912); West and West (1911)
M	*M. vaginatus*	Fritsch (1912)

Site Descriptions and Algal Distribution

Species composition and abundance varied greatly between streams. Tables 16-31 (Supplemental Data) list the taxa found at each site and their relative abundances while the percent composition that each species makes are graphically illustrated in Figures 4-19 (Supplemental Data). The small-scale topographic maps of the sites are presented in Figures 20-34 (Supplemental Data). Location of stream gages and transects can be found in Figure 1. A brief discussion about each stream follows.

Huey Creek

Huey Creek drains a small glacier that lies in a steep-sided hollow. In the upper stream reaches, the gradient is steep, with high banks subject to erosion during peak flows. In the lower 2 km the gradient is shallow, the stream-bed is wide and braided, and the banks are more gently sloping. The transect is located near the beginning of the more shallow gradient reach, about 1.5 km above the stream gage. During high flow periods, this reach will experience high bed-material transport rates and possible substantial net erosion or deposition depending upon the supply of sediment from upstream. The source ice sheet only receives direct sunlight for a limited period each day, therefore, flow in Huey Creek typically goes through a diel cycle with a large amplitude (factor of 10 change in flow). During the morning, low flow period of the diel cycle, streamwater is often clear, but during the afternoon peakflow, streamwater is turbid.

Algal mats were very sparse within the transect area. Only orange algal samples were collected from a hyporheic seep adjacent to the main channel of Huey Creek (Fig. 28). The orange algal samples were primarily a mixture of filamentous Oscillatoriaceae. However, these samples also contained a high abundance of other algal species (i.e., species diversity was very high). Orange (*Gleocapsa* sp.) algal samples #3 and #4 were the only two samples from all of the studied streams to have a rare species of *Gleocapsa*. Species diversity was probably high because the samples were collected from a seep rather than from the main channel. Seeps are less vulnerable to the abrasive effects of sediment transport and generally have a broader range of species. Invertebrates were rare (Table 16).

Canada Stream

Canada Stream is one of the major sources of inflow to Lake Fryxell and is typically the first stream in the basin to begin flowing in the austral summer. Canada Stream drains the east side of the Canada Glacier and is the location of the Site of Special Scientific Interest in Fryxell Basin. Algal mats and moss communities have been the focus of several previous research studies as already mentioned in this report. The gage is located at the site of a previous rock weir about 1.5 km above the lakeshore. In this reach, the particles in the streambed are rounded and wedged together. At the gage, flow draining the upper glacier has joined with flows from a large pond at the base of the glacier. The pond contains abundant moss and algae which may be sources for downstream populations of moss and algae.

Between the gage and the lakeshore the stream flows through a steeply incised channel with large boulders in the streambed and then across a broad alluvial fan. The alluvial fan is referred to as a "delta site" and is the only transect site that does not go all the way across the stream, but rather encompasses a section along the east side of the alluvial fan. Streambed particles are rounded and arranged in a flat pavement configuration. A pebble count was conducted without actually picking up the rocks to avoid causing disturbance to the streambed.

Two transects, one near the gage and one at the delta, were established on this stream. Algal mats were very abundant, covering the streambed at both sites. Orange, red, green, and black algae samples were collected near the gage. The orange samples contained a wide mixture of filamentous Oscillatoriaceae. The black algal samples were dominated by *Nostoc,* and a single desmid was found in black sample #1. The green algal samples were dominated by *Prasiola crispa*, while the red algal samples were largely filamentous Oscillatoriaceae including the rarely found morphotype J (*Phormidium autumnale*). In nearly all samples collected from this transect, *Actinotaenium cucurbita* was present, including significant percentages in all five orange algal samples. The orange, red, and green samples were all collected from the main flow channel of the stream, while the black algae samples were collected from the wetted zone (see Fig. 22). Invertebrates were common within the gage transect samples.

At the delta transect, red, green, and black algae samples were collected. An unusual mixture of species was found in the red samples. Red sample #1 was high in diatoms (55% of the total algal biomass), samples #1, #3, and #5 were high in *Nostoc* (40%, 65%, and 40%, respectively), and samples #2 and #4 were a mixture of filamentous Oscillatoriaceae. The black samples were dominated by *Nostoc*, while the green samples were dominated by *Prasiola crispa*. An unusual, indeterminate branched filament was found in green sample #2. Invertebrates were moderately abundant at the delta transect.

Bowles Creek

Bowles Creek is a small (0.9 km) creek that drains ponds fed by flows from the tongue of Canada Glacier, and enters Lake Fryxell on the west end of the south shore. The gradient is shallow and the channel is narrow (about 3 m across). The streambed is composed of a stable "stone pavement." Algal mats are abundant a different zones of algal mats (i.e. orange, black, etc.) occur symmetrically on either side of the channel. A transect was established above a small parshall flume. The flow in Bowles Creek is well correlated with the flow in the adjacent Green Creek, which drains the same network of ponds.

Orange and black algal samples were collected from the transect established above the gage. All of the samples except orange sample #4 were dominated by *Nostoc* spp. Some species of *Nostoc* often appear orangish in color (Broady, 1979). It is presumed that two distinct species of *Nostoc* were collected within this transect--one species being more orangish in color and the other being more dark-brown or black in color. [Due to the complexity of the *Nostoc* life-cycle (Mollenhauer, 1988), an exact determination of the species of *Nostoc* present in the samples could not be made without examining live cultures.] Most of the black algal samples were collected outside or just within the edge of the main flow channel, while the orange samples all were collected within the main channel, also indicating that two species of *Nostoc* were growing within the transect. However, further study examining the *Nostoc* in culture is required to determine if there are indeed two species. Invertebrates were moderately abundant.

Green Creek

Green Creek, which is adjacent to Bowles Creek, has a similar shallow gradient, but has a larger discharge. The channel is broad with low banks. The streambed particles are similarly arranged in flat pavement for most of the reach. Algal mats are abundant and quite thick. The gage on Green Creek is located in the mid-section of the stream and is a natural channel control site with minimal streambed disturbance.

One transect was established on this creek above the gage. Orange and black algal samples were collected from this transect. The orange algae consisted of a mixture of filamentous Oscillatoriaceae, *Nostoc*, and diatoms. The percentage of morphotype A (*Oscillatoria subproboscidea)* in the orange algal samples appears to be inversely proportional to the percentage of morphotype C (*Oscillatoria irrigua)*, but factors controlling this relation remain unknown. The black algal samples were dominated by *Nostoc*, and a species of *Euglena* was found in black samples #2 and #3. All orange algal samples were collected within 2 m of the stream's thalweg (the down channel course of the greatest cross-sectional depth). On the other hand, the black algal samples were all collected from minimal flow regions at the creek channel's edge (see Fig. 26). Invertebrates were moderately abundant in the Green Creek transect.

Delta Stream

Delta Stream is the longest stream (11.2 km) and is located on the south shore of Lake Fryxell which drains Howard Glacier in the Kukri Hills. The stream cuts through a series of perched deltas deposited during previous high lake stands; hence its name. In the upper reaches (above 1 km from the lakeshore) the stream has a moderate gradient and a wide streambed with a stone pavement similar to that in Green Creek. Algal mats are abundant in these upper reaches. The gage is located about 100 m above the outlet of the stream to the lake. The reach between the gage and the lake has a shallow gradient, and there is a steep bank on the west side of the channel.

Two transects, one upper site and one at the gage, were established on this stream. Samples of orange, black, and green algal mats were collected from the abundant algal mats of the upper transect. The upper site appears to be representative of the distribution and abundance of algal mats in most of the stream until about 0.5 km above the outlet to the lake. The orange algae was primarily a mixture of filamentous Oscillatoriaceae, but *Nostoc* and diatoms were also significant. Black algal samples collected at the upper transect were dominated by *Nostoc*, and an indeterminate colonial species of algae was identified in samples #2, #4, and #5. The green algal samples contained an abundance of *Prasiola crispa*. Black samples were collected from the edges of the stream channel, while the green and orange samples were collected closer to the center of the stream channel in the main flow zone. Rotifers and tardigrades were abundant in the upper transect samples.

Black and green algae were collected from the gage transect. *Nostoc* was predominate in the black algae except for sample #1 which had a high percentage (64%) of morphotype I (*Phormidium autumnale*). Green algal samples collected at the gage transect were dominated by large filamentous colonies of morphotype A (*Oscillatoria subproboscidea*). At this transect, a broad, shallow seep flowed into the main stream channel. The black algal samples were collected across this shallow flow zone, while the green algae were collected in a deeper reach of water where the seep connected with the main channel. Invertebrates were moderately abundant in the samples collected at the gage transect.

Von Guerard Stream

Von Guerard Stream is similar to Delta Stream in most characteristics. Three transects (upper, lower, and gage) were established on Von Guerard Stream. A downstream series of sites were also established in a relict channel. The upper transect site is located in a steep gradient reach near the source glacier. In this transect, the streambed has incised the glacial till, leaving steep-sided banks. The streambed is composed of large cobbles and boulders embedded with sand. From the accumulation of wind-blown snow, the streambed may be snow-covered for some time into the summer. Algal mats are sparse at this site. Below the steep upper reach, the gradient becomes gentle. Most of the flow (about 75%) is directed down a primary channel on the east. The remaining flow goes to the west and drains out into a broad, flat area. During low flow periods, a large area of alluvium is saturated. Under high flow, shallow pools form. Below this flat area, the gradient steepens, and a well-defined channel can be observed on the west side. However, flow had not been recorded in this channel during the summers of 1990/91, 1991/92, and 1993/94. Both the 1990/91 and 1991/92 summers were warm and the streamflows were high relative to previous years. The well-defined channel, with banks as high as 2-3 m in some reaches, suggests that during some period in the past a larger proportion of the flow from the steep upper reach was directed westward and into this channel. This relict channel joins Harnish Creek about 3 km from the outlet of Harnish Creek to the lake.

In early January 1995 a short sandbag wall was put in place to direct more of the flow from the upper reach to the west. The streamflow did not spread out across the flat area as much as expected, but rather followed a distinct route with some ponding in certain areas. The 1994/95 summer was relatively cold with low streamflows throughout the dry valleys. As a result, the flow advanced about 1.5 km within the two weeks after the installation of the sandbag wall before flow in the upper reach ceased altogether. Although the relict channel had not been apparent in this flat region beforehand, we observed that the flow encountered algal mats that when wetted began to grow. Four sampling sites were established in this upper reach of the relict channel.

The lower transect site on Von Guerard Stream is located below the flat region in a reach with moderate gradient and wide streambed with large, rounded particles in a flat stone pavement embedded in sediment. Algal mats cover most of the streambed at this site. (Particles were not picked up during the pebble count to minimize disturbance.) The algal abundance and streambed characteristics at this lower transect are representative of conditions extending down to within 0.5 km of the outlet to the lake.

The transect site at the gage is located in a sandy deltaic area where the stream channel is braided. Here, the algal mats are more abundant in the side channels and at the edge of the main channel than in the main channel itself.

Orange, black, and green algal samples were collected at the upper transect site. Orange samples #1, #3, and #4 were dominated by morphotype I (*Phormidium autumnale*), sample #2 was predominately morphotype A (*Oscillatoria subproboscidea*), and sample #5 was a broad mixture of algae including filamentous Oscillatoriaceae, diatoms, *Prasiola calophylla*, and *Nostoc*. Only one black algal sample was collected from the upper transect, and it primarily consisted of *Nostoc*. Two green algal samples were collected from the transect. Green sample #1 was predominately *Prasiola calophylla*, while sample #2 was dominated by *Oscillatoria subproboscidea*. Rotifers were abundant at the upper transect, but other invertebrate species were rare.

Two black algal samples were collected from the relict channel transect. These black samples were dominated by *Nostoc*, but a large number of other species were also present. The high species diversity was an indication of these taxa's ability to remain in a dormant condition for several years without being wetted. Invertebrates also were abundant in the relict channel transect samples.

At the lower transect site, orange and black algal samples were collected. The orange samples consisted of a mixture of filamentous Oscillatoriaceae, *Nostoc*, and diatoms. Surprisingly, all orange samples had unusually high percentages of diatoms, including a 65% dominance in sample #3. The black algal samples were dominated by *Nostoc*, but relatively high percentages of diatoms also were found in these samples. Invertebrates were moderately abundant at the lower transect.

Orange and black samples were collected from the gage transect. The orange samples consisted of a wide mixture of filamentous Oscillatoriaceae, *Nostoc*, and diatoms. Similar to the orange algal samples collected at the lower transect, all orange samples had high percentages of diatoms, including a 70% dominance in orange sample #2. Also, a marine diatom fragment (perhaps blown inland from the Ross Sea) was found in orange sample #4. Black algal samples collected at the gage transect were dominated by *Nostoc*. Two channels, a main channel and a side channel, were present at this transect. Most of the algal samples were collected in the shallow, side channel. However, black sample #5 was collected along the edge of the main channel, and orange sample #1 was collected in the middle of the main channel (see Fig. 29). Invertebrates were moderately abundant at the gage transect.

Andersen Creek

Andersen Creek drains the west side of Canada Glacier and flows adjacent to the face of the glacier for most of its length. Near the outlet to Lake Hoare the stream flows away from the glacier and across a flat sandy deltaic area. The gage at Andersen Creek is located only about 30 m from the stream mouth at Lake Hoare, where the flow is constrained between two small knolls.

The transect was established near the gage on Andersen Creek. The distribution of algal mats here is patchy and sparse. Orange and green algal samples were collected. Morphotype A (*Oscillatoria subproboscidea*) was dominant in the orange algal samples except for sample #5 which was 96% morphotype L (*Phormidium frigidum* and *Oscillatoria deflexa*). The green samples were dominated by *Prasiola calophylla*. All orange and green samples were collected from the main flow region of the stream's channel. Invertebrates were extremely rare in the Andersen Creek algal samples.

House Creek

House Creek flows into Lake Chad on the north shore, and drains the east side of the Suess Glacier. House Creek flows through ice bound moraine and is shaded for most of the day. The rocks in the streambed particles are angular fragments of broken boulders. The gage at House Creek is located about 100 m upstream from the lake where the valley has become fairly steep sided.

A transect was established on House Creek above the gaging site. However, only trace quantities of algae were found in the samples collected at this transect. As a result, no qualitative studies were performed for this stream (i.e. no qualitative tables or graphs were devised). No invertebrates were found in the House Creek samples.

Wharton Creek

Wharton Creek flows into Lake Chad at the west end and also drains the Suess Glacier. The stream primarily runs along the base of the glacier and flows across a sandy delta into the lake.

The transect was established on Wharton Creek at the delta. Algal abundance was low and orange and black algal samples were collected at the site only from areas at the edge of the main channel. Orange samples #1-3 were a mixture of filamentous Oscillatoriaceae, *Nostoc*, and diatoms, while samples #4 and #5 were dominated by morphotype L (*Phormidium frigidum* and *Oscillatoria deflexa*). The black algal samples were dominated by *Nostoc*. Rotifers were moderately abundant, and nematodes were abundant in the black algal samples.

Priscu Stream

Priscu Stream flows into the east end of the east lobe of Lake Bonney and is the only second order stream in the study. It receives flow from several streams draining glaciers on both the north and south sides of Taylor Valley. The channel is broad and sandy. At lowflow a small meandering channel carries the flow, but highflow fills the entire channel. Substantial reconfiguration of the streambed occurs at this site. The gage at Priscu Stream is located about 120 m upstream from the lake. The streambed here is wide, flat and sandy. During highflow there is active movement of sediment in this reach.

A transect was established on Priscu Stream above the gage. The algal mats are sparse and only orange algae was found in this transect. Orange samples #1 and #4 were both dominated by morphotype L (*Phormidium frigidum* and *Oscillatoria deflexa*). Samples #2 and #3 had very high percentages of diatoms, and sample #5 was a mixture of morphotype L (*Phormidium frigidum* and *Oscillatoria deflexa*), diatoms, and an unusually high percentage (28%) of *Gleocapsa kuetzingiana*. Invertebrates were rare in Priscu Stream samples.

Lawson Creek

Lawson Creek drains an alpine glacier adjacent to the Taylor Glacier and flows into the west end of the west lobe of Lake Bonney. The stream flows through a well-defined, steep-sided channel with a moderate to steep gradient and step-pool morphology. Bed particles are unevenly arranged, rather than a flat pavement as in other stream reaches with similar gradients. Furthermore, the algal mats are sparse and less apparent than at other sites of similar gradient.

The transect was established on Lawson Creek above the gage. Similar to Priscu Stream, only orange algae was visibly present in this transect. The orange algal samples were dominated by morphotype L (*Phormidium frigidum* and *Oscillatoria deflexa*). Morphotype I (*Phormidium autumnale*) and *Binuclearia tectorum* were also relatively abundant. Orange samples #1 was collected from the edge of the main channel, while samples #2-5 were all collected near the middle of the channel. Rotifers were common in the Lawson Creek samples, but no other invertebrates were found.

Bohner Stream

Bohner Stream drains an alpine glacier on the south side of the valley and flows into Priscu Stream. This stream has a steep gradient for the entire length. The channel is broad. Streambed particles are large, loosely packed, and are embedded in sand-sized sediment. (Larger particles were not picked up during the pebble count to avoid disturbance.) There is no evidence of algal mats on the upper rock surfaces in the main channel, although some green algal mats are found on the underside of large rocks in the main channel.

A transect was established on Bohner Stream at a site on the lower stream reach. The algal mats are sparse at this site. In addition to green algal samples collected from the underside of larger rocks, orange algal mat samples were collected from a seep adjacent to the main channel. Orange samples #1 and #2 were dominated by morphotype L (*Phormidium frigidum* and *Oscillatoria deflexa*), orange sample #3 was a mixture of morphotype A (*Oscillatoria subproboscidea*), morphotype L (*Phormidium frigidum* and *Oscillatoria deflexa*), and diatoms, and orange samples #4 and #5 were dominated by morphotype A (*Oscillatoria subproboscidea*). All green algal samples were dominated by *Prasiola calophylla*. Invertebrates were extremely rare in the Bohner Stream samples.

Intersite Comparisons

Species Distribution and Diversity

In general, algal species diversity varied greatly within each transect. The algae were distributed in distinct zones depending on moisture. Orange and red algae (primarily Oscillatoriaceae) and green algae (primarily Prasiolaceae) were most common in the main channel of the streams, whereas black algae (primarily Nostocaceae) was most common in wetted zone seeps. Along the edges of the main channel, a marginal zone existed in which all four types of algae were found. Figure 2 illustrates this general distributional pattern found in most streams.

Orange and red algae samples had a much higher number of species (i.e. greater species diversity) than black and green algae samples. In 88% of the green and black samples, species of *Prasiola* or *Nostoc* comprised 85% or more of the total biomass. This greater diversity in orange and red algal mats is true both within a given stream site, and between mat samples from different stream sites, as is summarized in Table 5.

Chlorophyll *a*

By examining chlorophyll *a* data (Table 6 and Table 32 in "Supplemental Data"), it is evident that certain streams, such as Canada Stream and Von Guerard Stream, have relatively high biomass while other streams, such as Priscu Stream and House Creek have relatively low biomass. Mean chlorophyll *a* values were also determined for each of the four types of algal mats (orange, red, green, and black) to better illustrate differences in algal biomass between sites (Table 6). (Note: the chlorophyll *a* data is a measure of the quantity of chlorophyll in each sample collected but is not an indication of the overall abundance of algal mats in these streams.) Moss samples generally had higher levels of chlorophyll *a* than did the algal mats, but the moss samples generally did not grow in the active channel (see small-scale stream contour maps Figures 20-34). Phaeopigments were comparable to chlorophyll *a* in most samples.

Water Quality

Conductivity, pH, major cations (Ca^{2+}, K^+, Mg^{2+}, and Na^+), and major anions (Cl^-, and SO_4^{2-}) were measured in water samples collected from the transect sites (Table 7). The pH of Taylor Valley streams was near neutral, ranging from 6.8 to 7.9. The shorter streams were dilute and poorly buffered, while the longer streams had higher levels of Ca^{2+} from the dissolution of calcite from the hyporheic zone. Longer streams (Delta Stream, Von Guerard Stream, Priscu Stream, and Huey Creek) had higher major ion concentrations and conductivity levels than the shorter streams (Lawson Creek, Bowles Creek, and Bohner Stream). Furthermore, major ion concentrations were consistently higher in the two hyporheic seeps sampled than in the main stream channels, because geochemical weathering in the hyporheic zone is a major source of solutes (i.e. major ions and nutrients) to the meltwater streams.

Nutrient Concentrations

Nutrients (NH_4^+, PO_4, NO_2^{2-}, NO_3^-, and DIC) were measured in water samples collected from the transect sites (Table 8). The results from the immediate analysis of the samples in McMurdo (colorimetric methods) are discussed here. [The data obtained subsequently (Quickchem AE) are presented because they confirm the differences between the sites but are less accurate due to storage.] In the McMurdo Dry Valleys, weathering of apatite is a source of dissolved phosphate, and nitrate has an atmospheric source from auroral activity. Thus, nitrate may be present in the glacial meltwater, and both phosphate and nitrate may enter the streams from interactions with streambed materials and leaching of atmospheric deposition.

For the most part, nutrient levels were low in Taylor Valley streams. Streams with abundant algal mats had low nutrient levels (< 1 µm) throughout the entire stream reach (Table 9). On the other hand, nutrient levels were high (3-13 µm) in streams with sparse algal mats independent of stream length. In short, nutrient levels were lower in streams with abundant algal mats compared to streams with sparse algal mats.

Similar to the major ion concentrations, nutrient levels were high in the hyporheic seeps (see Huey, Von Guerard, and Bohner Streams). However, nutrient levels in the seeps compared with the main channels was dependent upon the algal biomass in the stream. For instance, PO_4 and NO_3^- levels were lower in the Bohner Stream seep than in the main channel because algal mats are rare in the main channel but are present in the hyporheic seeps.

Table 5. Variation in algal dominance among algal mat types.

[Species listed accounted for 25% or more of algal biomass. A "+"indicates that the species accounted for more than 75% of algal biomass. NE denotes algal mat type not encountered. Number in "( )" indicates number of samples where the particular species was dominant. Stream transects are abbreviated as follows: G, gage; S, seep (hyporheic); D, delta; U, upper; L, lower.]

Stream and Basin	Orange	Black	Green	Red
Fryxell Basin				
Huey-G	Morph A (2)	NE	NE	NE
	Morph E (1)			
	Morphs A & L (1)			
	Morphs E & L (1)			
Canada-G	Highly Diverse (5)	*Nostoc* + (5)	*P. crispa* + (3)	Morph J (2)
				Morphs J & L (1)
				C. intricata (1)
Canada-D	NE	*Nostoc* + (5)	*P. crispa* + (2)	*Nostoc* (2)
				Nostoc, Diatoms (1)
				Diverse (2)
Bowles-G	*Nostoc* + (5)	*Nostoc* + (5)	NE	NE
Green-G	Morph A (2)	*Nostoc* + (5)	NE	NE
	Morph A, *Nostoc* (1)			
	Diverse (2)			
Delta-U	*Nostoc* (3)	*Nostoc* + (5)	*P. crispa* + (4)	NE
	Diverse (2)			
Delta-G	NE	*Nostoc* + (4)	Morph A + (2)	NE
		Morph H (1)		
Von Guerard-U	Morph I (3)	*Nostoc* + (1)	Morph A + (1)	NE
	Morph A + (1)		*P. calophylla* (1)	
	Diverse (1)			
Von Guerard-L	Diatoms (2)	*Nostoc* + (5)	NE	NE
	Morph F + (1)			
	Nostoc (1)			
	Diverse (1)			

[Species listed accounted for 25% or more of algal biomass. A "+'"indicates that the species accounted for more than 75% of algal biomass. NE denotes algal mat type not encountered. Number in "( )" indicates number of samples where the particular species was dominant. Stream transects are abbreviated as follows: G, gage; S, seep (hyporheic); D, delta; U, upper; L, lower.]

Stream and Basin	Orange	Black	Green	Red
Von Guerard-G	Diatoms + (1)	*Nostoc* + (5)	NE	NE
	Diverse (4)			
Von Guerard-G/S	NE	*Nostoc* + (2)	NE	NE
Hoare Basin				
Andersen-G	Morph A + (3)	NE	*P. calophylla* + (2)	NE
	Morph A (1)			
	Morph L + (1)			
Wharton-D	Diverse (3)	*Nostoc* + (5)	NE	NE
	Morph L + (2)			
Bonney Basin				
Priscu-G	Morph L + (2)	NE	NE	NE
	Diatoms, Morph L (3)			
Lawson-G	Morph L + (3)	NE	NE	NE
	Morph L, I (1)			
	Morph L, *B. tectorum* (1)			
Bohner-L	Morph A + (2)	NE	*P. calophylla* + (3)	NE
	Morph A (1)			
	Morph L + (2)			

Table 6. Mean chlorophyll *a* values for Taylor Valley stream sites illustrating differences in algal biomass.

[Stream transects are abbreviated as follows: G, gage; S, seep (hyporheic); D, delta; U, upper; L, lower. "Low" denotes <50% surface cover;"high" denotes >50% surface cover. NA denotes "no algal mats of this color were identified." Also note: column 1, "Visual Algal Abundance," is an indication of the total quantity of algal mats present in the streams, while the "Chlorophyll *a*" data is a measure of the amount of cholorphyll within select samples and is not an indication of overall algal abundance.]

Stream Site	Visual Algal Abundance	Chlorophyll *a* (μg/cm^2) (mean values)				
		Orange	Red	Green	Black	Moss
Fryxell Basin						
Huey-G	low	7.20	NA	NA	NA	NA
Huey-G/S	high	2.19	NA	NA	NA	167.5
Canada-G	high	64.17	4.98	87.62	62.78	16.84
Canada-D	low	NA	10.46	60.53	6.35	10.70
Bowles-G	high	10.93	NA	NA	86.08	169.57
Green-G	high	6.84	NA	NA	39.93	98.82
Delta-U	high	11.55	NA	91.85	41.22	NA
Delta-G	low	NA	NA	59.26	28.15	272.02
Von Guerard-U	low	46.50	NA	21.07	NA	43.96
Von Guerard-G	low	3.05	NA	NA	9.01	100.93
Von Guerard-G/S	high	10.28	NA	NA	11.08	47.31
Von Guerard-L	high	11.73	NA	NA	30.73	154.21
Hoare Basin						
Andersen-G	low	57.92	NA	299.01	NA	71.22
House-G	low	0.02	NA	NA	NA	0.45
Wharton-D	low	56.24	NA	NA	341.86	125.85
Bonney Basin						
Priscu-G	low	153.99	NA	NA	NA	NA
Lawson-G	low	258.01	NA	NA	NA	NA
Bohner-L	low	NA	NA	514.55	NA	NA
Bohner-L/S	high	39.58	NA	NA	NA	NA

Table 7. Conductivity, pH, and major ion data for Taylor Valley streams.

[Stream transects are abbreviated as follows: G, gage; S, seep (hyporheic); D, delta; U, upper; L, lower. "ND denotes "no data available."]

Site and Date	Stream Length to transect (km)	Cond. (mmhos /cm)	pH	Ca^{2+} (mg/L)	K^{+} (mg/L)	Mg^{2+} (mg/L)	Na^{+} (mg/L)	Cl^{-} (mg/L)	SO_4^{2-} (mg/L)
Fryxell Basin									
Huey Creek-G 1/13/94	1.5	92.8	ND	9.11	1.84	1.40	3.99	5.04	6.71
Huey Creek-G/S 1/13/94	1.5	151.0	ND	15.27	3.02	2.21	6.96	7.10	9.62
Canada-G 1/9/94	0.98	23.7	7.9	1.90	ND	0.36	1.18	1.83	1.75
Canada-D 1/7/94	1.45	27.0	7.86	2.18	0.55	0.39	1.28	1.88	1.80
Bowles-G 1/12/94	.73	42.5	7.44	4.69	1.08	0.61	1.38	1.16	ND
Green-G 1/12/94	.86	31.0	7.44	2.40	0.50	0.42	1.30	1.56	ND
Delta-U 1/11/94	4.87	89.2	7.40	10.20	0.74	1.12	2.91	5.37	3.84
Delta-G 1/11/94	11.16	143.7	7.40	10.20	0.74	1.12	2.91	10.38	5.41
Von Guerard-U 1/10/94	1.23	93.2	6.81	9.65	1.41	1.60	4.47	5.63	ND
Von Guerard-L 1/10/94	3.22	112.0	7.22	11.8	1.82	1.65	4.63	5.98	ND
Von Guerard-G 1/15/94	4.84	132.0	7.38	14.31	2.25	2.04	5.63	6.58	4.49
Von Guerard-G/S 1/15/94	4.84	153.7	7.38	15.20	2.94	3.02	7.66	6.41	4.55
Hoare Basin									
Andersen-G 1/6/94	1.44	24.0	ND	3.10	0.63	0.40	1.23	2.05	2.57
House-G 1/26/94	2.0	39.0	ND	ND	ND	ND	ND	ND	ND
Wharton-D	1.0	ND	ND	ND	ND	ND	ND	ND	ND
Bonney Basin									
Priscu-G 1/19/94	3.8	104.0	7.05	9.95	1.87	3.10	5.41	10.22	5.81
Lawson-G 1/20/94	0.3	ND	ND	1.99	0.47	0.74	2.37	2.80	2.37
Bohner-L 1/21/94	1.9	ND	ND	ND	ND	ND	ND	ND	ND
Bohner-L/S 1/21/94	1.9	ND	ND	ND	ND	ND	ND	ND	ND

Table 8. Nutrient data for Taylor Valley stream transect sites.

[Stream transects are abbreviated as follows: G, gage; S, seep (hyporheic); D, delta; U, upper; L, lower. ND denotes "no data available."]

	Samples Analyzed in McMurdo Using Colorimetric Methods (Feb. 1994)				Samples Analyzed in U.S. Using Lachat Quickchem AE (July-Aug. 1994)				
Stream Site and Date	**NH_4** µM	**PO_4** µM	**NO_2** µM	**NO_3** µM	**NH_4** µM	**PO_4** µM	**NO_2** µM	**NO_3** µM	**DIC** mg C/L
Fryxell Basin									
Huey-G 1/13/94	0.08	0.40	0.02	4.62	0.4	0.45	0.10	4.0	9.7
Huey-G/S 1/13/94	0.14	0.52	0.00	6.00	0.5	0.68	0.02	5.6	11.9
Canada-G 1/9/94	0.02	0.13	0.00	1.12	0.4	0.16	0.03	0.2	ND
Canada-D 1/7/94	0.02	0.25	0.00	0.74	0.3	0.26	0.00	0.0	ND
Bowles-G 1/12/94	0.11	0.21	0.00	0.71	0.3	0.30	0.01	0.0	ND
Green-G 1/12/94	0.11	0.15	0.00	0.79	0.3	0.15	0.01	0.0	6.70
Delta-U 1/11/94	0.08	0.05	0.00	0.74	0.3	0.07	0.01	0.0	7.10
Delta-G 1/11/94	0.05	0.09	0.00	0.81	0.1	0.24	0.01	0.0	11.20
Von Guerard-U 1/10/94	0.14	0.44	0.00	1.76	0.3	0.23	0.03	2.3	ND
Von Guerard-G 1/15/94	0.11	0.42	0.00	0.89	0.4	0.65	0.01	0.1	ND
Von Guerard-G/S 1/15/94	0.45	1.35	0.03	3.40	0.2	1.55	0.28	0.0	ND
Von Guerard-L 1/10/94	0.11	1.08	0.00	0.94	0.2	0.94	0.02	0.0	9.60
Hoare Basin									
Andersen-G 1/6/94	0.25	0.23	0.03	4.17	0.2	0.52	0.07	0.6	ND
House-G 1/26/94	0.25	0.65	0.08	3.91	0.5	0.07	0.08	4.7	ND
Wharton-D	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bonney Basin									
Priscu-G 1/19/94	0.22	0.36	0.02	5.98	0.3	0.07	0.05	2.2	ND
Lawson-G 1/20/94	0.28	0.21	0.01	12.17	0.8	0.18	0.02	9.5	ND
Bohner-L 1/21/94	0.25	0.61	0.00	9.28	0.3	0.47	0.23	5.1	ND
Bohner-L/S 1/21/94	14.49	0.48	0.01	5.99	1.5	0.53	0.02	9.5	ND

Table 9. Visual algal abundances for Taylor Valley Streams and related NO_3 and PO_4 values.

["Low" denotes <50% surface cover; "high" denotes >50% surface cover. ND denotes "no data available."]

