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Interdisciplinary insights into
paleoenvironments of the
Queen Charlotte Islands/Hecate Strait region

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A Dissertation Submitted in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in the Interdisciplinary Degree Program (Geography, and Earth and Ocean Sciences)

We accept this thesis as conforming
to the required standard

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ABSTRACT

Subsequent to the Last Glacial Maximum (LGM), complex coastal response resulted from deglaciation, eustatic sea-level change, and a relatively thin, flexible lithosphere in the Queen Charlotte Islands (QCI) region of northwestern Canada. Presented here is an interdisciplinary study that combines the methodologies and schools of thought from geology, biology, and geography to address a research problem that spans these disciplines, specifically to illustrate the environment, temporal and spatial dimensions of isostatic crustal adjustment and the Late Quaternary coastline of the northeast Pacific continental shelf. Molluscan distribution, lithology, and published sub-bottom profiles are used to deduce sea-levels, outline the influence of glacially-induced crustal displacement, and reconstruct the paleoenvironment of the northeast Pacific Late Quaternary coastline, including the absence of ice and the presence of emergent coastal plains. These data are used to ascertain the region's suitability as a home for an early migrating coastal people.

A series of paleogeographic maps and isostatic crustal displacement maps chart the sequence of evolving landscapes and display temporal changes in the magnitudes and extent of crustal flexure as a forebulge developed. The wave-length and amplitude of the glacially-induced forebulge supports thermal and refraction modeling of a thin (~25 km thick) lithosphere beneath Queen Charlotte (QC) Sound and Hecate Strait. Glacial ice at least 200 m thicker than present water depth began retreating from Dixon Entrance after 14,000 and prior to 12,640 ^{14}C years BP, generating 50 m of uplift in northern Hecate Strait. The position of the forebulge remained essentially constant after 12,750 ^{14}C years BP, implying a fixed ice-front and continued ice presence on the British Columbia (BC) mainland until ~ 10,000 ^{14}C years BP. A 3-dimensional model shows two ice-free terrains emerged: one extended eastward from the QCI, the other developed in QC Sound. By ~11,750 ^{14}C years BP a landbridge connected the BC mainland and QCI.

Malacological evidence indicates a paucity of Arctic molluscan fauna subsequent to glaciation, perhaps a consequence of shallow, narrowed straits, and the presence of ice sheets that interfered with ocean currents. Water temperature, sedimentation rates, turbidity, and photoperiod are factors that limited invertebrate colonization during the Late Pleistocene – Early Holocene. The oldest dated mollusc to colonize QCI region subsequent to LGM was *Macoma nasuta* at 13,210 ^{14}C years BP. Once habitat and sea-surface temperatures were conducive, rates of recolonization appear to be limited only by the availability of ocean currents to bring temperate pelagic larvae into the region from outlying areas. Between ~11,000 and 10,000 ^{14}C years BP the appearance of *Clinocardium ciliatum* and *Serripes groenlandicus*, concurrent with the disappearance, or significant reduction in number and productivity of temperate intertidal molluscs, indicates the onset of a short interval of cool sea-surface temperatures coincident with the Younger Dryas cooling event. Five molluscan species: *Macoma incongrua*, *Musculus taylori* (cf), *Mytilimeria nuttallii*, *Tellina nukuloides*, *Mytilus edulis/Mytilus trossulus* previously categorized as possessing a Recent geologic range were collected in sediments dating older than 10,000 ^{14}C years BP. Fossil mollusc shells indicate edible intertidal biomass densities well within commercially harvested levels on southern Moresby Island by 8,800 ^{14}C years BP, and on northern Graham Island by 8,990 ^{14}C years BP.

The presence and productivity of nutritious intertidal molluscs indicates the QCI region had a suitable climate, possessed open ocean conditions, and provided subsistence resources for potential early humans subsequent to at least 13,210 ^{14}C years BP. Three-dimensional modeling shows subaerially exposed land that could have been inhabited by plants, animals, including coastal-migrating early humans. Early coastlines that have not been drowned, and which may harbour early archaeological sites, are identified along the western and northern coasts of QCI and the BC mainland.

