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**LATE HOLOCENE CLIMATE CHANGE OF
FREDERICK SOUND,
BRITISH COLUMBIA, CANADA**

by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfilment of the requirements for the degree of

Master of Science

Department of Earth Sciences and Ottawa-Carleton Geoscience Centre

Carleton University,

Ottawa, Ontario

December 5, 2005

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ABSTRACT

Diatom abundances and flora were analyzed from late Holocene piston core VEC02A04 (~990 – 5270 cal yr BP) from Frederick Sound, an anoxic fjord within the Seymour-Belize Inlet Complex, mid-coastal British Columbia. Q-mode cluster analysis resulted in identification of four clusters. Stratigraphic oscillation between cluster types and similar changes in overall diatom abundance down core reflected changes in precipitation and cloudiness on an ~60 year cycle, similar to the periodicity of the Pacific Decadal Oscillation, which in turn reflects changes in the intensity and position of the Aleutian Low. Higher order grouping of clusters revealed five distinct successive climatic zones through the late Holocene of centennial to millennial duration, which are also interpreted to be linked to changes in the intensity and position of the Aleutian Low. Paleoclimatic interpretation of these zones indicate that the Frederick Sound area was dry and sunny between ~5270 - 3820 cal yr BP, then wetter and cloudier till ~3390 cal yr BP, back to drier and sunnier conditions up to ~2770, and then reverted back to the present cloudy and wet neoglacial conditions up to at least ~990 cal yr BP.

keywords: Diatoms, Holocene, paleoclimate, Aleutian Low, British Columbia

ACKNOWLEDGEMENTS

I would like to thank a number of people who have helped me complete this project and provided support in a number of ways.

Firstly, thanks to my thesis supervisor Dr. Tim Patterson for introducing me to the Seymour-Belize Inlet Project. Dr. Patterson provided valuable input and critical reviewing of the manuscript. Thanks also for exposing me to a side of the climate change debate to which I had previously not known.

Secondly, a big thank you to Dr. Alice Chang (University of British Columbia, Vancouver) who was my mentor in all things diatom related. I hadn't even heard of diatoms before I started this project and so everything I do know is due to the countless hours Alice spent patiently teaching me how to prep samples and identify diatoms. Alice also provided helpful discussion and ideas. Completion of this project would not have happened without her considerable help.

I am indebted to many others who also provided diatom-related help and technical expertise. I am grateful to Murray Hay (Ph.D. candidate, Université Laval, Quebec), Dr. Reinhard Pienitz (Université Laval, Quebec) and Dr. Michelle Poulin (Canadian Museum of Nature, Gatineau) for additional help on diatom identification and other diatom-related issues. Thanks to Dr. Bob Boudreau (Carleton University, Ottawa) and Dr. Andreas Prokoph (SpeedStat, Ottawa) for assistance with statistical analyses. Malcolm Bilz (Canadian Conservation Institute, Ottawa) was very helpful with freeze-drying all my sediment samples. Dr. Audrey Dallimore and other staff at the Pacific Geoscience Centre

and Institute of Ocean Sciences in Sydney, British Columbia, were very helpful, both at the Centre and on the cruise. Dr. Dallimore in particular deserves thanks for logging and x-raying the core I worked on, and for answering many questions. I would also like to give my thanks to the crew of the CCGS *Vector*, who were not only very professional, but also very enjoyable to work with, and provided rescue support when needed. Travelling to the Seymour-Belize Inlet on their research vessel was definitely the highlight of my studies.

I also owe gratitude to the other students in Dr. Patterson's lab: Jennifer Galloway (Ph.D. candidate), Natalia Vasquez-Riveiros (M.Sc. candidate), and Lameed Babalola (Ph.D. candidate), who acted as a sounding board for ideas and listened to my grumblings when things weren't going well. I am also indebted to Davin Carter (M.Sc. candidate) of Dr. Patterson's lab for all of his technical expertise, particularly Apple computer questions. I had a serious dislike of all things Mac when I started in this lab, but slowly and surely Davin converted me and now I am a Mac aficionado. Sheila Thayer of the College of Natural Sciences, Carleton University, deserves thanks for helping guide me through the bureaucracy of the College.

This project was made possible by financial support through a grant to Dr. Patterson from the Canadian Foundation for Climate and Atmospheric Sciences. The Canadian Museum of Nature also provided me with a generous scholarship. Lastly, but not least, I would like to thank my family, Sam, Karen, and Katie, and my wife, Katherine Connolly. You may not have known anything about diatoms and might wish you had never heard of them, but you all provided support that was just as critical.

Thank you.

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LIST OF ABBREVIATIONS

%Si _{OPAL}	percent biogenic silica opal
AL	Aleutian Low
ALPI	Aleutian Low Pressure Index
cal yr BP	calibrated radiocarbon dates in years before present
CC	California Current
CDD	Coastal Downwelling Domain
cm/yr	centimetres per year
COA	Centre of Action
CSD	Central Subarctic Domain
CTC	Coastal Transition Domain
CUD	Coastal Upwelling Domain
NPH	North Pacific High
PDO	Pacific Decadal Oscillation
PNE	Northeast Pacific Ocean
SBIC	Seymour-Belize Inlet Complex
yr BP	uncalibrated conventional radiocarbon dates in years before present

CHAPTER 1

INTRODUCTION

The Earth's climate is highly variable and has been since its inception. Over the past three million years the Earth has experienced more than 30 glacial/interglacial cycles, with the last glacial period peaking around 18,000 years ago. Even within a glacial or interglacial period, there can be considerable and rapid climate fluctuation, as there has been in the present interglacial - the Holocene. This is contrary to popular belief that the Holocene has been a period of relatively stable climatic conditions. Large and rapid fluctuations in climate during the Holocene include a sharp cooling event at around 8,200 years BP (Alley et al., 1997), and from historical times the Medieval Warm Period and Little Ice Age (Keigwin, 1996). Such climatic fluctuations have had a profound impact on ecosystems and human history alike through the past 10,000 years. In Europe, the overall warmth and genial conditions of the Medieval Warm Period resulted in an increase in human population, agricultural revolution, and technological advance (Trevor-Roper, 1965). However, deteriorating climatic conditions beginning around the mid 1300s in Europe marked the onset of the Little Ice Age. Disease and famine are common themes in this period, as extreme wetness and cool conditions during growing seasons led to crop failures and starvation (Lamb, 1995). On the North American Great Plains, a decline in precipitation during this period was the result of an extension of the Rocky Mountains rain-shadow, which is speculated to have caused large-scale abandonment of formerly highly populated aboriginal settlements.

A number of complex and interacting phenomena, which operate on time-scales ranging from days to years to hundreds and thousands of years modify the Earth's climate, resulting in differing climate regimes covering the same range. Understanding the magnitude and nature of the complex and highly variable drivers of Earth's climate is necessary if reliable predictions of future climate states are to be made and necessary adaptive measures taken. This is especially so now, as policy makers and planners strive to differentiate anthropogenic influence from natural climate variability. Unfortunately, the instrumental record is barely adequate for analyzing the characteristics of even decadal-scale climate variability. This is especially true along the west coast of Canada where measurement and collection of air and sea surface temperatures only began about 100 years ago. Therefore, it is necessary to turn to climate proxy records, such as archived in seafloor sediments, which host a wealth of proxy data, in order to identify older climate regimes and climate oscillations occurring on longer than a decadal-scale duration.

Instrumental and climate proxy data, including tree ring-width chronologies (e.g. Gedalof and Smith, 2001); sediment characteristics (Patterson et al., 2004a; 2004b), pollen data (Pellat and Mathewes, 1997), and microfossil data (Chang et al., 2003) have shown that the climate history of Canada's Pacific coast has varied significantly over the Holocene. The present climate of the west coast of Canada is influenced by a number phenomena including the seasonal pressure gyres the Aleutian Low and North Pacific High, the Jet Stream, and El Niño/La Niña events. Superimposed upon these interdependent sub-decadal cycles are less well understood, regionally modified, longer-scale events that operate on a global scale (Mann et al., 1995; Ware and Thomson, 2000;

Minobe, 1997). The interaction of these phenomena determine basic climate factors such as amount and form of precipitation, temperature, wind direction and intensity, and cloudiness. These in turn affect coastal ecosystems by impacting such things as upwelling, primary productivity, fish recruitment and community structure, and forest fire frequency. A number of studies over the past 10 years have shown that many biological and environmental phenomena (such as recruitment of fish species like anchovies, sardines and salmon, and sea surface and air temperatures) have roughly a 50 year periodicity. As British Columbia is extremely dependent upon the forestry and fisheries industry, an understanding of natural climate variability and its impacts is vital in order to successfully manage such natural stocks.

The objectives of this study were to statistically analyze diatom abundances and assemblages from a laminated sediment core from Frederick Sound, within the Coastal Transition Domain (CTD), in order to reconstruct atmosphere and oceanographic conditions through the late Holocene for a relatively understudied region of mid-coastal British Columbia. This study also aimed to identify whether significant climate shifts observed in southern coastal British Columbia within the highly productive Coastal Upwelling Domain (CUD) were present hundreds of kilometres north within the CTD and whether or not similar climate-influencing phenomena were driving such changes, thus providing an idea of how climatically connected these two regions are.

Based on an understanding of regional climate modifying phenomena, it was believed that the diatom productivity record would record changes in response to variations in the Aleutian Low and North Pacific High. The study site was believed to be too far north to be impacted by El Niño/La Niña events and an upwelling climate

signature would not be present as the study site is over 50 km inland and not within the CUD.

CHAPTER 2

BACKGROUND

LOCATION

The SBIC comprises Seymour Inlet, Belize Inlet, Alison Sound, and Frederick Sound, which together make up more than 1600 km of glacially-formed narrow fjords with steep and rocky shorelines and underwater slopes (Figure 2.1). The SBIC extends more than 90 km inland from Lascelles Point at the entrance, to the mouth of the Seymour River at the northeast terminus of Seymour Inlet. Entrance to the SBIC from Queen Charlotte Sound is via Nakwakto Rapids, which is only 150 m wide with a sill at only 34 m depth, resulting in tidal stream velocities that can reach up to 16 knots on the ebb during spring tides, which makes the tides in this channel amongst the strongest in the world (Thomson, 1981). The underlying bedrock of the SBIC consists primarily of Mesozoic granitic and volcanic rocks, which rise up to 3000 m.

Frederick Sound, which forms the southeast extension of Seymour Inlet, is accessed through the Eclipse Narrows, which are 30 m wide with a sill at 7 m. Water depths are up to 200 m in the middle of the fjord. Sills at the entrance to coastal fjords in British Columbia, such as those in the SBIC, mark a former terminus or interstadial deposit of a glacier. The proximity of these underwater ridges to the surface tends to inhibit the penetration of oxygen-rich ocean water into the deep water of fjords behind the sill, resulting in water at depth becoming low in oxygen and potentially becoming anoxic under prolonged stagnation (Kemp, 2003; Thomson, 1981). Such a situation is present in Frederick Sound, where a sill at the entrance to the sound, combined with

FIGURE 2.1. Location of study area and sampling site. Photo is of CCGS Vector in the Seymour-Belize Inlet Complex.

higher salinities at the bottom of the basin than at the surface, leads to stagnant water at depth and to dysoxia and anoxia. Water property data collected during an August 2000 cruise of the Canadian Coast Guard Ship (CCGS) *Vector* indicated that oxygen levels at depth varied between 0.00 - 0.92 mL/L and that salinity varied between 29 ppt at the surface to 27.5 ppt at the bottom of the sound. Anoxic bottom water conditions in Frederick Sound has inhibited the survival of sediment-disturbing bottom dwelling organisms, creating an opportune environment for the preservation of climate proxy-hosting laminated sediments.

CLIMATE AND OCEANOGRAPHY

Holocene Climate History

Previous research done along the Pacific Northwest coast of North America has shown that climate has varied significantly since the end of the last glaciation, which reached its maximum sometime after 21,000 yr BP, but before 15,000 to 16,000 yr BP (Barrie and Conway, 1999). Glacial retreat began soon after 15,000 yr BP, and by 13,500 to 13,000 yr BP Dixon Entrance, north of the Queen Charlotte Islands, was ice-free, as were areas of southern British Columbia (Barrie and Conway, 1999). Parts of Vancouver Island may have been ice-free even earlier (Hebda, 1983). From 14,600 to 12,500 yr BP, during deglaciation, sea level fell significantly along the Pacific margin of Canada due to rapid isostatic rebound (Barrie and Conway, 2002). Sea level reached a maximum lowering of greater than 150 m and stayed low until 12,400 yr BP after which a rapid transgression occurred due to eustatic sea level rise and subsidence of the glacioisostatic forebulge (Barrie and Conway, 2002).

Early late-glacial conditions in the Pacific Northwest were cool and dry and *Pinus contorta* dominated the vegetation, having rapidly colonized the land following the retreat of the glaciers (Hebda, 1983; Mathewes, 1973). Late-late glacial conditions were moister, which is reflected by the predominant vegetation in the region at the time (Hebda, 1983; Mathewes, 1973; Hebda, 1995).

Palynological studies have identified three main phases of vegetation and climate change in the Holocene record of the lowlands of the Pacific Northwest. The beginning of the Holocene (10, 000 yr BP) is marked by a rapid shift to a warmer and generally drier climate than present (Pellat and Mathewes, 1997; Brown and Hebda, 2002, 2003; Clague et al. 2004). This warm and dry interval has been termed the early Holocene xerothermic period (Mathewes and Heusser, 1981). By 8000 yr BP, temperatures were up to 2°C warmer and precipitation levels were half of present-day values (Heusser et al., 1985; Mathewes and Heusser, 1981; Clague et al., 1992). On the Queen Charlotte Islands, northwest of the SBIC, palynological studies record higher-than-present tree lines, suggesting a warmer-than-present climate (Pellat and Mathewes, 1997).

Between 7000 and 4500 yr BP a period of warm and moist conditions is recorded in the interior of British Columbia; Hebda (1995) suggested that this interval be termed the “mesothermic” period. Outside of the interior of British Columbia though, this warm and moist period is not clearly documented (Heusser, 1985; Mathewes, 1993; Hebda, 1995).

The transition from an early Holocene warm and dry climate to a cool and moist neoglacial climate occurred at different times and rates in the Pacific Northwest. In northwest Washington and the Puget Lowland region, the onset of neoglacial cooling was

evident around 7000-6000 yr BP. In south-coastal British Columbia, a trend towards gradual cooler and wetter conditions is evident after 7000 yr BP, although this mid-Holocene climatic transition period is poorly defined (Mathewes, 1973, 1985; Mathewes and Rouse, 1975; Mathewes and Heusser, 1981). For Vancouver Island, the Queen Charlotte Islands, northwest British Columbia, and southeast Alaska, cooling seems to have occurred at a slower rate than in northwest Washington and south-coastal British Columbia (Heusser, 1985; Hansen and Engstrom, 1996; Hebda, 1983, 1995). Glacial advances in the Fairweather Mountains and Glacier Bay in southeast Alaska, and Mount Garibaldi in southern British Columbia between 6000 and 5000 yr BP record the onset of progressive cooling in the Pacific Northwest (Ryder and Thomson, 1986; Mann and Hamilton, 1995).

In the Pacific Northwest, the typically cool and moist modern climate probably became established between 4500 and 3000 yr BP. Numerous neoglacial advances occurred in the late-Holocene, including the Tiedemann glacial advance in the Coast Mountains between 3300 to 1900 yr BP, and the Peyto and Robson glacial advances in the southern Canadian Rocky Mountains between 3100 and 2500 yr BP (Ryder and Thomson, 1986; Luckman et al, 1993). Conditions similar to present were established on the Queen Charlotte Islands around 3400 yr BP (Pellat and Mathewes, 1997).

More recent glacial advances, which occurred during the Little Ice Age, are also recorded in proxy geologic and tree-ring records (Clague et al. 2004). Over the past 3,000 years, the largest climate shifts have occurred during the Little Ice Age and the last century, which has warmed by about 1-2 °C (Clague et al. 2004).

A Holocene climate history based on pollen analysis from a lake within the SBIC (Galloway, submitted) is very similar to the Holocene climate history described for other regions in coastal British Columbia as outlined below. Early late-glacial (12,500 - 12,000 yr BP) conditions were cool and dry but became moister during the late late-glacial period (12,000 - 10,500 yr BP). An abrupt warming occurred at the beginning of the Holocene (10,500 yr BP) and warmer temperatures prevailed until 8,500 yr BP. Ca. 8,500 yr BP, when there was an onset of cool and moist conditions. Late Holocene conditions to present (5,000 yr BP - present) have been cool and moist and relatively stable, although Neoglacial cooling is evident ca. 1,500 yr BP.

An examination of Pacific Northwest palaeoecological studies shows that the timing of climate changes and the associated changes in vegetation are often similar, implying that the observed changes are responses to large-scale regional climate forcing and that they are teleconnected (Brown and Hebda, 2003). Such studies also show that late-glacial and early Holocene vegetation responses to changes in climate were relatively abrupt compared to more gradual responses during the middle- and late-Holocene (Brown and Hebda, 2003).

Modern Climate

The modern climate of the study area is part of the Coastal Western Hemlock Zone (Pojar and Mackimmon, 1994) which is characterized by cool summers and mild winters. Mean annual precipitation averages 2228 mm (ranging between 1000 to 4400 mm), with the majority falling in autumn and winter. The mean annual air temperature is around 8° C (Meidinger and Pojar, 1991). The period of peak freshwater input into the

inlet is assumed to be in late-spring and early summer in response to the melting of snow accumulated over the winter (this snowmelt period is also called the freshet), which is the case for most inlets on the mainland (Thomson, 1981). This is in contrast to most fjords on Vancouver Island, where freshwater input is mostly due to rainfall which is greatest during the late fall to early spring rainy season (Thomson, 1981).

Atmospheric Circulation

The seasonal climate of the Pacific Northwest is determined to a large degree by the location and intensities of two major semi-permanent atmospheric pressure cells: the Aleutian Low (AL) and the North Pacific High (NPH) (Figure 2.2). The strength and direction of the prevailing offshore winds, as well as their long-term climatic variability, are affected by variations in the intensity and location of these two large-scale pressure cells. These pressure cells also guide the movement of smaller synoptic scale cyclonic and anticyclonic pressure cells and their frontal systems, thus influencing the location, timing, and degree of precipitation along the British Columbia coast. Storm tracks are commonly directed northeastward between the centres of the two major pressure cells (Thomson, 1981).

The AL gradually increases in intensity from August to January as its Centre of Action (COA) shifts southeastward from the northern Bering Sea to the Gulf of Alaska (Figure 2.2). Maximum intensity (i.e. lowest pressures) of the low-pressure cell and its associated counterclockwise winds occurs in January, with an accompanying sudden shift of its COA to the western Aleutian Islands. After January it tapers off until July when it is no longer evident in the monthly average surface pressure maps for coastal British

FIGURE 2.2. The Aleutian Low (AL) and North Pacific High (NPH) atmospheric gyres and prevailing wind direction (arrows) during winter (January) and summer (July). Values are mean air pressure at sea level during winter and summer from 1951 to 1970. A large-scale counter-clockwise low pressure system (AL) develops during the winter when the land is cooler relative to the ocean. During the summer, when the land is warmer than the ocean, a large-scale clockwise high-pressure system (NPH) migrates from the south and dissipates the AL. Star symbol marks location of study area. Values + 10,000 divided by 10 gives pressure in millibars. After Favorite et al. (1976)

Columbia (Thomson, 1981). As a result, from late fall to early spring when strong cyclonic winds are most prevalent over the open ocean, prevailing coastal winds are from the southern quadrant (S, SE, and SW) nearly half the time (Thomson, 1981).

The NPH is present year-round with its COA located around 30-40° latitude off the California coast. It reaches maximum intensity (i.e. highest pressures) from June to August when it almost encompasses the entire Northeast Pacific Ocean (NEP). From May through September coastal winds flow in a clockwise direction over the ocean due to the combined effect of a greatly weakened AL and intensified NPH, and are predominantly from the northwest.

The transition to a strengthened AL and associated southerly winds during fall to early spring is also accompanied by an increase in the number and intensity of travelling cyclonic disturbances. Storms occur more often and with greater strength in fall and winter than in spring and summer (Thomson, 1981). This increase in storminess and wind strength is presumably linked to favourable conditions for cyclonic development that arise in the oceanic area between the strengthening AL and the weakening NPH (Thomson, 1981). The direction of storm tracks also changes in the winter. Storms formed over the open ocean at the southern edge of the AL are directed northeastwards towards the southern coast of British Columbia and northern Washington. Major storm systems in the Gulf of Alaska are directed southeastwards along the outer coast as well. The British Columbian coast thus receives the majority of its precipitation during winter months when a strengthened AL dominates the North Pacific and advects moisture-bearing storms towards the coast (Miller et al., 1994; Latif and Barnett, 1996)

The strength of the AL changes greatly over the course of a season, but interannual and longer-term variability in its strength and location are also common. A stronger, or intensified AL, is the result of basin-scale drops in sea level pressure centred over the Aleutian Islands (Graham, 1994; Trenberth and Hurrell, 1994). Variation in the strength of the AL in historical times (expressed by the Aleutian low pressure index, ALPI, which measures deviation in the AL from the 1950-1997 mean. Beamish et al., (1997), has shown that although there is much interannual variability there have also been several periods when one phase (+ve {stronger}, or -ve {weaker}) of the ALPI has dominated for many winters (Spooner et al., 2003). From 1900 to 1925, and from 1950 to 1975, the AL has on average been weaker; from 1925 to 1950, and from 1975 to the mid 1990s, the AL has been stronger on average (Mantua et al., 1997).

Other climatic and biological indices for the NEP have shown variability on the same ~ 50 year periodicity that the AL has exhibited over historical time. Such variability is partially in response to changes in the strength and position of the AL (Mantua et al., 1997; Minobe, 1997, 1999). Along the Pacific east coast up to ~48°N latitude, periods of an intensified AL correspond with decreased salmon, anchovy and zooplankton populations, decreased primary productivity, an increase in sardine populations, warmer sea surface temperatures and reduced salinity along the coast (Mantua et al., 1997; Chavez et al., 2003). Periods of a weaker AL correspond with decreased sardine populations, increased anchovy, salmon and zooplankton populations, enhanced primary productivity, and a shallower thermocline (Mantua et al., 1997; Chavez et al., 2003). Along the Alaskan coast however, these trends are reversed, with periods of an intensified AL corresponding to an increase in salmon populations and the reverse

during periods of a weaker AL (Mantua et al., 1997). This ~50 year cyclic nature in climatic and biological indices has been termed the Pacific Decadal Oscillation by Trenberth and Hurrell (1994).

As can be seen, variations in the intensity of the AL over historical times has had considerable impacts on the climate and ocean ecosystems of the Pacific Northwest. A number of studies have also demonstrated that the AL has varied in intensity over longer periods in the past and that its ~50 year cycle may be a higher frequency component of such change. Anderson et al. (2005) postulated that changes in the strength of the AL lasting thousands of years explain variations in an oxygen isotope record from a lake in the Yukon Territory by affecting the route of moisture-bearing winds. Spooner et al. (2003) suggest that an increase in exotic western Hemlock (*Tsuga heterophylla*) pollen in northern British Columbia, southwestern Yukon, and adjacent Alaska can be attributed to a sustained positive ALPI phase during the late Holocene. Hay et al., (in press) infer that a decrease in diatom productivity after 4000 cal yr BP is the result of an increase in the strength of the AL. Patterson et al. (2004a) interpret thick clay-rich sections of a core from Effingham Inlet around 2350, 2750 and 3350 yr BP as resulting from an intensification of the AL and resultant increases in precipitation.

Oceanography

The NEP is divided into three major fisheries production domains (and a transitional zone) based upon large-scale circulation features and distribution of commercial quantities of marine fishes (Ware and McFarlane, 1989) (Figure 2.3.). These are: the Coastal Upwelling Domain (CUD), the Coastal Transition Domain (CTD), the

Coastal Downwelling Domain (CDD), and the Central Subarctic Domain (CSD) (Figure 2.3). The SBIC is located within the CTD near the boundary with the CUD.

In the NEP, the Subarctic Current and West Wind Drift, large west-to-east surface currents situated at approximately 42-49°, are the two major currents that dominate circulation (Figure 2.3). As the currents approach North America they bifurcate within the CTD due to divergence in the prevailing wind patterns, splitting into the Alaska Current, which flows northward, and the California Current (CC), flowing southward (Ware and McFarlane, 1989). Off Vancouver Island, surface currents vary seasonally in response to the prevailing wind directions. In the winter the Northeast Pacific Coastal Current flows northwestward in response to southerly winds associated with the AL pressure system (Thomson, 1981). In the summer, northerly winds associated with the NPH pressure system produce the southeastward flowing shelf-break current (Thomson and Gower, 1998). To compensate for the southward flow of water at the surface, a slow northward flowing current, termed the California Undercurrent, develops below 200 m (Thomson, 1981).

Upwelling

Coastal upwelling generally occurs when winds push the surface water away from the coast and deeper, colder, nutrient-rich water rises up to replace it (Thomson, 1981). Upwelling acts like a “biological pump”, making nutrients available to phytoplankton and increasing total biological productivity. Although coastal upwelling areas comprise only 0.1% of the oceanic surface area, these nutrient-rich zones have a mean primary productivity five times greater than the open ocean (Ryther, 1969; Smith and Hollibaugh,

FIGURE 2.3. Fisheries production domains and general circulation in the northeast Pacific Ocean (from Ware and McFarlane, 1989). Study area indicated by star symbol.

1993) and account for 21% of the world's fish harvest (Pauly and Christensen, 1995).

Coastal upwelling also moderates the climate in regions where the prevailing winds have an onshore component, which are cooled by the cold surface waters (Thomson, 1981).

Within the NEP upwelling occurs in the aptly named Coastal Upwelling Domain which extends from Baja, California to northern Vancouver Island (Thomson, 1981). Upwelling in this region is initiated in response to wind-forced Ekman transport of surface waters away from the coast, which is in turn driven by northerly clockwise circulating winds associated with the NPH atmospheric pressure system (Thomson and Gower, 1998) (Figure 2.4). Upwelling conditions are prevalent off California year-round, but are most prevalent from May to September along the west coast of Vancouver Island (Ware and McFarlane, 1989). Even the weak upwelling region along Vancouver Island is capable of supporting great numbers of fish (Thomson, 1981).

Downwelling conditions are prevalent during the winter months due to a strengthened AL and weakened NPH, with the resulting southerly winds and Coriolis force directing surface water onshore (Ware and McFarlane, 1989).

From north of Vancouver Island up to Dixon Entrance is the CTD. Within this domain, the prevailing winds generally direct surface water toward the shore, and downwelling persists for most of the year (Ware and McFarlane, 1989).

Along the west coast of Vancouver Island, upwelled oxygenated, nutrient-rich waters are transported from seaward of the 200-m shelf break onto the outer shelf and then shoreward where they can lead to a marked increase in phytoplankton production (Thomson, 1989). Penetration of upwelled waters into coastal inlets can occur early in the annual spring upwelling season during a rare combination of weak tidal currents in

A. Summer: North Pacific High influenced coastal circulation off Vancouver Island.

B. Winter: Aleutian Low influenced coastal circulation off Vancouver Island.

FIGURE 2.4. Wind-induced coastal upwelling along the Vancouver Island continental shelf. In the spring and summer northerly winds associated with the NPH, combined with the Coriolis force move nearshore surface water offshore; colder, nutrient-rich water rises to replace it. During the winter, the AL pressure system brings southerly winds which cause onshore movement of surface waters and downwelling conditions. Modified from Thomson (1981).

the fjord, significant rainfall, and strong (>10 m/s) northeasterly winds (Thomson, 1981).

As the SBIC is located within the CTD, although near the boundary with the CUD, it is assumed that penetration of upwelled, nutrient-rich waters into the complex is rare.

LAMINATED SEDIMENTS AND DIATOMS

Diatoms

Diatoms (class Bacillariophyceae) are single-celled algae with a siliceous shell (frustule) and are the world's most important primary producer (Kemp, 2003), and also form the base of the food chain in upwelling regions (Cushing, 1989). Because of their rapid response to changes in environmental conditions (e.g. diatom blooms during periods of increased nutrient supply), their good preservation potential, rapid sedimentation once nutrients are depleted, and because their production in surface waters is correlated with the abundance of frustules in the underlying sediments, diatoms are an excellent proxy tool for examining environmental change (Kemp, 2003; Pitcher, 1990; Grimm et al. 1996; Sancetta, 1996; Stoermer and Smol, 1999). When the composition and absolute abundance of diatoms within a long sediment record is analyzed, much information can be gleaned regarding past oceanographic conditions.

Diatoms compose a major component of the phytoplankton population of the coastal waters of British Columbia. Diatom-based studies have mainly been from locations in southern British Columbia and Vancouver Island, including Effingham Inlet (Chang et al., 2003; Chang, 2004; Hay et al., 2003), Saanich Inlet (McQuoid and Hobson, 1997, 1998, 2001; Dean and Kemp, 2001; Sancetta, 1989, 1990), Jervis Inlet (Sancetta, 1989, 1990), Schelt Inlet (Haigh et al., 1992), Howe Sound (Stockner et al., 1977) and the

Strait of Georgia (Stockner et al., 1979). Paleoclimatic conditions inferred from some of the above studies include upwelling strength, precipitation, nutrient levels, and water temperature and salinity.

Laminated Sediments

Because historical climate records in coastal British Columbia extend back only about 100 years (Ware and Thomson, 2000), it is necessary to turn to non-historical records in order to examine long-term climate change and identify greater than decadal-scale climate phenomena. Laminated diatomaceous sediments represent such a record, as their annually deposited varves record variation due to changing precipitation and run-off from land or variation in biological productivity and flux in the water column (Kemp, 2003; Grimm et al., 1996). Due to their annual resolution, such sediments may capture abrupt changes of interannual to decadal scales, and thus are comparable to corals and ice cores in their resolution (Kemp, 2003). Laminated diatomaceous sediments are formed where there is a heterogeneous sediment supply and a lack of physical or biological reworking (Kemp, 2003; Grimm et al., 1996). An annually deposited couplet consists of a terrigenous laminae, composed dominantly of lithic particles, and a diatomaceous laminae, which may contain a number of sub-laminae composed of individual or a few taxa (Chang et al., 2003; Dean et al., 2001). The thickness of the biogenic lamina in laminated sequences may be regarded as a qualitative measure of surface productivity (Kemp, 2003). Laminated diatomaceous sediments are common in coastal upwelling environments along eastern boundary oceanic currents with high rates of primary productivity. They have been used to reconstruct climatic conditions such as

precipitation, upwelling strength, salinity, nutrients, and sea surface temperatures (Patterson et al., 2004a, 2004b, 2005; Dean and Kemp, 2004; Chang et al., 2003; Kemp, 2003; Dean et al., 2001; McQuoid and Hobson, 1997, 1998; Pike and Kemp, 1996; Sancetta, 1996, 1989; Sancetta and Calvert, 1988).

The climate of British Columbia and its many fjords are ideal for generating and preserving laminated diatomaceous sediments. A heterogeneous sediment supply results from the seasonal climate, in which the majority of precipitation occurs in the autumn and winter, and also because its coastal waters are productive, especially those in the CUD along the west coast of Vancouver Island. The numerous fjords along the coast are excellent repositories for such sediments, as sills at their entrance tend to prevent oxygen-rich ocean water from penetrating into the deeper regions behind them. As a consequence, water in these sheltered depths may become depleted in oxygen or even anoxic under prolonged stagnation (Thomson, 1981).

The terrigenous component of an annual couplet is deposited during the autumn and winter (Kemp, 2003; Chang et al., 2003; Dean et al., 2001; Sancetta, 1989). The AL dominates the NEP during this time, bringing moisture-bearing cyclonic systems towards the coast. In response to increased precipitation, terrigenous input into the basins via runoff increases. Diatom production is also significantly reduced in response to decreased sunlight and nutrients, and cold water temperatures. Sediment trap studies have confirmed that lithic particles compose the majority of bulk material during autumn and winter (Sancetta, 1989; Chang, 2004).

The diatomaceous component of an annual couplet is deposited during the late spring and summer when cool and wet conditions are replaced by warmer, and drier

conditions as the NPH migrates northward and increases in intensity and the AL dissipates (Kemp, 2003; Chang et al., 2003; Dean et al., 2001; Sancetta, 1989). The combination of a number of events, including an increase in sunlight, water temperature and nutrients, enables the onset of increased diatom production (Margalef, 1958; Guillard and Kilham, 1977). In coastal areas of northern latitudes, the majority of diatom production occurs in late spring and early summer (Kemp, 2003; Margalef, 1958; Guillard and Kilham, 1977).

Seasonal Succession of Diatoms

Planktic marine diatom species appear in a predictable three-stage succession during the course of a year in response to changing seasonal environmental conditions. This succession is most evident in higher latitude regions where seasonality is stronger, and is found in coastal temperate and Subarctic regions, including the fjords of British Columbia (Sancetta, 1989; McQuoid and Hobson, 1997; Chang et al., 2003), Alaskan waters (White et al., 1992), the fjords of Norway (Jochen, 2005), and the northeast coast of North America (Smayda, 1973). Margalef (1958) was the first to describe the three-stage annual succession; and later revised by Guillard and Kilham (1977).

Stage 1 is characterized by small, fast-growing diatom species with high rates of vegetative production that initiate the spring bloom in response to increased light and nutrient levels. Nutrients are introduced into the photic zone via upwelling, strong mixing or terrigenous runoff. The bloom sequence in temperate coastal regions begins with *Thalassiosira* spp. (Dean et al., 2001; Chang, 2004) because they respond to increased sunlight early in the spring while surface waters are still cool (White et al.,

1992). *S. costatum* and *Chaetoceros* spp. follow in late spring and early summer as light levels and water temperature increase (Dean et al., 2001; Haigh et al., 1992; Smayda, 1973; Hitchcock and Smayda, 1977). The majority of annual diatom production occurs in late spring and early summer when population densities can reach up to 10^7 cells/L. Stage II is characterized by a higher diversity of genera and lower population densities (on the order of 10^5 cells/L). . Stage III consists of large slow-growing species which are capable of growing in low nutrient waters, and are indicative of late summer to autumn production. This stage is typical of stratified conditions. Population densities in Stage III are typically less than 10^4 cells/L.

From sediment trap studies in fjords of British Columbia it has been observed that the majority of diatom production occurs in the late spring and is dominantly composed of *Skeletonema costatum* (Sancetta, 1989; Chang, 2004; Stockner et al., 1979; Haigh et al., 1992). From a sediment trap study in Jervis Inlet (a mainland fjord) over a period of three years, Sancetta (1989) observed that the annual maximum in diatom production occurred in May and June, corresponding to the onset of strong stratification induced by snowmelt and runoff. However, runoff induced stratification was observed to inhibit normal production in 1987 in response to the 1986-87 El Niño event in which winter temperatures were warmer than average and precipitation occurred only as rain. This influx was sufficient to suppress the spring bloom and Sancetta suggests that *Thalassiosira* spp. and *S. costatum* (the usual dominants during spring bloom) could not tolerate the low salinities which occurred in March and May.

Sediment core studies from coastal inlets and sounds of British Columbia have shown *S. costatum* was the dominant component of diatom assemblages in the past as

well. From Effingham Inlet, on the west coast of Vancouver Island, Chang et al. (2004) and Hay et al. (in press) observed that *S. costatum* made up the majority of diatom production at least as far back as ~5500 cal yr BP, representing greater than 70% of the assemblage in many parts of the core. From Saanich Inlet, McQuoid and Hobson also observed *S. costatum* as the dominant taxon in a core extending back to ~12 000 cal yr BP. Thick diatomaceous laminae and high production of *S. costatum* were interpreted as representing strongly seasonal conditions in which spring and summer seasons were relatively dry and sunny, and there is a good supply of nutrients into the inlet resulting from strong upwelling conditions (Chang et al., 2003; Chang and Patterson, 2005; Hay et al., in press). Thinner and siltier laminae, along with decreased abundance of *S. costatum* and increased abundance of brackish water, freshwater, and benthic species, reflected conditions of weak seasonality in which spring and summer were relatively wetter and cloudier, and nutrient delivery into the inlet declined due to diminished upwelling conditions.

Cyclotella choctawatcheeana, a brackish water species, is also a common constituent of the diatom community of coastal waters of British Columbia, and has been identified in sediment trap studies (identified as *C. caspia* by Sancetta (1989), but likely *C. choctawatcheeana* - see Håkansson et al., 1993 and Carvalho et al., 1995) and core and surface sediment sample studies (Hay et al., 2003, in press; Chang and Patterson, 2005). Sancetta (1989) observed that it had a marked seasonal restriction only occurring during summer months (July and August) when it is abundant and typically accounts for 20% of all diatoms present. The physical environment during this interval was unusual, being warm (surface temperatures 17-21°C) and strongly stratified with low surface

salinities (11.5-13.6‰), a result of summer snow-melt and runoff (Sancetta, 1989). Hay et al. (in press) have suggested an increased abundance of *C. choctawatcheeana* in the sediment record reflects the suppression of the typical *Thalassiosira-Skeletonema-Chaetoceros* bloom production. In a high-resolution 1500-yr box and Kasten core record from Effingham Inlet, (Hay et al., submitted) the occurrence of *C. choctawatcheeana* was irregular and negatively correlated with %Si_{OPAL}, total diatom abundance, *S. costatum*, *Chaetoceros* resting spores and *T. nordenskioeldii*. Hay suggested that the increase in *C. choctawatcheeana*, combined with a decrease in abundance of spring bloom species, may be the result of a deeper snowpack in the catchment leading to an enhanced spring-summer freshet marked by increased turbidity and reduced salinity in the surface waters of Effingham Inlet.

CHAPTER 3

METHODS AND MATERIALS

CORING

Coring took place in April 2002 in the SBIC aboard the CCGS *Vector* (Figure 3.1). Prior to coring, basins were profiled with a 3.5 kHz air gun to locate suitable piston core sites where the sediment appeared relatively gas-free in the upper few meters. Cores were taken from the deepest part of the basins and away from the sides of inlets to reduce the incidence of slumped deposits. Nine freeze cores (0.4 - 1.45 m long), and eight piston cores (10 cm diameter by 3-12 m long) were recovered from the SBIC.

Piston cores are taken to obtain a long sediment record, whereas freeze cores are taken to retrieve the very soft and easily disturbed uppermost sediment layers (the sediment-water interface) that are often not sampled by piston cores. Freeze core are ideal for sampling soft sediment-water interface samples because even high water content surface sediments are frozen onto the surface of the corer with minimal disturbance.

For each piston core a plastic core liner was inserted into a 12-m long x 11-cm wide core barrel, which was then lowered to within a few metres of the inlet floor. A trip mechanism was then activated, allowing the corer to penetrate the sediments by gravity.

Piston core VEC02A04 (12.2 m in length) was recovered from 240 m water depth in Frederick Sound. It was the focus of this study because laminated sediments comprised a large part of the core (41%). Upon recovery, the core was raised back on board and the plastic liner containing the sediments was extruded from the metal barrel and split into ten sections for easier handling. The ends of the individual core sections

FIGURE 3.1. Coring methods and study site. A. The CCGS *Vector*. B. Frederick Sound. C. Piston coring being lowered into the water.

were sealed with plastic core caps and taped shut. The sediments were quite gas-rich, and the section of core from 136-183 cm (measured from top of the core) was blown out and therefore was only recovered as bagged mud. This section of the core was not sampled for this study. Core sections were stored upright in an on-board cooler and transferred to the Pacific Geoscience Centre in Sydney, British Columbia upon docking.

SAMPLING

At the Pacific Geoscience Centre, the plastic core barrel liners were split in half lengthwise using a circular saw. Fishing line was then dragged the length of the core along the cuts and split the core into a working and an archive half. All ten sections of the core were then logged in detail and x-rayed by Audrey Dallimore of the Pacific Geoscience Centre. Core sections were wrapped in plastic cling wrap and stored horizontally in plastic D-tubes with a wet sponge to prevent desiccation. Core sections were stored in a hanger at the Pacific Geoscience Centre.

In October 2002, I travelled to Sydney to sample piston core VEC02A04. Two-cm long samples were taken at 8 cm intervals from each core section. These were stored in plastic bags and transported to Carleton University for processing.

CHRONOLOGY

Eight well-spaced wood samples were extracted from the core and submitted for accelerated mass spectrometry (AMS) radiocarbon dating to IsoTrace Radiocarbon Laboratory at the University of Toronto. After correction for $^{13}\text{C}/^{12}\text{C}$ isotope fractionation, obtained dates were calibrated using the radiocarbon calibration program

CALIB, Version 5.0.1, using the Intcal.04 calibration data set (Reimer et al., 2004; Stuiver and Reimer, 1993; Stuiver et al., 2005). CALIB makes the conversion from radiocarbon age to calibrated calendar years by calculating the probability distribution of the sample's true age (Stuiver et al., 2005). Dates are reported herein as calibrated calendar years before present (cal yr BP). The probability of calibrated calendar ages for a sample are reported at the 95.4% (2 sigma) confidence interval. Calibrated calendar age before present is the median probability of the 95.4% probability distribution curve and is reported rounded to the nearest 10 years because uncalibrated ages had standard deviations greater than 50 years (Stuiver et al., 2005). Radiocarbon ages were also calibrated to calendar dates (i.e. BC and AD dates) in the same manner as was done for calibrated ages. The obtained calibrated radiocarbon dates are reported in Table 2.1 and Appendix A.

SAMPLE PREPARATION

Procedures for preparing diatom samples for light microscopy closely follow the procedures used by Hay et al. (2003) and Chang (2004), with the exception that a commercially prepared microsphere solution (MS) (obtained from the Environmental Change Research Centre, University College London) of known concentration was used to calculate absolute diatom abundances in this study.

Each sample was freeze-dried to remove the moisture content of the sediments for storage and slide processing. Freeze drying was performed by Malcolm Bilz at the Canadian Conservation Institute in Ottawa. Samples maintained their original shape after freeze-drying but fell apart when slight pressure was added with a metal spatula. Dried

TABLE 3.1. Radiocarbon dates obtained for core VEC02A04.

Sample Number	Lab Number	Depth in Core (cm)	Material Dated	Radiocarbon age (yr BP)	Calibrated Calendar Ages (cal yr BP) [†]	Median Probability Age (cal yr BP) [§]	Calibrated Calendar Dates [†]	Median Probability Date [§]
VEC02A04-1-97	TO-10788	97	Wood fragment	1510 ± 60	1306 - 1523	1400	AD 427 - 644	BC 550
VEC02A04-2/3-16	TO-11082	313	Wood fragment	3070 ± 70	3076 - 3412 3423 - 3442	3280	BC 1493 - 1474 BC 1463 - 1127	BC 1330
VEC02A04-3-132a	TO-10789	457	Wood fragment	2560 ± 80	2362 - 2784	2620	BC 835 - 413	BC 670
VEC02A04-3-132b	TO-10790	457	Wood fragment	3050 ± 60	3076 - 3383	3260	BC 1434 - 1127	BC 1310
VEC02A04-5-115	TO-11084	734	Pine cone	2540 ± 70	2364 - 2415 2432 - 2759	2600	BC 810 - 483 BC 466 - 415	BC 650
VEC02A04-7-126	TO-10791	1051	Twig	4350 ± 80	4712 - 4718 4725 - 4753 4816 - 5093 5096 - 5144 5155 - 5287	4950	BC 3338 - 3206 BC 3195 - 3147 BC 3144 - 2867 BC 2804 - 2776 BC 2769 - 2763	BC 3000
VEC02A04-8-103	TO-10793	1182	Wood fragment	3770 ± 60	3935 - 3936 3973 - 4300 4314 - 4315 4325 - 4356 4367 - 4406	4140	BC 2457 - 2418 BC 2407 - 2376 BC 2366 - 2365 BC 2351 - 2024 BC 1987 - 1986	BC 2200

† Calibrated results are reported at the 95.4% (2 sigma) confidence interval.

§ Median probability ages and dates are rounded to the nearest 10 years.

samples were carefully disaggregated to speed the sediment digestion process, and care was taken to ensure that samples were not crushed or powdered, as this can destroy diatom frustules.

From each sample, 20 mg of freeze-dried sediment was added to a 20-ml scintillation vial, to which a few drops of 10% HCl and hydrogen peroxide were added to dissolve carbonate and organic material. The vials were placed on a hot-plate at a low setting to facilitate the reaction, and were left on for at least one half-hour, or until the slurry was transparent. 33% ethanol was used to subdue any violent bubbling during the reaction. Following this, samples were removed from the hot-plate and left to cool for 1.5 hours, after which 5-ml of 0.5% sodium hexametaphosphate was added to each vial in order to disperse clay particles. After one hour, scintillation vials were topped up to 20-ml with distilled water and left undisturbed for 24 hours. The supernatant from each vial was then decanted once per day, for five days, in order to remove HCl and hydrogen peroxide. Vials were topped up to exactly 20-ml with distilled water following each decantation. Extreme care was taken to ensure that no diatoms were removed during the decantation process, and this was checked by examining slides made from the discarded supernatant.

Following decantation, a test slide was made to determine appropriate dilution factors necessary for easy identification and counting of diatoms at 1000X magnification. It was determined that dilutions of 2X and 4X (1X being no dilution of slurry) were ideal for most samples. The MS was diluted from its initial concentration of 7.88×10^7 to 3.14×10^5 microspheres/mL (MS/mL) to facilitate counting. This way, the number of MS per field of view was approximately the same as the number of valves per field of view.

Before extracting the slurry from the scintillation vial, it was thoroughly shaken to ensure that heavy and light diatoms were well mixed; 1 mL of slurry was then immediately extracted using a calibrated micropipette and transferred to a plastic centrifuge tube. Two drops of HCl were added to the tube to prevent dissolution of valves and retard potential bacterial growth. For 2X dilution factor, 1 mL of MS solution was added to the extracted slurry in the centrifuge tube. For 4X dilution factor, 2 mL of distilled water, plus 1 mL of MS solution, was added to the extracted slurry in the centrifuge tube. Both 2X and 4X dilution factor solutions were made for each sample.

Following this, the centrifuge tube was thoroughly shaken to ensure mixing of diatoms and 0.5 mL of diluted slurry was extracted with a calibrated micropipette. It was then carefully plated onto 18x18 mm cover slips, pre-cleaned with 95% ethanol, starting with a drop at the centre and then one at each corner. Drops were then connected together and drawn to all edges of the cover slip to reduce the tendency for greater concentration of diatoms towards the centre (Hay et. al., 2003). Cover-slips were then covered and left to dry without disturbance for 24-36 h. Cover slips were then mounted to glass microscope slides using the thermoplastic mounting medium Meltmount® (refractive index = 1.704). Cover slips were placed diatom-side-down on the slide on a hot-plate at ~50 °C and Meltmount drops were placed around the edges of the cover slip and drawn underneath to completely cover the cover slip. Slides were then left to cool for a few hours.

DIATOM IDENTIFICATION AND COUNTING

Diatoms were counted and identified to the lowest taxonomic level possible at a magnification of 1000X on an Olympus BX-51 stereo light microscope equipped with a differential interference contrast filter. Counting rules followed those of Laws (1983) and Schrader and Gersonde (1978). Between 400 and 500 valves (one half of a diatom frustule) were counted for each slide to ensure statistical validity for that sample (Patterson and Fishbein, 1989). Transects and fields of view were spaced apart so that a comprehensive area of the slide was examined, and to ensure proper assessment of diatom abundance and composition. Taxonomic identification of diatom valves was mainly based upon the floras of Witkowski et al. (2000), Pienitz et al. (2003), Cumming et al. (1995), Campeau et al. (1999), and Carmelo (ed.) (1997). The number of microspheres encountered while counting diatoms for each slide was also recorded in order to calculate the absolute abundance of valves per gram of dry sediment for each sample.

Abundance Calculations

The absolute abundance (concentration) of diatom valves, $D_{[abs]}$, (valves/g of dry sediment) was calculated using the formula (modified from Batterbee and Kneen, 2003):

$$D_{[abs]} = (MS_{con} \times VMS_{con} \times DC \times VS) / (MS \times MSC \times VDS)$$

where MS_{con} is the concentration of the diluted MS solution (3.14×10^5 MS/mL); VMS_{con} is the volume (mL) of diluted MS solution added to the centrifuge tube (1 mL for both 2X and 4X); DC is the number of diatom valves counted for the sample; VS is the volume of the scintillation vial (20 mL); MS is the mass of sediment in the scintillation vial (0.020 g); MSC is the number of MS counted in the sample; and VDS is

the volume of diatom slurry extracted from the scintillation vial to the centrifuge tube (1 mL for both 2X and 4X). This formula then simplifies to:

$$D_{[\text{abs}]} = (6.28 \times 10^5 \text{ MS} \times \text{DC}) / (0.020 \text{ g} \times \text{MSC})$$

The absolute abundance was calculated for every sample as well as for every diatom taxon in every sample.

The relative abundance of a diatom taxon represents its proportion relative to the total number of diatoms counted in a sample. Relative abundance was calculated using the equation:

$$D_{[\text{relative}]} = (n_i/N)100\%$$

where $D_{[\text{relative}]}$ is the relative abundance of diatom taxon i expressed as a percentage; n_i is the number of diatom taxon i counted in the sample, and N is the total number of individuals counted in the sample. Relative abundance was calculated for every diatom taxon in every sample examined.

STATISTICAL ANALYSES

Q- and R-mode hierarchical cluster analyses were used to analyse diatom taxa and sample relationships. Q-mode cluster analysis, carried out using Ward's Minimum Variance method, was used to determine the overall statistical similarity between samples. Samples were grouped into clusters based on their similarity to each other in terms of taxa and abundance. R-mode cluster analysis was used to analyze species relationships. Taxa that are commonly associated with each other in samples clustered together.

Prior to Q- and R-mode analyses, samples were statistically analyzed to remove samples and species that were not statistically significant. A sample was judged to contain a statistically significant population (SSP) if the sum of the counts obtained for each taxa in a sample was greater than the probable error, calculated by:

$$pe = 1.96 (s / \text{sqrt} (X_i))$$

where s is the standard deviation of the population counts, and X_i is the number of counts at the station being investigated (Patterson and Fishbein, 1989). The relative fractional abundance (X_i) of each species in every sample was calculated as follows:

$$X_i = C_i / N_i$$

where C_i is the number of counts of the species in that sample, and N_i is the total of all species counts for that sample. Subsequently, the standard error (S_{X_i}) associated with each species was determined from:

$$S_{X_i} = 1.96 (\text{sqrt} (X_i(1-X_i) / N_i))$$

If the standard error was greater than the fractional abundance of the species for that sample, then the species was not included in subsequent Q- and R-mode analyses for that sample (Patterson and Fishbein, 1989).

BIOGENIC SILICA ANALYSIS

Maureen Soon, Department of Earth and Ocean Sciences, University of British Columbia carried out a biogenic silica (opal) analysis for every sample. The UBC procedure is modified from Mortlock and Froelich (1989) with values being presented as %Si_{OPAL}.

The skeletons of marine organisms such as diatoms, silicoflagellates, radiolaria and siliceous sponges are composed of silica. It has been shown that percent biogenic opal in surface sediments is closely linked to biosiliceous productivity in overlying surface waters (Leinen et al., 1986). Therefore, the biogenic silica content of marine sediments can be a valuable record of productivity of such organisms and provide insights into paleoceanographic conditions (Mortlock and Froelich, 1989). Since diatoms are by far the most abundant siliceous organism in coastal waters along British Columbia (Hobson, 1983; Sancetta, 1989; Haigh et al., 1992; Hobson and McQuoid, 1997), the biogenic silica record provides an excellent reflection of diatom, and higher food chain paleoproductivity in the region.

CHAPTER 4

RESULTS

CHRONOLOGY

Using linear regression, an age-depth model was generated using all available calibrated radiocarbon ages (Figure 4.1). Even though the rate of sedimentation undoubtedly changed at least slightly during deposition of the core, linear regression was chosen because it is the most appropriate method for establishing chronology when only a minimum of radiocarbon dates are available (Telford et al., 2004). Of the dated samples, two were obtained from 457 cm depth and the average of their calibrated ages was used in generation of the age model. Based on the spread of dates obtained from this single horizon it is obvious that at least some of the other dates are out of stratigraphic order. The redeposition of older material in younger sediments may have occurred during gravity-flows, or if a sample of wood floated for many years prior to sinking to the bottom of the sound. As no date could be excluded with certainty, all were used in the age-depth model. Despite the uncertainties outlined above, the resultant age-depth model is probably fairly accurate as not only are the derived chronology of climatic changes inferred from it in close agreement with similar changes observed elsewhere in British Columbia but the derived sedimentation rate (0.285 cm/yr) is similar to values obtained from comparable inlets in coastal British Columbia (e.g. Chang et al., 2003; Dean and Kemp, 2004; Prokoph and Patterson, 2004)

The average sediment accumulation rate was calculated based on the assumption that gravity-flow deposits added and eroded sediments equally, and that down-core

FIGURE 4.1. Age-depth relationship for calibrated radiocarbon wood dates. Sediment accumulation rate derived from slope of linear regression line. Horizontal error bars represent range of ages defined by probability distribution of sample's true age, and were not used in fitting linear regression line.

compaction was negligible. Based on the linear regression equation, the top of the core (0 cm depth) was calculated to be ~970 cal yr BP, indicating that ≈ 277 cm was missing from the top of the core, likely due to over penetration of the piston coring apparatus during coring, and/or removal of sediment during a gravity-flow event. The actual number of years of sedimentation missing from the top of the core is probably slightly less than calculated due to the less compacted nature of the sediment found at the sediment-water interface. The base of the core (1224 cm) was calculated to be ~5270 cal yr BP, giving an interval of deposition of ~4300 years. Using the calculated sedimentation rate of 0.285 cm/yr as a guide indicates that the homogenized two-cm thick samples used in this study represents ~7 years of sedimentation. For a sampling interval of 8 cm, the effective Nyquist sampling frequency (Davis, 2002) was 16 cm, giving an ~56 year resolution. Thus the diatom data presented here can only be used to interpret paleoceanographic and paleoclimatic phenomenon with a resolution of ~56 years or greater.

SEDIMENTOLOGY

The core was composed of organic-rich dark olive-grey mud that was variably laminated or non-laminated, with minor amounts of graded mud, sandy mud and sand layers. Woody debris and fecal pellets were found in some layers (Figure 4.2). Of the top 200 cm of core, 113 cm was lost on recovery due to sediment degassing. The upper approximately one fourth of the core (from ~265 cm upwards) was comprised of more non-laminated than laminated intervals. The interval from ~265 - 760 cm contained predominantly laminated sediments, whereas the interval from ~760 cm down to the base

FIGURE 4.2. Stratigraphic column of Frederick Sound core VEC02A04. Calibrated radiocarbon samples and dates indicated by arrows.

of the core was almost evenly split between intervals of laminated and non-laminated sediments.

A high-resolution analysis of the laminated sediments was not carried out as part of this research but it was assumed that the bulk composition of the laminae and pattern of deposition was the same as that observed at similar anoxic fjords along this coast (Sancetta and Calvert, 1988; Sancetta, 1989; McQuoid and Hobson, 2001; Chang et al., 2003; Dean and Kemp, 2004). These previous studies have confirmed that a couplet, comprising one light- and one dark-coloured laminae, represents one year of sedimentation. Light-coloured laminae are diatom-rich and deposited during spring and summer, whereas the dark-coloured laminae are rich in terrigenous material and are deposited during the fall and winter. Couplets were on the order of 0.07-0.3 cm thick.

DIATOMS

One hundred and sixty three species of diatoms representing 56 genera were quantified in 108 sediment samples. Seventy-two unknown species (identified to genus level where possible) were also identified (Appendix B). The presence of valves of finely silicified diatom species, such as *Skeletonema costatum*, which was often found in chains over ten cells in length, provided an indication of the excellent preservation level (McQuoid and Hobson, 2001).

The average absolute diatom abundance from the 108 samples was 6.16×10^8 valves/g dry sediment. This value is in line with diatom concentration values calculated from other inlets along the British Columbian coast (Sancetta 1989; McQuoid and Hobson, 2001; Chang et al., 2003; Hay et al., 2003; Chang, 2004; Chang and Patterson,

2005; Hay et al., in press). The largest concentration was from sample 512-514 cm at 1.53×10^9 valves/g; the lowest was 1.86×10^8 valves/g from sample 325-327 cm (Appendix C). Inter-sample variability in absolute diatom abundance was large, particularly in the middle portion of the core (Figure 4.3). Commonly, a sample with a relatively large absolute abundance was immediately followed, and preceded by, samples in which the absolute abundance was relatively low. Based on the effective Nyquist frequency, and the assumption of a relatively constant sedimentation rate, the inter-sample variability in abundance indicates a diatom productivity cycle of roughly 60 years.

In order to identify lower-frequency cycles or trends, a five-sample moving average was calculated (Figure 4.3). The resultant plot shows that the core was composed of alternating sections of high and low diatom abundance. There was variability in the overall pattern observed but the trend was toward a general increase in production through several samples followed by a fairly rapid decline, although the rate of observed decline following the production peaks decreased in the upper part of the core. Each successive up-core increase in abundance was less than the preceding one, producing a step-like declining trend in diatom abundance. Analysis of the non-moving average indicates that within zones of high and low abundance there was a high degree of inter-sample variability.

At a very coarse resolution diatom production was above average between ~520 cm to 720 cm, and from 780 cm to the base of the core (Figure 4.3). More specifically, diatom abundance was very consistent between the base of the core and ~1100 cm. From ~1100 cm to 800 cm, there was a steady increase in abundance followed by a significant

FIGURE 4.3. Total diatom abundance and %SiOPAL. (A) Total diatom abundance in hundreds of millions of valves/g dry sediment. Thicker line is 5-sample moving average. (B) %SiOPAL. Thicker line is 5-sample moving average. (C) Age-depth model. Dates are in cal yr BP.

and rapid decline. Diatom abundance values then show another consistent recovery between ~750 cm to 560 cm, which was then followed by another fairly rapid decline. A weaker recovery occurred between ~480 cm and ~410 cm followed by a gradual short decline, which was then succeeded by a very weak increase in abundance up to ~180 cm. From 180 cm to the top of the core, diatom abundance declined.

Diatom Species Distribution

Out of the 235 identified and unidentified species, only 39 had relative abundances above 1% in at least one sample (Appendix D). Of these, the majority were marine or brackish (Campeau et al., 1999) planktic species.

Dominant species, defined as greater than 5% abundance in at least two samples, were *Skeletonema costatum*, *Cyclotella choctawatcheeana*, *Thalassiosira pacific*, *T. nordenskiöldii*, and *T. tenera* (Appendix D). All were marine planktic species except *C. choctawatcheeana* which was brackish. These five species comprise an average of 86% of the total abundance of the 108 samples counted, with a maximum of 94% (sample 512-514 cm) and a minimum of 76% (sample 70-72 cm). Of these species, *S. costatum* was the major contributor, with an average relative abundance of 60.7%; *C. choctawatcheeana* was the second most abundant species with an average relative abundance of 13.5% (Appendix D).

A five-sample moving average was done for the five major species to better illustrate trends (Figure 4.4). *Skeletonema costatum*, *T. nordenskiöldii*, *T. pacifica*, and *T. tenera* all followed a trend toward an overall up-core decrease in concentration, while

FIGURE 4.4. Absolute abundance of the five major species (expressed in millions of valves/g dry sediment). Line without dots is five-sample moving average. Age-depth model dates in cal yr BP.

C. choctawatcheeana increased in concentration up-core. There was also a short-lived but significant decline in the abundance of all five major species beginning at 805 cm.

Cyclotella choctawatcheeana was characterized by an increase in production beginning around 1057 cm (4680 cal yr BP) and a significant increase in production between ~873 cm to 803 cm. A large decline in concentration occurred at 805 cm, but the interval between 805 cm to 689 cm had a larger average concentration than prior to 873 cm. Concentration of this species was also low between ~681 cm to 512 cm, but then increased fairly consistently to the top of core. There was a large degree of variability in concentration between samples for *C. choctawatcheeana* through the upper portion of the core.

Skeletonema costatum maintained a high concentration up to ~769 cm and then declined significantly. The species returned to its prior level of production between 689-512 cm, after which it again underwent a steady overall decline.

Thalassiosira pacific and *T. tenera* both maintained high levels of production up to ~813 cm, after which both underwent significant and sustained declines in concentration. *Thalassiosira nordenskiöldii* increased its production up to ~813 cm, after which it declined as well. It underwent a slight increase in abundance between 552 and 681 cm.

Less abundant species (but still present at 1% or greater in at least one sample) were plotted along with the five major species in Figure 4.5. Taxa were divided into two groups based on their niche: marine planktic species and brackish, freshwater and benthic species. Changes in the relative abundance of these two groups were interpreted to represent changes in climatic variables such as precipitation, which influences surface

Figure 4.5. Relative abundance (%) of major (>5% abundance in at least two samples) and minor (1% or more in one sample or more) species. Filled profiles represent percentages exaggerated by 10 times.

water salinity of coastal fjords via runoff, direct precipitation and the spring freshet.

Categorization was based on the niche descriptions of Cumming et al., (1995), Campeau et al., (1999) and Pientiz et al., (2003). There was no clear trend in terms of minor marine planktic taxa versus non-marine planktic taxa.

BIOGENIC SILICA

The plot of biogenic silica analysis (%Si_{OPAL}) (Figure 4.3) showed that inter-sample variability was large, particularly near the bottom of the core and between ~400 cm to 560 cm. A five-sample moving average calculation was also done for %Si_{OPAL} to better illustrate trends and patterns. The moving average plot was very similar in its pattern to that of diatom abundance. Sections of high %Si_{OPAL} corresponded with sections of high diatom abundance, and vice versa with the timing of changes also correlating well. Both measures followed an overall declining trend in value. The similarity between diatom abundance and %Si_{OPAL} indicated that dissolution of diatom valves was not very significant. Most of the observed variability between %Si_{OPAL} and absolute diatom abundance was likely due to presence of broken, dissolved or partially dissolved valves that were not counted but which would have been included in the biogenic silica analysis.

Differences between the moving average plots of absolute diatom abundance and %Si_{OPAL} were ones of magnitude. In %Si_{OPAL} the first major decline occurred around ~980 cm, whereas it occurred at ~800 cm for absolute diatom abundance. However, a decline in absolute abundance did occur at this depth. The major decline in diatom abundance at ~800 cm was also matched by a lesser one in %Si_{OPAL}. Both measures

showed a recovery towards the top of the core, beginning around 480 cm. However, the relative increase in %Si_{OPAL} was much greater than that observed for absolute abundance. %Si_{OPAL} was above average between the base of the core to 700 cm, and between 600 cm and 300 cm, with a section below average from 480 cm to 430 cm.

Q- AND R-MODE CLUSTER ANALYSIS

All 108 samples analyzed were judged to contain a statistically significant population, as the sum of the counts for every taxa in a sample was greater than the probable error for the sample. By comparing the relative fractional abundance and standard error of each species, 174 out 235 species were removed prior to Q- and R-mode cluster analysis because they were statistically insignificant, leaving 61 species. (Appendix F).

R-Mode Cluster Analysis

R-mode cluster analysis of species provided little valuable paleoenvironmental data, as was expected due to the dominance of *Skeletonema costatum* and *Cyclotella choctawatcheeana* throughout the entire core. At a Euclidean cut-off distance of 3.0, *S. costatum* existed as its own cluster and *C. choctawatcheeana* clustered with all other species (Figure 4.6). At a cut-off distance of 2.0, *S. costatum*, and *C. choctawatcheeana* were each a distinct cluster, and all other species were grouped into one cluster (Figure 4.6).

FIGURE 4.6. R-mode cluster diagram of statistically significant diatom taxa.

Q-Mode Cluster Analysis

For Q-mode cluster analysis of the 108 samples a Euclidean cut-off distance of 3.0 produced four clusters (Figure 4.7). Average absolute and fractional abundances of the four clusters were calculated using only the species, that were statistically significant (i.e. the remaining 61 species). Abundances of taxa for each cluster are listed in Appendices G and H. Taxa were again divided into two groups, reflecting their ecological niche: marine planktic species, and brackish water, freshwater and benthic species.

An examination of species abundances in each cluster shows that *C. choctawatcheeana*, *S. costatum*, *T. nordenskioeldii*, *T. pacifica*, and *T. tenera* made up nearly the entire abundance of each sample. Clusters were defined by their average absolute abundance, and by the fractional and absolute abundance of *S. costatum*, *C. choctawatcheeana*, and non-marine planktic species (Table 4.1). Average absolute abundance and abundance of *S. costatum* were negatively correlated, for the most part, with the abundance of *C. choctawatcheeana* and non-marine planktic species. Less common, low abundance species are therefore not discussed individually, but rather it is their contribution to the two niche groups that is accounted for. Since each sample represented approximately 7 years of deposition (based on a sedimentation rate of 0.285 cm/yr), paleoenvironmental interpretations for samples represent an average of conditions experienced over this period.

Cluster 1 comprised 26 samples, which have an average absolute abundance of 4.41×10^8 valves/g, the lowest of all four clusters (Appendix H). *Cyclotella*

FIGURE 4.7. Q-mode cluster diagram of samples.

TABLE 4.1. Absolute and relative abundances of dominant diatom taxa and brackish, freshwater and benthic taxa in Q-mode clusters.

		Cluster 1	Cluster 2	Cluster 3	Cluster 4
Average absolute abundance		4.41×10^8	5.69×10^8	5.99×10^8	7.35×10^8
<i>S. costatum</i>	Average absolute abundance	2.28×10^8	3.60×10^8	3.43×10^8	5.32×10^8
	Average fractional abundance	50.1%	61.2%	55.4%	69.5%
<i>C. choctawatcheeana</i>	Average absolute abundance	1.10×10^8	9.25×10^7	5.59×10^7	4.82×10^7
	Average fractional abundance	22.4%	15.9%	9.1%	6.8%
Brackish, freshwater and benthic species	Average absolute abundance	1.10×10^8	9.25×10^7	5.59×10^7	4.82×10^7
	Average fractional abundance	28.5%	21.4%	16.6%	11.8%

Abundances are calculated using only species which were statistically significant.

Average absolute abundance is in valves/g dry sediment.

choctawatcheeana has an average relative abundance of 22.4%, which is the largest of all the clusters, whereas *S. costatum* has an average relative abundance of 50.1%, the lowest of all clusters. Brackish water, freshwater and benthic taxa, including *C.*

choctawatcheeana, compose, on average, 28.5% of the total fractional abundance of this cluster, which is the largest amount for this group out of all clusters. Samples of cluster 1 are interpreted as representing deposition during periods of reduced seasonality in which spring, summer and early fall were relatively wetter and cloudier. Increased precipitation and cloudiness negatively impacted salinity and light sensitive marine planktic bloom species such as *S. costatum* and *Thalassiosira* spp. (Smayda, 1973; Hitchcock and Smayda, 1977), while providing a more suitable habitat for brackish water diatoms (Sancetta, 1989). Increased precipitation in the winter as snow would also have the effect of lowering surface water salinities as a result of a stronger freshet.

Cluster 4 was composed of 37 samples and had an average concentration of 7.35×10^8 , the largest of all four clusters. It contained the lowest average relative concentration of *C. choctawatcheeana* (6.8%) and the highest average relative concentration of *S. costatum* (69.5%) of all four clusters. Non-marine planktic diatom taxa made up, on average, only 11.8% of the total fractional abundance of this cluster, which was the lowest of all four clusters. Samples of Cluster 4 were thus interpreted as representing deposition during periods of strong seasonality in which spring, summer and early fall were relatively dry (and/or the freshet weak) and sunny - conditions conducive to the production of spring and early summer bloom species.