Stream and Basin	Total Stream Length (km)	Visual Algal Abundance	(Sites nearest the outlet)	
			NO_3 (µM)	PO_4 (µM)
Fryxell Basin				
Huey Creek	2.1	low	4.62	0.40
Canada Stream	1.5	high	0.74	0.25
Bowles Creek	0.9	high	0.71	0.21
Green Creek	1.2	high	0.79	0.15
Delta Stream	11.2	high	0.81	0.09
Von Guerard Stream	4.9	high	0.89	0.42
Hoare Basin				
Andersen Creek	1.4	low	4.17	0.23
House Creek	2.0	low	3.91	0.65
Wharton Creek	1.0	low	ND	ND
Bonney Basin				
Priscu Stream	3.8	low	5.98	0.36
Lawson Creek	0.3	low	12.17	0.21
Bohner Stream	1.9	low	9.28	0.61

Samples from Canada, Delta, and Von Guerard streams were collected at upstream and downstream locations (Table 10). In Canada and Von Guerard streams, nutrient levels decreased downstream probably as a result of assimilation by algal mats. However, nutrient concentrations increased slightly at the lower site of Delta Stream. At this site, the streambed becomes deltaic and algal mats decrease due to sediment deposition. These results, taken as a whole, indicate that nutrient levels may be controlled by the density of algal mats present in the streams. However, it does not appear that nutrients are a limiting factor to the algal mats--there was an abundance of nutrients in the Lake Hoare and Lake Bonney Basin streams, yet algal mats were rare compared to the mats found in the Fryxell Basin streams.

Streamflow and Stream Channel Characteristics

Streamflow is highly variable in the McMurdo Dry Valleys. The streams are fed primarily by meltwater from the glaciers with little or no baseflow. The time lag or retention of meltwater in the glacier is of short duration, thus the flow varies by two- to ten-fold during the day depending on sun angle and aspect of the source glacier. The flow also responds to temperature and cloud cover. After a few cloudy, cold (below freezing) days, average daily streamflow can drop from 10 cfs to less than 0.5 cfs. The variation in streamflow for the streams studied here is illustrated in Table 11, which presents the discharge measured at the transects and the average daily discharge at the gage for the 3-day period bracketing the time of the mapping. Algal mats experience a highly variable flow regime as a result of these flow variations. The one generalization that can be made is that algal mats on the edge of the main channel will experience fewer days of submersion than algal mats closer to the thalweg.

The stream and the boundary of the wetted zone adjacent to the stream were mapped (Figs. 20-34). These are transient boundaries representative of lower flow conditions following peak flows.

Discharge was generally less than 2 cfs at the time the streams were mapped. Table 12 presents data on the water velocity in the stream transects. These data represent low flow in a section of stream where the channel is relatively narrow. Velocities vary significantly across the channel, and for several sites there were large rocks or sand bars which were not covered by flowing water.

Stream gradient and bed-material particle size are positively correlated in the Taylor Valley stream, as commonly observed. Table 13 presents the distribution of bed particle size in the stream transects. The quality of habitat for development of algal mats will be influenced not only by the size of the particles but also by their orientation. Larger particles provide a stable substrate for growth. But, if they are oriented in an uneven manner, algal mats would experience a highly turbulent flow regime and are exposed to scour action if they are located on the protruding upper surface of the large rocks. Whereas, the stone pavement orientation provides a stable substrate with less abrasion at the water/rock interface.

The information on the particle size distribution allows for groupings of the streams, as shown in Figure 3. For transects located near the deltaic regions near the stream mouths, smaller rocks were most abundant (Fig. 3A). At the transects with moderate gradients, rocks were between 8 and 11 cm. in size. These sites typically had abundant algal populations and a stone pavement character to the streambed (Fig. 3B). At the three sites with the steepest gradients (Fig. 3C) the rocks were either larger (e.g., Bohner Stream) or oriented in a more uneven manner.

Table 10. Comparison of Canada Stream, Delta Stream, and Von Guerard Stream illustrating variation of algal abundances in differing reaches of the streams.

["Low" denotes <50% surface cover; "high" denotes >50% surface cover.]

Stream site	Stream Length (km)	Visual Algal Abundance	NO_3(μM)	PO_4(μM)
Canada Stream				
at gage	1.0	high	1.12	0.13
at delta	1.5	high	0.74	0.25
Delta Stream				
at upper site	4.9	high	0.74	0.05
at gage	11.2	low	0.81	0.09
Von Guerard Stream				
at upper site	1.2	low	1.76	0.44
at lower site	3.2	high	0.94	1.08
at gage	4.8	low	0.89	0.42
at gage seep	4.8	high	3.40	1.35

Table 11. Discharge values for Taylor Valley streams measured at the site and at the gage.

[Stream transects are abbreviated as follows: G=gage; D=delta; U=upper; L=lower. [1]Discharge at the site measured on 1/15/94.. [2]Discharge at the site measured on 1/6/94. ND denotes "no data available."]

Stream Site	Discharge at Site (L/s)	Discharge at Gage (L/s)			
		Day before	Day of	Day after	Previous Peak and Date
Fryxell Basin					
Huey Creek-G (1/13/94)	ND	33.07	23.93	4.30	56.04 (1/6/94)
Canada Stream-G (1/8/94)	54.37	94.64	81.67	71.93	96.76 (1/6/94)
Canada Stream-D (1/9/94)	108.17	81.67	71.93	99.05	96.76 (1/6/94)
Bowles Creek-G (1/12/94)	ND	ND	ND	ND	ND
Green Creek-G (1/12/94)	7.08[1]	48.48	37.58	28.01	63.09 (1/10/94)
Delta Stream-U (1/11/94)	17.27	77.96	60.66	34.58	95.57 (1/7/94)
Delta Stream-G (1/11/94)	46.44	77.96	60.66	34.58	95.57 (1/7/94)
Von Guerard Stream-U (1/10/94)	35.96	55.25	72.10	58.59	89.40 (1/6/94)
Von Guerard Stream-L (1/10/94)	30.87	55.25	72.10	58.59	89.40 (1/6/94)
Von Guerard Stream-G (1/15/94)	5.38	23.65	3.54	7.11	72.10 (1/10/94)
Hoare Basin					
Andersen Creek-G (1/14/94)	55.78[2]	15.69	4.73	6.48	39.67 (1/10/94)
House Creek-G (1/7/94)	33.13	9.43	8.24	6.63	10.96 (1/5/94)
Wharton Creek-D (1/22/94)	ND	ND	ND	ND	ND
Bonney Basin					
Priscu Stream-G (1/19/94)	62.86	32.57	38.00	10.59	65.41 (1/6/94)
Lawson Stream-G (1/20/94)	3.96	58.82	44.20	4.16	58.82 (1/19/94)
Bohner Stream-L (1/21/94)	ND	ND	ND	ND	ND

Table 12. Depth, Velocity, and Discharge Values for Taylor Valley Streams.

[LEW denotes "left edge of the water"; REW denotes "right edge of the water." - indicates no velocity measurements where depth was zero.]

Canada-G (1/8/94)	LEW													REW
Lateral Position (ft)	0.5	1.2	1.8	2.6	3.0	3.5	4.0	4.5	5.0	5.3	5.5	6.5	7.0	7.2
Depth (ft)	0.00	0.25	0.40	0.50	0.50	0.50	0.50	0.60	0.55	0.55	0.00	0.00	0.10	0.00
Velocity (ft/s)	-	0.79	1.18	1.48	1.25	1.01	1.66	1.29	1.33	0.78	-	-	0.40	-
Total Discharge (cfs)	1.92													

Canada-D (1/9/94)	LEW																			REW
Lateral Position (ft)	0.5	2.0	8.0	8.5	9.0	9.5	10.5	10.8	12.0	12.3	12.6	14.0	14.5	15.0	16.0	17.0	17.4	18.0	18.5	19.3
Depth (ft)	0.00	0.10	0.15	0.20	0.00	0.20	0.20	0.00	0.00	0.40	0.00	0.00	0.55	0.40	0.40	0.10	0.20	0.30	0.10	0.00
Velocity (ft/s)	-	2.33	0.69	1.08	-	0.88	1.98	-	0.00	0.74	-	-	2.47	1.89	0.32	0.60	1.18	2.47	1.25	0.00
Total Discharge (cfs)	3.82																			

Green-G(1/15/94)	LEW																			REW
Lateral Position (ft)	3.1	3.5	3.9	4.2	4.5	5.5	5.6	6.2	6.3	7.5	7.8	8.6	8.7	9.2	9.3	10.4	10.5	10.9	11.0	11.3
Depth (ft)	0.00	0.10	0.15	0.20	0.10	0.10	0.00	0.00	0.10	0.10	0.10	0.10	0.00	0.00	0.10	0.10	0.00	0.00	0.10	0.10
Velocity (ft/s)	-	0.32	0.88	0.13	0.13	0.07	-	-	0.19	0.68	0.68	0.35	0.00	0.00	0.35	0.35	-	-	0.35	0.35
Total Discharge (cfs)	0.25																			

Delta-U (1/11/94)	LEW														REW
Lateral Position (ft)	1.3	2.2	2.7	3.5	3.8	4.0	4.5	4.8	5.2	6.0	6.2	6.5	6.8	7.0	9.6
Depth (ft)	0.00	0.15	0.15	0.00	0.15	0.10	0.10	0.15	0.20	0.15	0.10	0.20	0.00	0.00	0.00
Velocity (ft/s)	-	0.45	1.06	-	1.48	1.48	1.25	1.25	0.68	0.52	0.76	1.01	-	0.27	0.27
Total Discharge (cfs)	0.61														

Delta-G (1/11/94)	LEW												REW
Lateral Position (ft)	0.8	4.0	4.5	5.2	5.8	6.5	7.4	7.9	8.6	9.3	10.0	10.7	11.2
Depth (ft)	0.10	0.10	0.20	0.25	0.20	0.30	0.30	0.25	0.25	0.30	0.25	0.20	0.20
Velocity (ft/s)	0.45	0.45	0.88	0.75	0.75	1.25	1.01	0.47	1.18	0.96	0.60	0.38	0.38
Total Discharge (cfs)	1.64												

[LEW denotes "left edge of the water"; REW denotes "right edge of the water." - indicates no velocity measurements where depth was zero.]

VonGuer.-U (1/10/94)	LEW																			REW
Lateral Position (ft)	0.5	1.5	1.6	2.0	2.5	3.0	3.5	4.0	4.5	4.8	5.0	5.5	6.2	6.5	7.5	8.0	10.0	10.5	11.0	11.5
Depth (ft)	0.2	0.2	0.00	0.00	0.4	0.00	0.15	0.00	0.00	0.30	0.10	0.00	0.00	0.10	0.10	0.00	0.10	0.25	0.40	0.00
Velocity (ft/s)	0.79	0.83	-	0.00	0.78	0.00	0.43	-	-	0.52	0.27	-	-	1.42	1.42	-	1.42	2.20	0.35	-
Total Discharge (cfs)	1.27																			

VonGuer.-L (1/10/94)	LEW																		REW
Lateral Position (ft)	0.5	0.75	0.80	3.7	3.75	3.8	5.9	6.0	6.5	8.0	8.75	8.8	9.5	10.0	10.7	12.0	12.5	13.0	13.5
Depth (ft)	0.00	0.15	0.10	0.10	0.15	0.10	0.10	0.15	0.00	0.00	0.15	0.00	0.00	0.05	0.10	0.20	0.20	0.20	0.00
Velocity (ft/s)	-	0.92	0.92	0.92	1.21	1.21	0.96	0.96	-	-	0.78	-	-	2.78	0.96	0.84	0.84	0.45	-
Total Discharge (cfs)	1.09																		

VonGuer.-G (1/15/94)	LEW						REW
Lateral Position (ft)	0.8	1.2	1.6	2.0	3.0	3.3	4.5
Depth (ft)	0.00	0.15	0.15	0.10	0.10	0.10	0.10
Velocity (ft/s)	-	0.22	0.35	0.35	0.78	0.78	0.40
Total Discharge (cfs)	0.19						

Andersen-G (1/6/94)	LEW														REW
Lateral Position (ft)	1.5	2.5	3.5	4.0	4.5	5.5	6.0	6.5	7.5	8.0	8.5	9.0	9.5	10.0	10.5
Depth (ft)	0.00	0.05	0.35	0.35	0.40	0.20	0.00	0.00	0.20	0.00	0.10	0.00	0.15	0.10	0.00
Velocity (ft/s)	-	1.06	2.09	2.41	1.62	1.13	-	-	1.13	0.00	0.80	0.80	0.80	0.39	-
Total Discharge (cfs)	1.97														

House-G (1/7/94)	LEW					REW
Lateral Position (ft)	1.5	2.0	2.75	3.5	4.5	6.5
Depth (ft)	0.00	0.20	0.20	0.20	0.30	0.10
Velocity (ft/s)	-	0.94	1.42	1.19	1.26	0.67
Total Discharge (cfs)	1.17					

[LEW denotes "left edge of the water"; REW denotes "right edge of the water." - indicates no velocity measurements where depth was zero.]

Priscu-G (1/19/94)		LEW																REW
Lateral Position (ft)		1.0	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6.3
Depth (ft)		0.00	0.15	0.10	0.10	0.10	0.18	0.20	0.20	0.22	0.25	0.22	0.20	0.20	0.23	0.25	0.22	0.10
Velocity (ft/s)		-	1.14	1.42	1.98	2.69	3.29	3.29	3.29	2.96	2.69	2.69	2.82	2.88	2.58	1.98	1.36	0.69
Total Discharge (cfs)	2.22																	

Lawson-G (1/20/94)		LEW														REW
Lateral Position (ft)		2.5	2.8	3.0	3.1	3.6	3.7	3.9	4.2	4.4	4.7	5.0	5.3	5.4	5.8	6.1
Depth (ft)		0.00	0.10	0.10	0.00	0.15	0.15	0.16	0.13	0.14	0.15	0.10	0.10	0.00	0.05	0.00
Velocity (ft/s)		-	0.42	0.42	0.00	0.00	0.36	0.36	0.18	0.96	1.03	0.27	0.27	0.00	0.09	-
Total Discharge (cfs)	0.14															

Table 13. Pebble counts for Taylor Valley streambeds.

[Stream transects are abbreviated as follows: G, gage; D, delta; U, upper; L, lower. Andersen Creek was corrected because fewer than 100 rocks were counted. Priscu Stream was corrected because fewer than 100 rocks of 2 cm or greater were counted. NC denotes not recorded, 0 indicates not encountered..

	Size (cm)												
Stream Site and Date	**1.4**	**2.0**	**2.6**	**4.0**	**5.6**	**8.0**	**11.0**	**16.0**	**22.0**	**32.0**	**45.0**	**63.0**	**80.0**
Fryxell Basin													
Canada-G 1/9/94	NC	8	22	14	13	22	14	5	2	0	0	0	0
Canada-D 1/9/94	NC	11	13	13	15	17	20	8	3	0	0	0	0
Bowles-G 1/15/94	NC	15	8	20	16	27	15	4	5	1	1	0	0
Green-G 1/15/94	NC	0	3	21	18	31	25	10	3	1	0	0	0
Delta-U 1/11/94	NC	0	2	15	14	25	38	15	10	4	2	0	0
Delta-G 1/11/94	NC	13	14	25	11	14	16	4	8	2	0	0	0
Von Guerard-U 1/10/94	NC	0	2	2	13	13	33	13	13	7	3	2	0
Von Guerard-L 1/10/94	NC	3	1	14	13	32	32	13	8	3	1	1	0
Hoare Basin													
Andersen-G 1/6/94	NC	4	2	2	2	3	1	2	0	0	1	0	0
Andrersen-G (corrected)	NC	23	12	12	12	17	6	12	0	0	6	0	0
House-G 1/7/94	NC	7	11	22	17	16	19	6	2	1	0	0	0
Bonney Basin													
Priscu-G 1/19/94	14	37	21	10	12	6	0	0	0	0	0	0	0
Priscu-G (corrected)	NC	43	24	12	14	7	0	0	0	0	0	0	0
Lawson-G 1/20/94	NC	0	7	22	19	22	11	14	5	0	0	0	0
Bohner-L 1/21/94	NC	0	0	2	1	10	23	27	29	3	5	0	1

Figure 3. Distribution of particles (pebble counts) in the stream-bed at the stream study sites: A, High gradient sites; B, Large cobble sites; C, Deltaic sites.

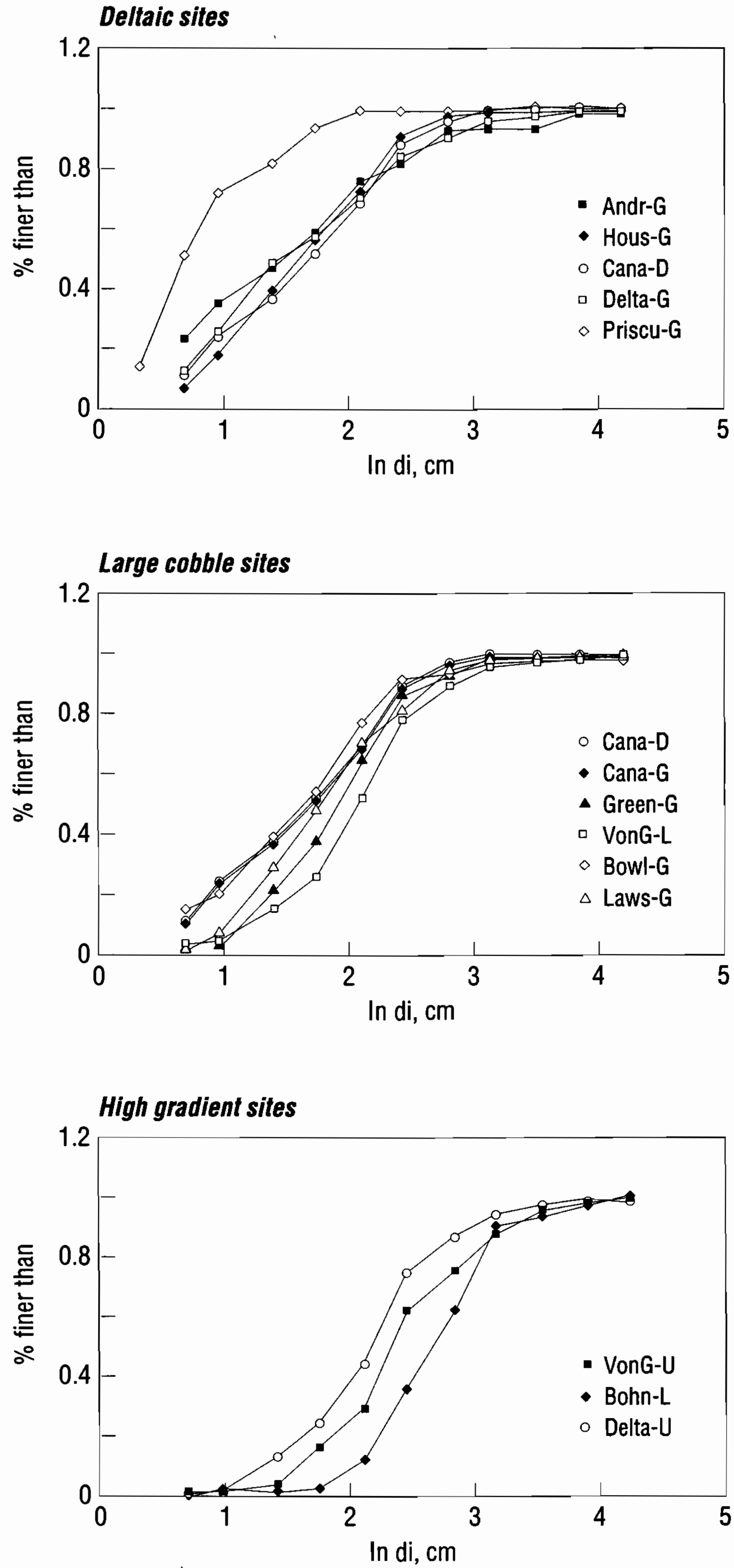

Table 14. Relation between stream gradient, streambed character, and algal abundance.

[Stream transects are abbreviated as follows: G, gage; D, delta; U, upper; L, lower. ND denotes "no data available."]

Stream site	Gradient In reach (m/m)	Most abundant rock size (cm)	Pattern	Visual Algal abundance
Deltaic sites				
Andersen-G	0.05	2	delta	low
House-G	0.05	4	ice bound moraine	low
Von Guerard-G	0.05	ND	delta	low
Delta-G	0.05	4	delta	low
Priscu-G	0.01	2	delta	low
Huey-G	0.03	ND	delta	low
Large Cobble sites				
Canada-D	0.05	11	pavement	high
Canada-G	0.03	2.6/8.0	pavement	high
Green-G	0.05	8.0	pavement	high
Von Guerard-L	0.06	8.0/11.0	pavement	high
Bowles-G	0.025	8.0	pavement	high
Lawson-G	0.07	2.6/8.0	uneven	low
High gradient sites				
Von Guerard-U	0.2	11	uneven	low
Bohner-L	0.25	29	uneven	low
Delta-U	0.10	11	pavement	high

The relation between gradient, particle size, distribution and pattern, and algal abundance are summarized in Table 13. It appears that gradient, in combination with the arrangement of particles in the streambed, is a controlling factor on habitat quality. Whether or not the rocks are arranged in a stone pavement may be controlled by the extent of saturated ground that promotes the formation of a pavement through freeze/thaw cycles. The sites with stone pavements are all located below ponds or flat areas that would create larger areas of saturated ground. For example, the lower Von Guerard site is located below an extensive flat area. Sites with an uneven arrangement of particles in the streambed may be caused by a lack of moisture, such that the streambed is not saturated when freezing temperatures occur at the end of the austral summer.

Summary

Previous algal studies in Taylor Valley have focused mainly on Canada Stream and a few other streams with high algal abundance (Broady, 1982; Howard-Williams et al., 1986; Vincent and Howard Williams, 1986, 1987, 1989; Vincent, 1988). This report examined twelve Taylor Valley streams with varying levels of algal biomass to identify the factors controlling the distribution and abundance of algae. Some of the factors examined were discharge, nutrients, major ions, landscape features, and substrate composition. The information obtained in this report is part of the McMurdo Long-Term Ecological Research (MCMLTER) project. As part of this ongoing ecological study, this information will be integrated into an overall landscape- or ecosystem-level synthesis.

Total algal biomass varied substantially between streams. All streams in Fryxell Basin, except for Huey Creek, had much greater visual abundances of algal mats than did streams in Hoare and Bonney basins. In general, nutrient concentrations in Fryxell Basin streams were much lower than nutrient concentrations measured for the Hoare and Bonney Basin streams. However, it does not appear that nutrient concentrations control the abundance and distribution of the algal mats. Instead, stream gradient and substrate stability appear to be the limiting factors. The south side of Fryxell Basin is a gently sloped valley where the streams have a greater tendency to meander. With the exception of Huey Creek which has a steep gradient, the streambeds in Fryxell Basin generally are composed of a stone pavement which may provide a more stable surface and abundant moisture for algal colonization. In contrast, the Lake Hoare and Lake Bonney basins are steep-walled, and the first order streams in these basins are either steep gradient and faster-flowing or flow directly along the base of the glacier. In steep gradient streams, sediment deposition is high, and algal mats are rare.

In both streams with abundant algal mats and streams with sparsely distributed algal mats, filamentous cyanobacteria accounted for most of the algal biomass. Algal species distribution was found to be heterogeneous in the orange and red algal mats found in the main channel. Whereas, two types of algal mats were essentially unialgal: the black algal mats were composed of *Nostoc* spp. and the green algal mats were composed of one of two species of *Prasiola*.

The information provided in this report is intended to serve as a comprehensive resource and will be used as a foundation for further studies of the stream ecology in the McMurdo Dry Valleys.

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Supplemental Data

Table 15. Descriptions of algal species found in Taylor Valley.

Family Oscillatoriaceae

Morphotype A / Oscillatoria subproboscidea W.& G.S. West Trichomes between 7.5-10 μm in width (including sheath in this and following taxa). Terminal cell rounded and sometimes swollen with calyptra. Trichomes often found within a sheath. Granules present along transverse walls.

Morphotype B / Oscillatoria subproboscidea W.& G.S. West Trichomes between 9-12 μm in width. Similar to morphotype A but wider and with more numerous granules. These granules may be gas vacoules, providing protection from the high levels of ultraviolet light encountered in Antarctica.

Morphotype C / Oscillaroria irrugua Kützing Trichomes between 7-9 μm in width and often surrounded by a sheath. Many cells had transverse walls with a convex shape (perhaps separation disks). Terminal cell often attenuated.

Morphotype D / Oscillaroria irrugua Kützing Trichomes between 7.5-9.5 μm in width, sometimes surrounded by a sheath. Dark, refractory surface obscures the cell interior. Cell walls thin. Terminal cell often with a calyptra.

Morphotype E / Phormidium crouani Gomont Trichomes between 8-10 μm in width. Dark, refractory surface obscures cell interior. Granules scattered throughout the trichome. Terminal cell slightly attenuated.

Morphotype F / Oscillaroria koettlitzi Fritsch Trichomes between 7-9.5 μm in width. Terminal cell swollen and often with a calyptra. Cells narrow with a distinct light-dark pattern. Necridia common (1-5) within each trichome.

Morphotype G / Oscillaroria koettlitzi Fritsch Trichomes between 7-9.5 μm in width. Similar to morphotype E but with much shorter cell length. Terminal cell swollen.

Morphotype H / Oscillaroria koettlitzi Fritsch Trichomes between 8-10 μm in width. Dense cells with a dark, refractory surface and no apparent sheath. Terminal cells often capitate with no visible calyptra. Distinct constrictions at the cell walls. Necridia rare.

Morphotype I / Phormidium autumnale (Agardh) Gomont Trichomes between 4-6 μm in width and often with a slight terminal hook. Variable position and quantity of granules. Terminal cell with a calyptra. Could be independent trichomes of *Microcoleus vaginatus* (see discussion in Broady, 1991, p. 44).

Morphotype J / Phormidium autumnale (Agardh) Gomont Trichomes between 2.5-3.5 μm in width. Generally, cell walls clearly visible; granules rare. Terminal cell with a calyptra.

Morphotype K / Phormidium autumnale (Agardh) Gomont Trichomes between 2-3.5 μm in width. Nearly identical to morphotype J except that trichomes arose from a common "clump." Trichomes also appeared to taper slightly at the terminal end. Rare occurrence.

Morphotype L / P.Frigidum Gomont & *O.deflexa* W.& G.S. West Trichomes all less than 2.5 μm in width. Very thin trichomes—probably more than one species. Usually, no cell structures were visible, but occasionally, cells were box-shaped with distinct constrictions at the transverse walls.

Morphotype M / Microcoleus vaginatus (Vaucher) Gomont Trichomes between 4-6 µm in width. Nearly identical to morphotype I except that all trichomes were contained within a common sheath. A few trichomes would protrude from the apex of the sheath. Terminal cell with a distinct calyptra. Could be colony of *Phormidium autumnale* (see discussion in Drouet, 1962, and Broady, 1991).

Family Rivulariaceae

Calothrix cf. *intricata* Fritsch Distinct, thick (1-8 µm), yellow sheaths surrounded these trichomes. Cell width varied from 6-9 µm at base to 4-8 µm at apex. Cells 2-3 µm long. Basal heterocyst often present within sheath. Granules scattered throughout trichome. Gradual attenuation of cells from basal to terminal end. Akinetes rare. Terminal cell slightly pointed. Immature trichomes with thinner, greenish colored sheaths. Occasionally, multiple trichomes intertwined together in thin mats but majority as independent trichomes. Similar to *Calothrix* sp. described by Broady (1982).

Family Prasiolaceae

Prasiola calophylla (Carmichael) Meneghini Young thalli consisting of uniseriate filaments 8-15 µm wide with cells 5-10 µm long. Most common growth in narrow, foliose ribbons ranging from 5-50+ mm in length. Growth progresses from uniseriate to biseriate filaments with cell division in two planes. Ribbons generally taper to a uniseriate ending often with a holdfast. Cells with stellate chloroplast and central pyrenoid. Aplanospores rare.

Prasiola crispa (Lightfoot) Meneghini This species most closely matched the description given by Fritsch (1917). Although Broady (1979) and others commonly found *Prasiola crispa* near penguin rookeries, we found thalli (that matched the description by Fritsch) in the hyporehic seeps of Taylor Valley streams (non-rookery locations). Most common as young thalli with uniseriate filaments 10-15 µm wide and cells 4-12 µm long. Axial chloroplast and central pyrenoid generally visible. Biseriate and multiseriate filaments produced after cell division in two planes. Cells often remaining in clusters of four. "Hormidium" form was common with its oval-shaped, opaque cells that appeared to be in a moribund state.

Family Nostocaceae

Nostoc spp. Ranged in growth from individual trichomes to dense, irregularly shaped colonies. Trichomes yellowish, 3-5 µm wide, 2-3 µm long, and closely packed within colonies. Heterocysts present at both endings and within the trichomes; akinetes ot observed. Thin sheath surrounded the trichomes while a thick, yellow, mucilaginous sheath surrounded the colonies. Size of colonies ranged from 10 µm in diameter to over 10 cm^2. Juvenile colonies with intercalary heterocysts also found. Difficult to identify to species level without cultures (see Mollenhaur, 1988 for discussion and detailed life cycles).

Nodularia cf. *harveyana* Thuret Trichomes 4-6 µm wide with no visible sheath. Cells 3-5 µm long and terminal cells slightly conical. Heterocysts large (5-8 µm long) and circular.

Family Chroococcaceae

Chroococcus cf. *minutus* (Kützing) Nägeli Spherical cells, 5-8 µm in diameter. Cells surrounded by a thin sheath. Cells have larger, colorless mucilage envelopes (4-10 µm) immediately surrounding the sheath. One-, two-, and four-cell clusters were found but most common in colonies of two cells.

cf. *Gloeocapsa kuetzingiana* Nägeli Generally, a dark orangish-brown colony of individual cells, 2-5 µm in diameter. Cells arranged irregularly in a mucilaginous sheath. Colonies ranged from 7-78 µm in width and contained 3-100+ cells.

Gleocapsa sp. Cells ovoid-ellipsoidal, 1-3 µm in width and contained within a sheath. Colonies spherical with 1-5 cells, often found growing adjacent to other colonies. Rare.

Family Mesotaeniaceae

Actinotaenium cf. *cucurbita* (Brébisson) Teil Cells 25-33 µm by 13-20 µm. Rounded hemi-cell with a slight median constriction. One chromatophore per half cell with four (?) ribs and a central, spherical pyrenoid.

Family Palmellaceae

Asterococcus sp. Spherical cells, 3 µm in diameter, found in a common gelatinous matrix. Each cell with an asteroidal shloroplast with arms radiating from a central pyrenoid. Rare.

Family Ulotrichaceae

cf. *Binuclearia tectorum* (Kützing) Beger Long uniseriate filaments with cells 6-11 µm in width and 8-13 µm long. Filaments surrounded by a mucilaginous sheath. Cells with a parietal chloroplast and a distinct pyrenoid.

Family Chlorellaceae

Chlorella sp. Globular, muscilaginous colonies, 8-10 µm in width, consisting of several (≈20) green, spherical cells, 1-2 µm in diameter. Rare.