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DEDICATIONS

I would like to dedicate this thesis to my parents,
who overcame challenges far greater than I shall ever face,
who strived to be the best that they could be,
and possessed wisdom and death far too early in their lives.

I also dedicate this thesis to my lover, friend, and husband,
Robert I. Thompson
who gave me the confidence and the unrelenting support
that allows me to be the best that I can be,
and to,
John and Ryley
for giving me the delights, joy, and pride
that only children can give.

Chapter 1

INTRODUCTION

The purpose of this research is to determine how the coastlines along Canada's north Pacific continental shelf were impacted by rapid changes in sea-level and climate during the Late Quaternary, what effect these changes had on extent, morphology, character and molluscan productivity of the near-shore environment, and whether the coastal zone was suitable for habitation by an early migrating coastal people.

The Late Quaternary was a time of rapid crustal displacements, induced by the weight of continental and alpine glaciers as they advanced and retreated across the region. Consequently, the position of coastlines changed, both substantially and rapidly; the degree and direction of those changes were dependent on where coastlines were situated relative to glacial ice. Charting coastal movements is made possible by careful examination of mollusc shells preserved within intertidal and benthic sediments deposited during the Late Quaternary. Most of these sedimentary successions are submerged beneath coastal waters. A few, however, have been found above sea-level along the fringe of the Queen Charlotte Islands (QCI) and the British Columbia (BC) mainland.

In this study, molluscs are also used as a tool to decipher the intertidal and nearshore ecology of the QCI/Hecate Strait region (Fig. 1) during the Late Pleistocene and Early Holocene. Wherever appropriate molluscan fossils are found, we can begin to describe their ancient environments from our knowledge of malacology. If those fossils are of species that survive to the present, what is known about their physiology and their environmental preferences make ecological inferences possible. For example, some species can be characterized by sediment type, degree of exposure to wave and storm action, vertical distribution, the range of temperatures in which they can survive, and the narrower range in which they can reproduce. The larger community structure can also be usefully inferred from the molluscan assemblage and accompanying fossils of other types of organism.

If we can accurately date molluscan fossils, we also can deduce the sea-water levels of the past from what we know about living intertidal molluscs, and their