Cluster 2, which comprised 32 samples, had an average absolute abundance of 5.69×10^8 valves/g of dry sediment - greater than that of Cluster 1, but less than both Cluster 3 and 4. *Cyclotella choctawatcheeana* had an average fractional abundance of 15.9%, which was greater than that of Clusters 3 and 4, and *S. costatum* had an average fractional abundance of 61.2%, which was less than Cluster 4 but more than Clusters 1 and 3. Brackish, freshwater, and benthic species made up on average 21.4% of the total fractional abundance, which was the second largest amount of all four clusters.

Cluster 3 contained 13 samples and had an average absolute abundance of 5.99×10^8 valves/g dry sediment - the second largest average concentration. *C. choctawatcheeana* averaged 9.1% and *S. costatum* averaged 55.4%, both of which were the second lowest average fractional abundances for these species out of the four clusters. *Thalassiosira pacific* and *T. tenera* averaged 11.8% and 4.0%, which was the largest average abundances for these species. Brackish, freshwater, and benthic species made up on average 16.6% of the total fractional abundance within this cluster, this the second lowest amount of the four clusters.

Samples of Cluster 2 and Cluster 3 were interpreted as representing deposition under conditions of moderate seasonality. The fractional abundance of freshwater, brackish water and benthic species was greater for both Clusters 2 and 3 than for Cluster 4, which supports the idea that precipitation was moderate, i.e. greater than that of Cluster 4, but less than that of Cluster 1. The large fractional and absolute abundance of *T. nordenskioeldii*, *T. pacifica*, and *T. tenera*, and the reduced abundance of *S. costatum* in Cluster 3 as compared to Cluster 2, indicate that bloom conditions were favourable in the

spring but not so later on in the season and in summer. *S. costatum* is light and temperature limited, whereas spring bloom *Thalassiosira* spp. are adapted to low light and cool water conditions (White et al., 1992; Chang 2004). Strong *S. costatum* production after the initial *Thalassiosira* spp. bloom also requires sufficient nitrate concentrations remaining in the water column, either by remaining above a critical threshold during the initial phase of the spring bloom or by nutrient-rich waters recharging the temporarily depleted nitrate levels (White et al., 1992). Therefore, cool, nutrient-poor waters and cloudy conditions may have characterized late-spring and summer conditions for Cluster 3 samples, inhibiting *S. costatum* production.

When the samples were plotted stratigraphically as cluster type, it was evident that there is a very regular and rapid oscillation between them throughout most of the core (Figure 4.8). Oscillation between two cluster types is prominent in the top 1/3, between samples of Cluster 1 and 2, and bottom 1/3 of the core, between samples of Cluster 3 and 4.

Cluster Zones

Based on a visual examination of the stratigraphic distribution of cluster types, it is obvious that certain clusters, or a combination of clusters, are naturally grouped together throughout the core (Figure 4.8). Such groupings, or zones, were interpreted as representing longer-scale climate regimes. It is likely that although the regimes probably transitioned from one state to the other over a time span greater than that represented by the duration between two adjacent samples hard divisions were made in order to facilitate

FIGURE 4.8. (A) Absolute abundance of the five major species (expressed in millions of valves/g dry sediment). Line without dots is five-sample moving average. (B) Stratigraphic distribution of cluster type; abundances in hundreds of millions of valves/g dry sediment. (C) Age-depth model dates in cal yr BP. (D) Zones

discussion of the zones. Just as cluster types were defined and interpreted on the basis of total absolute abundance and abundances of key species, so were the zones. The fractional and absolute abundances calculated for each zone used only the statistically significant species defined from the Q-mode analysis. Each zone is described below and abundances are given in Appendices I and J. Table 4.2 summarizes the data for each zone. Diatom taxa are split into two groups again; marine planktic taxa, and all others.

Zone 5

Zone 5 begins at the base of the core and ends at 1079 cm (4760 to 5270 cal yr BP) (Figure 4.8). It is composed entirely of Cluster 4 samples with the exception of one anomalous Cluster 3 sample. The average diatom valve concentration in samples from Zone 5 was 6.43×10^8 valves/g dry sediment. *Skeletonema costatum* averaged 66.2% (the second highest average relative abundance of this species), whereas *C. choctawatcheana* composed only 4.6% - the lowest fractional and total abundance for it out of all zones. Non-marine planktic species made up only 10.0% of the average fractional abundance - also the lowest of all five zones.

Zone 4

Zone 4 begins at 1057 cm and ends at 813 cm (3820 to 4680 cal yr BP) (Figure 4.8). It comprises alternating Cluster 4 and Cluster 3 samples through the lower half, and alternating Cluster 4, Cluster 3, and Cluster 2 samples through the upper half. An average diatom concentration of 6.91×10^8 valves/g characterized this zone, the highest of all zones. The average absolute abundance of *S. costatum* was slightly greater than

TABLE 4.2. Absolute and relative abundances of dominant diatom taxa and brackish, freshwater and benthic taxa for each zone.

		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Average absolute abundance		5.08×10^8	6.88×10^8	5.87×10^8	6.91×10^8	6.43×10^8
<i>S. costatum</i>	Average absolute abundance	3.03×10^8	5.07×10^8	3.53×10^8	4.45×10^8	4.40×10^8
	Average fractional abundance	56.8%	69.4%	56.6%	61.5%	66.2%
<i>C. choctawatcheeana</i>	Average absolute abundance	9.64×10^7	5.99×10^7	8.58×10^7	6.10×10^7	2.93×10^7
	Average fractional abundance	19.5%	9.7%	14.6%	8.7%	4.6%
Brackish, freshwater and benthic species	Average absolute abundance	1.23×10^8	8.83×10^7	1.28×10^8	1.09×10^8	6.46×10^7
	Average fractional abundance	24.7%	14.1%	21.9%	15.3%	10.0%

Abundances are calculated using only species which were statistically significant.

Average absolute abundance is in valves/g dry sediment.

observed in Zone 5 but its fractional abundance declined from 66.2% to 61.5%.

Cyclotella choctawatcheeana abundance increased steadily throughout the zone before declining and then increasing in abundance again before reaching its peak value at the top. This species averaged 8.7% of the total fractional abundance of the zone, almost double its average abundance in Zone 5 samples. Freshwater, brackish water and benthic species likewise increased in fractional abundance to 15.3%. *Thalassiosira pacifica*, and *T. tenera* showed an overall declining trend in absolute abundance in this zone, whereas *T. nordenskiöldii* increased in abundance up-zone.

Zone 3

Zone 3 begins at 805 cm and ends at 689 cm (3390 to 3800 cal yr BP) (Figure 4.8). The beginning of this zone is marked by the first appearance of Cluster 1-type samples. Cluster 1 and 2 samples dominated this zone with only two Cluster 4 samples included. The peak abundance of all major species occurred at the base of this zone, after which all showed a precipitous decline. The average absolute abundance for this zone was 5.87×10^8 valves/g dry sediment, the second lowest of the five zones. *Skeletonema costatum* composed only 56.6% of the relative abundance of this zone, which was also the lowest fractional abundance for this species out of the five zones. The relative and absolute abundance of *C. choctawatcheeana*, which rose in abundance after its initial decline at the beginning of the zone, was significantly greater than its respective values observed in Zone 4. In Zone 3, it made up 14.6% of the total relative abundance. Freshwater, brackish water and benthic species composed 21.9% of the fractional

abundance for this zone (including *C. choctawatcheeana*), also a large increase over that of the last zone.

Zone 2

This zone was similar to Zone 5 in that it was dominated by Cluster 4 samples. It begins at 681 cm and ends at 512 cm (2770 to 3360 cal yr BP) (Figure 4.8). *Cyclotella choctawatcheeana* undergoes a significant decline in abundance at the beginning of this zone but then showed a steady increase, although its average relative and absolute abundance was still significantly less than values observed in Zone 3. The average absolute diatom abundance observed in this zone (6.88×10^8 valves/g dry sediment) was also significantly higher than that observed in Zone 3. *Skeletonema costatum* averaged 69.4% of the relative abundance of this zone, which was the largest average relative abundance for this species out of the five zones. The relative abundance of non-marine planktic species declined to 14.1%

Zone 1

Zone 1 is similar to Zone 3 in that it was dominated by alternating Cluster 2 and Cluster 1 samples with only a few Cluster 4 samples. It begins at 504 cm and extends to the top of the core (2740 to 970 cal yr BP) (Figure 4.8). This zone was characterized by an low overall absolute abundance of diatoms (the lowest of all five zones), declining abundance of *S. costatum* and increasing abundance of *C. choctawatcheeana*. *Cyclotella choctawatcheeana* achieved its highest relative and absolute abundance in this zone; conversely, *S. costatum* was at its lowest average relative and absolute abundance within

this zone. However, within the overall declining trend of *S. costatum* and major *Thalassiosira* spp. there were intervals in which the abundance of these species, and average total absolute abundance, was greater than the surrounding samples.

CHAPTER 5

DISCUSSION

The present climate of coastal British Columbia is modified by the Aleutian Low and North Pacific High pressure gyres, the Jet Stream and El Niño/La Niña events. The interaction of these phenomena, along with less well understood, regionally-modified, longer-scale events operating on a global scale result in oscillating climate regimes ranging from interdecadal to centennial to millennial in duration (Ware and Thomson, 2000; Biondi et al., 2001; Minobe, 1997, 1999; Anderson et al., 2005; Hu et al., 2003; Nederbragt and Thurrow, 2001; Dean and Kemp, 2004; Patterson et al., 2005, 2004a, 2004b; Chang and Patterson, 2003). The location of study sites which have identified such oscillating climate regimes have mostly been concentrated in southern British Columbia, especially Vancouver Island, and northern British Columbia, Alaska and the Yukon Territory.

Based on a visual inspection of cluster type, the results from this study in mid-coastal British Columbia indicates that there are both a high and low frequency climate signal in the ~4300 year Frederick Sound record. The high frequency (interdecadal) climate signal was represented by the inter-sample oscillation of cluster types and absolute abundance. The lower frequency signal was represented by the groupings of clusters into zones, representing climate regimes lasting from centuries to millennia. The visual inspection of clusters is analogous to a low-tech wavelet scalogram analysis.

HIGH FREQUENCY CLUSTER AND ABUNDANCE VARIABILITY

There is a regular oscillation between cluster types and corresponding changes in overall diatom abundance in the Frederick Sound core (Figure 4.8). Based on the effective Nyquist sampling frequency (Davis, 2002) of 16 cm (deposited at 0.285 cm/yr), the highest frequency cycle detectable in the Frederick Sound core was ~56 years. The inter-sample variability in cluster type and abundance thus falls within the detectable range and is correlatable with the low frequency PDO cycle. During a PDO cycle the strength and position of the AL has been documented to oscillate over a 50-70 year period and to have a direct impact on ocean productivity (Trenberth and Hurrell, 1994; Minobe, 1997, 1999). For example, it has previously been observed that during periods in which the AL is stronger it tends to develop in a more easterly position for several years in a row, impacting primary productivity and causing populations of salmon and anchovy to plummet along the west coast of North America, south of Alaska (Chavez et al., 2003; Mantua et al., 1997). The inverse occurs during periods in which the AL is weaker and in a more westerly position. Evidence that the PDO has been in operation since the late Holocene in this region has been found in several fjords in coastal British Columbia. For example, Chang and Patterson (2005) interpreted a dramatic decrease in the thickness of diatomaceous laminae and an increase in brackish water species in a laminated sediment slab spanning 62 years from ~4400 years ago as representing a strengthening AL (and/or weakening NPH). They interpreted thinner siltier varves at the top of the same sediment slab as indicative of increased precipitation and decreased upwelling conditions associated with a weakened NPH. Dean and Kemp (2004) also recognized a decadal-scale periodicity from a high-resolution analysis of laminated sediments dating back to 2100 years BP from Saanich Inlet, and linked it to the PDO.

These studies, along with the results from Frederick Sound, provide evidence that the PDO has been operating at least since late Holocene time.

Based on a paleoclimatic interpretation of cluster types observed in the Frederick Sound core, the inter-sample fluctuation in clusters and abundance similarly represents a PDO influenced oscillation in the strength of seasonality where sediments deposited under drier and sunnier (NPH dominant - negative PDO) conditions alternate with sediments deposited under wetter and cloudier (AL dominant - positive PDO) conditions, each of which directly corresponds to very different levels and types of diatom productivity. During periods when a positive PDO prevailed, the AL was on average stronger and its COA positioned more easterly. Wet and cloudy conditions associated with the enhanced influence of the AL are proposed to have lasted longer into the spring and summer, and arrive earlier in the fall, negatively impacting spring and early summer diatom bloom production by reducing surface salinities (via direct precipitation, runoff, and an enhanced freshet) and light incidence. Periods characterized by a negative PDO during which the AL was on average weaker and its COA positioned more westerly (and/or a stronger NPH) resulted in relatively drier and sunnier conditions more conducive to a strong spring and early summer diatom bloom.

Paleoclimatically these oscillations correspond to strongly seasonal and moderately seasonal conditions in the basal half of the core, as represented by the fluctuation of Cluster 4-, 3-, and 2-type samples with large absolute abundances, which gradually changed to conditions that oscillated between moderately and weakly seasonal further up section, as represented by the variation between lower abundance samples of

cluster types 1 and 2. Through deposition of the entire core there was a trend towards generally wetter and cloudier conditions, as indicated by the increased abundance of Cluster 1- and 2-type samples and decreased abundance. This transition indicates that although there was still a cyclicity between NPH and AL dominated conditions, the average COA of the AL was moving progressively eastward through the late Holocene suggesting a tendency toward progressively stronger positive PDO conditions.

Although enhanced upwelling conditions during negative PDO, NPH dominant phases result in increased diatom productivity in coastal areas within the CUD (Ware and Thomson, 1991), it is unlikely that this was a pathway for increased diatom productivity in Frederick Sound. Frederick Sound is located in the CTD where upwelling is not common (Ware and McFarlane, 1989). Secondly it is unlikely that a nutrient-rich ocean current would be able to penetrate over 50 km inland and across a number of shallow sills in order to reach Frederick Sound.

The position and intensity of the COAs of the AL and NPH have also been linked to solar activity (Christoforou and Hameed, 1997; Hameed and Lee, 2003). During periods of minimum solar activity, the AL migrates up to 700 km eastward and increases in intensity while the NPH migrates southward and lessens in intensity. These systems move in opposite directions during periods of maximum solar activity. Not surprisingly, studies have found correlations between various climate proxy cycles and solar cycles at longer wavelengths in the NE Pacific as well as globally (Hu et al., 2003; Patterson et al., 2004a, 2004b Chang and Patterson, 2005; Bond et al., 2001). For example, Patterson et al. (2004a, 2004b) observed correlations between cycles in lamination thickness,

sediment colour and solar activity in Effingham Inlet, Vancouver Island, and determined that some of these cycles can be correlated with modern climate phenomenon in the northeast Pacific, such as the AL and PDO. Hay et al. (in press) attributes the overall decline in diatom production from ~4,000 cal yr BP to the present as resulting from decreased summer insolation, resulting in a gradual weakening of the NPH and increasing dominance of the AL. It is possible then, that the changes in climate inferred for Frederick Sound can ultimately be linked to variability in solar activity.

LOWER FREQUENCY CLIMATE VARIABILITY

The five paleoclimate zones identified in the core, which correspond to groupings of certain clusters, represent climate regimes that persisted for centuries to millennia with the higher frequency climate oscillations described above superimposed over them. Climatic interpretation of the zones is based on the average abundances key species in each zone, including *C. choctawatcheeana*, *S. costatum*, non-marine planktic species, and absolute average abundance. As with the decadal-scale, changes in the concentration of these species in each zone represents changes in the overall strength of seasonality, and hence changes in precipitation and cloudiness, but on much longer time-scales. Also similar to the higher frequency climate oscillations described above, changes in the overall strength and position of the AL and NPH are suggested as the primary driver behind the development of centennial- to millennial-scale climate regimes in the NE Pacific as evidenced by various climate proxies (oxygen isotopes, varve thickness and colour, pollen) (i.e. Patterson, et al., 2004a; Anderson et al., 2005; Spooner et al., 2003).

Zone 5

Zone 5 spans ~4760 to ~5270 cal yr BP (510 years) and is dominated by Cluster 4 samples (Figure 5.1). The high level of diatom production within this zone, and the low abundance of *C. choctawatcheeana* and other non-marine planktic species (Appendices I and J) indicate that climatic conditions during this time can be characterized as having been strongly seasonal with conditions conducive to the production of fast-growing spring and early-summer bloom species. The AL, on average, is proposed to have been relatively weak, in a more westerly position and not persisting long into the spring or developing early in the fall. The NPH, on average, is inferred to be strong and situated in a more northerly position during spring, summer and early fall. The climate during spring and summer and fall is inferred to have been dry and sunny and influenced by large anticyclonic systems.

Zone 4

Zone 4 spans ~3820-4680 cal yr BP (860 years). It comprises alternating Cluster 4 and Cluster 3 samples through the lower half, and alternating Cluster 4, Cluster 3, and Cluster 2 samples in the upper half of the sedimentary sequence (Figure 5.1). The largest average diatom concentration occurs in this zone, and combined with an increase in the abundance of *S. costatum*, *T. nordenskioeldii*, and *T. tenera* (*T. pacifica* abundance remained almost the same from the last zone), indicates that this period of deposition was, on average, characterized by strongly seasonal conditions during which spring and summer were relatively dry and sunny (Figure 4.8, 5.1, Appendices I and J). However, the overall up-zone increase in *C. choctawatcheeana* and other non-marine planktic

FIGURE 5.1. Diatom abundance, cluster type and inferred climatic states for Frederick Sound. (A) Total diatom abundance in hundreds of millions of valves/g dry sediment. (B) Cluster type and abundance (in hundreds of millions of valves/g dry sediment). (C) Age-depth model dates in cal yr BP. (D) Diatom abundances for a few major species. (E) Inferred AL and climatic conditions. (F) Zones and age ranges in cal yr BP.

species (Figure, 4.8, Appendices I and J) indicate that conditions in late summer were becoming progressively wetter and cloudier. Overall, this 860 year period is interpreted as one in which the AL, on average, was relatively weak and more westerly positioned. The NPH, on average, is assumed to have been strong during the spring, summer and early fall as it migrated to a northerly position, resulting in dry spring and early-summer conditions, clear skies, and sufficient nutrient availability to support spring and early summer bloom production. However, the increase in *C. choctawatcheeana* and other non-marine planktic species indicates a transition into a period during which the AL was stronger and its COA in a more easterly position. This evidence suggests that wet and cloudy AL conditions persisted further into spring, summer, and arrived earlier in the fall.

Zone 3

This zone spans 410 years, from ~3390 to 3800 cal yr BP. The beginning of this zone is marked by the first appearance of Cluster 1-type samples and it is characterized by the abundance of Cluster 1- and Cluster 2-type samples; only two Cluster 4-type samples are present in this zone (Figure 5.1). The average absolute abundance for this zone was the second lowest of the five zones. *Cyclotella choctawatcheeana* and other non-marine planktic species increased significantly in abundance over Zone 4, and *S. costatum* abundance was at its lowest level in any zone. The large decline in production and abundance of all major species near the bottom of this zone (Figure 4.8, 5.1) was probably in response to a significant and productivity detrimental climate shift. A pronounced cooling event would have impacted both the production of *S. costatum* and *C. choctawatcheeana*, which are both temperature sensitive (Sancetta, 1989; Hitchcock

and Smyada, 1979; Smayda, 1977). The increased abundance of *C. choctawatcheeana* and other brackish, benthic and freshwater species, and the decline in *S. costatum*, as compared to Zone 4 indicates the continuation of the wetter and cloudier climate initiated at the end of the previous zone. It is suggested that an intensified AL with an easterly COA, and/or a weaker NPH with a southerly COA, was the driver behind development of this wet and cloudy climate regime. The upward trend in abundance for *S. costatum* and *C. choctawatcheeana* after the initial decline may have represented a return to warmer conditions.

Zone 2

Zone 2 spans 590 years, from 2770-3360 cal yr BP, and is similar in composition to Zone 5 in that both are dominated by Cluster 4-type samples (Figure 5.1). The large increase in abundance over the preceding zone, including an increase for *S. costatum* to its maximum abundance for all zones, as well as a decrease in abundance for *C. choctawatcheeana* and other non-marine planktic species indicates a return to strongly seasonal conditions, similar to those that existed during Zone 5 time (Figure 4.8, Appendices I and J). Overall, spring and summer are inferred to be drier, and sunnier. During this period, the AL, on average, is suggested to have been less intense and its COA in a more westerly position, and/or the NPH stronger and its COA in a more northerly position during the spring and summer seasons.

Zone 1

Zone 1, which spans ~990 to 2740 cal yr BP (1750 years), is marked by the transition from a zone dominated by Cluster 4 samples to one dominated by Cluster 1 and 2 samples making it similar to Zone 3 (Figure 5.1). There is a massive decrease in total diatom abundance in this zone as characterized by the lowest absolute abundance levels of *S. costatum*, *Thalassiosira nordenskioeldii*, and *T. pacifica* observed in the core, coupled with the second lowest absolute abundance level of *T. tenera*. The concomitant significant increase in the abundance of *C. choctawatcheeana* and other non-marine planktic species indicates a return to weaker seasonality conditions as typified by increased precipitation and cloudiness (Figure 4.8, 5.1, Appendices I and J). As inferred for Zone 3 the diatom flora suggests that the AL was stronger, more persistent and more easterly-positioned, and/or in conjunction with a weaker and more southerly positioned NPH. Within this zone there is evidence that the NPH strengthened for a time (and/or the AL weakened) between ~2400 to 2100 cal yr BP. Evidence for this temporary climatic shift is based on the presence of Cluster 4-type samples and increased abundance of *S. costatum*, *T. nordenskioeldii* and *T. pacifica* in this depositional interval (Figure 4.8).

REGIONAL CLIMATE COMPARISON

Paleoclimatic conditions inferred for Frederick Sound are for the most part consistent with those observed elsewhere in the NEP region. The consistency between observed records in the NEP indicates that there is a regional, coherent response to large-scale climate modifying phenomena, such as modifications within the AL and NPH pressure systems.

Specifically the sunny, warm, and dry conditions inferred for Zones 5 and 4 (3820 - 5270 cal yr BP), is observed at many sites in the region (Pellat and Mathewes, 1997). During this sunnier, warmer and drier interval the AL was either weaker and/or the COA was positioned further to the west. In Effingham Inlet, Chang et al. (2003) found that in addition to there being evidence of warm sunny conditions, deposition between ~3600 to >5500 was characterized by strong seasonality. Evidence of strong seasonality in the Effingham Inlet study was indicated by the presence of the highest concentration of couplets showing evidence of a seasonal succession of laminae of any core interval studied. The presence of thick diatomaceous laminae within these successions provided very strong evidence of strong spring and early summer bloom production, particularly within the 4400 to 5500 cal yr BP. Chang et al. (2003) concluded that this evidence indicated that constant climatic conditions favourable to annual seasonal upwelling and light levels sufficient enough to sustain healthy annual diatom blooms were present prior to ~3600 cal yr BP. An oxygen isotope study of sediments from geographically distant Jelly Bean Lake in the Yukon Territory provides further evidence that the AL was predominantly weaker and/or westward between ~7500 and 4500 cal yr BP (Anderson et al., 2005) and indicates that this change in circulation directly impacted the entire region.

The transition to wetter and cloudier conditions over the latter part of Zone 4 and Zone 3 (3390 - 3800 cal yr BP) in Frederick Sound has been recognized in numerous palynological and other climate proxy records for the NEP (Pellat and Mathewes, 1997; Pellat et al., 2001). This transition correlates well with the onset of neoglacial conditions in the NEP, although estimates of when warm and dry conditions terminated vary from ~4,000 to 3,200 yr BP (Pellat et al., 2001). The neoglacial advance of the Tiedemann

Glacier is well documented and is placed at ~3300 yr BP (Pellatt and Mathewes, 1997).

To the northwest of the study site, on the Queen Charlotte Islands, a transition from warmer and drier conditions to cooler and wetter modern-day conditions occurred around 3400 yr BP, similar to when Frederick Sound experienced a transition to a wetter climate. From Effingham Inlet, Hay et al. (in press) observed a decline in diatom abundance beginning around 4,000 cal yr BP, particularly in species such as *S. costatum*. In another study from Effingham Inlet Chang et al. (2003) identified an increase in non-laminated intervals between ~2200 to ~4000 cal yr BP and interpreted this change to indicate that precipitation was likely higher during this interval. Hay et al. (in press) additionally attributes a decline in diatom production through this interval to indicate a progressively weakening NPH and progressively strengthening AL, which resulted in cooler summer temperatures and increased precipitation along the NEP. Support for this hypothesis has also been documented in the Jelly Bean Lake, Yukon, oxygen isotope study (Anderson et al., 2005) where evidence of a stronger/and or more easterly AL between ~4500 to 3500 cal yr BP has been observed. The Neoglacial advances that characterized this time interval may have come about as a result of increased moisture delivery during the winter, which would have been a direct outcome of an intensified/eastward AL (Heusser et al., 1985). Evidence that this neoglacial cooling was at least hemispheric in extent is provided by a dramatic increase in hematite-stained grains (drift-ice indicators) found in northeast Atlantic sediments deposited at this time (Bond et al., 2001).

Evidence of a return to a more seasonal climate, characterized by reduced precipitation and cloudiness, between ~2770 to 3360 cal yr BP (Zone 2), and associated weaker and westerly positioned AL, has been observed in the present research, as well as

several other studies from this region (e.g. Nederbragt and Thurow, 2001; Anderson et al., 2005; J. Galloway, pers. comm., 2005), but has not been observed in several others (e.g. Chang et al., 2003; Hay et al., in press; Patterson et al., 2004a; Mathewes and Heusser, 1981; Heusser et al., 1985; Pellatt and Mathewes, 1997; Brown and Hebda, 2002; Pellatt et al., 2001; Brown and Hebda, 2003; Clague et al., 2004). Pollen analysis of the same Frederick Sound core has provided multi-proxy corroborative evidence that the dry conditions inferred by the diatom record existed (J. Galloway, pers. comm., 2005). Nederbragt and Thurow (2001) found similar evidence of abrupt climate shifts from wet to dry conditions at ~3250 yr BP, and back to wet at ~2100 yr BP in Saanich Inlet, on Vancouver Island. The timing of the onset of dry condition in Saanich Inlet is similar to that observed for Frederick Sound, but the duration of the dry interval is much longer there (1150 years vs. 590 years). The isotopic analysis of the Jelly Bean Lake, Yukon Territory record indicates that there was a steady trend towards a weaker and/or more westward AL after 3500 cal yr BP (Anderson et al., 2005), a trend that is also consistent with the shift back to dry and sunny conditions observed for Frederick Sound between 3360 to 2770 cal yr BP. As these studies are geographically widespread through the region they provide evidence that this temporary shift to dryer conditions was widespread and not a local phenomenon. It is interesting to note that the records that do pick up this climate shift are more inland (Frederick Sound is over 50 km inland; Saanich Inlet is on the east coast of Vancouver Island; Jelly Bean Lake is in the Yukon) and not as exposed to the open ocean as the records that do not pick up the shift (the Queen Charlotte Islands have a hypermaritime climate; Effingham Inlet is on the west coast of

Vancouver Island). It may be that the more marine sites don't register this drier interval because their climate is moderated by the ocean and are less susceptible to change. Further research is required to reconcile these results with the studies where this shift was not observed.

The dominantly wet and cloudy conditions that characterized the Frederick Sound area between ~2740 and 990 cal yr BP agree well with previous paleoclimatic records from the region, although the timing varies from place to place (Heusser et al., 1985; Mathewes, 1985; Hebda, 1995; Pellat and Mathewes, 1997). These records all indicate that the influence of the AL was enhanced and/or positioned more eastward. Notable neoglacial advances that occurred during this period include a sustained Tiedemann glacial advance between 3300 to 1900 yr BP and the Peyto and Robson glacial advances in the southern Canadian Rocky Mountains between 3100 and 2500 yr BP (Ryder and Thomson, 1986; Luckman et al., 1993). In Effingham Inlet Chang et al. (2003) found fewer couplets with a seasonal succession of laminae between cal yr ~3100 - ~900 cal yr BP, indicating weaker seasonality and decreased nutrient delivery to the inlet via upwelling. Hay et al. (in press) also observed an overall increase in *C. choctawatcheeana* after 2700 cal yr BP, in the same core, concluding that the observed diatom assemblage provided evidence that there was an increase in precipitation.

CHAPTER 6

CONCLUSION

Statistical and qualitative analyses of diatom flora and abundance from a 12 m long variably laminated sediment core from Frederick Sound, British Columbia, revealed the presence of oscillating climate regimes on an interdecadal scale as well as on a centennial to millennial scale.

Q-mode cluster analysis of 108 samples identified four clusters, which were defined based on the proportion of marine planktic taxa. Although not considered during clustering the absolute abundance of samples within the different clusters was distinct, and correlated to the proportion of marine planktic taxa present. Clusters were interpreted as representing deposition under varying degrees of seasonality, with strong seasonality correlating to relatively dry and sunny spring, summer and early fall seasons, and conditions conducive to the production of spring and summer marine planktic diatom bloom taxa. Cluster type and abundance showed a regular intersample variation with a frequency of ~56 years, which is correlatable with the low frequency PDO cycle. Thus variations in seasonality and diatom production were attributed to regular variations in the strength of the Aleutian Low and North Pacific High Pressure systems. The overall decrease in diatom abundance and change in type of oscillating clusters indicates an intensifying and easterly progressing Aleutian Low, and a trend towards progressively stronger positive PDO conditions through the late Holocene.

Five climate zones were identified from the stratigraphic grouping of certain cluster types, which represent climate regimes of centennial to millennial duration with

the higher frequency interdecadal climate signal superimposed on them. Paleoclimate conditions inferred for the zones are consistent with records observed elsewhere in coastal British Columbia with the exception of a warm, dry and sunny interval identified in Frederick Sound between ~2770 to 3360 cal yr BP and from a few other sites in the Pacific Northwest but absent from a large number of other locations. More research is required to reconcile these differences. Long-term variation in the strength and position of the Aleutian Low and North Pacific High are suggested as driving the observed climate change at all scales examined in this study, with periods of an intensified and easterly Aleutian Low producing overall wetter and cloudier conditions. The consistency between paleoclimate records in the Pacific Northwest indicates a regional and coherent response to large-scale climate modifying phenomena, such as the Aleutian Low and North Pacific High. This study emphasizes the climatic importance in this region of variations in the Aleutian Low over a number of time-scales.

REFERENCES

- Alley, R.B., Mayewski, P.A., Sowers, T., Stuiver, M., Taylor, K.C., Clark, P.U., 1997. Holocene climatic instability: A prominent, widespread event 8200 yr ago. *Geology*, 25(6): 483-486.
- Anderson, L., Abbott, M.B., Rinnery, B.P., Burns, S.J., 2005. Regional atmospheric circulation change in the North Pacific during the Holocene inferred from lacustrine carbonate oxygen isotopes, Yukon Territory, Canada. *Quaternary Research*, 64: 21-35.
- Barlow, R.G., 1984. Dynamics of the decline of a phytoplankton bloom after an upwelling event. *Marine Ecology Progress Series*, 16: 121-126.
- Barrie, J.V., Conway, K. W., 2002. Rapid sea-level change and coastal evolution on the Pacific margin of Canada. *Sedimentary Geology*, 150: 170-183.
- Barrie, J.V., Conway, K.W., 1999. Late Quaternary Glaciation and Postglacial Stratigraphy of the Northern Pacific Margin of Canada. *Quaternary Research*, 51: 113-123.
- Barron, J.A., Heusser, L., Herbert, T., and Lyle, M., 2003. High-resolution climatic evolution of coastal northern California during the past 16,000 years. *Paleoceanography*, 18: 1020.
- Batterbee, R.W., and Kneen. M.J., 2003. The use of electronically counted microspheres in absolute diatom analysis. *Limnology & Oceanography*, 27(1): 184-188.
- Beamish, R.J. et al., 1999. The regime concept and natural trends in the production of Pacific salmon. *Canadian Journal of Fisheries and Aquatic Sciences*, 56(3): 516-526.

- Bérard-Therriault, L., Poulin, M., and Bossé, L., 1999. Guide d'identification du phytoplankton marin de l'estuaire et du golfe du Saint-Laurent, incluant également certains protozoaires. Publication spéciale canadienne des sciences halieutiques et aquatiques, 128, 1-387 pp.
- Biondi, F., Gershunov, A., Cayan, D.R., 2001. North Pacific Decadal Climate Variability since 1661. *American Meteorological Society*, 14: 5-10.
- Bond, G. et al., 2001. Persistent solar influence on North Atlantic Climate during the Holocene. *Science*, 294: 2130-2136.
- Braarud, T., Hofsvang, B.F., Hjelmfoss, P., and Överland, A.K., 1974. The natural history of the Hardangerfjord. *Sarsia*, 55: 63-98.
- Brown, K.J., Hebda, R.J., 2002. Origin, development, and dynamics of coastal temperate conifer rainforests of southern Vancouver Island, Canada. *Canadian Journal of Forest Research*, 32: 353-372.
- Brown, K.J., Hebda, R.J., 2003. Coastal rainforest connections disclosed through a Late Quaternary vegetation, climate, and fire history investigation from the Mountain Hemlock Zone on southern Vancouver Island, British Columbia, Canada. *Review of Palaeobotany and Palynology*, 123: 247-269.
- Calvert, S.E., 1966. Origin of diatom-rich, varved sediments from the Gulf of California. *Journal of Geology*, 74: 546-565.
- Campeau, S., Peintiz, R., Hequette, A., 1999. Diatoms from the Beaufort Sea coast, southern Arctic Ocean (Canada). *Bibliotheca Diatomologica*, 42. J. Cramer, Berlin/Stuttgart, 244 pp. pp.

- Carvalho, L.R., Cox, E.J., Fritz, S.C., Juggins, S., Sims, P.A., Gasse, F., Battarbee, R.W., 1995. Standardizing the taxonomy of saline lake *Cyclotella* spp. *Diatom Research*, 10: 229-240.
- Cayan, D.R., Peterson, D.H., 1989. Influence of North Pacific atmospheric circulation of streamflow in the west. *Geophysical Monograph*, 55: 375-396.
- Chang, A.S., 2004. Ultra-high resolution sediment analysis and diatom paleoecology from Effingham Inlet, British Columbia, Canada: Implications for Late Holocene Environmental Change. Unpublished Ph.D. Dissertation, Carleton University, Ottawa, 537 pp.
- Chang, A.S., Patterson, R.T. and McNeely, R., 2003. Seasonal sediment and diatom record from Late Holocene laminated sediments, Effingham Inlet, British Columbia, Canada. *Palaios*, 18: 477-494.
- Chang, A.S., Patterson, R.T., October 2005. Climate shift at 4400 years BP: Evidence from high-resolution diatom stratigraphy, Effingham Inlet, British Columbia, Canada. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 226: 72-92.
- Chavez, F.P., Ryan, J., Lluch-Cota, S.E. and Niquen C., M., 2003. From Anchovies to Sardines and Back: Multidecadal Change in the Pacific Ocean. *Science*, 299(5604): 217-221.
- Christoforou, P., and Hameed, S., 1997. Solar Cycle and the Pacific 'centers of action'. *Geophysical Research Letters*, 24: 293-296.
- Clague, J.J., Mathewes, R.W., Buhay, W.M., and Edards, T.W.D., 1992. Early Holocene climate at Castle Peak, southern Coast Mountains, British Columbia, Canada. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 95: 153-167.

- Clague, J.J., Wohlfarth, B., Ayotte, J., Eriksson, M., Hutchinson, I., Mathewes, R.W., Walker, R.R., Walker, L., 2004. Late Holocene environmental change at treeline in the northern Coast Mountains, British Columbia, Canada. *Quaternary Science Reviews*, 23: 2413-2431.
- Clemons, M.J., Miller, C.B., 1984. Blooms of large diatoms in the oceanic, subarctic Pacific. *Deep Sea Research*, 31: 85-95.
- Cochlan, W.P., Harrison, P.J., Thomopson, P.A. and Parsons, T.R., 1986. Preliminary observations of the summer production of three British Columbian coastal inlets. *Sarsia*, 71: 161-168.
- Cumming, B.F., Wilson, S.E., Hall, R.I., Smol, J.P., 1995. Diatoms from British Columbia (Canada) lakes and their relationship to salinity, nutrients and other limnological variables. *Bibliotheca Diatomologica*, 31. J. Cramer, Berlin/Stuttgart, 207 pp.
- Cushing, D.H., 1989. A difference in structure between ecosystems in strongly stratified waters and in those that are only weakly stratified. *Journal of Plankton Research*, 11: 1-13.
- Davis, J.C., 2002. *Statistics and Data Analysis in Geology*. John Wiley and Sons, New York.
- Dean, J.M., Kemp, A.E.S., 2004. A 2100 year BP record of the Pacific Decadal Oscillation, El Niño Southern Oscillation and Quasi-Biennial Oscillation in marine production and fluvial input from Saanich Inlet, British Columbia. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 213: 207-229.

- Dean, J.M., Kemp, A.E.S., Pearce, R.B., 2001. Palaeo-flux records from electron microscope studies of Holocene laminated sediments Saanich Inlet, British Columbia. *Marine Geology*, 174: 139-158.
- Dean, W.E., 2000. The Sun and Climate. USGS Fact Sheet, FS-095-00: 6.
- Favorite, F., Dodimead, A.J. and Nasu, K., 1976. Oceanography of the subarctic Pacific region, 1960-71. *International North Pacific Fisheries Commission Bulletin*, 33: 187 p.
- Gedalof, Z., Smith, D. J., 2001. Interdecadal climate variability and regime-scale shifts in Pacific North America. *Geophysical Research Letters*, 28(8): 1515-1518.
- Gershunov, A., Barnett, T.P., Cayan, D.R., 1999. North pacific interdecadal oscillation seen as factor in ENSO-related North American climate Anomalies. *EOS, Transactions - American Geophysical Union*, 80 (3): 25.
- Graham, N.E., 1994. Decadal-scale climate variability in the tropical and North Pacific during the 1970s and 1980s: observations and model results. *Climate Dynamics*, 10: 135-162.
- Grimm, K.A., Lange, C.B., Gill, A.S., 1996. Biological forcing of hemipelagic sedimentary laminae: Evidence from ODP Site 893, Santa Barbara Basin, California. *Journal of Sedimentary Research*, 66: 613-624.
- Guillard, R.R.L., and Kilham, P., 1977. The ecology of marine planktic diatoms. In: D. Werner (Editor), *The Biology of Diatoms*. Botanical Monographs. Blackwell Scientific Publications, New York, pp. 372-469.

- Haigh, R., Taylor, F.J.R., and Sutherland, T.F., 1992. Phytoplankton ecology of Sechart Inlet, a fjord system of the British Columbia coast. I. General features of the nano- and microplankton. *Marine Ecology Progress Series*, 89: 117-134.
- Håkansson, H., Hajdu, S., Snoeijs, P., and Loginova, L., 1993. *Cyclotella hakanssoniae* Wendker and its relationship to *C. caspia* Grunow and other similar brackish water *Cyclotella* species. *Diatom Research*, 8: 333-347.
- Hameed, S., and Lee, J.N., 2003. Displacements of the Aleutian Low and the Hawaiian High pressure systems during the solar cycle. EOS Transactions, American Geophysical Union 84 Fall Meeting Supplemental, Abstract SH11E-03.
- Hansen, B.C.S., and Engstrom, D.R., 1996. Vegetation history of Pleasant Island, Southeastern Alaska, since 13,000 yr B.P. *Quaternary Research*, 46: 161-175.
- Hasle, G.R., and Syvertsen, E.E., 1997. Marine Diatoms. Identifying Marine Phytoplankton. Academic Press, San Diego, California.
- Hay, M.B., Pientiz, R., Thomson, R.E., 2003. Distribution of diatom surface sediment assemblages within Effingham Inlet, a temperate fjord on the west coast of Vancouver Island (Canada). *Marine Micropaleontology*, 48: 291-320.
- Hay, M.B., Dallimore, A., Thomson, R.E., Calvert, S.E., Pienitz, R., accepted. Diatom record of late Holocen oceanography and climate along the west coast of Vancouver Island, British Columbia (Canada). *Quaternary Research*.
- Hay, M.B., Calvert, S.E., Pienitz, R., Dallimore, A., Thomson, R.E., and Baumgartner, T.R. submitted. Geochemical, isotopic and diatom signatures of deep water renewal events in sediment cores recovered from Effingham Inlet, British Columbia (Canada). *Marine Geology*.

- Hebda, R.J., 1983. Late-glacial and postglacial vegetation history at Bear Cove Bog, northeast Vancouver Island, British Columbia. *Canadian Journal of Botany*, 61: 3172-3192.
- Hebda, R.J., 1995. British Columbia vegetation and climate history with focus on 6 KA BP. *Geographie physique et Quaternaire*, 49: 55-79.
- Heusser, C.J., Heusser, L.E., Peteet, D.M., 1985. Late-quaternary climatic change on the American North Pacific Coast. *Nature*, 315: 485-487.
- Hitchcock, G.L.a.S., T.J., 1977. The importance of light in the initiation of the 1972-1973 winter-spring diatom bloom in Narragansett Bay. *Limnology & Oceanography*, 22: 126-131.
- Hobson, L.A., 1983. Phytoplankton crops, bacterial metabolism and oxygen in Saanich Inlet, a fjord in Vancouver Island, British Columbia. *Sedimentary Geology*, 36: 117-130.
- Hobson, L.A., McQuoid, M.R., 1997. Temporal variations among planktonic diatom assemblages in a turbulent environment of the southern Strait of Georgia, British Columbia, Canada. *Marine Ecology Progress Series*, 150: 263-274.
- Hu, F.S., Kaufman, D., Yoneji, S., Nelson, D., Shemesh, A., Huang, Y., Tian, J., Bond, G., Clegg, B., Brown, T., 2003. Cyclic variation and solar forcing of Holocen climate in the Alaskan subarctic. *Science*, 301: 1890-1893.
- Keigwin, L.D., 1996. The Little Ice Age and Medieval Warm Period in the Sargasso Sea. *Science*, 274: 1503-1508.

- Kemp, A.E.S., 2003. Evidence for abrupt climate changes in annually laminated marine sediments. *Philosophical Transactions of the Royal Society of London A*, 361: 1851-1870.
- Kutzbach, J.E., Guetter, P.J., Behling, P.J., and Selin, R., 1993. Simulated climatic changes: results of the COHMAP climate-model experiments. In: H.E. HWright, Kutzbach, J.E., Webb III, T., Ruddiman, W.F., Street-Perrott, F.A., Bartlein, P.J. (Editor), *Global climates of the last glaciation*. University of Minnesota Press, Minneapolis.
- Lamb, H.H., 1995. *Climate History and the Modern World*. Routledge, London, England.
- Lange, C.B., Hasle, G.R., and Syvertsen, E.E., 1992. Seasonal cycle of diatoms in the Skagerrak, North Atlantic, with emphasis on the period 1980-1990. *Sarsia*, 77: 173-187.
- Latif, M., and Barnett, T.P., 1996. Decadal variability over the North Pacific and North America: dynamics and predictability. *Journal of Climate*, 9: 2407-2422.
- Laws, R.A., 1983. Preparing strewn slides for quantitative microscopical analysis: A test using calibrated microspheres. *Micropaleontology*, 29: 60-55.
- Leinen, M., Cwienk, D., Ross, G.R., Biscaye, P.E., Kolla, V., Thiede, Dauphin, J.P., 1986. Distribution of biogenic silica and quartz in recent deep-sea sediment. *Geology*, 14: 199-203.
- Lisitzin, A.P. (Editor), 1971. *Distribution of siliceous microfossils in suspension and in bottom sediments. The Micropaleontology of Oceans*. Cambridge University Press, London, United Kingdom, pp.173-195 pp.

- Long, C.J., and Whitlock, C., 2002. Fire and vegetation history from the coastal rain forest of the western Oregon Coast Range. *Quaternary Research*, 58: 215-225.
- Luckman, B.H., and Kearney, M.S., 1986. Reconstruction of Holocene changes in alpine vegetation and climate in the Maligne Range, Jasper National Park, Alberta. *Quaternary Research*, 26: 244-261.
- Mackas, D.L., Thomson, R.E., Galbriath, M., 2001. Changes in the zooplankton community of the British Columbia continental margin, 1985-1999, and their covariations with oceanographic conditions. *Canadian Journal of Fisheries and Aquatic Sciences*, 58(4): 685-702.
- Mann, M.E., Park, J., Bradley, R.S., 1995. Global interdecadal and century-scale climate oscillations during the past five centuries. *Nature*, 378(16): 266-270.
- Mantua, N.J., Hare, S.R., Zhang, Y., Wallace, J.M. and Francis, R.C., 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. *Bulletin of the American Meteorological Society*, 78(6): 1069-1079.
- Margalef, R., 1958. Temporal succession and spatial heterogeneity in the phytoplankton. In: A.A. Traverso (Editor), *Perspectives in Marine Biology*. University of California Press, Berkeley, pp. 323-349.
- Mathewes, R.W., 1973. A Palynological study of postglacial vegetation changes in the University Research Forest, southwestern British Columbia. *Canadian Journal of Botany*, 51: 2085-2103.
- Mathewes, R.W., 1985. Paleobotanical evidence for climatic change in southern British Columbia during late-glacial and Holocene time. *Syllogeus*, 55: 397-422.

- Mathewes, R.W., 1993. Evidence for Younger Dryas-age cooling on the North Pacific of America. *Quaternary Science Reviews*, 12: 000-000.
- Mathewes, R.W., and Heusser, L.E., 1981. A 12,000 year palynological record of temperature and precipitation trends in southwestern British Columbia. *Canadian Journal of Botany*, 59: 707-710.
- Mathewes, R.W., and Rouse, G.E., 1975. Palynology and paleoecology of postglacial sediments from the lower Fraser River Canyon of British Columbia. *Canadian Journal of Earth Sciences*, 12: 745-756.
- McQuoid, M.R., and Hobson, L.A., 1998. Assessment of paleoenvironmental conditions on southern Vancouver Island, British Columbia, using the marine tychoplankter *Paralia Sulcata*. *Diatom Research*, 13: 311-321.
- McQuoid, M.R., and Hobson, L.A., 2001. A Holocene record of diatom and silicoflagellate microfossils in sediments of Saanich Inlet, ODP Leg 169S. *Marine Geology*, 174: 111-123.
- McQuoid, M.R.a.H., L.A., 1997. A 91-year record of seasonal and interannual variability of diatoms from laminated sediments in Saanich Inlet, British Columbia. *Journal of Plankton Research*, 19: 173-194.
- Meidinger, D., and Pojar, J. (Editor), 1991. *Ecosystems of British Columbia*. Research Branch, B.C. Ministry of Forests., Victoria, B.C.
- Miller, A.J., Cayan, D.R., Barnett, T.P., Graham, N.E. and Oberhuber, J.M., 1994. The 1976-77 climate shift of the Pacific Ocean. *Oceanography*, 7(1): 21-26.

- Minobe, S., 1999. Resonance in bidecadal and pentadecadal climate oscillations over the North Pacific: role in climatic regime shifts. *Geophysical Research Letters*, 26(7): 855-858.
- Mionbe, S., 1997. A 50-70 year climatic oscillation over the North Pacific and North America. *Geophysical Research Letters*, 24(6): 683-686.
- Mortlock, R.A., and Froelich, P.N., 1989. A simple method for the rapid determination of biogenic opal in pelagic marine sediments. *Deep Sea Research*, 36: 1415-1426.
- Nederbragt, A.J., and Thurrow, J.W., 2001. A 6000 yr varve record of Holocen climate in Saanich Inlet, British Columbia, from digital sediment colour analysis of ODP Leg 169S cores. *Marine Geology*, 174: 95-110.
- Patterson, R.T. and Fishbein, E., 1989. Re-examination of the statistical methods used to determine the number of point counts needed for micropaleontological quantitative research. *Journal of Paleontology*, 63: 245-248.
- Patterson, R.T., Prokoph, A., Chang, A.S., 2004a. Late Holocene sedimentary response to solar and cosmic ray activity influenced by climate variability in the NE Pacific. *Sedimentary Geology*, 172: 67-84.
- Patterson, R.T., Prokoph, A., Kumar, A., Chang, A.S., Roe, H.M., 2005. Late Holocen variability in pelagic fish scales and dinoflagellate cysts along the west coast of Vancouver Island, NE Pacific Ocean. *Marine Micropaleontology*, 55: 183-204.
- Patterson, R.T., Prokoph, A., Wright, C., Chang, A. S., Thomson, R. E., Ware, D. M., 2004b. Holocene solar variability and pelagic fish productivity in the NE Pacific. *Palaeontologia Electronica*, 7(1).

- Pauly, D., and Christensen, V., 1995. Primary production required to sustain global fisheries. *Nature*, 374: 255-257.
- Peintiz, R., Fedge, D., Poulin, M., 2003. Marine and non-marine diatoms from the Haida Gwaii Archipelago and surrounding coasts, northeastern Pacific, Canada. *Bibliotheca Diatomologica*, 48. J. Cramer, Berlin.
- Pellatt, M.G., Hebda, R.J., and Mathewes, R.W., 2001. High resolution Holocene vegetation history and climate from core 1034B ODP leg 169S, Saanich Inlet, Canada. *Marine Geology*, 174: 211-226.
- Pellatt, M.G.a.M., R.W., 1997. Holocene tree line and climate change on the Queen Charlotte Islands, Canada. *Quaternary Research*, 48: 88-99.
- Pike, J., and Kemp, A.E.S. (Editor), 1996. Records of seasonal flux in Holocene laminated sediments, Gulf of California. *Palaeoclimatology and Palaeoceanography from laminated sediments*, No. v. 116. Geological Society (London) Special Publication, London, 157-169 pp.
- Pike, J., and Kemp, A.E.S., 1997. Early Holocene decadal-scale variability recorded in Gulf of California laminated sediments. *Paleoceanography*, 12(2): 227-238.
- Pitcher, G.C., 1990. Phytoplankton seed population of the Cape Peninsula upwelling plume, with particular reference to resting spores of *Chaetoceros* (Bacillariophyceae) and their role in seeding upwelling waters. *Estuarine, Coastal and Shelf Science*, 31: 281-301.
- Pojar, J., and Mackinnon, A. (Editor), 1994. *Plants of the Pacific Northwest coast*. Lone Pine, Vancouver, B.C.

- Prasad, A.K.S.K., Nienow, J.A., Livingston, R.J., 1990. The genus *Cyclotella* (Bacillariophyta) in Choctawhatchee Bay, Florida, with special reference to *C. striata* and *C. choctawatcheeana* sp. nov. *Phycologia*, 29: 418-436.
- Prokoph, A., Patterson, R.T., 2004. From depth-scale to time-scale: transforming of sediment image color data into high-resolution time-series. In: P. Francus (Editor), *Image Analysis, Sediments and Paleoenvironments. Developments in Paleoenvironmental Research Series*. Springer, Dordrecht, pp. 143-164.
- Reimer, P.J., Baillie, M.G.L., Bard, E., Bayliss, A., Beck, J.W., Bertrand, C., Blackwell, P.G., Buck, C.E., Burr, G., Butler, K.B., Damon, P.E., Edwards, R.L., Fairbanks, F.G., Friedrich, M., Guilderson, T.P., Hughen, K.A., Kromer, B., McCormac, F.G., Manning, S., Bronk Ramsey, C., Reimer, R.W., Remmele, S., Southon, J.R., Stuiver, M., Talamo, S., Taylor, F.W., van der Plicht, J., and Weyhenmeyer, C.E., 2004. IntCal04 Terrestrial Radiocarbon Age Calibration, 0-26 Cal Kyr BP. *Radiocarbon*, 46: 1029-1058.
- Ryder, J.R., and Thomson, B., 1986. Neoglaciation in the southern Coast Mountains of British Columbia: Chronology prior to the late-Neoglacial maximum. *Canadian Journal of Earth Sciences*, 23: 273-287.
- Ryther, J.H., 1969. Photosynthesis and fish production in the sea. *Science*, 166: 72-76.
- Sancetta, C., 1996. Laminated diatomaceous sediments: controls on formation and strategies for analysis. In: A.E.S. Kemp (Editor), *Palaeoclimatology and Palaeoceanography from Laminated Sediments. Special Publication*. Geological Society, London, pp. 17-21.

- Sancetta, C., and Calvert, S.E., 1988. The annual cycle of sedimentation in Saanich Inlet, British Columbia: implications for the interpretation of diatom fossil assemblages. *Deep Sea Research*, 35: 71-90.
- Sancetta, C.A., 1989. Processes controlling the accumulation of diatoms in sediments: A model derived from British Columbian fjords. *Palaeogeography*, 4: 235-251.
- Sancetta, C.A., 1990. Occurrence of Thalassiosiraceae (Bacillariophyceae) in two fjords of British Columbia. *Beiheft zur Nova Hedwigia*, 100: 199-215.
- Schrader, H.J., Gersonde, R., 1978. Diatoms and silicoflagellates. *Utrecht Micropaleontology Bulletin*, 17: 129-176.
- Smayda, T.J., 1973. The growth of *Skeletonema costatum* during a winter-spring bloom in Narragansett Bay, Rhode Island. *Norwegian Journal of Botany*, 20: 218-247.
- Smith, S., and Hollibaugh, J., 1993. Coastal metabolism and the oceanic organic carbon balance. *Reviews of Geophysics*, 31: 75-89.
- Spooner, I.S., Barners, S., Baltzer, K.B., Raeside, R., Osborn, G.D., Mazzucchi, D., 2003. The impact of air mass circulation dynamics on Late Holocene paleoclimate in northwestern North America. *Quaternary International*, 108: 77-83.
- Stockner, J.G., and Cliff, D.D., 1975. Marine phytoplankton production, distribution and species composition in Pendress and Hotham Sounds, British Columbia. Technical Report Marine Fisheries Services Canada., 516: 80 pp.
- Stockner, J.G., Cliff, D.D., and Buchanan, D.B., 1977. Phytoplankton production and distribution in Howe Sound, British Columbia: a coastal marine embayment - fjord under stress. *Journal Fisheries Research Board of Canada*(34): 907-917.

- Stockner, J.G., Cliff, D.D., and Shortreed, K.R.S., 1979. Phytoplankton ecology of the Strait of Georgia, British Columbia. *Journal Fisheries Research Board of Canada*, 36: 657-666.
- Stoermer, E.F., and Smol, J.P., 1999. *The Diatoms: Applications for the Environmental and Earth Sciences*. Cambridge University Press, Cambridge, United Kingdom.
- Stuiver, M., and Reimer, P.J., 1993. Extended 14C database and revised CALIB radiocarbon calibration program. *Radiocarbon*, 35: 215-230.
- Stuiver, M., Reimer, P.J., and Reimer, R.W., 2005. CALIB 5.0.
<http://radiocarbon.pa.qub.ac.uk/calib/>, pp. WWW program and documentation.
- Subbotina, M.M., Thomson, R.E., and Rabinovich, A.B., 2001. Spectral characteristics of sea level variability along the west coast of North America during the 1982-83 and 1997-98 El Nino Events. *Progress in Oceanography*, 49: 353-372.
- Telford, R.J., Heegaard, E., Birks, H.J.B., 2004. All age-depth models are wrong: but how badly? *Quaternary Science Reviews*, 23: 1-5.
- Thomson, R.E., 1981. *Oceanography of the British Columbia Coast*. Canadian Special Publication of Fisheries and Aquatic Sciences., No. 56. Department of Fisheries and Oceans, Ottawa, 291 pp.
- Thomson, R.E., and Gower, J.F.R., 1998. A basin-scale oceanic instability event in the Gulf of Alaska. *Journal of Geophysical Research*, 103: 3033-3040.
- Thomson, R.E., Hickey, B.M., and LeBlond, P.H., 1989. The Vancouver Island Coastal Current: fisheries barrier and conduit. In: R.J. Beamish, and McFarlane, G.A. (Editor), *Effects of ocean variability on recruitment and an evaluation of parameters*

- used in stock assessment models. Canada Special Publication of Fisheries and Aquatic Sciences, Ottawa, pp. 265-296.
- Trenberth, K.E., Hurrell, J.W., 1994. Decadal atmosphere-ocean variations in the Pacific. *Climate Dynamics*, 9: 303-319.
- Trevor-Roper, H., 1965. *The Rise of Christian Europe*. Thames & Hudson, London, England.
- Ware, D.M., and G.A. McFarlane, 1989. Fisheries production domains in the Northeast Pacific Ocean. Effects of ocean variability on recruitment and an evaluation of parameters used in stock assessment models., 108. Canadian Special Publication of Fisheries and Aquatic Sciences, Ottawa, 359-379 pp.
- Ware, D.M., and R.E. Thomson, 1991. Link between long-term variability in upwelling and fish production in the northeast Pacific Ocean. *Canadian Journal of Fisheries and Aquatic Sciences*, 48: 2296-2306.
- Ware, D.M., and Thomson, Richard E., 2000. Interannual to Multidecadal Timescale Climate Variations in the Northeast Pacific. *Journal of Climate*, 13: 3209-3220.
- White, A., Bienfang, P.K., and Harrison, P.J., 1992. Spring bloom sedimentation in a subarctic ecosystem. II. Succession and Sedimentation. *Marine Biology*, 114: 131-138.
- Witowski, A., Lange-Bertalot, H., Metzeltin, D., 2000. *Diatom Flora of Marine Coasts*. Volume 1. *Iconographia Diatomologica* 7. A.R.G. Gantner Verlag K.G.

APPENDIX A

AMS Radiocarbon Dates From Core VEC02A04

The following are copies of the original reports supplied by Dr. Roelf Beukens of IsoTrace Laboratories, University of Toronto, for dating of piston cores recovered during the research cruise to the Seymour-Belize Inlet Complex. Dates for Frederick Sound core VEC02A04 are marked with an asterisk.

DEC-12-2002 15:18 FROM IsoTrace Lab

TO

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IsoTrace Radiocarbon LaboratoryAccelerator Mass Spectrometry Facility
at the University of Toronto60 St. George Street
Toronto (Ont) Canada M5S 1A7Telephone: 416-978-4628
Fax: 416-978-4711
Email: roelf.beukens@utoronto.ca**Radiocarbon Analysis Report**

December 12, 2002

Submitter: R.Thomson, Dept of Earth Sciences, Univ of BC, Vancouver BC

These results are the average of 2 separate analyses (normal precision) and are corrected for natural and sputtering isotope fractionation to a base of $\delta^{13}\text{C} = -25\text{‰}$, using the measured $^{13}\text{C}/^{12}\text{C}$ ratios. The sample ages are quoted as uncalibrated conventional radiocarbon dates in years before present (BP), using the Libby ^{14}C meanlife of 8033 years. The errors represent 68.3 % confidence limits.

Sample Identification	Description	Weight used (mg)	IsoTrace Lab number	Age (years BP)
* VEC02A04-8-103	wood frags	283	TO-10793	3770 $\pm$ 60
VEC02A07-5-92	wood frags	272	TO-10799	5720 $\pm$ 70

I would like to hear your comments on these results. If these results are used in a publication, I would appreciate it if you could send me a reprint.

Dr. R. P. Beukens

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Radiocarbon Analysis Report**COPY**

July 28, 2003

Submitter: R.Thomson, Dept of Earth Sciences, Univ of BC, Vancouver BC

These results are the average of 2 separate analyses (normal precision) and are corrected for natural and sputtering isotope fractionation to a base of $\delta^{13}\text{C} = -25\text{‰}$, using the measured $^{13}\text{C}/^{12}\text{C}$ ratios. The sample ages are quoted as uncalibrated conventional radiocarbon dates in years before present (BP), using the Libby ^{14}C meanlife of 8033 years. The errors represent 68.3 % confidence limits.

Sample Identification	Description	Weight used (mg)	IsoTrace Lab number	Age (years BP)
* VEC02A04-1-97	wood frags	148	TO-10788	1510 $\pm$ 60
* VEC02A04-3-132a	wood frag	9	TO-10789	2560 $\pm$ 80
* VEC02A04-3-132b	wood frag	47	TO-10790	3050 $\pm$ 60
* VEC02A04-7-126	twig	66	TO-10791	4350 $\pm$ 80
VEC02A07-1-27	wood stick	160	TO-10794	1210 $\pm$ 50
VEC02A07-2-118	wood frag	437	TO-10795	1580 $\pm$ 50
VEC02A07-2-134	wood frags	210	TO-10796	1510 $\pm$ 60
VEC02A07-3-140	wood frag	665	TO-10797	1960 $\pm$ 60

I would like to hear your comments on these results. If these results are used in a publication, I would appreciate it if you could send me a reprint.

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Radiocarbon Analysis Report

April 24, 2003

Submitter: A.Dallimore, Geological Survey of Canada, Sidney BC

These results are the average of 2 separate analyses (normal precision) and are corrected for natural and sputtering isotope fractionation to a base of $\delta^{13}\text{C} = -25\text{‰}$, using the measured $^{13}\text{C}/^{12}\text{C}$ ratios. The sample ages are quoted as uncalibrated conventional radiocarbon dates in years before present (BP), using the Libby ^{14}C meanlife of 8033 years. The errors represent 68.3 % confidence limits.

Sample Identification	Description	Weight used (mg)	IsoTrace Lab number	Age (years BP)
* VEC02A04-2/3-16	wood frag	217	TO-11082	3070 $\pm$ 70
* VEC02A04-5-115	pine cone	146	TO-11084	2540 $\pm$ 70
VEC02A07-3-59	wood frag	111	TO-11086	1460 $\pm$ 60
VEC02A07-5-72	wood frag	200	TO-11088	2830 $\pm$ 70

I would like to hear your comments on these results. If these results are used in a publication, I would appreciate it if you could send me a reprint.

Dr. R. P. Beukens

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Radiocarbon Analysis Report

January 31, 2004

Submitter: A.Dallimore, Geological Survey of Canada, Sidney BC

These results are the average of 2 separate analyses (normal precision) and are corrected for natural and sputtering isotope fractionation, using the measured $^{13}\text{C}/^{12}\text{C}$ ratios. The sample ages are quoted as uncalibrated conventional radiocarbon dates in years before present (BP), using the Libby ^{14}C meanlife of 8033 years. The errors represent 68.3 % confidence limits. TO-11083 was badly preserved and did not yield sufficient datable carbon for a reliable analysis.

Sample Identification	Description	Weight used (mg)	IsoTrace Lab number	Age (years BP)
* VEC02A04-4-109	twig	11	TO-11083	
VEC02A07-2-79	wood frag	89	TO-11085	1490 $\pm$ 100
VEC02A07-4/5-18	wood frag	479	TO-11087	2640 $\pm$ 60
VEC02A07-5-108	wood frag	55	TO-11089	2910 $\pm$ 60
VEC02A07-4-124	wood frag	17	TO-10798	3720 $\pm$ 60

I would like to hear your comments on these results. If these results are used in a publication, I would appreciate it if you could send me a reprint.