Table 16. *List of algal and invertebrate taxa from Huey Creek near Gage*

--Algal abundance shown as percent of total algal biomass. Invertebrate abundance shown as qualitative counts per subsample. [R = rare (1-2 organisms); M = moderate (2-10 organisms); A = abundant (10-50 organisms)]

TAXA	SITE				
	G-01	G-02	G-03	G-04	G-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	96.1	88	7	34	5.5
morph. B	--	--	--	--	--
Oscillatoria irrigua					
morph. C	--	1	7	5	--
morph. D	1	0.1	10	6	--
Phormidium crouani					
morph. E	0.1	0.1	1	3	--
Oscillatoria koettlitzi					
morph. F	--	--	--	--	--
morph. G	--	--	--	--	--
morph. H	--	2	--	--	--
Phormidium autumnale					
morph. I	--	--	--	--	--
morph. J	--	--	--	--	--
morph. K	--	--	61	10	51
P. frigidum & O. deflexa					
morph. L	2	7	13	33	33
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	0.1	0.2	--	1	--
Gleocapsa kuetzingiana	0.2	--	--	--	0.5
Gleocapsa sp.	--	--	0.1	1	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	--	0.1	0.1	--	--
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	0.2	--	--	1	4
Chlorella sp.	--	0.1	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	0.2	--	--	--
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	0.3	1	0.8	6	6
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	0.2	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	-	--	--	--	--
Protozoa	--	--	--	--	R
Rotifer	--	--	--	--	--
Tartigrade	--	--	--	--	--
Tartigrade egg	--	--	--	--	--
Nematode	--	--	--	--	--
Indeterminate eggs	M	R	--	--	A

Table 17. *List of algal and invertebrate taxa from Canada Stream near Gage*

TAXA	**SITE**				
	G-G1	G-G2	G-G3	- -	- -
		"GREEN ALGAE"			
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.1	- -	- -		
morph. B	0.2	0.4	0.2		
Oscillatoria irrigua					
morph. C	- -	- -	- -		
morph. D	0.1	- -	- -		
Phormidium crouani					
morph. E	- -	- -	- -		
Oscillatoria koettlitzi					
morph. F	- -	0.3	0.2		
morph. G	0.2	- -	0.1		
morph. H	0.3	0.2	0.5		
Phormidium autumnale					
morph. I	0.1	0.1	- -		
morph. J	0.1	- -	0.2		
morph. K	- -	- -	- -		
P. frigidum & O. deflexa					
morph. L	0.1	0.5	0.2		
Microcoleus vaginatus					
morph. M	- -	- -	- -		
Calothrix intricata	- -	- -	- -		
Chroococcus minutus	- -	- -	- -		
Gleocapsa kuetzingiana	- -	- -	0.1		
Gleocapsa sp.	- -	- -	- -		
Nodularia harveyana	0.1	- -	- -		
Nostoc spp.	- -	1.5	0.1		
CHLOROPHYTA					
Actinotaenium cucurbita	0.1	0.5	0.2		
Asterococcus sp.	- -	- -	- -		
Binuclearia tectorum	- -	- -	- -		
Chlorella sp.	- -	- -	- -		
Desmid sp.	- -	- -	- -		
Indeterminate unicells	- -	- -	0.1		
Indeterminate branched filament	- -	- -	- -		
Indeterminate colony	- -	- -	- -		
Prasiola calophylla	- -	- -	- -		
Prasiola crispa	98.5	96	98		
BACILLARIOPHYTA					
Diatom spp.	0.1	0.5	0.1		
Marine diatom fragment	- -	- -	- -		
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -		
EUGLENOPHYTA					
Euglena sp.	- -	5	- -		
INVERTEBRATES					
Carchesium sp.	- -	- -	- -		
Protozoa	- -	- -	- -		
Rotifer	A	M	M		
Tartigrade	- -	- -	- -		
Tartigrade egg	- -	- -	- -		
Nematode	R	- -	M		
Indeterminate eggs	- -	- -	- -		

Table 17. *List of algal and invertebrate taxa from Canada Stream near Gage*

TAXA	SITE G-01	G-02	G-03	G-04	G-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	5	14	12	17	6
morph. B	1	--	--	--	--
Oscillatoria irrigua					
morph. C	--	23	14	30	9
morph. D	--	--	0.4	--	--
Phormidium crouani					
morph. E	8	--	--	14	--
Oscillatoria koettlitzi					
morph. F	17	--	16	9	2
morph. G	20	--	--	--	--
morph. H	3	7	26	4	5
Phormidium autumnale					
morph. I	1	--	--	--	--
morph. J	16	5	--	0.8	7
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	3	7	7	6	8
Microcoleus vaginatus					
morph. M	3.4	1	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	1	--	0.3	0.4	15
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	0.5	4	--	0.5	--
CHLOROPHYTA					
Actinotaenium cucurbita	10	29	9	5	8
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	9	4	13	11	35
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	0.1	--	--	--	--
Indeterminate branched filament	--	--	--	0.3	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	2	--	1	2	5
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	R
Protozoa	--	M	--	--	--
Rotifer	A	M	A	A	M
Tartigrade	--	R	M	A	R
Tartigrade egg	--	--	--	--	--
Nematode	M	M	--	M	M
Indeterminate eggs	--	--	M	--	--

Table 17. *List of algal and invertebrate taxa from Canada Stream near Gage*

TAXA	SITE				
	G-R1	G-R2	- -	G-R4	G-R5
			"RED ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	1	- -		3	- -
morph. B	1	0.2		3	0.5
Oscillatoria irrigua					
morph. C	- -	- -		- -	- -
morph. D	17	0.3		- -	7
Phormidium crouani					
morph. E	- -	- -		0.2	- -
Oscillatoria koettlitzi					
morph. F	- -	0.2		0.2	0.5
morph. G	- -	- -		0.2	- -
morph. H	- -	- -		0.2	0.8
Phormidium autumnale					
morph. I	- -	0.5		1	5
morph. J	35	92		84	12
morph. K	- -	- -		- -	- -
P. frigidum & O. deflexa					
morph. L	27	1		1	25
Microcoleus vaginatus					
morph. M	- -	- -		2	- -
Calothrix intricata	- -	1		0.1	45
Chroococcus minutus	- -	- -		- -	- -
Gleocapsa kuetzingiana	1	1		0.8	1
Gleocapsa sp.	- -	- -		- -	- -
Nodularia harveyana	- -	- -		0.2	- -
Nostoc spp.	5	3.5		1	2
CHLOROPHYTA					
Actinotaenium cucurbita	0.8	0.1		0.1	- -
Asterococcus sp.	- -	- -		- -	- -
Binuclearia tectorum	- -	- -		0.1	- -
Chlorella sp.	- -	- -		- -	- -
Desmid sp.	- -	- -		- -	- -
Indeterminate unicells	0.2	- -		0.5	0.4
Indeterminate branched filament	- -	- -		- -	- -
Indeterminate colony	- -	- -		- -	- -
Prasiola calophylla	- -	- -		- -	- -
Prasiola crispa	- -	- -		- -	- -
BACILLARIOPHYTA					
Diatom spp.	8	0.2		2	0.5
Marine diatom fragment	- -	- -		- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	4	- -		0.2	0.3
EUGLENOPHYTA					
Euglena sp.	- -	- -		- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -		- -	- -
Protozoa	- -	- -		- -	- -
Rotifer	M	M		M	M
Tartigrade	- -	R		R	- -
Tartigrade egg	M	- -		- -	- -
Nematode	M	R		M	M
Indeterminate eggs	- -	- -		- -	- -

Table 17. *List of algal and invertebrate taxa from Canada Stream near Gage*

TAXA	SITE				
	G-B1	G-B2	G-B3	G-B4	G-B5
			"BLACK ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.1	0.2	0.4	0.3	0.2
morph. B	0.1	--	--	--	--
Oscillatoria irrigua					
morph. C	--	--	--	--	0.1
morph. D	--	--	0.6	0.1	--
Phormidium crouani					
morph. E	--	--	0.7	--	--
Oscillatoria koettlitzi					
morph. F	0.1	--	2	--	--
morph. G	0.3	--	2	--	--
morph. H	--	--	0.7	--	--
Phormidium autumnale					
morph. I	--	--	0.1	0.4	--
morph. J	--	0.1	--	0.1	0.3
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	0.6	0.2	0.5	0.7	0.5
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	0.2	0.1	0.2	0.1
Gleocapsa kuetzingiana	--	--	--	--	0.2
Gleocapsa sp.	--	--	--	--	
Nodularia harveyana	0.1	--	--	--	0.1
Nostoc spp.	98	97	92	97	97.5
CHLOROPHYTA					
Actinotaenium cucurbita	--	0.1	--	0.2	0.1
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	--	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	0.4	--	0.3	0.3	0.3
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	0.3	2	0.4	0.6	0.4
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	0.2	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	R	M	M	--	M
Tartigrade	M	A	R	--	R
Tartigrade egg	--	--	--	--	--
Nematode	M	R	--	R	--
Indeterminate eggs	R	M	--	R	M

Table 18. *List of algal and invertebrate taxa from Canada Stream at Delta*

TAXA	SITE				
	D-G1	D-G2	- -	- -	- -
	"GREEN ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.2	0.2			
morph. B	0.2	- -			
Oscillatoria irrigua					
morph. C	- -	- -			
morph. D	0.1	- -			
Phormidium crouani					
morph. E	- -	- -			
Oscillatoria koettlitzi					
morph. F	0.8	- -			
morph. G	- -	- -			
morph. H	0.1	0:1			
Phormidium autumnale					
morph. I	0.3	0.3			
morph. J	0.5	- -			
morph. K	- -	- -			
P. frigidum & O. deflexa					
morph. L	1	0.2			
Microcoleus vaginatus					
morph. M	- -	- -			
Calothrix intricata	0.1	- -			
Chroococcus minutus	- -	- -			
Gleocapsa kuetzingiana	- -	- -			
Gleocapsa sp.	- -	- -			
Nodularia harveyana	- -	- -			
Nostoc spp.	14	- -			
CHLOROPHYTA					
Actinotaenium cucurbita	0.3	0.1			
Asterococcus sp.	- -	- -			
Binuclearia tectorum	- -	- -			
Chlorella sp.	- -	- -			
Desmid sp.	- -	- -			
Indeterminate unicells	0.4	0.1			
Indeterminate branched filament	- -	- -			
Indeterminate colony	- -	- -			
Prasiola calophylla	- -	- -			
Prasiola crispa	80	99			
BACILLARIOPHYTA					
Diatom spp.	2	- -			
Marine diatom fragment	- -	- -			
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -			
EUGLENOPHYTA					
Euglena sp.	- -	- -			
INVERTEBRATES					
Carchesium sp.	- -	- -			
Protozoa	- -	- -			
Rotifer	M	R			
Tartigrade	- -	R			
Tartigrade egg	- -	- -			
Nematode	R	M			
Indeterminate eggs	- -	- -			

Table 18. *List of algal and invertebrate taxa from Canada Stream at Delta*

TAXA	SITE				
	D-R1	D-R2	D-R3	D-R4	D-R5
			"RED ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.5	11	10	12	5
morph. B	- -	- -	1	5	0.6
Oscillatoria irrigua					
morph. C	0.3	4	- -	- -	- -
morph. D	- -	12	3	15	8
Phormidium crouani					
morph. E	- -	- -	4	- -	0.4
Oscillatoria koettlitzi					
morph. F	- -	9	1	23	11
morph. G	- -	14	3	20	10
morph. H	- -	3	1	- -	0.5
Phormidium autumnale					
morph. I	0.3	6	1	10	8
morph. J	- -	1	5	0.6	5
morph. K	- -	- -	- -	- -	- -
P. frigidum & O. deflexa					
morph. L	1.7	5	2	8	9
Microcoleus vaginatus					
morph. M	- -	- -	- -	- -	- -
Calothrix intricata	- -	- -	- -	- -	- -
Chroococcus minutus	- -	- -	- -	- -	- -
Gleocapsa kuetzingiana	- -	- -	0.6	- -	0.4
Gleocapsa sp.	- -	- -	- -	- -	- -
Nodularia harveyana	- -	6	- -	- -	- -
Nostoc spp.	40	1	65	1.8	40
CHLOROPHYTA					
Actinotaenium cucurbita	0.2	- -	- -	- -	- -
Asterococcus sp.	- -	- -	- -	- -	- -
Binuclearia tectorum	2	- -	1	- -	- -
Chlorella sp.	- -	- -	- -	- -	- -
Desmid sp.	- -	- -	- -	- -	- -
Indeterminate unicells	- -	1	1	0.6	0.9
Indeterminate branched filament	- -	- -	- -	- -	- -
Indeterminate colony	- -	- -	- -	- -	- -
Prasiola calophylla	- -	- -	- -	- -	- -
Prasiola crispa	- -	- -	- -	- -	- -
BACILLARIOPHYTA					
Diatom spp.	55	27	1	4	0.5
Marine diatom fragment	- -	- -	- -	- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	0.4	- -	0.7
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -	- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	- -
Protozoa	- -	- -	- -	- -	- -
Rotifer	M	- -	M	M	A
Tartigrade	M	M	M	M	A
Tartigrade egg	- -	- -	- -	- -	- -
Nematode	M	M	M	M	A
Indeterminate eggs	- -	- -	- -	- -	- -

Table 18. *List of algal and invertebrate taxa from Canada Stream at Delta*

TAXA	SITE				
	D-B1	D-B2	D-B3	D-B4	D-B5
			"BLACK ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	- -	- -	0.5	0.2	0.3
morph. B	- -	- -	0.3	0.2	0.2
Oscillatoria irrigua					
morph. C	- -	- -	- -	- -	0.1
morph. D	0.2	1	0.3	0.2	- -
Phormidium crouani					
morph. E	- -	- -	- -	- -	- -
Oscillatoria koettlitzi					
morph. F	- -	- -	0.5	0.2	0.1
morph. G	- -	2	- -	- -	- -
morph. H	- -	0.3	- -	0.1	- -
Phormidium autumnale					
morph. I	- -	2	2	1	0.3
morph. J	- -	- -	- -	1	- -
morph. K	- -	- -	- -	- -	- -
P. frigidum & O. deflexa					
morph. L	0.7	2	0.9	- -	0.5
Microcoleus vaginatus					
morph. M	- -	- -	- -	1	- -
Calothrix intricata	- -	- -	- -	- -	- -
Chroococcus minutus	- -	0.2	- -	- -	- -
Gleocapsa kuetzingiana	- -	- -	- -	- -	- -
Gleocapsa sp.	- -	- -	- -	- -	- -
Nodularia harveyana	- -	2	2	- -	0.3
Nostoc spp.	98	90	93	95	97.5
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	0.1	- -	0.1
Asterococcus sp.	- -	- -	- -	- -	- -
Binuclearia tectorum	- -	- -	- -	- -	- -
Chlorella sp.	- -	- -	- -	- -	- -
Desmid sp.	- -	- -	- -	- -	- -
Indeterminate unicells	0.1	- -	0.2	0.1	0.2
Indeterminate branched filament	- -	- -	- -	- -	- -
Indeterminate colony	- -	- -	- -	- -	- -
Prasiola calophylla	- -	- -	- -	- -	- -
Prasiola crispa	- -	- -	- -	- -	- -
BACILLARIOPHYTA					
Diatom spp.	1	0.5	0.2	1	0.4
Marine diatom fragment	- -	- -	- -	- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -	- -	- -
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -	- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	- -
Protozoa	- -	- -	- -	- -	- -
Rotifer	M	M	R	- -	M
Tartigrade	- -	- -	R	- -	- -
Tartigrade egg	- -	- -	- -	- -	- -
Nematode	- -	R	R	M	M
Indeterminate eggs	R	- -	- -	- -	- -

Table 19. *List of algal and invertebrate taxa from Bowles Creek near Gage*

TAXA	SITE				
	G-01	G-02	G-03	G-04	G-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.2	0.1	4.2	8	9
morph. B	--	--	--	--	--
Oscillatoria irrigua					
morph. C	0.1	0.7	--	17	0.1
morph. D	0.1	1	0.2	4	2
Phormidium crouani					
morph. E	--	--	--	2	1
Oscillatoria koettlitzi					
morph. F	--	9	1	10	4
morph. G	--	--	--	--	--
morph. H	--	3	1	10	5
Phormidium autumnale					
morph. I	--	--	--	--	--
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	2	3	14	3	1.1
Microcoleus vaginatus					
morph. M	--	--	--	--	0.5
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	1	0.2	0.3	0.3	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	88	81	76	45	75
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	0.1	--	0.3	--	0.2
Chlorella sp.	--	--	--	0.1	0.1
Desmid sp.	--	--	--	--	--
Indeterminate unicells	0.5	--	--	--	--
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	8	2	3	0.6	2
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	M	A	A	M	M
Tartigrade	M	M	M	M	M
Tartigrade egg	--	--	--	--	--
Nematode	M	A	R	--	M
Indeterminate eggs	--	M	M	A	M

Table 19. *List of algal and invertebrate taxa from Bowles Creek near Gage*

TAXA	SITE				
	G-B1	G-B2	G-B3	G-B4	G-B5
	"BLACK ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.2	0.5	0.6	--	0.2
morph. B	--	--	--	--	0.1
Oscillatoria irrigua					
morph. C	0.1	0.2	0.1	--	0.1
morph. D	--	--	--	--	--
Phormidium crouani					
morph. E	0.1	--	0.2	--	--
Oscillatoria koettlitzi					
morph. F	0.6	0.4	0.3	0.1	0.1
morph. G	--	--	--	--	--
morph. H	1	2	1	--	0.1
Phormidium autumnale					
morph. I	1	--	--	0.1	--
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	1	2	--	1.4	2
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	0.1	0.2
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	95	94	95.5	97	96
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	--	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	--	0.2	--	0.1
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	1	1	2	1.3	1
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	0.1	--	0.1
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	R	--
Rotifer	A	M	M	--	--
Tartigrade	M	--	M	--	--
Tartigrade egg	--	--	--	--	--
Nematode	M	--	R	--	--
Indeterminate eggs	--	R	R	--	M

Table 20. *List of algal and invertebrate taxa from Green Creek above Gage*

TAXA	SITE				
	G-01	G-02	G-03	G-04	G-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	2	11	33	46	63
morph. B	--	--	--	--	--
Oscillatoria irrigua					
morph. C	34	28	6	17	12
morph. D	--	--	--	--	10
Phormidium crouani					
morph. E	7	9	6	0.4	0.5
Oscillatoria koettlitzi					
morph. F	5	12	4	--	7
morph. G	--	--	--	--	--
morph. H	1	--	6	--	0.5
Phormidium autumnale					
morph. I	--	--	--	--	--
morph. J	--	--	--	3	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	--	13	4	9	2
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	--	--	--	0.3	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	32	9	33	4	--
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	3	--	2	0.3	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	--	--	--	--
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	16	18	6	20	5
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	A	M	A	--	A
Tartigrade	M	M	M	R	R
Tartigrade egg	--	--	--	--	--
Nematode	M	M	R	R	--
Indeterminate eggs	--	--	--	--	--

Table 20. *List of algal and invertebrate taxa from Green Creek above Gage*

TAXA	SITE				
	G-B1	G-B2	G-B3	G-B4	G-B5
	"BLACK ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.2	0.7	1	0.1	0.8
morph. B	- -	- -	- -	- -	- -
Oscillatoria irrigua					
morph. C	0.2	0.6	0.2	0.1	- -
morph. D	- -	- -	- -	- -	- -
Phormidium crouani					
morph. E	- -	- -	- -	- -	- -
Oscillatoria koettlitzi					
morph. F	0.4	- -	0.2	- -	0.7
morph. G	- -	- -	- -	- -	- -
morph. H	- -	0.2	0.1	- -	- -
Phormidium autumnale					
morph. I	- -	- -	- -	0.2	- -
morph. J	- -	- -	- -	- -	- -
morph. K	- -	- -	0.2	- -	- -
P. frigidum & O. deflexa					
morph. L	- -	- -	1	2	- -
Microcoleus vaginatus					
morph. M	- -	1	- -	- -	- -
Calothrix intricata	- -	- -	- -	- -	- -
Chroococcus minutus	- -	- -	0.2	0.1	- -
Gleocapsa kuetzingiana	- -	- -	- -	- -	- -
Gleocapsa sp.	- -	- -	- -	- -	- -
Nodularia harveyana	- -	- -	- -	- -	- -
Nostoc spp.	99	98	93	97	94
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	- -	- -	- -
Asterococcus sp.	- -	- -	0.1	- -	- -
Binuclearia tectorum	- -	- -	- -	- -	- -
Chlorella sp.	- -	- -	- -	0.1	- -
Desmid sp.	- -	- -	- -	- -	- -
Indeterminate unicells	- -	- -	- -	- -	- -
Indeterminate branched filament	- -	- -	- -	- -	- -
Indeterminate colony	- -	- -	- -	- -	- -
Prasiola calophylla	- -	- -	- -	- -	- -
Prasiola crispa	- -	- -	- -	- -	- -
BACILLARIOPHYTA					
Diatom spp.	0.2	0.5	2	0.4	4.5
Marine diatom fragment	- -	- -	- -	- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -	- -	- -
EUGLENOPHYTA					
Euglena sp.	- -	1	2	- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	- -
Protozoa	- -	- -	- -	- -	- -
Rotifer	- -	- -	- -	R	- -
Tartigrade	- -	- -	R	A	- -
Tartigrade egg	- -	- -	- -	- -	- -
Nematode	R	M	- -	R	- -
Indeterminate eggs	- -	- -	- -	R	M

Table 21. *List of algal and invertebrate taxa from Delta Stream at Upper Site*

TAXA	SITE				
	U-F1	U-F2	U-F3	U-F4	- -
	"GREEN ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	1	1.2	1.2	0.5	
morph. B	- -	0.2	0.5	- -	
Oscillatoria irrigua					
morph. C	0.1	0.2	- -	- -	
morph. D	- -	- -	- -	0.1	
Phormidium crouani					
morph. E	- -	- -	- -	- -	
Oscillatoria koettlitzi					
morph. F	0.5	1	- -	0.1	
morph. G	1	0.2	0.2	2	
morph. H	1	2	2	2	
Phormidium autumnale					
morph. I	- -	- -	- -	- -	
morph. J	- -	- -	- -	- -	
morph. K	- -	- -	- -	- -	
P. frigidum & O. deflexa					
morph. L	4	2	2	1	
Microcoleus vaginatus					
morph. M	- -	1	0.5	0.5	
Calothrix intricata	0.1	0.1	0.1	0.1	
Chroococcus minutus	0.2	0.1	0.1	- -	
Gleocapsa kuetzingiana	- -	0.1	0.1	0.1	
Gleocapsa sp.	- -	- -	- -	- -	
Nodularia harveyana	- -	- -	- -	- -	
Nostoc spp.	15	6	2	2	
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	- -	- -	
Asterococcus sp.	- -	- -	- -	- -	
Binuclearia tectorum	- -	- -	- -	- -	
Chlorella sp.	- -	0.1	- -	- -	
Desmid sp.	- -	- -	- -	- -	
Indeterminate unicells	- -	0.1	0.2	0.1	
Indeterminate branched filament	- -	- -	- -	- -	
Indeterminate colony	- -	- -	- -	- -	
Prasiola calophylla	- -	- -	- -	- -	
Prasiola crispa	75	85	90	90	
BACILLARIOPHYTA					
Diatom spp.	2	1	1	1	
Marine diatom fragment	- -	- -	- -	- -	
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -	- -	
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -	- -	
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	
Protozoa	- -	M	- -	- -	
Rotifer	A	R	M	A	
Tartigrade	A	R	M	M	
Tartigrade egg	- -	- -	R	- -	
Nematode	M	R	M	M	
Indeterminate eggs	R	R	- -	R	

Table 21. *List of algal and invertebrate taxa from Delta Stream at Upper Site*

TAXA	SITE U-01	U-02	U-03	U-04	U-05
	"ORANGE ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	5.5	16	9	13	0.5
morph. B	--	1	--	2	0.4
Oscillatoria irrigua					
morph. C	0.5	4	--	12	0.7
morph. D	--	5	0.3	--	--
Phormidium crouani					
morph. E	--	--	--	--	--
Oscillatoria koettlitzi					
morph. F	20	9	8	11	20
morph. G	18	8	9	12	7
morph. H	13	16	7	6	6
Phormidium autumnale					
morph. I	1	2	3	0.4	2
morph. J	--	--	4	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	10	6	9	6	5
Microcoleus vaginatus					
morph. M	3	--	--	--	--
Calothrix intricata	--	0.2	--	--	--
Chroococcus minutus	--	--	0.3	0.6	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	2	--	--
Nostoc spp.	13	26	39	32	50
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	4	0.4	5	--	2
Chlorella sp.	--	0.2	--	0.1	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	1	0.2	0.4	0.3	0.4
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	11	6	5	4	6
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	0.6	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	A	A	A	A	M
Tartigrade	A	A	M	M	M
Tartigrade egg	M	--	R	--	--
Nematode	M	M	M	M	M
Indeterminate eggs	R	M	M	--	M

Table 21. *List of algal and invertebrate taxa from Delta Stream at Upper Site*

TAXA	SITE				
	U-B1	U-B2	U-B3	U-B4	U-B5
			"BLACK ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	1.3	0.5	0.2	0.6	0.4
morph. B	0.1	- -	- -	0.3	0.2
Oscillatoria irrigua					
morph. C	0.1	- -	- -	- -	- -
morph. D	0.1	- -	- -	0.2	- -
Phormidium crouani					
morph. E	- -	- -	- -	- -	- -
Oscillatoria koettlitzi					
morph. F	0.1	- -	- -	- -	0.2
morph. G	0.1	0.2	0.3	0.3	0.2
morph. H	0.2	- -	- -	0.1	0.5
Phormidium autumnale					
morph. I	0.1	0.1	3	1	1
morph. J	- -	0.5	- -	0.5	- -
morph. K	- -	- -	- -	- -	- -
P. frigidum & O. deflexa					
morph. L	0.2	0.2	0.2	0.3	0.8
Microcoleus vaginatus					
morph. M	0.3	- -	- -	- -	- -
Calothrix intricata	- -	- -	- -	- -	- -
Chroococcus minutus	- -	- -	- -	- -	- -
Gleocapsa kuetzingiana	- -	- -	- -	0.1	- -
Gleocapsa sp.	- -	- -	- -	- -	- -
Nodularia harveyana	- -	0.3	0.9	0.8	0.2
Nostoc spp.	97	97.5	95	95	95
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	- -	- -	- -
Asterococcus sp.	- -	- -	- -	- -	- -
Binuclearia tectorum	- -	- -	- -	- -	- -
Chlorella sp.	- -	- -	- -	- -	- -
Desmid sp.	- -	- -	- -	- -	- -
Indeterminate unicells	0.1	0.2	0.1	0.1	0.3
Indeterminate branched filament	- -	- -	- -	- -	- -
Indeterminate colony	- -	0.1	- -	0.1	0.1
Prasiola calophylla	- -	- -	- -	- -	- -
Prasiola crispa	- -	- -	- -	- -	- -
BACILLARIOPHYTA					
Diatom spp.	0.2	0.3	0.2	0.5	1
Marine diatom fragment	- -	- -	- -	- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -	- -	- -
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -	- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	- -
Protozoa	- -	- -	- -	- -	- -
Rotifer	A	R	M	R	M
Tartigrade	M	R	M	M	M
Tartigrade egg	- -	- -	- -	- -	R
Nematode	M	M	M	- -	M
Indeterminate eggs	R	R	M	R	- -

Table 22. *List of algal and invertebrate taxa from Delta Stream near Gage*

TAXA	SITE				
	G-F1	G-F2	- -	- -	- -
	"GREEN ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	78	90			
morph. B	- -	- -			
Oscillatoria irrigua					
morph. C		- -			
morph. D	8	5			
Phormidium crouani					
morph. E	- -	- -			
Oscillatoria koettlitzi					
morph. F	- -	0.1			
morph. G	- -	- -			
morph. H	3	1			
Phormidium autumnale					
morph. I	- -	- -			
morph. J	- -	- -			
morph. K	- -	- -			
P. frigidum & O. deflexa					
morph. L	2	0.5			
Microcoleus vaginatus					
morph. M	- -	- -			
Calothrix intricata	- -	- -			
Chroococcus minutus	- -	- -			
Gleocapsa kuetzingiana	- -	- -			
Gleocapsa sp.	- -	- -			
Nodularia harveyana	- -	- -			
Nostoc spp..	5	2			
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -			
Asterococcus sp.	- -	- -			
Binuclearia tectorum	1	0.1			
Chlorella sp.	- -	- -			
Desmid sp.	- -	- -			
Indeterminate unicells	1	0.5			
Indeterminate branched filament	- -	- -			
Indeterminate colony	- -	- -			
Prasiola calophylla	- -	- -			
Prasiola crispa	- -	- -			
BACILLARIOPHYTA					
Diatom spp.	2	1			
Marine diatom fragment	- -	- -			
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -			
EUGLENOPHYTA					
Euglena sp.	- -	- -			
INVERTEBRATES					
Carchesium sp.	- -	- -			
Protozoa	- -	- -			
Rotifer	A	M			
Tartigrade	M	R			
Tartigrade egg	- -	- -			
Nematode	R	- -			
Indeterminate eggs	- -	- -			

Table 22. *List of algal and invertebrate taxa from Delta Stream near Gage*

TAXA	SITE				
	G-B1	G-B2	G-B3	G-B4	G-B5
	"BLACK ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.3	0.2	1	0.4	3
morph. B	0.2	- -	- -	- -	1.7
Oscillatoria irrigua					
morph. C	- -	- -	- -	- -	- -
morph. D	0.3	0.2	0.7	0.2	- -
Phormidium crouani					
morph. E	- -	- -	- -	- -	- -
Oscillatoria koettlitzi					
morph. F	0.8	0.4	2	1	1.6
morph. G	0.8	- -	2	0.8	1.5
morph. H	- -	- -	- -	0.3	1.5
Phormidium autumnale					
morph. I	64	1	0.6	0.2	- -
morph. J	- -	- -	- -	- -	- -
morph. K	- -	- -	- -	- -	- -
P. frigidum & O. deflexa					
morph. L	1	1	0.6	0.6	1.7
Microcoleus vaginatus					
morph. M	- -	- -	- -	- -	- -
Calothrix intricata	- -	- -	- -	- -	- -
Chroococcus minutus	- -	- -	- -	- -	- -
Gleocapsa kuetzingiana	- -	- -	- -	- -	- -
Gleocapsa sp.	- -	- -	- -	- -	- -
Nodularia harveyana	1	- -	- -	- -	- -
Nostoc spp.	30	96	92	95	77
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	- -	- -	- -
Asterococcus sp.	- -	- -	- -	- -	- -
Binuclearia tectorum	- -	- -	- -	- -	- -
Chlorella sp.	- -	- -	- -	- -	- -
Desmid sp.	- -	- -	- -	- -	- -
Indeterminate unicells	0.4	0.2	0.4	0.4	0.2
Indeterminate branched filament	- -	- -	- -	- -	- -
Indeterminate colony	- -	- -	- -	- -	- -
Prasiola calophylla	- -	- -	- -	- -	- -
Prasiola crispa	- -	- -	- -	- -	- -
BACILLARIOPHYTA					
Diatom spp.	0.9	1	0.7	1	1.7
Marine diatom fragment	- -	- -	- -	- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -	- -	- -
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -	- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	- -
Protozoa	- -	- -	- -	- -	- -
Rotifer	M	M	M	A	M
Tartigrade	- -	M	R	- -	M
Tartigrade egg	- -	- -	- -	- -	- -
Nematode	R	R	M	M	M
Indeterminate eggs	A	- -		R	R

Table 23. *List of algal and invertebrate taxa from Von Guerard at Upper Site*

TAXA	SITE				
	U-F1	U-F2	- -	- -	- -
		"GREEN ALGAE"			
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	8	81			
morph. B	1	0.5			
Oscillatoria irrigua					
morph. C	- -	0.4			
morph. D	- -	- -			
Phormidium crouani					
morph. E	- -	0.1			
Oscillatoria koettlitzi					
morph. F	- -	- -			
morph. G	- -	- -			
morph. H	- -	- -			
Phormidium autumnale					
morph. I	- -	- -			
morph. J	- -	- -			
morph. K	- -	- -			
P. frigidum & O. deflexa					
morph. L	5	3			
Microcoleus vaginatus					
morph. M	- -	2.5			
Calothrix intricata	- -	- -			
Chroococcus minutus	- -	- -			
Gleocapsa kuetzingiana	- -	- -			
Gleocapsa sp.	- -	- -			
Nodularia harveyana	- -	- -			
Nostoc spp.	3	2			
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -			
Asterococcus sp.	- -	- -			
Binuclearia tectorum	1	- -			
Chlorella sp.	- -	- -			
Desmid sp.	- -	- -			
Indeterminate unicells	1	0.5			
Indeterminate branched filament	- -	- -			
Indeterminate colony	- -	- -			
Prasiola calophylla	85	- -			
Prasiola crispa	- -	- -			
BACILLARIOPHYTA					
Diatom spp.	2	10			
Marine diatom fragment	- -	- -			
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -			
EUGLENOPHYTA					
Euglena sp.	- -	- -			
INVERTEBRATES					
Carchesium sp.	- -	- -			
Protozoa	- -	- -			
Rotifer	M	M			
Tartigrade	- -	M			
Tartigrade egg	- -	- -			
Nematode	R	- -			
Indeterminate eggs	- -	- -			

Table 23. *List of algal and invertebrate taxa from Von Guerard Stream at Upper Site*

TAXA	SITE				
	U-01	U-02	U-03	U-04	U-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	2	80	15	18	22
morph. B	--	3	0.6	1	0.4
Oscillatoria irrigua					
morph. C	1	2	--	4	--
morph. D	--	--	7	--	--
Phormidium crouani					
morph. E	--	--	--	--	--
Oscillatoria koettlitzi					
morph. F	--	--	--	--	--
morph. G	--	--	--	--	--
morph. H	--	1	--	--	7
Phormidium autumnale					
morph. I	92	4	62	59	11
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	0.5	5	3	7	8
Microcoleus vaginatus					
morph. M	2	--	--	--	25
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	1.5	2	4	0.4	6
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	0.3	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	--	0.4	0.3	0.6
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	4
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	1	3	8	10	16
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	M	A	A	A	A
Tartigrade	--	--	--	R	M
Tartigrade egg	--	--	--	--	--
Nematode	--	--	--	--	R
Indeterminate eggs	--	--	--	--	--

Table 23. *List of algal and invertebrate taxa from Von Guerard Stream at Upper Site*

TAXA	SITE				
	U-B1	- -	- -	- -	- -
	"BLACK ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	3				
morph. B	0.3				
Oscillatoria irrigua					
morph. C	1				
morph. D	0.2				
Phormidium crouani					
morph. E	- -				
Oscillatoria koettlitzi					
morph. F	- -				
morph. G	0.3				
morph. H	- -				
Phormidium autumnale					
morph. I	0.7				
morph. J	- -				
morph. K	- -				
P. frigidum & O. deflexa					
morph. L	0.5				
Microcoleus vaginatus					
morph. M	2				
Calothrix intricata	- -				
Chroococcus minutus	- -				
Gleocapsa kuetzingiana	- -				
Gleocapsa sp.	- -				
Nodularia harveyana	- -				
Nostoc spp.	88				
CHLOROPHYTA					
Actinotaenium cucurbita	- -				
Asterococcus sp.	- -				
Binuclearia tectorum	0.3				
Chlorella sp.	- -				
Desmid sp.	- -				
Indeterminate unicells	0.2				
Indeterminate branched filament	- -				
Indeterminate colony	- -				
Prasiola calophylla	3				
Prasiola crispa	- -				
BACILLARIOPHYTA					
Diatom spp.	0.5				
Marine diatom fragment	- -				
CHRYSOPHYTA					
Chrysophyte cysts	- -				
EUGLENOPHYTA					
Euglena sp.	- -				
INVERTEBRATES					
Carchesium sp.	- -				
Protozoa	- -				
Rotifer	A				
Tartigrade	- -				
Tartigrade egg	- -				
Nematode	- -				
Indeterminate eggs	- -				