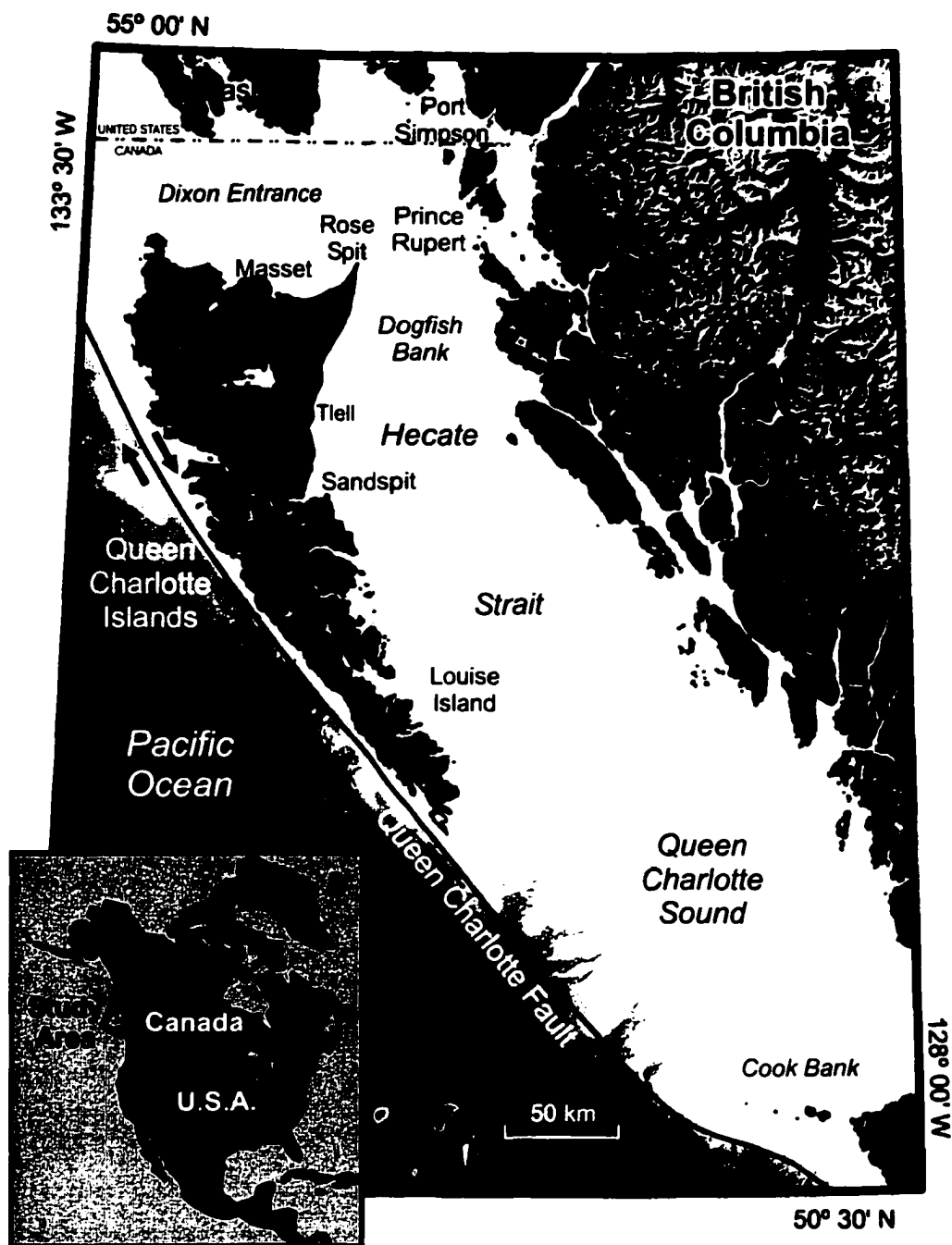


Figure 1. Present Queen Charlotte Island geography and tectonic configuration after Riddiough and Hyndman (1983), and Rohr and Dietrich (1992); arrows indicate relative plate motions.

characteristic communities (Conway *et al.*, 1999). This is of great value not only for geomorphological purposes but also for mapping land that could be inhabited by plants and animals including humans. The presence of intertidal molluscs indicates not only that the ice was gone (Conway *et al.*, 1999), but also that an accessible food source was present. Adequate samples of fossil molluscan shells make it also possible to quantify available biomass, providing insights into the region's ability to provide subsistence resources to early peoples migrating to the Americas.