Dr. R. P. Beukens

APPENDIX B**List of Identified Diatom Taxa From All Samples**

Achnanthes conspicua Mayer 1919
Achnanthes cf. *grana* Holn & Hellerman 1963
Achnanthes lanceolata (Brébisson ex Kützing) Grunow in Cleve & Grunow 1880
Achnanthes lemmermanii Hustedt 1933
Achnanthes cf. *lemmermannii*
Achnanthes rosenstockii Lange-Bertalot
Achnanthes subatomoides (Hustedt) Lange-Bertalot & Archibald in Krammer & Lange-Bertalot 1985.
Achnanthes sp.1
Achnanthes sp.2
Achnanthes sp.3
Achnanthidium cf. *macrocephalum* Round & Bukhtiyarova 1996
Achnanthidium minutissimum (Kützing) Czarnecki 1994
Actinopterychus senarius (Ehrenberg) Ehrenberg 1843
Actinopterychus splendens (Shadbolt) Ralfs in Pritchard 1861
Actinopterychus vulgaris Schumann 1867
Actinopterychus sp.1
Amphora acutiuscula Kützing 1844
Amphora coffeaeformis (Agardh) Kützing 1844
Amphora exigua Gregory
Amphora cf. *helensis* Giffen 1973
Amphora inariensis Krammer 1980
Amphora pseudohyalina
Amphora strigosa Hustedt 1949
Amphora sp.1
Amphora sp.2
Amphora sp.3
Aulacoseira islandica (O.F. Müller) Simonsen 1979
Aulacoseira lirata (Ehrenberg) Ross 1986
Bacillaria paxillifer (O.F. Müller) Hendey 1951
Bacillaria socialis (Gregory) Ralfs in Pritchard 1861
Berkeleya rutilans (Trentpohl) Grunow 1880
Brachysira brebissonii Ross in Hartley 1986
Caloneis crassa (Gregory) Ross in Hartley 1986
Caloneis cf. *liber* (W. Smith) Cleve 1895
Caloneis tenuis (Gregory) Krammer 1985
Cocconeis costata var. *costata* Gregory 1855
Cocconeis cf. *distantula* Giffen 1967 sensu Witkowski et al. 2000
Cocconeis placentula Ehrenberg 1838
Cocconeis placentula var. *euglypta* (Ehrenberg) Grunow 1884
Cocconeis scutellum Ehrenberg 1838
Cocconeis scutellum var. *parva* (Grunow in Van Heurck) Cleve 1895
Cocconeis sp.1
Cocconeis sp.2

Cocconeis sp.3
Coscinodiscus radiatus Ehrenberg 1839
Coscinodiscus sp.1
Craticula halophila (Grunow ex Van Heurck) Mann in Round et al. 1900
Ctenophora pulchella (Ralfs ex Kützing) Williams & Round 1986
Cyclotella caspia Grunow
Cyclotella choctawhatcheeana Prasad 1990
Cylotella litoralis Lange & Syvertsen
Cyclotella pseudostelligra Hustedt 1939
Cyclotella stelligra Cleve & Grunow in Van Heurck 1882
Cyclotella tripartita Håkansson 1990
Cymbella delicatula Kützing 1849
Diatoma mesodon (Ehrenberg) Kützing 1844
Diatoma monoliformis Kützing 1833
Diatoma sp.1
Diatoma sp.2
Diatomella cf. *minuta* Hustedt 1936 in A. Schmidt 1874-1959
Diatomella sp.1
Diploneis cf. *vacillans* (A. Schmidt) Cleve 1894
Encyonema hebridicum Grunow ex Cleve 1891
Encyonema minutum (Hilse ex Rabenhorst) Mann in Round et al. 1990
Encyonema paucistriatum (Cleve-Euler) Mann 1990
Encyonema silesiacum (Bleisch in Rabenhorst) Mann in Round et al. 1900
Eunotia cf. *bilunaris* (Ehrenberg) Mills
Eunotia lapponica Grunow ex A. Cleve 1895
Eunotia praerupta Ehrenberg 1843
Eunotia aff. *veneris* (Kützing) De Toni
Eunotia sp.1
Eunotia sp.2
Eunotia sp.3
Eunotia sp.4
Eunotia sp.5
Eunotia sp.6
Eunotia sp.7
Eunotia sp.8
Eunotia sp.9
Eunotia sp.10
Eunotia sp.11
Eunotia sp.12
Eunotia sp.13
Eunotia sp.14
Eunotia sp.15
Eunotia sp.16
Eunotia sp.17

- Fallacia littoricola* (Hustedt) Mann in Round et al. 1990
Fallacia solutpunctata (Hustedt) Mann 1990
Fallacia tschuktschorum comb. nov.
Fallacia sp.1
Fallacia sp.2
Fragilaria construens var. *construens* (Ehrenberg) Hustedt 1957
Fragilaria cf. *construens* var. *pumila* Grunow in Van Heurck
Fragilaria cyclopum (Brutschy) Lange-Bertalot
Fragilaria famelica (Kützing) Lange-Bertalot
Fragilaria cf. *tenera* (W. Smith) Lange-Bertalot
Fragilaria vaucheriae (Kützing) Petersen 1938
Fragilaria sp.1
Fragilaria sp.2
Fragilaria sp.3
Fragilariopsis cylindriciformis (Hasle in Hasle & Booth) Hasle
Fragilariopsis cylindrus (Grunow) Krieger in Helmcke & Krieger 1954
Fragilariopsis oceanica (Cleve) Hasle 1965
Fragilariopsis pseudonana (Hasle) Hasle 1993
Frustulia krammeri Lange-Bertalot & Metzeltin in Metzeltin & Lange-Bertalot 1998
Frustulia rhomboides (Ehrenberg) de Toni
Frustulia saxonica Rabenhorst 1853
Gomphonema parvulum (Kützing) Kützting 1849
Gomphonema sp.1
Gomphonemopsis obscurum (Krasske) Lange-Bertalot in Lange-Bertalot et al. 1996
Gramatophora marina (Lyngbye) Kützting 1844
Gramatophora oceanica Ehrenberg 1854
Gyrosigma cf. *articum* var. *subflexuosa* (Grunow ex Cleve) Mills 1934
Gyrosigma balticum (Ehrenberg) Rabenhorst 1853
Gyrosigma sp.1
Hannea arcus (Ehrenberg) Patrick in Patrick & Reimer 1966
Haslea crucigeroides (Smith) Simonsen 1974
Hyalodiscus scoticus (Kützing) Grunow 1879
Martyana atomus (Hustedt) Snoeijs in Snoeijs et al. 1991
Martyana martyi (Héribaude) Round in Round et al. 1990
Martyana cf. *schulzii* (Brockmann) Snoeijs in Snoeijs et al. 1991
Mastologia pumila (Grunow) 1878
Melosira Arentii (Kolbe) Nagumo & Kobayasi 1977
Melosira nummuloides (Kilwyn) Agardh 1824
Melosira varians C.A. Agardh 1827
Navicula cf. *cryptotenelloides* Lange-Bertalot 1993
Navicula directa (W. Smith) Ralfs in Pritchard 1861
Navicula gregaria Donkin 1861
Navicula cf. *jonssonii* Østrup 1918
Navicula luciae Witkowski & Lange-Bertalot in Lange-Bertalot & Genkal 1999

- Navicula oblonga* (Kützing) Kützing 1844
Navicula perminuta Grunow in van heurck 1880
Navicula cf. *petersenii* Hustedt in Schmidt et al. 1874-1959
Navicula phylepta Kützing 1844
Navicula phylleptosoma Lange-Bertalot in Lange-Bertalot & Genkal 1999
Navicula ramosissima (Agardh) Cleve 1895
Navicula cf. *rhynchocephala* Kützing 1844
Navicula salincola Hustedt 1939
Navicula schadei Krasske
Navicula cf. *subinflata* Grunow in Cleve 1883
Navicula veneta Kützing 1844
Navicula sp.1
Navicula sp.2
Navicula sp.3
Navicula sp.4
Navicula sp.5
Navicula sp.6
Navicula sp.7
Navicula sp.8
Neidium productum (W. Smith) Cleve 1894
Nitzschia cf. *alpina* Hustedt emend. Lange-Bertalot
Nitzschia cf. *bacillum* Hustedt in A. Schmidt et al.
Nitzschia cf. *communis* Rabenhorst
Nitzschia dissipata (Kützing) Grunow 1862
Nitzschia dissipata var. *media* (Hantzsch) Grunow
Nitzschia cf. *fonticola* Grunow in Cleve & Möller 1879
Nitzschia frustulum (Kützing) Grunow in Cleve & Grunow 1880
Nitzschia hungarica Grunow 1862
Nitzschia liebertruthii Rabenhorst 1864
Nitzschia perminuta (Grunow) M. Peragallo 1903
Nitzschia radicola Hustedt
Nitzschia sp.1
Nitzschia sp.2
Nitzschia sp.3
Nitzschia sp.4
Nitzschia sp.5
Nitzschia sp.6
Nitzschia sp.7
Odontella aurita (Lyngbye) C.A. Agardh 1832
Opephora cf. *gemmata* (Grunow) Hustedt 1931
Opephora gunter-grassii (Witkowski & Lange-Bertalot) Sabbe & Vyverman
Opephora horstiana Witkowski 1994
Opephora marina (Gregory) Petit 1888
Opephora mutabilis (Grunow) Sabbe & Vyverman 1995

- Opephora olsenii* Møller 1950
Opephora cf. *parva* (van Heurck) Krasske 1939
Paralia sulcata (Ehrenberg) Cleve 1873
Parlibellus berkeleyi (Kützing) Cox 1988
Peronia fibula (Brébisson ex Kützing) Ross 1956
Pinnularia microstauron (Ehrenberg) Cleve 1891
Pinnularia petersenii Krammer & Lange-Bertalot in Lange-Bertalot & Genkal 1999
Pinnularia rhomborea Krammer in Metzeltin & Lange-Bertalot 1998
Pinnularia cf. *tenuiraphe* Patrick & Freese 1961
Pinnularia sp.1
Planothidium cf. *Engelbrechtii* (Cholnoky) Round & Bukhtiyarova 1996
Planothidium delicatulum (Kützing) Round & Bukhtiyarova 1996
Planothidium lilljeborgii (Grunow) Witkowski et al. 2000
Pseudostaurosira brevistriata (Grunow in Van Heurck) Williams & Round 1987
Roicosphenia abbreviata (C.A. Agardh) Lange-Bertalot 1980
Sellaphora pupula (Kützing) Mereschkowsky 1902
Skeletonema costatum (Greville) Cleve 1878
Stauroneis neohyalina Lange-Bertalot & Krammer in Lange-Bertalot & Metzeltin 1996
Staurosirella pinnata (Ehrenberg) Williams & Round 1987
Stephanodiscus sp.1
Tabellaria flocculosa (Roth) Kützing 1844
Tabularia fasciculata (Agardh) Williams & Round 1986
Tabularia investiens (W. Smith) Williams & Round 1986
Tabularia tabulata (C.A. Agardh) Snoeijis 1992
Thalassionema bacillare (Heiden) Kolbe 1955
Thalassionema nitzschioides (Grunow) Grunow ex Hustedt 1932
Thalassiosira angulata (Gregory) Hasle 1978
Thalassiosira binata Fryxell
Thalassiosira bulbosa Syvertsen & Hasle 1984
Thalassiosira conferta Hasle in Hasle and Fryxell 1977
Thalassiosira decipiens (Grunow) Jørgensen 1905
Thalassiosira eccentrica (Ehrenberg) Cleve 1904
Thalassiosira guillardii (Guillard & Ryther) Hasle 1978
Thalassiosira hyalina (Grunow) Gran 1897
Thalassiosira leptopus (Grunow) Hasle and Fryxell 1977
Thalassiosira nordenskioeldii Cleve 1873
Thalassiosira oestrupii var. *oestrupii* Fryxell & Hasle 1980
Thalassiosira oestrupii var. *venrickae* Fryxell & Hasle 1980
Thalassiosira pacifica Gran & Angst 1931
Thalassiosira punctigera (Castracane) Hasle 1983
Thalassiosira tenera Proschkina-Lavrenko 1961
Thalassiosira sp.1
Thalassiosira sp.2
Thalassiosira sp.3

Thalassiosira sp.4

Thalassiosira sp.5

Thalassiosira sp.6

Thalassiosira sp.7

Thalassiosira sp.8

Thalassiosira sp.9

Thalassiosira sp.10

Thalassiosira sp.11

Thalassiosira sp.12

Thalassiosira sp.13

Thalassiosira sp.14

Thalassiosira sp.15

Thalassiosira sp.16

Thalassiosira sp.17

Tryblionella aerophila (Hustedt) Mann 1990

Tryblionella coarctata (Grunow) Mann in Round et al. 1990

Tryblionella marginulata Cleve & Grunnow 1880

APPENDIX C

Absolute Abundance Of All Diatom Taxa From All Samples

Sample (cm below top of core)	Absolute Abundance (valves/g dry sediment)	<i>Achnanthes conspicua</i>	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes lemmermanni</i>	<i>Achnanthes cf. lemmermanni</i>	<i>Achnanthes rosenstocki</i>	<i>Achnanthes subatomoides</i>	<i>Achnanthes</i> sp 1	<i>Achnanthes</i> sp 2	<i>Achnanthes</i> sp 3	<i>Achnanthes cf. macrocephalum</i>	<i>Achnanthes minutissimum</i>	<i>Actinocyclus senarius</i>
5-7	5 00E+08													
10-12	3 46E+08	7 49E+05												
20-22	3 61E+08			8 25E+05						2 47E+06				
30-32	4 55E+08			9 24E+05										
40-42	2 70E+08											2 40E+06		
50-52	4 52E+08								1 96E+06					3 91E+06
60-62	3 28E+08													
70-72	6 42E+08			2 76E+06						2 76E+06			2 76E+06	
80-82	5 86E+08			1 23E+06					2 46E+06					
90-92	2 62E+08								3 00E+06					
100-102	7 33E+08													
110-112	6 74E+08									2 86E+06				
120-122	4 14E+08									1 69E+06	8 44E+05			
130-132	6 41E+08			2 70E+06						2 70E+06			1 35E+06	
183-185	6 21E+08			2 56E+06						5 12E+06				
196-198	4 95E+08											9 84E+05		9 84E+05
206-208	5 66E+08								3 41E+06				5 69E+06	
216-218	6 89E+08			1 35E+06				1 35E+06						
226-228	2 80E+08			5 66E+05						2 27E+06			1 13E+06	5 66E+05
236-238	5 81E+08			3 55E+06						2 37E+06				2 37E+06
246-248	3 05E+08			3 09E+06						6 17E+05		6 17E+05	1 23E+06	
256-258	4 50E+08	9 01E+05												
266-268	3 43E+08			2 03E+06					6 77E+05	1 35E+06			2 03E+06	6 77E+05
276-278	5 76E+08	1 29E+06										1 29E+06	1 29E+06	1 29E+06
286-288	3 95E+08	7 97E+05								3 19E+06				
305-307	1 04E+09								6 11E+06	4 07E+06				
315-317	7 11E+08	1 41E+06							1 41E+06				1 41E+06	1 41E+06
325-327	1 86E+08			3 80E+05										3 80E+05
335-337	7 73E+08			1 54E+06										
345-347	5 31E+08			1 08E+06									3 24E+06	
355-357	5 31E+08									2 16E+06				2 16E+06
365-367	8 53E+08									1 72E+06				
375-377	6 97E+08			2 83E+06					1 41E+06	8 48E+06			1 41E+06	
385-387	6 76E+08									5 48E+06				
395-397	8 76E+08			1 73E+06									1 73E+06	
405-407	5 46E+08			4 39E+06						5 49E+06				
415-417	1 94E+08			7 97E+05						1 59E+06				3 99E+05
425-427	3 07E+08			6 25E+05					6 25E+05	1 25E+06		6 25E+05	6 25E+05	1 87E+06
435-437	5 51E+08									2 21E+06				1 11E+06
445-447	6 73E+08								2 72E+06					
467-469	2 93E+08			5 89E+05						5 89E+05				
472-474	3 73E+08			3 04E+06			7 60E+05							
482-484	5 19E+08	1 05E+06		1 05E+06					2 10E+06	4 20E+06				
492-494	5 49E+08			2 24E+06									4 48E+06	2 24E+06
502-504	5 00E+08								1 02E+06	4 07E+06			1 02E+06	
512-514	1 53E+09			1 22E+07						6 10E+06			3 05E+06	
522-524	4 36E+08	9 04E+05		1 81E+06						1 81E+06				9 04E+05
532-534	5 03E+08			2 03E+06						4 07E+06			2 03E+06	
552-554	9 69E+08													1 95E+06
562-564	6 83E+08					1 35E+06			1 35E+06	5 39E+06				
582-584	3 79E+08			1 54E+06						3 09E+06	7 72E+05			7 72E+05
592-594	1 04E+09												2 08E+06	
602-604	4 64E+08	9 27E+05		9 27E+05							1 85E+06			9 27E+05
612-614	7 44E+08	1 50E+06												
619-621	4 90E+08	9 70E+05		9 70E+05									9 70E+05	9 70E+05
629-631	5 01E+08	2 00E+06		2 00E+06						3 99E+06	2 00E+06			
639-641	2 55E+08	1 03E+06								5 15E+05			1 03E+06	1 54E+06
649-651	9 92E+08	3 92E+06												1 96E+06
659-661	5 73E+08	1 14E+06							1 14E+06		1 14E+06			
669-671	1 20E+09			2 40E+06					2 40E+06		9 61E+06			
679-681	5 75E+08	1 15E+06											2 29E+06	
689-691	2 93E+08			1 76E+06									1 17E+06	5 86E+05
699-701	9 13E+08	3 64E+06				1 82E+06				7 27E+06			1 82E+06	
709-711	7 38E+08									5 95E+06	1 49E+06			
719-721	3 95E+08	1 61E+06									8 03E+05		8 03E+05	
729-731	4 96E+08	1 96E+06								3 92E+06			9 80E+05	
739-741	2 65E+08				1 08E+06			5 42E+05		1 08E+06	1 63E+06			
749-751	6 55E+08			2 63E+06					1 31E+06	5 25E+06	2 63E+06			
759-761	3 24E+08	6 57E+05		1 31E+06					1 31E+06	6 57E+06	1 31E+06		1 31E+06	6 57E+05
769-771	5 25E+08									2 11E+06			2 11E+06	1 06E+06
783-785	9 75E+08								1 93E+06					
803-805	1 08E+09								4 34E+06					
813-815	7 97E+08			3 23E+06						6 47E+06				1 62E+06

Sample (cm below top of core)	Absolute Abundance (valves/g dry sediment)	<i>Achnanthes conspicua</i>	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes lemmermanni</i>	<i>Achnanthes cf. lemmermanni</i>	<i>Achnanthes rosenstocki</i>	<i>Achnanthes subatomoides</i>	<i>Achnanthes sp. 1</i>	<i>Achnanthes sp. 2</i>	<i>Achnanthes sp. 3</i>	<i>Achnantheidum cf. macrocephalum</i>	<i>Achnantheidum minussumum</i>	<i>Actinocyclus senarius</i>
823-825	9 05E+08		1 84E+06	3 69E+06				1 84E+06		1 11E+07			1 84E+06	
833-835	8 58E+08		3 34E+06							6 69E+06			1 67E+06	
843-845	4 74E+08			1 96E+06						3 91E+06				
853-855	5 17E+08		1 05E+06							2 09E+06			1 05E+06	
863-865	7 91E+08		1 60E+06	1 60E+06						3 20E+06			1 60E+06	
873-875	9 29E+08		1 89E+06					1 89E+06		7 57E+06			1 89E+06	
883-885	6 65E+08		1 35E+06							5 40E+06				1 35E+06
893-895	7 99E+08		1 63E+06							3 26E+06			1 63E+06	
913-915	6 28E+08		2 54E+06										1 27E+06	
923-925	3 81E+08									6 05E+06			1 51E+06	
925-927	6 46E+08												1 29E+06	
935-937	8 26E+08									6 59E+06				
945-947	6 32E+08		2 56E+06						1 28E+06	2 56E+06				
955-957	6 76E+08	1 36E+06	1 36E+06											
965-967	1 00E+09			4 05E+06									2 02E+06	
975-977	5 38E+08		5 38E+06											2 15E+06
985-987	1 27E+09		2 58E+06										2 58E+06	
995-997	4 97E+08		1 00E+06										1 00E+06	
1005-1007	6 65E+08		2 68E+06							5 36E+06				
1015-1017	6 01E+08		2 43E+06										1 22E+06	
1025-1027	5 74E+08		3 48E+06	1 16E+06				1 16E+06					3 48E+06	
1035-1037	6 54E+08	3 99E+06	7 99E+06	1 33E+06					1 33E+06	5 32E+06				
1045-1047	8 95E+08													
1055-1057	5 93E+08								1 21E+06	2 42E+06			3 62E+06	
1079-1081	4 75E+08		2 86E+06							1 91E+06			9 53E+05	9 53E+05
1089-1091	7 81E+08	3 16E+06	3 16E+06							3 16E+06			3 16E+06	
1109-1111	5 30E+08									2 07E+06			1 03E+06	
1119-1121	9 23E+08													
1129-1131	5 21E+08		1 05E+06						2 10E+06				2 10E+06	
1139-1141	6 08E+08									2 41E+06				
1149-1151	7 84E+08		3 12E+06											1 56E+06
1169-1171	5 18E+08													
1179-1181	9 25E+08		1 83E+06										1 83E+06	1 83E+06
1189-1191	6 28E+08		3 71E+06											
1209-1211	5 74E+08	1 14E+06	1 14E+06											

Sample (cm below top of core)	<i>Actinocyclus splendens</i>	<i>Actinocyclus vulgaris</i>	<i>Actinocyclus</i> sp 1	<i>Amphora aculeuscula</i>	<i>Amphora coffeiformis</i>	<i>Amphora exigua</i>	<i>Amphora cf. helensis</i>	<i>Amphora maritima</i>	<i>Amphora pseudocylindrica</i>	<i>Amphora sirigosa</i>	<i>Amphora</i> sp 1	<i>Amphora</i> sp 2	<i>Amphora</i> sp 3	<i>Aulacoseira islandica</i>
5-7														
10-12														
20-22										8.25E+05				8.25E+05
30-32														
40-42		5.99E+05												
50-52					9.78E+05							9.78E+05		
60-62			1.35E+06											
70-72			1.65E+07		1.38E+06									
80-82														
90-92		7.51E+05					7.51E+05							7.51E+05
100-102		2.95E+06												
110-112		1.43E+06												
120-122														
130-132					1.35E+06									
183-185														
196-198				9.84E+05		1.97E+06								
206-208		1.14E+06					2.28E+06						2.28E+06	
216-218														
226-228														
236-238					6.17E+05									
246-248														
256-258														
266-268		6.77E+05			6.77E+05									
276-278														
286-288							7.97E+05							
305-307														
315-317					2.81E+06									
325-327			3.80E+05		7.60E+05									
335-337													1.54E+06	
345-347														
355-357		1.08E+06											1.08E+06	
365-367														
375-377					1.41E+06									
385-387														
395-397														
405-407					1.10E+06									
415-417													3.99E+05	
425-427		6.25E+05												
435-437														
445-447														
467-469										5.89E+05				
472-474													7.60E+05	
482-484					1.05E+06									
492-494													2.24E+06	
502-504														
512-514														
522-524							1.81E+06						9.04E+05	
532-534														
552-554														
562-564					1.35E+06									
582-584							1.54E+06							
592-594														2.08E+06
602-604					9.27E+05									
612-614					3.01E+06									
619-621					9.70E+05									
629-631														
639-641							1.03E+06							
649-651					1.96E+06									
659-661			3.41E+06											
669-671						2.40E+06								
679-681														
689-691														
699-701						1.82E+06								
709-711														
719-721										8.03E+05				
729-731														
739-741														
749-751														
759-761														
769-771														
783-785														
803-805			2.17E+06	2.17E+06										
813-815														3.23E+06

Sample (cm below top of core)	<i>Actinocyclus splendens</i>	<i>Actinocyclus vulgaris</i>	<i>Actinocyclus</i> sp 1	<i>Amphora acutiuscula</i>	<i>Amphora coffeiformis</i>	<i>Amphora exigua</i>	<i>Amphora cf. helenis</i>	<i>Amphora maritima</i>	<i>Amphora pseudohyalina</i>	<i>Amphora sirigosa</i>	<i>Amphora</i> sp 1	<i>Amphora</i> sp 2	<i>Amphora</i> sp 3	<i>Aulacoseira islandica</i>
823-825														7 38E+06
833-835									1 67E+06					3 34E+06
843-845		9 78E+05												3 91E+06
853-855														
863-865		3 20E+06							3 20E+06					
873-875														7 57E+06
883-885				6 75E+06										
893-895		6 51E+06			4 88E+06		3 26E+06							
913-915														
923-925														
925-927														
935-937		3 30E+06												
945-947					1 28E+06									
955-957		2 72E+06												
965-967						4 05E+06								
975-977						1 08E+06								
985-987				2 58E+06										
995-997		1 00E+06					2 00E+06		2 00E+06					
1005-1007								2 68E+06						
1015-1017					1 22E+06									
1025-1027														
1035-1037													1 33E+06	
1045-1047														
1055-1057						2 42E+06								
1079-1081				9 53E+05										
1089-1091														
1109-1111														
1119-1121						3 72E+06	3 72E+06							
1129-1131										1 05E+06				
1139-1141							4 83E+06							
1149-1151				1 56E+06		3 12E+06								
1169-1171														
1179-1181														
1189-1191							2 47E+06	1 24E+06						
1209-1211		5 72E+06			3 43E+06								2 29E+06	

Sample (cm below top of core)	<i>Aulacoseira luvata</i>	<i>Bacillaria paxillifer</i>	<i>Berkeleya rutilans</i>	<i>Brachysira brebissonii</i>	<i>Calones crassa</i>	<i>Calones cf. liber</i>	<i>Calones tenuis</i>	<i>Cocconeis costata</i> var. <i>costata</i>	<i>Cocconeis cf. distantula</i>	<i>Cocconeis placentalis</i>	<i>Cocconeis placentalis</i> var. <i>euglypta</i>	<i>Cocconeis scutellum</i>	<i>Cocconeis scutellum</i> var. <i>parva</i>	<i>Cocconeis</i> sp. 1
5-7		1 11E+06	1 11E+06											
10-12								7 49E+05						
20-22									8 25E+05					
30-32		3 70E+06						9 24E+05						
40-42								5 99E+05					5 99E+05	
50-52		9 78E+05						1 96E+06						
60-62		6 74E+05		6 74E+05					6 74E+05					
70-72								1 38E+06				2 76E+06		
80-82								1 23E+06				1 23E+06		
90-92		7 51E+05												
100-102				1 48E+06										
110-112				1 43E+06								2 86E+06		
120-122														
130-132														
183-185													2 56E+06	
196-198		9 84E+05		1 97E+06				1 97E+06					9 84E+05	
206-208		1 14E+06												
216-218														
226-228													1 13E+06	
236-238				1 18E+06				1 18E+06						
246-248													6 17E+05	
256-258				9 01E+05					9 01E+05					
266-268								6 77E+05		6 77E+05			6 77E+05	
276-278													2 59E+06	
286-288								7 97E+05	7 97E+05					
305-307		2 04E+06											2 04E+06	
315-317		1 41E+06						1 41E+06					1 41E+06	
325-327				7 60E+05								3 80E+05		
335-337												1 54E+06		
345-347		1 08E+06						1 08E+06					1 08E+06	
355-357								1 08E+06					1 08E+06	
365-367														
375-377								1 41E+06		1 41E+06		2 83E+06		
385-387													1 37E+06	1 37E+06
395-397												1 73E+06		
405-407		1 10E+06											1 10E+06	
415-417														
425-427													1 87E+06	
435-437								2 21E+06					1 11E+06	
445-447														
467-469			5 89E+05	5 89E+05				5 89E+05		5 89E+05		5 89E+05	5 89E+05	
472-474				7 60E+05									7 60E+05	
482-484								1 05E+06						
492-494													1 12E+06	
502-504				1 02E+06									1 02E+06	
512-514	3 05E+06													
522-524				9 04E+05				9 04E+05						
532-534														
552-554													1 95E+06	
562-564		1 35E+06						2 70E+06						
582-584													7 72E+05	
592-594								2 08E+06		2 08E+06		2 08E+06	4 15E+06	
602-604												9 27E+05		
612-614													1 50E+06	
619-621				9 70E+05				9 70E+05					9 70E+05	
629-631													9 98E+05	2 99E+06
639-641				5 15E+05										
649-651														
659-661													3 41E+06	
669-671													2 40E+06	
679-681		2 29E+06											1 15E+06	
689-691				1 17E+06								5 86E+05		
699-701								1 82E+06						
709-711	2 98E+06	1 49E+06											1 49E+06	
719-721		8 03E+05							8 03E+05					
729-731									9 80E+05			9 80E+05		
739-741													1 08E+06	
749-751										1 31E+06				
759-761											6 57E+05			
769-771		3 17E+06		2 11E+06										
783-785		1 93E+06						3 86E+06						
803-805				4 34E+06									2 17E+06	2 17E+06
813-815		1 62E+06		3 23E+06						1 62E+06			4 85E+06	

Sample (cm below top of core)	<i>Aulacoseira lirata</i>	<i>Bacillaria paxillifer</i>	<i>Berkeleya rutilans</i>	<i>Brachysira brehussonii</i>	<i>Caloneis crassa</i>	<i>Caloneis cf. liber</i>	<i>Caloneis tenuis</i>	<i>Cocconeis costata</i> var. <i>costata</i>	<i>Cocconeis cf. distantula</i>	<i>Cocconeis placentula</i>	<i>Cocconeis placentula</i> var. <i>egyptia</i>	<i>Cocconeis scutellum</i>	<i>Cocconeis scutellum</i> var. <i>parva</i>	<i>Cocconeis</i> sp. 1
823-825				1 84E+06							1 84E+06	1 84E+06		
833-835			1 67E+06											
843-845		1 96E+06		9 78E+05								9 78E+05	1 96E+06	
853-855													1 05E+06	
863-865										3 20E+06				
873-875				1 89E+06				1 89E+06		3 79E+06			1 89E+06	
883-885		1 35E+06											4 05E+06	
893-895								4 88E+06						
913-915											1 27E+06			
923-925		7 57E+05		7 57E+05									2 27E+06	
925-927		1 29E+06		1 29E+06									1 29E+06	
935-937													1 65E+06	
945-947		1 28E+06		1 28E+06				1 28E+06					1 28E+06	
955-957							2 72E+06			2 72E+06				
965-967				6 07E+06				4 05E+06						
975-977														
985-987													2 58E+06	
995-997													3 01E+06	
1005-1007				1 34E+06									2 68E+06	
1015-1017				2 43E+06				1 22E+06					1 22E+06	
1025-1027		3 48E+06		1 16E+06									1 16E+06	
1035-1037		7 99E+06												
1045-1047														
1055-1057		2 42E+06						1 21E+06		1 21E+06				
1079-1081													9 53E+05	
1089-1091		3 16E+06	3 16E+06									1 58E+06	1 58E+06	
1109-1111								1 03E+06						
1119-1121														
1129-1131		1 05E+06				2 10E+06							2 10E+06	
1139-1141		1 21E+06												
1149-1151				1 56E+06										
1169-1171													3 14E+06	
1179-1181		1 83E+06						1 83E+06	1 83E+06					
1189-1191		1 24E+06		1 24E+06				1 24E+06					2 47E+06	
1209-1211				4 58E+06									2 29E+06	

Sample (cm below top of core)	<i>Oocoonas</i> sp 2	<i>Oocoonas</i> sp 3	<i>Cocconeis radiatus</i>	<i>Cocconeis</i> sp 1	<i>Criticaula halophila</i>	<i>Ctenophora pulchella</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella luorialis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>	<i>Cyclotella tripartita</i>	<i>Cymbella delicatula</i>	<i>Diatoma mesodon</i>
5-7							6 68E+06	1 10E+08						
10-12			3 00E+06				1 50E+06	7 04E+07	7 49E+05					
20-22			8 25E+05				3 30E+06	8 17E+07	1 65E+06					
30-32			9 24E+05					6 75E+07	1 85E+06				1 85E+06	
40-42			1 20E+06				1 20E+06	7 43E+07						
50-52			2 93E+06				9 78E+05	1 49E+08	9 78E+05					
60-62			6 74E+05					6 60E+07	2 02E+06					
70-72			2 76E+06					1 65E+08	1 38E+06					
80-82							1 23E+06	1 58E+08						
90-92							1 50E+06	7 06E+07	7 51E+05			1 50E+06		
100-102							1 48E+06	1 99E+08	8 85E+06					
110-112							4 28E+06	1 54E+08	2 86E+06					
120-122			8 44E+05					7 60E+07	8 44E+05				8 44E+05	
130-132			1 35E+06				1 35E+06	1 73E+08	1 35E+06					
183-185								1 39E+08						
196-198			3 94E+06				2 95E+06	8 56E+07	6 89E+06				9 84E+05	
206-208			2 28E+06				2 28E+06	6 03E+07	1 14E+06					
216-218					2 70E+06		2 70E+06	1 44E+08						
226-228							5 66E+05	9 34E+07						
236-238			1 18E+06				2 37E+06	9 95E+07						
246-248							3 09E+06	7 35E+07	1 85E+06					
256-258			9 01E+05					1 01E+08	1 80E+06				9 01E+05	
266-268			2 03E+06				2 03E+06	8 26E+07	6 77E+05					
276-278					1 29E+06		2 59E+06	9 05E+07	5 17E+06					
286-288								8 77E+07			7 97E+05			
305-307								3 66E+07			2 04E+06			
315-317			4 22E+06				2 81E+06	9 28E+07	1 41E+06					
325-327							7 60E+05	5 02E+07	1 14E+06					
335-337							3 08E+06	1 40E+08	4 62E+06					
345-347					1 08E+06		1 08E+06	1 12E+08	5 40E+06					
355-357			1 08E+06					7 87E+07	7 55E+06					
365-367			1 72E+06					1 70E+08						
375-377								1 03E+08						
385-387			1 37E+06				2 74E+06	7 26E+07						
395-397			3 46E+06	1 73E+06				7 09E+07						
405-407			1 10E+06				2 20E+06	8 34E+07	3 29E+06					
415-417							2 39E+06	3 99E+07			3 99E+05			
425-427								6 06E+07						
435-437							2 21E+06	7 31E+07	1 11E+06					
445-447		1 36E+06					5 43E+06	1 34E+08						
467-469			5 89E+05				2 36E+06	4 59E+07						
472-474				7 60E+05			1 52E+06	5 78E+07						
482-484			1 05E+06		2 10E+06		2 10E+06	9 35E+07	1 05E+06		1 05E+06			
492-494			1 12E+06				3 36E+06	8 73E+07	1 12E+06					
502-504			1 02E+06				4 07E+06	6 10E+07	1 02E+06		2 03E+06			
512-514							6 10E+06	4 27E+07						
522-524			9 04E+05		9 04E+05		9 04E+05	5 96E+07	9 04E+05		1 81E+06			
532-534				1 02E+06				7 93E+07	2 03E+06					
552-554				1 95E+06				9 92E+07	3 89E+06					
562-564			1 35E+06		1 35E+06		1 35E+06	5 66E+07			1 35E+06			
582-584	7 72E+05							2 93E+07						
592-594			4 15E+06					8 10E+07						
602-604			1 85E+06					5 56E+07	1 85E+06					
612-614			1 50E+06				3 01E+06	6 31E+07						
619-621							1 94E+06	3 24E+07						
629-631			9 98E+05				2 99E+06	6 98E+07	9 98E+05					
639-641			5 15E+05				5 15E+05	3 09E+07						
649-651			1 96E+06				1 96E+06	4 90E+07						
659-661							4 54E+06	6 13E+07	4 54E+06					
669-671			7 21E+06				2 40E+06	7 69E+07	7 21E+06					
679-681								5 16E+07	5 73E+06					
689-691			5 86E+05					4 28E+07	1 76E+06					
699-701			1 82E+06				3 64E+06	1 22E+08	1 82E+06					
709-711				1 49E+06			7 44E+06	1 18E+08						
719-721			1 61E+06					6 75E+07	8 03E+05					
729-731			9 80E+05	1 96E+06	9 80E+05			1 00E+08	4 90E+06					
739-741			5 42E+05		1 08E+06		1 63E+06	3 53E+07						
749-751			1 31E+06				1 31E+06	6 43E+07	2 63E+06					
759-761			6 57E+05	2 63E+06	6 57E+05		1 97E+06	5 06E+07			6 57E+05	6 57E+05		
769-771				1 06E+06	1 06E+06		1 06E+07	8 23E+07	4 22E+06		2 74E+07			
783-785					3 86E+06		5 79E+06	9 27E+07	3 86E+06				1 93E+06	
803-805			4 34E+06				4 34E+06	1 69E+08	6 51E+06	4 34E+06				
813-815			3 23E+06	1 62E+06			3 23E+06	1 28E+08	1 62E+06		3 23E+06			

Sample (cm below top of core)	<i>Cocconeis</i> sp 2	<i>Cocconeis</i> sp 3	<i>Cocconeis radiatus</i>	<i>Cocconeis</i> sp 1	<i>Craticula halophila</i>	<i>Ctenophora pulchella</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella luorals</i>	<i>Cyclotella pseudostellata</i>	<i>Cyclotella stelligra</i>	<i>Cyclotella wrightii</i>	<i>Cymbella delicatula</i>	<i>Diatoma mesodon</i>
823-825			5 53E+06				3 69E+06	1 51E+08	5 53E+06					
833-835								4 68E+07						
843-845			9 78E+05					5 28E+07	3 91E+06					
853-855			3 14E+06				1 05E+06	6 17E+07						
863-865							6 41E+06	6 57E+07	1 60E+06					
873-875			1 89E+06					1 02E+08	1 89E+06					
883-885			1 35E+06	2 70E+06				3 51E+07	5 40E+06		1 35E+06			
893-895				1 63E+06		1 63E+06	9 77E+06	7 65E+07			1 63E+06			
913-915			5 08E+06					5 46E+07						
923-925			7 57E+05				6 81E+06	5 60E+07	7 57E+05					
925-927			1 29E+06	1 29E+06			6 44E+06	5 66E+07						
935-937			3 30E+06				3 30E+06	3 46E+07	4 95E+06					
945-947			1 28E+06				7 67E+06	6 27E+07	1 28E+06					
955-957							5 44E+06	4 22E+07	2 72E+06					
965-967			4 05E+06				1 21E+07	8 09E+07						
975-977			5 38E+06					2 58E+07	2 15E+06					
985-987			5 16E+06	2 58E+06			1 29E+07	7 49E+07						
995-997			3 01E+06				7 01E+06	4 71E+07			1 00E+06			
1005-1007							5 36E+06	4 82E+07	1 34E+06					
1015-1017			2 43E+06			2 43E+06	2 19E+07	8 38E+07	3 65E+06					
1025-1027					1 16E+06		8 11E+06	4 29E+07						
1035-1037				1 33E+06				3 73E+07						1 33E+06
1045-1047			1 79E+06				8 97E+06	2 87E+07	1 79E+06			3 59E+06		
1055-1057			1 21E+06		1 21E+06		4 83E+06	2 78E+07	1 21E+06					
1079-1081			9 53E+05				2 86E+06	2 38E+07	2 86E+06					
1089-1091							1 58E+06	3 64E+07	1 74E+07					
1109-1111			2 07E+06	1 03E+06			1 97E+07	4 14E+07		4 14E+06	1 97E+07			
1119-1121			7 43E+06	1 86E+06			3 72E+06	1 67E+07		1 86E+06				
1129-1131			1 05E+06				4 21E+06	2 63E+07						
1139-1141			2 41E+06				8 45E+06	2 78E+07	1 21E+06					
1149-1151			1 56E+06				3 12E+06	4 05E+07	6 23E+06					
1169-1171							1 05E+06	1 88E+07	2 09E+06					
1179-1181				1 83E+06			3 67E+06	4 40E+07						
1189-1191			3 71E+06				4 95E+06	1 24E+07	7 42E+06					
1209-1211			1 14E+06	1 14E+06			3 43E+06	3 43E+07	1 14E+06					

Sample (cm below top of core)	<i>Diatoma moniliformis</i>	<i>Diatoma</i> sp 1	<i>Diatoma</i> sp 2	<i>Diatomella cf. minuta</i>	<i>Diatomella</i> sp 1	<i>Diploneis cf. vacillans</i>	<i>Encyonema hebradicum</i>	<i>Encyonema minutum</i>	<i>Encyonema paucistriatum</i>	<i>Encyonema silicicolum</i>	<i>Eunotha cf. bilunata</i>	<i>Eunotha lapponica</i>	<i>Eunotha praerupta</i>	<i>Eunotha aff. veneris</i>
5-7														
10-12														
20-22														
30-32	9 24E+05												9 24E+05	
40-42														
50-52														
60-62									1 35E+06					
70-72														
80-82														
90-92													7 51E+05	
100-102														
110-112														
120-122					8 44E+05				8 44E+05	8 44E+05				
130-132														
183-185													1 28E+06	
196-198										1 97E+06				
206-208														
216-218	1 35E+06													
226-228														
236-238										2 37E+06				
246-248														
256-258										5 41E+06				
266-268														
276-278														
286-288														
305-307														
315-317														
325-327									3 80E+05	3 80E+05				
335-337		1 54E+06							1 54E+06	3 08E+06				
345-347														
355-357										1 08E+06				
365-367	1 72E+06													
375-377										4 24E+06				
385-387														
395-397														
405-407														
415-417						7 97E+05								
425-427										2 50E+06	6 25E+05			
435-437														
445-447										6 79E+06				
467-469					5 89E+05				5 89E+05				5 89E+05	
472-474														
482-484														
492-494														
502-504		1 02E+06					1 02E+06			4 07E+06				
512-514														
522-524										2 71E+06				
532-534														
552-554					3 89E+06									
562-564														
582-584														
592-594														
602-604														
612-614														
619-621	9 70E+05													
629-631							9 98E+05							
639-641														
649-651														
659-661											2 27E+06			
669-671														
679-681										2 29E+06		1 15E+06	1 15E+06	
689-691						5 86E+05								
699-701										7 27E+06				
709-711							2 98E+06							
719-721														
729-731														
739-741				1 08E+06			5 42E+05			2 71E+06				
749-751							2 63E+06			5 25E+06				
759-761											6 57E+05			
769-771	2 11E+06													
783-785				3 86E+06										
803-805														
813-815						1 62E+06	3 23E+06	3 23E+06						

Sample (cm below top of core)	<i>Diatoma moniliformis</i>	<i>Diatoma</i> sp 1	<i>Diatoma</i> sp 2	<i>Diatomella cf. minuta</i>	<i>Diatomella</i> sp 1	<i>Diploneis cf. vacillans</i>	<i>Encyonema hybridum</i>	<i>Encyonema minutum</i>	<i>Encyonema paucistratum</i>	<i>Encyonema silvestrii</i>	<i>Eunotia cf. bilunaris</i>	<i>Eunotia lapponica</i>	<i>Eunotia praerupta</i>	<i>Eunotia aff. venteris</i>
823-825									5.53E+06					
833-835						3.34E+06								
843-845														
853-855														
863-865										3.20E+06				
873-875							3.79E+06			7.57E+06	1.89E+06			
883-885											1.35E+06			
893-895														
913-915						1.27E+06								
923-925										1.51E+06				
925-927										7.72E+06				
935-937														
945-947										5.12E+06		1.28E+06		
955-957														
965-967											4.05E+06			
975-977	1.08E+06													2.15E+06
985-987													5.16E+06	
995-997	1.00E+06						1.00E+06				2.00E+06			
1005-1007														
1015-1017	1.22E+06													
1025-1027														
1035-1037														
1045-1047										3.59E+06				
1055-1057	1.21E+06					1.21E+06				8.46E+06				
1079-1081														
1089-1091												1.58E+06		
1109-1111										3.10E+06				
1119-1121										3.72E+06				
1129-1131												1.05E+06		
1139-1141						1.21E+06							1.21E+06	
1149-1151														
1169-1171												1.05E+06		
1179-1181												1.83E+06		
1189-1191										4.95E+06				
1209-1211														

Sample (cm below top of core)	<i>Eunotia</i> sp 1	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 3	<i>Eunotia</i> sp 4	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 6	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 8	<i>Eunotia</i> sp 9	<i>Eunotia</i> sp 10	<i>Eunotia</i> sp 11	<i>Eunotia</i> sp 12	<i>Eunotia</i> sp 13	<i>Eunotia</i> sp 14
5-7	1 11E+06													
10-12		7 49E+05	7 49E+05											
20-22					8 25E+05									
30-32					1 85E+06	4 62E+06		1 85E+06		9 24E+05				
40-42	5 99E+05				1 20E+06									
50-52			9 78E+05	9 78E+05										9 78E+05
60-62					6 74E+05	6 74E+05								
70-72		2 76E+06			1 38E+06		1 38E+06							
80-82					1 23E+06	1 23E+06	1 23E+06							
90-92			1 50E+06	7 51E+05	7 51E+05			7 51E+05						
100-102			1 48E+06		2 95E+06									
110-112	1 43E+06				1 43E+06			1 43E+06	1 43E+06	1 43E+06				
120-122							1 69E+06			1 69E+06	8 44E+05			
130-132		2 70E+06												1 35E+06
183-185					1 28E+06									
196-198					2 95E+06					2 95E+06				9 84E+05
206-208							1 14E+06							
216-218					5 39E+06									
226-228		5 66E+05	5 66E+05	1 13E+06	5 66E+05					5 66E+05	5 66E+05			
236-238		2 37E+06		1 18E+06			1 18E+06			1 18E+06				
246-248			1 23E+06	6 17E+05	6 17E+05		6 17E+05	6 17E+05		1 23E+06				6 17E+05
256-258	9 01E+05				1 80E+06		9 01E+05							9 01E+05
266-268					6 77E+05									
276-278					3 88E+06		1 29E+06							
286-288		2 39E+06			2 39E+06		7 97E+05							
305-307					4 07E+06		4 07E+06			2 04E+06	4 07E+06			
315-317					1 41E+06					1 41E+06				
325-327					7 60E+05					7 60E+05				
335-337	1 54E+06				1 54E+06									
345-347					1 08E+06		2 16E+06				1 08E+06			
355-357							2 16E+06				1 08E+06			
365-367		1 72E+06			1 72E+06									
375-377							2 83E+06							
385-387		1 37E+06			1 37E+06									
395-397					5 19E+06									
405-407					1 10E+06					2 20E+06				
415-417		3 99E+05	3 99E+05	3 99E+05										
425-427		1 25E+06								1 25E+06				
435-437		1 11E+06			1 11E+06					3 32E+06	1 11E+06			
445-447					1 36E+06		1 36E+06							
467-469		5 89E+05			1 77E+06					5 89E+05		5 89E+05		
472-474					2 28E+06	7 60E+05								
482-484	1 05E+06				1 05E+06	1 05E+06								1 05E+06
492-494														1 12E+06
502-504					5 08E+06		1 02E+06				1 02E+06			
512-514														
522-524							9 04E+05		9 04E+05					1 81E+06
532-534	1 02E+06									1 02E+06				1 02E+06
552-554											3 89E+06			
562-564			1 35E+06	1 35E+06						2 70E+06				
582-584						7 72E+05	7 72E+05							
592-594					2 08E+06					2 08E+06				
602-604		9 27E+05					1 85E+06			3 71E+06				
612-614		3 01E+06	1 50E+06	3 01E+06			3 01E+06				1 50E+06			
619-621		9 70E+05												
629-631		2 00E+06			2 99E+06									
639-641	5 15E+05		5 15E+05		1 03E+06		1 03E+06			5 15E+05		5 15E+05		
649-651														
659-661						1 14E+06	1 14E+06			2 27E+06				
669-671	4 81E+06													
679-681		1 15E+06												
689-691							5 86E+05		5 86E+05	5 86E+05				
699-701							1 82E+06							
709-711		1 49E+06		1 49E+06			1 49E+06				1 49E+06			
719-721		8 03E+05												
729-731		9 80E+05	9 80E+05	9 80E+05			9 80E+05			9 80E+05				
739-741		5 42E+05		1 08E+06							1 08E+06			
749-751		1 31E+06	1 31E+06											
759-761			6 57E+05	6 57E+05			6 57E+05			1 31E+06	6 57E+05	6 57E+05	6 57E+05	
769-771		2 11E+06	1 06E+06	1 06E+06						5 28E+06				
783-785							1 93E+06			1 93E+06				
803-805			2 17E+06	2 17E+06										
813-815		1 62E+06					1 62E+06							

Sample (cm below top of core)	<i>Eunotia</i> sp 1	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 3	<i>Eunotia</i> sp 4	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 6	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 8	<i>Eunotia</i> sp 9	<i>Eunotia</i> sp 10	<i>Eunotia</i> sp 11	<i>Eunotia</i> sp 12	<i>Eunotia</i> sp 13	<i>Eunotia</i> sp 14
823-825	1 84E+06		1 84E+06		5 53E+06		1 84E+06			3 69E+06				
833-835				1 67E+06			1 67E+06							
843-845			9 78E+05											
853-855					4 18E+06		3 14E+06	2 09E+06						
863-865					1 60E+06		3 20E+06							3 20E+06
873-875						1 89E+06	1 89E+06	1 89E+06					1 89E+06	
883-885							1 35E+06			2 70E+06				
893-895	1 63E+06				3 26E+06					3 26E+06				
913-915			1 27E+06											1 27E+06
923-925			7 57E+05				5 30E+06							
925-927			6 44E+06							1 29E+06				
935-937			3 30E+06										3 30E+06	
945-947													1 28E+06	
955-957														
965-967					1 01E+07									
975-977					3 23E+06				2 15E+06					
985-987			2 58E+06				2 58E+06			5 16E+06				
995-997			1 00E+06		1 00E+06			1 00E+06		2 00E+06				
1005-1007				2 68E+06						2 68E+06				
1015-1017			2 43E+06											
1025-1027					4 64E+06									
1035-1037							1 33E+06				1 33E+06			
1045-1047														
1055-1057			2 42E+06				2 42E+06	1 21E+06						
1079-1081			9 53E+05											
1089-1091														
1109-1111	1 03E+06		2 07E+06											
1119-1121														
1129-1131			1 05E+06					1 05E+06		1 05E+06				
1139-1141										3 62E+06				
1149-1151			1 56E+06		3 12E+06									
1169-1171							2 09E+06			1 05E+06				
1179-1181			1 83E+06		1 83E+06		3 67E+06							
1189-1191	1 24E+06				1 24E+06			2 47E+06						
1209-1211			1 14E+06		2 29E+06					1 14E+06			1 14E+06	

Sample (cm below top of core)	<i>Eunotia</i> sp 15	<i>Eunotia</i> sp 16	<i>Eunotia</i> sp 17	<i>Fallacia littoralis</i>	<i>Fallacia solapunctata</i>	<i>Fallacia tschuktschorum</i>	<i>Fallacia</i> sp 1	<i>Fallacia</i> sp 2	<i>Fragilaria costriensis</i> var. <i>costriensis</i>	<i>Fragilaria cf. costriensis</i> var. <i>pumila</i>	<i>Fragilaria cyclophum</i>	<i>Fragilaria famelica</i>	<i>Fragilaria cf. tenera</i>	<i>Fragilaria vaucheriae</i>
5-7										1 11E+06				
10-12							7 49E+05							1 50E+06
20-22														
30-32				9 24E+05	9 24E+05									
40-42														
50-52								9 78E+05						
60-62					6 74E+05									
70-72	1 38E+06			1 38E+06										
80-82														
90-92					7 51E+05									
100-102					1 48E+06									
110-112														
120-122					1 69E+06									
130-132														
183-185					2 56E+06									
196-198														1 97E+06
206-208														
216-218														
226-228								5 66E+05						
236-238					1 18E+06							2 37E+06		
246-248		6 17E+05						6 17E+05						
256-258							9 01E+05							
266-268					6 77E+05									
276-278								1 29E+06						
286-288								1 59E+06	7 97E+05					
305-307					2 04E+06									
315-317					1 41E+06									
325-327							7 60E+05							
335-337														
345-347	1 08E+06													
355-357														
365-367														
375-377														
385-387					1 37E+06									
395-397					1 73E+06									
405-407														1 10E+06
415-417					3 99E+05			3 99E+05						3 99E+05
425-427														
435-437														
445-447														
467-469							5 89E+05							
472-474														
482-484														
492-494														
502-504														
512-514														
522-524					9 04E+05								9 04E+05	
532-534														
552-554														
562-564			1 35E+06		2 70E+06									
582-584					7 72E+05									
592-594														
602-604					1 85E+06									
612-614														
619-621		9 70E+05												
629-631			9 98E+05											
639-641	5 15E+05	5 15E+05	5 15E+05											
649-651				1 96E+06				1 96E+06						
659-661		1 14E+06												
669-671										4 81E+06				
679-681				1 15E+06	1 15E+06					1 15E+06				
689-691							5 86E+05				5 86E+05			
699-701		1 82E+06		1 82E+06										
709-711					1 49E+06									
719-721					8 03E+05			8 03E+05						
729-731					9 80E+05									
739-741		1 08E+06												5 42E+05
749-751				1 31E+06										1 31E+06
759-761							6 57E+05						6 57E+05	
769-771														
783-785					1 93E+06									
803-805								2 17E+06						
813-815														

Sample (cm below top of core)	<i>Eunotia</i> sp 15	<i>Eunotia</i> sp 16	<i>Eunotia</i> sp 17	<i>Fallacia litorea</i>	<i>Fallacia solapunctata</i>	<i>Fallacia tschuktschorum</i>	<i>Fallacia</i> sp 1	<i>Fallacia</i> sp 2	<i>Fragilaria costuensis</i> var <i>costuensis</i>	<i>Fragilaria</i> cf. <i>costuensis</i> var. <i>pumila</i>	<i>Fragilaria cyclopus</i>	<i>Fragilaria famelica</i>	<i>Fragilaria</i> cf. <i>tenera</i>	<i>Fragilaria vaucheriae</i>
823-825														
833-835														
843-845														
853-855														
863-865														
873-875													1 89E+06	
883-885														
893-895								1 63E+06						
913-915		1 27E+06												
923-925	7 57E+05													
925-927														
935-937														
945-947														
955-957													2 72E+06	2 72E+06
965-967														
975-977								2 15E+06						
985-987													2 58E+06	
995-997												1 00E+06		
1005-1007														
1015-1017					2 43E+06		2 43E+06							
1025-1027				1 16E+06										
1035-1037														
1045-1047														
1055-1057														
1079-1081		9 53E+05												
1089-1091						3 16E+06								
1109-1111		2 07E+06												
1119-1121														
1129-1131					1 05E+06									
1139-1141														
1149-1151														
1169-1171					1 05E+06									
1179-1181														
1189-1191					1 24E+06									
1209-1211														1 14E+06

Sample (cm below top of core)	<i>Fragilaria</i> sp 1	<i>Fragilaria</i> sp 2	<i>Fragilaria</i> sp 3	<i>Fragilaropsis</i> cylindricus	<i>Fragilaropsis</i> cylindrus	<i>Fragilaropsis</i> oceanica	<i>Fragilaropsis</i> pseudonana	<i>Frustulia</i> krameri	<i>Frustulia</i> rhomboides	<i>Frustulia</i> saxonica	<i>Gomphonema</i> parvulum	<i>Gomphonema</i> sp 1	<i>Gomphonopsis</i> obscurum	<i>Gramatophora</i> marna
5-7				1 11E+06			7 79E+06				1 11E+06			
10-12				5 24E+06	3 75E+06									
20-22				4 95E+06	1 65E+06		8 25E+05		8 25E+05					
30-32				9 24E+05			9 24E+05							
40-42				3 00E+06	5 99E+05				5 99E+05		5 99E+05	5 99E+05		
50-52				9 78E+05	9 78E+05		1 96E+06							
60-62					3 37E+06		6 74E+05							1 35E+06
70-72					2 89E+07		4 13E+06							
80-82				1 23E+06			1 23E+06							
90-92				1 50E+06										
100-102				8 85E+06	4 43E+06		2 95E+06							
110-112				1 43E+06	1 00E+07			1 43E+06						
120-122					1 69E+06									
130-132				5 39E+06	2 70E+06		4 05E+06		1 35E+06					
183-185				7 68E+06	1 28E+06									
196-198				4 92E+06			9 84E+05	1 97E+06		9 84E+05				
206-208				4 55E+06			2 28E+06	1 14E+06						
216-218					5 39E+06						1 35E+06			
226-228				2 83E+06	1 13E+06		1 13E+06					5 66E+05		
236-238				2 37E+06	2 37E+06		1 18E+06	1 18E+06			2 37E+06			
246-248				6 17E+05	6 17E+05		6 17E+05							
256-258					1 80E+06			2 70E+06						
266-268				4 06E+06	1 35E+06		6 77E+05							
276-278				7 76E+06										2 59E+06
286-288				3 19E+06	1 04E+07									
305-307							2 04E+06							
315-317				1 41E+06					1 41E+06					
325-327				3 80E+05	3 80E+05									
335-337				3 08E+06										
345-347				1 08E+06	6 48E+06			2 16E+06						2 16E+06
355-357				4 31E+06			1 08E+06	2 16E+06						
365-367				3 43E+06										3 43E+06
375-377				1 41E+06										2 83E+06
385-387				2 74E+06	1 37E+06									
395-397							1 73E+06	1 73E+06	1 73E+06					
405-407								1 10E+06						
415-417							3 99E+05		7 97E+05					
425-427				6 25E+05	6 25E+05		6 25E+05	1 25E+06						
435-437				3 32E+06			1 11E+06							
445-447				2 72E+06			4 07E+06							
467-469				5 89E+05										
472-474				7 60E+05	7 60E+05		1 52E+06							
482-484				2 10E+06	4 20E+06									
492-494				2 24E+06	1 12E+06									
502-504				1 02E+06			1 02E+06							
512-514				6 10E+06										
522-524				2 71E+06			9 04E+05		9 04E+05					
532-534					1 02E+06		1 02E+06							
552-554				1 95E+06			1 95E+06							
562-564														
582-584										7 72E+05				
592-594							2 08E+06							
602-604									9 27E+05					
612-614							1 50E+06						1 50E+06	
619-621	9 70E+05			9 70E+05			9 70E+05	1 94E+06						
629-631				9 98E+05					2 00E+06					2 00E+06
639-641										5 15E+05				
649-651														
659-661														
669-671				2 40E+06			4 81E+06		2 40E+06					4 81E+06
679-681				2 29E+06	1 15E+06					1 15E+06				2 29E+06
689-691					1 17E+06	5 86E+05				5 86E+05				
699-701				1 82E+06			1 82E+06			1 82E+06				
709-711	2 98E+06													
719-721				2 41E+06	8 03E+05									
729-731				3 92E+06			2 94E+06			1 96E+06				
739-741				2 71E+06			1 63E+06	5 42E+05		5 42E+05				
749-751				6 56E+06										
759-761				3 28E+06										
769-771				2 11E+06		1 06E+06	1 06E+06							
783-785							1 93E+06							
803-805				2 17E+06										
813-815														

Sample (cm below top of core)	<i>Fragilaria</i> sp 1	<i>Fragilaria</i> sp 2	<i>Fragilaria</i> sp 3	<i>Fragilariopsis cylindriciformis</i>	<i>Fragilariopsis cylindrus</i>	<i>Fragilariopsis oceanica</i>	<i>Fragilariopsis pseudonana</i>	<i>Frustulia krammeri</i>	<i>Frustulia rhomboides</i>	<i>Frustulia saxonica</i>	<i>Gomphonema parvulum</i>	<i>Gomphonema</i> sp 1	<i>Gomphonemopsis obscurum</i>	<i>Gramatophora marina</i>
823-825				5 53E+06					1 84E+06					
833-835														
843-845						1 96E+06			2 93E+06					
853-855				1 05E+06	1 05E+06						2 09E+06			
863-865				1 60E+06	1 60E+06									
873-875				7 57E+06							3 79E+06			
883-885				1 35E+06										2 70E+06
893-895				3 26E+06					3 26E+06					
913-915														
923-925														
925-927				1 29E+06			2 57E+06		1 29E+06		2 57E+06			
935-937							3 30E+06							
945-947								2 56E+06	2 56E+06					
955-957								2 72E+06						
965-967														
975-977				1 08E+06			1 08E+06				2 15E+06			
985-987								2 58E+06						
995-997				2 00E+06										
1005-1007				5 36E+06				2 68E+06						2 68E+06
1015-1017				1 22E+06										
1025-1027				2 32E+06		1 16E+06			1 16E+06					
1035-1037							1 33E+06							
1045-1047														
1055-1057							3 62E+06	1 21E+06		2 42E+06				
1079-1081													2 86E+06	1 91E+06
1089-1091				1 58E+06						1 58E+06				
1109-1111								1 03E+06		1 03E+06				
1119-1121				3 72E+06										1 86E+06
1129-1131					1 05E+06			1 05E+06						1 05E+06
1139-1141							1 21E+06	1 21E+06					2 41E+06	
1149-1151				1 56E+06										
1169-1171				1 05E+06	1 05E+06		1 05E+06						2 09E+06	
1179-1181			1 83E+06					1 83E+06						
1189-1191				2 47E+06									1 24E+06	
1209-1211										1 14E+06				

Sample (cm below top of core)	<i>Grammatophora oceanica</i>	<i>Gyrodinium cf. arcticum</i> var. <i>subglaciale</i>	<i>Gyrodinium ballianum</i>	<i>Gyrodinium</i> sp. 1	<i>Hantzschia arvensis</i>	<i>Hantzschia crucigeroides</i>	<i>Hyalodiscus scoticus</i>	<i>Maryanna atomus</i>	<i>Maryanna maritima</i>	<i>Maryanna cf. schultzei</i>	<i>Mastogloia pumila</i>	<i>Melosira arenata</i>	<i>Melosira nummellonides</i>	<i>Melosira varians</i>
5-7							1.11E+06	1.11E+06						
10-12														
20-22	1.65E+06								8.25E+05					
30-32														
40-42								1.20E+06	1.80E+06	5.99E+05				
50-52														
60-62								6.74E+05	5.39E+06	1.35E+06				
70-72									1.38E+07					
80-82	2.46E+06	1.23E+06					1.23E+06	3.69E+06	2.46E+06					
90-92							7.51E+05	3.00E+06	1.50E+06	4.51E+06				
100-102	1.48E+06						1.48E+06	7.38E+06						
110-112									2.86E+06					
120-122								5.06E+06		1.69E+06				
130-132								5.39E+06				1.35E+06		
183-185		1.28E+06						2.56E+06	5.12E+06				5.12E+06	
196-198									3.94E+06			9.84E+05		
206-208							2.28E+06	3.41E+06	4.55E+06					
216-218								4.04E+06	1.21E+07					
226-228								2.27E+06						
236-238					2.37E+06									
246-248								1.23E+06						
256-258	9.01E+05							3.60E+06						
266-268	6.77E+05								2.71E+06			6.77E+05		
276-278		1.29E+06					1.29E+06	3.88E+06				2.59E+06	2.59E+06	
286-288								3.98E+06	9.56E+06					
305-307														
315-317									2.81E+06	1.41E+06				
325-327								1.14E+06			3.80E+05	3.80E+05		
335-337	3.08E+06													
345-347	1.08E+06							2.16E+06	3.24E+06					
355-357	3.23E+06											1.08E+06	2.16E+06	
365-367												3.43E+06		
375-377									2.83E+06			2.83E+06		
385-387	2.74E+06													
395-397								6.91E+06	1.73E+06			1.73E+06		
405-407	1.10E+06							2.20E+06	2.20E+06					
415-417	3.99E+05						3.99E+05	3.99E+05				3.99E+05		
425-427	1.25E+06							1.25E+06	1.25E+06			6.25E+05		
435-437	2.21E+06			1.11E+06										
445-447													1.36E+06	
467-469									1.18E+06					
472-474							7.60E+05	1.52E+06	6.08E+06					
482-484						1.05E+06		1.05E+06						
492-494							1.12E+06	1.12E+06						
502-504			1.02E+06					3.05E+06	3.05E+06	1.02E+06		1.02E+06		
512-514														
522-524	9.04E+05		9.04E+05					9.04E+05						
532-534								1.02E+06				2.03E+06		
552-554									3.89E+06					
562-564							1.35E+06							
582-584	1.54E+06								6.17E+06				1.54E+06	
592-594	2.08E+06							2.08E+06	6.23E+06				2.08E+06	
602-604								9.27E+05	9.27E+05	1.85E+06	9.27E+05			
612-614	3.01E+06						1.50E+06		4.51E+06					
619-621								1.94E+06	1.94E+06			9.70E+05		
629-631	2.00E+06							2.00E+06	2.00E+06			9.98E+05		
639-641									1.54E+06					
649-651							1.96E+06		5.88E+06				1.96E+06	
659-661	2.27E+06							5.68E+06						
669-671						2.40E+06		2.40E+06	1.20E+07			2.40E+06		
679-681								2.29E+06				2.29E+06		
689-691	1.17E+06							1.17E+06	4.69E+06			1.17E+06		
699-701									1.82E+06					
709-711	1.49E+06							2.98E+06				1.49E+06		
719-721									8.03E+05			3.21E+06		
729-731								1.96E+06	1.96E+06					
739-741								2.71E+06						
749-751								3.94E+06	2.63E+06					
759-761														
769-771	2.11E+06							1.06E+06	2.11E+06			1.06E+06		
783-785	3.86E+06								3.86E+06			1.93E+06		
803-805								4.34E+06	2.17E+07					
813-815	1.62E+06						1.62E+06	3.23E+06		1.62E+06				

Sample (cm below top of core)	<i>Gramatophora oceanica</i>	<i>Gyrodinium cf. arcticum</i> var. <i>subflexuosa</i>	<i>Gyrodinium balticum</i>	<i>Gyrodinium</i> sp. 1	<i>Hantzschia arcus</i>	<i>Hantzschia crucigeroides</i>	<i>Hyalodiscus scoticus</i>	<i>Maryanna atomus</i>	<i>Maryanna martyi</i>	<i>Maryanna cf. schultzei</i>	<i>Mastoglossia pumila</i>	<i>Melosira arenata</i>	<i>Melosira nummiformis</i>	<i>Melosira varians</i>
823-825								5 53E+06			1 84E+06			
833-835				3 34E+06				8 36E+06						
843-845														
853-855								2 09E+06						
863-865	3 20E+06							3 20E+06						
873-875				3 79E+06				7 57E+06	3 79E+06					
883-885							1 35E+06	5 40E+06						1 35E+06
893-895							1 63E+06	1 63E+06	3 26E+06					
913-915	2 54E+06							1 27E+06	2 54E+06					1 27E+06
923-925									3 03E+06					1 51E+06
925-927	2 57E+06													
935-937							1 65E+06				3 30E+06			
945-947							1 28E+06	3 84E+06						
955-957	2 72E+06							2 72E+06	1 36E+06					
965-967	4 05E+06													
975-977	2 15E+06						1 08E+06	2 15E+06						
985-987								2 58E+06	5 16E+06	2 58E+06				
995-997	2 00E+06							2 00E+06	3 01E+06					
1005-1007														
1015-1017	1 22E+06							4 86E+06			1 22E+06			
1025-1027							1 16E+06	1 16E+06	1 16E+06					
1035-1037	1 33E+06			1 33E+06				3 99E+06						
1045-1047	1 79E+06							1 79E+06						
1055-1057	1 21E+06							3 62E+06	4 83E+06	1 21E+06				
1079-1081								9 53E+05	1 91E+06					
1089-1091	1 58E+06							3 16E+06						
1109-1111	2 07E+06							2 07E+06						
1119-1121							1 86E+06	1 86E+06	7 43E+06					
1129-1131							1 05E+06	4 21E+06						
1139-1141	2 41E+06							2 41E+06						
1149-1151	4 67E+06			1 56E+06				1 56E+06	3 12E+06					
1169-1171							2 09E+06							
1179-1181								1 83E+06						
1189-1191													2 47E+06	
1209-1211								2 29E+06	2 29E+06					

Sample (cm below top of core)	<i>Navicula cf. cryptotenelloides</i>	<i>Navicula directa</i>	<i>Navicula gregaria</i>	<i>Navicula cf. jousseauxii</i>	<i>Navicula luciae</i>	<i>Navicula oblonga</i>	<i>Navicula perminuta</i>	<i>Navicula cf. petersenii</i>	<i>Navicula phylegia</i>	<i>Navicula phylleptosoma</i>	<i>Navicula ramosissima</i>	<i>Navicula cf. rhynchocephala</i>	<i>Navicula salincola</i>	<i>Navicula schudae</i>
5-7		2.23E+06					2.23E+06							
10-12										7.49E+05				
20-22														
30-32														
40-42							1.20E+06							
50-52						1.96E+06								
60-62							6.74E+05							
70-72	1.38E+06													
80-82	1.23E+06													
90-92						7.51E+05								
100-102											1.48E+06			
110-112		2.86E+06												
120-122														
130-132		1.35E+06					4.05E+06							
183-185											2.56E+06			
196-198		1.97E+06			1.97E+06	1.97E+06	2.95E+06				1.97E+06			
206-208							2.28E+06							
216-218	1.35E+06									2.70E+06				
226-228							1.13E+06				1.70E+06		5.66E+05	
236-238		2.37E+06					1.18E+06				1.18E+06			
246-248	1.23E+06													
256-258										1.80E+06				
266-268														
276-278														
286-288		7.97E+05								7.97E+05	7.97E+05			
305-307	2.04E+06	2.04E+06												
315-317							2.81E+06			2.81E+06	1.41E+06			
325-327						7.60E+05	3.80E+05							
335-337						1.54E+06	9.24E+06							
345-347														
355-357							2.16E+06							
365-367														
375-377						1.41E+06	1.41E+06			2.83E+06				
385-387										1.37E+06				
395-397										1.73E+06				
405-407				1.10E+06			2.20E+06							
415-417				3.99E+05			7.97E+05			3.99E+05				
425-427							6.25E+05			1.87E+06				
435-437						1.11E+06	1.11E+06							
445-447														
467-469														
472-474							7.60E+05		7.60E+05					
482-484	1.05E+06	2.10E+06								1.05E+06				
492-494						1.12E+06	2.24E+06							
502-504														
512-514							3.05E+06							
522-524							1.81E+06							
532-534							2.03E+06							
552-554														
562-564														
582-584														
592-594						2.08E+06				6.23E+06				
602-604														
612-614	1.50E+06					1.50E+06	1.50E+06							
619-621						9.70E+05								
629-631												9.98E+05		
639-641														
649-651					1.96E+06									
659-661	1.14E+06									1.14E+06				
669-671							2.40E+06							
679-681		1.15E+06					1.15E+06	1.15E+06	1.15E+06					
689-691							1.76E+06				5.86E+05		5.86E+05	
699-701							1.82E+06							
709-711	1.49E+06						1.49E+06							
719-721							2.41E+06							
729-731										1.96E+06				
739-741						5.42E+05	5.42E+05							
749-751														
759-761						1.31E+06	6.57E+05			1.31E+06				
769-771						1.06E+06	1.06E+06			1.06E+06				
783-785							1.93E+06							
803-805							2.17E+06							
813-815														

Sample (cm below top of core)	<i>Navicula cf. cryptotenelloides</i>	<i>Navicula directa</i>	<i>Navicula gregaria</i>	<i>Navicula cf. jonsdottir</i>	<i>Navicula luciae</i>	<i>Navicula oblonga</i>	<i>Navicula perminuta</i>	<i>Navicula cf. peterseni</i>	<i>Navicula phylegia</i>	<i>Navicula phylleptosoma</i>	<i>Navicula ramosissima</i>	<i>Navicula cf. rhynchocephala</i>	<i>Navicula salmcola</i>	<i>Navicula schadei</i>
823-825	1.84E+06	1.84E+06				1.84E+06					1.84E+06			
833-835							1.67E+06							
843-845														
853-855	2.09E+06					1.05E+06								
863-865														
873-875														
883-885											4.05E+06			
893-895											1.63E+06			
913-915							3.81E+06							
923-925	1.51E+06						7.57E+05				7.57E+05			
925-927											2.57E+06			
935-937														
945-947							1.28E+06				1.28E+06	1.28E+06		
955-957														
965-967							4.05E+06							
975-977							1.08E+06							
985-987														
995-997							5.01E+06							
1005-1007														
1015-1017							2.43E+06				2.43E+06			
1025-1027	1.16E+06					1.16E+06								
1035-1037						1.33E+06					1.33E+06	1.33E+06		
1045-1047	1.79E+06													
1055-1057							2.42E+06							
1079-1081							2.86E+06							
1089-1091							3.16E+06							
1109-1111											1.03E+06			
1119-1121							1.86E+06				1.86E+06			
1129-1131							3.15E+06							
1139-1141							2.41E+06							
1149-1151	4.67E+06						1.56E+06							
1169-1171							1.05E+06					1.05E+06		
1179-1181	1.83E+06						1.83E+06							
1189-1191						1.24E+06	6.18E+06							
1209-1211		2.29E+06									1.14E+06			