Table 24. *List of algal and invertebrate taxa from Von Guerard Stream at Lower Site*

TAXA	SITE				
	L-01	L-02	L-03	L-04	L-0
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	20	7	6	6	1
morph. B	--	--	--	--	0.2
Oscillatoria irrigua					
morph. C	--	--	--	--	0.7
morph. D	--	--	1	--	--
Phormidium crouani					
morph. E	--	--	--	--	--
Oscillatoria koettlitzi					
morph. F	1	14	--	--	0.3
morph. G	3	--	4	28	3
morph. H	2	2	3	3	1
Phormidium autumnale					
morph. I	3	6	1	--	--
morph. J	--	--	--	20	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	5	8	2	4	0.5
Microcoleus vaginatus					
morph. M	--	--	2	--	78
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	60	17	15	5	5
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	--	--
Chlorella sp.	--	--	--	--	0.1
Desmid sp.	--	--	--	--	--
Indeterminate unicells	1	2	1	3	0.2
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	5	44	65	31	10
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	A	M	A	M	A
Tartigrade	A	R	M	R	M
Tartigrade egg	--	--	--	--	--
Nematode	R	R	R	--	M
Indeterminate eggs	--	--	--	--	--

Table 24. *List of algal and invertebrate taxa from Von Guerard Stream at Lower Site*

TAXA	SITE				
	L-B1	L-B2	L-B3	L-B4	L-B5
	"BLACK ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.4	2	2.1	1.5	1
morph. B	0.1	0.2	0.2	- -	- -
Oscillatoria irrigua					
morph. C	- -	0.5	0.5	0.5	- -
morph. D	- -	- -	0.1	- -	0.3
Phormidium crouani					
morph. E	0.1	0.1	- -	0.5	0.5
Oscillatoria koettlitzi					
morph. F	0.1	0.1	0.1	1	- -
morph. G	- -	1	2	1	1
morph. H	0.1	0.5	2	1	0.7
Phormidium autumnale					
morph. I	0.1	0.1	- -	0.5	1
morph. J	- -	- -	0.5	- -	- -
morph. K	- -	- -	- -	- -	- -
P. frigidum & O. deflexa					
morph. L	0.1	1.5	0.5	2	2.5
Microcoleus vaginatus					
morph. M	- -	- -	- -	- -	- -
Calothrix intricata	- -	- -	- -	- -	- -
Chroococcus minutus	- -	- -	- -	- -	- -
Gleocapsa kuetzingiana	- -	- -	- -	- -	- -
Gleocapsa sp.	- -	- -	- -	- -	- -
Nodularia harveyana	- -	- -	- -	- -	- -
Nostoc spp.	97	92	89	89	91
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	- -	- -	- -
Asterococcus sp.	- -	- -	- -	- -	- -
Binuclearia tectorum	- -	- -	- -	- -	- -
Chlorella sp.	- -	- -	- -	- -	- -
Desmid sp.	- -	- -	- -	- -	- -
Indeterminate unicells	- -	- -	- -	- -	- -
Indeterminate branched filament	- -	- -	- -	- -	- -
Indeterminate colony	- -	- -	- -	- -	- -
Prasiola calophylla	- -	- -	- -	- -	- -
Prasiola crispa	- -	- -	- -	- -	- -
BACILLARIOPHYTA					
Diatom spp.	2	2	3	3	2
Marine diatom fragment	- -	- -	- -	- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -	- -	- -
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -	- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	- -
Protozoa	- -	- -	- -	- -	- -
Rotifer	- -	M	M	M	R
Tartigrade	- -	R	R	R	R
Tartigrade egg	- -	- -	- -	- -	- -
Nematode	- -	M	R	- -	R
Indeterminate eggs	- -	- -	- -	- -	- -

Table 25. *List of algal and invertebrate taxa from Von Guerard Stream at Gage*

TAXA	SITE				
	G-01	G-02	G-03	G-04	G-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	10	4	15	21	28
morph. B	--	--	--	--	--
Oscillatoria irrigua					
morph. C	6	--	5	--	--
morph. D	0.5	--	--	3	13
Phormidium crouani					
morph. E	--	--	--	0.1	--
Oscillatoria koettlitzi					
morph. F	--	7	6	6	11
morph. G	11	3	5	5	16
morph. H	3	7	7	5	2
Phormidium autumnale					
morph. I	5	--	2	--	--
morph. J	6	--	--	2	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	7	1	4	2	3
Microcoleus vaginatus					
morph. M	--	--	14	0.8	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	31	7	12	23	6
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	--	--
Chlorella sp.	0.5	--	--	0.1	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	1	1	1	0.3	1
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	14	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	19	70	29	17	20
Marine diatom fragment	--	--	--	0.7	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	M	A	A	M	A
Tartigrade	--	A	M	M	M
Tartigrade egg	--	--	--	--	--
Nematode	M	M	M	--	--
Indeterminate eggs	A	--	A	--	A

Table 25. *List of algal and invertebrate taxa from Von Guerard Stream at Gage*

TAXA	SITE				
	G-B1	G-B2	G-B3	G-B4	G-B5
			"BLACK ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	2	2	0.1	0.2	2.3
morph. B	--	--	0.2	1	1
Oscillatoria irrigua					
morph. C	1	1	0.2	0.1	0.2
morph. D	--	--	0.2	1	--
Phormidium crouani					
morph. E	--	--	--	--	0.1
Oscillatoria koettlitzi					
morph. F	0.5	1	0.3	0.1	1
morph. G	--	--	1	1	1.5
morph. H	2	1	1	0.2	3
Phormidium autumnale					
morph. I	--	--	--	--	--
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	4	1.2	4	2.2	4.5
Microcoleus vaginatus					
morph. M	--	--	--	2	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	0.1	0.2	--	0.1	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	88	89	91	89	83
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	0.1	--	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	--	--	--	--
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	2	5	2	3	3
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	R	--	M	--	--
Tartigrade	--	M	M	--	--
Tartigrade egg	--	--	--	--	--
Nematode	R	R	R	R	--
Indeterminate eggs	M	M			

Table 26. *List of algal and invertebrate taxa from Von Guerard Relict Channel*

TAXA	SITE				
	R-B1	R-B2	- -	- -	- -
	"BLACK ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	- -	0.5			
morph. B	- -	0.2			
Oscillatoria irrigua					
morph. C	- -	- -			
morph. D	- -	- -			
Phormidium crouani					
morph. E	- -	- -			
Oscillatoria koettlitzi					
morph. F	- -	0.5			
morph. G	0.2	0.5			
morph. H	0.2	0.5			
Phormidium autumnale					
morph. I	- -	- -			
morph. J	- -	- -			
morph. K	- -	- -			
P. frigidum & O. deflexa					
morph. L	1	4			
Microcoleus vaginatus					
morph. M	- -	- -			
Calothrix intricata	- -	- -			
Chroococcus minutus	- -	- -			
Gleocapsa kuetzingiana	- -	- -			
Gleocapsa sp.	- -	- -			
Nodularia harveyana	- -	- -			
Nostoc spp.	97	93			
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -			
Asterococcus sp.	- -	- -			
Binuclearia tectorum	- -	- -			
Chlorella sp.	- -	- -			
Desmid sp.	- -	- -			
Indeterminate unicells	0.1	0.1			
Indeterminate branched filament	- -	- -			
Indeterminate colony	- -	- -			
Prasiola calophylla	- -	- -			
Prasiola crispa	- -	- -			
BACILLARIOPHYTA					
Diatom spp.	1.5	0.7			
Marine diatom fragment	- -	- -			
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -			
EUGLENOPHYTA					
Euglena sp.	- -	- -			
INVERTEBRATES					
Carchesium sp.	- -	- -			
Protozoa	- -	- -			
Rotifer	A	A			
Tartigrade	A	M			
Tartigrade egg	- -	- -			
Nematode	R	R			
Indeterminate eggs	- -	- -			

Table 27. *List of algal and invertebrate taxa from Andersen Creek near Gage*

TAXA	SITE				
	G-F1	G-F2	- -	- -	- -
	"GREEN ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	0.2	0.2			
morph. B	- -	- -			
Oscillatoria irrigua					
morph. C	- -	- -			
morph. D	- -	- -			
Phormidium crouani					
morph. E	- -	- -			
Oscillatoria koettlitzi					
morph. F	- -	- -			
morph. G	- -	- -			
morph. H	- -	- -			
Phormidium autumnale					
morph. I	- -	- -			
morph. J	- -	- -			
morph. K	- -	- -			
P. frigidum & O. deflexa					
morph. L	0.5	0.5			
Microcoleus vaginatus					
morph. M	- -	- -			
Calothrix intricata	- -	- -			
Chroococcus minutus	- -	- -			
Gleocapsa kuetzingiana	- -	0.2			
Gleocapsa sp.	- -	- -			
Nodularia harveyana	- -	- -			
Nostoc spp.	- -	- -			
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -			
Asterococcus sp.	- -	- -			
Binuclearia tectorum	- -	- -			
Chlorella sp.	- -	- -			
Desmid sp.	- -	- -			
Indeterminate unicells	- -	- -			
Indeterminate branched filament	- -	- -			
Indeterminate colony	- -	- -			
Prasiola calophylla	99	99			
Prasiola crispa	- -	- -			
BACILLARIOPHYTA					
Diatom spp.	0.3	- -			
Marine diatom fragment	- -	- -			
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -			
EUGLENOPHYTA					
Euglena sp.	- -	- -			
INVERTEBRATES					
Carchesium sp.	- -	- -			
Protozoa	- -	- -			
Rotifer	- -	R			
Tartigrade	- -	- -			
Tartigrade egg	- -	- -			
Nematode	- -	- -			
Indeterminate eggs	- -	- -			

Table 27. *List of algal and invertebrate taxa from Andersen Creek near Gage*

TAXA	SITE G-01	G-02	G-03	G-04	G-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	60	79	98	99	2
morph. B	--	--	--	--	--
Oscillatoria irrigua					
morph. C	22	--	--	--	--
morph. D	4	--	0.1	--	--
Phormidium crouani					
morph. E	--	--	--	--	--
Oscillatoria koettlitzi					
morph. F	--	--	--	--	--
morph. G	--	--	--	--	--
morph. H	--	--	1	--	--
Phormidium autumnale					
morph. I	--	--	--	--	--
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	13	4	0.8	1	96
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	0.5	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	--	--	--	--	--
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	2	--	--	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	--	--	--	--
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	0.5	15	0.1	--	2
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	--	--	--	--	--
Tartigrade	--	--	--	--	--
Tartigrade egg	--	--	--	--	--
Nematode	--	--	--	--	--
Indeterminate eggs	A	--	--	--	--

Table 28. *List of algal and invertebrate taxa Wharton Creek at Delta*

TAXA	SITE				
	D-01	D-02	D-03	D-04	D-05
	"ORANGE ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	6.3	5.3	12	8	2
morph. B	0.2	0.3	--	--	--
Oscillatoria irrigua					
morph. C	--	--	--	--	--
morph. D	9	15	10	10	7
Phormidium crouani					
morph. E	--	--	--	--	--
Oscillatoria koettlitzi					
morph. F	0.2	--	--	--	--
morph. G	--	--	--	--	--
morph. H	11	36	13	2	5
Phormidium autumnale					
morph. I	15	10	22	--	--
morph. J	--	--	--	--	--
morph. K	0.3	0.4	--	--	--
P. frigidum & O. deflexa					
morph. L	17	5	34	75	80
Microcoleus vaginatus					
morph. M	17	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	0.5	--	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	18	8	0.5	--	--
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	--	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	1	5	1	1	2
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	5	15	7	4	4
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	M	R	--	--	--
Tartigrade	--	--	--	--	--
Tartigrade egg	--	--	--	--	--
Nematode	--	--	--	--	--
Indeterminate eggs	R	M	--	--	--

Table 28. *List of algal and invertebrate taxa from Wharton Creek at Delta*

TAXA	SITE				
	D-B1	D-B2	D-B3	D-B4	D-B5
			"BLACK ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	1	0.1	0.6	- -	0.1
morph. B	- -	- -	- -	- -	- -
Oscillatoria irrigua					
morph. C	- -	- -	- -	- -	- -
morph. D	- -	- -	- -	- -	0.1
Phormidium crouani					
morph. E	- -	- -	- -	- -	- -
Oscillatoria koettlitzi					
morph. F	1	1	0.6	0.1	0.2
morph. G	3	- -	0.3	- -	0.2
morph. H	1	0.1	0.4	0.1	0.2
Phormidium autumnale					
morph. I	- -	0.1	0.1	- -	0.1
morph. J	- -	- -	- -	- -	- -
morph. K	- -	- -	- -	- -	- -
P. frigidum & O. deflexa					
morph. L	1	0.2	0.4	0.2	0.2
Microcoleus vaginatus					
morph. M	- -	- -	- -	- -	0.1
Calothrix intricata	- -	- -	- -	- -	- -
Chroococcus minutus	0.6	0.1	0.1	0.2	0.2
Gleocapsa kuetzingiana	- -	- -	- -	- -	- -
Gleocapsa sp.	- -	- -	- -	- -	- -
Nodularia harveyana	- -	- -	- -	- -	- -
Nostoc spp.	90	98	97	99	97
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	- -	- -	- -
Asterococcus sp.	- -	- -	- -	- -	- -
Binuclearia tectorum	- -	- -	- -	- -	- -
Chlorella sp.	- -	- -	- -	- -	- -
Desmid sp.	- -	- -	- -	- -	- -
Indeterminate unicells	0.3	0.1	0.1	0.2	0.1
Indeterminate branched filament	- -	- -	- -	- -	- -
Indeterminate colony	- -	- -	- -	- -	- -
Prasiola calophylla	- -	- -	- -	- -	- -
Prasiola crispa	- -	- -	- -	- -	- -
BACILLARIOPHYTA					
Diatom spp.	2	0.3	0.4	0.2	1.5
Marine diatom fragment	- -	- -	- -	- -	- -
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -	- -	- -
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -	- -	- -
INVERTEBRATES					
Carchesium sp.	- -	- -	- -	- -	- -
Protozoa	- -	- -	- -	- -	- -
Rotifer	M	M	M	M	R
Tartigrade	- -	- -	- -	- -	- -
Tartigrade egg	- -	- -	- -	- -	- -
Nematode	M	M	M	R	R
Indeterminate eggs	M	- -	- -	R	M

Table 29. *List of algal and invertebrate taxa from Priscu Stream near Gage*

TAXA	SITE				
	G-01	G-02	G-03	G-04	G-05
	"ORANGE ALGAE"				
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	--	--	--	0.4	0.4
morph. B	--	--	--	--	--
Oscillatoria irrigua					
morph. C	0.1	--	--	--	--
morph. D	--	--	--	--	--
Phormidium crouani					
morph. E	--	--	--	--	--
Oscillatoria koettlitzi					
morph. F	0.1	--	--	--	--
morph. G	0.1	--	--	--	--
morph. H	--	--	--	--	--
Phormidium autumnale					
morph. I	0.5	0.5	1	0.4	--
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	97	40	29	80	46
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	--	--	--	1	28
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	--	--	--	--	--
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	--	2
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	0.2	0.5	--	0.2	0.6
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	2	59	70	18	23
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	R	--	R	--	M
Tartigrade	--	--	--	--	--
Tartigrade egg	--	--	--	--	--
Nematode	--	--	--	--	--
Indeterminate eggs	--	--	--	--	M

Table 30. *List of algal and invertebrate taxa from Lawson Creek near Gage*

TAXA	SITE				
	G-01	G-02	G-03	G-04	G-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	1	--	--	2	1
morph. B	--	--	--	--	--
Oscillatoria irrigua					
morph. C	--	--	--	--	--
morph. D	1	--	--	--	--
Phormidium crouani					
morph. E	--	--	--	--	--
Oscillatoria koettlitzi					
morph. F	--	--	--	--	--
morph. G	--	--	--	--	--
morph. H	--	--	--	--	--
Phormidium autumnale					
morph. I	25	10	5	35	--
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	70	75	89	55	50
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	2	8	1	--	2
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	--	--	--	2	--
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	5	1	3	45
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	1	2	2	1
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	1	1	2	1	1
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	A	R	R	R	A
Tartigrade	--	--	--	--	--
Tartigrade egg	--	--	--	--	--
Nematode	--	--	--	--	--
Indeterminate eggs	--	--	--	--	--

Table 31. *List of algal and invertebrate taxa from Bohner Stream at Lower Site*

TAXA	SITE				
	L-G1	L-G2	L-G3	- -	- -
		"GREEN ALGAE"			
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	- -	- -	- -		
morph. B	- -	0.5	- -		
Oscillatoria irrigua					
morph. C	- -	- -	- -		
morph. D	- -	- -	- -		
Phormidium crouani					
morph. E	- -	- -	- -		
Oscillatoria koettlitzi					
morph. F	- -	- -	- -		
morph. G	- -	- -	- -		
morph. H	0.5	- -	- -		
Phormidium autumnale					
morph. I	- -	- -	- -		
morph. J	- -	- -	- -		
morph. K	- -	- -	- -		
P. frigidum & O. deflexa					
morph. L	1	2	1		
Microcoleus vaginatus					
morph. M	- -	- -	- -		
Calothrix intricata	- -	- -	- -		
Chroococcus minutus	- -	- -	- -		
Gleocapsa kuetzingiana	- -	- -	- -		
Gleocapsa sp.	- -	- -	- -		
Nodularia harveyana	- -	- -	- -		
Nostoc spp.	- -	- -	- -		
CHLOROPHYTA					
Actinotaenium cucurbita	- -	- -	- -		
Asterococcus sp.	- -	- -	- -		
Binuclearia tectorum	- -	- -	- -		
Chlorella sp.	- -	- -	- -		
Desmid sp.	- -	- -	- -		
Indeterminate unicells	- -	- -	- -		
Indeterminate branched filament	- -	- -	- -		
Indeterminate colony	- -	- -	- -		
Prasiola calophylla	98	97	98		
Prasiola crispa	- -	- -	- -		
BACILLARIOPHYTA					
Diatom spp.	0.5	0.5	1		
Marine diatom fragment	- -	- -	- -		
CHRYSOPHYTA					
Chrysophyte cysts	- -	- -	- -		
EUGLENOPHYTA					
Euglena sp.	- -	- -	- -		
INVERTEBRATES					
Carchesium sp.	- -	- -	- -		
Protozoa	- -	- -	- -		
Rotifer	R	- -	- -		
Tartigrade	- -	- -	- -		
Tartigrade egg	- -	- -	- -		
Nematode	- -	- -	- -		
Indeterminate eggs	- -	- -	- -		

Table 31. *List of algal and invertebrate taxa from Bohner Stream at Lower Site*

TAXA	SITE L-01	L-02	L-03	L-04	L-05
			"ORANGE ALGAE"		
CYANOPHYTA					
Oscillatoria subproboscidea					
morph. A	19	10	54	97	96
morph. B	--	--	1	0.5	0.5
Oscillatoria irrigua					
morph. C	--	--	1	0.5	0.5
morph. D	--	--	--	--	--
Phormidium crouani					
morph. E	--	--	--	--	0.5
Oscillatoria koettlitzi					
morph. F	--	--	1	0.5	--
morph. G	--	--	--	--	--
morph. H	--	--	--	--	--
Phormidium autumnale					
morph. I	--	--	--	--	--
morph. J	--	--	--	--	--
morph. K	--	--	--	--	--
P. frigidum & O. deflexa					
morph. L	80	88	23	1	2
Microcoleus vaginatus					
morph. M	--	--	--	--	--
Calothrix intricata	--	--	--	--	--
Chroococcus minutus	--	--	--	--	--
Gleocapsa kuetzingiana	--	--	--	--	--
Gleocapsa sp.	--	--	--	--	--
Nodularia harveyana	--	--	--	--	--
Nostoc spp.	--	--	--	--	--
CHLOROPHYTA					
Actinotaenium cucurbita	--	--	--	--	--
Asterococcus sp.	--	--	--	--	--
Binuclearia tectorum	--	--	--	--	--
Chlorella sp.	--	--	--	--	--
Desmid sp.	--	--	--	--	--
Indeterminate unicells	--	--	1	--	--
Indeterminate branched filament	--	--	--	--	--
Indeterminate colony	--	--	--	--	--
Prasiola calophylla	--	--	--	--	--
Prasiola crispa	--	--	--	--	--
BACILLARIOPHYTA					
Diatom spp.	1	2	19	0.5	0.5
Marine diatom fragment	--	--	--	--	--
CHRYSOPHYTA					
Chrysophyte cysts	--	--	--	--	--
EUGLENOPHYTA					
Euglena sp.	--	--	--	--	--
INVERTEBRATES					
Carchesium sp.	--	--	--	--	--
Protozoa	--	--	--	--	--
Rotifer	--	--	--	--	--
Tartigrade	--	R	--	--	--
Tartigrade egg	--	--	--	--	--
Nematode	--	--	--	--	--
Indeterminate eggs	--	--	--	--	--

Table 32. AFDM and Chlorophyll Data from McMurdo LTER 1993/94 Season

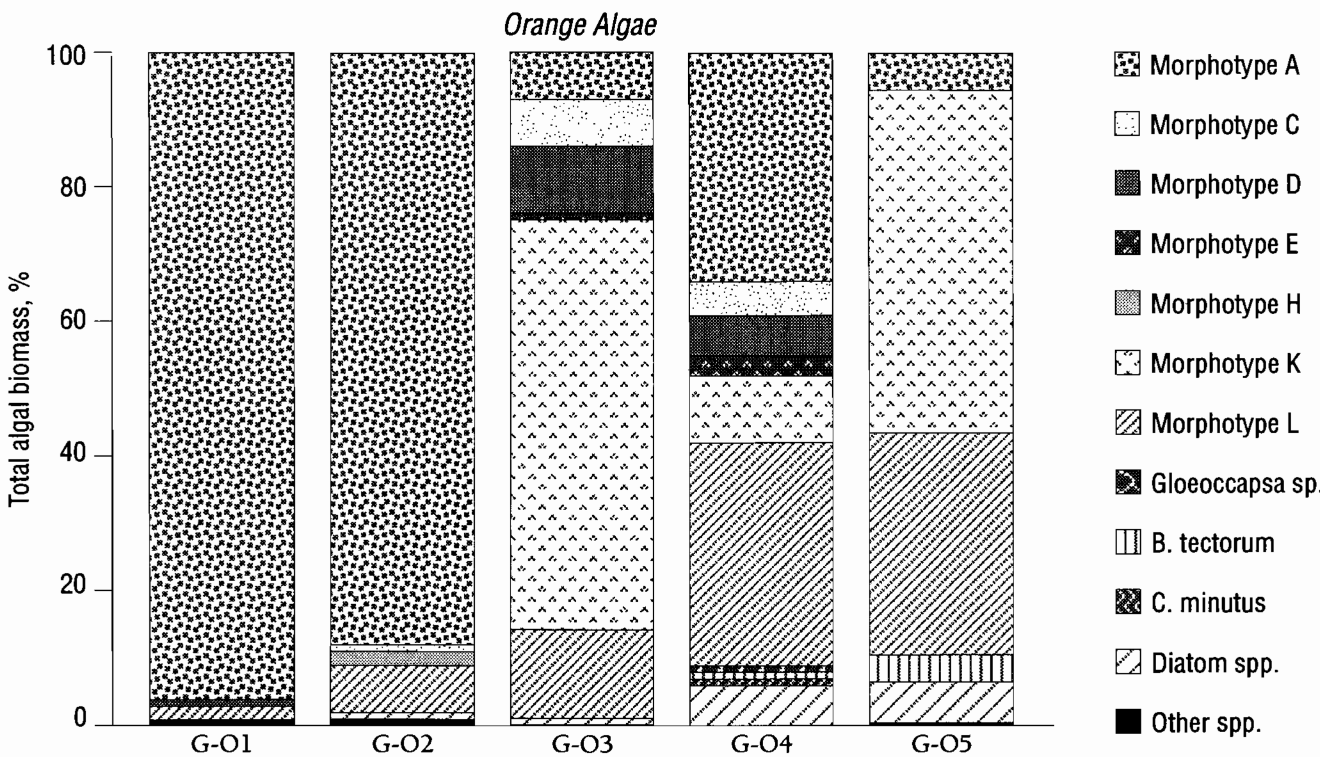
Sample ID	AFDM (mg/cm^2)	Chl a (µg/cm^2)	Chl b (µg/cm^2)	Chl c (µg/cm^2)	Car. (µg/cm^2)	Phaep. (µg/cm^2)
F11HueyGO1	7.14	6.16	4.06	6.05	11.85	2.28
F11HueyGO2	9.30	8.23	5.65	8.24	12.51	0.00
F11HueyGO3	3.88	1.79	1.23	1.54	3.67	0.00
F11HueyGO4	19.60	2.35	1.50	1.95	3.95	0.45
F11HueyGO5	4.27	2.42	1.69	2.15	3.44	0.50
F11HueyGM1	730.00	159.08	298.43	1613.65	794.24	392.60
F11HueyGM2	336.00	41.41	64.23	412.52	180.96	131.20
F11HueyGM3	944.00	314.15	391.36	1475.19	752.64	440.87
F11HueyGM4	1052.00	172.80	282.53	1401.58	656.03	282.87
F11HueyGM5	564.00	150.06	222.34	1084.08	530.40	258.27
F03CanaGM1	6.70	21.31	22.53	64.16	26.95	13.41
F03CanaGM2	134.93	17.17	29.58	108.48	39.82	29.30
F03CanaGM3	8.28	11.13	13.10	42.86	23.31	18.57
F03CanaGM4	28.72	25.27	35.62	124.88	50.02	31.74
F03CanaGM5	15.37	9.31	13.10	46.74	21.49	19.37
F03CanaGR1	19.56	6.91	5.96	13.70	13.76	5.70
F03CanaGR2	19.47	2.30	2.22	6.08	5.10	0.00
F03CanaGR3	7.18	5.20	4.33	10.39	12.57	1.67
F03CanaGR4	44.14	6.10	5.21	11.56	12.08	9.08
F03CanaGR5	10.93	4.37	4.55	14.40	12.46	6.05
F03CanaGO1	190.00	79.20	63.59	89.90	99.65	41.91
F03CanaGO2	104.00	103.70	96.47	152.92	187.98	64.67
F03CanaGO3	114.00	77.15	73.10	112.49	128.10	12.66
F03CanaGO4	164.00	32.44	25.60	58.17	59.14	0.00
F03CanaGO5	224.00	28.34	23.80	52.24	36.00	9.61
F03CanaGG1	58.00	98.74	82.41	119.34	38.16	174.94
F03CanaGG2	54.00	78.73	72.36	156.70	60.38	107.48
F03CanaGG3	80.00	85.38	73.59	93.17	35.40	96.92
F03CanaGB1	14.45	36.98	63.21	267.49	102.56	33.02
F03CanaGB2	17.49	30.77	45.19	169.21	55.31	12.79
F03CanaGB3	9.96	9.50	10.28	35.25	25.27	12.61
F03CanaGB4	19.07	146.24	230.99	760.79	108.41	0.00
F03CanaGB5	13.44	90.43	143.53	467.56	75.67	0.00
F04CanaDR1	97.58	5.60	4.94	12.37	8.96	2.97
F04CanaDR2	12.42	1.16	0.00	0.00	4.62	14.32
F04CanaDR3	17.58	5.43	4.84	16.28	13.35	3.12
F04CanaDR4	26.17	10.59	8.78	18.72	22.95	4.23
F04CanaDR5	16.21	29.50	33.63	115.60	63.31	25.82
F04CanaDM1	86.26	2.38	4.13	20.08	9.22	6.00
F04CanaDM2	93.13	3.45	5.68	27.00	14.64	6.74
F04CanaDM3	32.11	29.94	45.36	179.25	83.14	69.78
F04CanaDM4	17.40	14.12	24.47	110.00	0.00	39.44
F04CanaDM5	72.42	3.63	6.94	34.57	15.72	9.42
F04CanaDB1	28.37	5.87	5.78	17.50	13.21	6.82
F04CanaDB2	27.97	5.13	5.74	18.91	9.42	6.28
F04CanaDB3	17.49	6.85	8.34	31.07	19.01	9.23
F04CanaDB4	32.56	7.18	9.95	41.49	24.66	11.90
F04CanaDB5	51.37	6.72	8.54	34.00	21.95	9.54
F04CanaDG1	116.00	85.97	92.31	276.94	124.80	7.21
F04CanaDG2	86.00	35.08	36.56	83.95	8.84	0.00
F10BowlGB1	15.42	13.48	19.82	70.51	30.78	1.65

Sample ID	AFDM (mg/cm^2)	Chl a (µg/cm^2)	Chl b (µg/cm^2)	Chl c (µg/cm^2)	Car. (µg/cm^2)	Phaep. (µg/cm^2)
F10BowlGB2	13.61	120.06	174.96	543.15	82.56	0.00
F10BowlGB3	27.53	91.22	136.65	428.05	62.31	0.00
F10BowlGB4	31.01	112.57	176.10	569.03	90.96	0.00
F10BowlGB5	50.04	93.06	150.66	486.06	78.80	0.00
F10BowlGO1	8.15	10.81	11.31	34.13	18.80	8.39
F10BowlGO2	17.22	7.16	7.25	21.41	13.80	7.50
F10BowlGO3	11.32	6.70	0.00	397.93	13.83	4.68
F10BowlGO4	8.50	15.26	15.03	42.98	26.95	25.06
F10BowlGO5	12.07	14.73	14.00	38.94	25.34	15.78
F10BowlGM1	148.00	115.12	198.42	998.73	426.82	20.29
F10BowlGM2	430.00	138.37	205.85	896.93	503.57	300.73
F10BowlGM3	228.00	42.16	52.38	187.66	96.00	58.07
F10BowlGM4	616.00	59.53	73.33	297.19	127.16	95.77
F10BowlGM5	666.00	492.68	1126.59	6131.16	1613.64	1885.95
F09GreeGO1	8.90	7.99	5.73	8.87	11.76	1.55
F09GreeGO2	33.66	3.99	3.09	6.28	5.52	6.62
F09GreeGO3	8.59	10.09	7.86	14.62	18.03	17.27
F09GreeGO4	17.36	3.57	2.55	4.20	4.82	4.89
F09GreeGO5	6.87	8.57	5.96	9.04	14.24	14.88
F09GreeGM1	666.00	107.44	203.05	1157.60	518.58	194.57
F09GreeGM2	444.00	ND	ND	ND	ND	ND
F09GreeGM3	4356.00	82.31	108.16	482.52	234.88	170.03
F09GreeGM4	2538.00	106.72	123.69	525.26	266.57	166.78
F09GreeGM5	1022.00	98.80	158.17	869.17	413.44	209.25
F09GreeGB1	114.41	ND	ND	ND	ND	ND
F09GreeGB2	58.15	39.62	71.53	318.47	90.88	68.17
F09GreeGB3	12.82	60.78	98.29	345.36	71.59	8.93
F09GreeGB4	54.76	19.39	89.08	322.24	72.44	66.66
F09GreeGB5	34.23	ND	ND	ND	ND	ND
F07DeltUO1	14.80	9.37	10.16	35.86	25.98	10.89
F07DeltUO2	27.40	ND	ND	ND	ND	ND
F07DeltUO3	26.52	14.55	16.36	53.14	34.69	14.67
F07DeltUO4	18.85	13.32	13.57	40.60	34.79	19.63
F07DeltUO5	15.59	8.94	10.20	38.09	24.73	13.80
F07DeltUB1	23.13	54.11	93.10	392.24	125.20	91.36
F07DeltUB2	25.37	44.42	81.79	346.16	95.29	16.21
F07DeltUB3	21.45	13.40	17.96	70.59	42.08	21.97
F07DeltUB4	41.63	47.59	85.09	334.98	76.57	0.00
F07DeltUB5	20.88	46.57	83.83	356.58	99.16	18.64
F07DeltUF1	140.00	141.78	157.46	505.73	286.72	93.13
F07DeltUF2	66.00	65.23	78.35	286.71	149.69	32.87
F07DeltUF3	102.00	74.98	78.23	238.59	124.44	44.03
F07DeltUF4	126.00	85.42	84.06	207.36	102.00	106.53
F08DeltGB1	43.83	43.82	74.41	268.76	69.02	0.00
F08DeltGB2	14.76	6.12	11.04	51.92	21.58	4.58
F08DeltGB3	22.29	43.77	84.44	356.53	87.71	12.45
F08DeltGB4	22.69	41.47	67.26	238.73	59.85	0.00
F08DeltGB5	153.00	5.55	7.43	30.31	14.31	5.99
F08DeltGM1	630.00	313.18	427.00	1651.12	690.88	274.61
F08DeltGM2	334.00	312.69	538.63	2270.77	821.70	87.33
F08DeltGM3	780.00	203.66	292.77	1275.22	583.04	149.09
F08DeltGM4	438.00	300.09	471.26	2082.55	812.16	86.29
F08DeltGM5	208.00	230.46	397.67	1777.90	603.43	0.00