This interdisciplinary research project focuses on the past ~14,000 ¹⁴C years before present (BP) of QCI earth history. The results derived from the modeling of crustal flexure complement earlier geophysical estimates of crustal displacement (Sweeney and Seeman, 1991; Lewis *et al.*, 1991; James *et al.*, 2000). The distribution and age of molluscan species together with the data-base generated herein, builds on earlier ecological studies done along Canada's northwest Pacific coast (Cornwall, 1955; McKenzie and Goldwaith, 1971; Quayle and Bourne, 1972; Bernard, 1979, 1983a, 1983b; White *et al.*, 1985; Mathewes, 1989; Bernard *et al.*, 1991; Mathewes, 1993; Mathewes *et al.*, 1993; Heaton *et al.*, 1996; Dyke *et al.*, 1996). The research supports oceanographic studies suggesting a Younger Dryas cooling event in the north Pacific (Thomson, 1981, 1989; Mathewes, 1993; Mathewes *et al.*, 1993; Patterson, 1993; Thomson, 1994; Patterson *et al.*, 1995; Guilbault *et al.*, 1997) and complements previous geological surveys, particularly those dealing with coastal migration route theory (Sutherland-Brown, 1968; Haynes, 1969; Hopkins, 1973; Fladmark, 1979; Clague and Bornhold, 1980; West, 1981; Clague *et al.*, 1982a; Clague *et al.*, 1982b; Erlandson, 1984; Dillehay, 1989; Luternauer *et al.*, 1989a; Luternauer *et al.*, 1989b; Blaise *et al.*, 1990; Engstrom, 1990; Barrie *et al.*, 1991; Easton, 1992; Barrie *et al.*, 1993; Fedje, 1993; Josenhans *et al.*, 1995; Mann and Hamilton, 1995; Dyke, 1996; Fedje *et al.*, 1996; Dixon *et al.*, 1997; Jackson *et al.*, 1997; Josenhans *et al.*, 1997; Archer, 1998; Barrie and Conway, 1999; Bonnicksen and Schneider, 1999; Fedje and Christensen, 1999; Hamilton and Geobel, 1999; Wilson and Burns, 1999; Fedje and Josenhans, 2000; Dixon, 2001; Fedje *et al.*, 2001; Mandryk *et al.*, 2001; Barrie and Conway, 2002).

The traditional “Clovis First” hypothesis (Haynes, 1969; West, 1981) suggests that the first Americans were large game hunters who migrated from northeast Asia across the Beringian landbridge circa 12,000 ^{14}C years BP, spreading southward via a continental “ice-free corridor” located east of the Canadian Rockies (Fig. 2). However, research into the timing and extent of Wisconsinian glaciation (White *et al.*, 1985; Dyke, 1996; Jackson and Duk-Rodkin, 1996; Jackson *et al.*, 1997) precludes this possibility between 11,500 and 20,000 ^{14}C years BP. Further, archaeological finds in North and South America predate 11,500 ^{14}C years BP, and although most remain controversial, the Monte Verde site in southern Chile, dated to at least 12,500 ^{14}C years BP, is generally accepted as a pre-Clovis site (Dillehay, 1989). These findings have led various researchers to propose an alternate migration route for early humans – a water route along Pacific North and South America that passed by the QCI (Fladmark, 1979; Josenhans *et al.*, 1995; Heaton *et al.*, 1996; Mandryk *et al.*, 2001). At present, the earliest archaeological evidence for human occupation of the BC - Alaskan coast dates to 10,300 ^{14}C years BP (Dixon, 2001).

Fedje and Josenhans (2000) have recently reported the discovery of a stone tool in 53 m of water in Juan Perez Sound, Moresby Island. The tool was recovered using an underwater grab sampler (sample V98-44). The sample site is described as a drowned delta flood plain, adjacent to a 4 m terrace “formed by fluvial down-cutting during regression” (Fedje and Josenhans, 2000:101). The sample site is located just below the confluence of Arrow Creek (see Fig. 3), which carries seasonally variable sediment loads, and is subject to erosion and slumping during rapid spring runoff and storm flooding. The stone tool was found on a lag surface, and therefore was not in geologic context (Barrie and Conway, 2002). Two dates were obtained from sample V98-44, the first, a barnacle encrusted on the stone tool, dated modern (Fedje and Josenhans, 2000), the second, an intertidal gastropod *Nucella lamellosa* obtained from the same grab sample dated to 380 +/- 50 ^{14}C marine reservoir corrected (MRC) years BP (Fedje and Josenhans, 2000; see Chapter 3). Another grab sample site V98-57, located adjacent to V98-44, contained a shell from the intertidal bivalve *Protothaca staminea*, which dated to 450 +/-