Sample (cm below top of core)	<i>Navicula cf. subinflata</i>	<i>Navicula veneta</i>	<i>Navicula</i> sp 1	<i>Navicula</i> sp 2	<i>Navicula</i> sp 3	<i>Navicula</i> sp 4	<i>Navicula</i> sp 5	<i>Navicula</i> sp 6	<i>Navicula</i> sp 7	<i>Navicula</i> sp 8	<i>Neidium productum</i>	<i>Nitzschia cf. alpina</i>	<i>Nitzschia cf. bacillum</i>	<i>Nitzschia cf. communis</i>
5-7														
10-12						7.49E+05								
20-22														
30-32														
40-42														
50-52										9.78E+05				
60-62														
70-72														
80-82														
90-92											7.51E+05			
100-102									1.48E+06					
110-112			1.43E+06											
120-122														
130-132				1.35E+06										
183-185														
196-198											9.84E+05			
206-208														
216-218													1.35E+06	
226-228													5.66E+05	
236-238														
246-248									6.17E+05					
256-258														
266-268				1.35E+06										
276-278														
286-288													7.97E+05	
305-307														
315-317														
325-327														
335-337														
345-347														
355-357														
365-367														
375-377														
385-387														
395-397														
405-407														
415-417														
425-427														
435-437														
445-447	1.36E+06													
467-469									5.89E+05					
472-474														
482-484														
492-494														
502-504							1.02E+06							
512-514														
522-524									9.04E+05					
532-534														
552-554														
562-564									1.35E+06					
582-584														
592-594														
602-604											9.27E+05			
612-614														
619-621					9.70E+05									
629-631														
639-641														
649-651														
659-661														
669-671														
679-681														
689-691														
699-701									1.82E+06					
709-711									1.49E+06					
719-721														
729-731									9.80E+05					
739-741														
749-751									1.31E+06					
759-761													1.31E+06	
769-771														
781-783														
803-805														
813-815														

Sample (cm below top of core)	<i>Navicula cf. subinflata</i>	<i>Navicula veneta</i>	<i>Navicula</i> sp 1	<i>Navicula</i> sp 2	<i>Navicula</i> sp 3	<i>Navicula</i> sp 4	<i>Navicula</i> sp 5	<i>Navicula</i> sp 6	<i>Navicula</i> sp 7	<i>Navicula</i> sp 8	<i>Neidium productum</i>	<i>Nitzschia cf. alpina</i>	<i>Nitzschia cf. bacillum</i>	<i>Nitzschia cf. communis</i>
823-825														
833-835									1.67E+06					
843-845														
853-855	1.05E+06													
863-865														
873-875														
883-885	1.35E+06								2.70E+06					
893-895														1.63E+06
913-915														
923-925	1.51E+06													
925-927														
935-937	1.65E+06	3.30E+06												
945-947														
955-957														
965-967														
975-977							2.15E+06				2.15E+06			
985-987		5.16E+06												
995-997		2.00E+06												
1005-1007	2.68E+06	1.34E+06												
1015-1017														
1025-1027		2.32E+06												
1035-1037								2.66E+06						
1045-1047	1.79E+06													
1055-1057		1.21E+06									2.42E+06			
1079-1081		9.53E+05												
1089-1091									1.58E+06					
1109-1111	1.03E+06										1.03E+06			
1119-1121												3.72E+06		
1129-1131	1.05E+06										1.05E+06			
1139-1141														
1149-1151														
1169-1171		1.05E+06												
1179-1181												3.67E+06		
1189-1191		1.24E+06									2.47E+06			
1209-1211														

Sample (cm below top of core)	<i>Nitzschia dissipata</i>	<i>Nitzschia dissipata</i> var. <i>media</i>	<i>Nitzschia cf. fonticola</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia hungarica</i>	<i>Nitzschia laevis</i>	<i>Nitzschia peruviana</i>	<i>Nitzschia radicata</i>	<i>Nitzschia</i> sp 1	<i>Nitzschia</i> sp 2	<i>Nitzschia</i> sp 3	<i>Nitzschia</i> sp 4	<i>Nitzschia</i> sp 5	<i>Nitzschia</i> sp 6
5-7				1.11E+06		2.23E+06	2.23E+06							
10-12				7.49E+05		1.50E+06	7.49E+05							
20-22				1.65E+06		1.65E+06	3.30E+06					1.65E+06		
30-32				3.70E+06			1.85E+06							
40-42				1.20E+06	1.20E+06	5.99E+05								
50-52				1.96E+06		1.96E+06	1.96E+06							
60-62						1.35E+06	1.35E+06							
70-72				2.76E+06		4.13E+06	4.13E+06							
80-82				1.23E+06		2.46E+06								
90-92						7.51E+05			1.50E+06					
100-102	1.48E+06			1.48E+06		1.48E+06	2.95E+06							
110-112	1.43E+06		2.86E+06	1.43E+06		2.86E+06	2.86E+06							
120-122						8.44E+05	8.44E+05							
130-132				1.35E+06		4.05E+06	5.39E+06							
183-185							8.96E+06			1.28E+06				
196-198		9.84E+05		2.95E+06		4.92E+06	1.97E+06							
206-208		1.14E+06		2.28E+06		2.28E+06								
216-218			2.70E+06			2.70E+06	2.70E+06							
226-228						1.13E+06	2.27E+06							
236-238				1.18E+06		1.18E+06	7.11E+06							
246-248	6.17E+05						6.17E+05							
256-258		9.01E+05				9.01E+05	3.60E+06							
266-268	6.77E+05			2.03E+06		2.03E+06								
276-278				1.29E+06		1.29E+06	5.17E+06							
286-288				7.97E+05		2.39E+06								
305-307				4.07E+06		4.07E+06	4.07E+06							
315-317				2.81E+06		7.03E+06	4.22E+06							
325-327														
335-337														
345-347				1.08E+06		1.08E+06	5.40E+06				1.08E+06			
355-357							2.16E+06							
365-367			3.43E+06	5.15E+06		1.72E+06	6.87E+06							
375-377						5.65E+06	4.24E+06							
385-387						1.37E+06	1.37E+06							
395-397							3.46E+06							
405-407				2.20E+06		5.49E+06	1.10E+06					1.10E+06		
415-417						7.97E+05	3.99E+05		7.97E+05					
425-427			1.25E+06	6.25E+05		6.25E+05								
435-437				2.21E+06		5.54E+06	2.21E+06							
445-447						4.07E+06			2.72E+06		1.36E+06			
467-469	1.18E+06			2.94E+06		5.89E+06	1.18E+06		5.89E+05					
472-474			1.52E+06	1.52E+06		3.04E+06	2.28E+06							
482-484				5.25E+06		5.25E+06	7.35E+06							
492-494						2.24E+06	2.24E+06							
502-504				1.02E+06		3.05E+06	3.05E+06							
512-514						6.10E+06	6.10E+06							
522-524				2.71E+06		6.33E+06	3.61E+06		1.81E+06					
532-534						2.03E+06	2.03E+06							
552-554							3.89E+06		3.89E+06					
562-564		1.35E+06	4.04E+06			2.70E+06	2.70E+06							
582-584						3.09E+06	7.72E+05							
592-594	2.08E+06	2.08E+06		4.15E+06		4.15E+06								
602-604						1.85E+06								
612-614				1.50E+06		7.51E+06							3.01E+06	
619-621				1.94E+06		2.91E+06	1.94E+06							
629-631							9.98E+05							
639-641						1.03E+06	1.03E+06		5.15E+05					
649-651	3.92E+06		1.96E+06			5.88E+06	3.92E+06						1.96E+06	
659-661				4.54E+06		2.27E+06	2.27E+06		2.27E+06				1.14E+06	
669-671						2.40E+06								
679-681	2.29E+06					4.58E+06	3.44E+06							
689-691							2.34E+06							
699-701	3.64E+06					1.82E+06								
709-711				2.98E+06										
719-721				3.21E+06		8.03E+05	1.61E+06		8.03E+05					
729-731	9.80E+05			2.94E+06		5.88E+06			1.96E+06					
739-741				5.42E+05		5.42E+05								
749-751				1.31E+06										
759-761				3.94E+06		4.60E+06								
769-771						2.11E+06	1.06E+06	1.06E+06						
783-785				3.86E+06			1.93E+06							
803-805	6.51E+06			8.67E+06		4.34E+06	6.51E+06							
813-815		3.23E+06				3.23E+06								

Sample (cm below top of core)	<i>Nitzschia dissipata</i>	<i>Nitzschia dissipata</i> var. <i>media</i>	<i>Nitzschia cf. fonticola</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia hungarica</i>	<i>Nitzschia lubberti</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia radicata</i>	<i>Nitzschia</i> sp. 1	<i>Nitzschia</i> sp. 2	<i>Nitzschia</i> sp. 3	<i>Nitzschia</i> sp. 4	<i>Nitzschia</i> sp. 5	<i>Nitzschia</i> sp. 6
823-825	1.84E+06			3.69E+06		5.53E+06	3.69E+06							
833-835							3.34E+06							
843-845	9.78E+05													
853-855						4.18E+06								
863-865														
873-875				7.57E+06		7.57E+06	1.32E+07							
883-885							5.40E+06	2.70E+06						
893-895				1.63E+06										
913-915									2.54E+06					
923-925						7.57E+05								
925-927				2.57E+06										
935-937						3.30E+06	1.65E+06							
945-947				2.56E+06			2.56E+06							
955-957	1.36E+06					2.72E+06								
965-967						2.02E+07	1.01E+07							
975-977				2.15E+06		4.31E+06	5.38E+06							
985-987	5.16E+06					5.16E+06	1.29E+07	5.16E+06						
995-997						2.00E+06								
1005-1007	2.68E+06			8.03E+06		9.37E+06								
1015-1017						4.86E+06	3.65E+06	1.22E+06						
1025-1027	1.16E+06			1.16E+06		2.32E+06	2.32E+06							
1035-1037				2.66E+06		2.66E+06	2.66E+06							
1045-1047						1.79E+06								
1055-1057				1.21E+06		3.62E+06								
1079-1081	9.53E+05			1.91E+06										
1089-1091						3.16E+06								
1109-1111														
1119-1121				1.86E+06		3.72E+06								
1129-1131				1.05E+06		3.15E+06								
1139-1141								2.41E+06						
1149-1151						9.35E+06								
1169-1171				2.09E+06		6.28E+06								
1179-1181														
1189-1191														
1209-1211														

Sample (cm below top of core)	<i>Nitzschia</i> sp 7	<i>Odontella aurita</i>	<i>Opephora cf. gemmata</i>	<i>Opephora gunter-grassii</i>	<i>Opephora horstiana</i>	<i>Opephora marina</i>	<i>Opephora mutabilis</i>	<i>Opephora olsonii</i>	<i>Opephora cf. parva</i>	<i>Paralia sulcata</i>	<i>Paribellus berkeleyi</i>	<i>Peronia fibula</i>	<i>Pinularia microstauron</i>	<i>Pinularia peterseni</i>
5-7														
10-12														
20-22														
30-32														
40-42				5 99E+05										
50-52				9 78E+05									9 78E+05	
60-62					6 74E+05									
70-72							1 38E+06							
80-82														
90-92	7 51E+05													
100-102														
110-112														
120-122														
130-132														
183-185											1 28E+06		1 28E+06	
196-198														
206-208														
216-218														
226-228													5 66E+05	
236-238							1 18E+06				2 37E+06		1 18E+06	1 18E+06
246-248														
256-258														
266-268														
276-278													1 29E+06	
286-288														
305-307														
315-317														
325-327											3 80E+05			
335-337												1 54E+06		
345-347												1 08E+06		
355-357														
365-367											1 72E+06			
375-377														
385-387					1 37E+06									
395-397					1 73E+06									
405-407							1 10E+06					1 10E+06		
415-417			7 97E+05		3 99E+05							3 99E+05		
425-427														
435-437														
445-447				1 36E+06									1 36E+06	
467-469														
472-474							7 60E+05							
482-484														
492-494														
502-504				1 02E+06										
512-514														
522-524											9 04E+05			
532-534		1 02E+06												
552-554					1 95E+06									
562-564													1 35E+06	
582-584														
592-594														
602-604											9 27E+05			
612-614														
619-621		9 70E+05												
629-631										9 98E+05			9 98E+05	
639-641		1 03E+06												
649-651														
659-661	2 27E+06													
669-671											2 40E+06		2 40E+06	
679-681		1 15E+06												
689-691														
699-701	3 64E+06										1 82E+06			
709-711	1 49E+06													
719-721										4 82E+06				
729-731										9 80E+05				
739-741		5 42E+05												
749-751									1 31E+06					
759-761						1 31E+06								
769-771	1 06E+06		1 06E+06					1 06E+06						
783-785														
803-805					2 17E+06									
813-815							1 62E+06			3 23E+06		1 62E+06		

Sample (cm below top of core)	<i>Nitzschia</i> sp 7	<i>Odontella aurita</i>	<i>Opephora</i> cf. <i>gemma</i>	<i>Opephora gunter-grassii</i>	<i>Opephora horstiana</i>	<i>Opephora marina</i>	<i>Opephora mutabilis</i>	<i>Opephora olsenii</i>	<i>Opephora</i> cf. <i>parva</i>	<i>Paralia sulcata</i>	<i>Parlibellus berkeleyi</i>	<i>Peronia fibula</i>	<i>Psidium microstaurum</i>	<i>Psidium petersenii</i>
823-825														
833-835														
843-845														
853-855		2.09E+06			1.05E+06									
863-865														
873-875														
883-885														
893-895														
913-915														
923-925														
925-927													1.29E+06	2.57E+06
935-937														
945-947														
955-957				1.36E+06										
965-967														
975-977	3.23E+06													
985-987														
995-997														
1005-1007		1.34E+06												
1015-1017														
1025-1027	3.48E+06													
1035-1037														
1045-1047				3.59E+06							1.79E+06			
1055-1057	3.62E+06									2.42E+06				
1079-1081				9.53E+05										
1089-1091				1.58E+06										
1109-1111														
1119-1121														
1129-1131														
1139-1141														
1149-1151														
1169-1171	2.09E+06													
1179-1181	7.34E+06	1.83E+06												1.83E+06
1189-1191	2.47E+06													
1209-1211													1.24E+06	

Sample (cm below top of core)	<i>Pinularia rhomborea</i>	<i>Pinularia cf. tenuisaphe</i>	<i>Pinularia</i> sp. 1	<i>Planolithidium delicatulum</i>	<i>Planolithidium cf. Engelbreckii</i>	<i>Planolithidium hiljeborgii</i>	<i>Pseudostauroneis brevisstrata</i>	<i>Rozosphenia abbreviata</i>	<i>Sellaphora pupula</i>	<i>Skeletonema costatum</i>	<i>Stauroneis neohyalis</i>	<i>Stauroneis pinnata</i>	<i>Stephanodiscus</i> sp. 1	<i>Tabellaria foeculosa</i>
5-7				4 45E+06	1 11E+06					2 83E+08				
10-12				3 75E+06						1 86E+08				
20-22				4 12E+06	8 25E+05					1 63E+08				8 25E+05
30-32				3 70E+06				1 85E+06		2 65E+08				2 77E+06
40-42				1 80E+06				1 20E+06		1 23E+08				
50-52				1 91E+06	9 78E+05					1 83E+08				
60-62				6 74E+05	6 74E+05					2 00E+08		1 35E+06		
70-72				2 76E+06	1 38E+06					2 78E+08				
80-82				3 69E+06						3 26E+08				
90-92				1 50E+06						2 19E+08				
100-102				1 48E+06	1 48E+06			1 48E+06		3 58E+08		2 95E+06		1 48E+06
110-112				1 43E+06	2 86E+06					3 86E+08				
120-122				1 69E+06	1 69E+06					2 71E+08				
130-132				5 39E+06						3 17E+08				
183-185					6 40E+06					3 36E+08				
196-198				9 84E+05						2 55E+08				2 95E+06
206-208				2 28E+06	1 14E+06			1 14E+06		3 67E+08				1 14E+06
216-218				2 70E+06						4 02E+08				
226-228				5 66E+05	1 13E+06					1 17E+08				5 66E+05
236-238				3 55E+06	1 18E+06					3 39E+08				2 37E+06
246-248										1 64E+08				6 17E+05
256-258										2 70E+08				9 01E+05
266-268				6 77E+05	6 77E+05					1 60E+08				
276-278				3 88E+06						3 18E+08		1 29E+06		
286-288				1 59E+06	7 97E+05					2 04E+08				
305-307										7 80E+08				2 04E+06
315-317				1 41E+06						3 91E+08		2 81E+06		
325-327				3 80E+05						9 88E+07				7 60E+05
335-337										5 33E+08				1 54E+06
345-347				1 08E+06		1 08E+06				2 55E+08				
355-357				3 23E+06						3 49E+08				
365-367				3 43E+06	3 43E+06					5 41E+08		1 72E+06		
375-377				1 41E+06						4 17E+08				
385-387				1 37E+06	1 37E+06					4 78E+08				1 37E+06
395-397				3 46E+06	5 19E+06					6 31E+08				
405-407				2 20E+06	1 10E+06					3 11E+08				
415-417										1 05E+08		3 99E+05		
425-427				6 25E+05	6 25E+05					1 64E+08				6 25E+05
435-437				3 32E+06						3 47E+08				
445-447				1 36E+06						4 49E+08				
467-469				1 18E+06	5 89E+05					1 64E+08				
472-474				3 80E+06	1 52E+06					2 24E+08			7 60E+05	
482-484				2 10E+06	1 05E+06					2 75E+08				
492-494				1 12E+06	1 12E+06					3 45E+08				
502-504				2 03E+06						2 93E+08				1 02E+06
512-514										1 28E+09				
522-524				9 04E+05						2 56E+08		9 04E+05		9 04E+05
532-534				2 03E+06						3 24E+08				
552-554										6 71E+08				
562-564				1 35E+06						4 86E+08				1 35E+06
582-584				1 54E+06				1 54E+06		2 79E+08				7 72E+05
592-594				2 08E+06	2 08E+06					7 18E+08				2 08E+06
602-604				1 85E+06						3 33E+08		9 27E+05		
612-614				1 50E+06	1 50E+06					5 14E+08		1 50E+06		
619-621				9 70E+05	1 94E+06					3 32E+08		9 70E+05		
629-631					9 98E+05					3 32E+08				9 98E+05
639-641				1 54E+06		1 03E+06				1 54E+08		1 03E+06		5 15E+05
649-651				1 96E+06						7 68E+08				
659-661				1 14E+06	1 14E+06					3 51E+08				2 27E+06
669-671										9 03E+08				
679-681	1 15E+06		2 29E+06	1 15E+06						4 03E+08				
689-691				1 76E+06						1 68E+08		1 76E+06		
699-701	1 82E+06				1 82E+06					5 91E+08		9 09E+06		
709-711				2 98E+06	1 49E+06					4 64E+08				
719-721				1 61E+06						1 96E+08				
729-731				9 80E+05	9 80E+05					2 24E+08				2 94E+06
739-741				5 42E+05						1 48E+08				5 42E+05
749-751				5 25E+06	1 31E+06					4 50E+08		3 94E+06		1 31E+06
759-761				1 97E+06						1 62E+08				
769-771				2 11E+06						2 60E+08				
783-785				1 93E+06						6 45E+08				
803-805				2 17E+06						5 72E+08		4 34E+06		
813-815				4 85E+06						4 59E+08		1 62E+06		1 62E+06

Sample (cm below top of core)	<i>Pinularia rhomborea</i>	<i>Pinularia cf. tenuisaphe</i>	<i>Pinularia</i> sp. 1	<i>Planolothidium delicatulum</i>	<i>Planolothidium cf. Engelbrechti</i>	<i>Planolothidium liljeborgi</i>	<i>Pseudostauroneis brevisstrata</i>	<i>Roccapenna abbreviata</i>	<i>Sellaphora pupula</i>	<i>Skeletonema costatum</i>	<i>Stauroneis neohyalis</i>	<i>Stauroneis pinata</i>	<i>Stephanodiscus</i> sp. 1	<i>Tabellaria flocculosa</i>
823-825				3 69E+06	3 69E+06					4 92E+08				
833-835				3 34E+06						6 42E+08				
843-845				2 93E+06	1 96E+06					2 88E+08				
853-855				3 14E+06	1 05E+06					3 22E+08				
863-865				8 01E+06	1 60E+06					5 22E+08				
873-875				1 89E+06						5 60E+08				1 89E+06
883-885				4 05E+06						4 24E+08		1 35E+06		
893-895				1 63E+06				3 26E+06		4 49E+08		1 63E+06		3 26E+06
913-915					1 27E+06					4 32E+08		5 08E+06		
923-925					7 57E+05					2 12E+08		1 51E+06		
925-927				1 29E+06						3 93E+08			1 29E+06	3 86E+06
935-937				4 95E+06				3 30E+06		6 03E+08				
945-947				3 84E+06	1 28E+06			2 56E+06		3 43E+08				1 28E+06
955-957				5 44E+06				1 36E+06		4 57E+08				
965-967				2 02E+06	2 02E+06				4 05E+06	5 87E+08				6 07E+06
975-977				1 08E+06	1 08E+06					3 23E+08				2 15E+06
985-987				7 75E+06				5 16E+06		9 22E+08				2 58E+06
995-997				1 00E+06	3 01E+06					2 72E+08			1 00E+06	2 00E+06
1005-1007		2 68E+06		4 02E+06						4 27E+08				
1015-1017				1 22E+06	2 43E+06					2 33E+08		1 22E+06		2 43E+06
1025-1027				1 16E+06	1 16E+06					3 80E+08				1 16E+06
1035-1037				5 32E+06						3 90E+08				
1045-1047				1 79E+06						7 18E+08				
1055-1057				3 62E+06	2 42E+06					2 75E+08				
1079-1081										3 30E+08				
1089-1091					1 58E+06					5 60E+08				
1109-1111										3 33E+08		3 10E+06		
1119-1121				1 86E+06						6 71E+08		3 72E+06		
1129-1131				1 05E+06						3 08E+08				
1139-1141				1 21E+06						4 00E+08		2 41E+06		
1149-1151				1 56E+06	1 56E+06		3 12E+06	3 12E+06		4 95E+08		6 23E+06		
1169-1171										3 38E+08	1 05E+06			
1179-1181		3 67E+06								6 31E+08				
1189-1191				1 24E+06						4 08E+08				
1209-1211										3 72E+08		1 14E+06		

Sample (cm below top of core)	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	<i>Thalassionema bacillare</i>	<i>Thalassionema nitzeichoides</i>	<i>Thalassiosira angulata</i>	<i>Thalassiosira lunata</i>	<i>Thalassiosira bulbosa</i>	<i>Thalassiosira conferta</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira gullardii</i>	<i>Thalassiosira lyclina</i>	<i>Thalassiosira lapidus</i>
5-7	3 34E+06					1 11E+06	1 11E+06		1 11E+06	3 34E+06	3 34E+06			1 11E+06
10-12	7 49E+05				3 75E+06	1 50E+06				4 49E+06	7 49E+05			
20-22	1 65E+06				4 12E+06				8 25E+05	2 47E+06	1 65E+06			1 65E+06
30-32	1 85E+06		3 70E+06		9 24E+06		9 24E+05		9 24E+05	1 85E+06	2 77E+06			9 24E+05
40-42				1 20E+06	1 80E+06	1 80E+06	5 99E+05			4 19E+06				5 99E+05
50-52					3 91E+06		9 78E+05			1 57E+07	1 96E+06			4 89E+06
60-62										1 35E+06	1 35E+06			6 74E+05
70-72	4 13E+06				1 24E+07					1 52E+07				1 38E+06
80-82	1 23E+06		1 23E+06		3 69E+06					8 62E+06	3 69E+06			
90-92	1 50E+06				1 50E+06					3 76E+06	7 51E+05			
100-102					4 43E+06					1 18E+07	4 43E+06			
110-112			1 43E+06		1 43E+06					1 43E+06				
120-122					1 69E+06					5 91E+06	2 53E+06			
130-132	2 70E+06									1 08E+07				1 35E+06
183-185		6 40E+06			2 56E+06					3 84E+06				2 56E+06
196-198			6 89E+06		4 92E+06					9 84E+05	1 97E+06		9 84E+05	
206-208		2 28E+06	3 41E+06		7 96E+06					2 28E+06				3 41E+06
216-218			1 35E+06		4 04E+06					5 39E+06	1 35E+06			
226-228	5 66E+05				1 70E+06					1 70E+06	5 66E+05			1 13E+06
236-238					8 29E+06	1 18E+06				4 74E+06	2 37E+06			
246-248					7 41E+06					1 23E+06	3 70E+06			
256-258			9 01E+05		3 60E+06					2 70E+06				
266-268		6 77E+05			3 39E+06					6 77E+05	1 35E+06			
276-278	1 29E+06		1 29E+06		2 59E+06					1 81E+07	3 88E+06			
286-288			1 59E+06		3 98E+06					3 19E+06				
305-307			2 04E+06		4 07E+06					2 04E+06				
315-317	1 41E+06				3 94E+07					1 41E+06	5 62E+06		1 41E+06	1 41E+06
325-327			1 90E+06		3 80E+05					3 80E+05	3 80E+05			
335-337					1 54E+06					6 16E+06	3 08E+06		1 54E+06	1 54E+06
345-347			1 08E+06		4 32E+06					3 24E+06	1 08E+06			
355-357		2 16E+06			1 08E+06					5 39E+06	4 31E+06		1 08E+06	3 23E+06
365-367			1 72E+06		1 72E+06					8 58E+06	3 43E+06			
375-377	1 41E+06	1 41E+06	4 24E+06		1 41E+06					1 41E+07	2 83E+06			2 83E+06
385-387			2 74E+06		5 48E+06					1 10E+07	6 85E+06			4 11E+06
395-397					1 04E+07					8 64E+06	3 46E+06			
405-407	1 10E+06				1 10E+06					3 29E+06	2 20E+06			
415-417			7 97E+05		1 59E+06					7 97E+05	1 59E+06			
425-427			6 25E+05		1 25E+06					1 25E+06	6 25E+05			6 25E+05
435-437			2 21E+06		4 43E+06					3 32E+06	2 21E+06			
445-447			1 36E+06							5 43E+06	1 36E+06			2 72E+06
467-469		5 89E+05	1 77E+06		2 36E+06					4 71E+06				
472-474			1 52E+06		1 52E+06					3 80E+06	3 04E+06		7 60E+05	
482-484			1 05E+06		8 40E+06					3 15E+06	4 20E+06			1 05E+06
492-494			2 24E+06		1 12E+07		1 12E+06			3 36E+06	3 36E+06			1 12E+06
502-504			2 03E+06		5 08E+06					5 08E+06	3 05E+06			5 08E+06
512-514			3 05E+06		3 05E+06					6 10E+06	3 05E+06			3 05E+06
522-524			9 04E+05		8 13E+06		9 04E+05			3 61E+06	2 71E+06			
532-534			1 02E+06		5 08E+06					4 07E+06	5 08E+06			
552-554			3 89E+06						1 95E+06	3 89E+06				1 95E+06
562-564			1 35E+06		4 04E+06					1 35E+06				4 04E+06
582-584	7 72E+05		3 09E+06		7 72E+05					2 32E+06	7 72E+05			7 72E+05
592-594			8 30E+06		4 15E+06					6 23E+06			6 23E+06	2 08E+06
602-604			2 78E+06		4 64E+06	9 27E+05	1 85E+06		9 27E+05	9 27E+05	9 27E+05			
612-614	1 50E+06		3 01E+06		3 01E+06		1 50E+06			7 51E+06	1 50E+06			
619-621	1 94E+06		9 70E+05		8 73E+06					9 70E+05	1 94E+06			
629-631			2 99E+06		4 99E+06					9 98E+05	9 98E+05			
639-641	5 15E+05		5 66E+06		5 15E+05					1 54E+06	5 15E+05			5 15E+05
649-651			3 92E+06		7 84E+06					1 96E+06	1 96E+06			
659-661	1 14E+06		3 41E+06		1 36E+07	1 14E+06	1 14E+06			3 41E+06	5 68E+06			
669-671	1 20E+07				2 40E+06	2 40E+06	2 40E+06			7 21E+06				
679-681			3 44E+06			1 15E+06				9 17E+06				1 15E+06
689-691	2 93E+06		2 93E+06		1 76E+06		5 86E+05			3 51E+06				1 17E+06
699-701	5 45E+06	1 82E+06	5 45E+06		1 82E+06					5 45E+06	7 27E+06		9 09E+06	5 45E+06
709-711			5 95E+06		1 64E+07					1 49E+06	1 49E+06			4 46E+06
719-721	8 03E+05		2 41E+06		1 61E+06		2 41E+06	8 03E+05		4 82E+06	5 62E+06		1 61E+06	3 21E+06
729-731	9 80E+05		4 90E+06		4 90E+06		9 80E+05			2 94E+06	1 96E+06		9 80E+05	
739-741	1 08E+06		1 63E+06		1 63E+06	1 08E+06	1 08E+06	5 42E+05		1 08E+06			5 42E+05	1 08E+06
749-751	3 94E+06		2 63E+06			1 31E+06				7 88E+06				1 31E+06
759-761	1 31E+06	6 57E+05	5 25E+06							2 63E+06	1 97E+06		1 31E+06	
769-771			4 22E+06		1 16E+07					5 28E+06				
783-785	1 93E+06		3 86E+06		1 93E+06		1 93E+06			3 86E+06	3 86E+06		1 93E+06	3 86E+06
803-805	2 17E+06		1 52E+07		2 17E+06					2 17E+06	4 34E+06			
813-815	3 23E+06		1 29E+07		4 85E+06					1 62E+06			3 23E+06	

Sample (cm below top of core)	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	<i>Thalassonema bacillare</i>	<i>Thalassonema nitzschoides</i>	<i>Thalassosira angulata</i>	<i>Thalassosira binata</i>	<i>Thalassosira bulbosa</i>	<i>Thalassosira conferta</i>	<i>Thalassosira decipiens</i>	<i>Thalassosira eccentrica</i>	<i>Thalassosira guillardii</i>	<i>Thalassosira hyalina</i>	<i>Thalassosira leptopus</i>
823-825			1 84E+07		3 69E+06								1 48E+07	
833-835			5 02E+06		1 67E+06	1 67E+06				3 34E+06			3 34E+06	
843-845			7 82E+06		3 91E+06				9 78E+05					5 87E+06
853-855			6 28E+06		3 14E+06				3 14E+06	3 14E+06				3 14E+06
863-865			1 28E+07		3 20E+06				3 20E+06				1 60E+06	
873-875			1 89E+06				1 89E+06							5 68E+06
883-885			1 49E+07		4 05E+06		1 35E+06		1 35E+06	8 10E+06	5 40E+06			1 35E+06
893-895			6 51E+06		6 51E+06				4 88E+06	1 95E+07	1 63E+06			4 88E+06
913-915			1 52E+07		2 54E+06				1 27E+06	1 27E+06				2 54E+06
923-925			3 78E+06						4 54E+06	1 51E+06				1 51E+06
925-927			9 01E+06		3 86E+06				6 44E+06	2 57E+06	1 29E+06	1 29E+06		
935-937			8 24E+06		3 30E+06				1 65E+06					3 30E+06
945-947			1 02E+07						2 56E+06	6 40E+06				3 84E+06
955-957		2 72E+06	9 52E+06						1 09E+07	4 08E+06				4 08E+06
965-967			1 42E+07		4 05E+06				8 09E+06	2 02E+06	4 05E+06			2 02E+06
975-977			4 31E+06		8 61E+06				4 31E+06				2 15E+06	4 31E+06
985-987			1 03E+07							2 58E+06			1 81E+07	2 58E+06
995-997			1 20E+07		1 00E+06					2 00E+06			2 00E+06	2 00E+06
1005-1007	1 34E+06		4 02E+06						2 68E+06	1 34E+06	5 36E+06			1 34E+06
1015-1017	1 22E+06		4 86E+06		4 86E+06				2 43E+06	2 43E+06			3 65E+06	3 65E+06
1025-1027	1 16E+06		4 64E+06						1 16E+06		1 16E+06		2 32E+06	
1035-1037			5 32E+06							1 33E+06			2 66E+06	3 99E+06
1045-1047		1 79E+06	5 38E+06						8 97E+06				1 79E+06	
1055-1057	4 83E+06		1 09E+07		2 42E+06				4 83E+06					3 62E+06
1079-1081			9 53E+05		9 53E+05				1 91E+06	1 91E+06			5 72E+06	1 91E+06
1089-1091			1 58E+06			1 58E+06		1 58E+06	1 58E+06	1 58E+06				1 58E+06
1109-1111			3 10E+06		4 14E+06				3 10E+06					1 03E+06
1119-1121	1 86E+06		3 72E+06		1 86E+06				7 43E+06	7 43E+06			1 86E+06	
1129-1131	2 10E+06		8 41E+06		4 21E+06				2 10E+06	2 10E+06				2 10E+06
1139-1141			3 62E+06		2 41E+06				1 21E+06	4 83E+06				2 41E+06
1149-1151			3 12E+06						6 23E+06	3 12E+06			3 12E+06	1 56E+06
1169-1171			2 09E+06		1 05E+06				1 05E+06		1 05E+06		2 09E+06	2 09E+06
1179-1181			7 34E+06		1 83E+06				1 83E+06	3 67E+06			7 34E+06	
1189-1191	1 24E+06					1 24E+06			3 71E+06	1 24E+06				4 95E+06
1209-1211			2 29E+06		1 14E+06				2 29E+06				3 43E+06	3 43E+06

Sample (cm below top of core)	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira oestrupii</i> var. <i>oestrupii</i>	<i>Thalassiosira oestrupii</i> var. <i>venrickae</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira punctigera</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 1	<i>Thalassiosira</i> sp 2	<i>Thalassiosira</i> sp 3	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 5	<i>Thalassiosira</i> sp 6	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8
5-7	1 56E+07			7 79E+06		2 45E+07	1 11E+06							
10-12	1 65E+07			1 87E+07	1 50E+06	1 12E+07								
20-22	1 15E+07			3 46E+07		1 24E+07								
30-32	2 68E+07	9 24E+05		1 66E+07	1 85E+06	1 20E+07							2 47E+06	
40-42	5 39E+06			1 92E+07		6 59E+06			1 20E+06				1 80E+06	
50-52	1 17E+07			1 86E+07		1 57E+07				9 78E+05			1 96E+06	
60-62	9 43E+06			1 01E+07		6 74E+06								
70-72	2 48E+07			2 20E+07									5 51E+06	
80-82	1 97E+07			1 23E+07		1 11E+07	1 23E+06			2 46E+06			1 23E+06	1 23E+06
90-92	9 01E+06			9 01E+06		8 26E+06				1 50E+06			3 00E+06	7 51E+05
100-102	3 69E+07			1 48E+07		2 66E+07				4 43E+06			1 48E+06	
110-112	1 29E+07			3 00E+07		1 43E+07				2 86E+06			2 86E+06	
120-122	1 18E+07			1 01E+07		7 60E+06								
130-132	2 70E+07			1 48E+07		1 89E+07	1 35E+06			2 70E+06		4 05E+06	4 05E+06	
183-185	2 43E+07			2 69E+07		1 15E+07								
196-198	9 84E+06	9 84E+05		3 44E+07		1 48E+07							1 97E+06	
206-208	2 05E+07			1 71E+07		2 05E+07							5 69E+06	
216-218	2 16E+07			2 43E+07		1 35E+07							2 70E+06	
226-228	9 63E+06			1 19E+07		7 93E+06				1 13E+06			1 13E+06	
236-238	7 11E+06			2 13E+07		1 18E+07	1 18E+06			2 37E+06			7 11E+06	
246-248	7 41E+06			1 11E+07		9 88E+06				6 17E+05			1 23E+06	
256-258	7 21E+06			1 08E+07		1 17E+07				9 01E+05			2 70E+06	
266-268	1 08E+07			2 03E+07	1 35E+06	1 63E+07							5 42E+06	
276-278	5 17E+06			2 59E+07		1 94E+07			2 59E+06	1 29E+06			6 46E+06	
286-288	4 78E+06			1 12E+07		1 04E+07	7 97E+05			5 58E+06			3 98E+06	
305-307	8 14E+07			4 28E+07		2 65E+07				4 07E+06				2 04E+06
315-317	1 27E+07			5 62E+07		3 37E+07				5 62E+06			9 84E+06	
325-327	8 74E+06			3 04E+06	3 80E+05	5 70E+06				3 80E+05			7 60E+05	3 80E+05
335-337	1 39E+07			1 23E+07		1 39E+07								
345-347	2 59E+07	1 08E+06		4 21E+07		2 59E+07	1 08E+06						3 24E+06	
355-357	1 19E+07			1 40E+07		1 40E+07				1 08E+06				
365-367	2 92E+07			2 58E+07		1 89E+07							3 43E+06	
375-377	1 70E+07			4 66E+07		2 26E+07							5 65E+06	
385-387	1 37E+07			1 51E+07		2 06E+07				5 48E+06			5 48E+06	
395-397	2 25E+07			3 46E+07		3 11E+07				6 91E+06			6 91E+06	
405-407	3 84E+07			3 18E+07	1 10E+06	1 87E+07							2 20E+06	
415-417	9 96E+06			6 38E+06	3 99E+05	9 96E+06								
425-427	1 25E+07		1 25E+06	1 31E+07		1 87E+07							1 25E+06	
435-437	1 77E+07			3 43E+07		1 77E+07				1 11E+06			3 32E+06	
445-447	1 49E+07			1 22E+07		9 50E+06								
467-469	1 59E+07			4 71E+06		2 12E+07				5 89E+05				
472-474	9 12E+06			1 60E+07	7 60E+05	1 22E+07				7 60E+05			7 60E+05	
482-484	1 47E+07		2 10E+06	1 26E+07		4 41E+07				1 05E+06			2 10E+06	
492-494	1 79E+07			2 69E+07		1 12E+07								2 24E+06
502-504	1 63E+07			2 34E+07		1 63E+07				3 05E+06	1 02E+06		8 13E+06	1 02E+06
512-514	3 66E+07			6 40E+07		1 83E+07							3 05E+06	
522-524	7 23E+06			2 17E+07		1 36E+07				5 42E+06			1 81E+06	
532-534	9 15E+06			1 02E+07	1 02E+06	2 95E+07				3 05E+06			1 02E+06	
552-554	7 01E+07			4 67E+07	1 95E+06	1 36E+07				9 73E+06		1 95E+06	1 95E+06	1 95E+06
562-564	1 89E+07			4 72E+07	1 35E+06	1 21E+07							1 35E+06	
582-584	1 16E+07			1 47E+07		3 09E+06							1 54E+06	
592-594	4 78E+07			6 44E+07		3 11E+07							2 08E+06	
602-604	9 27E+06			9 27E+06		1 11E+07							9 27E+05	
612-614	2 25E+07	3 01E+06		4 51E+07		1 80E+07								
619-621	2 13E+07			1 75E+07		1 45E+07							1 94E+06	
629-631	1 30E+07	9 98E+05		1 90E+07		9 98E+06				9 98E+05			9 98E+05	
639-641	8 24E+06			1 29E+07		9 78E+06				1 54E+06			2 57E+06	5 15E+05
649-651	2 74E+07		1 96E+06	5 29E+07		2 16E+07							5 88E+06	
659-661	2 50E+07			2 04E+07	2 27E+06	1 36E+07	1 14E+06			1 14E+06			4 54E+06	
669-671	3 60E+07			3 60E+07		1 44E+07	2 40E+06			4 81E+06			2 40E+06	
679-681	6 88E+06			3 21E+07		8 02E+06				1 15E+06				1 15E+06
689-691	1 17E+07			1 46E+07		9 96E+06							5 86E+05	
699-701	9 09E+06			3 82E+07		2 36E+07	1 82E+06						1 82E+06	
709-711	1 93E+07			2 08E+07		2 23E+07	1 49E+06			2 98E+06			1 49E+06	
719-721	1 93E+07	8 03E+05		2 81E+07		1 93E+07	8 03E+05						4 01E+06	8 03E+05
729-731	2 55E+07			4 51E+07		1 47E+07				3 92E+06			1 96E+06	
739-741	1 03E+07			1 14E+07		1 19E+07				1 63E+06		5 42E+05	4 34E+06	5 42E+05
749-751	1 05E+07			2 63E+07		1 97E+07				1 31E+06			1 31E+06	
759-761	1 05E+07		6 57E+05	1 77E+07		1 18E+07				1 97E+06			2 63E+06	
769-771	1 58E+07			3 17E+07		1 69E+07				1 06E+06			2 11E+06	
783-785	3 86E+07			8 30E+07		1 54E+07							2 12E+07	
803-805	5 86E+07			8 24E+07	2 17E+06	3 69E+07				6 51E+06			1 95E+07	
813-815	2 26E+07			5 17E+07	1 62E+06	2 26E+07				4 85E+06				

Sample (cm below top of core)	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira oestrupii</i> var. <i>oestrupii</i>	<i>Thalassiosira oestrupii</i> var. <i>venrickae</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira punctigera</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 1	<i>Thalassiosira</i> sp 2	<i>Thalassiosira</i> sp 3	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 5	<i>Thalassiosira</i> sp 6	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8
823-825	2 58E+07			3 50E+07		3 69E+07			1 11E+07				1 84E+06	
833-835	4 52E+07			4 68E+07		1 34E+07								1 67E+06
843-845	1 56E+07	9 78E+05		4 60E+07		1 47E+07							1 96E+06	1 96E+06
853-855	1 67E+07	1 05E+06		2 93E+07		2 09E+07							2 09E+06	3 14E+06
863-865	3 36E+07			6 89E+07		1 92E+07							4 80E+06	
873-875	2 27E+07			6 62E+07		3 60E+07			1 89E+06				5 68E+06	1 89E+06
883-885	1 49E+07	1 35E+06		4 59E+07		1 76E+07			2 70E+06				2 70E+06	
893-895	3 58E+07			6 67E+07		2 12E+07			4 88E+06				1 30E+07	
913-915	3 30E+07			3 81E+07		7 62E+06							1 27E+06	
923-925	9 84E+06			4 01E+07		6 81E+06							1 51E+06	
925-927	1 80E+07		3 86E+06	6 44E+07		1 29E+07			5 15E+06				5 15E+06	
935-937	2 64E+07			5 94E+07		2 14E+07							1 65E+06	
945-947	1 41E+07			8 06E+07		3 33E+07			2 56E+06				1 28E+06	
955-957	2 18E+07			4 76E+07	1 36E+06	1 90E+07			2 72E+06					
965-967	6 07E+07	2 02E+06		9 11E+07		2 63E+07			4 05E+06				6 07E+06	4 05E+06
975-977	1 40E+07			6 14E+07		2 15E+07			1 08E+06				3 23E+06	1 08E+06
985-987	2 32E+07	2 58E+06	2 58E+06	5 16E+07		3 87E+07			5 16E+06					
995-997	1 60E+07			5 91E+07		1 80E+07			3 01E+06				2 00E+06	
1005-1007	1 87E+07			3 88E+07		2 28E+07			1 34E+06				4 02E+06	1 34E+06
1015-1017	3 77E+07			8 75E+07		3 65E+07			4 86E+06				4 86E+06	
1025-1027	1 74E+07			3 59E+07		2 20E+07							2 32E+06	
1035-1037	1 20E+07			1 03E+08		2 13E+07							3 99E+06	3 99E+06
1045-1047	1 26E+07			5 02E+07		2 15E+07							3 59E+06	
1055-1057	1 21E+07			9 91E+07		5 92E+07			1 21E+06				3 62E+06	
1079-1081	1 91E+07			3 14E+07	9 53E+05	1 91E+07							1 91E+06	
1089-1091	1 42E+07			5 22E+07		2 37E+07							1 26E+07	
1109-1111	9 31E+06			3 41E+07		1 55E+07			1 03E+06				8 28E+06	1 03E+06
1119-1121	4 09E+07			7 62E+07		2 04E+07			1 86E+06				3 72E+06	
1129-1131	1 58E+07			8 10E+07		1 37E+07			4 21E+06				6 31E+06	2 10E+06
1139-1141	2 05E+07			5 67E+07		1 69E+07			4 83E+06					1 09E+07
1149-1151	1 40E+07			6 86E+07		2 96E+07			7 79E+06				6 23E+06	
1169-1171	1 46E+07			4 60E+07	1 05E+06	2 51E+07			1 26E+07				2 09E+06	1 05E+06
1179-1181	3 85E+07			6 24E+07		4 04E+07			3 67E+06					1 83E+06
1189-1191	8 66E+06			7 92E+07		1 48E+07			4 95E+06				1 24E+06	1 24E+06
1209-1211	1 14E+07			6 06E+07		1 60E+07			3 43E+06					2 29E+06

Sample (cm below top of core)	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 12	<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 14	<i>Thalassiosira</i> sp 15	<i>Thalassiosira</i> sp 16	<i>Thalassiosira</i> sp 17	<i>Tribionella aerophila</i>	<i>Tribionella coarctata</i>	<i>Tribionella marginulata</i>
5-7					4 45E+06							
10-12					3 00E+06							
20-22					4 95E+06							
30-32												9 24E+05
40-42	5 99E+05				3 00E+06							
50-52					1 96E+06			2 93E+06				
60-62					2 69E+06			6 74E+05				
70-72					5 51E+06							
80-82					1 23E+06							
90-92					7 51E+05							
100-102	1 48E+06				2 95E+06							
110-112	4 28E+06				1 43E+06			2 86E+06				
120-122					8 44E+05							
130-132					4 05E+06							
183-185					5 12E+06							1 28E+06
196-198												
206-208										1 14E+06		
216-218					1 48E+07							
226-228					3 40E+06							
236-238	1 18E+06	1 18E+06			4 74E+06			2 37E+06				
246-248												
256-258	1 80E+06	9 01E+05										
266-268	1 35E+06				3 39E+06			2 03E+06				
276-278	5 17E+06				1 16E+07			2 59E+06			1 29E+06	
286-288	2 39E+06				4 78E+06							
305-307					4 07E+06							
315-317												
325-327	3 80E+05				1 14E+06							
335-337	1 54E+06				3 08E+06							
345-347	2 16E+06				2 16E+06							
355-357	2 16E+06											
365-367	3 43E+06											
375-377	1 41E+06											
385-387												1 37E+06
395-397					1 73E+06							
405-407												
415-417			2 20E+06									
425-427			3 12E+06									
435-437	3 32E+06		2 21E+06									
445-447										1 36E+06		
467-469			5 89E+05									
472-474	1 52E+06											
482-484												
492-494			2 24E+06									
502-504	1 02E+06		3 05E+06									
512-514			1 22E+07									
522-524			2 71E+06									
532-534			2 03E+06									
552-554			3 89E+06									
562-564			2 70E+06									
582-584			1 54E+06									
592-594												
602-604			9 27E+05									
612-614	1 50E+06		1 50E+06									1 50E+06
619-621												
629-631												
639-641			2 06E+06	5 15E+05								
649-651												
659-661			4 54E+06	1 14E+06								
669-671	2 40E+06				2 40E+06							
679-681			1 15E+06		1 15E+06							
689-691			1 17E+06		5 86E+05							
699-701			1 09E+07									
709-711			1 49E+06		1 49E+06							
719-721			2 41E+06									
729-731			1 96E+06		1 96E+06			1 96E+06				
739-741			1 63E+06		1 08E+06							
749-751			2 63E+06		1 31E+06							
759-761			3 28E+06		1 97E+06							
769-771			2 11E+06		1 06E+06	1 06E+06						
783-785												
803-805												
813-815												1 62E+06

Sample (cm below top of core)	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 12	<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 14	<i>Thalassiosira</i> sp 15	<i>Thalassiosira</i> sp 16	<i>Thalassiosira</i> sp 17	<i>Triblonella aerophila</i>	<i>Triblonella coarctata</i>	<i>Triblonella marginulata</i>
823-825			1.84E+06									
833-835												
843-845												
853-855												
863-865												
873-875									7.57E+06			
883-885	1.35E+06								1.22E+07			
893-895			1.63E+06						8.14E+06			
913-915									3.81E+06			
923-925	1.51E+06								2.27E+06			
925-927	2.57E+06		1.29E+06						3.86E+06			
935-937	1.65E+06								4.95E+06			
945-947									1.02E+07			2.56E+06
955-957	2.72E+06								4.08E+06			
965-967	2.02E+06											
975-977									2.15E+06			
985-987									5.16E+06			
995-997									4.01E+06			
1005-1007	2.68E+06		1.34E+06						1.21E+07			1.34E+06
1015-1017	3.65E+06		2.43E+06						4.86E+06			
1025-1027									5.79E+06			
1035-1037									6.66E+06			
1045-1047									7.18E+06			
1055-1057									7.25E+06			
1079-1081	9.53E+05								2.86E+06			
1089-1091		1.58E+06							6.32E+06			
1109-1111			1.03E+06						2.07E+06			
1119-1121			1.86E+06						5.57E+06			
1129-1131									1.05E+06			
1139-1141		1.21E+06	3.62E+06						7.24E+06			
1149-1151			1.25E+07		4.67E+06				1.71E+07			
1169-1171					5.23E+06	1.05E+06	2.09E+06		7.32E+06			
1179-1181			3.67E+06		1.83E+06			1.83E+06	2.02E+07			
1189-1191			6.18E+06		7.42E+06		3.71E+06		4.95E+06			
1209-1211			8.01E+06		3.43E+06				5.72E+06			

APPENDIX D

Relative Abundance Of All Diatom Taxa From All Samples

Sample (cm below top of core)	<i>Achnanthes conspicua</i>	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes lemmermannii</i>	<i>Achnanthes cf. lemmermannii</i>	<i>Achnanthes rosenstockii</i>	<i>Achnanthes subatomoides</i>	<i>Achnanthes sp. 1</i>	<i>Achnanthes sp. 2</i>	<i>Achnanthes sp. 3</i>	<i>Achnanthes cf. macrocephalum</i>	<i>Achnanthes minutissimum</i>	<i>Actinocyclus senarius</i>	<i>Actinocyclus splendens</i>	<i>Actinocyclus vulgaris</i>	<i>Actinocyclus sp. 1</i>	<i>Amphora aculeata</i>	<i>Amphora coffeiformis</i>	<i>Amphora exigua</i>	<i>Amphora cf. helensis</i>	<i>Amphora marinus</i>	<i>Amphora pseudohyalina</i>	<i>Amphora strigosa</i>
5-7																							
10-12	0 002																						
20-22		0 002							0 007														
30-32		0 002																					
40-42												0 009		0 002									
50-52								0 004				0 009						0 002					
60-62																0 004							
70-72		0 004						0 004			0 004					0 026		0 002					
80-82		0 002						0 004															
90-92								0 008							0 002						0 002		
100-102															0 004								
110-112								0 004							0 002								
120-122								0 004	0 002														
130-132		0 004						0 004			0 002							0 002					
183-185		0 004						0 008															
196-198											0 002		0 002				0 002		0 004				
206-208								0 006				0 010			0 002						0 004		
216-218		0 002				0 002																	
226-228		0 002						0 008			0 004	0 002											
236-238		0 006						0 004				0 004											
246-248		0 010						0 002			0 002	0 004						0 002					
256-258	0 002																						
266-268		0 006						0 002	0 004			0 006	0 002		0 002			0 002					
276-278	0 002										0 002	0 002	0 002										
286-288	0 002							0 008													0 002		
305-307								0 006	0 004														
315-317	0 002							0 002				0 002	0 002					0 004					
325-327		0 002											0 002			0 002		0 004					
335-337		0 002																					
345-347		0 002										0 006											
355-357								0 004				0 004	0 002										
365-367								0 002															
375-377		0 004						0 002	0 012			0 002						0 002					
385-387								0 008															
395-397		0 002										0 002											
405-407		0 008						0 010										0 002					
415-417		0 004						0 008					0 002										
425-427		0 002						0 002	0 004		0 002	0 002	0 006		0 002								
435-437								0 004					0 002										
445-447								0 004															
467-469		0 002							0 002														
472-474		0 008				0 002																	
482-484	0 002	0 002						0 004	0 008									0 002					
492-494		0 004										0 008	0 004										
502-504								0 002	0 008			0 002											
512-514		0 008						0 004				0 002											
522-524	0 002	0 004						0 004				0 002									0 004		
532-534		0 004						0 008			0 004												
552-554													0 002										
562-564				0 002				0 002	0 008									0 002					
582-584		0 004						0 008	0 002				0 002								0 004		
592-594												0 002											
602-604	0 002	0 002								0 004			0 002					0 002					
612-614		0 002																0 004					
619-621	0 002	0 002										0 002	0 002					0 002					
629-631	0 004	0 004						0 008	0 004														
639-641	0 004							0 002			0 004	0 006									0 004		
649-651	0 004												0 002					0 002					
659-661	0 002					0 002				0 002	0 002				0 006								
669-671		0 002				0 002		0 008													0 002		
679-681	0 002											0 004											
689-691		0 006										0 004	0 002										
699-701	0 004			0 002				0 008				0 002								0 002			
709-711								0 008	0 002														
719-721	0 004									0 002		0 002											0 002
729-731	0 004							0 008				0 002											
739-741			0 004			0 002		0 004	0 006														
749-751		0 004						0 002	0 008	0 004													
759-761	0 002	0 004						0 004	0 020	0 004		0 004	0 002										

Sample (cm below top of core)	<i>Achnanthes conspicua</i>	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes lemmermanii</i>	<i>Achnanthes cf. lemmermanii</i>	<i>Achnanthes rosenstockii</i>	<i>Achnanthes subatomoides</i>	<i>Achnanthes sp. 1</i>	<i>Achnanthes sp. 2</i>	<i>Achnanthes sp. 3</i>	<i>Achnanthes cf. macrocephalum</i>	<i>Achnanthes minutissimum</i>	<i>Actinopychus senarius</i>	<i>Actinopychus splendens</i>	<i>Actinopychus vulgaris</i>	<i>Actinopychus sp. 1</i>	<i>Amphora acutiuscula</i>	<i>Amphora coffeiformis</i>	<i>Amphora exigua</i>	<i>Amphora cf. helensis</i>	<i>Amphora maritima</i>	<i>Amphora pseudohyalina</i>	<i>Amphora strigosa</i>
769-771								0 004				0 004	0 002										
783-785								0 002															
803-805								0 004									0 002	0 002					
813-815		0 004							0 008				0 002										
823-825		0 002	0 004			0 002			0 012				0 002										
833-835		0 004							0 008				0 002									0 002	
843-845			0 004						0 008						0 002								
853-855		0 002							0 004				0 002										
863-865		0 002	0 002						0 004				0 002		0 004							0 004	
873-875		0 002				0 002			0 008				0 002										
883-885		0 002							0 008				0 002				0 010						
893-895		0 002							0 004				0 002	0 008			0 006		0 004				
913-915		0 004											0 002										
923-925									0 016				0 004										
925-927													0 002										
935-937									0 008						0 004								
945-947		0 004						0 002	0 004									0 002					
955-957	0 002	0 002													0 004								
965-967			0 004										0 002						0 004				
975-977		0 010											0 004						0 002				
985-987		0 002											0 002				0 002						
995-997		0 002											0 002		0 002					0 004	0 004		
1005-1007		0 004							0 008													0 004	
1015-1017		0 004											0 002					0 002					
1025-1027		0 006	0 002			0 002							0 006										
1035-1037	0 006	0 012	0 002					0 002	0 008														
1045-1047																							
1055-1057								0 002	0 004				0 006						0 004				
1079-1081		0 006							0 004				0 002	0 002			0 002						
1089-1091	0 004	0 004							0 004				0 004										
1109-1111									0 004				0 002										
1119-1121																			0 004	0 004			
1129-1131		0 002						0 004					0 004										0 002
1139-1141									0 004											0 008			
1149-1151		0 004											0 002				0 002		0 004				
1169-1171																							
1179-1181		0 002											0 002	0 002									
1189-1191		0 006																		0 004	0 002		
1209-1211	0 002	0 002													0 010		0 006						

Sample (cm below top of core)	<i>Amphora</i> sp 1	<i>Amphora</i> sp 2	<i>Amphora</i> sp 3	<i>Aulacoseira islandica</i>	<i>Aulacoseira lirata</i>	<i>Bacillaria paxillifer</i>	<i>Berkeleya rutilans</i>	<i>Brachysira brebussoni</i>	<i>Caloneis crassa</i>	<i>Caloneis cf. liber</i>	<i>Caloneis tenuis</i>	<i>Cocconeis costata</i> var. <i>costata</i>	<i>Cocconeis cf. distantula</i>	<i>Cocconeis placentula</i>	<i>Cocconeis placentula</i> var. <i>euglypta</i>	<i>Cocconeis scutellum</i>	<i>Cocconeis scutellum</i> var. <i>parva</i>	<i>Cocconeis</i> sp 1	<i>Cocconeis</i> sp 2	<i>Cocconeis</i> sp 3	<i>Cocconeis radiatus</i>	<i>Cocconeis</i> sp 1	<i>Craticula halophila</i>
5-7						0 002	0 002																
10-12												0 002										0 009	
20-22	0 002			0 002									0 002									0 002	
30-32						0 008						0 002										0 002	
40-42												0 002					0 002					0 004	
50-52		0 002				0 002						0 004										0 006	
60-62						0 002		0 002				0 002										0 002	
70-72												0 002					0 004					0 004	
80-82												0 002					0 002						
90-92				0 002		0 002																	
100-102								0 002															
110-112								0 002									0 004						
120-122																						0 002	
130-132																						0 002	
183-185																		0 004					
196-198						0 002		0 004				0 004					0 002					0 008	
206-208			0 004			0 002																0 004	
216-218																							0 004
226-228																	0 004						
236-238								0 002				0 002										0 002	
246-248																	0 002						
256-258								0 002				0 002										0 002	
266-268												0 002	0 002				0 002					0 006	
276-278																	0 004						0 002
286-288												0 002	0 002										
305-307						0 002											0 002						
315-317						0 002						0 002					0 002					0 006	
325-327							0 004										0 002						
335-337		0 002															0 002						
345-347						0 002						0 002					0 002						0 002
355-357		0 002										0 002					0 002					0 002	
365-367																						0 002	
375-377												0 002	0 002		0 004								
385-387																	0 002	0 002				0 002	
395-397																	0 002					0 004	0 002
405-407						0 002											0 002					0 002	
415-417		0 002																					
425-427																	0 006						
435-437												0 004					0 002						
445-447																					0 002		
467-469	0 002					0 002	0 002					0 002	0 002		0 002	0 002					0 002		
472-474		0 002					0 002										0 002					0 002	
482-484												0 002										0 002	0 004
492-494		0 004															0 002					0 002	
502-504							0 002										0 002					0 002	
512-514				0 002																			
522-524		0 002						0 002				0 002										0 002	0 002
532-534																						0 002	
552-554																	0 002					0 002	
562-564					0 002							0 004										0 002	0 002
582-584																	0 002	0 002					
592-594			0 002									0 002	0 002		0 002	0 004						0 004	
602-604																	0 002					0 004	
612-614																	0 002					0 002	
619-621								0 002				0 002					0 002						
629-631																	0 002	0 006				0 002	
639-641								0 002														0 002	
649-651																						0 002	
659-661																	0 006						
669-671																	0 002					0 006	
679-681						0 004											0 002						
689-691								0 004									0 002					0 002	
699-701												0 002										0 002	
709-711				0 004	0 002												0 002						0 002
719-721						0 002						0 002										0 004	
729-731												0 002					0 002					0 002	0 004
739-741																	0 004					0 002	0 004
749-751													0 002									0 002	
759-761														0 002								0 002	0 008

Sample (cm below top of core)	<i>Amphora</i> sp 1	<i>Amphora</i> sp 2	<i>Amphora</i> sp 3	<i>Aulacoseira islandica</i>	<i>Aulacoseira lirata</i>	<i>Bacillaria paxillifer</i>	<i>Berkeleya rutilans</i>	<i>Brachysira brebissonii</i>	<i>Caloneis crassa</i>	<i>Caloneis cf. iber</i>	<i>Caloneis tenuis</i>	<i>Cocconeis costata</i> var. <i>costata</i>	<i>Cocconeis cf. dactyloides</i>	<i>Cocconeis placenticula</i>	<i>Cocconeis placenticula</i> var. <i>euglypta</i>	<i>Cocconeis scutellum</i>	<i>Cocconeis scutellum</i> var. <i>parva</i>	<i>Cocconeis</i> sp 1	<i>Cocconeis</i> sp 2	<i>Cocconeis</i> sp 3	<i>Coscinodiscus radiatus</i>	<i>Coscinodiscus</i> sp 1	<i>Cratichia halophila</i>
769-771						0 006		0 004														0 002	0 002
783-785						0 002						0 004											0 004
803-805								0 004								0 002	0 002				0 004		
813-815				0 004		0 002		0 004						0 002			0 006				0 004	0 002	
823-825				0 008				0 002								0 002	0 002				0 006		
833-835				0 004			0 002																
843-845				0 008		0 004		0 002								0 002	0 004				0 002		
853-855																	0 002				0 006		
863-865															0 004								
873-875				0 008				0 002				0 002		0 004			0 002				0 002		
883-885						0 002											0 006				0 002	0 004	
893-895												0 006										0 002	
913-915																0 002					0 008		
923-925						0 002		0 002									0 006				0 002		
925-927						0 002		0 002									0 002				0 002	0 002	
935-937																	0 002				0 004		
945-947						0 002		0 002				0 002					0 002				0 002		
955-957											0 004		0 004										
965-967								0 006				0 004									0 004		
975-977																					0 010		
985-987																	0 002				0 004	0 002	
995-997																	0 006				0 006		
1005-1007								0 002									0 004						
1015-1017								0 004				0 002						0 002			0 004		
1025-1027						0 006		0 002									0 002					0 002	
1035-1037			0 002			0 012																0 002	
1045-1047																					0 002		
1055-1057						0 004						0 002	0 002								0 002	0 002	
1079-1081																	0 002				0 002		
1089-1091						0 004	0 004									0 002	0 002						
1109-1111												0 002									0 004	0 002	
1119-1121																					0 008	0 002	
1129-1131						0 002				0 004							0 004				0 002		
1139-1141						0 002															0 004		
1149-1151								0 002													0 002		
1169-1171																	0 006						
1179-1181						0 002						0 002	0 002									0 002	
1189-1191						0 002		0 002				0 002					0 004				0 006		
1209-1211			0 004					0 008									0 004				0 002	0 002	

Sample (cm below top of core)	<i>Oenophora pulchella</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litoralis</i>	<i>Cyclotella pseudostelligera</i>	<i>Cyclotella stelligera</i>	<i>Cyclotella tripartita</i>	<i>Cymbella delicatula</i>	<i>Diatoma mesodon</i>	<i>Diatoma moniliformis</i>	<i>Diatoma</i> sp 1	<i>Diatoma</i> sp 2	<i>Diatomella cf. minuta</i>	<i>Diatomella</i> sp 1	<i>Diploneis cf. vacillans</i>	<i>Encyonema hebradicum</i>	<i>Encyonema minutum</i>	<i>Encyonema paucistratum</i>	<i>Encyonema silasticum</i>	<i>Eunotia cf. bilunaris</i>	<i>Eunotia lapponica</i>	<i>Eunotia praerupta</i>	<i>Eunotia aff. venteris</i>
5-7		0 013	0 220																				
10-12		0 004	0 203	0 002																			
20-22		0 009	0 227	0 005																			
30-32			0 148	0 004				0 004		0 002												0 002	
40-42		0 004	0 275																				
50-52		0 002	0 329	0 002																			
60-62			0 201	0 006													0 004						
70-72			0 258	0 002																			
80-82		0 002	0 269																				
90-92		0 004	0 195	0 002			0 004															0 002	
100-102		0 002	0 272	0 012																			
110-112		0 006	0 229	0 004																			
120-122			0 183	0 002				0 002						0 002			0 002	0 002					
130-132		0 002	0 269	0 002																			
183-185			0 225																			0 002	
196-198		0 006	0 173	0 014				0 002										0 004					
206-208		0 004	0 106	0 002																			
216-218		0 004	0 209							0 002													
226-228		0 002	0 333																				
236-238		0 004	0 171															0 004					
246-248		0 010	0 241	0 006																			
256-258		0 224	0 004					0 002										0 012					
266-268		0 006	0 241	0 002																			
276-278		0 004	0 157	0 009																			
286-288		0 222				0 002																	
305-307		0 035				0 002																	
315-317		0 004	0 130	0 002																			
325-327		0 004	0 269	0 006														0 002	0 002				
335-337		0 004	0 181	0 006							0 002							0 002	0 004				
345-347		0 002	0 211	0 010																			
355-357		0 148	0 014															0 002					
365-367		0 199							0 002														
375-377		0 148																0 006					
385-387		0 004	0 108																				
395-397		0 081																					
405-407		0 004	0 153	0 006																			
415-417		0 012	0 206			0 002										0 004							
425-427		0 197																0 008	0 002				
435-437		0 004	0 133	0 002																			
445-447		0 008	0 200																0 010				
467-469		0 008	0 157											0 002			0 002				0 002		
472-474		0 004	0 155																				
482-484		0 004	0 180	0 002		0 002																	
492-494		0 006	0 159	0 002																			
502-504		0 008	0 122	0 002		0 004				0 002						0 002		0 008					
512-514		0 004	0 028																				
522-524		0 002	0 137	0 002		0 004												0 006					
532-534		0 158	0 004																				
552-554		0 102	0 004											0 004									
562-564		0 002	0 083			0 002																	
582-584		0 077																					
592-594		0 078																					
602-604		0 120	0 004																				
612-614		0 004	0 085																				
619-621		0 004	0 107							0 002													
629-631		0 006	0 139	0 002												0 002							
639-641		0 002	0 121																				
649-651		0 002	0 049																				
659-661		0 008	0 107	0 008																0 004			
669-671		0 002	0 064	0 006																			
679-681		0 090	0 010															0 004		0 002	0 002		
689-691		0 146	0 006										0 002										
699-701		0 004	0 133	0 002														0 008					
709-711		0 010	0 159													0 004							
719-721		0 171	0 002																				
729-731		0 202	0 010																				
739-741		0 006	0 133										0 004			0 002		0 010					
749-751		0 002	0 098	0 004												0 004		0 008					
759-761		0 006	0 156			0 002	0 002													0 002			