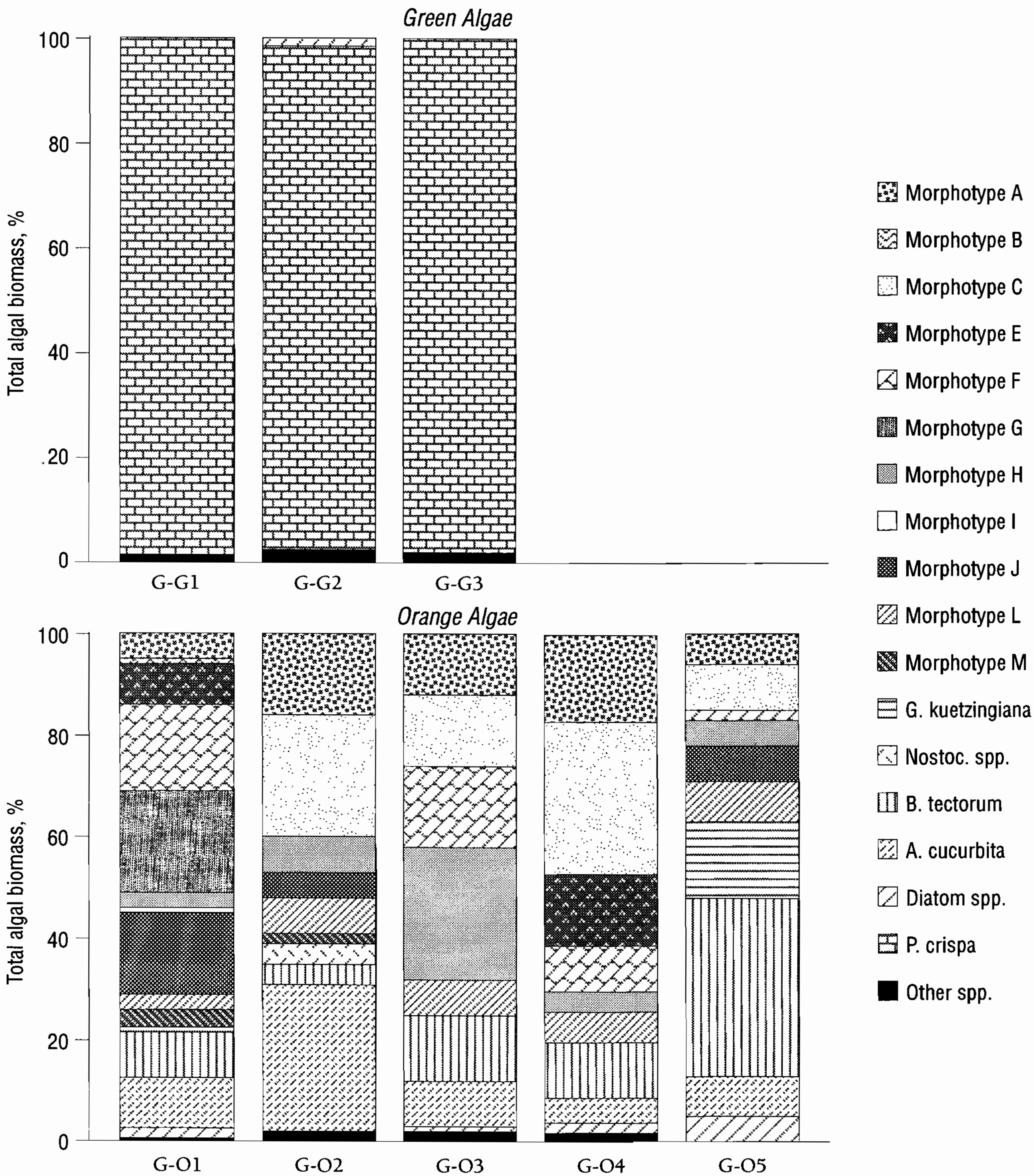
Sample ID	AFDM (mg/cm^2)	Chl a (µg/cm^2)	Chl b (µg/cm^2)	Chl c (µg/cm^2)	Car. (µg/cm^2)	Phaep. (µg/cm^2)
F08DeltGF1	212.00	31.24	24.07	41.75	55.10	17.95
F08DeltGF2	22.00	87.27	58.91	90.82	157.10	73.29
F05VonGUO1	96.00	36.43	34.53	74.44	40.32	20.93
F05VonGUO2	48.00	36.41	28.53	57.93	84.00	23.63
F05VonGUO3	120.00	36.86	24.31	38.07	79.80	10.01
F05VonGUO4	56.00	70.47	51.21	81.42	150.28	23.60
F05VonGUO5	204.00	52.35	22.58	37.51	181.94	89.97
F05VonGUM1	290.00	43.96	62.87	292.90	124.80	56.87
F05VonGUF1	94.00	22.58	55.80	116.58	43.17	0.00
F05VonGUF2	110.00	19.56	21.12	52.11	38.08	0.00
F06VonGLO1	21.76	10.17	9.28	26.92	20.81	10.31
F06VonGLO2	43.57	16.12	12.67	25.94	29.25	9.58
F06VonGLO3	20.31	8.32	5.92	11.16	14.25	2.49
F06VonGLO4	41.06	7.17	5.90	14.90	13.91	3.50
F06VonGLO5	16.74	16.86	14.41	32.86	29.42	10.16
F06VonGLB1	186.00	99.37	107.55	369.98	225.60	66.48
F06VonGLB2	81.72	8.69	10.33	33.27	20.08	12.78
F06VonGLB3	38.72	5.94	6.41	23.67	15.49	7.65
F06VonGLB4	14.45	ND	ND	ND	ND	ND
F06VonGLB5	27.93	8.91	8.07	22.81	19.17	5.66
F06VonGLM1	734.00	108.08	145.13	657.98	345.91	173.29
F06VonGLM2	3522.00	50.62	65.20	284.17	121.72	64.45
F06VonGLM3	1020.00	157.98	189.03	627.24	298.52	300.03
F06VonGLM4	1066.00	312.12	453.69	2055.02	844.93	791.25
F06VonGLM5	484.00	142.26	177.57	691.50	303.84	216.75
F12VonGGO1	32.51	3.05	2.28	5.26	4.00	2.90
F12VonGGO2	7.44	5.38	3.98	6.51	8.33	4.77
F12VonGGO3	19.82	10.15	7.67	13.37	18.52	6.12
F12VonGGO4	33.08	21.72	19.02	42.47	39.14	13.91
F12VonGGO5	12.86	3.86	2.62	4.44	6.74	1.29
F12VonGGB1	11.54	12.19	16.14	65.66	40.30	23.67
F12VonGGB2	23.35	5.91	5.21	14.29	11.72	5.45
F12VonGGB3	11.76	15.59	17.32	57.28	44.05	23.49
F12VonGGB4	27.31	10.62	11.02	36.98	27.26	12.76
F12VonGGB5	11.85	9.01	10.28	40.29	25.89	14.02
F12VonGGM1	480.00	64.38	53.92	130.41	120.18	62.05
F12VonGGM2	576.00	137.48	258.66	1506.40	728.32	626.70
F12VonGGM3	666.00	ND	ND	ND	ND	ND
F12VonGGM4	620.00	85.60	139.62	780.59	380.48	190.92
F12VonGGB5	11.85	9.01	10.28	40.29	25.89	14.02
F12VonGGM1	480.00	64.38	53.92	130.41	120.18	62.05
F12VonGGM2	576.00	137.48	258.66	1506.40	728.32	626.70
F12VonGGM3	666.00	ND	ND	ND	ND	ND
F12VonGGM4	620.00	85.60	139.62	780.59	380.48	190.92
F12VonGGM5	1326.00	123.67	111.90	277.05	215.34	104.71
H01AndrGO1	22.00	67.01	47.15	69.84	127.16	17.25
H01AndrGO2	82.00	47.70	33.58	52.86	54.40	83.73
H01AndrGO3	44.00	26.69	23.65	48.42	38.08	47.66
H01AndrGO4	34.00	47.53	36.85	73.83	51.00	50.06
H01AndrGO5	20.00	100.67	71.67	115.34	142.76	116.57
H01AndrGG1	7.93	442.48	371.23	510.07	319.19	545.86
H01AndrGG2	1.06	155.53	110.24	117.52	99.92	114.86
H01AndrGM1	540.00	ND	ND	ND	ND	ND

Sample ID	AFDM (mg/cm^2)	Chl a (μg/cm^2)	Chl b (μg/cm^2)	Chl c (μg/cm^2)	Car. (μg/cm^2)	Phaep. (μg/cm^2)
H01AndrGM2	442.00	58.16	116.56	722.18	336.64	112.35
H01AndrGM3	300.00	ND	ND	ND	ND	ND
H01AndrGM4	384.00	84.27	108.84	485.16	230.52	104.85
H02HousGS1	0.22	0.01	0.02	0.07	0.00	0.01
H02HousGS2	0.27	0.05	0.07	0.29	0.05	0.08
H02HousGS3	0.28	0.01	0.01	0.05	0.00	0.03
H02HousGRK1	0.05	0.00	1.09	0.00	0.00	2.40
H02HousGRK2	0.10	0.00	0.11	2.20	0.00	0.00
H02HousGRK3	0.03	0.75	0.11	2.52	0.00	0.00
H02HousGRK4	0.07	ND	ND	ND	ND	ND
H02HousGRK5	0.39	1.04	0.00	13.09	0.00	0.00
H16WharDO1	128.00	65.06	52.86	75.70	98.50	93.00
H16WharDO2	246.00	60.31	45.09	60.54	88.75	35.82
H16WharDO3	86.00	87.28	57.14	81.94	127.16	152.51
H16WharDO4	66.00	38.01	31.41	61.36	47.47	51.89
H16WharDO5	104.00	30.54	19.92	30.55	18.14	15.25
H16WharDM1	136.00	137.92	207.21	974.19	359.28	200.41
H16WharDM2	240.00	62.67	77.43	319.22	133.00	91.31
H16WharDM3	270.00	66.99	98.78	452.04	193.92	172.16
H16WharDM4	430.00	154.44	288.39	1471.23	665.28	381.11
H16WharDM5	526.00	140.92	197.07	832.24	399.17	211.76
H16WharDB1	534.00	912.50	1828.54	9128.22	2633.90	3755.34
H16WharDB2	420.00	252.59	432.72	2159.07	1110.00	679.28
H16WharDB3	584.00	97.77	143.26	698.22	307.25	282.14
H16WharDB4	608.00	234.71	385.35	1767.72	778.60	364.94
H16WharDB5	534.00	211.72	342.69	1707.90	825.84	464.34
B13PrisGO1	0.38	62.21	45.79	54.51	72.14	86.50
B13PrisGO2	5.80	4.54	3.88	7.48	3.20	7.35
B13PrisGO3	0.94	158.51	118.52	208.65	175.58	345.15
B13PrisGO4	0.87	114.67	87.46	112.01	144.80	165.54
B13PrisGO5	2.96	430.03	337.56	549.03	594.26	793.34
B14LawsGO1	0.07	22.39	16.17	24.53	41.05	21.43
B14LawsGO2	0.51	641.65	432.74	595.65	1244.55	94.64
B14LawsGO3	0.24	171.05	141.96	217.05	252.97	8.66
B14LawsGO4	1.41	1.78	1.23	1.56	2.49	1.52
B14LawsGO5	0.61	453.16	291.64	300.55	646.96	734.78
B15BohnLO1	128.00	12.14	6.00	30.02	5.11	0.00
B15BohnLO2	78.00	30.30	19.92	42.80	35.39	2.95
B15BohnLO3	22.00	23.48	16.82	30.26	21.76	18.16
B15BohnLO4	30.00	29.11	19.68	20.29	39.04	0.00
B15BohnLO5	112.00	102.88	69.71	89.89	234.39	0.00
B15BohnLG1	3.07	793.35	668.36	976.91	470.70	301.39
B15BohnLG2	4.62	86.72	73.11	137.48	25.38	96.56
B15BohnLG3	0.82	663.57	544.32	782.66	338.50	902.65