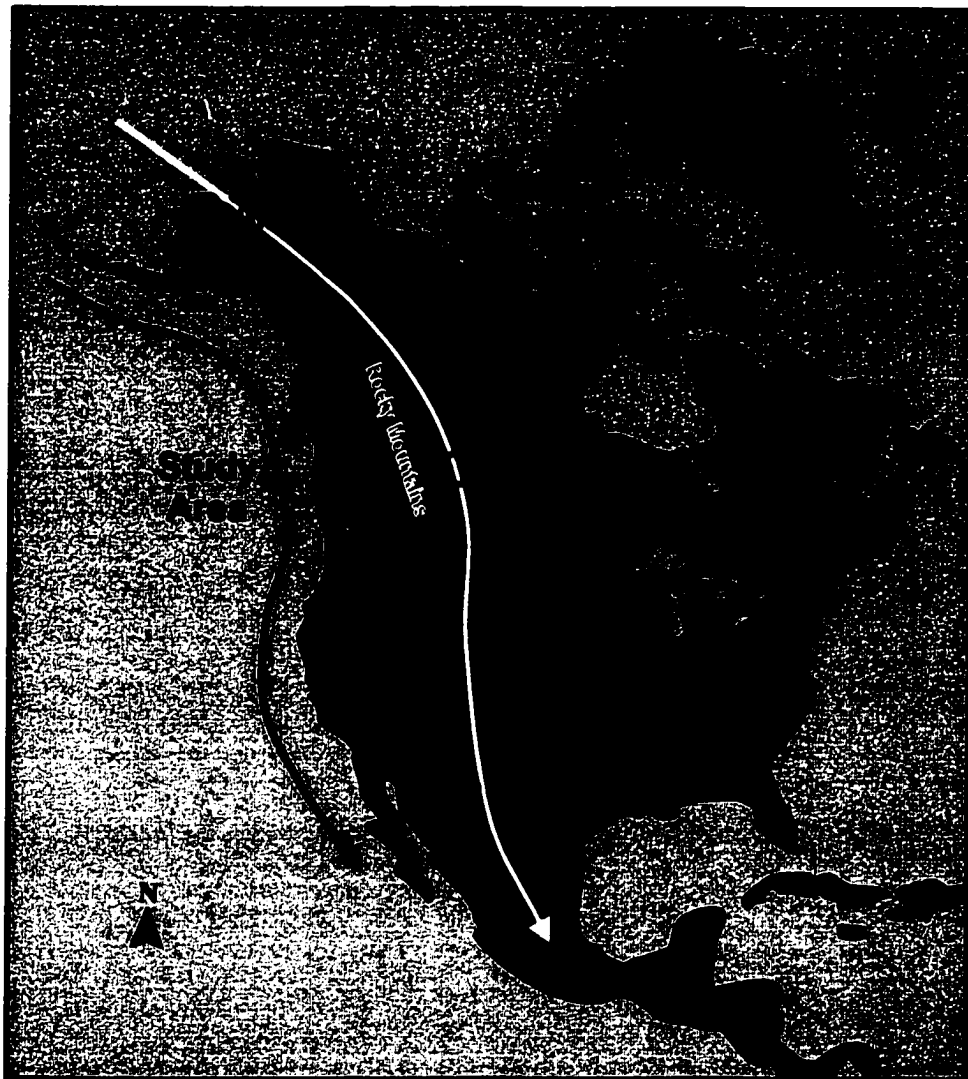


Figure 2, Map of North America showing the Traditional human migration route (yellow), across Beringia and into North America via a route east of the Canadian Rocky Mountains, and the Coastal migration route (red), down the Pacific coast of Canada and the U.S.A. Area outlined in black indicates the Queen Charlotte Islands/Hecate Strait region study area.