Sample (cm below top of core)	<i>Ctenophora pulchella</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litoralis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>	<i>Cyclotella tripartita</i>	<i>Cymbella delatula</i>	<i>Diatoma mesodon</i>	<i>Diatoma moniliformis</i>	<i>Diatoma</i> sp 1	<i>Diatoma</i> sp 2	<i>Diatomella cf. minuta</i>	<i>Diatomella</i> sp 1	<i>Diploneis cf. vacillans</i>	<i>Encyonema hebradicum</i>	<i>Encyonema minutum</i>	<i>Encyonema paucistratum</i>	<i>Encyonema silasticum</i>	<i>Eunotia cf. bilunaris</i>	<i>Eunotia lapponica</i>	<i>Eunotia praerupta</i>	<i>Eunotia aff. veners</i>
769-771		0 020	0 157	0 008		0 052				0 004													
783-785		0 006	0 095	0 004				0 002					0 004										
803-805		0 004	0 156	0 006	0 004																		
813-815		0 004	0 160	0 002		0 004									0 002	0 004	0 004						
823-825		0 004	0 167	0 006															0 006				
833-835			0 055												0 004								
843-845			0 111	0 008																			
853-855		0 002	0 119																				
863-865		0 008	0 083	0 002															0 004				
873-875			0 110	0 002												0 004			0 008	0 002			
883-885			0 053	0 008		0 002														0 002			
893-895	0 002	0 012	0 096			0 002																	
913-915			0 087												0 002								
923-925		0 018	0 147	0 002															0 004				
925-927		0 010	0 088																0 012				
935-937		0 004	0 042	0 006																			
945-947		0 012	0 099	0 002															0 008		0 002		
955-957		0 008	0 062	0 004																			
965-967		0 012	0 081																0 004				
975-977			0 048	0 004						0 002													0 004
985-987		0 010	0 059																		0 004		
995-997		0 014	0 095			0 002				0 002							0 002				0 004		
1005-1007		0 008	0 072	0 002																			
1015-1017	0 004	0 036	0 139	0 006						0 002													
1025-1027		0 014	0 075																				
1035-1037			0 057						0 002														
1045-1047		0 010	0 032	0 002			0 004												0 004				
1055-1057		0 008	0 047	0 002						0 002						0 002			0 014				
1079-1081		0 006	0 050	0 006																			
1089-1091		0 002	0 047	0 022																	0 002		
1109-1111		0 037	0 078		0 008	0 037													0 006				
1119-1121		0 004	0 018		0 002														0 004				
1129-1131		0 008	0 051																		0 002		
1139-1141		0 014	0 046	0 002												0 002						0 002	
1149-1151		0 004	0 052	0 008																			
1169-1171		0 002	0 036	0 004																	0 002		
1179-1181		0 004	0 048																		0 002		
1189-1191		0 008	0 020	0 012															0 008				
1209-1211		0 006	0 060	0 002																			

Sample (cm below top of core)	<i>Eunotia</i> sp 1	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 3	<i>Eunotia</i> sp 4	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 6	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 8	<i>Eunotia</i> sp 9	<i>Eunotia</i> sp 10	<i>Eunotia</i> sp 11	<i>Eunotia</i> sp 12	<i>Eunotia</i> sp 13	<i>Eunotia</i> sp 14	<i>Eunotia</i> sp 15	<i>Eunotia</i> sp 16	<i>Eunotia</i> sp 17	<i>Fallacia</i> <i>litorcola</i>	<i>Fallacia</i> <i>sulcipunctata</i>	<i>Fallacia</i> <i>schultzei</i>	<i>Fallacia</i> sp 1	<i>Fallacia</i> sp 2	<i>Fragilaria</i> <i>costriata</i> var. <i>costriata</i>
5-7	0 002																						
10-12		0 002 0 002																				0 002	
20-22			0 002																				
30-32				0 004 0 010				0 004		0 002								0 002 0 002					
40-42	0 002				0 004																		
50-52			0 002 0 002											0 002									0 002
60-62					0 002 0 002														0 002				
70-72			0 004		0 002		0 002								0 002				0 002				
80-82					0 002 0 002 0 002																		
90-92			0 004 0 002	0 002				0 002											0 002				
100-102			0 002		0 004														0 002				
110-112	0 002				0 002			0 002 0 002 0 002															
120-122							0 004			0 004 0 002									0 004				
130-132			0 004										0 002										
183-185					0 002														0 004				
196-198					0 006					0 006		0 002											
206-208							0 002																
216-218					0 008																		
226-228		0 002 0 002 0 004	0 002							0 002 0 002													0 002
236-238			0 004		0 002		0 002			0 002									0 002				
246-248			0 004 0 002	0 002		0 002	0 002 0 002	0 004					0 002		0 002								0 002
256-258	0 002				0 004		0 002						0 002									0 002	
266-268					0 002														0 002				
276-278					0 007		0 002																0 002
286-288			0 006		0 006		0 002																0 004
305-307					0 004		0 004			0 002 0 004									0 002				
315-317					0 002					0 002									0 002				
325-327					0 004					0 004												0 004	
335-337		0 002			0 002																		
345-347					0 002		0 004			0 002					0 002								
355-357							0 004			0 002													
365-367			0 002		0 002																		
375-377							0 004																
385-387			0 002		0 002														0 002				
395-397					0 006														0 002				
405-407					0 002					0 004													
415-417			0 002 0 002 0 002																0 002				0 002
425-427			0 004							0 004													
435-437			0 002		0 002					0 006 0 002													
445-447					0 002		0 002																
467-469			0 002		0 006					0 002		0 002											0 002
472-474					0 006 0 002																		
482-484		0 002			0 002 0 002								0 002										
492-494													0 002										
502-504					0 010		0 002			0 002													
512-514																							
522-524							0 002		0 002				0 004						0 002				
532-534		0 002								0 002			0 002										
552-554													0 004										
562-564				0 002 0 002						0 004							0 002		0 004				
582-584					0 002 0 002														0 002				
592-594					0 002					0 002													
602-604			0 002				0 004			0 008									0 004				
612-614			0 004 0 002 0 004		0 004							0 002											
619-621			0 002														0 002						
629-631			0 004		0 006												0 002						
639-641	0 002		0 002		0 004		0 004			0 002		0 002			0 002 0 002 0 002								0 002
649-651																			0 002				0 002
659-661					0 002 0 002					0 004					0 002								
669-671	0 004																						
679-681		0 002																	0 002 0 002				
689-691							0 002		0 002 0 002														0 002
699-701							0 002									0 002		0 002					
709-711			0 002		0 002		0 002				0 002								0 002				
719-721			0 002																0 002				0 002
729-731			0 002 0 002 0 002		0 002		0 002			0 002									0 002				
739-741			0 002		0 004						0 004					0 004							
749-751			0 002 0 002																0 002				
759-761			0 002 0 002		0 002		0 002			0 004 0 002 0 002 0 002												0 002	

Sample (cm below top of core)	<i>Eunotia</i> sp 1	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 3	<i>Eunotia</i> sp 4	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 6	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 8	<i>Eunotia</i> sp 9	<i>Eunotia</i> sp 10	<i>Eunotia</i> sp 11	<i>Eunotia</i> sp 12	<i>Eunotia</i> sp 13	<i>Eunotia</i> sp 14	<i>Eunotia</i> sp 15	<i>Eunotia</i> sp 16	<i>Eunotia</i> sp 17	<i>Fallacia</i> <i>luorcola</i>	<i>Fallacia</i> <i>solipunctata</i>	<i>Fallacia</i> <i>schultzeorum</i>	<i>Fallacia</i> sp 1	<i>Fallacia</i> sp 2	<i>Fragilaria</i> <i>costriens</i> var. <i>costriens</i>
769-771			0 004	0 002	0 002					0 010													
783-785					0 002			0 002		0 002									0 002				
803-805				0 002	0 002																	0 002	
813-815			0 002				0 002																
823-825	0 002		0 002		0 006		0 002			0 004													
833-835				0 002			0 002																
843-845			0 002																				
853-855					0 008		0 006	0 004															
863-865					0 002		0 004							0 004									
873-875						0 002	0 002	0 002					0 002										
883-885							0 002			0 004													
893-895	0 002				0 004					0 004												0 002	
913-915			0 002											0 002		0 002							
923-925			0 002				0 014								0 002								
925-927			0 010							0 002													
935-937			0 004										0 004										
945-947													0 002										
955-957																							
965-967					0 010																		
975-977					0 006				0 004														0 004
985-987		0 002					0 002			0 004													
995-997		0 002		0 002				0 002		0 004													
1005-1007				0 004						0 004													
1015-1017		0 004																	0 004		0 004		
1025-1027					0 008														0 002				
1035-1037							0 002				0 002												
1045-1047																							
1055-1057			0 004				0 004	0 002															
1079-1081			0 002													0 002							
1089-1091																				0 004			
1109-1111	0 002		0 004													0 004							
1119-1121																							
1129-1131		0 002						0 002		0 002										0 002			
1139-1141										0 006													
1149-1151			0 002		0 004																		
1169-1171							0 004			0 002										0 002			
1179-1181			0 002		0 002		0 004																
1189-1191	0 002				0 002			0 004												0 002			
1209-1211			0 002		0 004					0 002			0 002										

Sample (cm below top of core)	<i>Fragilaria cf. costuensis</i> var. <i>pumila</i>	<i>Fragilaria cycloptum</i>	<i>Fragilaria famelica</i>	<i>Fragilaria cf. tenera</i>	<i>Fragilaria vaucheriae</i>	<i>Fragilaria</i> sp 1	<i>Fragilaria</i> sp 2	<i>Fragilaria</i> sp 3	<i>Fragilariopsis cylindriciformis</i>	<i>Fragilariopsis cylindrus</i>	<i>Fragilariopsis oceanica</i>	<i>Fragilariopsis pseudonana</i>	<i>Frustulia brummeri</i>	<i>Frustulia rhomboides</i>	<i>Frustulia saxonica</i>	<i>Gomphonema parvulum</i>	<i>Gomphonema</i> sp 1	<i>Gomphonemopsis obscurum</i>	<i>Grammatophora marna</i>	<i>Grammatophora oceanica</i>	<i>Gyrodinium cf. arcticum</i> var. <i>subflexuosa</i>	<i>Gyrodinium balicum</i>	<i>Gyrodinium</i> sp 1
5-7	0 002								0 002			0 016				0 002							
10-12					0 004				0 015	0 011													
20-22									0 014	0 005		0 002	0 002							0 005			
30-32									0 002														
40-42									0 011	0 002				0 002		0 002	0 002						
50-52									0 002	0 002		0 004											
60-62										0 010		0 002								0 004			
70-72										0 045		0 006											
80-82									0 002			0 002								0 004	0 002		
90-92									0 004														
100-102									0 012	0 006		0 004								0 002			
110-112									0 002	0 015			0 002										
120-122										0 004													
130-132									0 008	0 004		0 006		0 002									
183-185									0 012	0 002											0 002		
196-198					0 004				0 010			0 002	0 004		0 002								
206-208									0 008			0 004	0 002										
216-218										0 008						0 002							
226-228									0 010	0 004		0 004					0 002						
236-238			0 004						0 004	0 004		0 002	0 002			0 004							
246-248									0 002	0 002		0 002											
256-258										0 004			0 006							0 002			
266-268									0 012	0 004		0 002								0 002			
276-278									0 013										0 004		0 002		
286-288	0 002								0 008	0 026													
305-307												0 002											
315-317									0 002					0 002									
325-327									0 002	0 002													
335-337									0 004											0 004			
345-347									0 002	0 012			0 004						0 004	0 002			
355-357									0 008			0 002	0 004							0 006			
365-367									0 004										0 004				
375-377									0 002										0 004				
385-387									0 004	0 002										0 004			
395-397												0 002	0 002	0 002									
405-407				0 002									0 002							0 002			
415-417			0 002									0 002		0 004						0 002			
425-427									0 002	0 002		0 002	0 004							0 004			
435-437									0 006			0 002								0 004			0 002
445-447									0 004			0 006								0 004			
467-469									0 002														
472-474									0 002	0 002		0 004											
482-484									0 004	0 008													
492-494									0 004	0 002													
502-504									0 002			0 002										0 002	
512-514									0 004														
522-524			0 002						0 006			0 002		0 002						0 002		0 002	
532-534										0 002		0 002											
552-554									0 002			0 002											
562-564																							
582-584																0 002				0 004			
592-594													0 002							0 002			
602-604														0 002									
612-614												0 002						0 002		0 004			
619-621						0 002			0 002			0 002	0 004										
629-631									0 002					0 004					0 004	0 004			
639-641															0 002								
649-651																							
659-661																				0 004			
669-671	0 004								0 002			0 004		0 002						0 004			
679-681	0 002								0 004	0 002					0 002					0 004			
689-691		0 002								0 004	0 002				0 002					0 004			
699-701									0 002			0 002		0 002									
709-711							0 004													0 002			
719-721									0 006	0 002													
729-731									0 008			0 006		0 004									
739-741				0 002					0 010			0 006	0 002		0 002								
749-751					0 002				0 010														
759-761			0 002						0 010														

Sample (cm below top of core)	<i>Fragilaria cf. costata</i> var. <i>pumila</i>	<i>Fragilaria cyclopus</i>	<i>Fragilaria lamellica</i>	<i>Fragilaria cf. tenera</i>	<i>Fragilaria vaucheriae</i>	<i>Fragilaria</i> sp. 1	<i>Fragilaria</i> sp. 2	<i>Fragilaria</i> sp. 3	<i>Fragilaropsis cylindricus</i>	<i>Fragilaropsis cylindrus</i>	<i>Fragilaropsis oceanica</i>	<i>Fragilaropsis pseudonana</i>	<i>Frustulia krameri</i>	<i>Frustulia rhomboides</i>	<i>Frustulia saxonica</i>	<i>Gomphonema parvulum</i>	<i>Gomphonema</i> sp. 1	<i>Gomphonemopsis obscurum</i>	<i>Gramatophora marna</i>	<i>Gramatophora oceanica</i>	<i>Gyrodinium cf. artium</i> var. <i>sublaetosa</i>	<i>Gyrodinium balticum</i>	<i>Gyrodinium</i> sp. 1
769-771									0 004		0 002	0 002								0 004			
783-785												0 002								0 004			
803-805									0 002														
813-815																				0 002			
823-825									0 006					0 002									
833-835																							
843-845											0 004			0 006									
853-855									0 002	0 002						0 004							
863-865									0 002	0 002										0 004			
873-875				0 002					0 008							0 004							0 004
883-885									0 002										0 004				
893-895									0 004					0 004									
913-915																				0 004			
923-925																							
925-927									0 002		0 004		0 002		0 004					0 004			
935-937											0 004												
945-947													0 004	0 004									
955-957				0 004	0 004								0 004							0 004			
965-967																				0 004			
975-977									0 002		0 002					0 004				0 004			
985-987				0 002									0 002										
995-997			0 002						0 004											0 004			
1005-1007									0 008				0 004						0 004				
1015-1017									0 002											0 002			
1025-1027									0 004	0 002				0 002									
1035-1037											0 002									0 002			0 002
1045-1047																				0 002			
1055-1057											0 006	0 002		0 004						0 002			
1079-1081																		0 006	0 004				
1089-1091								0 002						0 002						0 002			
1109-1111													0 002	0 002						0 004			
1119-1121								0 004												0 002			
1129-1131									0 002				0 002							0 002			
1139-1141												0 002	0 002					0 004		0 004			
1149-1151								0 002												0 006			0 002
1169-1171								0 002	0 002		0 002							0 004					
1179-1181								0 002					0 002										
1189-1191									0 004									0 002					
1209-1211				0 002											0 002								

Sample (cm below top of core)	<i>Hanea arcus</i>	<i>Haslea crucigeroides</i>	<i>Hyalodiscus scoticus</i>	<i>Maryena atomus</i>	<i>Maryena maris</i>	<i>Maryena cf. schultzei</i>	<i>Mastodonta pumila</i>	<i>Melosira arenita</i>	<i>Melosira numelloides</i>	<i>Melosira varians</i>	<i>Navicula cf. cryptotenelloides</i>	<i>Navicula directa</i>	<i>Navicula gregaria</i>	<i>Navicula cf. joussonii</i>	<i>Navicula luciae</i>	<i>Navicula oblonga</i>	<i>Navicula perminuta</i>	<i>Navicula cf. peterseni</i>	<i>Navicula phylepta</i>	<i>Navicula phylloptoma</i>	<i>Navicula ramosissima</i>	<i>Navicula cf. rhynchocephala</i>	<i>Navicula salicola</i>
5-7		0 002	0 002								0 004					0 004							
10-12																					0 002		
20-22				0 002																			
30-32																							
40-42				0 004	0 007	0 002											0 004						
50-52																0 004							
60-62				0 002	0 016	0 004											0 002						
70-72					0 021						0 002												
80-82			0 002		0 006	0 004					0 002												
90-92			0 002	0 008	0 004	0 012										0 002							
100-102			0 002	0 010																		0 002	
110-112				0 004								0 004											
120-122			0 012		0 004																		
130-132			0 008				0 002				0 002						0 006						
183-185				0 004	0 008			0 008														0 004	
196-198				0 008			0 002				0 004				0 004	0 004	0 006					0 004	
206-208			0 004	0 006	0 008												0 004						
216-218				0 006	0 018						0 002											0 004	
226-228				0 008													0 004					0 006	0 002
236-238	0 004											0 004					0 002				0 002		
246-248				0 004							0 004											0 004	
256-258				0 008																			
266-268				0 008			0 002																
276-278			0 002	0 007			0 004	0 004															
286-288			0 010	0 024								0 002										0 002	0 002
305-307											0 002	0 002											
315-317				0 004	0 002												0 004				0 004	0 002	
325-327				0 006		0 002	0 002										0 004	0 002					
335-337																	0 002	0 012					
345-347				0 004	0 006																		
355-357							0 002	0 004									0 004						
365-367								0 004															
375-377				0 004				0 004								0 002	0 002					0 004	
385-387																						0 002	
395-397				0 008	0 002		0 002															0 002	
405-407				0 004	0 004									0 002			0 004						
415-417			0 002	0 002			0 002						0 002				0 004					0 002	
425-427				0 004	0 004		0 002										0 002					0 006	
435-437																0 002	0 002						
445-447							0 002																
467-469				0 004																			
472-474			0 002	0 004	0 016												0 002		0 002				
482-484		0 002		0 002							0 002	0 004										0 002	
492-494			0 002	0 002												0 002	0 004						
502-504				0 006	0 006	0 002	0 002																
512-514																	0 002						
522-524				0 002													0 004						
532-534				0 002			0 004										0 004						
552-554					0 004																		
562-564		0 002																					
582-584				0 016					0 004														
592-594				0 002	0 006				0 002								0 002				0 006		
602-604			0 002	0 002	0 004	0 002																	
612-614			0 002	0 006							0 002						0 002	0 002					
619-621				0 004	0 004		0 002										0 002						
629-631				0 004	0 004		0 002															0 002	
639-641				0 006																			
649-651		0 002		0 006					0 002						0 002								
659-661			0 010						0 002													0 002	
669-671		0 002		0 002	0 010		0 002										0 002						
679-681				0 004			0 004				0 002						0 002	0 002	0 002				
689-691				0 004	0 016		0 004										0 006					0 002	
699-701				0 002													0 002						
709-711			0 004				0 002			0 002							0 002						
719-721				0 002			0 008										0 006						
729-731				0 004	0 004																	0 004	
739-741				0 010													0 002	0 002					
749-751				0 006	0 004																		
759-761																0 004	0 002				0 004		

Sample (cm below top of core)	<i>Hantzschia arcus</i>	<i>Hantzschia crucigeroides</i>	<i>Hyalodiscus scoticus</i>	<i>Maryina atomus</i>	<i>Maryina marys</i>	<i>Maryina cf. schultzei</i>	<i>Mastogonia pumila</i>	<i>Melosira arenit</i>	<i>Melosira numellodes</i>	<i>Melosira varians</i>	<i>Navicula cf. cryptotenellodes</i>	<i>Navicula directa</i>	<i>Navicula gregaria</i>	<i>Navicula cf. jonsomii</i>	<i>Navicula luciae</i>	<i>Navicula oblonga</i>	<i>Navicula perminuta</i>	<i>Navicula cf. peterseni</i>	<i>Navicula phylepta</i>	<i>Navicula phylloptosoma</i>	<i>Navicula ramostissima</i>	<i>Navicula cf. rhynchoccephala</i>	<i>Navicula salincola</i>
769-771			0 002	0 004				0 002								0 002	0 002			0 002			
783-785				0 004				0 002									0 002						
803-805				0 004	0 020												0 002						
813-815			0 002	0 004		0 002																	
823-825				0 006			0 002				0 002	0 002				0 002						0 002	
833-835	0 004			0 010													0 002						
843-845																							
853-855				0 004							0 004					0 002							
863-865				0 004																			
873-875				0 008	0 004																		
883-885			0 002	0 008						0 002												0 006	
893-895			0 002	0 002	0 004																	0 002	
913-915				0 002	0 004					0 002							0 006						
923-925				0 008						0 004	0 004						0 002					0 002	
925-927																						0 004	
935-937			0 002					0 004															
945-947			0 002	0 006													0 002				0 002	0 002	
955-957				0 004	0 002																		
965-967																	0 004						
975-977			0 002	0 004													0 002						
985-987				0 002	0 004	0 002																	
995-997				0 004	0 006												0 010						
1005-1007																							
1015-1017				0 008				0 002									0 004					0 004	
1025-1027			0 002	0 002	0 002							0 002					0 002						
1035-1037				0 006													0 002					0 002	0 002
1045-1047				0 002								0 002											
1055-1057				0 006	0 008	0 002											0 004						
1079-1081				0 002	0 004												0 006						
1089-1091				0 004													0 004						
1109-1111				0 004																		0 002	
1119-1121			0 002	0 002	0 008												0 002					0 002	
1129-1131			0 002		0 008												0 006						
1139-1141				0 004													0 004						
1149-1151				0 002	0 004						0 006						0 002						
1169-1171		0 004															0 002					0 002	
1179-1181				0 002							0 002						0 002						
1189-1191									0 004							0 002	0 010						
1209-1211				0 004	0 004							0 004										0 002	

Sample (cm below top of core)	<i>Navicula schrodes</i>	<i>Navicula cf. subinflata</i>	<i>Navicula veneta</i>	<i>Navicula</i> sp 1	<i>Navicula</i> sp 2	<i>Navicula</i> sp 3	<i>Navicula</i> sp 4	<i>Navicula</i> sp 5	<i>Navicula</i> sp 6	<i>Navicula</i> sp 7	<i>Navicula</i> sp 8	<i>Nesidium productum</i>	<i>Nitzschia cf. alpina</i>	<i>Nitzschia cf. bacillum</i>	<i>Nitzschia cf. communis</i>	<i>Nitzschia dissipata</i>	<i>Nitzschia dissipata</i> var. <i>media</i>	<i>Nitzschia cf. fonticola</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia hungarica</i>	<i>Nitzschia liebertii</i>	<i>Nitzschia peruviana</i>	<i>Nitzschia radicola</i>
5-7																			0.002		0.004	0.004	
10-12							0.002												0.002		0.004	0.002	
20-22																			0.005		0.005	0.009	
30-32																			0.008			0.004	
40-42																			0.004	0.004	0.002		
50-52											0.002								0.004		0.004	0.004	
60-62																					0.004	0.004	
70-72																			0.004		0.006	0.006	
80-82																			0.002		0.004		
90-92												0.002									0.002		
100-102										0.002							0.002		0.002		0.002	0.004	
110-112			0.002														0.002	0.004	0.002		0.004	0.004	
120-122																					0.002	0.002	
130-132						0.002													0.002		0.006	0.008	
183-185																						0.014	
196-198												0.002					0.002		0.006		0.010	0.004	
206-208																	0.002		0.004		0.004		
216-218															0.002			0.004		0.004	0.004		
226-228															0.002					0.004	0.008		
236-238																			0.002		0.002	0.012	
246-248										0.002						0.002					0.002		
256-258																0.002		0.002		0.002	0.008		
266-268						0.004										0.002			0.006		0.006		
276-278																			0.002		0.002	0.009	
286-288															0.002				0.002			0.006	
305-307																			0.004		0.004	0.004	
315-317																			0.004		0.010	0.006	
325-327																							
335-337																							
345-347																			0.002		0.002	0.010	
355-357																						0.004	
365-367																			0.004	0.006	0.002	0.008	
375-377																					0.008	0.006	
385-387																					0.002	0.002	
395-397																						0.004	
405-407																			0.004		0.010	0.002	
415-417																					0.004	0.002	
425-427																			0.004	0.002		0.002	
435-437																			0.004		0.010	0.004	
445-447		0.002																				0.006	
467-469										0.002						0.004			0.010		0.020	0.004	
472-474																			0.004	0.004	0.008	0.006	
482-484																				0.010	0.010	0.014	
492-494																					0.004	0.004	
502-504							0.002												0.002		0.006	0.006	
512-514																					0.004	0.004	
522-524										0.002									0.006		0.015	0.008	
532-534																					0.004	0.004	
552-554																					0.004		
562-564																	0.002	0.006		0.004	0.004		
582-584																					0.008	0.002	
592-594																	0.002	0.002	0.004		0.004		
602-604																					0.004		
612-614												0.002									0.010		
619-621						0.002													0.004		0.006	0.004	
629-631																						0.002	
639-641																					0.004	0.004	
649-651																0.004		0.002		0.006	0.004		
659-661																			0.008		0.004	0.004	
669-671																					0.002		
679-681																	0.004				0.008	0.006	
689-691		0.002																				0.008	
699-701										0.002							0.004				0.002		
709-711										0.002									0.004				
719-721																			0.008		0.002	0.004	
729-731										0.002							0.002		0.006		0.012		
739-741																			0.002		0.002		
749-751										0.002									0.002				
759-761														0.004					0.012		0.014		

Sample (cm below top of core)	<i>Navicula schaden</i>	<i>Navicula cf. subinflata</i>	<i>Navicula veneta</i>	<i>Navicula</i> sp 1	<i>Navicula</i> sp 2	<i>Navicula</i> sp 3	<i>Navicula</i> sp 4	<i>Navicula</i> sp 5	<i>Navicula</i> sp 6	<i>Navicula</i> sp 7	<i>Navicula</i> sp 8	<i>Nesidium productum</i>	<i>Nitzschia cf. alpina</i>	<i>Nitzschia cf. bacillum</i>	<i>Nitzschia cf. communis</i>	<i>Nitzschia dissipata</i>	<i>Nitzschia dissipata</i> var. <i>media</i>	<i>Nitzschia cf. fonticola</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia hungarica</i>	<i>Nitzschia liebertii</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia radialis</i>	
769-771																					0 004	0 002	0 002	
783-785																			0 004			0 002		
803-805																	0 006	0 008			0 004	0 006		
813-815																	0 004				0 004			
823-825																	0 002	0 004			0 006	0 004		
833-835										0 002												0 004		
843-845																	0 002							
853-855		0 002																			0 008			
863-865																								
873-875																			0 008		0 008	0 014		
883-885		0 002								0 004												0 008	0 004	
893-895															0 002			0 002						
913-915																								
923-925		0 004																				0 002		
925-927																			0 004					
935-937		0 002	0 004																		0 004	0 002		
945-947																			0 004			0 004		
955-957																	0 002				0 004			
965-967																					0 020	0 010		
975-977								0 004			0 004								0 004		0 008	0 010		
985-987			0 004														0 004				0 004	0 010		
995-997			0 004																		0 004			
1005-1007		0 004	0 002														0 004	0 012				0 014		
1015-1017																					0 008	0 006		
1025-1027			0 004														0 002	0 002			0 004	0 004		
1035-1037									0 004										0 004		0 004	0 004		
1045-1047		0 002																			0 002			
1055-1057			0 002									0 004							0 002		0 006			
1079-1081			0 002														0 002		0 004					
1089-1091									0 002												0 004			
1109-1111		0 002										0 002												
1119-1121													0 004						0 002			0 004		
1129-1131		0 002										0 002							0 002			0 006		
1139-1141																								
1149-1151																					0 012			
1169-1171			0 002															0 004			0 012			
1179-1181												0 004												
1189-1191			0 002									0 004												
1209-1211																								

Sample (cm below top of core)	<i>Nitzschia</i> sp 1	<i>Nitzschia</i> sp 2	<i>Nitzschia</i> sp 3	<i>Nitzschia</i> sp 4	<i>Nitzschia</i> sp 5	<i>Nitzschia</i> sp 6	<i>Nitzschia</i> sp 7	<i>Odontella aurita</i>	<i>Ophephora cf. gemmala</i>	<i>Ophephora guntter-grassii</i>	<i>Ophephora horstiana</i>	<i>Ophephora marina</i>	<i>Ophephora muabils</i>	<i>Ophephora olsoni</i>	<i>Ophephora cf. parva</i>	<i>Paralia sulcata</i>	<i>Parlibellus berkeleyi</i>	<i>Peronia fibula</i>	<i>Pinnularia microstauron</i>	<i>Pinnularia peterseni</i>	<i>Pinnularia rhomborea</i>	<i>Pinnularia cf. tenuisaghe</i>	<i>Pinnularia</i> sp 1
5-7																							
10-12																							
20-22			0 005																				
30-32																							
40-42										0 002													
50-52										0 002										0 002			
60-62											0 002												
70-72												0 002											
80-82																							
90-92	0 004						0 002																
100-102																							
110-112																							
120-122																							
130-132																							
183-185		0 002															0 002			0 002			
196-198																							
206-208																							
216-218																							
226-228																			0 002				
236-238													0 002				0 004		0 002	0 002			
246-248																							
256-258																							
266-268																							
276-278																				0 002			
286-288																							
305-307																							
315-317																							
325-327																		0 002					
335-337																			0 002				
345-347		0 002																	0 002				
355-357																							
365-367																	0 002						
375-377																							
385-387										0 002													
395-397										0 002													
405-407			0 002										0 002					0 002					
415-417	0 004							0 004		0 002								0 002					
425-427																							
435-437																							
445-447	0 004	0 002								0 002									0 002				
467-469	0 002																						
472-474													0 002										
482-484																							
492-494																							
502-504										0 002													
512-514																							
522-524	0 004																0 002						
532-534								0 002															
552-554	0 004									0 002													
562-564																				0 002			
582-584																							
592-594																							
602-604																		0 002					
612-614			0 004																				
619-621								0 002															
629-631																	0 002		0 002				
639-641	0 002							0 004															
649-651	0 002					0 002																	
659-661	0 004					0 002	0 004																
669-671																							
679-681								0 002										0 002		0 002		0 002	0 004
689-691																							
699-701							0 004										0 002			0 002			
709-711							0 002																
719-721	0 002																0 012						
729-731	0 004																0 002						
739-741								0 002															
749-751															0 002								
759-761												0 004											

Sample (cm below top of core)	<i>Nitzschia</i> sp 1	<i>Nitzschia</i> sp 2	<i>Nitzschia</i> sp 3	<i>Nitzschia</i> sp 4	<i>Nitzschia</i> sp 5	<i>Nitzschia</i> sp 6	<i>Nitzschia</i> sp 7	<i>Odontella aurita</i>	<i>Opaphora cf. geminata</i>	<i>Opaphora guiter-grassii</i>	<i>Opaphora horstiana</i>	<i>Opaphora marina</i>	<i>Opaphora mutabilis</i>	<i>Opaphora olivacea</i>	<i>Opaphora cf. parva</i>	<i>Paralia sulcata</i>	<i>Parthellus berkeleyi</i>	<i>Peronia filula</i>	<i>Pinularia microstauron</i>	<i>Pinularia peterseni</i>	<i>Pinularia rhomboides</i>	<i>Pinularia cf. tenuicarpa</i>	<i>Pinularia</i> sp 1
769-771							0 002		0 002					0 002									
783-785																							
803-805										0 002													
813-815														0 002			0 004		0 002				
823-825																							
833-835																							
843-845																							
853-855								0 004		0 002													
863-865																							
873-875																							
883-885																							
893-895																							
913-915	0 004																						
923-925																							
925-927																		0 002	0 004				
935-937																							
945-947																							
955-957									0 002														
965-967																							
975-977							0 006																
985-987	0 004																						
995-997																							
1005-1007								0 002														0 004	
1015-1017	0 002																						
1025-1027						0 006																	
1035-1037																							
1045-1047										0 004							0 002						
1055-1057							0 006									0 004							
1079-1081										0 002													
1089-1091										0 002													
1109-1111																							
1119-1121																							
1129-1131																							
1139-1141	0 004																						
1149-1151																							
1169-1171							0 004																
1179-1181							0 008	0 002												0 002		0 004	
1189-1191							0 004												0 002				
1209-1211																							

Sample (cm below top of core)	<i>Planolothidium delicatulum</i>	<i>Planolothidium cf. Engelbrechtii</i>	<i>Planolothidium liljeborgii</i>	<i>Pseudosira brevisstrata</i>	<i>Rocospira abbreviata</i>	<i>Sellaphora pupula</i>	<i>Skellonema costatum</i>	<i>Stauroneis neohyalis</i>	<i>Stauroneis punctata</i>	<i>Stephanodiscus sp. 1</i>	<i>Tabellaria foveolata</i>	<i>Tabellaria fasciculata</i>	<i>Tabellaria investiens</i>	<i>Tabellaria tabulata</i>	<i>Thalassionema bacillare</i>	<i>Thalassionema nitens</i>	<i>Thalassionema nitens</i>	<i>Thalassiosira angulata</i>	<i>Thalassiosira binata</i>	<i>Thalassiosira bulbosa</i>	<i>Thalassiosira conferta</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>
5-7	0 009	0 002					0 566				0 007							0 002	0 002		0 002	0 007	0 007	
10-12	0 011						0 537				0 002							0 011	0 004				0 013	0 002
20-22	0 011	0 002					0 453				0 002	0 005						0 011				0 002	0 007	0 005
30-32	0 008				0 004		0 583				0 006	0 004		0 008				0 020		0 002		0 002	0 004	0 006
40-42	0 007				0 004		0 455								0 004	0 007	0 007	0 002					0 016	
50-52	0 009	0 002					0 405									0 009		0 002					0 035	0 004
60-62	0 002	0 002					0 610	0 004															0 004	0 004
70-72	0 004	0 002					0 433					0 006						0 019						0 024
80-82	0 006						0 557					0 002		0 002				0 006					0 015	0 006
90-92	0 004						0 606					0 004						0 004					0 010	0 002
100-102	0 002	0 002			0 002		0 489	0 004		0 002								0 006					0 016	0 006
110-112	0 002	0 004					0 572							0 002				0 002						0 002
120-122	0 004	0 004					0 654											0 004					0 014	0 006
130-132	0 008						0 495					0 004											0 017	
183-185		0 010					0 542						0 010				0 004							0 006
196-198	0 002						0 515				0 006			0 014			0 010						0 002	0 004
206-208	0 004	0 002			0 002		0 649				0 002		0 004	0 006			0 014							0 004
216-218	0 004						0 583							0 002			0 006						0 008	0 002
226-228	0 002	0 004					0 418				0 002	0 002					0 006						0 006	0 002
236-238	0 006	0 002					0 584					0 004					0 014	0 002					0 008	0 004
246-248							0 536					0 002						0 024					0 004	0 012
256-258							0 601					0 002			0 002		0 008							0 006
266-268	0 002	0 002					0 465						0 002				0 010						0 002	0 004
276-278	0 007						0 552	0 002			0 002		0 002				0 004						0 031	0 007
286-288	0 004	0 002					0 516							0 004			0 010							0 008
305-307							0 751				0 002			0 002			0 004							0 002
315-317	0 002						0 549	0 004				0 002		0 002			0 055						0 002	0 008
325-327	0 002						0 531				0 004			0 010			0 002						0 002	0 002
335-337							0 689				0 002						0 002						0 008	0 004
345-347	0 002		0 002				0 480								0 002		0 008						0 006	0 002
355-357	0 006						0 657						0 004				0 002						0 010	0 008
365-367	0 004	0 004					0 634	0 002						0 002			0 002						0 010	0 004
375-377	0 002						0 598					0 002	0 002	0 006			0 002						0 020	0 004
385-387	0 002	0 002					0 708				0 002			0 004			0 008						0 016	0 010
395-397	0 004	0 006					0 720										0 012						0 010	0 004
405-407	0 004	0 002					0 569					0 002					0 002						0 006	0 004
415-417							0 541	0 002						0 004			0 008						0 004	0 008
425-427	0 002	0 002					0 535				0 002			0 002			0 004						0 004	0 002
435-437	0 006						0 629							0 004			0 008						0 006	0 004
445-447	0 002						0 667							0 002									0 008	0 002
467-469	0 004	0 002					0 561						0 002	0 006			0 008						0 016	
472-474	0 010	0 004					0 601		0 002					0 004			0 004						0 010	0 008
482-484	0 004	0 002					0 530							0 002			0 016						0 006	0 008
492-494	0 002	0 002					0 627							0 004			0 020		0 002				0 006	0 006
502-504	0 004						0 585				0 002			0 004			0 010						0 010	0 006
512-514							0 839							0 002			0 002						0 004	0 002
522-524	0 002						0 587	0 002		0 002				0 002			0 019		0 002				0 008	0 006
532-534	0 004						0 644							0 002			0 010						0 008	0 010
552-554							0 693							0 004							0 002			0 004
562-564	0 002						0 712				0 002			0 002			0 006							0 002
582-584	0 004				0 004		0 737				0 002	0 002		0 008			0 002						0 006	0 002
592-594	0 002	0 002					0 693				0 002			0 008			0 004							0 006
602-604	0 004						0 718	0 002						0 006			0 010	0 002	0 004		0 002		0 002	0 002
612-614	0 002	0 002					0 691	0 002				0 002		0 004			0 004		0 002				0 010	0 002
619-621	0 002	0 004					0 677	0 002				0 004		0 002			0 018						0 002	0 004
629-631		0 002					0 663				0 002			0 006			0 010						0 002	0 002
639-641	0 006		0 004				0 606	0 004		0 002	0 002			0 022			0 002						0 006	0 002
649-651	0 002						0 775							0 004			0 008						0 002	0 002
659-661	0 002	0 002					0 612				0 004	0 002		0 006			0 024	0 002	0 002				0 006	0 010
669-671							0 755					0 010					0 002	0 002	0 002					0 006
679-681	0 002						0 701							0 006					0 002					0 016
689-691	0 006						0 574	0 006				0 010		0 010			0 006		0 002					0 012
699-701		0 002					0 647	0 010				0 006	0 002	0 006			0 002						0 006	0 008
709-711	0 004	0 002					0 629							0 008			0 022						0 002	0 002
719-721	0 004						0 496					0 002		0 006			0 004			0 006	0 002		0 012	0 014
729-731	0 002	0 002					0 453				0 006	0 002		0 010			0 010		0 002				0 006	0 004
739-741	0 002						0 556				0 002	0 004		0 006			0 006	0 004	0 004	0 002				0 004
749-751	0 008	0 002					0 687	0 006		0 002	0 006		0 004				0 002						0 012	
759-761	0 006						0 500					0 004	0 002	0 016									0 008	0 006

Sample (cm below top of core)	<i>Planolithidium delicatulum</i>	<i>Planolithidium cf. Engelbrechtii</i>	<i>Planolithidium liljeborgii</i>	<i>Pseudostaurosira brevisstrata</i>	<i>Roccosiphonia abbreviata</i>	<i>Sellaphora pupula</i>	<i>Skeletonema costatum</i>	<i>Stauroneis neohyalia</i>	<i>Stauroneisella pinata</i>	<i>Stephanodiscus</i> sp. 1	<i>Tubellaria flocculosa</i>	<i>Tubularia fasciculata</i>	<i>Tubularia investiens</i>	<i>Tubularia tubulata</i>	<i>Thalassionema bacillare</i>	<i>Thalassionema nitzschoides</i>	<i>Thalassiosira angulata</i>	<i>Thalassiosira bonata</i>	<i>Thalassiosira bulbosa</i>	<i>Thalassiosira conferta</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>
769-771	0 004						0 495							0 008	0 022							0 010	
783-785	0 002						0 661				0 002	0 004		0 002		0 002	0 002				0 004	0 004	
803-805	0 002						0 529	0 004			0 002	0 014		0 002							0 002	0 004	
813-815	0 006						0 576	0 002		0 002	0 004	0 016		0 006								0 002	
823-825	0 004	0 004					0 544					0 020		0 004									
833-835	0 004						0 749					0 006		0 002	0 002							0 004	
843-845	0 006	0 004					0 608					0 016		0 008						0 002			
853-855	0 006	0 002					0 623					0 012		0 006						0 006	0 006		
863-865	0 010	0 002					0 660					0 016		0 004						0 004			
873-875	0 002						0 603				0 002	0 002					0 002						
883-885	0 006						0 638	0 002				0 022		0 006	0 002					0 002	0 012	0 008	
893-895	0 002				0 004		0 562	0 002	0 004			0 008		0 008		0 008				0 006	0 024	0 002	
913-915		0 002					0 687	0 008				0 024		0 004						0 002	0 002		
923-925		0 002					0 556	0 004				0 010								0 012	0 004		
925-927	0 002						0 608			0 002	0 006	0 014		0 006						0 010	0 004	0 002	
935-937	0 006				0 004		0 731					0 010		0 004						0 002			
945-947	0 006	0 002			0 004		0 543				0 002	0 016								0 004	0 010		
955-957	0 008				0 002		0 676					0 004	0 014							0 016	0 006		
965-967	0 002	0 002				0 004	0 586				0 006	0 014		0 004						0 008	0 002	0 004	
975-977	0 002	0 002					0 600				0 004	0 008		0 016						0 008			
985-987	0 006				0 004		0 726				0 002	0 008									0 002		
995-997	0 002	0 006					0 548			0 002	0 004	0 024		0 002							0 004		
1005-1007	0 006						0 642					0 002	0 006								0 004	0 002	0 008
1015-1017	0 002	0 004					0 388	0 002			0 004	0 002	0 008		0 008					0 004	0 004		
1025-1027	0 002	0 002					0 663				0 002	0 002	0 008							0 002		0 002	
1035-1037	0 008						0 597						0 008								0 002		
1045-1047	0 002						0 802					0 002	0 006							0 010			
1055-1057	0 006	0 004					0 464				0 008	0 018		0 004						0 008			
1079-1081							0 693					0 002		0 002							0 004	0 004	
1089-1091		0 002					0 717					0 002					0 002		0 002	0 002	0 002		
1109-1111							0 629	0 006				0 006		0 008						0 006			
1119-1121	0 002						0 726	0 004			0 002	0 004		0 002						0 008	0 008		
1129-1131	0 002						0 592				0 004	0 016		0 008						0 004	0 004		
1139-1141	0 002						0 657	0 004				0 006		0 004						0 002	0 008		
1149-1151	0 002	0 002		0 004	0 004		0 632	0 008				0 004								0 008	0 004		
1169-1171							0 653	0 002				0 004		0 002						0 002		0 002	
1179-1181							0 683					0 008		0 002						0 002	0 004		
1189-1191	0 002						0 650				0 002						0 002			0 006	0 002		
1209-1211							0 647	0 002				0 004		0 002						0 004			

Sample (cm below top of core)	<i>Thalassiosira hyalina</i>	<i>Thalassiosira leptopus</i>	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira oestrupii</i> var <i>oestrupii</i>	<i>Thalassiosira oestrupii</i> var <i>venricolae</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira punctigera</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 1	<i>Thalassiosira</i> sp 2	<i>Thalassiosira</i> sp 3	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 5	<i>Thalassiosira</i> sp 6	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 12	<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 14	<i>Thalassiosira</i> sp 15	
5-7	0 002	0 031				0 016		0 049	0 002													0 009		
10-12		0 048				0 054	0 004	0 032														0 009		
20-22		0 005	0 032			0 096		0 034							0 007							0 014		
30-32		0 002	0 059	0 002		0 037	0 004	0 026							0 004									
40-42		0 002	0 020			0 071		0 024			0 004				0 007		0 002					0 011		
50-52		0 011	0 026			0 041		0 035			0 002				0 004							0 004		
60-62		0 002	0 029			0 031		0 021														0 008		
70-72		0 002	0 039			0 034									0 009							0 009		
80-82			0 034			0 021		0 019	0 002			0 004			0 002	0 002						0 002		
90-92			0 025			0 025		0 023				0 004			0 008	0 002						0 002		
100-102			0 050			0 020		0 036				0 006			0 002		0 002					0 004		
110-112			0 019			0 044		0 021				0 004			0 004		0 006					0 002		
120-122			0 029			0 024		0 018														0 002		
130-132		0 002	0 042			0 023		0 029	0 002			0 004		0 006	0 006							0 006		
183-185			0 004	0 039		0 043		0 019														0 008		
196-198	0 002		0 020	0 002		0 070		0 030							0 004									
206-208		0 006	0 036			0 030		0 036							0 010									
216-218			0 031			0 035		0 020							0 004							0 022		
226-228		0 004	0 034			0 042		0 028				0 004			0 004							0 012		
236-238			0 012			0 037		0 020	0 002			0 004			0 012		0 002	0 002				0 008		
246-248			0 024			0 036		0 032				0 002			0 004									
256-258			0 016			0 024		0 026				0 002			0 006		0 004	0 002						
266-268			0 032			0 059	0 004	0 047							0 016		0 004					0 010		
276-278			0 009			0 045		0 034			0 004	0 002			0 011		0 009					0 020		
286-288			0 012			0 028		0 026	0 002			0 014			0 010		0 006					0 012		
305-307			0 078			0 041		0 025				0 004				0 002						0 004		
315-317	0 002	0 002	0 018			0 079		0 047				0 008			0 014									
325-327			0 047			0 016	0 002	0 031				0 002			0 004	0 002	0 002					0 006		
335-337	0 002	0 002	0 018			0 016		0 018									0 002					0 004		
345-347			0 049	0 002		0 079		0 049	0 002						0 006		0 004					0 004		
355-357	0 002	0 006	0 022			0 026		0 026				0 002					0 004							
365-367			0 034			0 030		0 022							0 004		0 004							
375-377		0 004	0 024			0 067		0 032							0 008		0 002							
385-387		0 006	0 020			0 022		0 030				0 008			0 008									
395-397			0 026			0 039		0 036				0 008			0 008							0 002		
405-407			0 070			0 058	0 002	0 034							0 004				0 004					
415-417			0 051			0 033	0 002	0 051																
425-427		0 002	0 041		0 004	0 043		0 061							0 004					0 010				
435-437			0 032			0 062		0 032				0 002			0 006		0 006		0 004					
445-447		0 004	0 022			0 018		0 014																
467-469			0 054			0 016		0 072				0 002							0 002					
472-474	0 002		0 024			0 043	0 002	0 033				0 002			0 002		0 004							
482-484		0 002	0 028		0 004	0 024		0 085				0 002			0 004									
492-494		0 002	0 033			0 049		0 020								0 004				0 004				
502-504		0 010	0 033			0 047		0 033				0 006	0 002		0 016	0 002	0 002				0 006			
512-514		0 002	0 024			0 042		0 012							0 002					0 008				
522-524			0 017			0 050		0 031				0 012			0 004					0 006				
532-534			0 018			0 020	0 002	0 059				0 006			0 002					0 004				
552-554		0 002	0 072			0 048	0 002	0 014				0 010		0 002	0 002	0 002				0 004				
562-564		0 006	0 028			0 069	0 002	0 018							0 002					0 004				
582-584		0 002	0 031			0 039		0 008							0 004					0 004				
592-594	0 006	0 002	0 046			0 062		0 030							0 002									
602-604			0 020			0 020		0 024							0 002					0 002				
612-614		0 030	0 004			0 061		0 024									0 002			0 002				
619-621			0 044			0 036		0 030							0 004									
629-631			0 026	0 002		0 038		0 020				0 002			0 002									
639-641		0 002	0 032			0 051		0 038				0 006			0 010	0 002				0 008	0 002			
649-651			0 028		0 002	0 053		0 022							0 006									
659-661			0 044			0 036	0 004	0 024	0 002			0 002			0 008					0 008	0 002			
669-671			0 030			0 030		0 012	0 002			0 004			0 002		0 002					0 002		
679-681		0 002	0 012			0 056		0 014				0 002				0 002				0 002		0 002		
689-691		0 004	0 040			0 050		0 034							0 002					0 004		0 002		
699-701	0 010	0 006	0 010			0 042		0 026	0 002						0 002					0 012				
709-711	0 006		0 026			0 028		0 030	0 002			0 004			0 002					0 002		0 002		
719-721	0 004	0 008	0 049	0 002		0 071		0 049	0 002						0 010	0 002				0 006				
729-731	0 002		0 051			0 091		0 030				0 008			0 004					0 004		0 004		
739-741	0 002	0 004	0 039			0 043		0 045				0 006		0 002	0 016	0 002				0 006		0 004		
749-751		0 002	0 016			0 040		0 030				0 002			0 002					0 004		0 002		
759-761	0 004		0 032		0 002	0 055		0 036				0 006			0 008					0 010		0 006		

Sample (cm below top of core)	<i>Thalassiosira hyalina</i>	<i>Thalassiosira leptopus</i>	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira oestrupii</i> var. <i>oestrupii</i>	<i>Thalassiosira oestrupii</i> var. <i>venrickae</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira punctigera</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp. 1	<i>Thalassiosira</i> sp. 2	<i>Thalassiosira</i> sp. 3	<i>Thalassiosira</i> sp. 4	<i>Thalassiosira</i> sp. 5	<i>Thalassiosira</i> sp. 6	<i>Thalassiosira</i> sp. 7	<i>Thalassiosira</i> sp. 8	<i>Thalassiosira</i> sp. 9	<i>Thalassiosira</i> sp. 10	<i>Thalassiosira</i> sp. 11	<i>Thalassiosira</i> sp. 12	<i>Thalassiosira</i> sp. 13	<i>Thalassiosira</i> sp. 14	<i>Thalassiosira</i> sp. 15
769-771			0.030			0.060		0.032				0.002			0.004				0.004		0.002	0.002	
783-785	0.002	0.004	0.040			0.085		0.016							0.022								
803-805			0.054			0.076	0.002	0.034				0.006			0.018								
813-815	0.004		0.028			0.065	0.002	0.028				0.006											
823-825	0.016		0.029			0.039		0.041				0.012			0.002				0.002				
833-835	0.004		0.053			0.055		0.016							0.002								
843-845		0.012	0.033	0.002		0.097		0.031							0.004	0.004							
853-855		0.006	0.032	0.002		0.057		0.040							0.004	0.006							
863-865	0.002		0.043			0.087		0.024							0.006								
873-875		0.006	0.024			0.071		0.039				0.002			0.006	0.002							
883-885		0.002	0.022	0.002		0.069		0.026				0.004			0.004	0.002							
893-895		0.006	0.045			0.084		0.026				0.006			0.016				0.002				
913-915		0.004	0.053			0.061		0.012							0.002								
923-925		0.004	0.026			0.105		0.018							0.004	0.004							
925-927	0.002		0.028		0.006	0.100		0.020				0.008			0.008	0.004			0.002				
935-937		0.004	0.032			0.072		0.026							0.002	0.002							
945-947		0.006	0.022			0.128		0.053				0.004			0.002								
955-957		0.006	0.032			0.070	0.002	0.028				0.004					0.004						
965-967		0.002	0.061	0.002		0.091		0.026				0.004			0.006	0.004	0.002						
975-977	0.004	0.008	0.026			0.114		0.040				0.002			0.006	0.002							
985-987	0.014	0.002	0.018	0.002	0.002	0.041		0.030				0.004											
995-997	0.004	0.004	0.032			0.119		0.036				0.006			0.004								
1005-1007		0.002	0.028			0.058		0.034				0.002			0.006	0.002	0.004		0.002				
1015-1017	0.006	0.006	0.063			0.145		0.061				0.008			0.008	0.006	0.004		0.004				
1025-1027	0.004		0.030			0.063		0.038							0.004								
1035-1037	0.004	0.006	0.018			0.157		0.033							0.006	0.006							
1045-1047	0.002		0.014			0.056		0.024							0.004								
1055-1057		0.006	0.020			0.167		0.100				0.002			0.006								
1079-1081	0.012	0.004	0.040			0.066	0.002	0.040							0.004	0.002							
1089-1091		0.002	0.018			0.067		0.030							0.016		0.002						
1109-1111		0.002	0.018			0.064		0.029				0.002			0.016	0.002			0.002				
1119-1121	0.002		0.044			0.082		0.022				0.002			0.004				0.002				
1129-1131		0.004	0.030			0.156		0.026				0.008			0.012	0.004							
1139-1141		0.004	0.034			0.093		0.028				0.008			0.018		0.002	0.006					
1149-1151	0.004	0.002	0.018			0.087		0.038				0.010			0.008			0.016		0.006			
1169-1171	0.004	0.004	0.028			0.089	0.002	0.048				0.024			0.004	0.002			0.010	0.002	0.004		
1179-1181	0.008		0.042			0.067		0.044				0.004			0.002			0.004		0.002			
1189-1191		0.008	0.014			0.126		0.024				0.008			0.002	0.002		0.010		0.012		0.006	
1209-1211	0.006	0.006	0.020			0.106		0.028				0.006			0.004			0.014		0.006			

Sample (cm below top of core)	<i>Thalassiosira</i> sp 16	<i>Thalassiosira</i> sp 17	<i>Tribionella aerophila</i>	<i>Tribionella coarctata</i>	<i>Tribionella marginulata</i>
5-7					
10-12					
20-22					
30-32				0 002	
40-42					
50-52	0 006				
60-62	0 002				
70-72					
80-82					
90-92					
100-102					
110-112	0 004				
120-122					
130-132					
183-185				0 002	
196-198					
206-208			0 002		
216-218					
226-228					
236-238	0 004				
246-248					
256-258					
266-268	0 006				
276-278	0 004		0 002		
286-288					
305-307					
315-317					
325-327					
335-337					
345-347					
355-357					
365-367					
375-377					
385-387				0 002	
395-397					
405-407					
415-417					
425-427					
435-437					
445-447			0 002		
467-469					
472-474					
482-484					
492-494					
502-504					
512-514					
522-524					
532-534					
552-554					
562-564					
582-584					
592-594					
602-604					
612-614				0 002	
619-621					
629-631					
639-641					
649-651					
659-661					
669-671					
679-681					
689-691					
699-701					
709-711					
719-721					
729-731	0 004				
739-741					
749-751					
759-761					

Sample (cm below top of core)	<i>Thalassiosira</i> sp 16	<i>Thalassiosira</i> sp 17	<i>Trithionella aerophila</i>	<i>Trithionella coarctata</i>	<i>Trithionella marginulata</i>
769-771					
783-785					
803-805					
813-815					0.002
823-825					
833-835					
843-845					
853-855					
863-865					
873-875		0.008			
883-885		0.018			
893-895		0.010			
913-915		0.006			
923-925		0.006			
925-927		0.006			
935-937		0.006			
945-947		0.016			0.004
955-957		0.006			
965-967					
975-977		0.004			
985-987		0.004			
995-997		0.008			
1005-1007		0.018			0.002
1015-1017		0.008			
1025-1027		0.010			
1035-1037		0.010			
1045-1047		0.008			
1055-1057		0.012			
1079-1081		0.006			
1089-1091		0.008			
1109-1111		0.004			
1119-1121		0.006			
1129-1131		0.002			
1139-1141		0.012			
1149-1151		0.022			
1169-1171		0.014			
1179-1181	0.002	0.022			
1189-1191		0.008			
1209-1211		0.010			

APPENDIX E

Biogenic Silica (%Si_{OPAL}) Analysis

Sample (cm below top of core)	%Si _{OPAL}	Sample (cm below top of core)	%Si _{OPAL}	Sample (cm below top of core)	%Si _{OPAL}
5-7	7.140	425-427	6.146	793-795	8.881
10-12	7.079	435-437	6.632	803-805	10.079
20-22	6.487	445-447	8.948	813-815	5.814
30-32	4.209	455-457	5.221	823-825	8.837
40-42	3.843	467-469	8.459	833-835	9.842
50-52	8.882	472-474	8.206	843-845	6.228
60-62	3.983	482-484	10.091	853-855	6.656
70-72	7.811	492-494	7.837	863-865	9.361
80-82	7.491	502-504	5.898	873-875	9.449
90-92	4.900	512-514	11.335	883-885	10.051
100-102	7.616	522-524	6.788	893-895	6.249
110-112	7.959	532-534	7.397	903-905	5.733
120-122	6.278	542-544	3.586	913-915	8.955
130-132	6.702	552-554	9.823	923-924	7.781
183-185	6.912	562-564	10.157	925-927	8.215
196-198	7.080	572-574	5.704	935-937	10.096
206-208	5.676	582-584	7.193	945-947	9.608
216-218	7.240	592-594	9.124	955-957	9.458
226-228	4.444	602-604	5.820	965-967	10.441
236-238	8.213	612-614	8.773	975-977	10.552
246-248	5.455	619-621	7.001	985-987	10.314
256-258	4.745	629-631	5.166	995-997	9.285
266-268	6.936	639-641	5.089	1005-1007	8.044
276-278	7.986	649-651	8.358	1015-1017	9.069
286-288	7.539	659-661	7.576	1025-1027	8.025
295-297	9.986	669-671	8.631	1035-1037	9.110
305-307	10.666	679-681	6.713	1045-1047	5.387
315-317	9.158	689-691	6.742	1055-1057	10.552
325-327	6.274	699-701	8.887	1065-1067	5.215
335-337	8.210	709-711	9.074	1070-1072	7.731
345-347	8.248	719-721	8.135	1079-1081	5.333
355-357	8.462	729-731	9.179	1089-1091	9.104
365-367	9.070	739-741	6.350	1099-1101	3.881
375-377	9.303	749-751	9.460	1109-1111	6.373
385-387	8.090	759-761	6.164	1119-1121	11.484
395-397	10.540	769-771	6.934	1129-1131	9.235
405-407	8.947	773-775	7.375	1139-1141	7.943
415-417	4.899	783-785	9.510	1149-1151	7.676

Sample (cm below top of core)	%Si _{OPAL}
1159-1161	3.873
1169-1171	8.189
1179-1181	10.610
1189-1191	9.565
1199-1201	9.632
1209-1211	8.230

APPENDIX F

Diatom Taxa Used in Q- and R-Mode Analyses

Achnanthes cf. *grana*
Achnanthes lanceolata
Achnanthes sp.2
Achnanthidium minutissimum
Actinoptychus senarius
Actinoptychus sp.1
Actinoptychus vulgaris
Amphora acutiuscula
Amphora cf. *helensis*
Aulacoseira islandica
Bacillaria paxillifer
Brachysira brebissonii
Coscinodiscus radiatus
Coscinodiscus sp.1
Cyclotella caspia
Cyclotella choctawhatcheeana
Cyclotella pseudostelligra
Cyclotella stelligra
Cylotella litoralis
Encyonema silesciacum
Eunotia sp.10
Eunotia sp.2
Eunotia sp.5
Eunotia sp.7
Fragilariopsis cylindriciformis
Fragilariopsis cylindrus
Fragilariopsis pseudonana
Martyana atomus
Martyana cf. *schulzii*
Martyana martyi
Melosira arentii
Melosira numelloides
Navicula perminuta
Nitzschia frustulum
Nitzschia liebertruthii
Nitzschia perminuta
Nitzschia sp.7
Paralia sulcata

Planothidium cf. *Engelbrechtii*
Planothidium delicatulum
Skeletonema costatum
Staurosirella pinata
Tabularia fasciculata
Tabularia investiens
Tabularia tabulata
Thalassionema nitzschioides
Thalassiosira decipiens
Thalassiosira eccentrica
Thalassiosira guillardii
Thalassiosira hyalina
Thalassiosira leptopus
Thalassiosira nordenskiöldii
Thalassiosira pacifica
Thalassiosira tenera
Thalassiosira sp.10
Thalassiosira sp.11
Thalassiosira sp.13
Thalassiosira sp.17
Thalassiosira sp.4
Thalassiosira sp.7
Thalassiosira sp.8
Thalassiosira sp.9

APPENDIX G

Relative Abundance Of Statistically Significant Diatom Taxa In Q-Mode Clusters

Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Cluster	Sample (cm below surface)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes</i> sp. 2	<i>Achnanthes minutissimum</i>	<i>Amphora aculeolata</i>	<i>Amphora cf. helensis</i>	<i>Bacillaria paxillifer</i>	<i>Brachyura brebissoni</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litorea</i>	<i>Cyclotella pseudostelligera</i>	<i>Cyclotella stelligera</i>	<i>Encyonema nileticum</i>	<i>Eunotia</i> sp. 2	<i>Eunotia</i> sp. 5	<i>Eunotia</i> sp. 7	<i>Eunotia</i> sp. 10	<i>Maryana atomus</i>	<i>Maryana maryn</i>	<i>Maryana cf. schulzei</i>
	100-102								0 002	0 002	0 272	0 012					0 004			0 010		
	130-132		0 004	0 004	0 002					0 002	0 269	0 002								0 008		
	80-82		0 002							0 002	0 269						0 002	0 002			0 006	0 004
	325-327		0 002							0 004	0 269	0 006			0 002		0 004		0 004	0 006		
	246-248		0 010	0 002	0 004					0 010	0 241	0 006					0 002	0 002	0 004	0 004		
	50-52							0 002		0 002	0 329	0 002										
	226-228		0 002	0 008	0 004					0 002	0 333					0 002	0 002		0 002	0 008		
	345-347		0 002		0 006			0 002		0 002	0 211	0 010					0 002	0 004		0 004	0 006	
	729-731			0 008	0 002						0 202	0 010					0 002	0 002	0 002	0 004	0 004	
	20-22		0 002	0 007						0 009	0 227	0 005									0 002	
	40-42				0 009					0 004	0 275						0 004			0 004	0 007	0 002
	266-268		0 006	0 004	0 006					0 006	0 241	0 002					0 002				0 008	
	70-72		0 004	0 004	0 004						0 258	0 002					0 002	0 002			0 021	
Cluster 1	196-198					0 002		0 002	0 004	0 006	0 173	0 014			0 004		0 006		0 006		0 008	
	759-761		0 004	0 020	0 004					0 006	0 156			0 002			0 002	0 002	0 004			
	719-721				0 002			0 002			0 171	0 002									0 002	
	803-805					0 002			0 004	0 004	0 156	0 006	0 004				0 002			0 004	0 020	
	769-771				0 004			0 006	0 004	0 020	0 157	0 008		0 052			0 002		0 010	0 002	0 004	
	467-469		0 002	0 002				0 002	0 008	0 157							0 006		0 002		0 004	
	482-484		0 002	0 008					0 004	0 180	0 002		0 002			0 002	0 002			0 002		
	10-12								0 004	0 203	0 002					0 002						
	183-185		0 004	0 008						0 225							0 002			0 004	0 008	
	415-417		0 004	0 008						0 012	0 206		0 002				0 002			0 002		
	425-427		0 002	0 004	0 002					0 197					0 008				0 004	0 004	0 004	
	5-7							0 002		0 013	0 220									0 002		
	286-288			0 008						0 222				0 002			0 006	0 002		0 010	0 024	
	average									0 224												
	435-437			0 004						0 004	0 133	0 002					0 002		0 006			
	853-855	0 002		0 004	0 002					0 002	0 119						0 008	0 006			0 004	
	639-641				0 004		0 004		0 002	0 002	0 121						0 004	0 004	0 002		0 006	
	873-875	0 002		0 008	0 002				0 002		0 110	0 002			0 008			0 002		0 008	0 004	
	659-661									0 008	0 107	0 008						0 002	0 004	0 010		
	236-238		0 006	0 004					0 002	0 004	0 171			0 004			0 002	0 002	0 002			
	276-278				0 002					0 004	0 157	0 009					0 007	0 002		0 007		
	823-825	0 002	0 004	0 012	0 002				0 002	0 004	0 167	0 006		0 006			0 006	0 002	0 004		0 006	
	30-32		0 002					0 008			0 148	0 004					0 010		0 002			
	405-407		0 008	0 010				0 002		0 004	0 153	0 006					0 002		0 004	0 004	0 004	
	689-691		0 006		0 004				0 004		0 146	0 006						0 002	0 002	0 004	0 016	
	813-815		0 004	0 008				0 002	0 004	0 004	0 160	0 002		0 004				0 002		0 004		0 002
	375-377		0 004	0 012	0 002						0 148				0 006			0 004			0 004	
	472-474		0 008						0 002	0 004	0 155						0 006			0 004	0 016	
	502-504			0 008	0 002				0 002	0 008	0 122	0 002		0 004	0 008		0 010	0 002		0 006	0 006	0 002
	552-554									0 102	0 004										0 004	
Cluster 2	739-741			0 004						0 006	0 133			0 010			0 004			0 010		
	60-62							0 002	0 002		0 201	0 006					0 002			0 002	0 016	0 004
	90-92			0 008				0 002		0 004	0 195	0 002					0 002			0 008	0 004	0 012
	365-367			0 002							0 199						0 002					
	110-112			0 004					0 002	0 006	0 229	0 004					0 002		0 002		0 004	
	216-218		0 002							0 004	0 209						0 008			0 006	0 018	
	256-258							0 002			0 224	0 004		0 012			0 004	0 002		0 008		
	120-122			0 004							0 183	0 002		0 002				0 004	0 004	0 012		0 004
	445-447									0 008	0 200			0 010			0 002	0 002				
	335-337		0 002							0 004	0 181	0 006			0 004	0 002	0 002					
	355-357			0 004							0 148	0 014			0 002			0 004				
	629-631		0 004	0 008						0 006	0 139	0 002					0 006			0 004	0 004	
	699-701			0 008	0 002					0 004	0 133	0 002			0 008			0 002			0 002	
	492-494		0 004		0 008					0 006	0 159	0 002								0 002		
	709-711			0 008				0 002		0 010	0 159						0 002	0 002		0 004		
	532-534		0 004	0 008	0 004					0 158	0 004					0 002			0 002	0 002		
	average									0 159												
	1015-1017	0 004			0 002				0 004	0 036	0 139	0 006									0 008	
	1055-1057			0 004	0 006			0 004		0 008	0 047	0 002		0 014				0 004		0 006	0 008	0 002
	1035-1037	0 012	0 002	0 008				0 012			0 057							0 002			0 006	
Cluster 3	1129-1131	0 002			0 004			0 002		0 008	0 051								0 002		0 008	
	975-977	0 010									0 048	0 004					0 006				0 004	
	843-845		0 004	0 008				0 004	0 002		0 111	0 008										
	925-927				0 002			0 002	0 002	0 010	0 088			0 012					0 002			
	893-895	0 002		0 004	0 002		0 004			0 012	0 096		0 002				0 004		0 004	0 002	0 004	