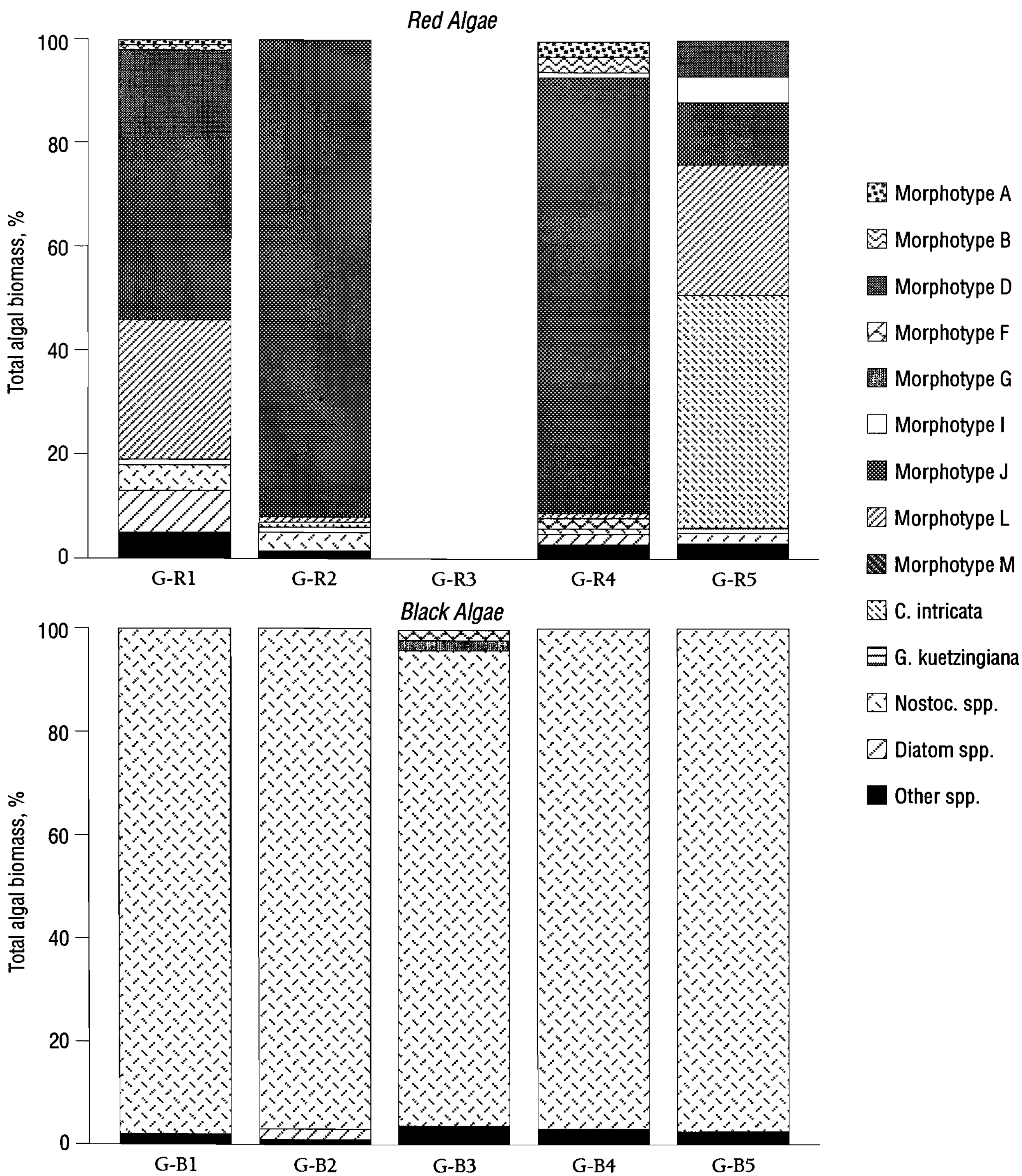
Huey Creek near Gage



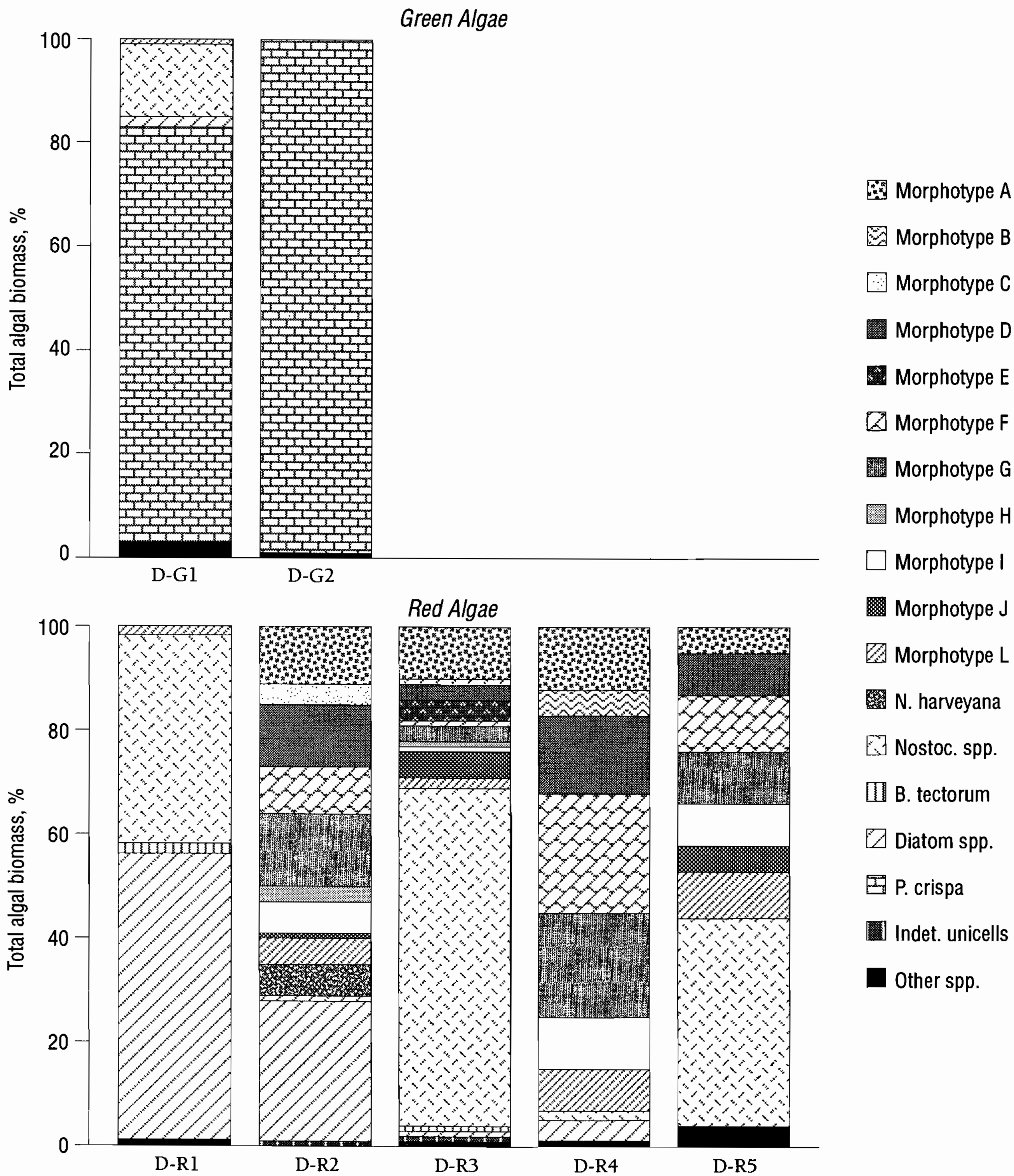
Canada Stream near Gage



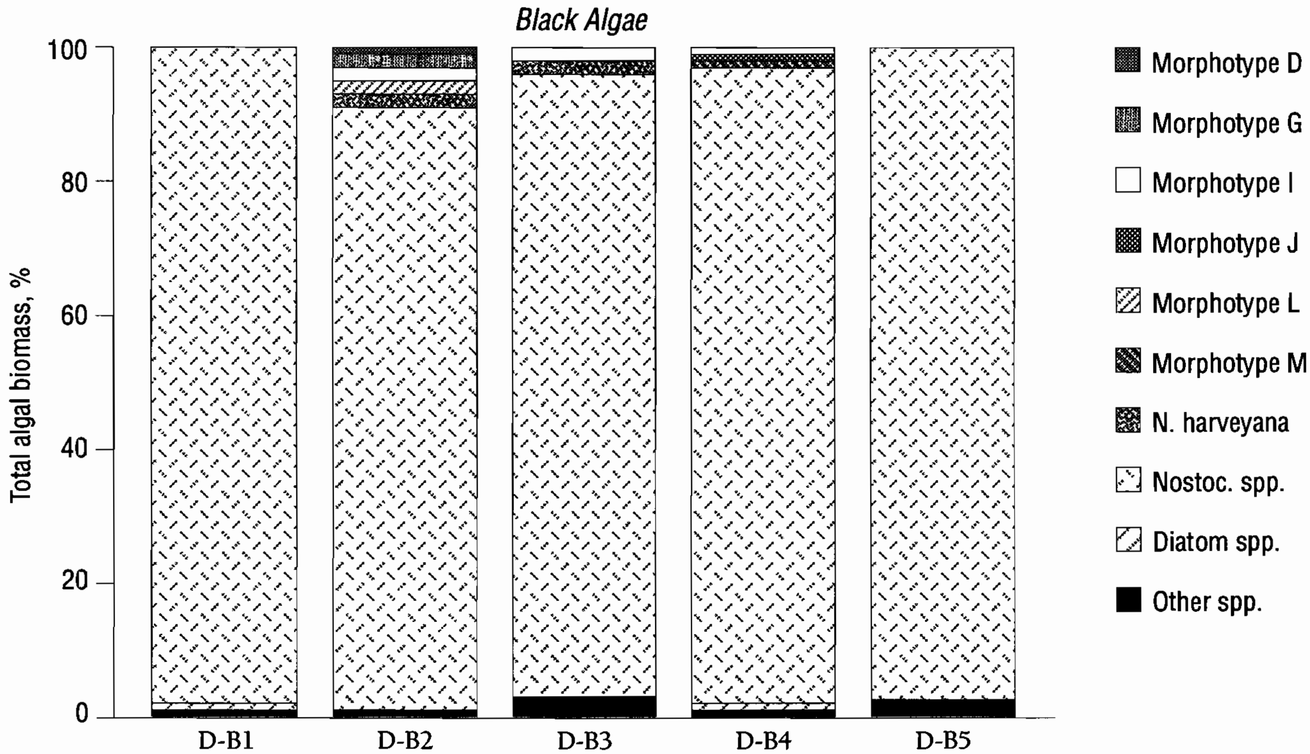
Canada Stream near Gage



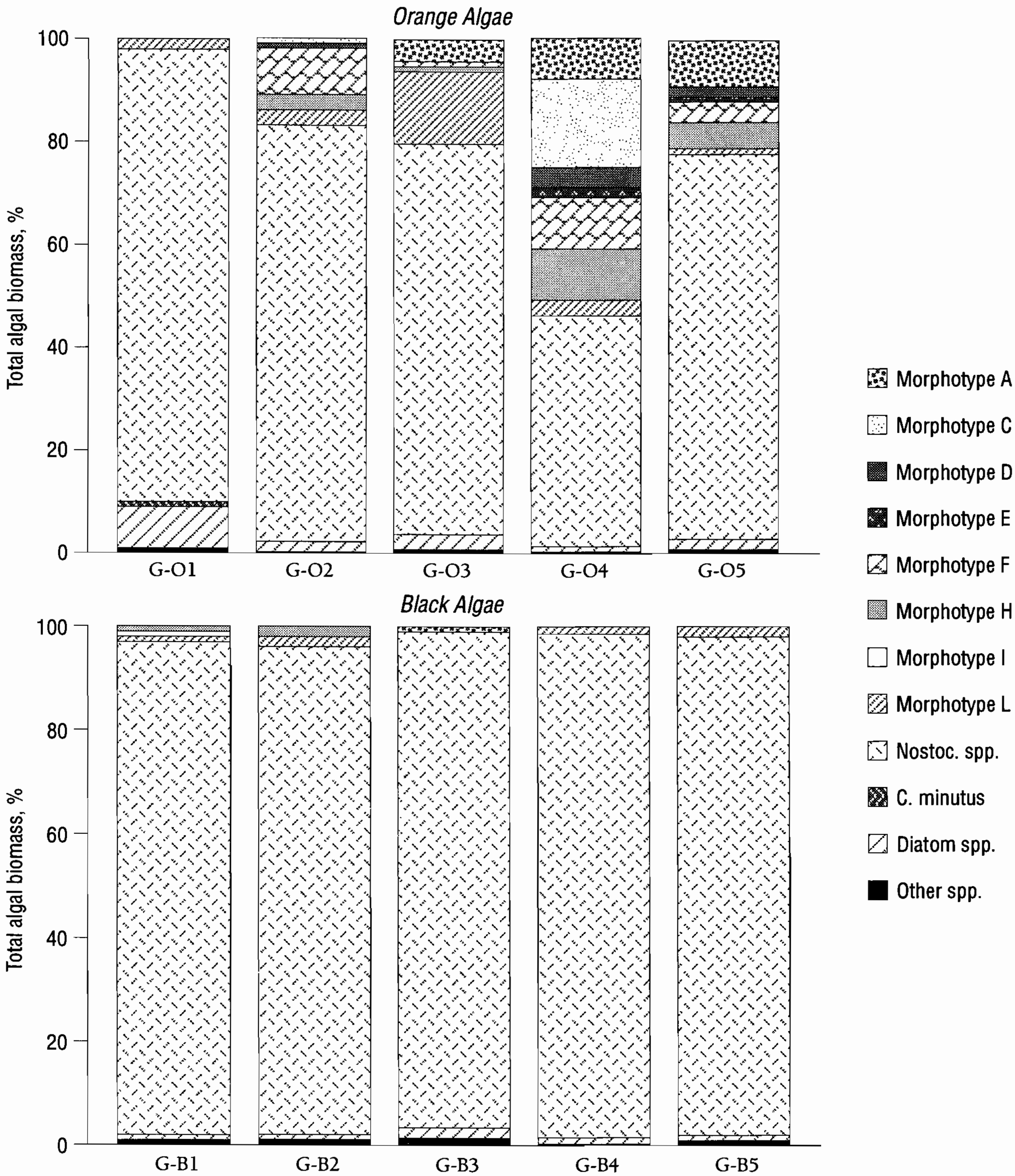
Canada Stream at Delta



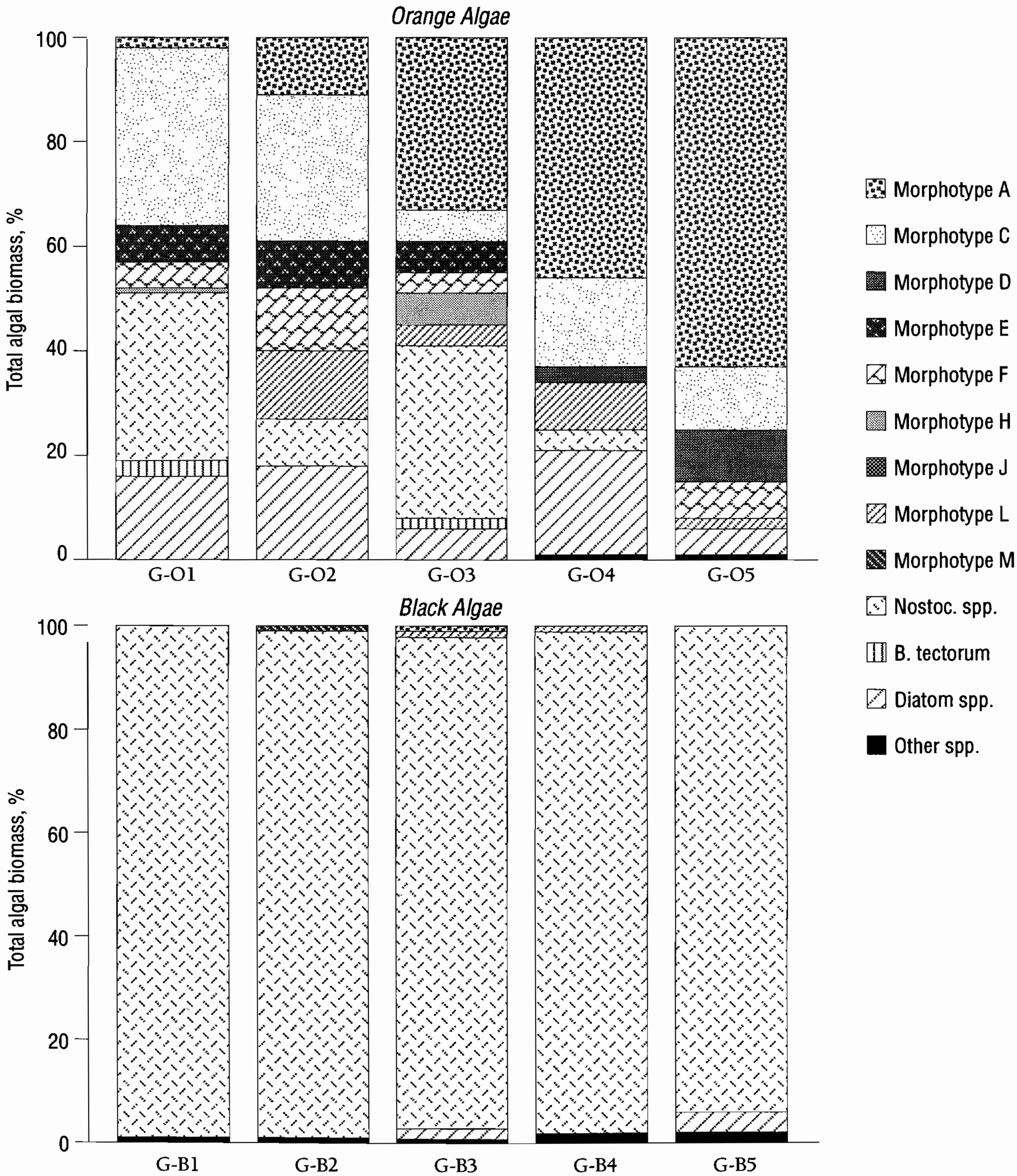
Canada Stream at Delta



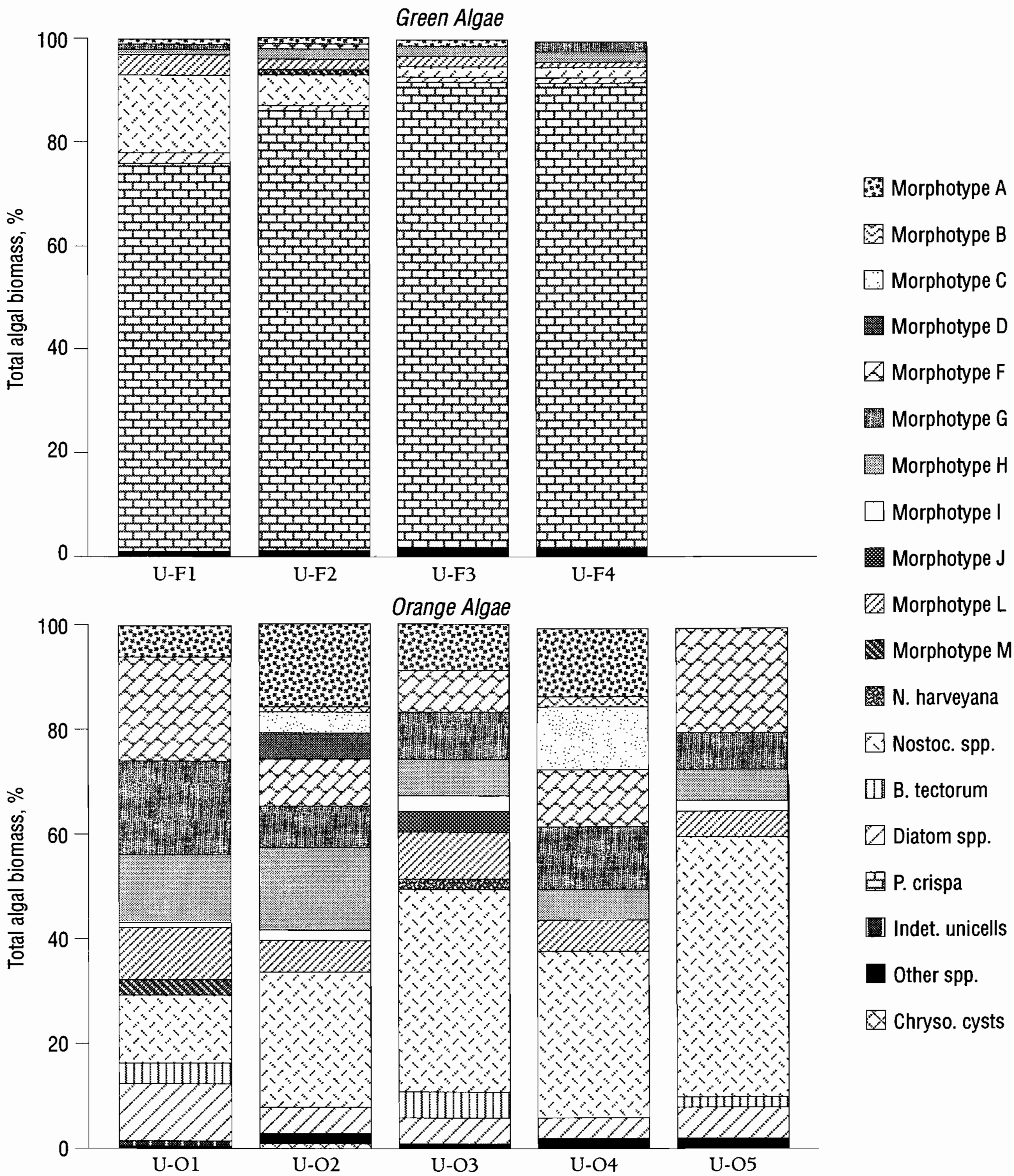
Bowles Creek near Gage



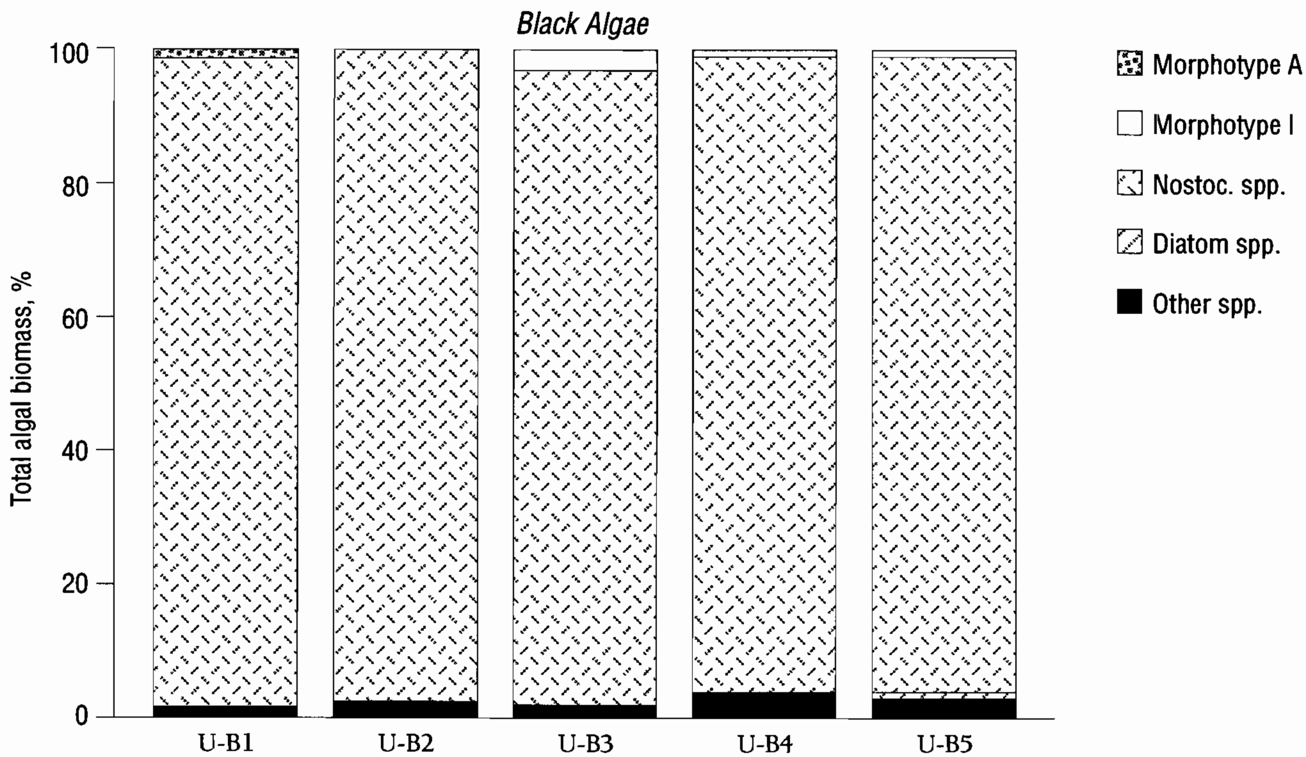
Green Creek above Gage



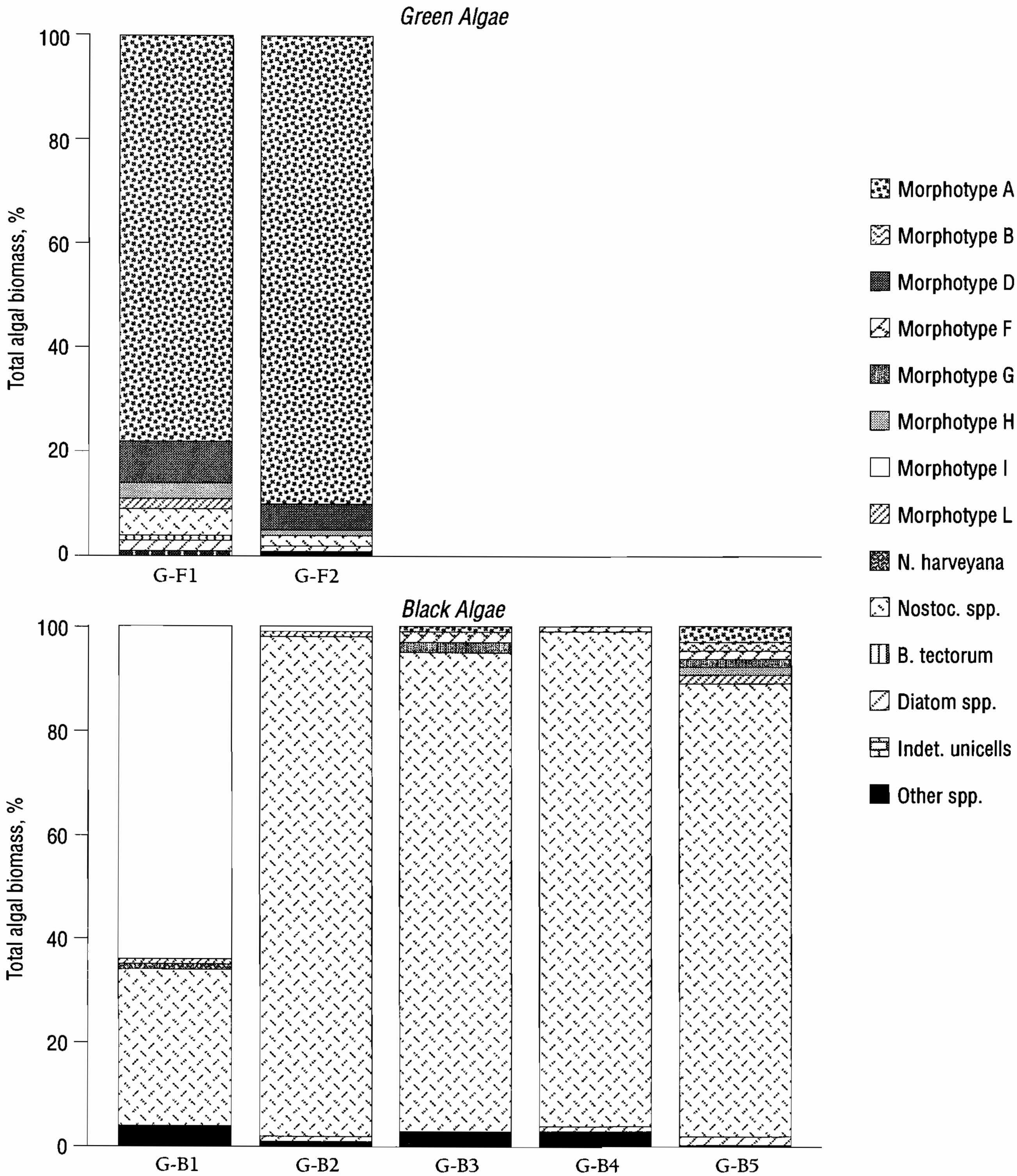
Delta Stream at Upper Site



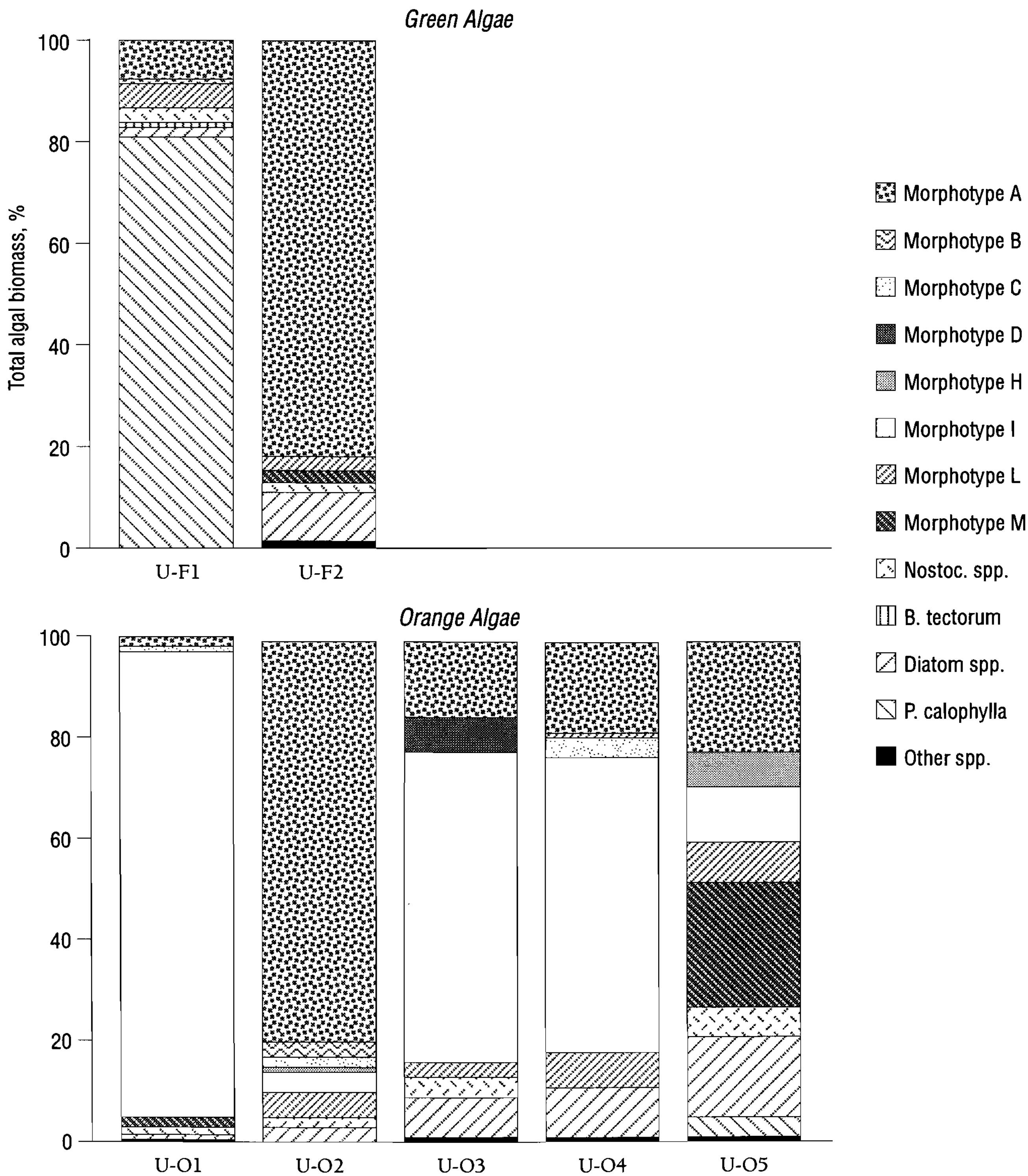
Delta Stream at Upper Site



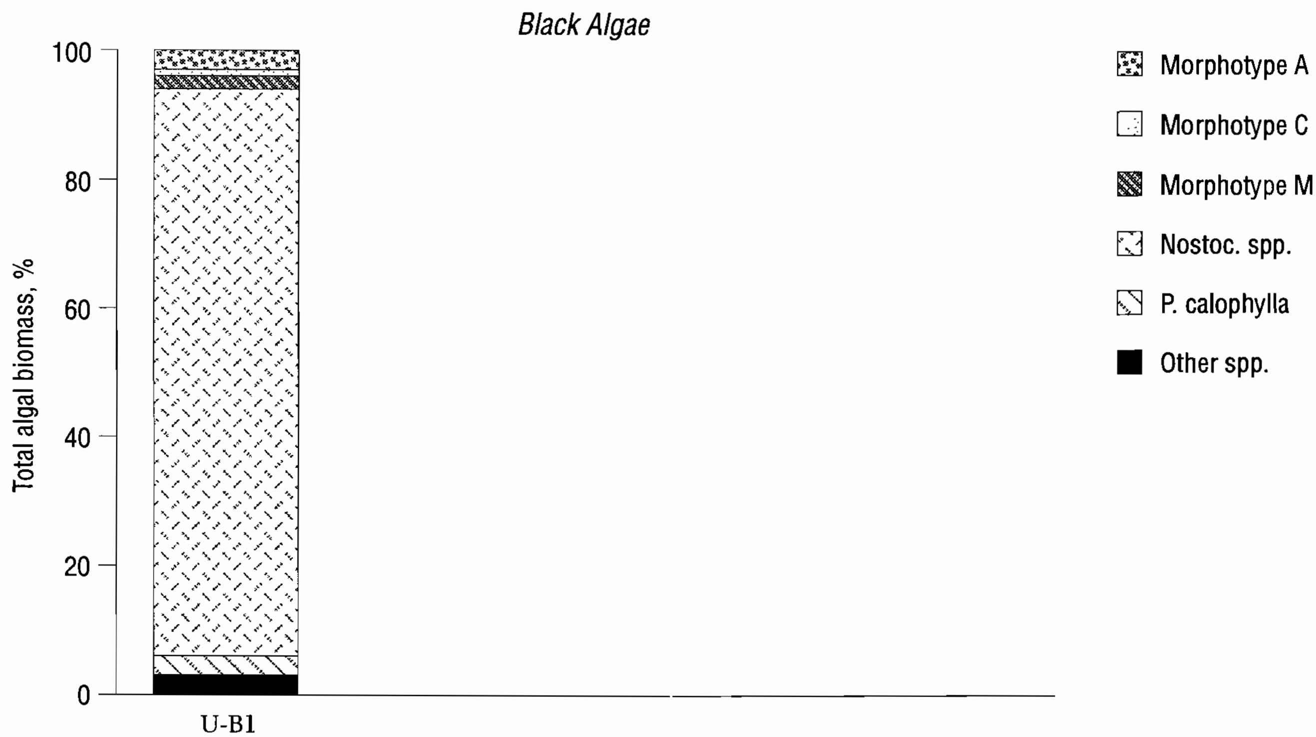
Delta Stream near Gage



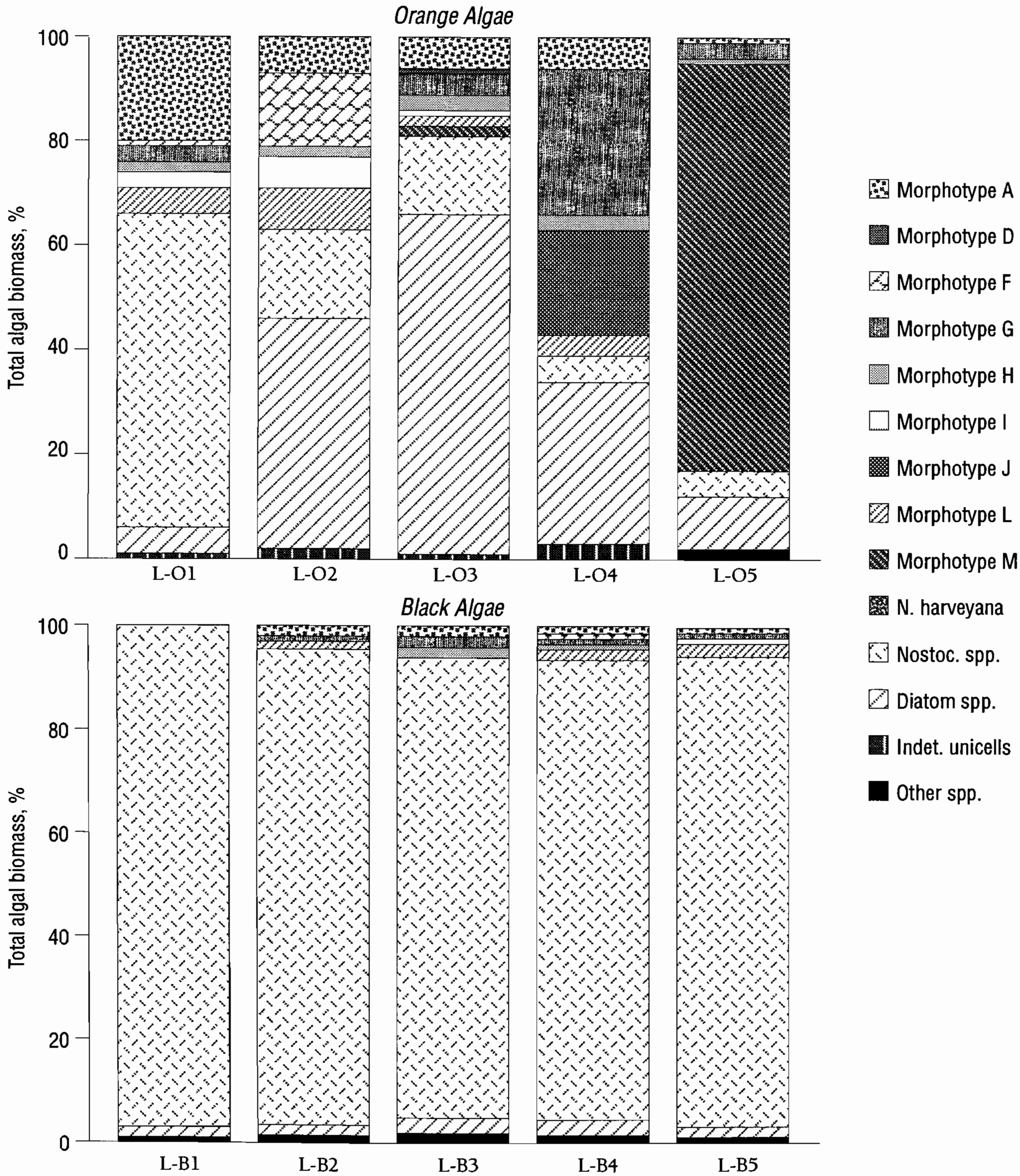
Von Guerard Stream at Upper Site



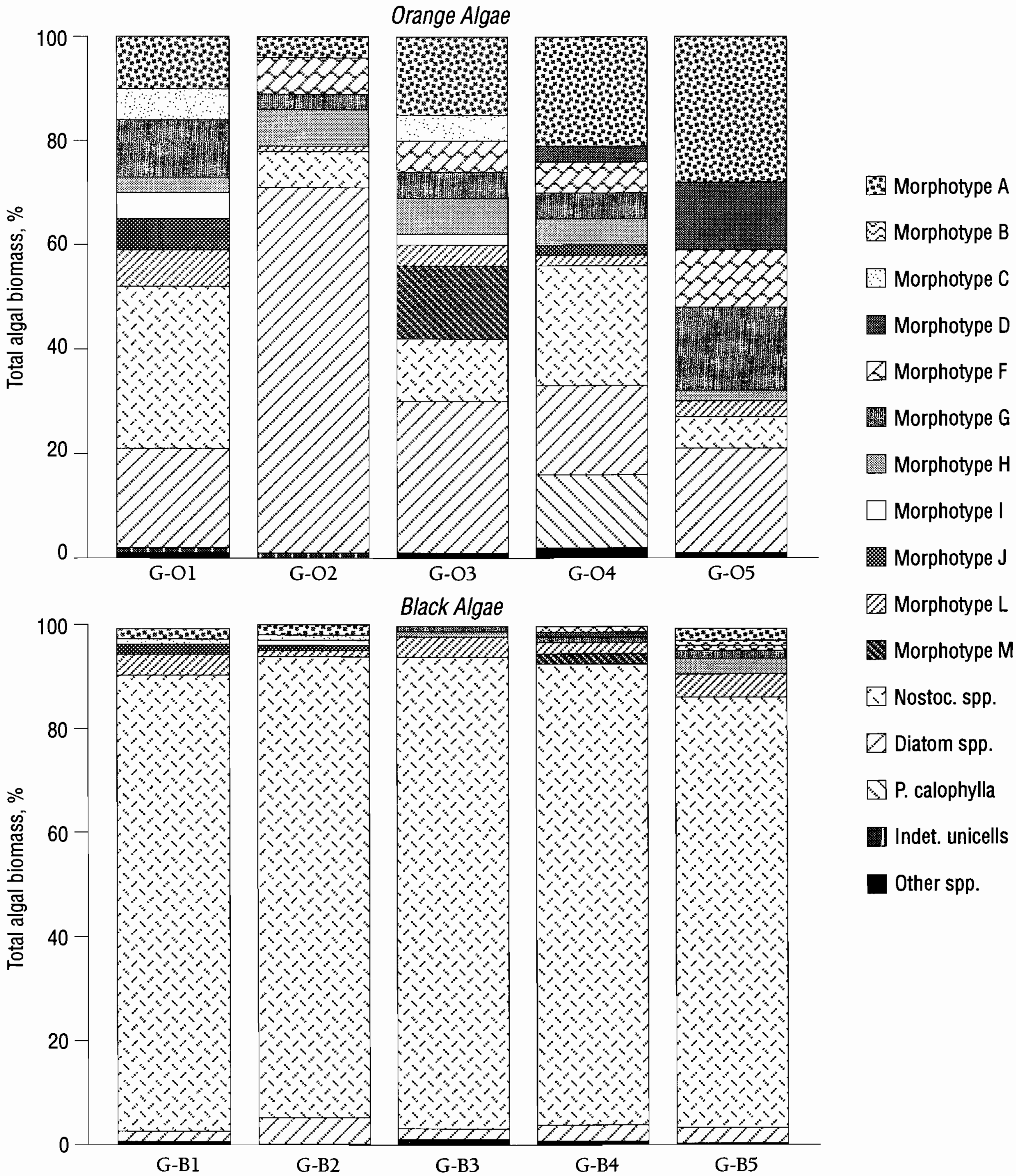
Von Guerard Stream at Upper Site



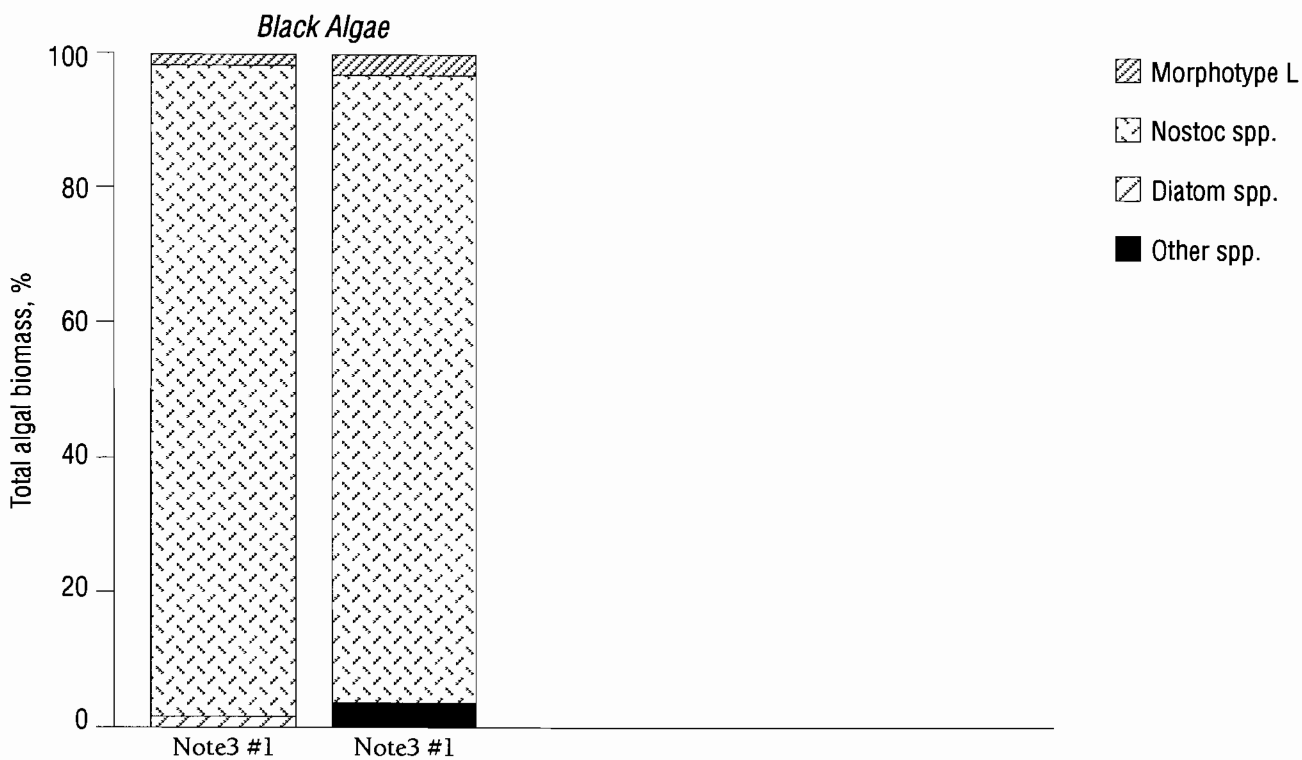