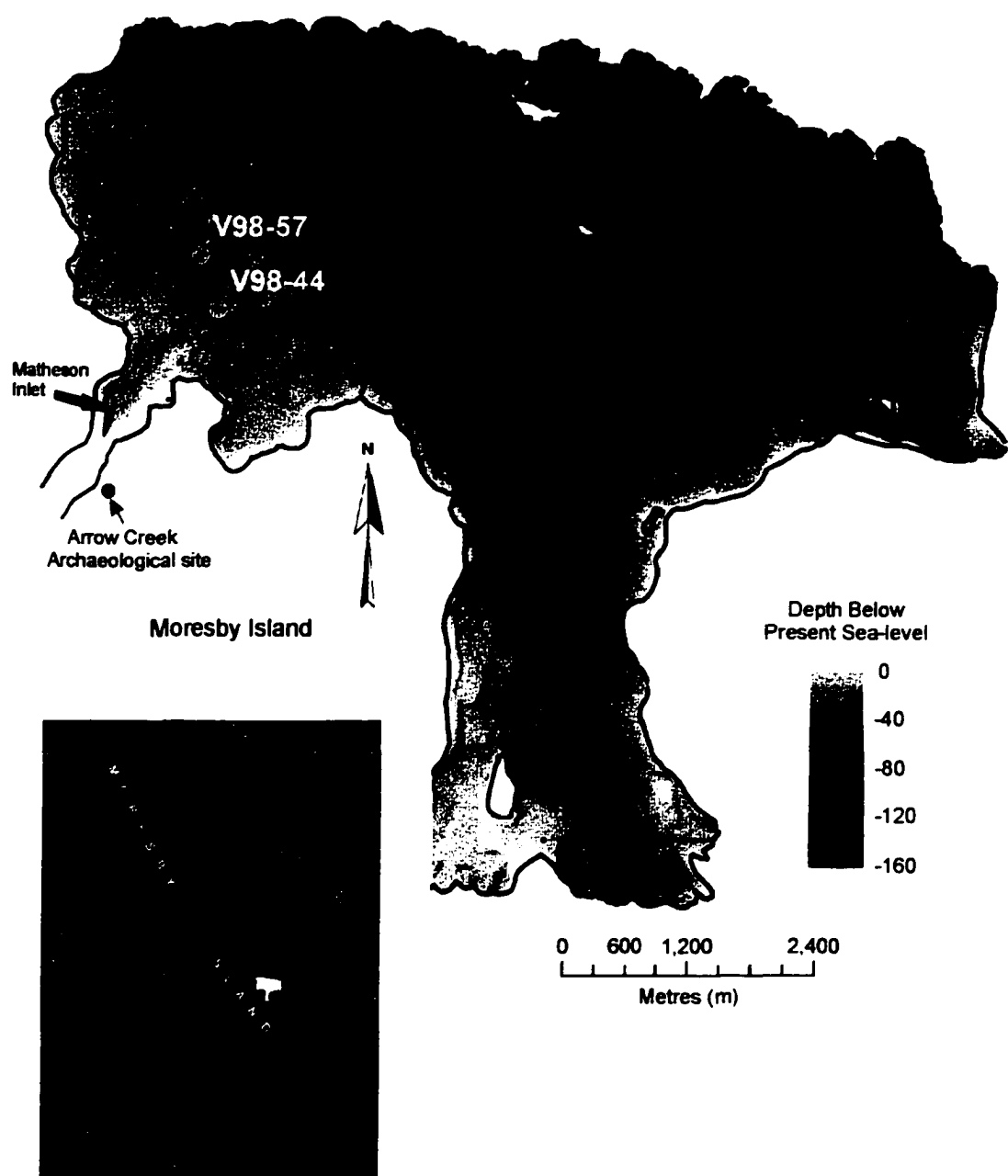


Figure 3, Juan Perez Sound, southern Moresby Island, showing underwater grab samples V98-57 and V98-44, as well as the Arrow Creek Archaeological site. V98-44 is the location where a stone tool was found. Orange dots are identified grab sample sites. Inset map shows Vector 1998 sampling location.

50 ^{14}C MRC years BP (Fedje and Josenhans, 2000; see Chapter 3). These recent dates suggest the stone tool may have formed part of a recent submarine slump deposit, downstream of Arrow Creek. As such, it provides only equivocal evidence, for early Holocene human occupation of the QCI, as inferred by Fedje and Josenhans (2000).