Cluster	Sample (cm below surface)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes sp. 2</i>	<i>Achnanthes minutissimum</i>	<i>Amphora acutiuscula</i>	<i>Amphora cf. helensis</i>	<i>Bacillaria paxillifer</i>	<i>Brachysira brebassonii</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litoralis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>	<i>Encyonema silvestrii</i>	<i>Eunota sp. 2</i>	<i>Eunota sp. 5</i>	<i>Eunota sp. 7</i>	<i>Eunota sp. 10</i>	<i>Maryana atomus</i>	<i>Maryana martyi</i>	<i>Maryana cf. schulzei</i>
Cluster 3, cont'd	965-967		0 004		0 002				0 006	0 012	0 081							0 010				
	945-947	0 004		0 004				0 002	0 002	0 012	0 099	0 002			0 008							0 006
	995-997	0 002			0 002	0 004				0 014	0 095			0 002			0 002		0 004	0 004		0 006
	923-925			0 016	0 004			0 002	0 002	0 018	0 147	0 002			0 004			0 014				0 008
	315-317 average				0 002			0 002		0 004	0 130	0 002					0 002		0 002		0 004	0 002
Cluster 4	649-651									0 002	0 049											0 006
	1045-1047									0 010	0 032	0 002			0 004					0 002		
	512-514		0 008	0 004	0 002					0 004	0 028											0 016
	582-584		0 004	0 008			0 004				0 077							0 002				0 016
	669-671		0 002	0 008						0 002	0 064	0 006				0 004				0 002	0 010	
	395-397		0 002		0 002						0 081						0 006				0 008	0 002
	985-987	0 002			0 002	0 002				0 010	0 059							0 002	0 004	0 002	0 004	0 002
	305-307			0 004				0 002			0 035			0 002			0 004	0 004	0 002			
	833-835	0 004		0 008	0 002						0 055							0 002				0 010
	935-937			0 008						0 004	0 042	0 006										
	1119-1121					0 004				0 004	0 018		0 002	0 004						0 002	0 008	
	1089-1091	0 004		0 004	0 004			0 004		0 002	0 047	0 022									0 004	
	522-524		0 004	0 004						0 002	0 137	0 002		0 004	0 006			0 002		0 002		
	913-915	0 004			0 002						0 087									0 002	0 004	
	592-594				0 002						0 078						0 002		0 002	0 002	0 006	
	612-614									0 004	0 085						0 004	0 004				0 006
	562-564		0 008				0 002			0 002	0 083		0 002				0 002		0 004			
	679-681			0 004			0 004				0 090	0 010			0 004					0 004		
	749-751	0 004	0 008							0 002	0 098	0 004			0 008					0 006	0 004	
	385-387		0 008							0 004	0 108						0 002					
	602-604		0 002								0 120	0 004						0 004	0 008	0 002	0 004	0 002
	206-208				0 010	0 004	0 002			0 004	0 106	0 002						0 002		0 006	0 008	
	619-621		0 002		0 002				0 002	0 004	0 107									0 004	0 004	
	1149-1151	0 004				0 002			0 002	0 004	0 052	0 008					0 004			0 002	0 004	
	1209-1211	0 002							0 008	0 006	0 060	0 002					0 004		0 002	0 004	0 004	
	1139-1141		0 004			0 008	0 002			0 014	0 046	0 002							0 006		0 004	
	1169-1171									0 002	0 036	0 004						0 004	0 002			
	1189-1191	0 006				0 004	0 002	0 002	0 008	0 020	0 012			0 008			0 002					
	883-885	0 002		0 008		0 010	0 002			0 053	0 008		0 002					0 002	0 004		0 008	
	1005-1007	0 004		0 008				0 002	0 008	0 072	0 002								0 004			
	1109-1111		0 004	0 002						0 037	0 078		0 008	0 037	0 006							0 004
	783-785						0 002			0 006	0 095	0 004					0 002		0 002			0 004
	863-865	0 002	0 002	0 004	0 002					0 008	0 083	0 002			0 004		0 002	0 004				0 004
	1079-1081	0 006		0 004	0 002	0 002				0 006	0 050	0 006								0 002	0 004	
	1179-1181	0 002			0 002			0 002		0 004	0 048						0 002	0 004				0 002
	955-957	0 002								0 008	0 062	0 004								0 004	0 002	
	1025-1027	0 006	0 002		0 006			0 006	0 002	0 014	0 075						0 008			0 002	0 002	
	average										0 068											

APPENDIX G. Relative abundance of statistically significant species in Q-mode clusters

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Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Marine Planktic Diatom Taxa

	Sample (cm below surface)	<i>Navicula perminuta</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia lubbertii</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia</i> sp 7	<i>Paralia sulcata</i>	<i>Planorhodium delicatulum</i>	<i>Planorhodium cf. engelbrechtii</i>	<i>Stauroneis pinnata</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	sum of non-planktic species	<i>Actinocyclus senarius</i>	<i>Actinocyclus vulgaris</i>	<i>Actinocyclus</i> sp 1	<i>Aulacoseira islandica</i>	<i>Coscinodiscus radiatus</i>	<i>Coscinodiscus</i> sp 1	<i>Fragilaropsis cylindriciformis</i>
Cluster 1	100-102	0 002	0 002	0 004				0 002	0 002	0 004				0 318		0 004					0 012
	130-132	0 006	0 002	0 006	0 008			0 008			0 004			0 328					0 002		0 008
	80-82		0 002	0 004				0 006			0 002			0 305							0 002
	325-327	0 002						0 002					0 010	0 312	0 002		0 002				0 002
	246-248				0 002									0 287							0 002
	50-52		0 004	0 004	0 004			0 009	0 002					0 359	0 009				0 006		0 002
	226-228	0 004		0 004	0 008			0 002	0 004		0 002			0 388	0 002						0 010
	345-347		0 002	0 002	0 010			0 002					0 002	0 268							0 002
	729-731		0 006	0 012			0 002	0 002	0 002		0 002		0 010	0 271					0 002	0 004	0 008
	20-22		0 005	0 005	0 009			0 011	0 002		0 005			0 288				0 002	0 002		0 014
	40-42	0 004	0 004	0 002				0 007						0 324		0 002			0 004		0 011
	266-268		0 006	0 006				0 002	0 002			0 002		0 292	0 002	0 002			0 006		0 012
	70-72		0 004	0 006	0 006			0 004	0 002		0 006			0 328			0 026		0 004		
	196-198	0 006	0 006	0 010	0 004			0 002					0 014	0 266		0 002			0 008		0 010
	759-761		0 002	0 012	0 014			0 006			0 004	0 002	0 002	0 016	0 257	0 002			0 002	0 008	0 010
	719-721		0 006	0 008	0 002	0 004	0 012	0 004				0 002		0 006	0 224				0 004		0 006
	803-805	0 002	0 008	0 004	0 006			0 002		0 004	0 002			0 014	0 244			0 002	0 004		0 002
	769-771	0 002		0 004	0 002	0 002		0 004						0 008	0 292	0 002				0 002	0 004
	467-469		0 010	0 020	0 004			0 004	0 002			0 002	0 002	0 006	0 231				0 002		0 002
	482-484		0 010	0 010	0 014			0 004	0 002					0 002	0 247				0 002		0 004
	10-12		0 002	0 004	0 002			0 011			0 002				0 234				0 009		0 015
	183-185				0 014				0 010			0 010			0 287						0 012
	415-417	0 004		0 004	0 002					0 002				0 004	0 253	0 002					
	425-427	0 002	0 002	0 002					0 002	0 002				0 002	0 238	0 006	0 002				0 002
	5-7	0 004	0 002	0 004	0 004			0 009	0 002		0 007				0 272						0 002
	286-288		0 002		0 006			0 004	0 002					0 004	0 292						0 008
	average														0 285						
Cluster 2	435-437	0 002	0 004	0 010	0 004			0 006					0 004	0 181	0 002						0 006
	853-855			0 008				0 006	0 002					0 176					0 006		0 002
	639-641			0 004	0 004			0 006		0 004	0 002			0 192	0 006				0 002		
	873-875		0 008	0 008	0 014			0 002						0 183				0 008	0 002		0 008
	659-661		0 008	0 004	0 004	0 004		0 002	0 002		0 002		0 006	0 170			0 006				
	236-238	0 002	0 002	0 002	0 012			0 006	0 002					0 224	0 004				0 002		0 004
	276-278		0 002	0 002	0 009			0 007		0 002	0 002		0 002	0 215	0 002						0 013
	823-825		0 004	0 006	0 004			0 004	0 004					0 267				0 008	0 006		0 006
	30-32		0 008		0 004			0 008			0 004			0 207					0 002		0 002
	405-407	0 004	0 004	0 010	0 002			0 004	0 002		0 002			0 225					0 002		
	689-691	0 006			0 008			0 006		0 006	0 010		0 010	0 236	0 002				0 002		
	813-815			0 004				0 006		0 002	0 004			0 016	0 229	0 002			0 004	0 004	0 002
	375-377	0 002		0 008	0 006			0 002			0 002	0 002	0 006	0 209							0 002
	472-474	0 002	0 004	0 008	0 006			0 010	0 004					0 004	0 234					0 002	0 002
	502-504		0 002	0 006	0 006			0 004						0 004	0 205				0 002		0 002
	552-554				0 004									0 004	0 118	0 002				0 002	0 002
	739-741	0 002	0 002	0 002				0 002			0 004		0 006	0 186					0 002		0 010
	60-62	0 002		0 004	0 004			0 002	0 002	0 004				0 255			0 004		0 002		
	90-92			0 002		0 002		0 004			0 004			0 251		0 002		0 002			0 004
	365-367		0 006	0 002	0 008			0 004	0 004	0 002				0 002	0 231				0 002		0 004
	110-112		0 002	0 004	0 004			0 002	0 004					0 002	0 273		0 002				0 002
	216-218			0 004	0 004			0 004						0 002	0 260						
	256-258			0 002	0 008									0 002	0 269				0 002		
	120-122			0 002	0 002			0 004	0 004						0 228				0 002		
	445-447				0 006			0 002						0 002	0 232						0 004
	335-337	0 012													0 213						0 004
	355-357	0 004			0 004			0 006				0 004			0 191	0 004			0 002		0 008
	629-631				0 002		0 002		0 002					0 006	0 185				0 002		0 002
	699-701	0 002		0 002		0 004			0 002	0 010	0 006	0 002		0 006	0 195				0 002		0 002
	492-494	0 004		0 004	0 004			0 002	0 002					0 004	0 202	0 004			0 002		0 004
	709-711	0 002	0 004			0 002		0 004	0 002					0 008	0 210					0 002	
	532-534	0 004		0 004	0 004			0 004						0 002	0 202					0 002	
	average														0 214						
Cluster 3	1015-1017	0 004		0 008	0 006			0 002	0 004	0 002	0 002		0 008	0 236					0 004		0 002
	1055-1057	0 004	0 002	0 006		0 006	0 004	0 006	0 004		0 008			0 165				0 002			
	1035-1037		0 004	0 004	0 004			0 008					0 008	0 128					0 002		
	1129-1131	0 006	0 002		0 006			0 002			0 004		0 016	0 113				0 002			
	975-977	0 002	0 004	0 008	0 010	0 006		0 002	0 002				0 008	0 114	0 004			0 010		0 002	
	843-845							0 006	0 004				0 016	0 165		0 002		0 008	0 002		
	925-927		0 004					0 002					0 014	0 137				0 002	0 002	0 002	
	893-895		0 002					0 002		0 002			0 008	0 151		0 008			0 002	0 004	

Cluster	Sample (cm below surface)	<i>Navicula perminuta</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia lieberttruthi</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia</i> sp 7	<i>Porella sulcata</i>	<i>Planolothidium delicatulum</i>	<i>Planolothidium cf. engelbrechtii</i>	<i>Staurastrella pinnata</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	sum of non-planktic species	<i>Actinoptychus semarius</i>	<i>Actinoptychus vulgaris</i>	<i>Actinoptychus</i> sp 1	<i>Aulacoseira islandica</i>	<i>Coscinodiscus radiatus</i>	<i>Coscinodiscus</i> sp 1	<i>Fragilaropsis cylindriciformis</i>
Cluster 3, cont'd	965-967	0 004		0 020	0 010			0 002	0 002				0 014	0 168					0 004		
	945-947	0 002	0 004		0 004			0 006	0 002				0 016	0 174					0 002		
	995-997	0 010		0 004				0 002	0 006				0 024	0 181	0 002				0 006	0 004	
	923-925	0 002			0 002				0 002	0 004			0 010	0 236					0 002		
	315-317 average	0 004	0 004	0 010	0 006			0 002		0 004	0 002		0 002	0 184	0 002				0 006	0 002	
Cluster 4	649-651			0 006	0 004			0 002					0 004	0 073	0 002				0 002		
	1045-1047			0 002				0 002				0 002	0 006	0 062					0 002		
	512-514	0 002		0 004	0 004								0 002	0 058						0 004	
	582-584			0 008	0 002			0 004		0 002			0 008	0 136	0 002						
	669-671	0 002		0 002						0 010			0 112					0 006	0 002		
	395-397				0 004			0 004	0 006				0 114					0 004	0 002		
	985-987			0 004	0 010			0 006					0 008	0 118				0 004	0 002		
	305-307		0 004	0 004	0 004								0 002	0 067					0 004	0 002	
	833-835	0 002			0 004			0 004					0 006	0 096			0 004				
	935-937			0 004	0 002			0 006					0 010	0 082	0 004				0 004		
	1119-1121	0 002	0 002		0 004			0 002		0 004	0 002		0 004	0 062				0 008	0 002	0 004	
	1089-1091	0 004		0 004					0 002				0 002	0 103						0 002	
	522-524	0 004	0 006	0 015	0 008			0 002		0 002			0 002	0 203	0 002				0 002	0 006	
	913-915	0 006							0 002	0 008			0 024	0 139				0 008			
	592-594		0 004	0 004				0 002	0 002				0 008	0 112			0 002	0 004			
	612-614	0 002	0 002	0 010				0 002	0 002	0 002	0 002		0 004	0 129				0 002			
	562-564			0 004	0 004			0 002					0 002	0 114				0 002			
	679-681	0 002		0 008	0 006			0 002					0 006	0 139						0 004	
	749-751		0 002					0 008	0 002	0 006	0 006		0 004	0 162				0 002	0 010		
	385-387			0 002	0 002			0 002	0 002				0 004	0 134				0 002	0 002	0 004	
	602-604			0 004				0 004		0 002			0 006	0 162	0 002			0 004			
	206-208	0 004	0 004	0 004				0 004	0 002		0 004		0 006	0 173		0 002		0 004		0 008	
	619-621		0 004	0 006	0 004			0 002	0 004	0 002	0 004		0 002	0 152	0 002					0 002	
	1149-1151	0 002		0 012				0 002	0 002	0 008			0 004	0 111	0 002				0 002	0 002	
	1209-1211									0 002			0 004	0 098		0 010			0 002	0 002	
	1139-1141	0 004						0 002		0 004			0 006	0 101					0 004		
	1169-1171	0 002		0 012		0 004							0 004	0 071						0 002	
	1189-1191	0 010				0 004		0 002		0 002			0 081						0 006	0 004	
	883-885				0 008			0 006		0 002			0 022	0 138	0 002				0 002	0 004	0 002
	1005-1007		0 012		0 014			0 006			0 002		0 006	0 141						0 008	
	1109-1111									0 006			0 006	0 188					0 004	0 002	
	783-785	0 002	0 004		0 002			0 002			0 002		0 004	0 131							
	863-865							0 010	0 002				0 016	0 146		0 004				0 002	
	1079-1081	0 006	0 004										0 002	0 094	0 002				0 002		
	1179-1181	0 002				0 008							0 008	0 083	0 002				0 002		
	955-957			0 004				0 008			0 004		0 014	0 113		0 004					
	1025-1027		0 002	0 004	0 004	0 006		0 002	0 002		0 002		0 008	0 154						0 004	
	average													0 118							

Statistically Significant Marine Planktic Diatom Taxa

	Sample (cm below surface)	<i>Fragilaropsis cylindrus</i>	<i>Fragilaropsis pseudonana</i>	<i>Melosira aretula</i>	<i>Melosira numellouides</i>	<i>Skeletonema costatum</i>	<i>Thalassionema nitzschoides</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>	<i>Thalassiosira hyalina</i>	<i>Thalassiosira leopopus</i>	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 13
Cluster 1	100-102	0 006	0 004			0 489	0 006	0 016	0 006				0 050	0 020	0 036	0 006	0 002		0 002		0 004	
	130-132	0 004	0 006	0 002		0 495		0 017				0 002	0 042	0 023	0 029	0 004	0 006				0 006	
	80-82		0 002			0 557	0 006	0 015	0 006				0 034	0 021	0 019	0 004	0 002	0 002			0 002	
	325-327	0 002		0 002		0 531	0 002	0 002	0 002				0 047	0 016	0 031	0 002	0 004	0 002	0 002		0 006	
	246-248	0 002	0 002			0 536	0 024	0 004	0 012				0 024	0 036	0 032	0 002	0 004					
	50-52	0 002	0 004			0 405	0 009	0 035	0 004			0 011	0 026	0 041	0 035	0 002	0 004				0 004	
	226-228	0 004	0 004			0 418	0 006		0 006	0 002		0 004	0 034	0 042	0 028	0 004	0 004				0 012	
	345-347	0 012				0 480	0 008	0 006	0 002				0 049	0 079	0 049		0 006		0 004		0 004	
	729-731		0 006			0 453	0 010	0 006	0 004		0 002		0 051	0 091	0 030	0 008	0 004			0 004	0 004	
	20-22	0 005	0 002			0 453	0 011	0 007	0 005			0 005	0 032	0 096	0 034		0 007				0 014	
	40-42	0 002				0 455	0 007	0 016				0 002	0 020	0 071	0 024		0 007		0 002		0 011	
	266-268	0 004	0 002	0 002		0 465	0 010	0 002	0 004				0 032	0 059	0 047		0 016		0 004		0 010	
	70-72	0 045	0 006			0 433	0 019	0 024				0 002	0 039	0 034			0 009				0 009	
	196-198		0 002	0 002		0 515	0 010	0 002	0 004		0 002		0 020	0 070	0 030		0 004					
	759-761					0 500		0 008	0 006		0 004		0 032	0 055	0 036	0 006	0 008				0 010	0 006
	719-721	0 002		0 008		0 496	0 004	0 012	0 014		0 004	0 008	0 049	0 071	0 049		0 010	0 002			0 006	
	803-805					0 529	0 002	0 002	0 004				0 054	0 076	0 034	0 006	0 018					
	769-771		0 002	0 002		0 495	0 022		0 010				0 030	0 060	0 032	0 002	0 004				0 004	0 002
	467-469					0 561	0 008	0 016					0 054	0 016	0 072	0 002					0 002	
	482-484	0 008				0 530	0 016	0 006	0 008			0 002	0 028	0 024	0 085	0 002	0 004					
	10-12	0 011				0 537	0 011	0 013	0 002				0 048	0 054	0 032						0 009	
	183-185	0 002			0 008	0 542	0 004	0 006				0 004	0 039	0 043	0 019						0 008	
	415-417		0 002	0 002		0 541	0 008	0 004	0 008				0 051	0 033	0 051							
	425-427	0 002	0 002	0 002		0 535	0 004	0 004	0 002			0 002	0 041	0 043	0 061		0 004				0 010	
	5-7		0 016			0 566		0 007	0 007			0 002	0 031	0 016	0 049						0 009	
	286-288	0 026				0 516	0 010	0 008					0 012	0 028	0 026	0 014	0 010		0 006		0 012	
	average					0 501							0 037	0 047	0 039							
Cluster 2	435-437		0 002			0 629	0 008	0 006	0 004				0 032	0 062	0 032	0 002	0 006		0 006		0 004	
	853-855	0 002				0 623	0 006	0 006	0 006			0 006	0 032	0 057	0 040		0 004	0 006				
	639-641					0 606	0 002	0 006	0 002			0 002	0 032	0 051	0 038	0 006	0 010	0 002			0 008	
	873-875					0 603						0 006	0 024	0 071	0 039	0 002	0 006	0 002				
	659-661					0 612	0 024	0 006	0 010				0 044	0 036	0 024	0 002	0 008				0 008	
	236-238	0 004	0 002			0 584	0 014	0 008	0 004				0 012	0 037	0 020	0 004	0 012		0 002	0 002	0 008	
	276-278			0 004	0 004	0 552	0 004	0 031	0 007				0 009	0 045	0 034	0 002	0 011		0 009		0 020	
	823-825					0 544	0 004				0 016		0 029	0 039	0 041	0 012	0 002				0 002	
	30-32		0 002			0 583	0 020	0 004	0 006			0 002	0 059	0 037	0 026		0 004					
	405-407					0 569	0 002	0 006	0 004				0 070	0 058	0 034		0 004				0 004	
	689-691	0 004		0 004		0 574	0 006	0 012				0 004	0 040	0 050	0 034		0 002			0 004	0 002	
	813-815					0 576	0 006		0 002		0 004		0 028	0 065	0 028	0 006						
	375-377				0 004	0 598	0 002	0 020	0 004			0 004	0 024	0 067	0 032		0 008		0 002			
	472-474	0 002	0 004			0 601	0 004	0 010	0 008		0 002		0 024	0 043	0 033	0 002	0 002		0 004			
	502-504		0 002	0 002		0 585	0 010	0 010	0 006			0 010	0 033	0 047	0 033	0 006	0 016	0 002	0 002		0 006	
	552-554		0 002			0 693			0 004			0 002	0 072	0 048	0 014	0 010	0 002	0 002			0 004	
	739-741		0 006			0 556	0 006		0 004		0 002	0 004	0 039	0 043	0 045	0 006	0 016	0 002		0 006	0 004	
	60-62	0 010	0 002			0 610		0 004	0 004			0 002	0 029	0 031	0 021						0 008	
	90-92					0 606	0 004	0 010	0 002				0 025	0 025	0 023	0 004	0 008	0 002			0 002	
	365-367				0 004	0 634	0 002	0 010	0 004				0 034	0 030	0 022		0 004		0 004			
	110-112	0 015				0 572	0 002	0 002					0 019	0 044	0 021	0 004	0 004		0 006		0 002	
	216-218	0 008				0 583	0 006		0 008	0 002			0 031	0 035	0 020		0 004				0 022	
	256-258	0 004				0 601	0 008	0 006					0 016	0 024	0 026	0 002	0 006		0 004	0 002		
	120-122	0 004				0 654	0 004	0 014	0 006				0 029	0 024	0 018						0 002	
	445-447		0 006	0 002		0 667		0 008	0 002			0 004	0 022	0 018	0 014							
	335-337					0 689	0 002	0 008	0 004		0 002	0 002	0 018	0 016	0 018			0 002			0 004	
	355-357		0 002	0 002	0 004	0 657	0 002	0 010	0 008		0 002	0 006	0 022	0 026	0 026	0 002		0 004				
629-631			0 002		0 663	0 010	0 002	0 002				0 026	0 038	0 020	0 002	0 002						
699-701		0 002			0 647	0 002	0 006	0 008			0 010	0 006	0 010	0 042	0 026		0 002			0 012		
492-494	0 002				0 627	0 020	0 006	0 006			0 002	0 033	0 049	0 020			0 004			0 004		
709-711			0 002		0 629	0 022	0 002	0 002		0 006		0 026	0 028	0 030	0 004	0 002			0 002	0 002		
532-534	0 002	0 002	0 004		0 644	0 010	0 008	0 010				0 018	0 020	0 059	0 006	0 002				0 004		
average					0 612							0 030	0 041	0 028								
Cluster 3	1015-1017		0 002			0 388	0 008	0 004	0 004		0 006	0 006	0 063	0 145	0 061	0 008	0 008		0 006		0 004	
	1055-1057		0 006			0 464	0 004	0 008				0 006	0 020	0 167	0 100	0 002	0 006					
	1035-1037		0 002			0 597			0 002		0 004	0 006	0 018	0 157	0 033		0 006	0 006				
	1129-1131	0 002				0 592	0 008	0 004	0 004			0 004	0 030	0 156	0 026	0 008	0 012	0 004				
	975-977		0 002			0 600	0 016	0 008			0 004	0 008	0 026	0 114	0 040	0 002	0 006	0 002				
	843-845					0 608	0 008	0 002				0 012	0 033	0 097	0 031		0 004	0 004				
	925-927		0 004																			

	Sample (cm below surface)	<i>Fragilaropsis cylindrus</i>	<i>Fragilariopops pseudonana</i>	<i>Melosira a arentii</i>	<i>Melosira numellouides</i>	<i>Skeletonema costatum</i>	<i>Thalassiosonema nitzschoides</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>	<i>Thalassiosira hyalina</i>	<i>Thalassiosira leptopus</i>	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 13
Cluster 3, cont'd	965-967					0.586	0.004	0.008	0.002	0.004		0.002	0.061	0.091	0.026	0.004	0.006	0.004	0.002			
	945-947					0.543		0.004	0.010			0.006	0.022	0.128	0.053	0.004	0.002					
	995-997					0.548	0.002		0.004		0.004	0.004	0.032	0.119	0.036	0.006	0.004					
	923-925					0.556		0.012	0.004			0.004	0.026	0.105	0.018		0.004		0.004			
	315-317					0.549	0.055	0.002	0.008		0.002	0.002	0.018	0.079	0.047	0.008	0.014					
	average					0.554							0.032	0.118	0.040							
Cluster 4	649-651					0.775	0.008	0.002	0.002				0.028	0.053	0.022		0.006					
	1045-1047					0.802		0.010		0.002			0.014	0.056	0.024		0.004					
	512-514					0.839	0.002	0.004	0.002			0.002	0.024	0.042	0.012		0.002				0.008	
	582-584					0.737	0.002	0.006	0.002			0.002	0.031	0.039	0.008		0.004				0.004	
	669-671		0.004	0.002		0.755	0.002		0.006				0.030	0.030	0.012	0.004	0.002		0.002		0.002	
	395-397		0.002	0.002		0.720	0.012	0.010	0.004				0.026	0.039	0.036	0.008	0.008				0.002	
	985-987					0.726			0.002		0.014	0.002	0.018	0.041	0.030	0.004						
	305-307		0.002			0.751	0.004		0.002				0.078	0.041	0.025	0.004		0.002			0.004	
	833-835					0.749	0.002		0.004		0.004		0.053	0.055	0.016		0.002					
	935-937		0.004	0.004		0.731	0.004	0.002				0.004	0.032	0.072	0.026		0.002		0.002			
	1119-1121					0.726	0.002	0.008	0.008		0.002		0.044	0.082	0.022	0.002	0.004				0.002	
	1089-1091					0.717		0.002	0.002			0.002	0.018	0.067	0.030		0.016		0.002			
	522-524		0.002			0.587	0.019	0.008	0.006				0.017	0.050	0.031	0.012	0.004				0.006	
	913-915					0.687	0.004	0.002	0.002			0.004	0.053	0.061	0.012		0.002					
	592-594		0.002			0.693	0.004		0.006		0.006	0.002	0.046	0.062	0.030		0.002					
	612-614		0.002			0.691	0.004	0.010	0.002				0.030	0.061	0.024			0.002		0.002	0.002	
	562-564					0.712	0.006		0.002				0.006	0.028	0.069	0.018		0.002			0.004	
	679-681	0.002		0.004		0.701		0.016				0.002	0.012	0.056	0.014	0.002		0.002			0.002	0.002
	749-751					0.687		0.012				0.002	0.016	0.040	0.030	0.002	0.002				0.004	0.002
	385-387	0.002				0.708	0.008	0.016	0.010			0.006	0.020	0.022	0.030	0.008	0.008					
	602-604					0.718	0.010	0.002	0.002				0.020	0.020	0.024		0.002				0.002	
	206-208		0.004			0.649	0.014		0.004			0.006	0.036	0.030	0.036		0.010					
	619-621		0.002	0.002		0.677	0.018	0.002	0.004				0.044	0.036	0.030		0.004					
	1149-1151					0.632		0.008	0.004		0.004	0.002	0.018	0.087	0.038	0.010	0.008				0.016	0.006
	1209-1211					0.647	0.002	0.004			0.006	0.006	0.020	0.106	0.028	0.006		0.004			0.014	0.006
	1139-1141		0.002			0.657	0.004	0.002	0.008			0.004	0.034	0.093	0.028	0.008		0.018		0.002	0.006	
	1169-1171	0.002	0.002			0.653	0.002	0.002		0.002	0.004	0.004	0.028	0.089	0.048	0.024	0.004	0.002				0.010
	1189-1191				0.004	0.650		0.006	0.002			0.008	0.014	0.126	0.024	0.008	0.002	0.002			0.010	0.012
	883-885					0.638	0.006	0.002	0.012	0.008		0.002	0.022	0.069	0.026	0.004	0.004		0.002			
	1005-1007					0.642		0.004	0.002	0.008		0.002	0.028	0.058	0.034	0.002	0.006	0.002	0.004		0.002	
	1109-1111					0.629	0.008	0.006				0.002	0.018	0.064	0.029	0.002	0.016	0.002			0.002	
	783-785		0.002	0.002		0.661	0.002	0.004	0.004		0.002	0.004	0.040	0.085	0.016		0.022					
	863-865	0.002				0.660	0.004	0.004			0.002		0.043	0.087	0.024		0.006					
	1079-1081					0.693	0.002	0.004	0.004		0.012	0.004	0.040	0.066	0.040		0.004		0.002			
	1179-1181					0.683	0.002	0.002	0.004		0.008		0.042	0.067	0.044	0.004		0.002			0.004	0.002
	955-957					0.676		0.016	0.006			0.006	0.032	0.070	0.028	0.004		0.004				
	1025-1027					0.663		0.002		0.002	0.004		0.030	0.063	0.038		0.004					
	average					0.695							0.030	0.061	0.027							

Cluster	Sample (cm below surface)	<i>Thalassiosira</i> sp 17	sum of marine planktic species
	100-102		0.664
	130-132		0.648
	80-82		0.672
	325-327		0.657
	246-248		0.682
	50-52		0.600
	226-228		0.582
	345-347		0.701
	729-731		0.686
	20-22		0.689
	40-42		0.634
	266-268		0.679
	70-72		0.650
Cluster 1	196-198		0.680
	759-761		0.694
	719-721		0.746
	803-805		0.733
	769-771		0.674
	467-469		0.736
	482-484		0.721
	10-12		0.740
	183-185		0.689
	415-417		0.704
	425-427		0.722
	5-7		0.704
	286-288		0.677
	average		0.683
	435-437		0.801
	853-855		0.798
	639-641		0.774
	873-875	0.008	0.780
	659-661		0.778
	236-238		0.724
	276-278		0.749
	823-825		0.709
	30-32		0.748
	405-407		0.755
	689-691		0.740
	813-815		0.728
	375-377		0.769
	472-474		0.743
	502-504		0.774
	552-554		0.859
Cluster 2	739-741		0.753
	60-62		0.727
	90-92		0.720
	365-367		0.755
	110-112		0.697
	216-218		0.718
	256-258		0.701
	120-122		0.758
	445-447		0.748
	335-337		0.769
	355-357		0.789
	629-631		0.771
	699-701		0.777
	492-494		0.784
	709-711		0.760
	532-534		0.792
	average		0.758
	1015-1017	0.008	0.727
	1055-1057	0.012	0.798
	1035-1037	0.010	0.843
	1129-1131	0.002	0.855
Cluster 3	975-977	0.004	0.848
	843-845		0.812
	925-927	0.006	0.817
	893-895	0.010	0.813

Cluster	Sample (cm below surface)	<i>Thalassiosira</i> sp 17	sum of marine planktic species
Cluster 3, cont'd	965-967		0.804
	945-947	0.016	0.789
	995-997	0.008	0.780
	923-925	0.006	0.740
	315-317		0.794
	average		0.802
Cluster 4	649-651		0.899
	1045-1047	0.008	0.922
	512-514		0.940
	582-584		0.837
	669-671		0.859
	395-397		0.874
	985-987	0.004	0.848
	305-307		0.914
	833-835		0.887
	935-937	0.006	0.896
	1119-1121	0.006	0.924
	1089-1091	0.008	0.866
	522-524		0.753
	913-915	0.006	0.840
	592-594		0.860
	612-614		0.830
	562-564		0.848
	679-681		0.819
	749-751		0.810
	385-387		0.846
	602-604		0.806
	206-208		0.803
	619-621		0.822
	1149-1151	0.022	0.861
	1209-1211	0.010	0.873
	1139-1141	0.012	0.881
	1169-1171	0.014	0.893
	1189-1191	0.008	0.884
	883-885	0.018	0.825
	1005-1007	0.018	0.821
	1109-1111	0.004	0.787
	783-785		0.844
	863-865		0.838
	1079-1081	0.006	0.882
	1179-1181	0.022	0.889
	955-957	0.006	0.853
	1025-1027	0.010	0.820
	average		0.855

APPENDIX H

Absolute Abundance of Statistically Significant Diatom Taxa in Q-mode Clusters

APPENDIX H. Absolute Abundance of statistically significant species in Q-mode clusters

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Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Cluster	Sample (cm below top of core)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes</i> sp. 2	<i>Achnanthes minutissimum</i>	<i>Amphora acutiuscula</i>	<i>Amphora cf. helenae</i>	<i>Bacillaria paxillifer</i>	<i>Brachyura brevissoni</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litoralis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>
Cluster 1	100-102								1.48E+06	1.48E+06	1.99E+08	8.85E+06		
	130-132		2.70E+06	2.70E+06	1.35E+06					1.35E+06	1.73E+08	1.35E+06		
	80-82		1.23E+06							1.23E+06	1.58E+08			
	325-327		3.80E+05							7.60E+05	5.02E+07	1.14E+06		
	246-248		3.09E+06	6.17E+05	1.23E+06					3.09E+06	7.35E+07	1.85E+06		
	50-52							9.78E+05		9.78E+05	1.49E+08	9.78E+05		
	226-228		5.66E+05	2.27E+06	1.13E+06					5.66E+05	9.34E+07			
	345-347		1.08E+06		3.24E+06			1.08E+06		1.08E+06	1.12E+08	5.40E+06		
	729-731			3.92E+06	9.80E+05						1.00E+08	4.90E+06		
	20-22		8.25E+05	2.47E+06						3.30E+06	8.17E+07	1.65E+06		
	40-42				2.40E+06					1.20E+06	7.43E+07			
	266-268		2.03E+06	1.35E+06	2.03E+06					2.03E+06	8.26E+07	6.77E+05		
	70-72		2.76E+06	2.76E+06	2.76E+06						1.65E+08	1.38E+06		
	196-198					9.84E+05		9.84E+05	1.97E+06	2.95E+06	8.56E+07	6.89E+06		
	759-761		1.31E+06	6.57E+06	1.31E+06					1.97E+06	5.06E+07		6.57E+05	
	719-721				8.03E+05			8.03E+05			6.75E+07	8.03E+05		
	803-805					2.17E+06			4.34E+06	4.34E+06	1.69E+08	6.51E+06	4.34E+06	
	769-771				2.11E+06			3.17E+06	2.11E+06	1.06E+07	8.23E+07	4.22E+06		2.74E+07
	467-469		5.89E+05	5.89E+05					5.89E+05	2.36E+06	4.59E+07			
	482-484		1.05E+06	4.20E+06						2.10E+06	9.35E+07	1.05E+06		1.05E+06
	10-12									1.50E+06	7.04E+07	7.49E+05		
	183-185		2.56E+06	5.12E+06							1.39E+08			
	415-417		7.97E+05	1.59E+06						2.39E+06	3.99E+07			3.99E+05
	425-427		6.25E+05	1.25E+06	6.25E+05						6.06E+07			
	5-7							1.11E+06		6.68E+06	1.10E+08			
	286-288			3.19E+06							8.77E+07			7.97E+05
	average										1.01E+08			
Cluster 2	435-437			2.21E+06						2.21E+06	7.31E+07	1.11E+06		
	853-855	1.05E+06		2.09E+06	1.05E+06					1.05E+06	6.17E+07			
	639-641				1.03E+06		1.03E+06		5.15E+05	5.15E+05	3.09E+07			
	873-875	1.89E+06		7.57E+06	1.89E+06				1.89E+06		1.02E+08	1.89E+06		
	659-661									4.54E+06	6.13E+07	4.54E+06		
	236-238		3.55E+06	2.37E+06					1.18E+06	2.37E+06	9.95E+07			
	276-278				1.29E+06					2.59E+06	9.05E+07	5.17E+06		
	823-825	1.84E+06	3.69E+06	1.11E+07	1.84E+06				1.84E+06	3.69E+06	1.51E+08	5.53E+06		
	30-32		9.24E+05					3.70E+06			6.75E+07	1.85E+06		
	405-407		4.39E+06	5.49E+06				1.10E+06		2.20E+06	8.34E+07	3.29E+06		
	689-691		1.76E+06		1.17E+06				1.17E+06		4.28E+07	1.76E+06		
	813-815		3.23E+06	6.47E+06				1.62E+06	3.23E+06	3.23E+06	1.28E+08	1.62E+06		3.23E+06
	375-377		2.83E+06	8.48E+06	1.41E+06						1.03E+08			
	472-474		3.04E+06						7.60E+05	1.52E+06	5.78E+07			
	502-504			4.07E+06	1.02E+06				1.02E+06	4.07E+06	6.10E+07	1.02E+06		2.03E+06
	552-554										9.92E+07	3.89E+06		
	739-741			1.08E+06						1.63E+06	3.53E+07			
	60-62							6.74E+05	6.74E+05		6.60E+07	2.02E+06		
	90-92		3.00E+06					7.51E+05		1.50E+06	7.06E+07	7.51E+05		
	365-367		1.72E+06								1.70E+08			
	110-112			2.86E+06					1.43E+06	4.28E+06	1.54E+08	2.86E+06		
	216-218		1.35E+06							2.70E+06	1.44E+08			
	256-258								9.01E+05		1.01E+08	1.80E+06		
	120-122			1.69E+06							7.60E+07	8.44E+05		
	445-447									5.43E+06	1.34E+08			
	335-337		1.54E+06							3.08E+06	1.40E+08	4.62E+06		
	355-357			2.16E+06							7.87E+07	7.55E+06		
	629-631		2.00E+06	3.99E+06						2.99E+06	6.98E+07	9.98E+05		
	699-701			7.27E+06	1.82E+06					3.64E+06	1.22E+08	1.82E+06		
	492-494		2.24E+06		4.48E+06					3.36E+06	8.73E+07	1.12E+06		
	709-711			5.95E+06				1.49E+06		7.44E+06	1.18E+08			
	532-534		2.03E+06	4.07E+06	2.03E+06						7.93E+07	2.03E+06		
	average										9.25E+07			
Cluster 3	1015-1017	2.43E+06			1.22E+06				2.43E+06	2.19E+07	8.38E+07	3.65E+06		
	1055-1057			2.42E+06	3.62E+06			2.42E+06		4.83E+06	2.78E+07	1.21E+06		
	1035-1037	7.99E+06	1.33E+06	5.32E+06				7.99E+06			3.73E+07			
	1129-1131	1.05E+06			2.10E+06			1.05E+06		4.21E+06	2.63E+07			
	975-977	5.38E+06									2.58E+07	2.15E+06		
	843-845		1.96E+06	3.91E+06				1.96E+06	9.78E+05		5.28E+07	3.91E+06		
	925-927				1.29E+06			1.29E+06	1.29E+06	6.44E+06	5.66E+07			

Cluster	Sample (cm below top of core)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes</i> sp. 2	<i>Achnanthidium minusimum</i>	<i>Amphora acutiuscula</i>	<i>Amphora cf. helensis</i>	<i>Bacillaria paxillifer</i>	<i>Brachyseta brevissonii</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litoralis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>
Cluster 3, cont'd	893-895	1 63E+06		3 26E+06	1 63E+06		3 26E+06			9 77E+06	7 65E+07			1 63E+06
	965-967		4 05E+06		2 02E+06				6 07E+06	1 21E+07	8 09E+07			
	945-947	2 56E+06		2 56E+06				1 28E+06	1 28E+06	7 67E+06	6 27E+07	1 28E+06		
	995-997	1 00E+06			1 00E+06		2 00E+06			7 01E+06	4 71E+07			1 00E+06
	923-925			6 05E+06	1 51E+06			7 57E+05	7 57E+05	6 81E+06	5 60E+07	7 57E+05		
Cluster 4	315-317				1 41E+06			1 41E+06		2 81E+06	9 28E+07	1 41E+06		
	average									5 59E+07				
	649-651									1 96E+06	4 90E+07			
	1045-1047									8 97E+06	2 87E+07	1 79E+06		
	512-514		1 22E+07	6 10E+06	3 05E+06					6 10E+06	4 27E+07			
Cluster 5	582-584		1 54E+06	3 09E+06			1 54E+06				2 93E+07			
	669-671		2 40E+06	9 61E+06						2 40E+06	7 69E+07	7 21E+06		
	395-397		1 73E+06		1 73E+06						7 09E+07			
	985-987	2 58E+06			2 58E+06	2 58E+06				1 29E+07	7 49E+07			
	305-307			4 07E+06				2 04E+06			3 66E+07			2 04E+06
Cluster 6	833-835	3 34E+06		6 69E+06	1 67E+06						4 68E+07			
	935-937			6 59E+06										
	1119-1121						3 72E+06			3 30E+06	3 46E+07	4 95E+06		
	1089-1091	3 16E+06		3 16E+06	3 16E+06			3 16E+06		3 72E+06	1 67E+07		1 86E+06	
	522-524		1 81E+06	1 81E+06						1 58E+06	3 64E+07	1 74E+07		
Cluster 7	913-915	2 54E+06			1 27E+06					9 04E+05	5 96E+07	9 04E+05		1 81E+06
	592-594				2 08E+06						5 46E+07			
	612-614										8 10E+07			
	562-564			5 39E+06			1 35E+06			3 01E+06	6 31E+07			
	679-681				2 29E+06		2 29E+06			1 35E+06	5 66E+07			1 35E+06
Cluster 8	749-751		2 63E+06	5 25E+06							5 16E+07	5 73E+06		
	385-387			5 48E+06						1 31E+06	6 43E+07	2 63E+06		
	602-604		9 27E+05							2 74E+06	7 26E+07			
	206-208				5 69E+06		2 28E+06	1 14E+06			5 56E+07	1 85E+06		
	619-621		9 70E+05		9 70E+05				9 70E+05	1 94E+06	5 24E+07			
Cluster 9	1149-1151	3 12E+06				1 56E+06				1 56E+06	3 12E+06	4 05E+07	6 23E+06	
	1209-1211	1 14E+06								4 58E+06	3 43E+06	3 43E+07	1 14E+06	
	1139-1141			2 41E+06			4 83E+06	1 21E+06		8 45E+06	2 78E+07	1 21E+06		
	1169-1171									1 05E+06	1 88E+07	2 09E+06		
	1189-1191	3 71E+06					2 47E+06	1 24E+06	1 24E+06	4 95E+06	1 24E+07	7 42E+06		
Cluster 10	883-885	1 35E+06		5 40E+06		6 75E+06		1 35E+06			3 51E+07	5 40E+06		1 35E+06
	1005-1007	2 68E+06		5 36E+06					1 34E+06	5 36E+06	4 82E+07	1 34E+06		
	1109-1111			2 07E+06	1 03E+06					1 97E+07	4 14E+07		4 14E+06	1 97E+07
	783-785							1 93E+06		5 79E+06	9 27E+07	3 86E+06		
	863-865	1 60E+06	1 60E+06	3 20E+06	1 60E+06					6 41E+06	6 57E+07	1 60E+06		
Cluster 11	1079-1081	2 86E+06		1 91E+06	9 53E+05	9 53E+05				2 86E+06	2 38E+07	2 86E+06		
	1179-1181	1 83E+06			1 83E+06			1 83E+06		3 67E+06	4 40E+07			
	955-957	1 36E+06								5 44E+06	4 22E+07	2 72E+06		
	1025-1027	3 48E+06	1 16E+06		3 48E+06			3 48E+06	1 16E+06	8 11E+06	4 29E+07			
	average									4 82E+07				

Cluster	Sample (cm below top of core)	<i>Encyonema stilesianum</i>	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 10	<i>Maryina atomus</i>	<i>Maryina maryi</i>	<i>Maryina cf. schulzei</i>	<i>Navicula perminuta</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia lebertii</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia</i> sp 7
	100-102			2 95E+06			7 38E+06				1 48E+06	1 48E+06	2 95E+06	
	130-132						5 39E+06				4 05E+06	1 35E+06	4 05E+06	5 39E+06
	80-82			1 23E+06	1 23E+06			3 69E+06	2 46E+06		1 23E+06	2 46E+06		
	325-327	3 80E+05		7 60E+05		7 60E+05	1 14E+06			3 80E+05				
	246-248			6 17E+05	6 17E+05	1 23E+06	1 23E+06							6 17E+05
	50-52										1 96E+06	1 96E+06	1 96E+06	
	226-228		5 66E+05	5 66E+05		5 66E+05	2 27E+06			1 13E+06		1 13E+06	2 27E+06	
	345-347			1 08E+06	2 16E+06		2 16E+06	3 24E+06			1 08E+06	1 08E+06	5 40E+06	
	729-731			9 80E+05	9 80E+05	9 80E+05	1 96E+06	1 96E+06			2 94E+06	5 88E+06		
	20-22							8 25E+05			1 65E+06	1 65E+06	3 30E+06	
	40-42			1 20E+06			1 20E+06	1 80E+06	5 99E+05	1 20E+06	1 20E+06	5 99E+05		
	266-268			6 77E+05				2 71E+06			2 03E+06			
	70-72			1 38E+06	1 38E+06			1 38E+07			2 76E+06	4 13E+06	4 13E+06	
Cluster 1	196-198	1 97E+06		2 95E+06		2 95E+06				2 95E+06	2 95E+06	4 92E+06	1 97E+06	
	759-761			6 57E+05	6 57E+05	1 31E+06				6 57E+05	3 94E+06	4 60E+06		
	719-721							8 03E+05		2 41E+06	3 21E+06	8 03E+05	1 61E+06	
	803-805			2 17E+06			4 34E+06	2 17E+07		2 17E+06	8 67E+06	4 34E+06	6 51E+06	
	769-771			1 06E+06		5 28E+06	1 06E+06	2 11E+06		1 06E+06	2 11E+06	1 06E+06	1 06E+06	1 06E+06
	467-469			1 77E+06		5 89E+05		1 18E+06			2 94E+06	5 89E+06	1 18E+06	
	482-484		1 05E+06	1 05E+06			1 05E+06				5 25E+06	5 25E+06	7 35E+06	
	10-12		7 49E+05								7 49E+05	1 50E+06	7 49E+05	
	183-185			1 28E+06			2 56E+06	5 12E+06					8 96E+06	
	415-417			3 99E+05				3 99E+05		7 97E+05		7 97E+05	3 99E+05	
	425-427	2 50E+06				1 25E+06	1 25E+06	1 25E+06		6 25E+05	6 25E+05	6 25E+05		
	5-7						1 11E+06			2 23E+06	1 11E+06	2 23E+06	2 23E+06	
	286-288			2 39E+06	7 97E+05		3 98E+06	9 56E+06			7 97E+05		2 39E+06	
	average													
	435-437			1 11E+06		3 32E+06				1 11E+06	2 21E+06	5 54E+06	2 21E+06	
	853-855			4 18E+06	3 14E+06			2 09E+06			4 18E+06			
	639-641			1 03E+06	1 03E+06	5 15E+05		1 54E+06				1 03E+06	1 03E+06	
	873-875	7 57E+06		1 89E+06			7 57E+06	3 79E+06			7 57E+06	7 57E+06	1 32E+07	
	659-661			1 14E+06	2 27E+06	5 68E+06					4 54E+06	2 27E+06	2 27E+06	2 27E+06
	236-238	2 37E+06		1 18E+06	1 18E+06	1 18E+06				1 18E+06	1 18E+06	1 18E+06	7 11E+06	
	276-278			3 88E+06	1 29E+06		3 88E+06				1 29E+06	1 29E+06	5 17E+06	
	823-825	5 53E+06		5 53E+06	1 84E+06	3 69E+06		5 53E+06			3 69E+06	5 53E+06	3 69E+06	
	30-32			4 62E+06		9 24E+05					3 70E+06		1 85E+06	
	405-407			1 10E+06		2 20E+06	2 20E+06	2 20E+06		2 20E+06	2 20E+06	5 49E+06	1 10E+06	
	689-691			5 86E+05	5 86E+05	1 17E+06	4 69E+06			1 76E+06			2 34E+06	
	813-815			1 62E+06		3 23E+06			1 62E+06			3 23E+06		
	375-377	4 24E+06		2 83E+06			2 83E+06			1 41E+06		5 65E+06	4 24E+06	
	472-474			2 28E+06			1 52E+06	6 08E+06		7 60E+05	1 52E+06	3 04E+06	2 28E+06	
	502-504	4 07E+06		5 08E+06	1 02E+06		3 05E+06	3 05E+06	1 02E+06		1 02E+06	3 05E+06	3 05E+06	
	552-554						3 89E+06						3 89E+06	
Cluster 2	739-741	2 71E+06		1 08E+06			2 71E+06			5 42E+05	5 42E+05	5 42E+05		
	60-62			6 74E+05			6 74E+05	5 39E+06	1 35E+06	6 74E+05		1 35E+06	1 35E+06	
	90-92			7 51E+05			3 00E+06	1 50E+06	4 51E+06			7 51E+05		7 51E+05
	365-367			1 72E+06							5 15E+06	1 72E+06	6 87E+06	
	110-112			1 43E+06		1 43E+06		2 86E+06			1 43E+06	2 86E+06	2 86E+06	
	216-218			5 39E+06			4 04E+06	1 21E+07				2 70E+06	2 70E+06	
	256-258	5 41E+06		1 80E+06	9 01E+05		3 60E+06					9 01E+05	3 60E+06	
	120-122	8 44E+05			1 69E+06	1 69E+06	5 06E+06		1 69E+06			8 44E+05	8 44E+05	
	445-447	6 79E+06		1 36E+06	1 36E+06								4 07E+06	
	335-337	3 08E+06	1 54E+06	1 54E+06						9 24E+06				
	355-357	1 08E+06			2 16E+06					2 16E+06			2 16E+06	
	629-631			2 99E+06			2 00E+06	2 00E+06					9 98E+05	
	699-701	7 27E+06			1 82E+06			1 82E+06		1 82E+06		1 82E+06	3 64E+06	
	492-494						1 12E+06			2 24E+06		2 24E+06	2 24E+06	
	709-711			1 49E+06	1 49E+06		2 98E+06			1 49E+06	2 98E+06			1 49E+06
	532-534		1 02E+06			1 02E+06	1 02E+06			2 03E+06		2 03E+06	2 03E+06	
	average													
	1015-1017							4 86E+06		2 43E+06		4 86E+06	3 65E+06	
	1055-1057	8 46E+06			2 42E+06		3 62E+06	4 83E+06	1 21E+06	2 42E+06	1 21E+06	3 62E+06		3 62E+06
	1035-1037				1 33E+06			3 99E+06			2 66E+06	2 66E+06	2 66E+06	
Cluster 3	1129-1131					1 05E+06		4 21E+06		3 15E+06	1 05E+06		3 15E+06	
	975-977			3 23E+06				2 15E+06		1 08E+06	2 15E+06	4 31E+06	5 38E+06	3 23E+06
	843-845													
	925-927	7 72E+06				1 29E+06					2 57E+06			

Cluster	Sample (cm below top of core)	<i>Euglenema silvestrii</i>	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 10	<i>Maryana atomus</i>	<i>Maryana muryi</i>	<i>Maryana cf. schultzei</i>	<i>Nannocula perminuta</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia liebertii</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia</i> sp 7
Cluster 3, cont'd	893-895			3 26E+06		3 26E+06	1 63E+06	3 26E+06			1 63E+06			
	965-967			1 01E+07						4 05E+06		2 02E+07	1 01E+07	
	945-947	5 12E+06						3 84E+06		1 28E+06	2 56E+06		2 56E+06	
	995-997			1 00E+06		2 00E+06	2 00E+06	3 01E+06		5 01E+06		2 00E+06		
	923-925	1 51E+06			5 30E+06			3 03E+06		7 57E+05			7 57E+05	
	315-317 average			1 41E+06		1 41E+06		2 81E+06	1 41E+06	2 81E+06	2 81E+06	7 03E+06	4 22E+06	
Cluster 4	649-651							5 88E+06				5 88E+06	3 92E+06	
	1045-1047	3 59E+06					1 79E+06					1 79E+06		
	512-514									3 05E+06		6 10E+06	6 10E+06	
	582-584				7 72E+05			6 17E+06				3 09E+06	7 72E+05	
	669-671		4 81E+06				2 40E+06	1 20E+07		2 40E+06		2 40E+06		
	395-397			5 19E+06			6 91E+06	1 73E+06					3 46E+06	
	985-987				2 58E+06	5 16E+06	2 58E+06	5 16E+06	2 58E+06			5 16E+06	1 29E+07	
	305-307			4 07E+06	4 07E+06	2 04E+06					4 07E+06	4 07E+06	4 07E+06	
	833-835				1 67E+06			8 36E+06		1 67E+06			3 34E+06	
	935-937											3 30E+06	1 65E+06	
	1119-1121	3 72E+06					1 86E+06	7 43E+06		1 86E+06	1 86E+06	3 72E+06		
	1089-1091							3 16E+06		3 16E+06		3 16E+06		
	522-524	2 71E+06			9 04E+05		9 04E+05			1 81E+06	2 71E+06	6 33E+06	3 61E+06	
	913-915						1 27E+06	2 54E+06		3 81E+06				
	592-594			2 08E+06		2 08E+06	2 08E+06	6 23E+06			4 15E+06	4 15E+06		
	612-614			3 01E+06	3 01E+06			4 51E+06		1 50E+06	1 50E+06	7 51E+06		
	562-564			1 35E+06		2 70E+06						2 70E+06	2 70E+06	
	679-681	2 29E+06					2 29E+06			1 15E+06		4 58E+06	3 44E+06	
	749-751	5 25E+06					3 94E+06	2 63E+06			1 31E+06			
	385-387			1 37E+06								1 37E+06	1 37E+06	
	602-604				1 85E+06	3 71E+06	9 27E+05	1 85E+06	9 27E+05			1 85E+06		
	206-208				1 14E+06		3 41E+06	4 55E+06		2 28E+06	2 28E+06	2 28E+06		
	619-621						1 94E+06	1 94E+06			1 94E+06	2 91E+06	1 94E+06	
	1149-1151			3 12E+06			1 56E+06	3 12E+06		1 56E+06		9 35E+06		
	1209-1211			2 29E+06		1 14E+06	2 29E+06	2 29E+06						
	1139-1141					3 62E+06		2 41E+06		2 41E+06				
	1169-1171				2 09E+06	1 05E+06				1 05E+06		6 28E+06		2 09E+06
	1189-1191	4 95E+06		1 24E+06						6 18E+06				2 47E+06
	883-885				1 35E+06	2 70E+06		5 40E+06					5 40E+06	
	1005-1007					2 68E+06					8 03E+06		9 37E+06	
	1109-1111	3 10E+06						2 07E+06						
	783-785			1 93E+06		1 93E+06		3 86E+06		1 93E+06	3 86E+06		1 93E+06	
	863-865	3 20E+06		1 60E+06	3 20E+06			3 20E+06						
	1079-1081						9 53E+05	1 91E+06		2 86E+06	1 91E+06			
	1179-1181			1 83E+06	3 67E+06		1 83E+06			1 83E+06				7 34E+06
	955-957						2 72E+06	1 36E+06				2 72E+06		
	1025-1027			4 64E+06			1 16E+06	1 16E+06			1 16E+06	2 32E+06	2 32E+06	3 48E+06
	average													

Cluster	Sample (cm below top of core)	<i>Paralia sulcata</i>	<i>Planohidium delicatulum</i>	<i>Planohidium cf. engelbrechtii</i>	<i>Saurosirella pinata</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	sum of non-planktic species	<i>Actinocyclus senarius</i>	<i>Actinocyclus vulgaris</i>	<i>Actinocyclus</i> sp. 1	<i>Aulacoseira islandica</i>	<i>Coscinodiscus radiatus</i>
Cluster 1	100-102		1 48E+06	1 48E+06	2 95E+06				2 33E+08		2 95E+06			
	130-132		5 39E+06			2 70E+06			2 10E+08					1 35E+06
	80-82		3 69E+06			1 23E+06		1 23E+06	1 79E+08					
	325-327		3 80E+05					1 90E+06	5 81E+07	3 80E+05		3 80E+05		
	246-248								8 77E+07					
	50-52		3 91E+06	9 78E+05					1 62E+08	3 91E+06				2 93E+06
	226-228		5 66E+05	1 13E+06		5 66E+05			1 09E+08	5 66E+05				
	345-347		1 08E+06					1 08E+06	1 42E+08					
	729-731	9 80E+05	9 80E+05	9 80E+05		9 80E+05		4 90E+06	1 34E+08					9 80E+05
	20-22		4 12E+06	8 25E+05		1 65E+06			1 04E+08				8 25E+05	8 25E+05
	40-42		1 80E+06						8 75E+07		5 99E+05			1 20E+06
	266-268		6 77E+05	6 77E+05			6 77E+05		1 00E+08	6 77E+05	6 77E+05			2 03E+06
	70-72		2 76E+06	1 38E+06		4 13E+06			2 11E+08			1 65E+07		2 76E+06
	196-198		9 84E+05					6 89E+06	1 32E+08	9 84E+05				3 94E+06
	759-761		1 97E+06			1 31E+06	6 57E+05	5 25E+06	8 34E+07	6 57E+05				6 57E+05
	719-721	4 82E+06	1 61E+06			8 03E+05		2 41E+06	8 83E+07					1 61E+06
	803-805		2 17E+06		4 34E+06	2 17E+06		1 52E+07	2 65E+08			2 17E+06		4 34E+06
	769-771		2 11E+06					4 22E+06	1 53E+08	1 06E+06				
	467-469		1 18E+06	5 89E+05			5 89E+05	1 77E+06	6 77E+07					5 89E+05
	482-484		2 10E+06	1 05E+06				1 05E+06	1 28E+08					1 05E+06
	10-12		3 75E+06			7 49E+05			8 09E+07					3 00E+06
	183-185			6 40E+06			6 40E+06		1 78E+08					
	415-417				3 99E+05			7 97E+05	4 90E+07	3 99E+05				
	425-427		6 25E+05	6 25E+05				6 25E+05	7 31E+07	1 87E+06	6 25E+05			
	5-7		4 45E+06	1 11E+06		3 34E+06			1 36E+08					
	286-288		1 59E+06	7 97E+05				1 59E+06	1 16E+08					
	average								1 30E+08					
Cluster 2	435-437		3 32E+06					2 21E+06	9 97E+07	1 11E+06				
	853-855		3 14E+06	1 05E+06				6 28E+06	9 10E+07					3 14E+06
	639-641		1 54E+06		1 03E+06	5 15E+05		5 66E+06	4 89E+07	1 54E+06				5 15E+05
	873-875		1 89E+06					1 89E+06	1 70E+08				7 57E+06	1 89E+06
	659-661		1 14E+06	1 14E+06		1 14E+06		3 41E+06	9 76E+07			3 41E+06		
	236-238		3 55E+06	1 18E+06					1 30E+08	2 37E+06				1 18E+06
	276-278		3 88E+06		1 29E+06	1 29E+06		1 29E+06	1 24E+08	1 29E+06				
	823-825		3 69E+06	3 69E+06				1 84E+07	2 42E+08				7 38E+06	5 53E+06
	30-32		3 70E+06			1 85E+06		3 70E+06	9 43E+07					9 24E+05
	405-407		2 20E+06	1 10E+06		1 10E+06			1 23E+08					1 10E+06
	689-691		1 76E+06		1 76E+06	2 93E+06		2 93E+06	6 91E+07	5 86E+05				5 86E+05
	813-815		4 85E+06		1 62E+06	3 23E+06		1 29E+07	1 83E+08	1 62E+06			3 23E+06	3 23E+06
	375-377		1 41E+06			1 41E+06	1 41E+06	4 24E+06	1 46E+08					
	472-474		3 80E+06	1 52E+06				1 52E+06	8 74E+07					
	502-504		2 03E+06					2 03E+06	1 03E+08					1 02E+06
	552-554							3 89E+06	1 15E+08	1 95E+06				
	739-741		5 42E+05			1 08E+06		1 63E+06	4 94E+07					5 42E+05
	60-62		6 74E+05	6 74E+05	1 35E+06				8 35E+07			1 35E+06		6 74E+05
	90-92		1 50E+06			1 50E+06			9 09E+07		7 51E+05		7 51E+05	
	365-367		3 43E+06	3 43E+06	1 72E+06			1 72E+06	1 97E+08					1 72E+06
	110-112		1 43E+06	2 86E+06				1 43E+06	1 84E+08		1 43E+06			
	216-218		2 70E+06					1 35E+06	1 79E+08					
	256-258							9 01E+05	1 21E+08					9 01E+05
	120-122		1 69E+06	1 69E+06					9 45E+07					8 44E+05
	445-447		1 36E+06					1 36E+06	1 56E+08					
	335-337								1 65E+08					
	355-357		3 23E+06				2 16E+06		1 01E+08	2 16E+06				1 08E+06
	629-631	9 98E+05		9 98E+05				2 99E+06	9 28E+07					9 98E+05
	699-701		1 82E+06		9 09E+06	5 45E+06	1 82E+06	5 45E+06	1 78E+08					1 82E+06
	492-494		1 12E+06	1 12E+06				2 24E+06	1 11E+08	2 24E+06				1 12E+06
	709-711		2 98E+06	1 49E+06				5 95E+06	1 55E+08					
	532-534		2 03E+06					1 02E+06	1 02E+08					
	average								1 24E+08					
Cluster 3	1015-1017		1 22E+06	2 43E+06	1 22E+06	1 22E+06		4 86E+06	1 42E+08					2 43E+06
	1055-1057	2 42E+06	3 62E+06	2 42E+06		4 83E+06		1 09E+07	9 78E+07					1 21E+06
	1035-1037		5 32E+06					5 32E+06	8 39E+07					
	1129-1131		1 05E+06			2 10E+06		8 41E+06	5 89E+07					1 05E+06
	975-977		1 08E+06	1 08E+06				4 31E+06	6 14E+07	2 15E+06				5 38E+06
	843-845		2 93E+06	1 96E+06				7 82E+06	7 82E+07		9 78E+05		3 91E+06	9 78E+05
	925-927		1 29E+06					9 01E+06	8 88E+07					1 29E+06

Cluster	Sample (cm below top of core)	<i>Paralella sulcata</i>	<i>Planolium delatavium</i>	<i>Planolium cf. engelbrechii</i>	<i>Stauraula puvla</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	sum of non-planktic species	<i>Actinoprychus senarius</i>	<i>Actinoprychus vulgaris</i>	<i>Actinoprychus</i> sp. 1	<i>Aulacosera islandica</i>	<i>Cocconeis radiatus</i>
Cluster 3, cont'd	893-895		1 63E+06		1 63E+06			6 51E+06	1 20E+08		6 51E+06			
	965-967		2 02E+06	2 02E+06				1 42E+07	1 68E+08					4 05E+06
	945-947		3 84E+06	1 28E+06				1 02E+07	1 10E+08					1 28E+06
	995-997		1 00E+06	3 01E+06				1 20E+07	9 02E+07		1 00E+06			3 01E+06
	923-925			7 57E+05	1 51E+06			3 78E+06	9 01E+07					7 57E+05
	315-317 average		1 41E+06		2 81E+06	1 41E+06		1 41E+06	1 31E+08 1 02E+08	1 41E+06				4 22E+06
Cluster 4	649-651		1 96E+06					3 92E+06	7 25E+07	1 96E+06				1 96E+06
	1045-1047		1 79E+06				1 79E+06	5 38E+06	5 56E+07					1 79E+06
	512-514							3 05E+06	8 84E+07					
	582-584		1 54E+06			7 72E+05		3 09E+06	5 17E+07	7 72E+05				
	669-671					1 20E+07			1 35E+08					7 21E+06
	395-397		3 46E+06	5 19E+06					1 00E+08					3 46E+06
	985-987		7 75E+06					1 03E+07	1 50E+08					5 16E+06
	305-307							2 04E+06	6 92E+07					
	833-835		3 34E+06					5 02E+06	8 19E+07				3 34E+06	
	935-937		4 95E+06					8 24E+06	6 76E+07		3 30E+06			3 30E+06
	1119-1121		1 86E+06			3 72E+06	1 86E+06	3 72E+06	5 76E+07					7 43E+06
	1089-1091			1 58E+06				1 58E+06	8 06E+07					
	522-524		9 04E+05		9 04E+05			9 04E+05	8 86E+07	9 04E+05				9 04E+05
	913-915			1 27E+06	5 08E+06			1 52E+07	8 76E+07					5 08E+06
	592-594		2 08E+06	2 08E+06				8 30E+06	1 16E+08				2 08E+06	4 15E+06
	612-614		1 50E+06	1 50E+06	1 50E+06	1 50E+06		3 01E+06	9 62E+07					1 50E+06
	562-564		1 35E+06					1 35E+06	7 82E+07					1 35E+06
	679-681		1 15E+06					3 44E+06	8 02E+07					
	749-751		5 25E+06	1 31E+06	3 94E+06	3 94E+06		2 63E+06	1 06E+08					1 31E+06
	385-387		1 37E+06	1 37E+06				2 74E+06	9 04E+07					1 37E+06
	602-604		1 85E+06		9 27E+05			2 78E+06	7 51E+07	9 27E+05				1 85E+06
	206-208		2 28E+06	1 14E+06			2 28E+06	3 41E+06	9 78E+07		1 14E+06			2 28E+06
	619-621		9 70E+05	1 94E+06	9 70E+05	1 94E+06		9 70E+05	7 47E+07	9 70E+05				
	1149-1151		1 56E+06	1 56E+06	6 23E+06			3 12E+06	8 72E+07	1 56E+06				1 56E+06
	1209-1211				1 14E+06			2 29E+06	5 61E+07		5 72E+06			1 14E+06
	1139-1141		1 21E+06		2 41E+06			3 62E+06	6 16E+07					2 41E+06
	1169-1171							2 09E+06	3 66E+07					
	1189-1191		1 24E+06			1 24E+06			5 07E+07					3 71E+06
	883-885		4 05E+06		1 35E+06			1 49E+07	9 18E+07	1 35E+06				1 35E+06
	1005-1007		4 02E+06			1 34E+06		4 02E+06	9 37E+07					
	1109-1111				3 10E+06			3 10E+06	9 93E+07					2 07E+06
	783-785		1 93E+06			1 93E+06		3 86E+06	1 27E+08					
	863-865		8 01E+06	1 60E+06				1 28E+07	1 15E+08		3 20E+06			
	1079-1081							9 53E+05	4 48E+07	9 53E+05				9 53E+05
	1179-1181							7 34E+06	7 71E+07	1 83E+06				
	955-957		5 44E+06				2 72E+06	9 52E+06	7 62E+07		2 72E+06			
	1025-1027		1 16E+06	1 16E+06		1 16E+06		4 64E+06	8 81E+07					
	average								8 40E+07					

APPENDIX H. Absolute Abundance of statistically significant species in Q-mode clusters
Statistically Significant Marine Planktic Diatom Taxa