Von Guerard Stream at Lower Site



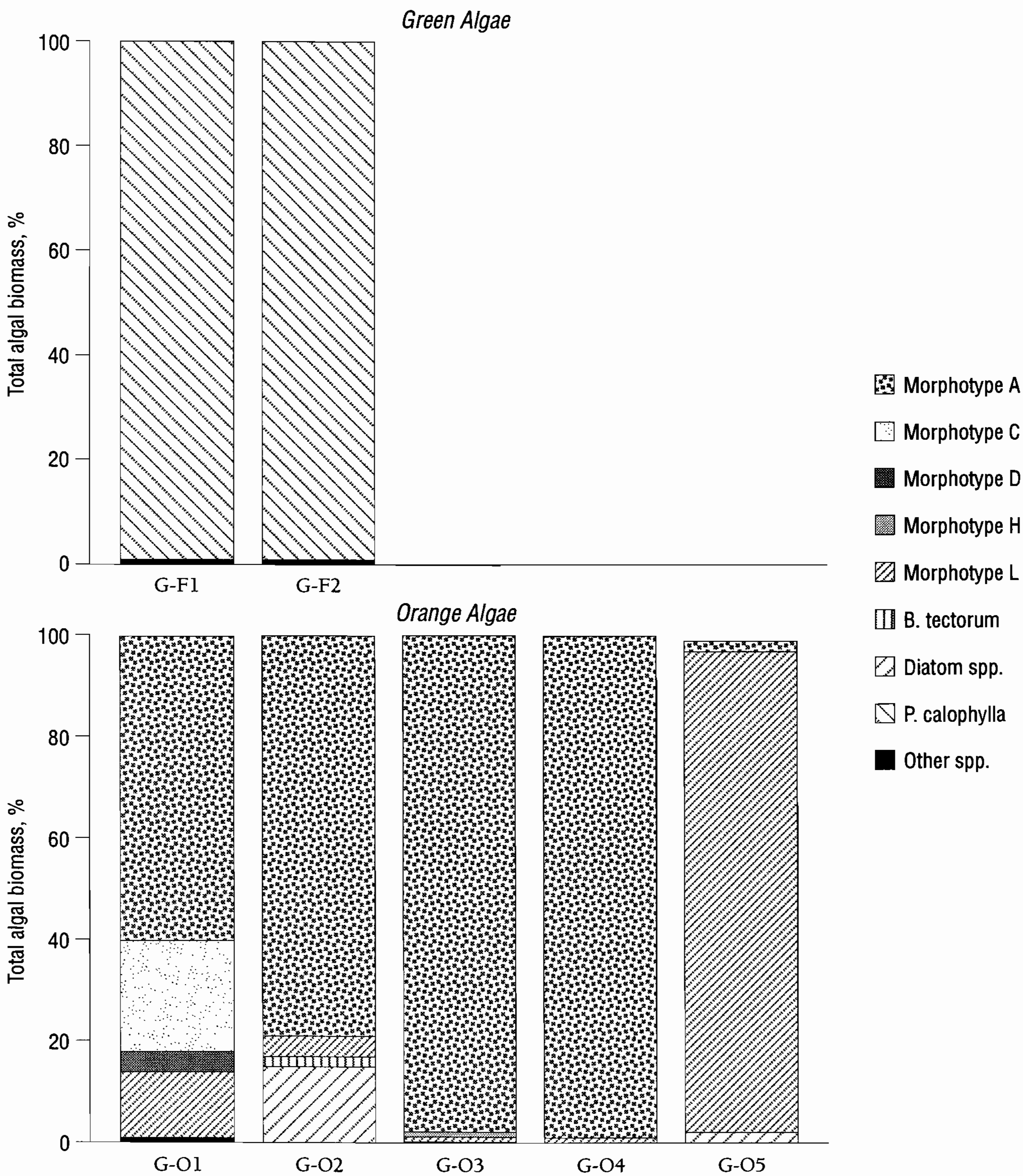
Von Guerard Stream at Gage



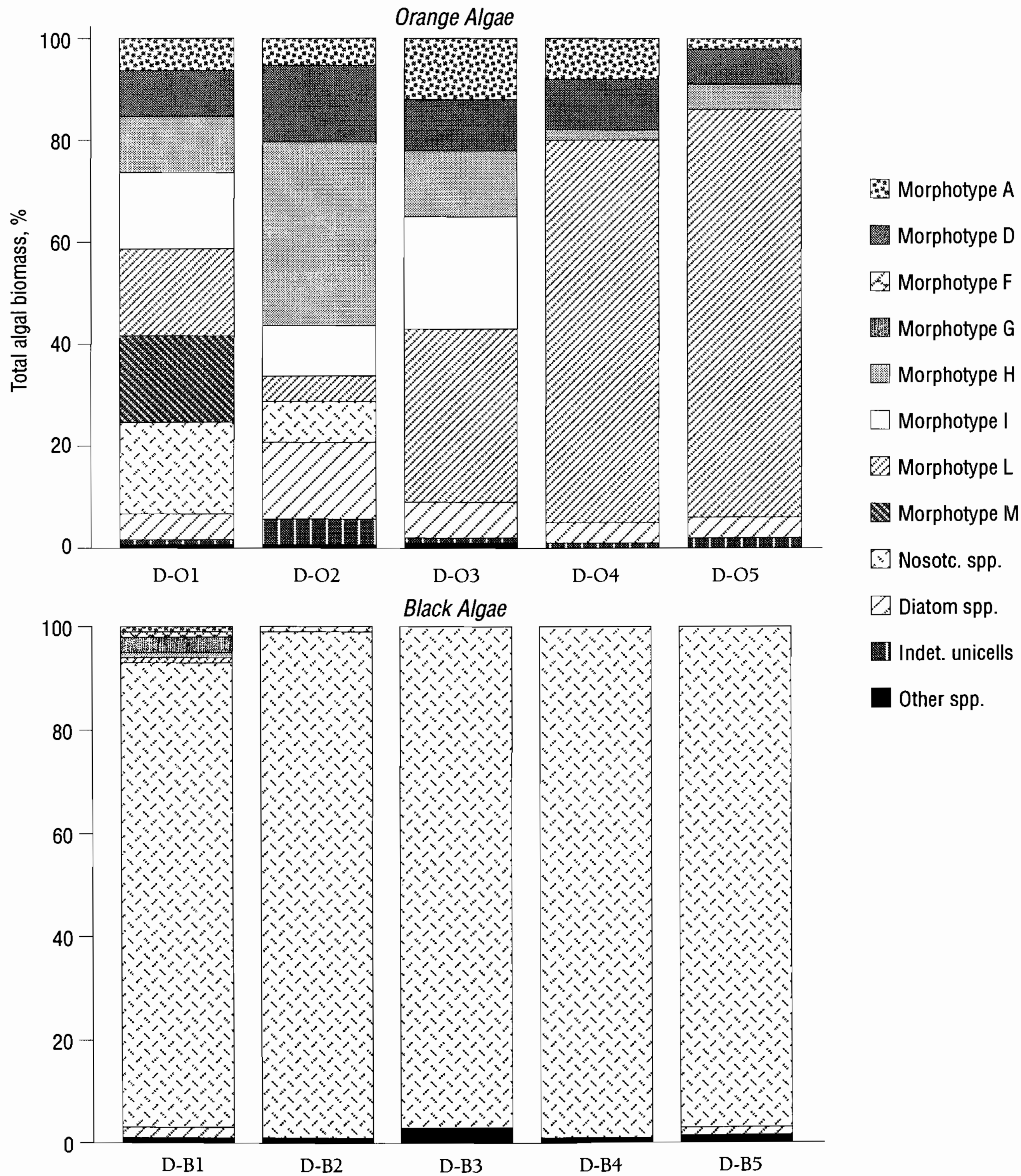
Von Guerard Relict Channel



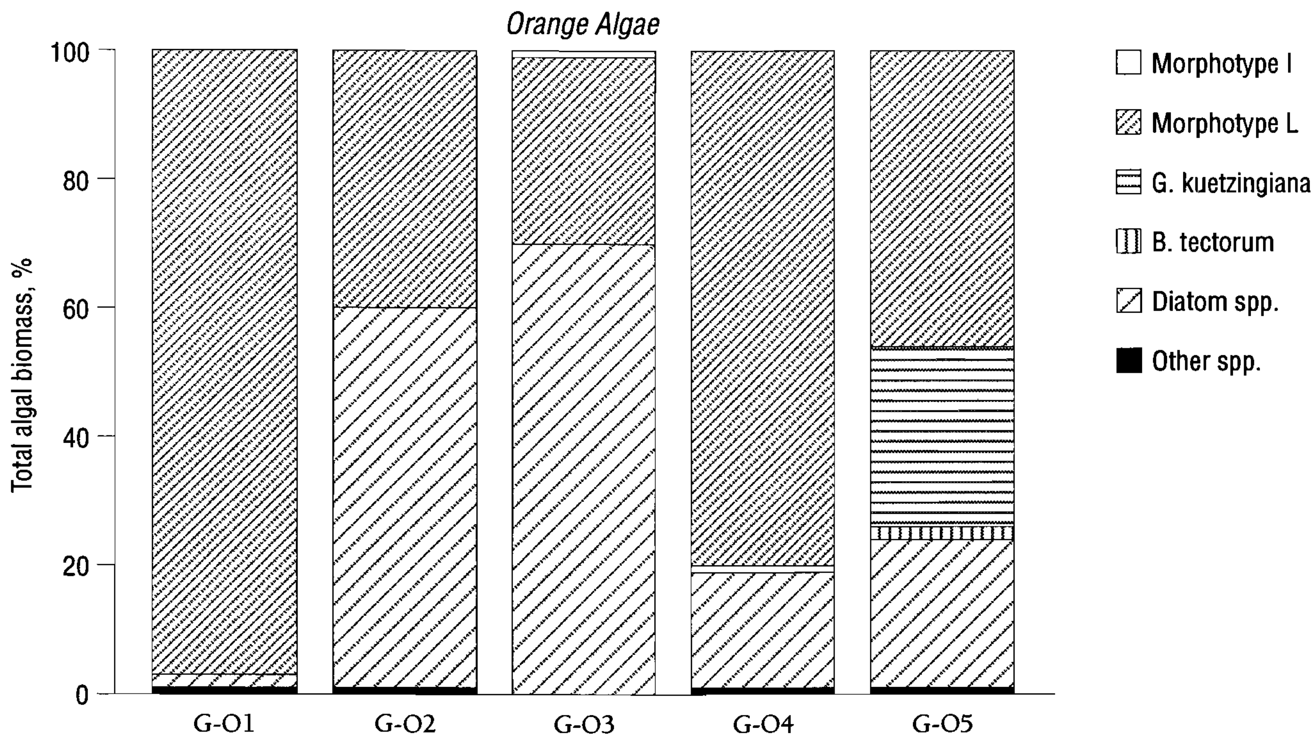
Andersen Creek near Gage



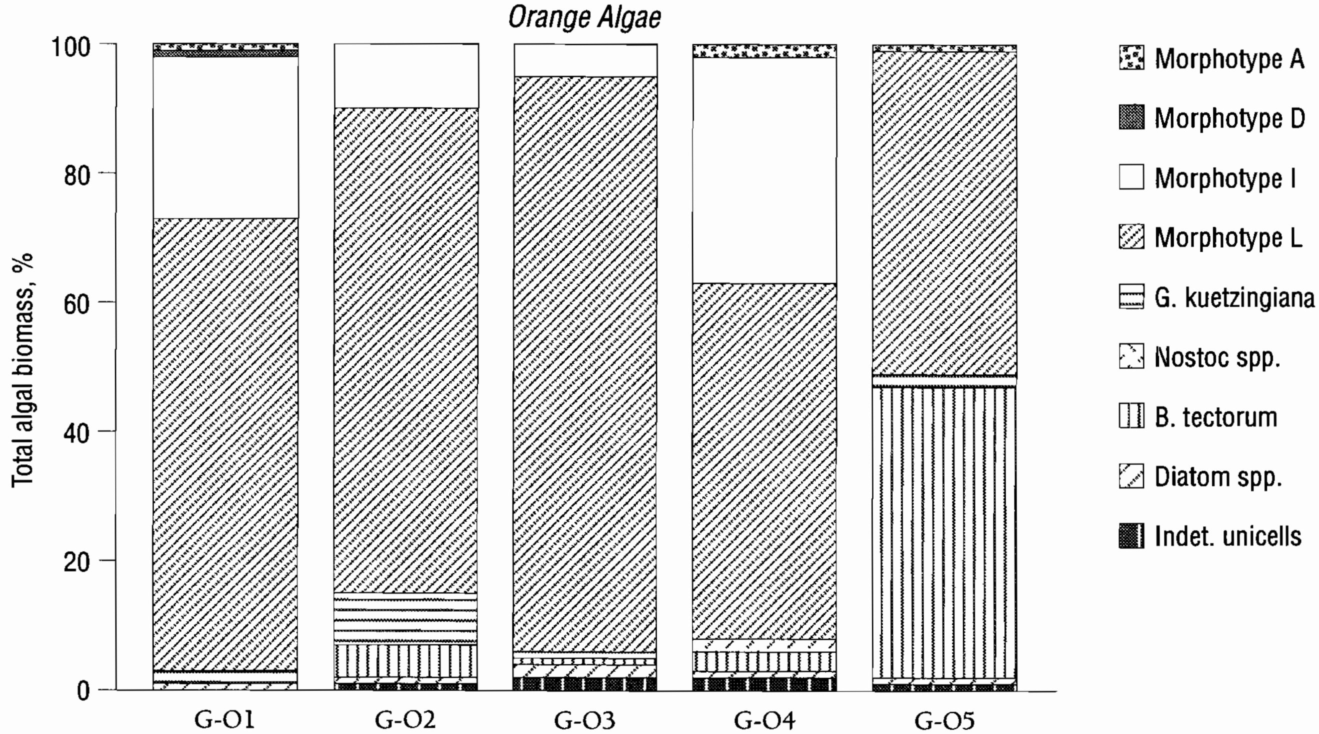
Wharton Creek at Delta



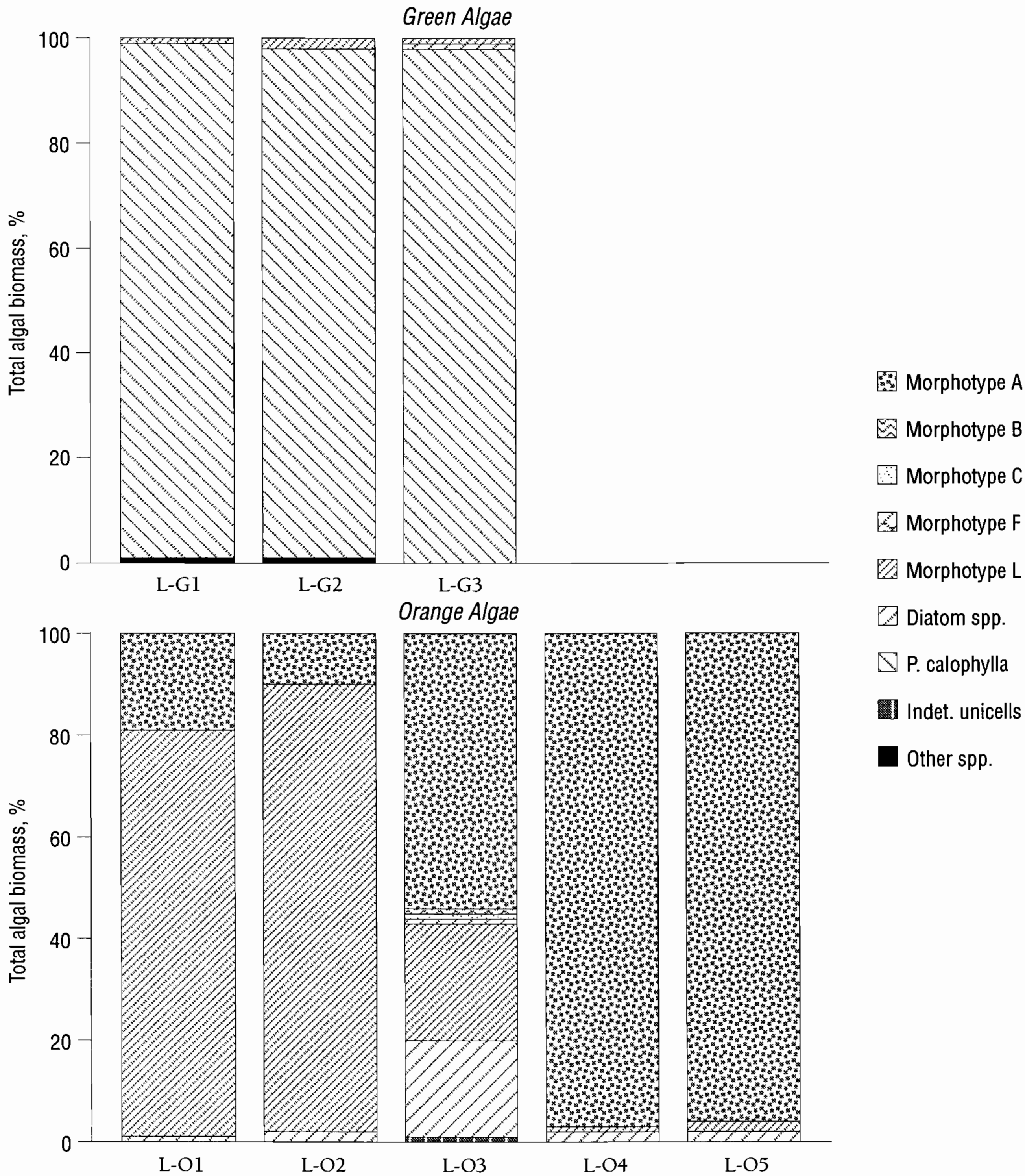
Priscu Stream near Gage



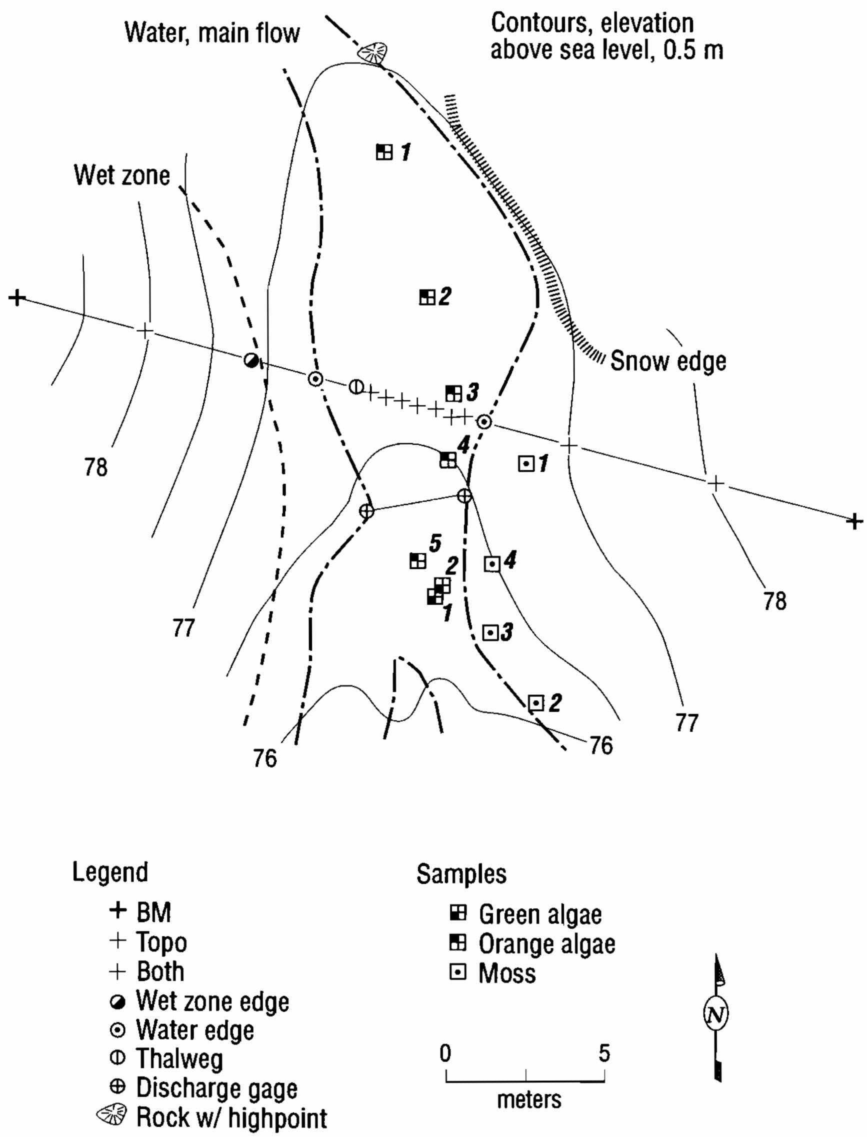
Lawson Creek near Gage



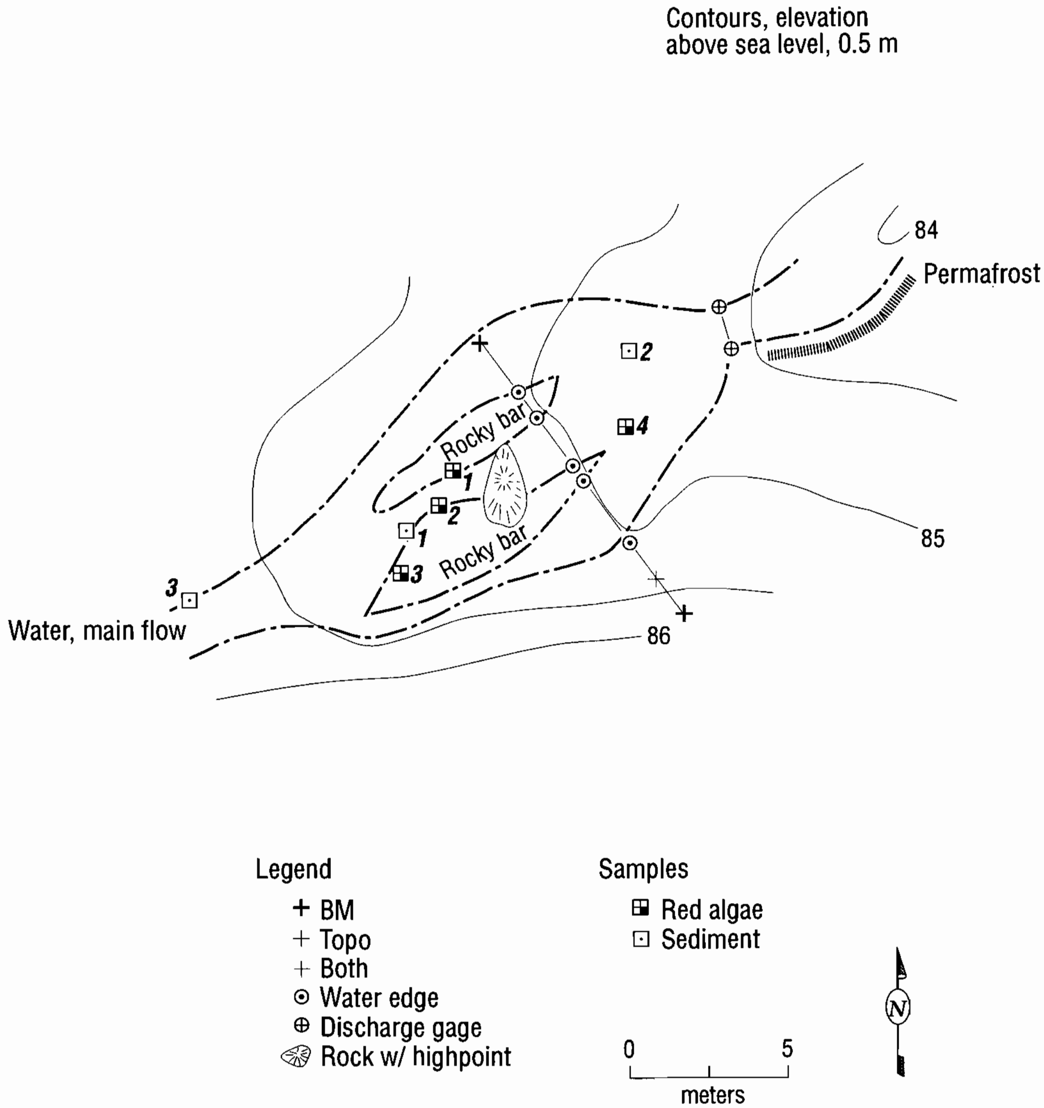
Bohner Sream at Lower Site



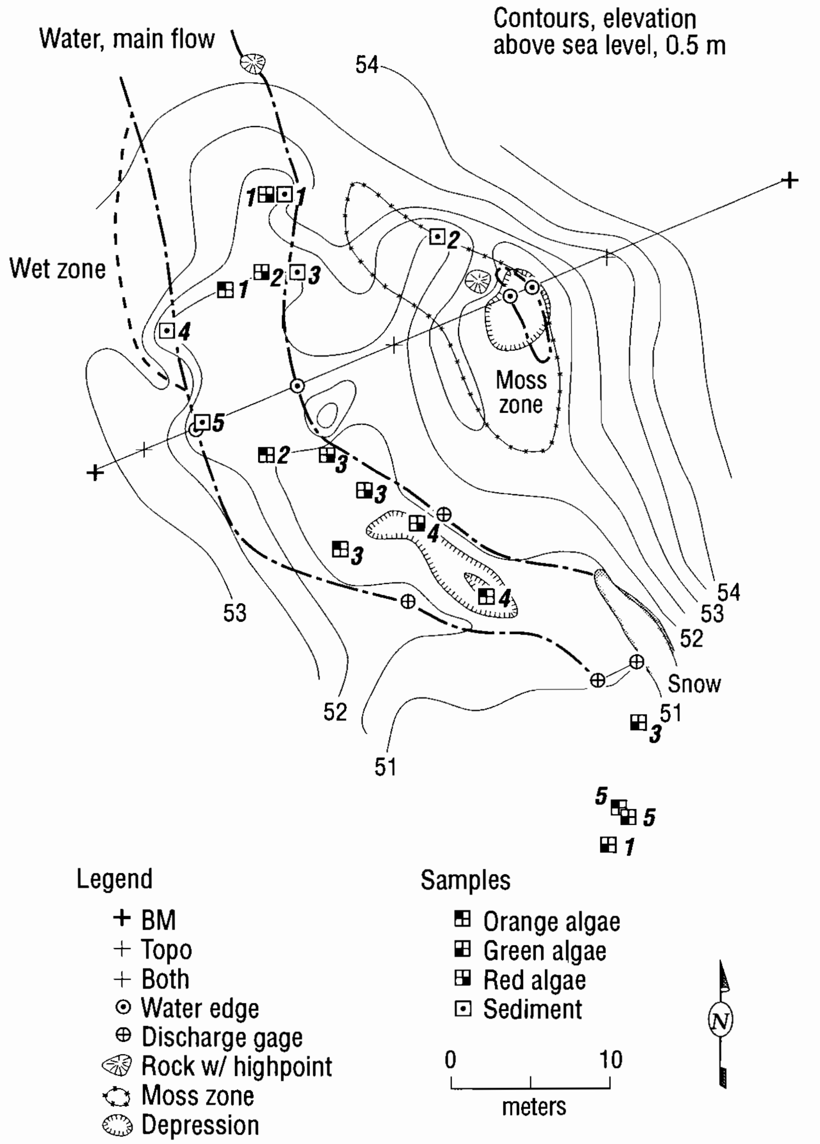
Andersen Creek Gage
Lake Hoare Basin
Transect #1



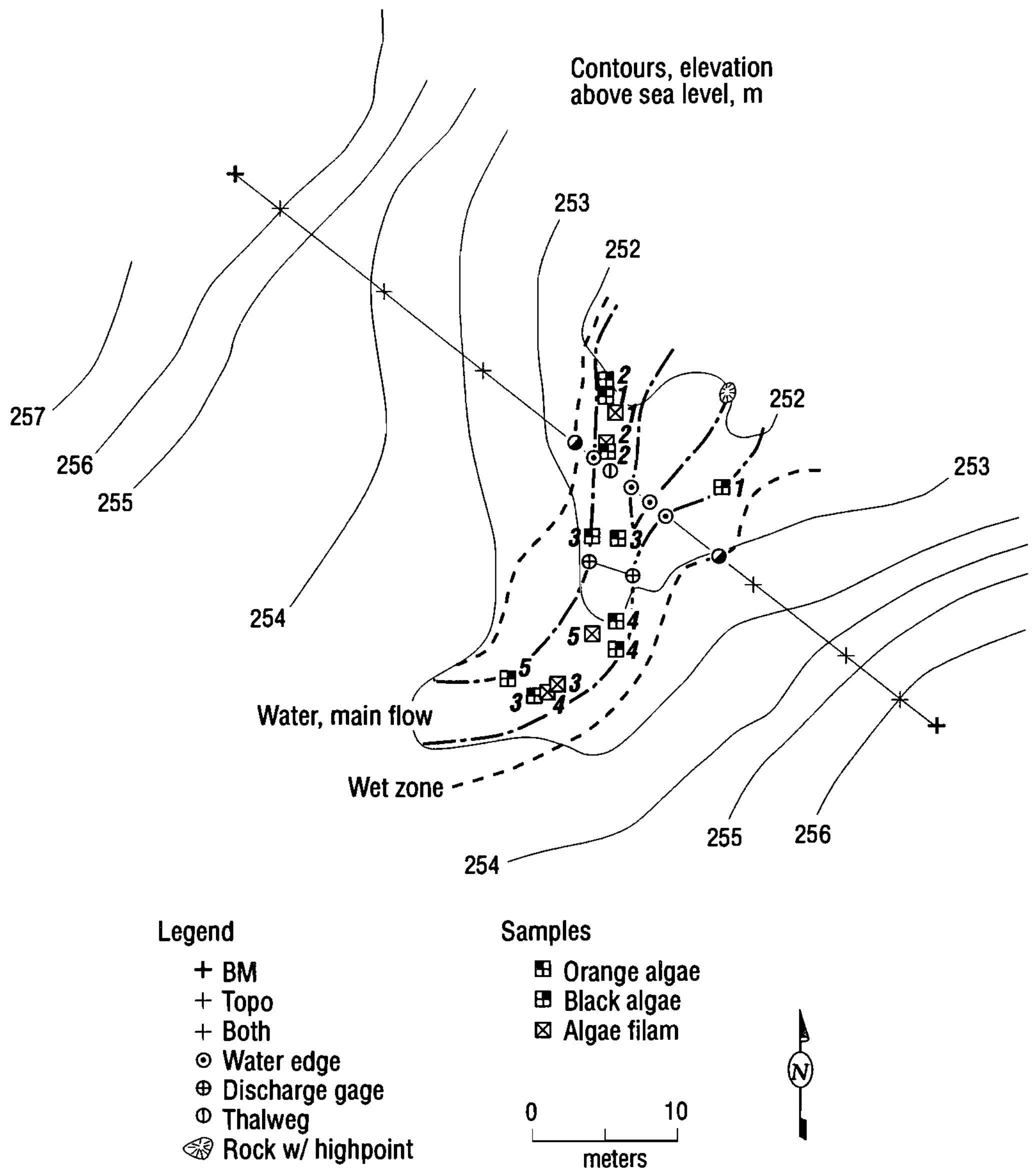
House Creek Gage
Lake Hoare Basin
Transect #2

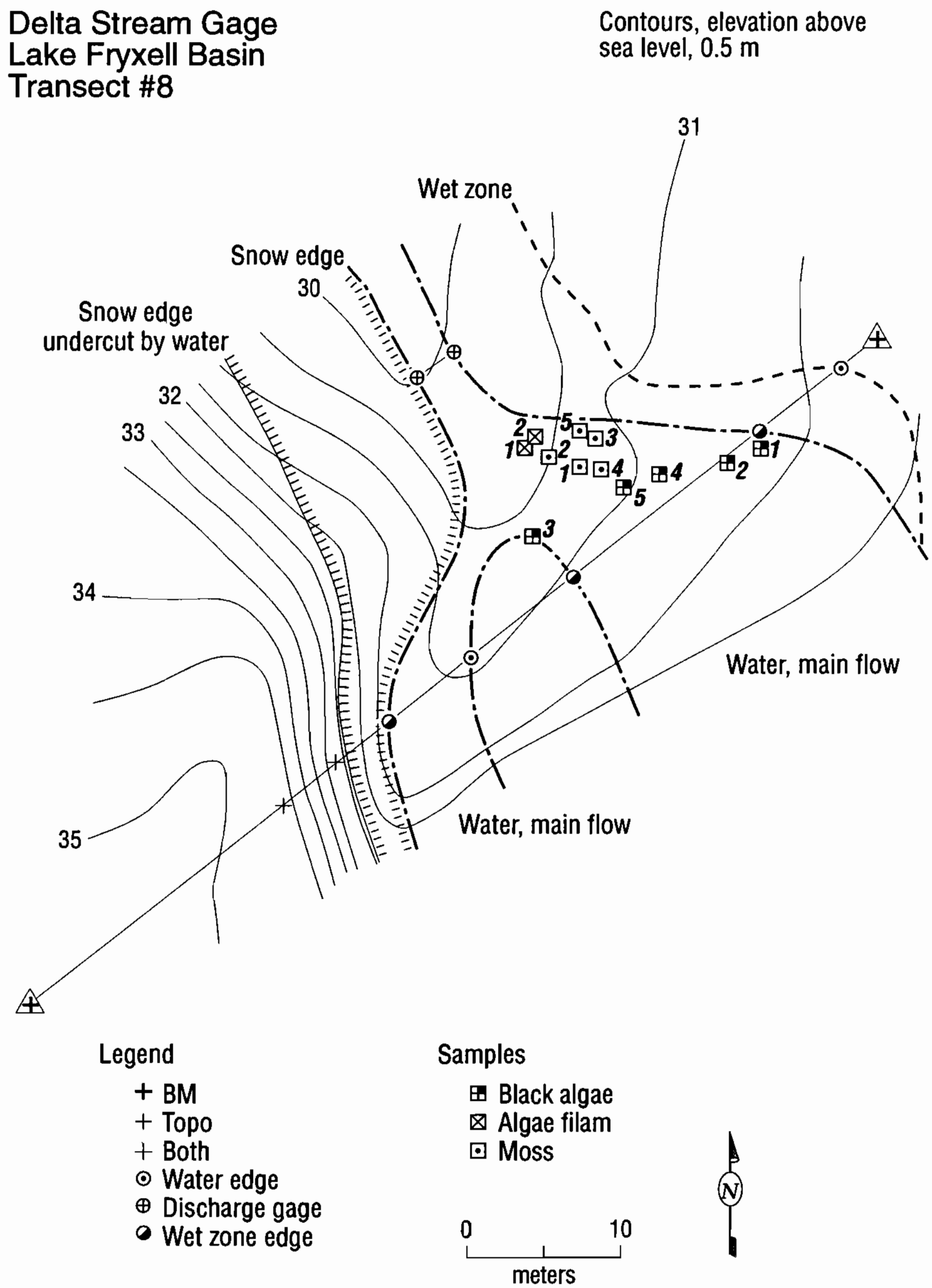


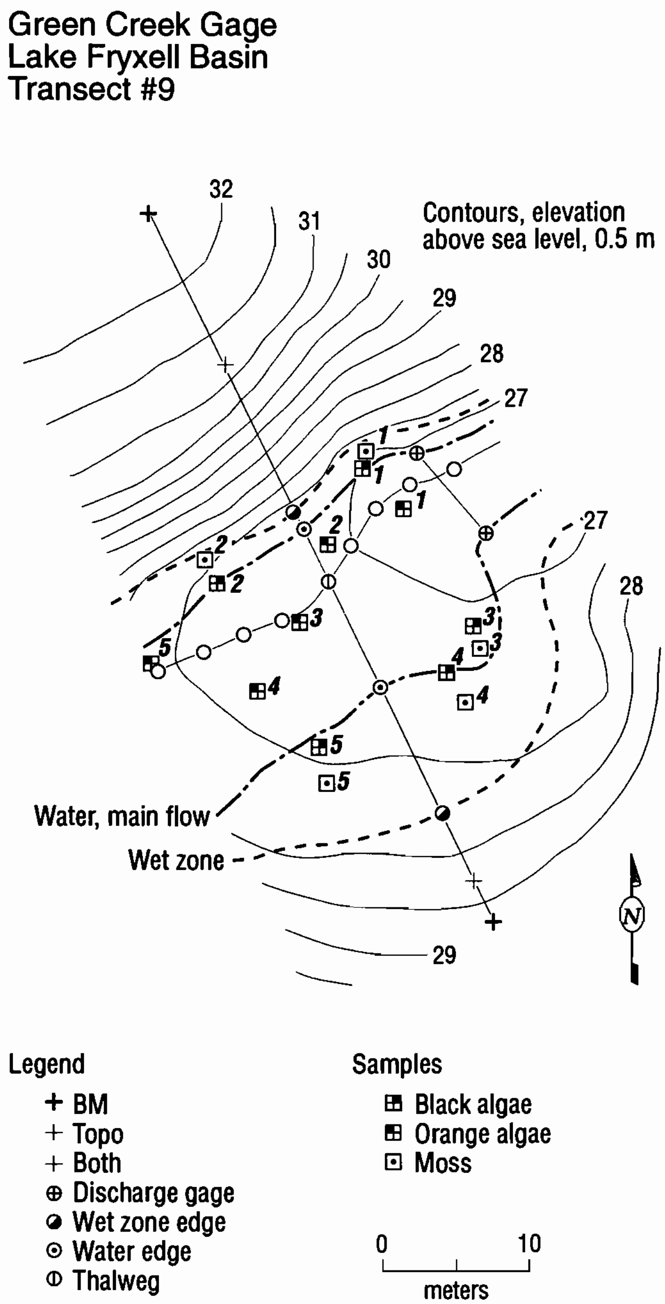
Canada Stream Gage
Lake Fryxell Basin
Transect #3