Cluster	Sample (cm below top of core)	<i>Coscinodiscus</i> sp 1	<i>Fragilaropus cylindriciformis</i>	<i>Fragilaropus cylindrus</i>	<i>Fragilaropus pseudonana</i>	<i>Melosira arenita</i>	<i>Melosira nummeloides</i>	<i>Skellatonema costatum</i>	<i>Thalassiothema nitzeioides</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>	<i>Thalassiosira hyalina</i>	<i>Thalassiosira leptopus</i>
	100-102		8 85E+06	4 43E+06	2 95E+06			3 58E+08	4 43E+06	1 18E+07	4 43E+06			
	130-132		5 39E+06	2 70E+06	4 05E+06	1 35E+06		3 17E+08		1 08E+07				1 35E+06
	80-82		1 23E+06		1 23E+06			3 26E+08	3 69E+06	8 62E+06	3 69E+06			
	325-327		3 80E+05	3 80E+05		3 80E+05		9 88E+07	3 80E+05	3 80E+05	3 80E+05			
	246-248		6 17E+05	6 17E+05	6 17E+05			1 64E+08	7 41E+06	1 23E+06	3 70E+06			
	50-52		9 78E+05	9 78E+05	1 96E+06			1 83E+08	3 91E+06	1 57E+07	1 96E+06			4 89E+06
	226-228		2 83E+06	1 13E+06	1 13E+06			1 17E+08	1 70E+06		1 70E+06	5 66E+05		1 13E+06
	345-347		1 08E+06	6 48E+06				2 55E+08	4 32E+06	3 24E+06	1 08E+06			
	729-731	1 96E+06	3 92E+06		2 94E+06			2 24E+08	4 90E+06	2 94E+06	1 96E+06		9 80E+05	
	20-22		4 95E+06	1 65E+06	8 25E+05			1 63E+08	4 12E+06	2 47E+06	1 63E+06			1 65E+06
	40-42		3 00E+06	5 99E+05				1 23E+08	1 80E+06	4 19E+06				5 99E+05
	266-268		4 06E+06	1 35E+06	6 77E+05	6 77E+05		1 60E+08	3 39E+06	6 77E+05	1 35E+06			
	70-72		2 89E+07	4 13E+06				2 78E+08	1 24E+07	1 52E+07				1 38E+06
Cluster 1	196-198		4 92E+06		9 84E+05	9 84E+05		2 55E+08	4 92E+06	9 84E+05	1 97E+06		9 84E+05	
	759-761	2 63E+06	3 28E+06					1 62E+08		2 63E+06	1 97E+06		1 31E+06	
	719-721		2 41E+06	8 03E+05		3 21E+06		1 96E+08	1 61E+06	4 82E+06	5 62E+06		1 61E+06	3 21E+06
	803-805		2 17E+06					5 72E+08	2 17E+06	2 17E+06	4 34E+06			
	769-771	1 06E+06	2 11E+06		1 06E+06	1 06E+06		2 60E+08	1 16E+07		5 28E+06			
	467-469		5 89E+05					1 64E+08	2 36E+06	4 71E+06				
	482-484		2 10E+06	4 20E+06				2 75E+08	8 40E+06	3 15E+06	4 20E+06			1 05E+06
	10-12		5 24E+06	3 75E+06				1 86E+08	3 75E+06	4 49E+06	7 49E+05			
	183-185		7 68E+06	1 28E+06			5 12E+06	3 36E+08	2 56E+06	3 84E+06				2 56E+06
	415-417				3 99E+05	3 99E+05		1 05E+08	1 59E+06	7 97E+05	1 59E+06			
	425-427		6 25E+05	6 25E+05	6 25E+05	6 25E+05		1 64E+08	1 25E+06	1 25E+06	6 25E+05			6 25E+05
	5-7		1 11E+06		7 79E+06			2 83E+08		3 34E+06	3 34E+06			1 11E+06
	286-288		3 19E+06	1 04E+07				2 04E+08	3 98E+06	3 19E+06				
	average							2 28E+08						
	435-437		3 32E+06		1 11E+06			3 47E+08	4 43E+06	3 32E+06	2 21E+06			
	853-855		1 05E+06	1 05E+06				3 22E+08	3 14E+06	3 14E+06	3 14E+06			3 14E+06
	639-641							1 54E+08	5 15E+05	1 54E+06	5 15E+05			5 15E+05
	873-875		7 57E+06					5 60E+08						5 68E+06
	659-661							3 51E+08	1 36E+07	3 41E+06	5 68E+06			
	236-238		2 37E+06	2 37E+06	1 18E+06			3 39E+08	8 29E+06	4 74E+06	2 37E+06			
	276-278		7 76E+06			2 59E+06	2 59E+06	3 18E+08	2 59E+06	1 81E+07	3 88E+06			
	823-825		5 53E+06					4 92E+08	3 69E+06			1 48E+07		
	30-32		9 24E+05		9 24E+05			2 65E+08	9 24E+06	1 85E+06	2 77E+06			9 24E+05
	405-407							3 11E+08	1 10E+06	3 29E+06	2 20E+06			
	689-691			1 17E+06		1 17E+06		1 68E+08	1 76E+06	3 51E+06			1 17E+06	
	813-815	1 62E+06						4 59E+08	4 85E+06		1 62E+06		3 23E+06	
	375-377		1 41E+06				2 83E+06	4 17E+08	1 41E+06	1 41E+07	2 83E+06			2 83E+06
	472-474	7 60E+05	7 60E+05	7 60E+05	1 52E+06			2 24E+08	1 52E+06	3 80E+06	3 04E+06		7 60E+05	
	502-504		1 02E+06		1 02E+06	1 02E+06		2 93E+08	5 08E+06	5 08E+06	3 05E+06			5 08E+06
	552-554	1 95E+06	1 95E+06		1 95E+06			6 71E+08			3 89E+06			1 95E+06
Cluster 2	739-741		2 71E+06		1 63E+06			1 48E+08	1 63E+06		1 08E+06		5 42E+05	1 08E+06
	60-62			3 37E+06	6 74E+05			2 00E+08		1 35E+06	1 35E+06			6 74E+05
	90-92		1 50E+06					2 19E+08	1 50E+06	3 76E+06	7 51E+05			
	365-367		3 43E+06				3 43E+06	5 41E+08	1 72E+06	8 58E+06	3 43E+06			
	110-112		1 43E+06	1 00E+07				3 86E+08	1 43E+06	1 43E+06				
	216-218			5 39E+06				4 02E+08	4 04E+06		5 39E+06	1 35E+06		
	256-258			1 80E+06				2 70E+08	3 60E+06	2 70E+06				
	120-122			1 69E+06				2 71E+08	1 69E+06	5 91E+06	2 53E+06			
	445-447		2 72E+06		4 07E+06	1 36E+06		4 49E+08		5 43E+06	1 36E+06			2 72E+06
	335-337		3 08E+06					5 33E+08	1 54E+06	6 16E+06	3 08E+06		1 54E+06	1 54E+06
	355-357		4 31E+06		1 08E+06	1 08E+06	2 16E+06	3 49E+08	1 08E+06	5 39E+06	4 31E+06		1 08E+06	3 23E+06
	629-631		9 98E+05			9 98E+05		3 32E+08	4 99E+06	9 98E+05	9 98E+05			
	699-701		1 82E+06		1 82E+06			5 91E+08	1 82E+06	5 45E+06	7 27E+06		9 09E+06	5 45E+06
	492-494		2 24E+06	1 12E+06				3 45E+08	1 12E+07	3 36E+06	3 36E+06			1 12E+06
	709-711	1 49E+06				1 49E+06		4 64E+08	1 64E+07	1 49E+06	1 49E+06		4 46E+06	
	532-534	1 02E+06		1 02E+06	1 02E+06	2 03E+06		3 24E+08	5 08E+06	4 07E+06	5 08E+06			
	average							3 60E+08						
	1015-1017		1 22E+06			1 22E+06		2 33E+08	4 86E+06	2 43E+06	2 43E+06		3 65E+06	3 65E+06
	1055-1057				3 62E+06			2 75E+08	2 42E+06	4 83E+06				3 62E+06
Cluster 3	1035-1037	1 33E+06			1 33E+06			3 90E+08			1 33E+06		2 66E+06	3 99E+06
	1129-1131			1 05E+06				3 08E+08	4 21E+06	2 10E+06	2 10E+06			2 10E+06
	975-977		1 08E+06		1 08E+06			3 23E+08	8 61E+06	4 31E+06			2 15E+06	4 31E+06
	843-845							2 88E+08	3 91E+06	9 78E+05				5 87E+06
	925-927	1 29E+06	1 29E+06		2 57E+06			3 93E+08	3 86E+06	6 44E+06	2 57E+06	1 29E+06	1 29E+06	

Cluster	Sample (cm below top of core)	<i>Coccolithus</i> sp 1	<i>Fragilaropsis cylindricus</i>	<i>Fragilaropsis cylindrus</i>	<i>Fragilaropsis pseudonana</i>	<i>Melosira arenita</i>	<i>Melosira numellouides</i>	<i>Skeletonema costatum</i>	<i>Thalassionema nitzschoides</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>	<i>Thalassiosira hyalina</i>	<i>Thalassiosira leptopus</i>
Cluster 3, cont'd	893-895	1 63E+06	3 26E+06					4 49E+08	6 51E+06	4 88E+06	1 95E+07	1 63E+06		4 88E+06
	965-967							5 87E+08	4 05E+06	8 09E+06	2 02E+06	4 05E+06		2 02E+06
	945-947							3 43E+08		2 56E+06	6 40E+06			3 84E+06
	995-997		2 00E+06					2 72E+08	1 00E+06		2 00E+06		2 00E+06	2 00E+06
	923-925							2 12E+08		4 54E+06	1 51E+06			1 51E+06
	315-317		1 41E+06					3 91E+08	3 94E+07	1 41E+06	5 62E+06		1 41E+06	1 41E+06
	average							3 43E+08						
Cluster 4	649-651							7 68E+08	7 84E+06	1 96E+06	1 96E+06			
	1045-1047							7 18E+08		8 97E+06			1 79E+06	
	512-514		6 10E+06					1 28E+09	3 05E+06	6 10E+06	3 05E+06			3 05E+06
	582-584							2 79E+08	7 72E+05	2 32E+06	7 72E+05			7 72E+05
	669-671		2 40E+06		4 81E+06	2 40E+06		9 03E+08	2 40E+06		7 21E+06			
	395-397	1 73E+06			1 73E+06	1 73E+06		6 31E+08	1 04E+07	8 64E+06	3 46E+06			
	985-987	2 58E+06						9 22E+08			2 58E+06		1 81E+07	2 58E+06
	305-307				2 04E+06			7 80E+08	4 07E+06		2 04E+06			
	833-835							6 42E+08	1 67E+06		3 34E+06		3 34E+06	
	935-937				3 30E+06	3 30E+06		6 03E+08	3 30E+06	1 65E+06				3 30E+06
	1119-1121	1 86E+06	3 72E+06					6 71E+08	1 86E+06	7 43E+06	7 43E+06		1 86E+06	
	1089-1091		1 58E+06					5 60E+08		1 58E+06	1 58E+06			1 58E+06
	522-524		2 71E+06		9 04E+05			2 56E+08	8 13E+06	3 61E+06	2 71E+06			
	913-915							4 32E+08	2 54E+06	1 27E+06	1 27E+06			2 54E+06
	592-594				2 08E+06			7 18E+08	4 15E+06		6 23E+06		6 23E+06	2 08E+06
	612-614				1 50E+06			5 14E+08	3 01E+06	7 51E+06	1 50E+06			
	562-564							4 86E+08	4 04E+06		1 35E+06			4 04E+06
	679-681		2 29E+06	1 15E+06		2 29E+06		4 03E+08		9 17E+06				1 15E+06
	749-751		6 56E+06					4 50E+08		7 88E+06				1 31E+06
	385-387		2 74E+06	1 37E+06				4 78E+08	5 48E+06	1 10E+07	6 85E+06			4 11E+06
	602-604							3 33E+08	4 64E+06	9 27E+05	9 27E+05			
	206-208		4 55E+06		2 28E+06			3 67E+08	7 96E+06		2 28E+06			3 41E+06
	619-621		9 70E+05		9 70E+05	9 70E+05		3 32E+08	8 73E+06	9 70E+05	1 94E+06			
	1149-1151		1 56E+06					4 95E+08		6 23E+06	3 12E+06		3 12E+06	1 56E+06
	1209-1211	1 14E+06						3 72E+08	1 14E+06	2 29E+06			3 43E+06	3 43E+06
	1139-1141				1 21E+06			4 00E+08	2 41E+06	1 21E+06	4 83E+06			2 41E+06
	1169-1171		1 05E+06	1 05E+06	1 05E+06			3 38E+08	1 05E+06	1 05E+06		1 05E+06	2 09E+06	2 09E+06
	1189-1191		2 47E+06				2 47E+06	4 08E+08		3 71E+06	1 24E+06			4 95E+06
	883-885	2 70E+06	1 35E+06					4 24E+08	4 05E+06	1 35E+06	8 10E+06	5 40E+06		1 35E+06
	1005-1007		5 36E+06					4 27E+08		2 68E+06	1 34E+06	5 36E+06		1 34E+06
	1109-1111	1 03E+06						3 33E+08	4 14E+06	3 10E+06				1 03E+06
	783-785				1 93E+06	1 93E+06		6 45E+08	1 93E+06	3 86E+06	3 86E+06		1 93E+06	3 86E+06
	863-865		1 60E+06	1 60E+06				5 22E+08	3 20E+06	3 20E+06			1 60E+06	
	1079-1081							3 30E+08	9 53E+05	1 91E+06	1 91E+06		5 72E+06	1 91E+06
	1179-1181	1 83E+06						6 31E+08	1 83E+06	1 83E+06	3 67E+06		7 34E+06	
	955-957							4 57E+08		1 09E+07	4 08E+06			4 08E+06
	1025-1027		2 32E+06					3 80E+08		1 16E+06		1 16E+06	2 32E+06	
	average							5 32E+08						

APPENDIX H Absolute Abundance of statistically significant species in Q-mode clusters
Statistically Significant Marine Planktic Diatom Taxa

Cluster	Sample (cm below top of core)	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 17	sum of marine planktic species	Sum of all statistically significant species
Cluster 1	100-102	3 69E+07	1 48E+07	2 66E+07	4 43E+06	1 48E+06		1 48E+06			2 95E+06		4 87E+08	7 20E+08
	130-132	2 70E+07	1 48E+07	1 89E+07	2 70E+06	4 05E+06					4 05E+06		4 15E+08	6 26E+08
	80-82	1 97E+07	1 23E+07	1 11E+07	2 46E+06	1 23E+06	1 23E+06				1 23E+06		3 94E+08	5 73E+08
	325-327	8 74E+06	3 04E+06	5 70E+06	3 80E+05	7 60E+05	3 80E+05	3 80E+05			1 14E+06		1 22E+08	1 81E+08
	246-248	7 41E+06	1 11E+07	9 88E+06	6 17E+05	1 23E+06							2 08E+08	2 96E+08
	50-52	1 17E+07	1 86E+07	1 57E+07	9 78E+05	1 96E+06					1 96E+06		2 71E+08	4 33E+08
	226-228	9 63E+06	1 19E+07	7 93E+06	1 13E+06	1 13E+06					3 40E+06		1 63E+08	2 72E+08
	345-347	2 59E+07	4 21E+07	2 59E+07		3 24E+06		2 16E+06			2 16E+06		3 72E+08	5 15E+08
	729-731	2 55E+07	4 51E+07	1 47E+07	3 92E+06	1 96E+06				1 96E+06	1 96E+06		3 40E+08	4 74E+08
	20-22	1 15E+07	3 46E+07	1 24E+07		2 47E+06					4 95E+06		2 48E+08	3 52E+08
	40-42	5 39E+06	1 92E+07	6 59E+06		1 80E+06		5 99E+05			3 00E+06		1 71E+08	2 59E+08
	266-268	1 08E+07	2 03E+07	1 63E+07		5 42E+06		1 35E+06			3 39E+06		2 33E+08	3 33E+08
	70-72	2 48E+07	2 20E+07			5 51E+06					5 51E+06		4 18E+08	6 28E+08
	196-198	9 84E+06	3 44E+07	1 48E+07		1 97E+06							3 36E+08	4 68E+08
	759-761	1 05E+07	1 77E+07	1 18E+07	1 97E+06	2 63E+06					3 28E+06	1 97E+06	2 25E+08	3 09E+08
	719-721	1 93E+07	2 81E+07	1 93E+07		4 01E+06	8 03E+05				2 41E+06		2 95E+08	3 83E+08
	803-805	5 86E+07	8 24E+07	3 69E+07	6 51E+06	1 95E+07							7 94E+08	1 06E+09
	769-771	1 58E+07	3 17E+07	1 69E+07	1 06E+06	2 11E+06					2 11E+06	1 06E+06	3 54E+08	5 07E+08
	467-469	1 59E+07	4 71E+06	2 12E+07	5 89E+05						5 89E+05		2 16E+08	2 83E+08
	482-484	1 47E+07	1 26E+07	4 41E+07	1 05E+06	2 10E+06							3 74E+08	5 02E+08
	10-12	1 65E+07	1 87E+07	1 12E+07							3 00E+06		2 56E+08	3 37E+08
	183-185	2 43E+07	2 69E+07	1 15E+07							5 12E+06		4 27E+08	6 05E+08
	415-417	9 96E+06	6 38E+06	9 96E+06									1 36E+08	1 85E+08
	425-427	1 25E+07	1 31E+07	1 87E+07		1 25E+06					3 12E+06		2 22E+08	2 95E+08
	5-7	1 56E+07	7 79E+06	2 45E+07							4 45E+06		3 52E+08	4 87E+08
	286-288	4 78E+06	1 12E+07	1 04E+07	5 58E+06	3 98E+06		2 39E+06			4 78E+06		2 68E+08	3 83E+08
	average	1 74E+07	2 18E+07	1 69E+07									3 11E+08	4 41E+08
Cluster 2	435-437	1 77E+07	3 43E+07	1 77E+07	1 11E+06	3 32E+06		3 32E+06			2 21E+06		4 42E+08	5 41E+08
	853-855	1 67E+07	2 93E+07	2 09E+07		2 09E+06	3 14E+06						4 12E+08	5 03E+08
	639-641	8 24E+06	1 29E+07	9 78E+06	1 54E+06	2 57E+06	5 15E+05				2 05E+06		1 97E+08	2 46E+08
	873-875	2 27E+07	6 62E+07	3 60E+07	1 89E+06	5 68E+06	1 89E+06					7 57E+06	7 25E+08	8 95E+08
	659-661	2 50E+07	2 04E+07	1 36E+07	1 14E+06	4 54E+06				4 54E+06			4 46E+08	5 44E+08
	236-238	7 11E+06	2 13E+07	1 18E+07	2 37E+06	7 11E+06		1 18E+06	1 18E+06		4 74E+06		4 21E+08	5 51E+08
	276-278	5 17E+06	2 59E+07	1 94E+07	1 29E+06	6 46E+06		5 17E+06			1 16E+07		4 32E+08	5 56E+08
	823-825	2 58E+07	3 50E+07	3 69E+07	1 11E+07	1 84E+06				1 84E+06			6 42E+08	8 83E+08
	30-32	2 68E+07	1 66E+07	1 20E+07		1 85E+06							3 40E+08	4 34E+08
	405-407	3 84E+07	3 18E+07	1 87E+07		2 20E+06				2 20E+06			4 12E+08	5 35E+08
	689-691	1 17E+07	1 46E+07	9 96E+06		5 86E+05				1 17E+06	5 86E+05		2 17E+08	2 86E+08
	813-815	2 26E+07	5 17E+07	2 26E+07	4 85E+06								5 80E+08	7 63E+08
	375-377	1 70E+07	4 66E+07	2 26E+07		5 65E+06	1 41E+06						5 36E+08	6 81E+08
	472-474	9 12E+06	1 60E+07	1 22E+07	7 60E+05	7 60E+05	1 52E+06						2 78E+08	3 65E+08
	502-504	1 63E+07	2 34E+07	1 63E+07	3 05E+06	8 13E+06	1 02E+06	1 02E+06		3 05E+06			3 87E+08	4 90E+08
	552-554	7 01E+07	4 67E+07	1 36E+07	9 73E+06	1 95E+06	1 95E+06			3 89E+06			8 33E+08	9 48E+08
	739-741	1 03E+07	1 14E+07	1 19E+07	1 63E+06	4 34E+06	5 42E+05			1 63E+06	1 08E+06		2 00E+08	2 49E+08
	60-62	9 43E+06	1 01E+07	6 74E+06							2 69E+06		2 38E+08	3 22E+08
	90-92	9 01E+06	9 01E+06	8 26E+06	1 50E+06	3 00E+06	7 51E+05				7 51E+05		2 61E+08	3 52E+08
	365-367	2 92E+07	2 58E+07	1 89E+07		3 43E+06		3 43E+06					6 44E+08	8 41E+08
	110-112	1 29E+07	3 00E+07	1 43E+07	2 86E+06	2 86E+06		4 28E+06			1 43E+06		4 70E+08	6 54E+08
	216-218	2 16E+07	2 43E+07	1 35E+07		2 70E+06					1 48E+07		4 95E+08	6 74E+08
	256-258	7 21E+06	1 08E+07	1 17E+07	9 01E+05	2 70E+06		1 80E+06	9 01E+05				3 15E+08	4 36E+08
	120-122	1 18E+07	1 01E+07	7 60E+06							8 44E+05		3 14E+08	4 09E+08
	445-447	1 49E+07	1 22E+07	9 50E+06									5 04E+08	6 60E+08
	335-337	1 39E+07	1 23E+07	1 39E+07									5 94E+08	7 59E+08
	355-357	1 19E+07	1 40E+07	1 40E+07	1 08E+06			2 16E+06					4 19E+08	5 21E+08
	629-631	1 30E+07	1 90E+07	9 98E+06	9 98E+05	9 98E+05							3 86E+08	4 79E+08
	699-701	9 09E+06	3 82E+07	2 36E+07		1 82E+06				1 09E+07			7 09E+08	8 87E+08
	492-494	1 79E+07	2 69E+07	1 12E+07			2 24E+06			2 24E+06			4 31E+08	5 42E+08
	709-711	1 93E+07	2 08E+07	2 23E+07	2 98E+06	1 49E+06				1 49E+06	1 49E+06		5 61E+08	7 16E+08
	532-534	9 15E+06	1 02E+07	2 95E+07	3 05E+06	1 02E+06				2 03E+06			3 98E+08	5 00E+08
	average	1 75E+07	2 43E+07	1 63E+07									4 45E+08	5 69E+08
Cluster 3	1015-1017	3 77E+07	8 75E+07	3 65E+07	4 86E+06	4 86E+06		3 65E+06		2 43E+06		4 86E+06	4 37E+08	5 80E+08
	1055-1057	1 21E+07	9 91E+07	5 92E+07	1 21E+06	3 62E+06							7 25E+06	4 74E+08
	1035-1037	1 20E+07	1 03E+08	2 13E+07		3 99E+06	3 99E+06						6 66E+06	5 51E+08
	1129-1131	1 58E+07	8 10E+07	1 37E+07	4 21E+06	6 31E+06	2 10E+06						1 05E+06	4 45E+08
	975-977	1 40E+07	6 14E+07	2 15E+07	1 08E+06	3 23E+06	1 08E+06						2 15E+06	4 56E+08
	843-845	1 56E+07	4 60E+07	1 47E+07		1 96E+06	1 96E+06						3 85E+08	4 63E+08
	925-927	1 80E+07	6 44E+07	1 29E+07	5 15E+06	5 15E+06		2 57E+06		1 29E+06		3 86E+06	5 28E+08	6 17E+08

Cluster	Sample (cm below top of core)	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 17	sum of marine planktic species	Sum of all statistically significant species
Cluster 3, cont'd	893-895	3 58E+07	6 67E+07	2 12E+07	4 88E+06	1 30E+07				1 63E+06		8 14E+06	6 49E+08	7 70E+08
	965-967	6 07E+07	9 11E+07	2 63E+07	4 05E+06	6 07E+06	4 05E+06	2 02E+06					8 05E+08	9 73E+08
	945-947	1 41E+07	8 06E+07	3 33E+07	2 56E+06	1 28E+06						1 02E+07	4 99E+08	6 09E+08
	995-997	1 60E+07	5 91E+07	1 80E+07	3 01E+06	2 00E+06						4 01E+06	3 88E+08	4 78E+08
	923-925	9 84E+06	4 01E+07	6 81E+06		1 51E+06		1 51E+06				2 27E+06	2 82E+08	3 72E+08
	315-317	1 27E+07	5 62E+07	3 37E+07	5 62E+06	9 84E+06							5 65E+08	6 96E+08
	average	2 11E+07	7 20E+07	2 45E+07									4 97E+08	5 99E+08
Cluster 4	649-651	2 74E+07	5 29E+07	2 16E+07		5 88E+06							8 92E+08	9 64E+08
	1045-1047	1 26E+07	5 02E+07	2 15E+07		3 59E+06						7 18E+06	8 25E+08	8 81E+08
	512-514	3 66E+07	6 40E+07	1 83E+07		3 05E+06				1 22E+07			1 44E+09	1 53E+09
	582-584	1 16E+07	1 47E+07	3 09E+06		1 54E+06				1 54E+06			3 17E+08	3 69E+08
	669-671	3 60E+07	3 60E+07	1 44E+07	4 81E+06	2 40E+06		2 40E+06			2 40E+06		1 03E+09	1 16E+09
	395-397	2 25E+07	3 46E+07	3 11E+07	6 91E+06	6 91E+06					1 73E+06		7 66E+08	8 66E+08
	985-987	2 32E+07	5 16E+07	3 87E+07	5 16E+06							5 16E+06	1 08E+09	1 23E+09
	305-307	8 14E+07	4 28E+07	2 65E+07	4 07E+06		2 04E+06				4 07E+06		9 49E+08	1 02E+09
	833-835	4 52E+07	4 68E+07	1 34E+07		1 67E+06							7 61E+08	8 43E+08
	935-937	2 64E+07	5 94E+07	2 14E+07		1 65E+06		1 65E+06					4 95E+06	7 40E+08
	1119-1121	4 09E+07	7 62E+07	2 04E+07	1 86E+06	3 72E+06				1 86E+06			5 57E+06	8 53E+08
	1089-1091	1 42E+07	5 22E+07	2 37E+07		1 26E+07			1 58E+06				6 32E+06	6 77E+08
	522-524	7 23E+06	2 17E+07	1 36E+07	5 42E+06	1 81E+06				2 71E+06			3 28E+08	4 17E+08
	913-915	3 30E+07	3 81E+07	7 62E+06		1 27E+06						3 81E+06	5 28E+08	6 16E+08
	592-594	4 78E+07	6 44E+07	3 11E+07		2 08E+06							8 91E+08	1 01E+09
	612-614	2 25E+07	4 51E+07	1 80E+07			1 50E+06			1 50E+06			6 18E+08	7 14E+08
	562-564	1 89E+07	4 72E+07	1 21E+07		1 35E+06				2 70E+06			5 79E+08	6 58E+08
	679-681	6 88E+06	3 21E+07	8 02E+06	1 15E+06		1 15E+06			1 15E+06	1 15E+06		4 71E+08	5 51E+08
	749-751	1 05E+07	2 63E+07	1 97E+07	1 31E+06	1 31E+06				2 63E+06	1 31E+06		5 30E+08	6 37E+08
	385-387	1 37E+07	1 51E+07	2 06E+07	5 48E+06	5 48E+06							5 71E+08	6 62E+08
	602-604	9 27E+06	9 27E+06	1 11E+07		9 27E+05				9 27E+05			3 74E+08	4 49E+08
	206-208	2 05E+07	1 71E+07	2 05E+07		5 69E+06							4 55E+08	5 53E+08
	619-621	2 13E+07	1 75E+07	1 45E+07		1 94E+06							4 03E+08	4 77E+08
	1149-1151	1 40E+07	6 86E+07	2 96E+07	7 79E+06	6 23E+06				1 25E+07	4 67E+06	1 71E+07	6 75E+08	7 62E+08
	1209-1211	1 14E+07	6 06E+07	1 60E+07	3 43E+06		2 29E+06			8 01E+06	3 43E+06	5 72E+06	5 01E+08	5 57E+08
	1139-1141	2 05E+07	5 67E+07	1 69E+07	4 83E+06		1 09E+07		1 21E+06	3 62E+06		7 24E+06	5 36E+08	5 97E+08
	1169-1171	1 46E+07	4 60E+07	2 51E+07	1 26E+07	2 09E+06	1 05E+06				5 23E+06	7 32E+06	4 63E+08	4 99E+08
	1189-1191	8 66E+06	7 92E+07	1 48E+07	4 95E+06	1 24E+06	1 24E+06			6 18E+06	7 42E+06	4 95E+06	5 55E+08	6 06E+08
	883-885	1 49E+07	4 59E+07	1 76E+07	2 70E+06	2 70E+06		1 35E+06				1 22E+07	5 48E+08	6 40E+08
	1005-1007	1 87E+07	3 88E+07	2 28E+07	1 34E+06	4 02E+06	1 34E+06	2 68E+06		1 34E+06		1 21E+07	5 46E+08	6 40E+08
	1109-1111	9 31E+06	3 41E+07	1 55E+07	1 03E+06	8 28E+06	1 03E+06			1 03E+06		2 07E+06	4 17E+08	5 16E+08
	783-785	3 86E+07	8 30E+07	1 54E+07		2 12E+07							8 23E+08	9 50E+08
	863-865	3 36E+07	6 89E+07	1 92E+07		4 80E+06							6 63E+08	7 78E+08
	1079-1081	1 91E+07	3 14E+07	1 91E+07		1 91E+06		9 53E+05				2 86E+06	4 19E+08	4 64E+08
	1179-1181	3 85E+07	6 24E+07	4 04E+07	3 67E+06		1 83E+06			3 67E+06	1 83E+06	2 02E+07	8 22E+08	8 99E+08
	955-957	2 18E+07	4 76E+07	1 90E+07	2 72E+06			2 72E+06					4 08E+06	5 77E+08
	1025-1027	1 74E+07	3 59E+07	2 20E+07		2 32E+06							5 79E+06	4 70E+08
	average	2 35E+07	4 53E+07	1 96E+07									6 51E+08	7 35E+08

APPENDIX I

Relative Abundance of Statistically Significant Diatom Taxa In Each Zone

Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Zone	Sample (cm below top of core)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes</i> sp 2	<i>Achnanthisidium minutissimum</i>	<i>Amphora acutiuscula</i>	<i>Amphora cf. helensis</i>	<i>Bacillaria paxillifer</i>	<i>Brachysira brebissoni</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella littoralis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>	<i>Encyonema nitescens</i>	<i>Eunota</i> sp 2	<i>Eunota</i> sp 5	<i>Eunota</i> sp 7	<i>Eunota</i> sp 10	<i>Maryana atomus</i>	<i>Maryana marryi</i>	<i>Maryana cf. schubertii</i>
Zone 1	5-7							0 002		0 013	0 220									0 002		
	10-12									0 004	0 203	0 002				0 002						
	20-22		0 002	0 007						0 009	0 227	0 005									0 002	
	30-32		0 002					0 008			0 148	0 004					0 010		0 002			
	40-42				0 009					0 004	0 275						0 004			0 004	0 007	0 002
	50-52							0 002		0 002	0 329	0 002										
	60-62							0 002	0 002		0 201	0 006					0 002			0 002	0 016	0 004
	70-72		0 004	0 004	0 004						0 258	0 002					0 002	0 002		0 021		
	80-82		0 002							0 002	0 269						0 002	0 002		0 006	0 004	
	90-92			0 008				0 002		0 004	0 195	0 002					0 002			0 008	0 004	0 012
	100-102								0 002	0 002	0 272	0 012					0 004			0 010		
	110-112		0 004						0 002	0 006	0 229	0 004					0 002		0 002		0 004	
	120-122		0 004								0 183	0 002				0 002		0 004	0 012		0 004	
	130-132		0 004	0 004	0 002					0 002	0 269	0 002				0 002				0 008		
	183-185		0 004	0 008							0 225						0 002			0 004	0 008	
	196-198					0 002		0 002	0 004	0 006	0 173	0 014				0 004	0 006		0 006		0 008	
	206-208				0 010		0 004	0 002		0 004	0 106	0 002						0 002		0 006	0 008	
	216-218		0 002							0 004	0 209						0 008			0 006	0 018	
	226-228		0 002	0 008	0 004					0 002	0 333					0 002	0 002		0 002	0 008		
	236-238		0 006	0 004					0 002	0 004	0 171				0 004		0 002	0 002	0 002			
	246-248		0 010	0 002	0 004					0 010	0 241	0 006					0 002	0 002	0 004	0 004		
	256-258								0 002		0 224	0 004				0 012	0 004	0 002		0 008		
	266-268		0 006	0 004	0 006					0 006	0 241	0 002					0 002				0 008	
	276-278				0 002					0 004	0 157	0 009					0 007	0 002		0 007		
	286-288			0 008							0 222				0 002		0 006	0 002		0 010	0 024	
	303-307			0 004				0 002			0 035				0 002		0 004	0 004	0 002			
	315-317				0 002			0 002		0 004	0 130	0 002					0 002		0 002	0 004	0 002	
	325-327		0 002							0 004	0 269	0 006			0 002		0 004		0 004	0 006		
	335-337		0 002							0 004	0 181	0 006			0 004	0 002	0 002					
	345-347		0 002		0 006			0 002		0 002	0 211	0 010					0 002	0 004		0 004	0 006	
	355-357			0 004							0 148	0 014			0 002			0 004				
	365-367			0 002							0 199						0 002					
	375-377		0 004	0 012	0 002						0 148				0 006		0 004			0 004		
	385-387			0 008						0 004	0 108						0 002					
	395-397		0 002		0 002						0 081						0 006			0 008	0 002	
	405-407		0 008	0 010				0 002		0 004	0 153	0 006					0 002		0 004	0 004	0 004	
	415-417		0 004	0 008						0 012	0 206			0 002			0 002			0 002		
	425-427		0 002	0 004	0 002						0 197				0 008				0 004	0 004	0 004	
	435-437			0 004						0 004	0 133	0 002					0 002		0 006			
	445-447									0 008	0 200				0 010		0 002	0 002				
	467-469		0 002	0 002					0 002	0 008	0 157						0 006		0 002		0 004	
	472-474		0 008						0 002	0 004	0 155						0 006			0 004	0 016	
	482-484		0 002	0 008						0 004	0 180	0 002			0 002		0 002	0 002		0 002		
	492-494		0 004		0 008					0 006	0 159	0 002								0 002		
	502-504			0 008	0 002				0 002	0 008	0 122	0 002		0 004	0 008		0 010	0 002		0 006	0 006	0 002
	average										0 195											
Zone 2	512-514		0 008	0 004	0 002					0 004	0 028											
	522-524		0 004	0 004						0 002	0 137	0 002		0 004	0 006			0 002		0 002		
	532-534		0 004	0 008	0 004						0 158	0 004				0 002			0 002	0 002		
	552-554										0 102	0 004									0 004	
	562-564			0 008				0 002		0 002	0 083		0 002				0 002		0 004			
	582-584		0 004	0 008			0 004				0 077							0 002			0 016	
	592-594				0 002						0 078						0 002		0 002	0 002	0 006	
	602-604		0 002								0 120	0 004						0 004	0 008	0 002	0 004	0 002
	612-614									0 004	0 085						0 004	0 004			0 006	
	619-621		0 002		0 002				0 002	0 004	0 107									0 004	0 004	
	629-631		0 004	0 008						0 006	0 139	0 002					0 006			0 004	0 004	
	639-641				0 004		0 004		0 002	0 002	0 121						0 004	0 004	0 002		0 006	
	649-651									0 002	0 049										0 006	
	659-661									0 008	0 107	0 008								0 010		
	669-671		0 002	0 008						0 002	0 064	0 006				0 004				0 002	0 010	
	679-681				0 004			0 004			0 090	0 010			0 004					0 004		
	average										0 097											
Zone 3	689-691		0 006		0 004				0 004		0 146	0 006						0 002	0 002	0 004	0 016	
	699-701			0 008	0 002					0 004	0 133	0 002		0 008				0 002			0 002	
	709-711			0 008				0 002		0 010	0 159						0 002	0 002		0 004		
	719-721				0 002			0 002			0 171	0 002									0 002	
	729-731			0 008	0 002						0 202	0 010					0 002	0 002	0 002	0 004	0 004	
	739-741			0 004						0 006	0 133			0 010			0 004			0 010		
	749-751		0 004	0 008						0 002	0 098	0 004		0 008						0 006	0 004	
	759-761		0 004	0 020	0 004					0 006	0 156		0 002				0 002	0 002	0 004			
	769-771				0 004			0 006	0 004	0 020	0 157	0 008	0 052				0 002		0 010	0 002	0 004	
	783-785							0 002		0 006	0 095	0 004					0 002		0 002		0 004	

Zone	Sample (cm below top of core)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes sp. 2</i>	<i>Achnanthes minutissimum</i>	<i>Amphora acutiuscula</i>	<i>Amphora cf. helensis</i>	<i>Bacillaria paxillifer</i>	<i>Brachyera brevissonii</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litoralis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>	<i>Encyonema silesiacum</i>	<i>Eunotia sp. 2</i>	<i>Eunotia sp. 5</i>	<i>Eunotia sp. 7</i>	<i>Eunotia sp. 10</i>	<i>Maryana atomus</i>	<i>Maryana meryi</i>	<i>Maryana cf. schultzei</i>
Zone 3, cont'd	803-805 average				0.002			0.004	0.004	0.004	0.146	0.006	0.004			0.002				0.004	0.020	
	813-815		0.004	0.008				0.002	0.004	0.004	0.160	0.002		0.004				0.002		0.004		0.002
	823-825	0.002	0.004	0.012	0.002				0.002	0.004	0.167	0.006			0.006		0.006	0.002	0.004		0.006	
	833-835	0.004		0.008	0.002						0.055							0.002			0.010	
	843-845		0.004	0.008				0.004	0.002		0.111	0.008										
	853-855	0.002		0.004	0.002					0.002	0.119						0.008	0.006			0.004	
	863-865	0.002	0.002	0.004	0.002					0.008	0.083	0.002			0.004		0.002	0.004			0.004	
	873-875	0.002		0.008	0.002				0.002		0.110	0.002			0.008			0.002		0.008	0.004	
	883-885	0.002		0.008		0.010		0.002			0.053	0.008		0.002				0.002	0.004		0.008	
	893-895	0.002		0.004	0.002		0.004			0.012	0.096			0.002			0.004		0.004	0.002	0.004	
	913-915	0.004			0.002						0.087									0.002	0.004	
	923-925			0.016	0.004			0.002	0.002	0.018	0.147	0.002			0.004			0.014			0.008	
	925-927				0.002			0.002	0.002	0.010	0.088			0.012				0.002				
Zone 4	935-937			0.008						0.004	0.042	0.006										
	945-947	0.004		0.004				0.002	0.002	0.012	0.099	0.002			0.008						0.006	
	955-957	0.002								0.008	0.062	0.004								0.004	0.002	
	965-967		0.004		0.002				0.006	0.012	0.081						0.010					
	975-977	0.010									0.048	0.004					0.006				0.004	
	985-987	0.002			0.002	0.002				0.010	0.059							0.002	0.004	0.002	0.004	0.002
	995-997	0.002			0.002		0.004			0.014	0.095		0.002				0.002		0.004	0.004	0.006	
	1005-1007	0.004		0.008					0.002	0.008	0.072	0.002							0.004			
	1015-1017	0.004			0.002				0.004	0.036	0.139	0.006									0.008	
	1025-1027	0.006	0.002		0.006			0.006	0.002	0.014	0.075						0.008		0.002	0.002		
	1035-1037	0.012	0.002	0.008				0.012			0.057							0.002			0.006	
	1045-1047									0.010	0.032	0.002			0.004					0.002		
	1055-1057			0.004	0.006			0.004		0.008	0.047	0.002			0.014			0.004		0.006	0.008	0.002
	average										0.087											
	1079-1081	0.006		0.004	0.002	0.002				0.006	0.050	0.006								0.002	0.004	
	1089-1091	0.004		0.004	0.004			0.004		0.002	0.047	0.022									0.004	
	1109-1111			0.004	0.002					0.037	0.078		0.008	0.037	0.006						0.004	
	1119-1121						0.004			0.004	0.018		0.002		0.004					0.002	0.008	
	1129-1131	0.002			0.004			0.002		0.008	0.051								0.002	0.008		
Zone 5	1139-1141			0.004			0.008	0.002		0.014	0.046	0.002							0.006		0.004	
	1149-1151	0.004				0.002			0.002	0.004	0.052	0.008					0.004			0.002	0.004	
	1169-1171									0.002	0.036	0.004						0.004	0.002			
	1179-1181	0.002			0.002			0.002		0.004	0.048						0.002	0.004		0.002		
	1189-1191	0.006					0.004	0.002	0.002	0.008	0.020	0.012			0.008		0.002					
	1209-1211	0.002							0.008	0.006	0.060	0.002					0.004		0.002	0.004	0.004	
	average										0.046											

APPENDIX I. Relative abundance of statistically significant diatom taxa in each zone
Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Marine Planktic Diatom Taxa

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Zone	Sample (cm below top of core)	<i>Navicula perminuta</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia hebertuthi</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia</i> sp 7	<i>Paralia sulcata</i>	<i>Planolithidium delicatulum</i>	<i>Planolithidium cf. engelbrechii</i>	<i>Stauroneis pinnata</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tubulata</i>	sum of non-planktic species	<i>Actinopychus senarius</i>	<i>Actinopychus wilgarsi</i>	<i>Actinopychus</i> sp 1	<i>Aulacoseira islandica</i>	<i>Coscinodiscus radiatus</i>	<i>Coscinodiscus</i> sp 1	
Zone 1	5-7	0 004	0 002	0 004	0 004			0 009	0 002		0 007			0 272							
	10-12		0 002	0 004	0 002			0 011			0 002			0 234					0 009		
	20-22		0 005	0 005	0 009			0 011	0 002		0 005			0 288				0 002	0 002		
	30-32		0 008		0 004			0 008			0 004		0 008	0 207					0 002		
	40-42	0 004	0 004	0 002				0 007						0 324		0 002			0 004		
	50-52		0 004	0 004	0 004			0 009	0 002					0 359	0 009				0 006		
	60-62	0 002		0 004	0 004			0 002	0 002	0 004				0 255			0 004		0 002		
	70-72		0 004	0 006	0 006			0 004	0 002		0 006			0 328			0 026		0 004		
	80-82		0 002	0 004				0 006		0 002			0 002	0 305							
	90-92			0 002		0 002		0 004		0 004				0 251		0 002		0 002			
	100-102		0 002	0 002	0 004			0 002	0 002	0 004				0 318		0 004					
	110-112		0 002	0 004	0 004				0 002	0 004				0 002	0 273	0 002					
	120-122			0 002	0 002				0 004	0 004					0 228					0 002	
	130-132	0 006	0 002	0 006	0 008			0 008			0 004			0 328					0 002		
	183-185				0 014				0 010				0 010	0 287							
	196-198	0 006	0 006	0 010	0 004			0 002						0 014	0 266	0 002				0 008	
	206-208	0 004	0 004	0 004				0 004	0 002			0 004	0 006	0 173			0 002			0 004	
	216-218			0 004	0 004			0 004					0 002	0 260							
	226-228	0 004		0 004	0 008			0 002	0 004		0 002			0 388	0 002						
	236-238	0 002	0 002	0 002	0 012			0 006	0 002					0 224	0 004					0 002	
	246-248				0 002									0 287							
	256-258			0 002	0 008									0 002	0 269					0 002	
	266-268		0 006	0 006					0 002	0 002			0 002	0 292		0 002	0 002			0 006	
	276-278		0 002	0 002	0 009			0 007		0 002	0 002			0 002	0 215	0 002					
	286-288		0 002		0 006			0 004	0 002					0 004	0 292						
	305-307		0 004	0 004	0 004									0 002	0 067						
	315-317	0 004	0 004	0 010	0 006			0 002		0 004	0 002			0 002	0 184	0 002				0 006	
	325-327	0 002						0 002						0 010	0 312	0 002		0 002			
	335-337	0 012													0 213						
	345-347		0 002	0 002	0 010			0 002						0 002	0 268						
	355-357	0 004			0 004			0 006					0 004		0 191	0 004				0 002	
	365-367		0 006	0 002	0 008			0 004	0 004	0 002				0 002	0 231					0 002	
	375-377	0 002		0 008	0 006			0 002			0 002	0 002		0 006	0 209						
	385-387			0 002	0 002			0 002	0 002					0 004	0 134					0 002	
	395-397				0 004			0 004	0 006						0 114					0 004	0 002
405-407	0 004	0 004	0 010	0 002			0 004	0 002		0 002				0 225					0 002		
415-417	0 004		0 004	0 002						0 002			0 004	0 253	0 002						
425-427	0 002	0 002	0 002				0 002	0 002					0 002	0 238	0 006	0 002					
435-437	0 002	0 004	0 010	0 004			0 006						0 004	0 181	0 002						
445-447				0 006			0 002						0 002	0 232							
467-469		0 010	0 020	0 004			0 004	0 002				0 002	0 006	0 231					0 002		
472-474	0 002	0 004	0 008	0 006			0 010	0 004					0 004	0 234					0 002		
482-484		0 010	0 010	0 014			0 004	0 002					0 002	0 247					0 002		
492-494	0 004		0 004	0 004			0 002	0 002					0 004	0 202	0 004				0 002		
502-504		0 002	0 006	0 006			0 004						0 004	0 205					0 002		
average														0 247							
Zone 2	512-514	0 002		0 004	0 004								0 002	0 058							
	522-524	0 004	0 006	0 015	0 008			0 002		0 002			0 002	0 203	0 002				0 002		
	532-534	0 004		0 004	0 004			0 004					0 002	0 202					0 002		
	552-554				0 004								0 004	0 118	0 002				0 002		
	562-564			0 004	0 004			0 002					0 002	0 114					0 002		
	582-584			0 008	0 002			0 004		0 002			0 008	0 136	0 002						
	592-594		0 004	0 004				0 002	0 002				0 008	0 112			0 002	0 004			
	602-604			0 004				0 004		0 002			0 006	0 162	0 002			0 004			
	612-614	0 002	0 002	0 010				0 002	0 002	0 002	0 002		0 004	0 129				0 002			
	619-621		0 004	0 006	0 004			0 002	0 004	0 002	0 004		0 002	0 152	0 002						
	629-631				0 002		0 002		0 002				0 006	0 185					0 002		
	639-641			0 004	0 004			0 006		0 004	0 002		0 022	0 192	0 006				0 002		
	649-651			0 006	0 004			0 002					0 004	0 073	0 002				0 002		
	659-661		0 008	0 004	0 004	0 004		0 002	0 002		0 002		0 006	0 170			0 006				
	669-671	0 002		0 002							0 010			0 112					0 006		
	679-681	0 002		0 008	0 006			0 002					0 006	0 139							
	average													0 141							
	Zone 3	689-691	0 006			0 008			0 006		0 006	0 010		0 010	0 236	0 002				0 002	
699-701		0 002		0 002		0 004			0 002	0 010	0 006	0 002	0 006	0 195					0 002		
709-711		0 002	0 004			0 002		0 004	0 002				0 008	0 210						0 002	
719-721		0 006	0 008	0 002	0 004		0 012	0 004			0 002		0 006	0 224					0 004		
729-731			0 006	0 012			0 002	0 002	0 002		0 002		0 010	0 271					0 002	0 004	
739-741		0 002	0 002	0 002				0 002			0 004		0 006	0 186					0 002		
749-751			0 002					0 008	0 002	0 006			0 004	0 162					0 002		
759-761		0 002	0 012	0 014				0 006		0 004	0 002		0 016	0 257	0 002				0 002	0 008	
769-771		0 002		0 004	0 002	0 002		0 004					0 008	0 292	0 002					0 002	
783-785	0 002	0 004		0 002			0 002			0 002		0 004	0 131								

Zone	Sample (cm below top of core)	<i>Navicula perminuta</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia lebertrithu</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia</i> sp 7	<i>Porosira sulcata</i>	<i>Planolothidium delicatulum</i>	<i>Planolothidium cf. engelbrechtii</i>	<i>Stauroneis pinnata</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	sum of non-planktic species	<i>Actinocyclus senarius</i>	<i>Actinocyclus vulgaris</i>	<i>Actinocyclus</i> sp 1	<i>Aulacoseira islandica</i>	<i>Coscinodiscus radiatus</i>	<i>Cocconeodiscus</i> sp 1
Zone 3, cont'd	803-805 average	0 002	0 008	0 004	0 006			0 002		0 004	0 002		0 014	0 244 0 219			0 002		0 004	
	813-815			0 004				0 006		0 002	0 004		0 016	0 229	0 002			0 004	0 004	0 002
	823-825		0 004	0 006	0 004			0 004	0 004				0 020	0 267				0 008	0 006	
	833-835	0 002			0 004			0 004					0 006	0 096				0 004		
	843-845							0 006	0 004				0 016	0 165		0 002		0 008	0 002	
	853-855			0 008				0 006	0 002				0 012	0 176					0 006	
	863-865							0 010	0 002				0 016	0 146		0 004				
	873-875		0 008	0 008	0 014			0 002					0 002	0 183				0 008	0 002	
	883-885				0 008			0 006		0 002			0 022	0 138	0 002			0 002	0 004	
	893-895		0 002					0 002	0 002				0 008	0 151		0 008			0 002	
	913-915	0 006							0 002	0 008			0 024	0 139					0 008	
	923-925	0 002			0 002				0 002	0 004			0 010	0 236					0 002	
	925-927		0 004					0 002					0 014	0 137				0 002	0 002	
	935-937			0 004	0 002			0 006					0 010	0 082		0 004		0 004		
	945-947	0 002	0 004		0 004			0 006	0 002				0 016	0 174				0 002		
	955-957			0 004				0 008			0 004		0 014	0 113		0 004				
	965-967	0 004		0 020	0 010			0 002	0 002				0 014	0 168				0 004		
	975-977	0 002	0 004	0 008	0 010	0 006		0 002	0 002				0 008	0 114	0 004			0 010		
	985-987			0 004	0 010			0 006					0 008	0 118				0 004	0 002	
	995-997	0 010		0 004				0 002	0 006				0 024	0 181		0 002		0 006		
	1005-1007		0 012		0 014			0 006			0 002		0 006	0 141						
	1015-1017	0 004		0 008	0 006			0 002	0 004	0 002	0 002		0 008	0 236				0 004		
	1025-1027		0 002	0 004	0 004	0 006		0 002	0 002		0 002		0 008	0 154						
	1035-1037		0 004	0 004	0 004			0 008					0 008	0 128					0 002	
	1045-1047			0 002				0 002				0 002	0 006	0 062				0 002		
	1055-1057 average	0 004	0 002	0 006		0 006	0 004	0 006	0 004		0 008		0 018	0 165 0 153				0 002		
	1079-1081	0 006	0 004										0 002	0 094	0 002			0 002		
	1089-1091	0 004		0 004					0 002				0 002	0 103						
	1109-1111									0 006			0 006	0 188				0 004	0 002	
	1119-1121	0 002	0 002		0 004			0 002		0 004	0 002		0 004	0 062				0 008	0 002	
	1129-1131	0 006	0 002		0 006			0 002			0 004		0 016	0 113				0 002		
	1139-1141	0 004						0 002		0 004			0 006	0 101				0 004		
	1149-1151	0 002		0 012				0 002	0 002	0 008			0 004	0 111	0 002			0 002		
	1169-1171	0 002		0 012		0 004							0 004	0 071						
	1179-1181	0 002				0 008							0 008	0 083	0 002				0 002	
	1189-1191	0 010				0 004		0 002			0 002			0 081				0 006		
	1209-1211 average									0 002			0 004	0 098 0 100	0 010			0 002	0 002	

Statistically Significant Marine Planktic Diatom Taxa

Zone	Sample (cm below top of core)	<i>Fragilaropsis cylindriciformis</i>	<i>Fragilaropsis cylindrus</i>	<i>Fragilaropsis pseudonana</i>	<i>Melosira arenita</i>	<i>Melosira numellouides</i>	<i>Skeletonema costatum</i>	<i>Thalassionema nitzschoides</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>	<i>Thalassiosira hyalina</i>	<i>Thalassiosira leptopus</i>	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11
Zone 1	5-7	0 002		0 016			0 566		0 007	0 007			0 002	0 031	0 016	0 049						
	10-12	0 015	0 011				0 537	0 011	0 013	0 002				0 048	0 054	0 032						
	20-22	0 014	0 005	0 002			0 453	0 011	0 007	0 005			0 005	0 032	0 096	0 034		0 007				
	30-32	0 002		0 002			0 583	0 020	0 004	0 006			0 002	0 059	0 037	0 026		0 004				
	40-42	0 011	0 002				0 455	0 007	0 016				0 002	0 020	0 071	0 024		0 007			0 002	
	50-52	0 002	0 002	0 004			0 405	0 009	0 035	0 004			0 011	0 026	0 041	0 035	0 002	0 004				
	60-62		0 010	0 002			0 610		0 004	0 004			0 002	0 029	0 031	0 021						
	70-72		0 045	0 006			0 433	0 019	0 024				0 002	0 039	0 034			0 009				
	80-82	0 002		0 002			0 557	0 006	0 015	0 006				0 034	0 021	0 019	0 004	0 002	0 002			
	90-92	0 004					0 606	0 004	0 010	0 002				0 025	0 025	0 023	0 004	0 008	0 002			
	100-102	0 012	0 006	0 004			0 489	0 006	0 016	0 006				0 050	0 020	0 036	0 006	0 002			0 002	
	110-112	0 002	0 015				0 572	0 002	0 002					0 019	0 044	0 021	0 004	0 004			0 006	
	120-122		0 004				0 654	0 004	0 014	0 006				0 029	0 024	0 018						
	130-132	0 008	0 004	0 006	0 002		0 495		0 017				0 002	0 042	0 023	0 029	0 004	0 006				
	183-185	0 012	0 002			0 008	0 542	0 004	0 006				0 004	0 039	0 043	0 019						
	196-198	0 010		0 002	0 002		0 515	0 010	0 002	0 004		0 002		0 020	0 070	0 030		0 004				
	206-208	0 008		0 004			0 649	0 014		0 004			0 006	0 036	0 030	0 036		0 010				
	216-218		0 008				0 583	0 006		0 008	0 002			0 031	0 035	0 020		0 004				
	226-228	0 010	0 004	0 004			0 418	0 006		0 006	0 002		0 004	0 034	0 042	0 028	0 004	0 004				
	236-238	0 004	0 004	0 002			0 584	0 014	0 008	0 004				0 012	0 037	0 020	0 004	0 012			0 002	0 002
	246-248	0 002	0 002	0 002			0 536	0 024	0 004	0 012				0 024	0 036	0 032	0 002	0 004				
	256-258		0 004				0 601	0 008	0 006					0 016	0 024	0 026	0 002	0 006		0 004	0 002	
	266-268	0 012	0 004	0 002	0 002		0 465	0 010	0 002	0 004				0 032	0 059	0 047		0 016		0 004		
	276-278	0 013			0 004	0 004	0 552	0 004	0 031	0 007				0 009	0 045	0 034	0 002	0 011		0 009		
	286-288	0 008	0 026				0 516	0 010	0 008					0 012	0 028	0 026	0 014	0 010		0 006		
	305-307			0 002			0 751	0 004		0 002				0 078	0 041	0 025	0 004		0 002			
	315-317	0 002					0 549	0 055	0 002	0 008			0 002	0 002	0 018	0 079	0 047	0 008	0 014			
	325-327	0 002	0 002		0 002		0 531	0 002	0 002	0 002				0 047	0 016	0 031	0 002	0 004	0 002	0 002		
	335-337	0 004					0 689	0 002	0 008	0 004			0 002	0 002	0 018	0 016	0 018				0 002	
	345-347	0 002	0 012				0 480	0 008	0 006	0 002				0 049	0 079	0 049		0 006		0 004		
	355-357	0 008		0 002	0 002	0 004	0 657	0 002	0 010	0 008			0 002	0 006	0 022	0 026	0 026	0 002			0 004	
	365-367	0 004				0 004	0 634	0 002	0 010	0 004				0 034	0 030	0 022		0 004		0 004		
	375-377	0 002				0 004	0 598	0 002	0 020	0 004			0 004	0 024	0 067	0 032		0 008		0 002		
	385-387	0 004	0 002				0 708	0 008	0 016	0 010			0 006	0 020	0 022	0 030	0 008	0 008				
	395-397			0 002	0 002		0 720	0 012	0 010	0 004				0 026	0 039	0 036	0 008	0 008				
	405-407						0 569	0 002	0 006	0 004				0 070	0 058	0 034		0 004				0 004
	415-417			0 002	0 002		0 541	0 008	0 004	0 008				0 051	0 033	0 051						
	425-427	0 002	0 002	0 002	0 002		0 535	0 004	0 004	0 002			0 002	0 041	0 043	0 061		0 004				0 010
	435-437	0 006		0 002			0 629	0 008	0 006	0 004				0 032	0 062	0 032	0 002	0 006		0 006		0 004
	445-447	0 004		0 006	0 002		0 667		0 008	0 002			0 004	0 022	0 018	0 014						
	467-469	0 002					0 561	0 008	0 016					0 054	0 016	0 072	0 002					0 002
	472-474	0 002	0 002	0 004			0 601	0 004	0 010	0 008		0 002		0 024	0 043	0 033	0 002	0 002		0 004		
	482-484	0 004	0 008				0 530	0 016	0 006	0 008			0 002	0 028	0 024	0 085	0 002	0 004				
	492-494	0 004	0 002				0 627	0 020	0 006	0 006			0 002	0 033	0 049	0 020			0 004		0 004	
	502-504	0 002		0 002	0 002		0 585	0 010	0 010	0 006			0 010	0 033	0 047	0 033	0 006	0 016	0 002	0 002		0 006
	average						0 568							0 033	0 040	0 033						
Zone 2	512-514	0 004					0 839	0 002	0 004	0 002			0 002	0 024	0 042	0 012		0 002				0 008
	522-524	0 006		0 002			0 587	0 019	0 008	0 006				0 017	0 050	0 031	0 012	0 004				0 006
	532-534		0 002	0 002	0 004		0 644	0 010	0 008	0 010				0 018	0 020	0 059	0 006	0 002				0 004
	552-554	0 002		0 002			0 693						0 002	0 072	0 048	0 014	0 010	0 002	0 002			0 004
	562-564						0 712	0 006		0 002			0 006	0 028	0 069	0 018		0 002				0 004
	582-584						0 737	0 002	0 006	0 002			0 002	0 031	0 039	0 008		0 004				0 004
	592-594			0 002			0 693	0 004		0 006		0 006	0 002	0 046	0 062	0 030		0 002				
	602-604						0 718	0 010	0 002	0 002				0 020	0 020	0 024		0 002				0 002
	612-614		0 002				0 691	0 004	0 010	0 002				0 030	0 061	0 024			0 002			0 002
	619-621	0 002		0 002	0 002		0 677	0 018	0 002	0 004				0 044	0 036	0 030		0 004				
	629-631	0 002			0 002		0 663	0 010	0 002	0 002				0 026	0 038	0 020	0 002	0 002				
	639-641						0 606	0 002	0 006	0 002			0 002	0 032	0 051	0 038	0 006	0 010	0 002			0 008
	649-651						0 775	0 008	0 002	0 002				0 028	0 053	0 022		0 006				
	659-661						0 612	0 024	0 006	0 010				0 044	0 036	0 024	0 002	0 008				0 008
	669-671	0 002		0 004	0 002		0 755	0 002		0 006				0 030	0 030	0 012	0 004	0 002		0 002		
	679-681	0 004	0 002		0 004		0 701		0 016				0 002	0 012	0 056	0 014	0 002		0 002			0 002
	average						0 694							0 031	0 044	0 024						
Zone 3	689-691		0 004		0 004		0 574	0 006	0 012				0 004	0 040	0 050							

Zone	Sample (cm below top of core)	<i>Fragilaropsis cylindricus</i>	<i>Fragilaropsis cylindrus</i>	<i>Fragilaropsis pseudonana</i>	<i>Melosira arenii</i>	<i>Melosira numellouides</i>	<i>Skeletonema costatum</i>	<i>Thalassonema nitzschoides</i>	<i>Thalassosira decipiens</i>	<i>Thalassosira eccentrica</i>	<i>Thalassosira guillardii</i>	<i>Thalassosira hyalina</i>	<i>Thalassosira leptopus</i>	<i>Thalassosira nordenskiöldii</i>	<i>Thalassosira pacifica</i>	<i>Thalassosira tenera</i>	<i>Thalassosira</i> sp 4	<i>Thalassosira</i> sp 7	<i>Thalassosira</i> sp 8	<i>Thalassosira</i> sp 9	<i>Thalassosira</i> sp 10	<i>Thalassosira</i> sp 11
Zone 3, cont'd	803-805 average	0 002					0 529 0 566	0 002	0 002	0 004				0 054 0 035	0 076 0 058	0 034 0 033	0 006	0 018				
	813-815						0 576 0 006			0 002		0 004		0 028 0 065	0 065 0 028	0 006						
	823-825	0 006					0 544 0 004					0 016		0 029 0 039	0 041 0 012	0 002						0 002
	833-835						0 749 0 002			0 004		0 004		0 053 0 055	0 016				0 002			
	843-845						0 608 0 008	0 002					0 012 0 033	0 097 0 031				0 004	0 004			
	853-855	0 002	0 002				0 623 0 006	0 006	0 006	0 006			0 006 0 032	0 057 0 040				0 004	0 006			
	863-865	0 002	0 002				0 660 0 004	0 004				0 002		0 043 0 087	0 024			0 006				
	873-875	0 008					0 603						0 006 0 024	0 071 0 039	0 002	0 006	0 002					
	883-885	0 002					0 638 0 006	0 002	0 012	0 008			0 002 0 022	0 069 0 026	0 004	0 004				0 002		
	893-895	0 004					0 562 0 008	0 006	0 024	0 002			0 006 0 045	0 084 0 026	0 006	0 016					0 002	
	913-915						0 687 0 004	0 002	0 002				0 004 0 053	0 061 0 012		0 002						
	923-925						0 556 0 012	0 004					0 004 0 026	0 105 0 018		0 004				0 004		
	925-927	0 002		0 004			0 608 0 006	0 010	0 004	0 002	0 002		0 028 0 100	0 020 0 008	0 008				0 004		0 002	
Zone 4	935-937			0 004	0 004		0 731 0 004	0 002					0 004 0 032	0 072 0 026		0 002				0 002		
	945-947						0 543 0 004	0 010					0 006 0 022	0 128 0 053	0 004	0 002						
	955-957						0 676 0 016	0 006					0 006 0 032	0 070 0 028	0 004						0 004	
	965-967						0 586 0 004	0 008	0 002	0 004			0 002 0 061	0 091 0 026	0 004	0 006	0 004	0 002				
	975-977	0 002		0 002			0 600 0 016	0 008				0 004 0 008	0 026 0 114	0 040 0 002	0 006	0 002						
	985-987						0 726 0 002		0 002			0 014 0 002	0 018 0 041	0 030 0 004								
	995-997	0 004					0 548 0 002	0 004				0 004 0 004	0 032 0 119	0 036 0 006	0 004							
	1005-1007	0 008					0 642 0 004	0 004	0 002	0 008			0 002 0 028	0 058 0 034	0 002	0 006	0 002	0 004	0 002			
	1015-1017	0 002			0 002		0 388 0 008	0 004	0 004			0 006 0 006	0 063 0 145	0 061 0 008	0 008				0 006			0 004
	1025-1027	0 004					0 663 0 002				0 002 0 004		0 030 0 063	0 038		0 004						
	1035-1037			0 002			0 597 0 002		0 010			0 004 0 006	0 018 0 157	0 033		0 006	0 006					
	1045-1047						0 802 0 010					0 002	0 014 0 056	0 024		0 004						
	1055-1057			0 006			0 464 0 004	0 008					0 006 0 020	0 167 0 100	0 002	0 006						
	average						0 615						0 033 0 087	0 034								
	1079-1081						0 693 0 002	0 004	0 004			0 012 0 004	0 040 0 066	0 040				0 004		0 002		
	1089-1091	0 002					0 717 0 002	0 002	0 002				0 002 0 018	0 067 0 030		0 016				0 002		
	1109-1111						0 629 0 008	0 006					0 002 0 018	0 064 0 029	0 002	0 016	0 002					0 002
	1119-1121	0 004					0 726 0 002	0 008	0 008			0 002	0 044 0 082	0 022 0 002	0 004							0 002
	1129-1131		0 002				0 592 0 008	0 004	0 004				0 004 0 030	0 156 0 026	0 008	0 012	0 004					
	1139-1141			0 002			0 657 0 004	0 002	0 008				0 004 0 034	0 093 0 028	0 008			0 018		0 002	0 006	
Zone 5	1149-1151	0 002					0 632 0 008	0 004				0 004 0 002	0 018 0 087	0 038 0 010	0 008							0 016
	1169-1171	0 002	0 002	0 002			0 653 0 002	0 002			0 002 0 004	0 004 0 004	0 028 0 089	0 048 0 024	0 004	0 002						
	1179-1181						0 683 0 002	0 002	0 004			0 008	0 042 0 067	0 044 0 004		0 002						0 004
	1189-1191	0 004				0 004	0 650 0 006	0 002				0 008 0 014	0 126 0 024	0 008 0 002	0 002	0 002						0 010
	1209-1211						0 647 0 002	0 004				0 006 0 006	0 020 0 106	0 028 0 006		0 004						0 014
	average						0 662						0 028 0 091	0 032								

Zone	Sample (cm below top of core)	sum of marine planktic species		
		<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 17	
Zone 1	5-7	0.009	0.704	
	10-12	0.009	0.740	
	20-22	0.014	0.689	
	30-32		0.748	
	40-42	0.011	0.634	
	50-52	0.004	0.600	
	60-62	0.008	0.727	
	70-72	0.009	0.650	
	80-82	0.002	0.672	
	90-92	0.002	0.720	
	100-102	0.004	0.664	
	110-112	0.002	0.697	
	120-122	0.002	0.758	
	130-132	0.006	0.648	
	183-185	0.008	0.689	
	196-198		0.680	
	206-208		0.803	
	216-218	0.022	0.718	
	226-228	0.012	0.582	
Zone 2	236-238	0.008	0.724	
	246-248		0.682	
	256-258		0.701	
	266-268	0.010	0.679	
	276-278	0.020	0.749	
	286-288	0.012	0.677	
	305-307	0.004	0.914	
	315-317		0.794	
	325-327	0.006	0.657	
	335-337	0.004	0.769	
	345-347	0.004	0.701	
	355-357		0.789	
	365-367		0.755	
	375-377		0.769	
	385-387		0.846	
	395-397		0.874	
	405-407	0.002	0.755	
Zone 3	415-417		0.704	
	425-427		0.722	
	435-437		0.801	
	445-447		0.748	
	467-469		0.736	
	472-474		0.743	
	482-484		0.721	
	492-494		0.784	
	502-504		0.774	
	average		0.726	
	512-514		0.940	
	522-524		0.753	
	532-534		0.792	
	552-554		0.859	
	562-564		0.848	
	582-584		0.837	
	592-594		0.860	
	602-604		0.806	
	612-614		0.830	
Zone 4	619-621		0.822	
	629-631		0.771	
	639-641		0.774	
	649-651		0.899	
	659-661		0.778	
	669-671	0.002	0.859	
	679-681	0.002	0.819	
	average		0.828	
	689-691	0.002	0.740	
	699-701		0.777	
	709-711	0.002	0.760	
	719-721		0.746	
	729-731	0.004	0.686	
	739-741	0.004	0.753	
	749-751	0.002	0.810	
	759-761	0.006	0.694	
	769-771	0.002	0.674	
	783-785		0.844	

Zone	Sample (cm below top of core)	<i>Thalassioira</i> sp 13	<i>Thalassioira</i> sp 17	sum of marine planktonic species
Zone 3, cont'd	803-805			0.733
	average			0.747
	813-815			0.728
	823-825			0.709
	833-835			0.887
	843-845			0.812
	853-855			0.798
	863-865			0.838
	873-875	0.008		0.780
	883-885	0.018		0.825
	893-895	0.010		0.813
	913-915	0.006		0.840
	923-925	0.006		0.740
	925-927	0.006		0.817
Zone 4	935-937	0.006		0.896
	945-947	0.016		0.789
	955-957	0.006		0.853
	965-967			0.804
	975-977	0.004		0.848
	985-987	0.004		0.848
	995-997	0.008		0.780
	1005-1007	0.018		0.821
	1015-1017	0.008		0.727
	1025-1027	0.010		0.820
	1035-1037	0.010		0.843
	1045-1047	0.008		0.922
	1055-1057	0.012		0.798
	average			0.813
	1079-1081	0.006		0.882
	1089-1091	0.008		0.866
	1109-1111	0.004		0.787
	1119-1121	0.006		0.924
	1129-1131	0.002		0.855
Zone 5	1139-1141	0.012		0.881
	1149-1151	0.006	0.022	0.861
	1169-1171	0.010	0.014	0.893
	1179-1181	0.002	0.022	0.889
	1189-1191	0.012	0.008	0.884
	1209-1211	0.006	0.010	0.873
	average			0.872

APPENDIX J

Absolute Abundance of Statistically Significant Diatom Taxa in Each Zone

Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Zone	Sample (cm below top of core)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes</i> sp 2	<i>Achnantheidum minutissimum</i>	<i>Amphora acinuscula</i>	<i>Amphora cf. helensis</i>	<i>Bacillaria paxillifer</i>	<i>Brachysira brebusonii</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella luovaleis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>
Zone 1	5-7							1 11E+06		6 68E+06	1 10E+08			
	10-12									1 50E+06	7 04E+07	7 49E+05		
	20-22		8 25E+05	2 47E+06						3 30E+06	8 17E+07	1 65E+06		
	30-32		9 24E+05					3 70E+06		6 75E+07	1 85E+06			
	40-42				2 40E+06					1 20E+06	7 43E+07			
	50-52							9 78E+05		9 78E+05	1 49E+08	9 78E+05		
	60-62							6 74E+05	6 74E+05		6 60E+07	2 02E+06		
	70-72		2 76E+06	2 76E+06	2 76E+06						1 65E+08	1 38E+06		
	80-82		1 23E+06							1 23E+06	1 58E+08			
	90-92			3 00E+06				7 51E+05		1 50E+06	7 06E+07	7 51E+05		
	100-102								1 48E+06	1 48E+06	1 99E+08	8 85E+06		
	110-112			2 86E+06					1 43E+06	4 28E+06	1 54E+08	2 86E+06		
	120-122			1 69E+06							7 60E+07	8 44E+05		
	130-132		2 70E+06	2 70E+06	1 35E+06					1 35E+06	1 73E+08	1 35E+06		
	183-185		2 56E+06	5 12E+06							1 39E+08			
	196-198					9 84E+05		9 84E+05	1 97E+06	2 95E+06	8 56E+07	6 89E+06		
	206-208				5 69E+06		2 28E+06	1 14E+06		2 28E+06	6 03E+07	1 14E+06		
	216-218		1 35E+06							2 70E+06	1 44E+08			
	226-228		5 66E+05	2 27E+06	1 13E+06					5 66E+05	9 34E+07			
	236-238		3 55E+06	2 37E+06					1 18E+06	2 37E+06	9 95E+07			
	246-248		3 09E+06	6 17E+05	1 23E+06					3 09E+06	7 35E+07	1 85E+06		
	256-258								9 01E+05	1 01E+08	1 80E+06			
	266-268		2 03E+06	1 35E+06	2 03E+06					2 03E+06	8 26E+07	6 77E+05		
	276-278				1 29E+06					2 59E+06	9 05E+07	5 17E+06		
	286-288			3 19E+06						8 77E+07				7 97E+05
	305-307			4 07E+06				2 04E+06		3 66E+07				2 04E+06
	315-317				1 41E+06			1 41E+06		2 81E+06	9 28E+07	1 41E+06		
	325-327		3 80E+05							7 60E+05	5 02E+07	1 14E+06		
	335-337		1 54E+06							3 08E+06	1 40E+08	4 62E+06		
	345-347		1 08E+06		3 24E+06			1 08E+06		1 08E+06	1 12E+08	5 40E+06		
	355-357			2 16E+06							7 87E+07	7 55E+06		
	365-367			1 72E+06							1 70E+08			
	375-377		2 83E+06	8 48E+06	1 41E+06						1 03E+08			
	385-387			5 48E+06						2 74E+06	7 26E+07			
	395-397		1 73E+06		1 73E+06					7 09E+07				
	405-407		4 39E+06	5 49E+06				1 10E+06		2 20E+06	8 34E+07	3 29E+06		
	415-417		7 97E+05	1 59E+06						2 39E+06	3 99E+07			3 99E+05
	425-427		6 25E+05	1 25E+06	6 25E+05						6 06E+07			
	435-437			2 21E+06						2 21E+06	7 31E+07	1 11E+06		
	445-447									5 43E+06	1 34E+08			
	467-469		5 89E+05	5 89E+05					5 89E+05	2 36E+06	4 59E+07			
	472-474		3 04E+06						7 60E+05	1 52E+06	5 78E+07			
	482-484		1 05E+06	4 20E+06						2 10E+06	9 35E+07	1 05E+06		1 05E+06
	492-494		2 24E+06		4 48E+06					3 36E+06	8 73E+07	1 12E+06		
	502-504			4 07E+06	1 02E+06				1 02E+06	4 07E+06	6 10E+07	1 02E+06		2 03E+06
	average										9 64E+07			
Zone 2	512-514		1 22E+07	6 10E+06	3 05E+06					6 10E+06	4 27E+07			
	522-524		1 81E+06	1 81E+06						9 04E+05	5 96E+07	9 04E+05		1 81E+06
	532-534		2 03E+06	4 07E+06	2 03E+06						7 93E+07	2 03E+06		
	552-554										9 92E+07	3 89E+06		
	562-564			5 39E+06				1 35E+06		1 35E+06	5 66E+07			1 35E+06
	582-584		1 54E+06	3 09E+06			1 54E+06				2 93E+07			
	592-594				2 08E+06						8 10E+07			
	602-604		9 27E+05								5 56E+07	1 85E+06		
	612-614									3 01E+06	6 31E+07			
	619-621		9 70E+05		9 70E+05				9 70E+05	1 94E+06	5 24E+07			
	629-631		2 00E+06	3 99E+06						2 99E+06	6 98E+07	9 98E+05		
	639-641				1 03E+06		1 03E+06		5 15E+05	5 15E+05	3 09E+07			
	649-651									1 96E+06	4 90E+07			
	659-661									4 54E+06	6 13E+07	4 54E+06		
	669-671		2 40E+06	9 61E+06						2 40E+06	7 69E+07	7 21E+06		
	679-681				2 29E+06			2 29E+06			5 16E+07	5 73E+06		
	average										5 99E+07			
Zone 3	689-691		1 76E+06		1 17E+06				1 17E+06		4 28E+07	1 76E+06		
	699-701			7 27E+06	1 82E+06					3 64E+06	1 22E+08	1 82E+06		
	709-711			5 95E+06				1 49E+06		7 44E+06	1 18E+08			
	719-721				8 03E+05			8 03E+05			6 75E+07	8 03E+05		
	729-731			3 92E+06	9 80E+05						1 00E+08	4 90E+06		
	739-741			1 08E+06						1 63E+06	3 53E+07			
	749-751		2 63E+06	5 25E+06						1 31E+06	6 43E+07	2 63E+06		
	759-761		1 31E+06	6 57E+06	1 31E+06					1 97E+06	5 06E+07			6 57E+05

Zone	Sample (cm below top of core)	<i>Achnanthes cf. grana</i>	<i>Achnanthes lanceolata</i>	<i>Achnanthes</i> sp. 2	<i>Achnanthisidium minutissimum</i>	<i>Amphora acutiuscula</i>	<i>Amphora cf. helensis</i>	<i>Bacillaria paxillifer</i>	<i>Brachyura brebassonii</i>	<i>Cyclotella caspia</i>	<i>Cyclotella choctawhatcheeana</i>	<i>Cyclotella litoralis</i>	<i>Cyclotella pseudostelligra</i>	<i>Cyclotella stelligra</i>
Zone 3, cont'd	769-771				2 11E+06			3 17E+06	2 11E+06	1 06E+07	8 23E+07	4 22E+06		2 74E+07
	783-785							1 93E+06		5 79E+06	9 27E+07	3 86E+06		
	803-805 average				2 17E+06			4 34E+06	4 34E+06	1 69E+08	6 51E+06	4 34E+06		
Zone 4	813-815		3 23E+06	6 47E+06				1 62E+06	3 23E+06	3 23E+06	1 28E+08	1 62E+06		3 23E+06
	823-825	1 84E+06	3 69E+06	1 11E+07	1 84E+06				1 84E+06	3 69E+06	5 51E+08	5 53E+06		
	833-835	3 34E+06		6 69E+06	1 67E+06						4 68E+07			
	843-845		1 96E+06	3 91E+06				1 96E+06	9 78E+05		5 28E+07	3 91E+06		
	853-855	1 05E+06		2 09E+06	1 05E+06					1 05E+06	6 17E+07			
	863-865	1 60E+06	1 60E+06	3 20E+06	1 60E+06					6 41E+06	6 57E+07	1 60E+06		
	873-875	1 89E+06		7 57E+06	1 89E+06				1 89E+06		1 02E+08	1 89E+06		
	883-885	1 35E+06		5 40E+06		6 75E+06		1 35E+06			3 51E+07	5 40E+06		1 35E+06
	893-895	1 63E+06		3 26E+06	1 63E+06		3 26E+06			9 77E+06	7 65E+07			1 63E+06
	913-915	2 54E+06			1 27E+06						5 46E+07			
	923-925			6 05E+06	1 51E+06			7 57E+05	7 57E+05	6 81E+06	5 60E+07	7 57E+05		
	925-927				1 29E+06			1 29E+06	1 29E+06	6 44E+06	5 66E+07			
	935-937			6 59E+06						3 30E+06	3 46E+07	4 95E+06		
	945-947	2 56E+06		2 56E+06				1 28E+06	1 28E+06	7 67E+06	6 27E+07	1 28E+06		
	955-957	1 36E+06								5 44E+06	4 22E+07	2 72E+06		
	965-967		4 05E+06		2 02E+06				6 07E+06	1 21E+07	8 09E+07			
	975-977	5 38E+06									2 58E+07	2 15E+06		
	985-987	2 58E+06			2 58E+06	2 58E+06				1 29E+07	7 49E+07			
	995-997	1 00E+06			1 00E+06		2 00E+06			7 01E+06	4 71E+07			1 00E+06
	1005-1007	2 68E+06		5 36E+06					1 34E+06	5 36E+06	4 82E+07	1 34E+06		
	1015-1017	2 43E+06			1 22E+06				2 43E+06	2 19E+07	8 38E+07	3 65E+06		
	1025-1027	3 48E+06	1 16E+06		3 48E+06			3 48E+06	1 16E+06	8 11E+06	4 29E+07			
	1035-1037	7 99E+06	1 33E+06	5 32E+06				7 99E+06			3 73E+07			
	1045-1047									8 97E+06	2 87E+07	1 79E+06		
	1055-1057 average			2 42E+06	3 62E+06			2 42E+06		4 83E+06	2 78E+07	1 21E+06		
Zone 5	1079-1081	2 86E+06		1 91E+06	9 53E+05	9 53E+05				2 86E+06	2 38E+07	2 86E+06		
	1089-1091	3 16E+06		3 16E+06	3 16E+06			3 16E+06		1 58E+06	3 64E+07	1 74E+07		
	1109-1111			2 07E+06	1 03E+06					1 97E+07	4 14E+07		4 14E+06	1 97E+07
	1119-1121						3 72E+06			3 72E+06	1 67E+07		1 86E+06	
	1129-1131	1 05E+06			2 10E+06			1 05E+06		4 21E+06	2 63E+07			
	1139-1141		2 41E+06				4 83E+06	1 21E+06		8 45E+06	2 78E+07	1 21E+06		
	1149-1151	3 12E+06				1 56E+06			1 56E+06	3 12E+06	4 05E+07	6 23E+06		
	1169-1171									1 05E+06	1 88E+07	2 09E+06		
	1179-1181	1 83E+06			1 83E+06			1 83E+06		3 67E+06	4 40E+07			
	1189-1191	3 71E+06					2 47E+06	1 24E+06	1 24E+06	4 95E+06	1 24E+07	7 42E+06		
	1209-1211	1 14E+06							4 58E+06	3 43E+06	3 43E+07	1 14E+06		
	average										2 93E+07			

Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Zone	Sample (cm below top of core)	<i>Encyonema silesiacum</i>	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 10	<i>Maryena atomus</i>	<i>Maryena maryi</i>	<i>Maryena cf. schultzei</i>	<i>Navicula perminuta</i>	<i>Nitzschia fusulinum</i>	<i>Nitzschia lebertii</i>	<i>Nitzschia perminuta</i>	<i>Nitzschia</i> sp 7
Zone 1	5-7						1 11E+06			2 23E+06	1 11E+06	2 23E+06	2 23E+06	
	10-12		7 49E+05								7 49E+05	1 50E+06	7 49E+05	
	20-22						8 25E+05				1 65E+06	1 65E+06	3 30E+06	
	30-32			4 62E+06		9 24E+05					3 70E+06		1 85E+06	
	40-42			1 20E+06			1 20E+06	1 80E+06	5 99E+05	1 20E+06	1 20E+06	5 99E+05		
	50-52										1 96E+06	1 96E+06	1 96E+06	
	60-62			6 74E+05			6 74E+05	5 39E+06	1 35E+06	6 74E+05	1 35E+06	1 35E+06	1 35E+06	
	70-72			1 38E+06	1 38E+06			1 38E+07			2 76E+06	4 13E+06	4 13E+06	
	80-82			1 23E+06	1 23E+06			3 69E+06	2 46E+06		1 23E+06	2 46E+06		
	90-92			7 51E+05			3 00E+06	1 50E+06	4 51E+06			7 51E+05		7 51E+05
	100-102			2 95E+06			7 38E+06				1 48E+06	1 48E+06	2 95E+06	
	110-112			1 43E+06		1 43E+06		2 86E+06			1 43E+06	2 86E+06	2 86E+06	
	120-122	8 44E+05			1 69E+06	1 69E+06	5 06E+06		1 69E+06			8 44E+05	8 44E+05	
	130-132						5 39E+06			4 05E+06	1 35E+06	4 05E+06	5 39E+06	
	183-185			1 28E+06			2 56E+06	5 12E+06					8 96E+06	
	196-198	1 97E+06		2 95E+06		2 95E+06		3 94E+06		2 95E+06	2 95E+06	4 92E+06	1 97E+06	
	206-208				1 14E+06		3 41E+06	4 55E+06		2 28E+06	2 28E+06	2 28E+06		
	216-218			5 39E+06			4 04E+06	1 21E+07			2 70E+06	2 70E+06	2 70E+06	
	226-228		5 66E+05	5 66E+05		5 66E+05	2 27E+06			1 13E+06		1 13E+06	2 27E+06	
	236-238	2 37E+06		1 18E+06	1 18E+06	1 18E+06				1 18E+06	1 18E+06	1 18E+06	7 11E+06	
	246-248			6 17E+05	6 17E+05	1 23E+06	1 23E+06						6 17E+05	
	256-258	5 41E+06		1 80E+06	9 01E+05		3 60E+06					9 01E+05	3 60E+06	
	266-268			6 77E+05				2 71E+06			2 03E+06	2 03E+06		
	276-278			3 88E+06	1 29E+06		3 88E+06				1 29E+06	1 29E+06	5 17E+06	
	286-288			2 39E+06	7 97E+05		3 98E+06	9 56E+06			7 97E+05		2 39E+06	
	305-307			4 07E+06	4 07E+06	2 04E+06					4 07E+06	4 07E+06	4 07E+06	
	315-317			1 41E+06		1 41E+06		2 81E+06	1 41E+06	2 81E+06	2 81E+06	7 03E+06	4 22E+06	
	325-327	3 80E+05		7 60E+05		7 60E+05	1 14E+06			3 80E+05				
	335-337	3 08E+06	1 54E+06	1 54E+06						9 24E+06				
	345-347			1 08E+06	2 16E+06		2 16E+06	3 24E+06			1 08E+06	1 08E+06	5 40E+06	
	355-357	1 08E+06			2 16E+06					2 16E+06			2 16E+06	
	365-367			1 72E+06							5 15E+06	1 72E+06	6 87E+06	
	375-377	4 24E+06			2 83E+06			2 83E+06		1 41E+06		5 65E+06	4 24E+06	
	385-387			1 37E+06							1 37E+06	1 37E+06		
	395-397			5 19E+06			6 91E+06	1 73E+06					3 46E+06	
	405-407			1 10E+06		2 20E+06	2 20E+06	2 20E+06		2 20E+06	2 20E+06	5 49E+06	1 10E+06	
	415-417			3 99E+05			3 99E+05			7 97E+05	7 97E+05	3 99E+05		
	425-427	2 50E+06				1 25E+06	1 25E+06	1 25E+06		6 25E+05	6 25E+05	6 25E+05		
	435-437			1 11E+06		3 32E+06				1 11E+06	2 21E+06	5 54E+06	2 21E+06	
	445-447	6 79E+06		1 36E+06	1 36E+06								4 07E+06	
	467-469			1 77E+06		5 89E+05		1 18E+06			2 94E+06	5 89E+06	1 18E+06	
	472-474			2 28E+06			1 52E+06	6 08E+06		7 60E+05	1 52E+06	3 04E+06	2 28E+06	
	482-484		1 05E+06	1 05E+06			1 05E+06				5 25E+06	5 25E+06	7 35E+06	
	492-494						1 12E+06			2 24E+06	2 24E+06	2 24E+06		
	502-504	4 07E+06		5 08E+06	1 02E+06		3 05E+06	3 05E+06	1 02E+06		1 02E+06	3 05E+06	3 05E+06	
	average													
Zone 2	512-514									3 05E+06		6 10E+06	6 10E+06	
	522-524	2 71E+06			9 04E+05		9 04E+05			1 81E+06	2 71E+06	6 33E+06	3 61E+06	
	532-534		1 02E+06			1 02E+06	1 02E+06			2 03E+06		2 03E+06	2 03E+06	
	552-554						3 89E+06						3 89E+06	
	562-564			1 35E+06		2 70E+06						2 70E+06	2 70E+06	
	582-584				7 72E+05		6 17E+06					3 09E+06	7 72E+05	
	592-594			2 08E+06		2 08E+06	2 08E+06	6 23E+06		4 15E+06	4 15E+06			
	602-604				1 85E+06	3 71E+06	9 27E+05	1 85E+06	9 27E+05			1 85E+06		
	612-614			3 01E+06	3 01E+06			4 51E+06		1 50E+06	1 50E+06	7 51E+06		
	619-621						1 94E+06	1 94E+06			1 94E+06	2 91E+06	1 94E+06	
	629-631			2 99E+06			2 00E+06	2 00E+06					9 98E+05	
	639-641			1 03E+06	1 03E+06	5 15E+05		1 54E+06				1 03E+06	1 03E+06	
	649-651						5 88E+06					5 88E+06	3 92E+06	
	659-661				1 14E+06	2 27E+06	5 68E+06			4 54E+06	2 27E+06	2 27E+06	2 27E+06	
	669-671		4 81E+06				2 40E+06	1 20E+07		2 40E+06		2 40E+06		
	679-681	2 29E+06					2 29E+06			1 15E+06		4 58E+06	3 44E+06	
Zone 3	average													
	689-691				5 86E+05	5 86E+05	1 17E+06	4 69E+06		1 76E+06			2 34E+06	
	699-701	7 27E+06			1 82E+06			1 82E+06				1 82E+06		3 64E+06
	709-711			1 49E+06	1 49E+06		2 98E+06			1 49E+06	2 98E+06			1 49E+06
	719-721							8 03E+05		2 41E+06	3 21E+06	8 03E+05	1 61E+06	
	729-731			9 80E+05	9 80E+05	9 80E+05	1 96E+06	1 96E+06			2 94E+06	5 88E+06		
	739-741	2 71E+06		1 08E+06			2 71E+06			5 42E+05	5 42E+05	5 42E+05		
	749-751	5 25E+06					3 94E+06	2 63E+06			1 31E+06			
	759-761			6 57E+05	6 57E+05	1 31E+06				6 57E+05	3 94E+06	4 60E+06		

Zone	Sample (cm below top of core)	<i>Encyonema stilesii</i>	<i>Eunotia</i> sp 2	<i>Eunotia</i> sp 5	<i>Eunotia</i> sp 7	<i>Eunotia</i> sp 10	<i>Maryanna domus</i>	<i>Maryanna marty</i>	<i>Maryanna cf. schultze</i>	<i>Navicula perminua</i>	<i>Nitzschia frustulum</i>	<i>Nitzschia leberttrubus</i>	<i>Nitzschia perminua</i>	<i>Nitzschia</i> sp 7
Zone 3, cont'd	769-771			1 06E+06		5 28E+06	1 06E+06	2 11E+06		1 06E+06		2 11E+06	1 06E+06	1 06E+06
	783-785			1 93E+06		1 93E+06		3 86E+06		1 93E+06	3 86E+06		1 93E+06	
	803-805			2 17E+06			4 34E+06	2 17E+07		2 17E+06	8 67E+06	4 34E+06	6 51E+06	
	average													
Zone 4	813-815				1 62E+06		3 23E+06		1 62E+06			3 23E+06		
	823-825	5 53E+06		5 53E+06		3 69E+06		5 53E+06			3 69E+06	5 53E+06	3 69E+06	
	833-835				1 67E+06			8 36E+06		1 67E+06			3 34E+06	
	843-845													
	853-855			4 18E+06	3 14E+06			2 09E+06				4 18E+06		
	863-865	3 20E+06		1 60E+06	3 20E+06			3 20E+06						
	873-875	7 57E+06			1 89E+06		7 57E+06	3 79E+06			7 57E+06	7 57E+06	1 32E+07	
	883-885				1 35E+06	2 70E+06		5 40E+06					5 40E+06	
	893-895			3 26E+06		3 26E+06		1 63E+06	3 26E+06		1 63E+06			
	913-915						1 27E+06	2 54E+06		3 81E+06				
	923-925	1 51E+06			5 30E+06			3 03E+06		7 57E+05			7 57E+05	
	925-927	7 72E+06				1 29E+06				2 57E+06				
	935-937											3 30E+06	1 65E+06	
	945-947	5 12E+06						3 84E+06		1 28E+06	2 56E+06		2 56E+06	
	955-957						2 72E+06	1 36E+06				2 72E+06		
	965-967			1 01E+07						4 05E+06		2 02E+07	1 01E+07	
	975-977			3 23E+06				2 15E+06		1 08E+06	2 15E+06	4 31E+06	5 38E+06	3 23E+06
	985-987				2 58E+06	5 16E+06	2 58E+06	5 16E+06	2 58E+06			5 16E+06	1 29E+07	
	995-997			1 00E+06		2 00E+06	2 00E+06	3 01E+06		5 01E+06		2 00E+06		
	1005-1007					2 68E+06					8 03E+06		9 37E+06	
	1015-1017							4 86E+06		2 43E+06		4 86E+06	3 65E+06	
	1025-1027			4 64E+06			1 16E+06	1 16E+06			1 16E+06	2 32E+06	2 32E+06	3 48E+06
	1035-1037				1 33E+06			3 99E+06				2 66E+06	2 66E+06	
	1045-1047	3 59E+06					1 79E+06					1 79E+06		
	1055-1057	8 46E+06			2 42E+06		3 62E+06	4 83E+06	1 21E+06	2 42E+06	1 21E+06	3 62E+06		3 62E+06
	average													
Zone 5	1079-1081						9 53E+05	1 91E+06		2 86E+06	1 91E+06			
	1089-1091							3 16E+06		3 16E+06		3 16E+06		
	1109-1111	3 10E+06						2 07E+06						
	1119-1121	3 72E+06					1 86E+06	7 43E+06		1 86E+06	1 86E+06		3 72E+06	
	1129-1131					1 05E+06		4 21E+06		3 15E+06	1 05E+06		3 15E+06	
	1139-1141					3 62E+06		2 41E+06		2 41E+06				
	1149-1151			3 12E+06			1 56E+06	3 12E+06				9 35E+06		
	1169-1171				2 09E+06	1 05E+06				1 05E+06		6 28E+06		2 09E+06
	1179-1181			1 83E+06	3 67E+06		1 83E+06			1 83E+06				7 34E+06
	1189-1191	4 95E+06			1 24E+06					6 18E+06				2 47E+06
	1209-1211			2 29E+06		1 14E+06	2 29E+06	2 29E+06						
	average													

Statistically Significant Freshwater, Brackish Water and Benthic Diatom Taxa

Statistically Significant Marine Planktic Diatom Taxa

Zone	Sample (cm below top of core)	<i>Paralia sulcata</i>	<i>Planorbulina delicatulum</i>	<i>Planorbulina cf. engelbrechii</i>	<i>Sinuorella penata</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	sum of non-planktic species	<i>Actinocyclus senarius</i>	<i>Actinocyclus vulgaris</i>	<i>Actinocyclus</i> sp. 1	<i>Aulacoseira islandica</i>
Zone 1	5-7		4 45E+06	1 11E+06		3 34E+06			1 36E+08				
	10-12		3 75E+06			7 49E+05			8 09E+07				
	20-22		4 12E+06	8 25E+05		1 65E+06			1 04E+08				8 25E+05
	30-32		3 70E+06			1 85E+06		3 70E+06	9 43E+07				
	40-42		1 80E+06						8 75E+07		5 99E+05		
	50-52		3 91E+06	9 78E+05					1 62E+08	3 91E+06			
	60-62		6 74E+05	6 74E+05	1 35E+06				8 35E+07			1 35E+06	
	70-72		2 76E+06	1 38E+06		4 13E+06			2 11E+08			1 65E+07	
	80-82		3 69E+06			1 23E+06		1 23E+06	1 79E+08				
	90-92		1 50E+06			1 50E+06			9 09E+07		7 51E+05		7 51E+05
	100-102		1 48E+06	1 48E+06	2 95E+06				2 33E+08		2 95E+06		
	110-112		1 43E+06	2 86E+06				1 43E+06	1 84E+08		1 43E+06		
	120-122		1 69E+06	1 69E+06					9 45E+07				
	130-132		5 39E+06			2 70E+06			2 10E+08				
	183-185			6 40E+06			6 40E+06		1 78E+08				
	196-198		9 84E+05					6 89E+06	1 32E+08	9 84E+05			
	206-208		2 28E+06	1 14E+06			2 28E+06	3 41E+06	9 78E+07		1 14E+06		
	216-218		2 70E+06					1 35E+06	1 79E+08				
	226-228		5 66E+05	1 13E+06		5 66E+05			1 09E+08	5 66E+05			
	236-238		3 55E+06	1 18E+06					1 30E+08	2 37E+06			
	246-248								8 77E+07				
	256-258							9 01E+05	1 21E+08				
	266-268		6 77E+05	6 77E+05			6 77E+05		1 00E+08	6 77E+05	6 77E+05		
	276-278		3 88E+06		1 29E+06	1 29E+06		1 29E+06	1 24E+08	1 29E+06			
	286-288		1 59E+06	7 97E+05				1 59E+06	1 16E+08				
	305-307							2 04E+06	6 92E+07				
	315-317		1 41E+06		2 81E+06	1 41E+06		1 41E+06	1 31E+08	1 41E+06			
	325-327		3 80E+05					1 90E+06	5 81E+07	3 80E+05		3 80E+05	
	335-337								1 65E+08				
	345-347		1 08E+06					1 08E+06	1 42E+08				
	355-357		3 23E+06				2 16E+06		1 01E+08	2 16E+06			
	365-367		3 43E+06	3 43E+06	1 72E+06			1 72E+06	1 97E+08				
	375-377		1 41E+06			1 41E+06	1 41E+06	4 24E+06	1 46E+08				
	385-387		1 37E+06	1 37E+06				2 74E+06	9 04E+07				
	395-397		3 46E+06	5 19E+06					1 00E+08				
	405-407		2 20E+06	1 10E+06		1 10E+06			1 23E+08				
	415-417				3 99E+05			7 97E+05	4 90E+07	3 99E+05			
	425-427		6 25E+05	6 25E+05				6 25E+05	7 31E+07	1 87E+06	6 25E+05		
	435-437		3 32E+06					2 21E+06	9 97E+07	1 11E+06			
	445-447		1 36E+06					1 36E+06	1 56E+08				
	467-469		1 18E+06	5 89E+05			5 89E+05	1 77E+06	6 77E+07				
	472-474		3 80E+06	1 52E+06				1 52E+06	8 74E+07				
	482-484		2 10E+06	1 05E+06				1 05E+06	1 28E+08				
	492-494		1 12E+06	1 12E+06				2 24E+06	1 11E+08	2 24E+06			
	502-504		2 03E+06					2 03E+06	1 03E+08				
	average								1 23E+08				
Zone 2	512-514							3 05E+06	8 84E+07				
	522-524		9 04E+05		9 04E+05			9 04E+05	8 86E+07	9 04E+05			
	532-534		2 03E+06					1 02E+06	1 02E+08				
	552-554							3 89E+06	1 15E+08	1 95E+06			
	562-564		1 35E+06					1 35E+06	7 82E+07				
	582-584		1 54E+06			7 72E+05		3 09E+06	5 17E+07	7 72E+05			
	592-594		2 08E+06	2 08E+06				8 30E+06	1 16E+08				2 08E+06
	602-604		1 85E+06		9 27E+05			2 78E+06	7 51E+07	9 27E+05			
	612-614		1 50E+06	1 50E+06	1 50E+06	1 50E+06		3 01E+06	9 62E+07				
	619-621		9 70E+05	1 94E+06	9 70E+05	1 94E+06		9 70E+05	7 47E+07	9 70E+05			
	629-631	9 98E+05		9 98E+05				2 99E+06	9 28E+07				
	639-641		1 54E+06		1 03E+06	5 15E+05		5 66E+06	4 89E+07	1 54E+06			
	649-651		1 96E+06					3 92E+06	7 25E+07	1 96E+06			
	659-661		1 14E+06	1 14E+06		1 14E+06		3 41E+06	9 76E+07			3 41E+06	
	669-671					1 20E+07			1 35E+08				
	679-681		1 15E+06					3 44E+06	8 02E+07				
	average								8 83E+07				
Zone 3	689-691		1 76E+06		1 76E+06	2 93E+06		2 93E+06	6 91E+07	5 86E+05			
	699-701			1 82E+06	9 09E+06	5 45E+06	1 82E+06	5 45E+06	1 78E+08				
	709-711		2 98E+06	1 49E+06				5 95E+06	1 55E+08				
	719-721	4 82E+06	1 61E+06			8 03E+05		2 41E+06	8 83E+07				
	729-731	9 80E+05	9 80E+05	9 80E+05		9 80E+05		4 90E+06	1 34E+08				
	739-741		5 42E+05			1 08E+06		1 63E+06	4 94E+07				
	749-751		5 25E+06	1 31E+06	3 94E+06	3 94E+06		2 63E+06	1 06E+08				
	759-761		1 97E+06			1 31E+06	6 57E+05	5 25E+06	8 34E+07	6 57E+05			

Zone	Sample (cm below top of core)	<i>Pseudo-nitzschia sulcata</i>	<i>Planolothidium delicatulum</i>	<i>Planolothidium cf. engelbrechtii</i>	<i>Stauroneisirella punctata</i>	<i>Tabularia fasciculata</i>	<i>Tabularia investiens</i>	<i>Tabularia tabulata</i>	sum of non-planktic species	<i>Actinopychus senarius</i>	<i>Actinopychus vulgaris</i>	<i>Actinopychus sp. 1</i>	<i>Mulacoseira islandica</i>
Zone 3, cont'd	769-771		2 11E+06					4 22E+06	1 53E+08	1 06E+06			
	783-785		1 93E+06			1 93E+06		3 86E+06	1 27E+08				
	803-805		2 17E+06		4 34E+06	2 17E+06		1 52E+07	2 65E+08			2 17E+06	
	average							1 28E+08					
Zone 4	813-815		4 85E+06	1 62E+06	3 23E+06			1 29E+07	1 83E+08	1 62E+06			3 23E+06
	823-825		3 69E+06	3 69E+06				1 84E+07	2 42E+08				7 38E+06
	833-835		3 34E+06					5 02E+06	8 19E+07				3 34E+06
	843-845		2 93E+06	1 96E+06				7 82E+06	7 82E+07		9 78E+05		3 91E+06
	853-855		3 14E+06	1 05E+06				6 28E+06	9 10E+07				
	863-865		8 01E+06	1 60E+06				1 28E+07	1 15E+08		3 20E+06		
	873-875		1 89E+06					1 89E+06	1 70E+08				7 57E+06
	883-885		4 05E+06		1 35E+06			1 49E+07	9 18E+07	1 35E+06			
	893-895		1 63E+06		1 63E+06			6 51E+06	1 20E+08		6 51E+06		
	913-915			1 27E+06	5 08E+06			1 52E+07	8 76E+07				
	923-925			7 57E+05	1 51E+06			3 78E+06	9 01E+07				
	925-927		1 29E+06					9 01E+06	8 88E+07				
	935-937		4 95E+06					8 24E+06	6 76E+07		3 30E+06		
	945-947		3 84E+06	1 28E+06				1 02E+07	1 10E+08				
	955-957		5 44E+06				2 72E+06	9 52E+06	7 62E+07		2 72E+06		
	965-967		2 02E+06	2 02E+06				1 42E+07	1 68E+08				
	975-977		1 08E+06	1 08E+06				4 31E+06	6 14E+07	2 15E+06			
	985-987		7 75E+06					1 03E+07	1 50E+08				
	995-997		1 00E+06	3 01E+06				1 20E+07	9 02E+07		1 00E+06		
	1005-1007		4 02E+06			1 34E+06		4 02E+06	9 37E+07				
	1015-1017		1 22E+06	2 43E+06	1 22E+06	1 22E+06		4 86E+06	1 42E+08				
	1025-1027		1 16E+06	1 16E+06		1 16E+06		4 64E+06	8 81E+07				
	1035-1037		5 32E+06					5 32E+06	8 39E+07				
	1045-1047		1 79E+06				1 79E+06	5 38E+06	5 56E+07				
	1055-1057	2 42E+06	3 62E+06	2 42E+06		4 83E+06		1 09E+07	9 78E+07				
	average							1 09E+08					
Zone 5	1079-1081							9 53E+05	4 48E+07	9 53E+05			
	1089-1091			1 58E+06				1 58E+06	8 06E+07				
	1109-1111				3 10E+06			3 10E+06	9 93E+07				
	1119-1121		1 86E+06		3 72E+06	1 86E+06		3 72E+06	5 76E+07				
	1129-1131		1 05E+06			2 10E+06		8 41E+06	5 89E+07				
	1139-1141		1 21E+06		2 41E+06			3 62E+06	6 16E+07				
	1149-1151		1 56E+06	1 56E+06	6 23E+06			3 12E+06	8 72E+07	1 56E+06			
	1169-1171							2 09E+06	3 66E+07				
	1179-1181							7 34E+06	7 71E+07	1 83E+06			
	1189-1191		1 24E+06			1 24E+06			5 07E+07				
	1209-1211				1 14E+06			2 29E+06	5 61E+07		5 72E+06		
	average							6 46E+07					

Statistically Significant Marine Plankton Diatom Taxa

Zone	Sample (cm below top of core)	<i>Coscinodiscus radiatus</i>	<i>Coscinodiscus</i> sp. 1	<i>Fragilaria cylindrica</i>	<i>Fragilaria cylindrica</i>	<i>Fragilaria pseudonana</i>	<i>Melosira arenaria</i>	<i>Melosira humellana</i>	<i>Skellernia costatum</i>	<i>Thalassionema nitidum</i>	<i>Thalassiosira decipiens</i>	<i>Thalassiosira eccentrica</i>	<i>Thalassiosira guillardii</i>	<i>Thalassiosira hyalina</i>
Zone 1	5-7			1.11E+06		7.79E+06				2.83E+08	3.34E+06	3.34E+06		
	10-12	3.00E+06		5.24E+06	3.75E+06				1.86E+08	3.75E+06	4.49E+06	7.49E+05		
	20-22	8.25E+05		4.95E+06	1.65E+06	8.25E+05			1.63E+08	4.12E+06	2.47E+06	1.65E+06		
	30-32	9.24E+05		9.24E+05		9.24E+05			2.65E+08	9.24E+06	1.85E+06	2.77E+06		
	40-42	1.20E+06		3.00E+06	5.99E+05				1.23E+08	1.80E+06	4.19E+06			
	50-52	2.93E+06		9.78E+05	9.78E+05	1.96E+06			1.83E+08	3.91E+06	1.57E+07	1.96E+06		
	60-62	6.74E+05		3.37E+06	6.74E+05				2.00E+08		1.35E+06	1.35E+06		
	70-72	2.76E+06		2.89E+07	4.13E+06				2.78E+08	1.24E+07	1.52E+07			
	80-82			1.23E+06		1.23E+06			3.26E+08	3.69E+06	8.62E+06	3.69E+06		
	90-92			1.50E+06					2.19E+08	1.50E+06	3.76E+06	7.51E+05		
	100-102			8.85E+06	4.43E+06	2.95E+06			3.58E+08	4.43E+06	1.18E+07	4.43E+06		
	110-112			1.43E+06	1.00E+07				3.86E+08	1.43E+06	1.43E+06			
	120-122	8.44E+05		1.69E+06					2.71E+08	1.69E+06	5.91E+06	2.53E+06		
	130-132	1.35E+06		5.39E+06	2.70E+06	4.05E+06	1.35E+06		3.17E+08		1.08E+07			
	183-185			7.68E+06	1.28E+06			5.12E+06	3.36E+08	2.56E+06	3.84E+06			
	196-198	3.94E+06		4.92E+06		9.84E+05	9.84E+05		2.55E+08	4.92E+06	9.84E+05	1.97E+06		9.84E+05
	206-208	2.28E+06		4.55E+06		2.28E+06			3.67E+08	7.96E+06		2.28E+06		
	216-218			5.39E+06					4.02E+08	4.04E+06		5.39E+06	1.35E+06	
	226-228			2.83E+06	1.13E+06	1.13E+06			1.17E+08	1.70E+06		1.70E+06	5.66E+05	
	236-238	1.18E+06		2.37E+06	2.37E+06	1.18E+06			3.39E+08	8.29E+06	4.74E+06	2.37E+06		
	246-248			6.17E+05	6.17E+05	6.17E+05			1.64E+08	7.41E+06	1.23E+06	3.70E+06		
	256-258	9.01E+05		1.80E+06					2.70E+08	3.60E+06	2.70E+06			
	266-268	2.03E+06		4.06E+06	1.35E+06	6.77E+05	6.77E+05		1.60E+08	3.39E+06	6.77E+05	1.35E+06		
	276-278			7.76E+06			2.59E+06	2.59E+06	3.18E+08	2.59E+06	1.81E+07	3.88E+06		
	286-288			3.19E+06	1.04E+07				2.04E+08	3.98E+06	3.19E+06			
	305-307					2.04E+06			7.80E+08	4.07E+06		2.04E+06		
	315-317	4.22E+06		1.41E+06					3.91E+08	3.94E+07	1.41E+06	5.62E+06	1.41E+06	
	325-327			3.80E+05	3.80E+05		3.80E+05		9.88E+07	3.80E+05	3.80E+05	3.80E+05		
	335-337			3.08E+06					5.33E+08	1.54E+06	6.16E+06	3.08E+06		1.54E+06
	345-347			1.08E+06	6.48E+06				2.55E+08	4.32E+06	3.24E+06	1.08E+06		
	355-357	1.08E+06		4.31E+06		1.08E+06	1.08E+06	2.16E+06	3.49E+08	1.08E+06	5.39E+06	4.31E+06		1.08E+06
	365-367	1.72E+06		3.43E+06			3.43E+06		3.43E+06	5.41E+08	1.72E+06	8.58E+06	3.43E+06	
	375-377			1.41E+06				2.83E+06	4.17E+08	1.41E+06	1.41E+07	2.83E+06		
	385-387	1.37E+06		2.74E+06	1.37E+06				4.78E+08	5.48E+06	1.10E+07	6.85E+06		
	395-397	3.46E+06	1.73E+06			1.73E+06	1.73E+06		6.31E+08	1.04E+07	8.64E+06	3.46E+06		
	405-407	1.10E+06							3.11E+08	1.10E+06	3.29E+06	2.20E+06		
	415-417					3.99E+05	3.99E+05		1.05E+08	1.59E+06	7.97E+05	1.59E+06		
	425-427			6.25E+05	6.25E+05	6.25E+05	6.25E+05		1.64E+08	1.25E+06	1.25E+06	6.25E+05		
	435-437			3.32E+06		1.11E+06			3.47E+08	4.43E+06	3.32E+06	2.21E+06		
	445-447			2.72E+06		4.07E+06	1.36E+06		4.49E+08		5.43E+06	1.36E+06		
	467-469	5.89E+05		5.89E+05					1.64E+08	2.36E+06	4.71E+06			
	472-474		7.60E+05	7.60E+05	7.60E+05	1.52E+06			2.24E+08	1.52E+06	3.80E+06	3.04E+06		7.60E+05
	482-484	1.05E+06		2.10E+06	4.20E+06				2.75E+08	8.40E+06	3.15E+06	4.20E+06		
	492-494	1.12E+06		2.24E+06	1.12E+06				3.45E+08	1.12E+07	3.36E+06	3.36E+06		
	502-504	1.02E+06		1.02E+06		1.02E+06	1.02E+06		2.93E+08	5.08E+06	5.08E+06	3.05E+06		
	average								3.03E+08					
Zone 2	512-514			6.10E+06					1.28E+09	3.05E+06	6.10E+06	3.05E+06		
	522-524	9.04E+05		2.71E+06		9.04E+05			2.56E+08	8.13E+06	3.61E+06	2.71E+06		
	532-534		1.02E+06		1.02E+06	1.02E+06	2.03E+06		3.24E+08	5.08E+06	4.07E+06	5.08E+06		
	552-554		1.95E+06	1.95E+06		1.95E+06			6.71E+08			3.89E+06		
	562-564	1.35E+06							4.86E+08	4.04E+06		1.35E+06		
	582-584								2.79E+08	7.72E+05	2.32E+06	7.72E+05		
	592-594	4.15E+06				2.08E+06			7.18E+08	4.15E+06		6.23E+06		6.23E+06
	602-604	1.85E+06							3.33E+08	4.64E+06	9.27E+05	9.27E+05		
	612-614	1.50E+06				1.50E+06			5.14E+08	3.01E+06	7.51E+06	1.50E+06		
	619-621			9.70E+05		9.70E+05	9.70E+05		3.32E+08	8.73E+06	9.70E+05	1.94E+06		
	629-631	9.98E+05		9.98E+05			9.98E+05		3.32E+08	4.99E+06	9.98E+05	9.98E+05		
	639-641	5.15E+05							1.54E+08	5.15E+05	1.54E+06	5.15E+05		
	649-651	1.96E+06							7.68E+08	7.84E+06	1.96E+06	1.96E+06		
	659-661								3.51E+08	1.36E+07	3.41E+06	5.68E+06		
	669-671	7.21E+06		2.40E+06		4.81E+06	2.40E+06		9.03E+08	2.40E+06		7.21E+06		
	679-681			2.29E+06	1.15E+06		2.29E+06		4.03E+08		9.17E+06			
	average								5.07E+08					
Zone 3	689-691	5.86E+05		1.17E+06		1.17E+06			1.68E+08	1.76E+06	3.51E+06			
	699-701	1.82E+06		1.82E+06		1.82E+06			5.91E+08	1.82E+06	5.45E+06	7.27E+06		9.09E+06
	709-711		1.49E+06				1.49E+06		4.64E+08	1.64E+07	1.49E+06	1.49E+06		4.46E+06
	719-721	1.61E+06		2.41E+06	8.03E+05		3.21E+06		1.96E+08	1.61E+06	4.82E+06	5.62E+06		1.61E+06
	729-731	9.80E+05	1.96E+06	3.92E+06		2.94E+06			2.24E+08	4.90E+06	2.94E+06	1.96E+06		9.80E+05
	739-741	5.42E+05		2.71E+06		1.63E+06			1.48E+08	1.63E+06		1.08E+06		5.42E+05
	749-751	1.31E+06		6.56E+06					4.50E+08		7.88E+06			
	759-761	6.57E+05	2.63E+06	3.28E+06					1.62E+08		2.63E+06	1.97E+06		1.31E+06

Zone	Sample (cm below top of core)	<i>Coscinodiscus radiatus</i>	<i>Coscinodiscus</i> sp. 1	<i>Fragilaropsis cylindricus</i>	<i>Fragilaropsis cylindrus</i>	<i>Fragilaropsis pseudonana</i>	<i>Melosira arenita</i>	<i>Melosira numelloides</i>	<i>Skeletonema costatum</i>	<i>Thalassionema nitidichloides</i>	<i>Thalassosira deepensis</i>	<i>Thalassosira eccentrica</i>	<i>Thalassosira gullerdi</i>	<i>Thalassosira hyalina</i>
Zone 3, cont'd	769-771		1 06E+06	2 11E+06		1 06E+06	1 06E+06		2 60E+08	1 16E+07		5 28E+06		
	783-785					1 93E+06	1 93E+06		6 45E+08	1 93E+06	3 86E+06	3 86E+06		1 93E+06
	803-805	4 34E+06		2 17E+06					5 72E+08	2 17E+06	2 17E+06	4 34E+06		
	average								3 53E+08					
Zone 4	813-815	3 23E+06	1 62E+06						4 59E+08	4 85E+06		1 62E+06		3 23E+06
	823-825	5 53E+06		5 53E+06					4 92E+08	3 69E+06				1 48E+07
	833-835								6 42E+08	1 67E+06		3 34E+06		3 34E+06
	843-845	9 78E+05							2 88E+08	3 91E+06	9 78E+05			
	853-855	3 14E+06		1 05E+06	1 05E+06				3 22E+08	3 14E+06	3 14E+06	3 14E+06		
	863-865			1 60E+06	1 60E+06				5 22E+08	3 20E+06	3 20E+06			1 60E+06
	873-875	1 89E+06		7 57E+06					5 60E+08					
	883-885	1 35E+06	2 70E+06	1 35E+06					4 24E+08	4 05E+06	1 35E+06	8 10E+06	5 40E+06	
	893-895		1 63E+06	3 26E+06					4 49E+08	6 51E+06	4 88E+06	1 95E+07	1 63E+06	
	913-915	5 08E+06							4 32E+08	2 54E+06	1 27E+06	1 27E+06		
	923-925	7 57E+05							2 12E+08		4 54E+06	1 51E+06		
	925-927	1 29E+06	1 29E+06	1 29E+06		2 57E+06			3 93E+08	3 86E+06	6 44E+06	2 57E+06	1 29E+06	1 29E+06
	935-937	3 30E+06				3 30E+06	3 30E+06		6 03E+08	3 30E+06	1 65E+06			
	945-947	1 28E+06							3 43E+08		2 56E+06	6 40E+06		
	955-957								4 57E+08		1 09E+07	4 08E+06		
	965-967	4 05E+06							5 87E+08	4 05E+06	8 09E+06	2 02E+06	4 05E+06	
	975-977	5 38E+06		1 08E+06		1 08E+06			3 23E+08	8 61E+06	4 31E+06			2 15E+06
	985-987	5 16E+06	2 58E+06						9 22E+08			2 58E+06		1 81E+07
	995-997	3 01E+06		2 00E+06					2 72E+08	1 00E+06		2 00E+06		2 00E+06
	1005-1007			5 36E+06					4 27E+08		2 68E+06	1 34E+06	5 36E+06	
	1015-1017	2 43E+06		1 22E+06			1 22E+06		2 33E+08	4 86E+06	2 43E+06	2 43E+06		3 65E+06
	1025-1027			2 32E+06					3 80E+08		1 16E+06		1 16E+06	2 32E+06
	1035-1037		1 33E+06				1 33E+06		3 90E+08			1 33E+06		2 66E+06
	1045-1047	1 79E+06							7 18E+08		8 97E+06			1 79E+06
	1055-1057	1 21E+06				3 62E+06			2 75E+08	2 42E+06	4 83E+06			
	average								4 45E+08					
Zone 5	1079-1081	9 53E+05							3 30E+08	9 53E+05	1 91E+06	1 91E+06		5 72E+06
	1089-1091			1 58E+06					5 60E+08		1 58E+06	1 58E+06		
	1109-1111	2 07E+06	1 03E+06						3 33E+08	4 14E+06	3 10E+06			
	1119-1121	7 43E+06	1 86E+06	3 72E+06					6 71E+08	1 86E+06	7 43E+06	7 43E+06		1 86E+06
	1129-1131	1 05E+06			1 05E+06				3 08E+08	4 21E+06	2 10E+06	2 10E+06		
	1139-1141	2 41E+06				1 21E+06			4 00E+08	2 41E+06	1 21E+06	4 83E+06		
	1149-1151	1 56E+06		1 56E+06					4 95E+08		6 23E+06	3 12E+06		3 12E+06
	1169-1171			1 05E+06	1 05E+06	1 05E+06			3 38E+08	1 05E+06	1 05E+06		1 05E+06	2 09E+06
	1179-1181		1 83E+06						6 31E+08	1 83E+06	1 83E+06	3 67E+06		7 34E+06
	1189-1191	3 71E+06		2 47E+06				2 47E+06	4 08E+08		3 71E+06	1 24E+06		
	1209-1211	1 14E+06	1 14E+06						3 72E+08	1 14E+06	2 29E+06			3 43E+06
	average								4 40E+08					

Statistically Significant Marine Planktic Diatom Taxa

Zone	Sample (cm below top of core)	<i>Thalassiosira leptopus</i>	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 17	sum of marine planktic species
Zone 1	5-7	1 11E+06	1 56E+07	7 79E+06	2 45E+07							4 45E+06		3 52E+08
	10-12		1 65E+07	1 87E+07	1 12E+07							3 00E+06		2 56E+08
	20-22	1 65E+06	1 15E+07	3 46E+07	1 24E+07		2 47E+06					4 95E+06		2 48E+08
	30-32	9 24E+05	2 68E+07	1 66E+07	1 20E+07		1 85E+06							3 40E+08
	40-42	5 99E+05	5 39E+06	1 92E+07	6 59E+06		1 80E+06		5 99E+05			3 00E+06		1 71E+08
	50-52	4 89E+06	1 17E+07	1 86E+07	1 57E+07	9 78E+05	1 96E+06					1 96E+06		2 71E+08
	60-62	6 74E+05	9 43E+06	1 01E+07	6 74E+06							2 69E+06		2 38E+08
	70-72	1 38E+06	2 48E+07	2 20E+07			5 51E+06					5 51E+06		4 18E+08
	80-82		1 97E+07	1 23E+07	1 11E+07	2 46E+06	1 23E+06	1 23E+06				1 23E+06		3 94E+08
	90-92		9 01E+06	9 01E+06	8 26E+06	1 50E+06	3 00E+06	7 51E+05				7 51E+05		2 61E+08
	100-102		3 69E+07	1 48E+07	2 66E+07	4 43E+06	1 48E+06		1 48E+06			2 95E+06		4 87E+08
	110-112		1 29E+07	3 00E+07	1 43E+07	2 86E+06	2 86E+06		4 28E+06			1 43E+06		4 70E+08
	120-122		1 18E+07	1 01E+07	7 60E+06							8 44E+05		3 14E+08
	130-132	1 35E+06	2 70E+07	1 48E+07	1 89E+07	2 70E+06	4 05E+06					4 05E+06		4 15E+08
	183-185	2 56E+06	2 43E+07	2 69E+07	1 15E+07							5 12E+06		4 27E+08
	196-198		9 84E+06	3 44E+07	1 48E+07		1 97E+06							3 36E+08
	206-208	3 41E+06	2 05E+07	1 71E+07	2 05E+07		5 69E+06							4 55E+08
	216-218		2 16E+07	2 43E+07	1 35E+07		2 70E+06					1 48E+07		4 95E+08
	226-228	1 13E+06	9 63E+06	1 19E+07	7 93E+06	1 13E+06	1 13E+06					3 40E+06		1 63E+08
	236-238		7 11E+06	2 13E+07	1 18E+07	2 37E+06	7 11E+06		1 18E+06	1 18E+06		4 74E+06		4 21E+08
	246-248		7 41E+06	1 11E+07	9 88E+06	6 17E+05	1 23E+06							2 08E+08
	256-258		7 21E+06	1 08E+07	1 17E+07	9 01E+05	2 70E+06		1 80E+06	9 01E+05				3 15E+08
	266-268		1 08E+07	2 03E+07	1 63E+07		5 42E+06		1 35E+06			3 39E+06		2 33E+08
	276-278		5 17E+06	2 59E+07	1 94E+07	1 29E+06	6 46E+06		5 17E+06			1 16E+07		4 32E+08
	286-288		4 78E+06	1 12E+07	1 04E+07	5 58E+06	3 98E+06		2 39E+06			4 78E+06		2 68E+08
	305-307		8 14E+07	4 28E+07	2 65E+07	4 07E+06		2 04E+06				4 07E+06		9 49E+08
	315-317	1 41E+06	1 27E+07	5 62E+07	3 37E+07	5 62E+06	9 84E+06							5 65E+08
	325-327		8 74E+06	3 04E+06	5 70E+06	3 80E+05	7 60E+05	3 80E+05	3 80E+05			1 14E+06		1 22E+08
	335-337	1 54E+06	1 39E+07	1 23E+07	1 39E+07				1 54E+06			3 08E+06		5 94E+08
	345-347		2 59E+07	4 21E+07	2 59E+07		3 24E+06		2 16E+06			2 16E+06		3 72E+08
	355-357	3 23E+06	1 19E+07	1 40E+07	1 40E+07	1 08E+06			2 16E+06					4 19E+08
	365-367		2 92E+07	2 58E+07	1 89E+07		3 43E+06		3 43E+06					6 44E+08
	375-377	2 83E+06	1 70E+07	4 66E+07	2 26E+07		5 65E+06		1 41E+06					5 36E+08
	385-387	4 11E+06	1 37E+07	1 51E+07	2 06E+07	5 48E+06	5 48E+06							5 71E+08
	395-397		2 25E+07	3 46E+07	3 11E+07	6 91E+06	6 91E+06					1 73E+06		7 66E+08
	405-407		3 84E+07	3 18E+07	1 87E+07		2 20E+06				2 20E+06			4 12E+08
	415-417		9 96E+06	6 38E+06	9 96E+06									1 36E+08
	425-427	6 25E+05	1 25E+07	1 31E+07	1 87E+07		1 25E+06				3 12E+06			2 22E+08
	435-437		1 77E+07	3 43E+07	1 77E+07	1 11E+06	3 32E+06		3 32E+06		2 21E+06			4 42E+08
	445-447	2 72E+06	1 49E+07	1 22E+07	9 50E+06									5 04E+08
	467-469		1 59E+07	4 71E+06	2 12E+07	5 89E+05					5 89E+05			2 16E+08
	472-474		9 12E+06	1 60E+07	1 22E+07	7 60E+05	7 60E+05		1 52E+06					2 78E+08
	482-484	1 05E+06	1 47E+07	1 26E+07	4 41E+07	1 05E+06	2 10E+06							3 74E+08
	492-494	1 12E+06	1 79E+07	2 69E+07	1 12E+07			2 24E+06			2 24E+06			4 31E+08
	502-504	5 08E+06	1 63E+07	2 34E+07	1 63E+07	3 05E+06	8 13E+06	1 02E+06	1 02E+06		3 05E+06			3 87E+08
	average		1 71E+07	2 06E+07	1 63E+07									3 85E+08
Zone 2	512-514	3 05E+06	3 66E+07	6 40E+07	1 83E+07		3 05E+06				1 22E+07			1 44E+09
	522-524		7 23E+06	2 17E+07	1 36E+07	5 42E+06	1 81E+06				2 71E+06			3 28E+08
	532-534		9 15E+06	1 02E+07	2 95E+07	3 05E+06	1 02E+06				2 03E+06			3 98E+08
	552-554	1 95E+06	7 01E+07	4 67E+07	1 36E+07	9 73E+06	1 95E+06	1 95E+06			3 89E+06			8 33E+08
	562-564	4 04E+06	1 89E+07	4 72E+07	1 21E+07		1 35E+06				2 70E+06			5 79E+08
	582-584	7 72E+05	1 16E+07	1 47E+07	3 09E+06		1 54E+06				1 54E+06			3 17E+08
	592-594	2 08E+06	4 78E+07	6 44E+07	3 11E+07		2 08E+06							8 91E+08
	602-604		9 27E+06	9 27E+06	1 11E+07		9 27E+05				9 27E+05			3 74E+08
	612-614		2 25E+07	4 51E+07	1 80E+07				1 50E+06		1 50E+06			6 18E+08
	619-621		2 13E+07	1 75E+07	1 45E+07		1 94E+06							4 03E+08
	629-631		1 30E+07	1 90E+07	9 98E+06	9 98E+05	9 98E+05							3 86E+08
	639-641	5 15E+05	8 24E+06	1 29E+07	9 78E+06	1 54E+06	2 57E+06	5 15E+05			2 06E+06			1 97E+08
	649-651		2 74E+07	5 29E+07	2 16E+07		5 88E+06							8 92E+08
	659-661		2 50E+07	2 04E+07	1 36E+07	1 14E+06	4 54E+06				4 54E+06			4 46E+08
	669-671		3 60E+07	3 60E+07	1 44E+07	4 81E+06	2 40E+06		2 40E+06		2 40E+06			1 03E+09
	679-681	1 15E+06	6 88E+06	3 21E+07	8 02E+06	1 15E+06		1 15E+06			1 15E+06	1 15E+06		4 71E+08
	average		2 32E+07	3 21E+07	1 52E+07									6 00E+08
Zone 3	689-691	1 17E+06	1 17E+07	1 46E+07	9 96E+06		5 86E+05				1 17E+06	5 86E+05		2 17E+08
	699-701	5 45E+06	9 09E+06	3 82E+07	2 36E+07		1 82E+06				1 09E+07			7 09E+08
	709-711		1 93E+07	2 08E+07	2 23E+07	2 98E+06	1 49E+06				1 49E+06	1 49E+06		5 61E+08
	719-721	3 21E+06	1 93E+07	2 81E+07	1 93E+07		4 01E+06	8 03E+05			2 41E+06			2 95E+08
	729-731		2 55E+07	4 51E+07	1 47E+07	3 92E+06	1 96E+06				1 96E+06	1 96E+06		3 40E+08
	739-741	1 08E+06	1 03E+07	1 14E+07	1 19E+07	1 63E+06	4 34E+06	5 42E+05			1 63E+06	1 08E+06		2 00E+08
	749-751	1 31E+06	1 05E+07	2 63E+07	1 97E+07	1 31E+06	1 31E+06				2 63E+06	1 31E+06		5 30E+08
	759-761		1 05E+07	1 77E+07	1 18E+07	1 97E+06	2 63E+06				3 28E+06	1 97E+06		2 25E+08

Zone	Sample (cm below top of core)	<i>Thalassiosira leiopus</i>	<i>Thalassiosira nordenskiöldii</i>	<i>Thalassiosira pacifica</i>	<i>Thalassiosira tenera</i>	<i>Thalassiosira</i> sp 4	<i>Thalassiosira</i> sp 7	<i>Thalassiosira</i> sp 8	<i>Thalassiosira</i> sp 9	<i>Thalassiosira</i> sp 10	<i>Thalassiosira</i> sp 11	<i>Thalassiosira</i> sp 13	<i>Thalassiosira</i> sp 17	sum of marine planktic species
Zone 3, cont'd	769-771		1 58E+07	3 17E+07	1 69E+07	1 06E+06	2 11E+06				2 11E+06	1 06E+06		3 54E+08
	783-785	3 86E+06	3 86E+07	8 30E+07	1 54E+07		2 12E+07							8 23E+08
	803-805		5 86E+07	8 24E+07	3 69E+07	6 51E+06	1 95E+07							7 94E+08
	average		2 08E+07	3 63E+07	1 84E+07									4 59E+08
Zone 4	813-815		2 26E+07	5 17E+07	2 26E+07	4 85E+06								5 80E+08
	823-825		2 58E+07	3 50E+07	3 69E+07	1 11E+07	1 84E+06				1 84E+06			6 42E+08
	833-835		4 52E+07	4 68E+07	1 34E+07									7 61E+08
	843-845	5 87E+06	1 56E+07	4 60E+07	1 47E+07		1 96E+06	1 96E+06						3 85E+08
	853-855	3 14E+06	1 67E+07	2 93E+07	2 09E+07		2 09E+06	3 14E+06						4 12E+08
	863-865		3 36E+07	6 89E+07	1 92E+07		4 80E+06							6 63E+08
	873-875	5 68E+06	2 27E+07	6 62E+07	3 60E+07	1 89E+06	5 68E+06	1 89E+06						7 57E+06 7 25E+08
	883-885	1 35E+06	1 49E+07	4 59E+07	1 76E+07	2 70E+06	2 70E+06							1 22E+07 5 48E+08
	893-895	4 88E+06	3 58E+07	6 67E+07	2 12E+07	4 88E+06	1 30E+07							8 14E+06 6 49E+08
	913-915	2 54E+06	3 30E+07	3 81E+07	7 62E+06		1 27E+06				1 63E+06			3 81E+06 5 28E+08
	923-925	1 51E+06	9 84E+06	4 01E+07	6 81E+06		1 51E+06							2 27E+06 2 82E+08
	925-927		1 80E+07	6 44E+07	1 29E+07	5 15E+06					1 29E+06			3 86E+06 5 28E+08
	935-937	3 30E+06	2 64E+07	5 94E+07	2 14E+07		1 65E+06							4 95E+06 7 40E+08
	945-947	3 84E+06	1 41E+07	8 06E+07	3 33E+07	2 56E+06	1 28E+06							1 02E+07 4 99E+08
	955-957	4 08E+06	2 18E+07	4 76E+07	1 90E+07	2 72E+06								4 08E+06 5 77E+08
	965-967	2 02E+06	6 07E+07	9 11E+07	2 63E+07	4 05E+06	6 07E+06	4 05E+06	2 02E+06					8 05E+08
	975-977	4 31E+06	1 40E+07	6 14E+07	2 15E+07	1 08E+06	3 23E+06	1 08E+06						2 15E+06 4 56E+08
	985-987	2 58E+06	2 32E+07	5 16E+07	3 87E+07	5 16E+06								5 16E+06 1 08E+09
	995-997	2 00E+06	1 60E+07	5 91E+07	1 80E+07	3 01E+06	2 00E+06							4 01E+06 3 88E+08
	1005-1007	1 34E+06	1 87E+07	3 88E+07	2 28E+07	1 34E+06	4 02E+06	1 34E+06	2 68E+06		1 34E+06			1 21E+07 5 46E+08
	1015-1017	3 65E+06	3 77E+07	8 75E+07	3 65E+07	4 86E+06	4 86E+06		3 65E+06		2 43E+06			4 86E+06 4 37E+08
	1025-1027		1 74E+07	3 59E+07	2 20E+07		2 32E+06							5 79E+06 4 70E+08
	1035-1037	3 99E+06	1 20E+07	1 03E+08	2 13E+07		3 99E+06	3 99E+06						6 66E+06 5 51E+08
	1045-1047		1 26E+07	5 02E+07	2 15E+07		3 59E+06							7 18E+06 8 25E+08
	1055-1057	3 62E+06	1 21E+07	9 91E+07	5 92E+07	1 21E+06	3 62E+06							7 25E+06 4 74E+08
	average		2 32E+07	5 86E+07	2 37E+07									5 82E+08
Zone 5	1079-1081	1 91E+06	1 91E+07	3 14E+07	1 91E+07		1 91E+06		9 53E+05					2 86E+06 4 19E+08
	1089-1091	1 58E+06	1 42E+07	5 22E+07	2 37E+07		1 26E+07			1 58E+06				6 32E+06 6 77E+08
	1109-1111	1 03E+06	9 31E+06	3 41E+07	1 55E+07	1 03E+06	8 28E+06	1 03E+06			1 03E+06			2 07E+06 4 17E+08
	1119-1121		4 09E+07	7 62E+07	2 04E+07	1 86E+06	3 72E+06				1 86E+06			5 57E+06 8 53E+08
	1129-1131	2 10E+06	1 58E+07	8 10E+07	1 37E+07	4 21E+06	6 31E+06	2 10E+06						1 05E+06 4 45E+08
	1139-1141	2 41E+06	2 05E+07	5 67E+07	1 69E+07	4 83E+06		1 09E+07		1 21E+06	3 62E+06			7 24E+06 5 36E+08
	1149-1151	1 56E+06	1 40E+07	6 86E+07	2 96E+07	7 79E+06	6 23E+06				1 25E+07	4 67E+06		1 71E+07 6 75E+08
	1169-1171	2 09E+06	1 46E+07	4 60E+07	2 51E+07	1 26E+07	2 09E+06	1 05E+06				5 23E+06		7 32E+06 4 63E+08
	1179-1181		3 85E+07	6 24E+07	4 04E+07	3 67E+06		1 83E+06			3 67E+06	1 83E+06		2 02E+07 8 22E+08
	1189-1191	4 95E+06	8 66E+06	7 92E+07	1 48E+07	4 95E+06	1 24E+06				6 18E+06	7 42E+06	4 95E+06	5 55E+08
	1209-1211	3 43E+06	1 14E+07	6 06E+07	1 60E+07	3 43E+06		2 29E+06			8 01E+06	3 43E+06	5 72E+06	5 01E+08
	average		1 88E+07	5 89E+07	2 14E+07									5 78E+08

Zone	Sample (cm below top of core)	Sum of statistically significant species
	5-7	4 87E+08
	10-12	3 37E+08
	20-22	3 52E+08
	30-32	4 34E+08
	40-42	2 59E+08
	50-52	4 33E+08
	60-62	3 22E+08
	70-72	6 28E+08
	80-82	5 73E+08
	90-92	3 52E+08
	100-102	7 20E+08
	110-112	6 54E+08
	120-122	4 09E+08
	130-132	6 26E+08
	183-185	6 05E+08
	196-198	4 68E+08
	206-208	5 53E+08
	216-218	6 74E+08
	226-228	2 72E+08
	236-238	5 51E+08
	246-248	2 96E+08
	256-258	4 36E+08
Zone 1	266-268	3 33E+08
	276-278	5 56E+08
	286-288	3 83E+08
	305-307	1 02E+09
	315-317	6 96E+08
	325-327	1 81E+08
	335-337	7 59E+08
	345-347	5 15E+08
	355-357	5 21E+08
	365-367	8 41E+08
	375-377	6 81E+08
	385-387	6 62E+08
	395-397	8 66E+08
	405-407	5 35E+08
	415-417	1 85E+08
	425-427	2 95E+08
	435-437	5 41E+08
	445-447	6 60E+08
	467-469	2 83E+08
	472-474	3 65E+08
	482-484	5 02E+08
	492-494	5 42E+08
	502-504	4 90E+08
	average	5 08E+08
Zone 2	512-514	1 53E+09
	522-524	4 17E+08
	532-534	5 00E+08
	552-554	9 48E+08
	562-564	6 58E+08
	582-584	3 69E+08
	592-594	1 01E+09
	602-604	4 49E+08
	612-614	7 14E+08
	619-621	4 77E+08
	629-631	4 79E+08
	639-641	2 46E+08
	649-651	9 64E+08
	659-661	5 44E+08
	669-671	1 16E+09
	679-681	5 51E+08
	average	6 88E+08
Zone 3	689-691	2 86E+08
	699-701	8 87E+08
	709-711	7 16E+08
	719-721	3 83E+08
	729-731	4 74E+08
	739-741	2 49E+08
	749-751	6 37E+08
	759-761	3 09E+08

Zone	Sample (cm below top of core)	Sum of statistically significant species
Zone 3, cont'd	769-771	5 07E+08
	783-785	9 50E+08
	803-805	1 06E+09
	average	5 87E+08
Zone 4	813-815	7 63E+08
	823-825	8 83E+08
	833-835	8 43E+08
	843-845	4 63E+08
	853-855	5 03E+08
	863-865	7 78E+08
	873-875	8 95E+08
	883-885	6 40E+08
	893-895	7 70E+08
	913-915	6 16E+08
	923-925	3 72E+08
	925-927	6 17E+08
	935-937	8 08E+08
	945-947	6 09E+08
	955-957	6 53E+08
	965-967	9 73E+08
	975-977	5 18E+08
	985-987	1 23E+09
	995-997	4 78E+08
	1005-1007	6 40E+08
Zone 5	1015-1017	5 80E+08
	1025-1027	5 59E+08
	1035-1037	6 35E+08
	1045-1047	8 81E+08
	1055-1057	5 71E+08
	average	6 91E+08
	1079-1081	4 64E+08
	1089-1091	7 57E+08
	1109-1111	5 16E+08
	1119-1121	9 10E+08
	1129-1131	5 04E+08
	1139-1141	5 97E+08
	1149-1151	7 62E+08
	1169-1171	4 99E+08
	1179-1181	8 99E+08
	1189-1191	6 06E+08
	1209-1211	5 57E+08
	average	6 43E+08