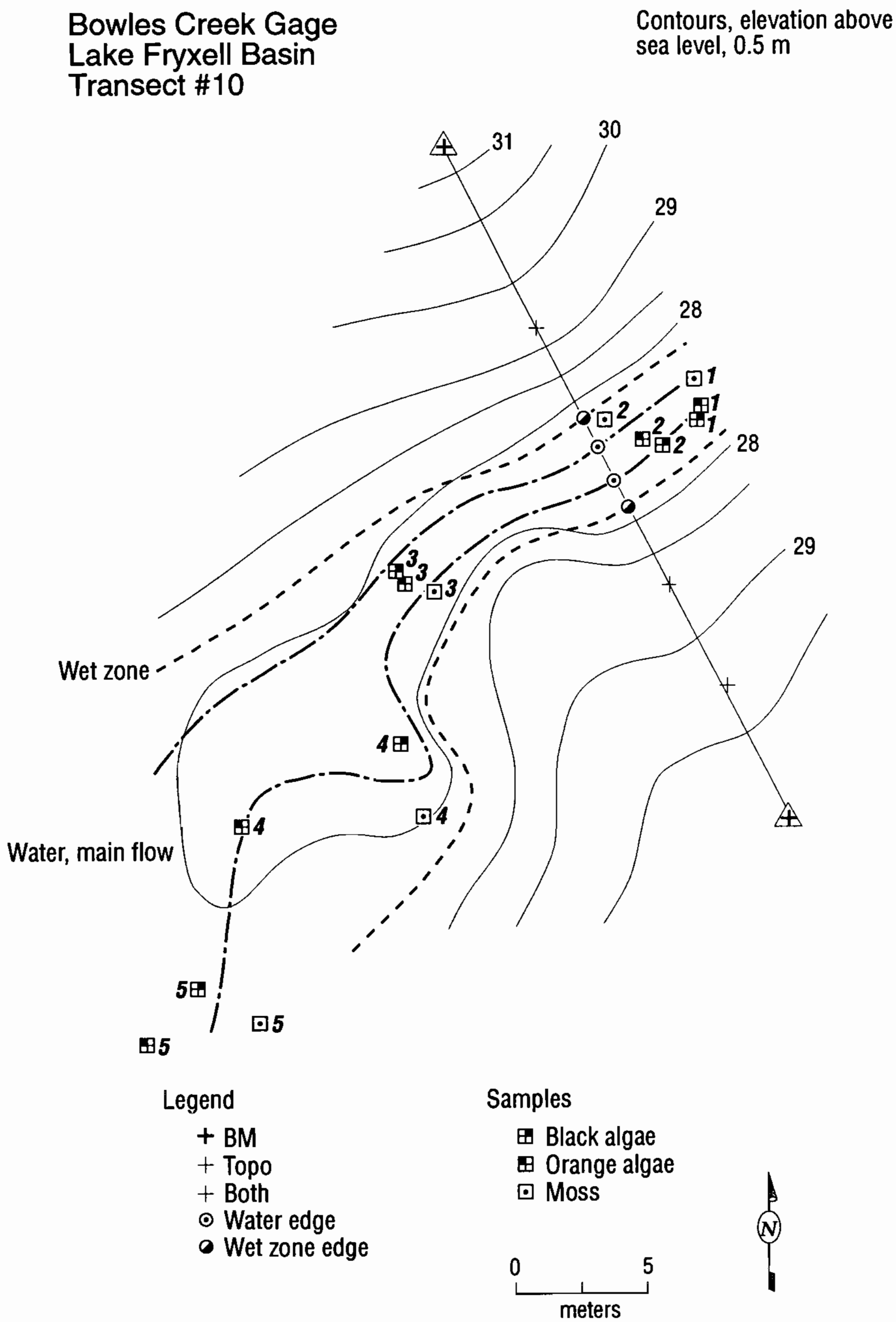


Upper Delta Stream
Lake Fryxell Basin
Transect #7



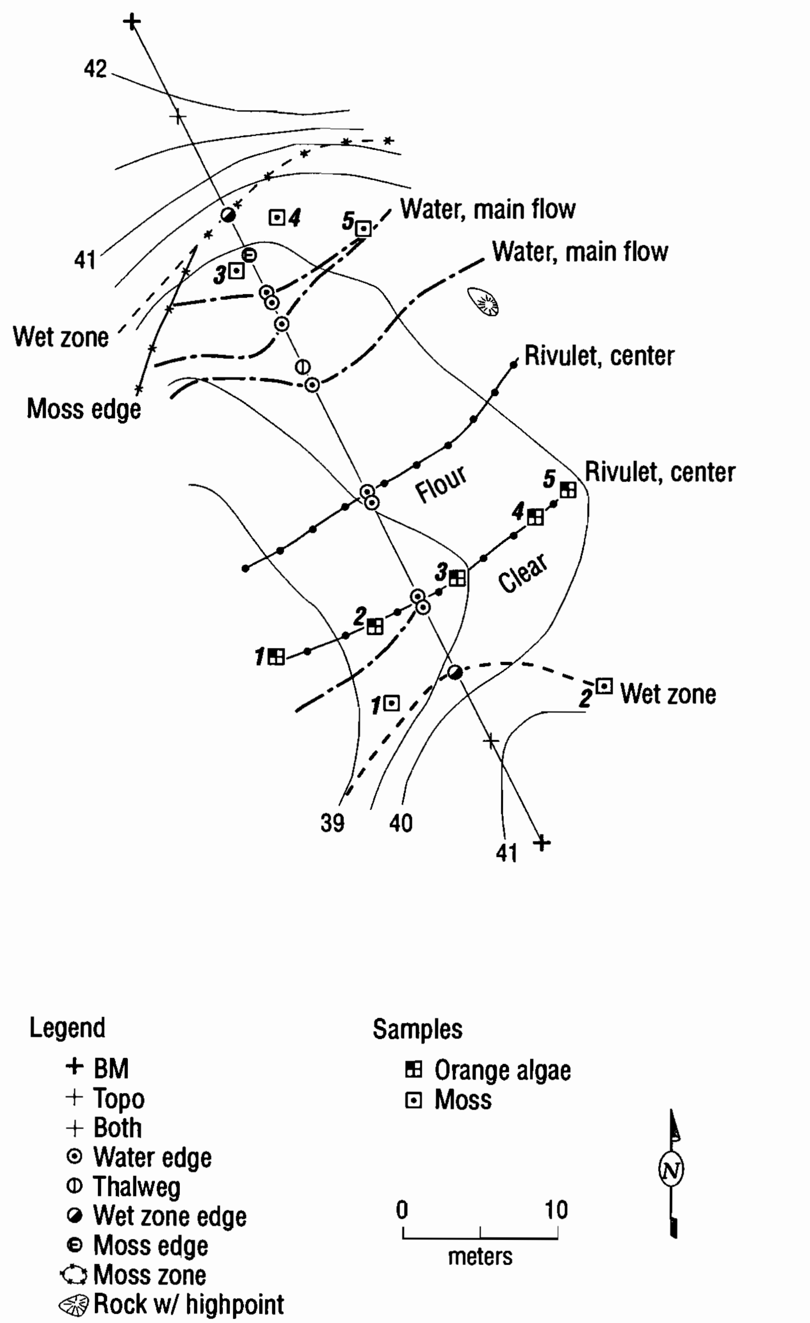

Delta Stream Gage
Lake Fryxell Basin
Transect #8
Contours, elevation above sea level, 0.5 m
31
Wet zone
Snow edge
30
Snow edge undercut by water
32
33
34
35
Water, main flow
Water, main flow
Legend
BM
Topo
Both
Water edge
Discharge gage
Wet zone edge
Samples
Black algae
Algae filam
Moss
0
10
meters
N


Green Creek Gage
Lake Fryxell Basin
Transect #9
32
31
30
29
28
27
Contours, elevation above sea level, 0.5 m
Water, main flow
Wet zone
N
Legend
BM
Topo
Both
Discharge gage
Wet zone edge
Water edge
Thalweg
Samples
Black algae
Orange algae
Moss
0
10
meters


Bowles Creek Gage
Lake Fryxell Basin
Transect #10
Contours, elevation above sea level, 0.5 m
31
30
29
28
28
29
Wet zone
Water, main flow
1
1
1
2
2
2
3
3
3
4
4
4
4
5
5
5
Legend
BM
Topo
Both
Water edge
Wet zone edge
Samples
Black algae
Orange algae
Moss
0
5
meters
N

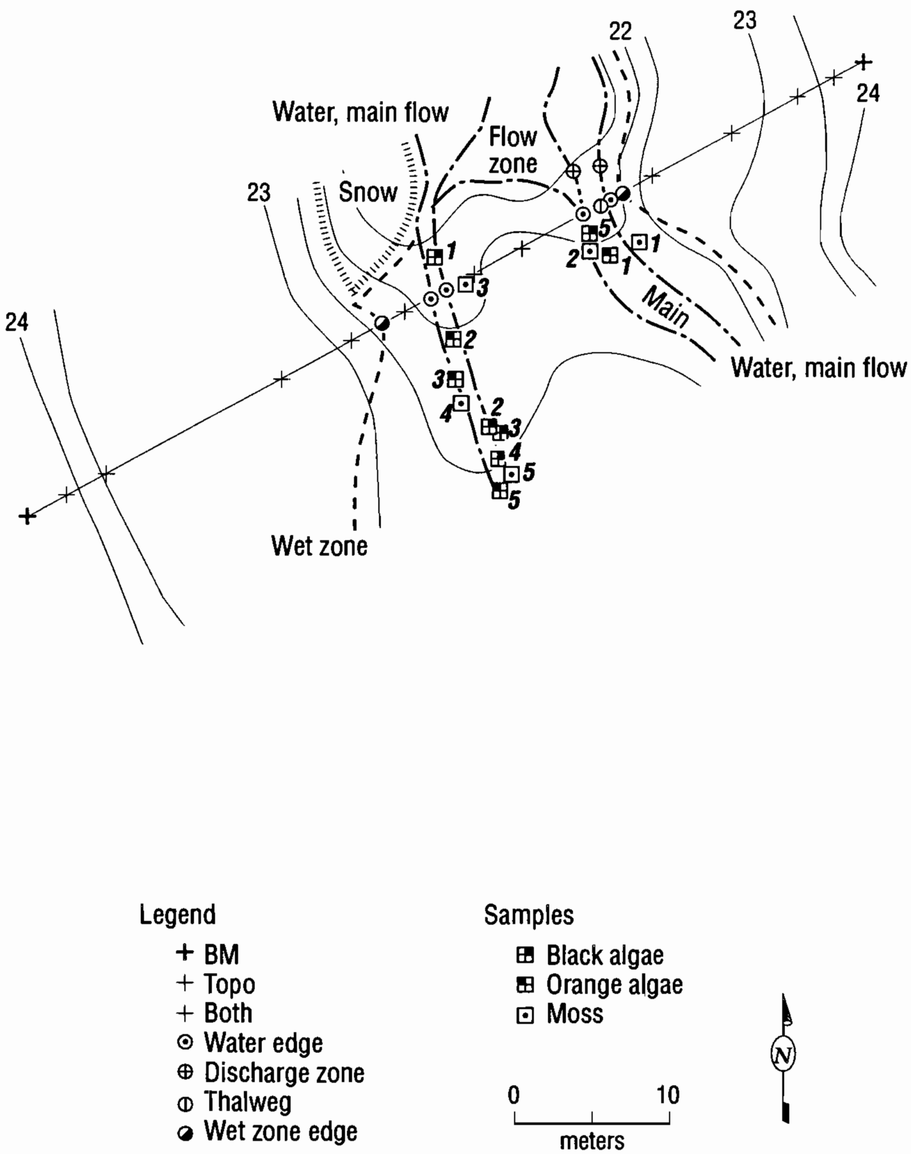
Huey Creek Gage
Lake Fryxell Basin
Transect #11

Contours, elevation above sea level, 0.5 m



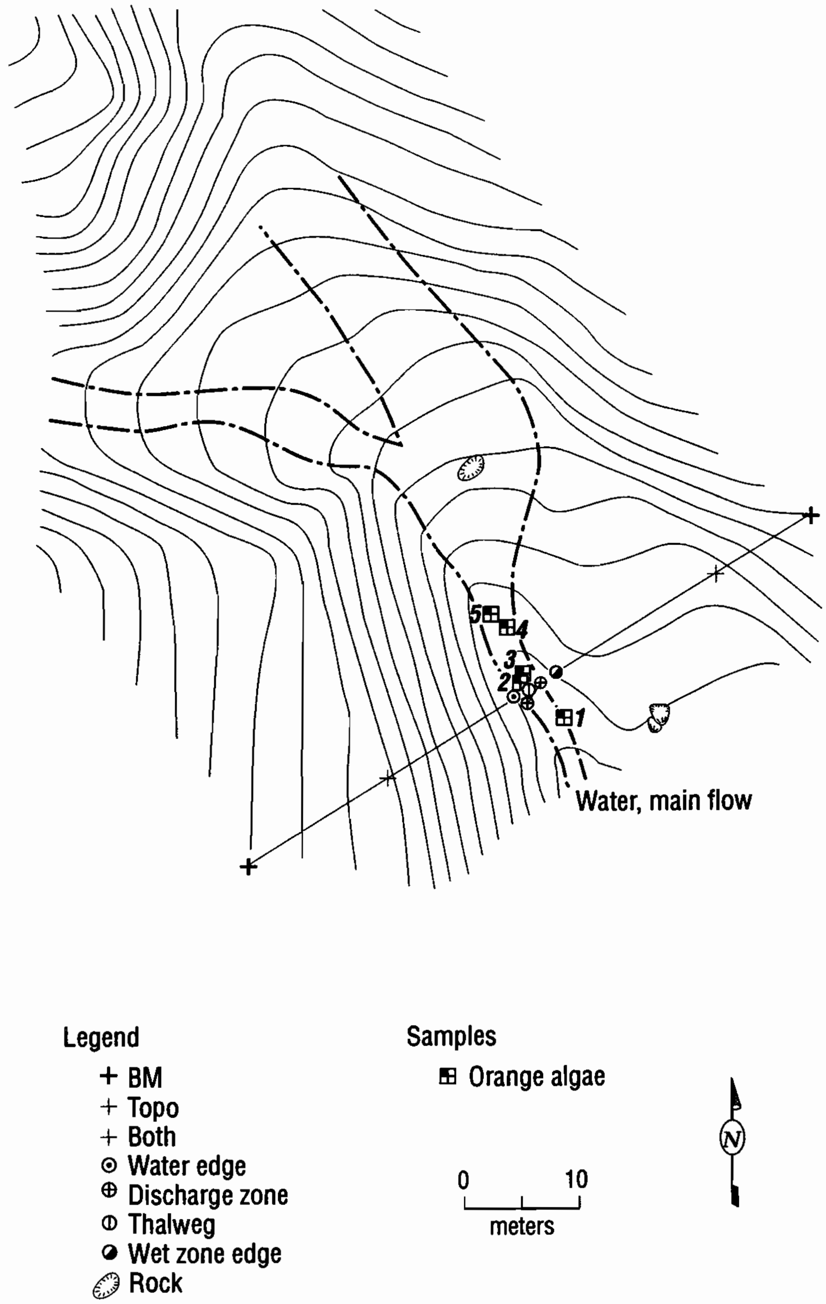
Von Guerard St. Gage
Lake Fryxell Basin
Transect #12

Contours, elevation above
sea level, 0.5 m

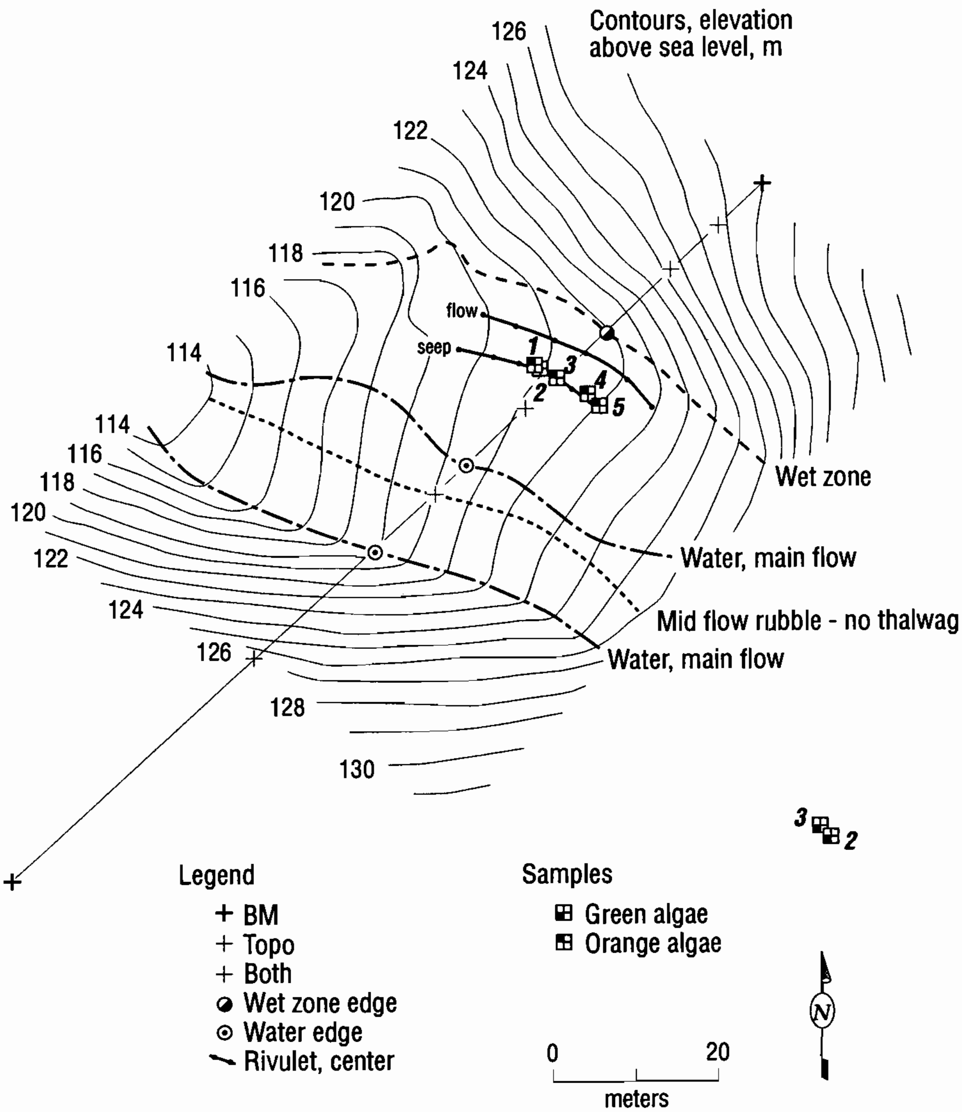


Lawson Creek Gage
Lake Bonney Basin
Transect #14

Contours, elevation above sea level, m



Lower Bohner Stream
Lake Fryxell Basin
Transect #15



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University of Colorado at Boulder

Table 32, as originally printed, contained an error.
The following table is the correct data.

Table 32. Ash-free dry mass (AFDM) and Chlorophyll data from McMurdo LTER 1993/94 Season.
[ND = no data, Chl a = chlorophyll *a*, Chl b = chlorophyll *b*, Chl c = chlorphyll *c*, Car = carotenoid, Phaep. = phaeophytin].

Transect ID	AFDM (mg/cm^2)	Chl a ($\mu g/cm^2$)	Chl b ($\mu g/cm^2$)	Chl c ($\mu g/cm^2$)	Car ($\mu g/cm^2$)	Phaep ($\mu g/cm^2$)
H01AndeGO1	2.20	6.70	4.72	6.98	12.72	1.72
H01AndeGO2	8.20	4.77	3.36	5.29	5.44	8.37
H01AndeGO3	4.40	2.67	2.36	4.84	3.81	4.77
H01AndeGO4	3.40	4.75	3.68	7.38	5.10	5.01
H01AndeGO5	2.00	10.07	7.17	11.53	14.28	11.66
H01AndeGG1	7.93	442.48	371.23	510.07	319.19	545.86
H01AndeGG2	1.06	155.53	110.24	117.52	99.92	114.86
H01AndeGM1	54.00	ND	ND	ND	ND	ND
H01AndeGM2	44.20	5.82	11.66	72.22	33.66	11.24
H01AndeGM3	30.00	ND	ND	ND	ND	ND
H01AndeGM4	38.40	8.43	10.88	48.52	23.05	10.49
H02HousGS1	0.22	0.01	0.02	0.07	0.00	0.01
H02HousGS2	0.27	0.05	0.07	0.29	0.05	0.08
H02HousGS3	0.28	0.01	0.01	0.05	0.00	0.03
H02HousGRK1	0.05	0.00	1.09	0.00	0.00	2.40
H02HousGRK2	0.10	0.00	0.11	2.20	0.00	0.00
H02HousGRK3	0.03	0.75	0.11	2.52	0.00	0.00
H02HousGRK4	0.07	0.00	0.00	0.00	0.00	0.00
H02HousGRK5	0.39	1.04	0.00	13.09	0.00	0.00
F03CanaGM1	6.70	21.31	22.53	64.16	26.95	13.41
F03CanaGM2	134.93	17.17	29.58	108.48	39.82	29.30
F03CanaGM3	8.28	11.13	13.10	42.86	23.31	18.57
F03CanaGM4	28.72	25.27	35.62	124.88	50.02	31.74
F03CanaGM5	15.37	9.31	13.10	46.74	21.49	19.37
F03CanaGR1	19.56	6.91	5.96	13.70	13.76	5.70
F03CanaGR2	19.47	2.30	2.22	6.08	5.10	0.00
F03CanaGR3	7.18	5.20	4.33	10.39	12.57	1.67
F03CanaGR4	44.14	6.10	5.21	11.56	12.08	9.08
F03CanaGR5	10.93	4.37	4.55	14.40	12.46	6.05
F03CanaGO1	19.00	7.92	6.36	8.99	9.96	4.19
F03CanaGO2	10.40	10.37	9.65	15.29	18.80	6.47
F03CanaGO3	11.40	7.71	7.31	11.25	12.81	1.27
F03CanaGO4	16.40	3.24	2.56	5.82	5.91	0.00
F03CanaGO5	22.40	2.83	2.38	5.22	3.60	0.96
F03CanaGG1	5.80	9.87	8.24	11.93	3.82	17.49
F03CanaGG2	5.40	7.87	7.24	15.67	6.04	10.75
F03CanaGG3	8.00	8.54	7.36	9.32	3.54	9.69
F03CanaGB1	14.45	36.98	63.21	267.49	102.56	33.02
F03CanaGB2	17.49	30.77	45.19	169.21	55.31	12.79
F03CanaGB3	9.96	9.50	10.28	35.25	25.27	12.61
F03CanaGB4	19.07	146.24	230.99	760.79	108.41	0.00
F03CanaGB5	13.44	90.43	143.53	467.56	75.67	0.00
F04CanaDR1	97.58	5.60	4.94	12.37	8.96	2.97

Table 32. continued

Transect ID	AFDM (mg/cm²)	Chl a (µg/cm²)	Chl b (µg/cm²)	Chl c (µg/cm²)	Car (µg/cm²)	Phaep (µg/cm²)
F04CanaDR2	12.42	1.16	0.00	0.00	4.62	14.32
F04CanaDR3	17.58	5.43	4.84	16.28	13.35	3.12
F04CanaDR4	26.17	10.59	8.78	18.72	22.95	4.23
F04CanaDR5	16.21	29.50	33.63	115.60	63.31	25.82
F04CanaDM1	86.26	2.38	4.13	20.08	9.22	6.00
F04CanaDM2	93.13	3.45	5.68	27.00	14.64	6.74
F04CanaDM3	32.11	29.94	45.36	179.25	83.14	69.78
F04CanaDM4	17.40	14.12	24.47	110.00	0.00	39.44
F04CanaDM5	72.42	3.63	6.94	34.57	15.72	9.42
F04CanaDB1	28.37	5.87	5.78	17.50	13.21	6.82
F04CanaDB2	27.97	5.13	5.74	18.91	9.42	6.28
F04CanaDB3	17.49	6.85	8.34	31.07	19.01	9.23
F04CanaDB4	32.56	7.18	9.95	41.49	24.66	11.90
F04CanaDB5	51.37	6.72	8.54	34.00	21.95	9.54
F04CanaDG1	11.60	8.60	9.23	27.69	12.48	0.72
F04CanaDG2	8.60	3.51	3.66	8.39	0.88	0.00
F05VonGUO1	9.60	3.64	3.45	7.44	4.03	2.09
F05VonGUO2	4.80	3.64	2.85	5.79	8.40	2.36
F05VonGUO3	12.00	3.69	2.43	3.81	7.98	1.00
F05VonGUO4	5.60	7.05	5.12	8.14	15.03	2.36
F05VonGUO5	20.40	5.23	2.26	3.75	18.19	9.00
F05VonGUM1	29.00	4.40	6.29	29.29	12.48	5.69
F05VonGUF1	9.40	2.26	5.58	11.66	4.32	0.00
F05VonGUF2	11.00	1.96	2.11	5.21	3.81	0.00
F06VonGLO1	21.76	10.17	9.28	26.92	20.81	10.31
F06VonGLO2	43.57	16.12	12.67	25.94	29.25	9.58
F06VonGLO3	20.31	8.32	5.92	11.16	14.25	2.49
F06VonGLO4	41.06	7.17	5.90	14.90	13.91	3.50
F06VonGLO5	16.74	16.86	14.41	32.86	29.42	10.16
F06VonGLB1	18.60	9.94	10.76	37.00	22.56	6.65
F06VonGLB2	81.72	8.69	10.33	33.27	20.08	12.78
F06VonGLB3	38.72	5.94	6.41	23.67	15.49	7.65
F06VonGLB4	14.45	ND	ND	ND	ND	ND
F06VonGLB5	27.93	8.91	8.07	22.81	19.17	5.66
F06VonGLM1	73.40	10.81	14.51	65.80	34.59	17.33
F06VonGLM2	352.20	5.06	6.52	28.42	12.17	6.45
F06VonGLM3	102.00	15.80	18.90	62.72	29.85	30.00
F06VonGLM4	106.60	31.21	45.37	205.50	84.49	79.12
F06VonGLM5	48.40	14.23	17.76	69.15	30.38	21.68
F07DeltUO1	14.80	9.37	10.16	35.86	25.98	10.89
F07DeltUO2	27.40	ND	ND	ND	ND	ND
F07DeltUO3	26.52	14.55	16.36	53.14	34.69	14.67
F07DeltUO4	18.85	13.32	13.57	40.60	34.79	19.63
F07DeltUO5	15.59	8.94	10.20	38.09	24.73	13.80
F07DeltUB1	23.13	54.11	93.10	392.24	125.20	91.36
F07DeltUB2	25.37	44.42	81.79	346.16	95.29	16.21

Table 32. continued

Transect ID	AFDM (mg/cm^2)	Chl a (μg/cm^2)	Chl b (μg/cm^2)	Chl c (μg/cm^2)	Car (μg/cm^2)	Phaep (μg/cm^2)
F07DeltUB3	21.45	13.40	17.96	70.59	42.08	21.97
F07DeltUB4	41.63	47.59	85.09	334.98	76.57	0.00
F07DeltUB5	20.88	46.57	83.83	356.58	99.16	18.64
F07DeltUF1	14.00	14.18	15.75	50.57	28.67	9.31
F07DeltUF2	6.60	6.52	7.83	28.67	14.97	3.29
F07DeltUF3	10.20	7.50	7.82	23.86	12.44	4.40
F07DeltUF4	12.60	8.54	8.41	20.74	10.20	10.65
F08DeltGB1	43.83	43.82	74.41	268.76	69.02	0.00
F08DeltGB2	14.76	6.12	11.04	51.92	21.58	4.58
F08DeltGB3	22.29	43.77	84.44	356.53	87.71	12.45
F08DeltGB4	22.69	41.47	67.26	238.73	59.85	0.00
F08DeltGB5	153.00	5.55	7.43	30.31	14.31	5.99
F08DeltGM1	63.00	31.32	42.70	165.11	69.09	27.46
F08DeltGM2	33.40	31.27	53.86	227.08	82.17	8.73
F08DeltGM3	78.00	20.37	29.28	127.52	58.30	14.91
F08DeltGM4	43.80	30.01	47.13	208.26	81.22	8.63
F08DeltGM5	20.80	23.05	39.77	177.79	60.34	0.00
F08DeltGF1	21.20	3.12	2.41	4.18	5.51	1.80
F08DeltGF2	2.20	8.73	5.89	9.08	15.71	7.33
F09GreeGO1	8.90	7.99	5.73	8.87	11.76	1.55
F09GreeGO2	33.66	3.99	3.09	6.28	5.52	6.62
F09GreeGO3	8.59	10.09	7.86	14.62	18.03	17.27
F09GreeGO4	17.36	3.57	2.55	4.20	4.82	4.89
F09GreeGO5	6.87	8.57	5.96	9.04	14.24	14.88
F09GreeGM1	66.60	10.74	20.31	115.76	51.86	19.46
F09GreeGM2	44.40	ND	ND	ND	ND	ND
F09GreeGM3	435.60	8.23	10.82	48.25	23.49	17.00
F09GreeGM4	253.80	10.67	12.37	52.53	26.66	16.68
F09GreeGM5	102.20	9.88	15.82	86.92	41.34	20.92
F09GreeGB1	114.41	ND	ND	ND	ND	ND
F09GreeGB2	58.15	39.62	71.53	318.47	90.88	68.17
F09GreeGB3	12.82	60.78	98.29	345.36	71.59	8.93
F09GreeGB4	54.76	19.39	89.08	322.24	72.44	66.66
F09GreeGB5	34.23	ND	ND	ND	ND	ND
F10BowlGB1	15.42	13.48	19.82	70.51	30.78	1.65
F10BowlGB2	13.61	120.06	174.96	543.15	82.56	0.00
F10BowlGB3	27.53	91.22	136.65	428.05	62.31	0.00
F10BowlGB4	31.01	112.57	176.10	569.03	90.96	0.00
F10BowlGB5	50.04	93.06	150.66	486.06	78.80	0.00
F10BowlGO1	8.15	10.81	11.31	34.13	18.80	8.39
F10BowlGO2	17.22	7.16	7.25	21.41	13.80	7.50
F10BowlGO3	11.32	6.70	0.00	397.93	13.83	4.68
F10BowlGO4	8.50	15.26	15.03	42.98	26.95	25.06
F10BowlGO5	12.07	14.73	14.00	38.94	25.34	15.78
F10BowlGM1	14.80	11.51	19.84	99.87	42.68	2.03
F10BowlGM2	43.00	13.84	20.58	89.69	50.36	30.07

Table 32. continued

Transect ID	AFDM (mg/cm²)	Chl a (µg/cm²)	Chl b (µg/cm²)	Chl c (µg/cm²)	Car (µg/cm²)	Phaep (µg/cm²)
F10BowlGM3	22.80	4.22	5.24	18.77	9.60	5.81
F10BowlGM4	61.60	5.95	7.33	29.72	12.72	9.58
F10BowlGM5	66.60	49.27	112.66	613.12	161.36	188.60
F11HueyGO1	7.14	6.16	4.06	6.05	11.85	2.28
F11HueyGO2	9.30	8.23	5.65	8.24	12.51	0.00
F11HueyGO3	3.88	1.79	1.23	1.54	3.67	0.00
F11HueyGO4	19.60	2.35	1.50	1.95	3.95	0.45
F11HueyGO5	4.27	2.42	1.69	2.15	3.44	0.50
F11HueyGM1	73.00	15.91	29.84	161.37	79.42	39.26
F11HueyGM2	33.60	4.14	6.42	41.25	18.10	13.12
F11HueyGM3	94.40	31.41	39.14	147.52	75.26	44.09
F11HueyGM4	105.20	17.28	28.25	140.16	65.60	28.29
F11HueyGM5	56.40	15.01	22.23	108.41	53.04	25.83
F12VonGGO1	32.51	3.05	2.28	5.26	4.00	2.90
F12VonGGO2	7.44	5.38	3.98	6.51	8.33	4.77
F12VonGGO3	19.82	10.15	7.67	13.37	18.52	6.12
F12VonGGO4	33.08	21.72	19.02	42.47	39.14	13.91
F12VonGGO5	12.86	3.86	2.62	4.44	6.74	1.29
F12VonGGB1	11.54	12.19	16.14	65.66	40.30	23.67
F12VonGGB2	23.35	5.91	5.21	14.29	11.72	5.45
F12VonGGB3	11.76	15.59	17.32	57.28	44.05	23.49
F12VonGGB4	27.31	10.62	11.02	36.98	27.26	12.76
F12VonGGB5	11.85	9.01	10.28	40.29	25.89	14.02
F12VonGGM1	48.00	6.44	5.39	13.04	12.02	6.21
F12VonGGM2	57.60	13.75	25.87	150.64	72.83	62.67
F12VonGGM3	66.60	ND	ND	ND	ND	ND
F12VonGGM4	62.00	8.56	13.96	78.06	38.05	19.09
F12VonGGM5	132.60	12.37	11.19	27.70	21.53	10.47
B13PrisGO1	0.38	62.21	45.79	54.51	72.14	86.50
B13PrisGO2	5.80	4.54	3.88	7.48	3.20	7.35
B13PrisGO3	0.94	158.51	118.52	208.65	175.58	345.15
B13PrisGO4	0.87	114.67	87.46	112.01	144.80	165.54
B13PrisGO5	2.96	430.03	337.56	549.03	594.26	793.34
B14LawsGO1	0.07	22.39	16.17	24.53	41.05	21.43
B14LawsGO2	0.51	641.65	432.74	595.65	1244.55	94.64
B14LawsGO3	0.24	171.05	141.96	217.05	252.97	8.66
B14LawsGO4	1.41	1.78	1.23	1.56	2.49	1.52
B14LawsGO5	0.61	453.16	291.64	300.55	646.96	734.78
B15BohnLO1	12.80	1.21	0.60	3.00	0.51	0.00
B15BohnLO2	7.80	3.03	1.99	4.28	3.54	0.30
B15BohnLO3	2.20	2.35	1.68	3.03	2.18	1.82
B15BohnLO4	3.00	2.91	1.97	2.03	3.90	0.00
B15BohnLO5	11.20	10.29	6.97	8.99	23.44	0.00
B15BohnLG1	3.07	793.35	668.36	976.91	470.70	301.39
B15BohnLG2	4.62	86.72	73.11	137.48	25.38	96.56
B15BohnLG3	0.82	663.57	544.32	782.66	338.50	902.65

Table 32. continued

Transect ID	AFDM (mg/cm²)	Chl a (μg/cm²)	Chl b (μg/cm²)	Chl c (μg/cm²)	Car (μg/cm²)	Phaep (μg/cm²)
H16WharDO1	12.80	6.51	5.29	7.57	9.85	9.30
H16WharDO2	24.60	6.03	4.51	6.05	8.88	3.58
H16WharDO3	8.60	8.73	5.71	8.19	12.72	15.25
H16WharDO4	6.60	3.80	3.14	6.14	4.75	5.19
H16WharDO5	10.40	3.05	1.99	3.05	1.81	1.53
H16WharDM1	13.60	13.79	20.72	97.42	35.93	20.04
H16WharDM2	24.00	6.27	7.74	31.92	13.30	9.13
H16WharDM3	27.00	6.70	9.88	45.20	19.39	17.22
H16WharDM4	43.00	15.44	28.84	147.12	66.53	38.11
H16WharDM5	52.60	14.09	19.71	83.22	39.92	21.18
H16WharDB1	53.40	91.25	182.85	912.82	263.39	375.53
H16WharDB2	42.00	25.26	43.27	215.91	111.00	67.93
H16WharDB3	58.40	9.78	14.33	69.82	30.72	28.21
H16WharDB4	60.80	23.47	38.53	176.77	77.86	36.49
H16WharDB5	53.40	21.17	34.27	170.79	82.58	46.43