However, the question of the QCI providing habitable landscape for early coastal migrators remains. The hypothesis that the first people's of North and South America migrated via a coastal route carries with it the presumption that the QCI region had a suitable climate and the right combination of natural resources to make habitation possible. Early coastal inhabitants would have been influenced by shifting glacial ice and rapid changes in sea-level, and their habitation sites would likely have been located in close proximity to resource-rich shorelines and estuaries.

Previous researchers (Barrie *et al.*, 1993; Clague, 1983; Mann and Hamilton, 1995; Josenhans *et al.*, 1997; Mandryk *et al.*, 2001) have attempted to reconstruct the Late Pleistocene and Early Holocene environment. Most recently Josenhans *et al.* (1997), Fedje and Josenhans (2000) and Mandryk *et al.* (2002) have surveyed Burnaby Strait and Werner Bay adjacent to southern Moresby Island. They inferred the presence of a paleo-river system, and they developed a relative sea-level curve specific to this small region east of Moresby Island. However, despite recognizing the complexity of sea-level change on the Northwest coast, including the influence of isostatic rebound and glacial advance, terrestrial exposure of the entire Hecate Strait region is inferred through application of the southern Moresby Island-specific swath bathymetry and sea-level curve to the region as a whole. Although no specific crustal displacement model is presented or applied, it appears a planar model is adopted, whereby crustal uplift to the west is linearly related to crustal subsidence to the east. This approach does not consider the influence of glacially-induced isostatic crustal movements that resulted in the development of a forebulge within the broader QCI region and the temporal variation in those movements. Consequently, the interpretations necessarily presume that changes in sea-level noted in the Juan Perez Sound area, both temporally and physically apply to the region as a whole, during a time when different directions and magnitudes of crustal displacement were

occurring simultaneously across the region. This research seeks to decipher the complex pattern of isostatic displacement by applying data collected from across the region.

The four-dimensional character – latitude, longitude, elevation, and time – of the reconstruction problem has undoubtedly limited researchers' ability to accurately model the complex crustal displacement history of the northeast Pacific continental shelf. Clague *et al.* (1982a) and Clague (1983), and more recently Barrie and Conway (2002) demonstrate a complicated sea-level history along the coast of BC. Late Quaternary relative sea-level curves developed for a number of sites differ one from the other. These location-specific sea-level curves reflect complex glacially-induced crustal displacements (Clague *et al.*, 1982a; Clague, 1983; Barrie and Conway, 2002), making regional paleogeographic and paleoenvironmental reconstruction a challenge. This research addresses these complexities by developing a spatial and temporal interpolation model based on site-specific relative sea-level data. The eustatic component of sea-level history is removed from relative sea-level observations to generate a model of glacially-induced crustal displacement throughout the QCI region. These data, when combined with malacological interpretations, are then used to elucidate Late Pleistocene and Early Holocene paleoshorelines and paleoenvironment.

Objectives

This thesis has the following six objectives: 1) to identify, compare, and contrast molluscan intertidal species and assemblages from the QCI region; 2) to use geo-statistical interpolation to reconstruct and date relative sea-level changes by inferring data between sample points; 3) to determine the location and extent of paleoshorelines and thereby create paleoshoreline maps for the QCI region; 4) to compare edible intertidal molluscan densities and biomass through time as a means of calculating edible intertidal molluscan biomass; 5) to interpret the paleoenvironment and edible shellfish abundance in terms of their ability to provide a viable subsistence resource for early migrating peoples, and 6) to identify potential early archaeological site locations.

Methodologies

This study combines methodologies and data from geology, biology, geography,

and archaeology. Malacological, lithological, sedimentological and geological survey data was obtained, analyzed, and integrated using geo-statistical interpolation modeling. The QCI archipelago has undergone a complex pattern of crustal displacement during the past 15,000 ^{14}C years; modeling required that all relative sea-level data was geo-referenced by latitude, longitude, and elevation (x, y , and z) and data between known sample points was inferred in four dimensional space. All field and analytical data collected are archived at the Geological Survey of Canada's (GSC) Pacific office in Sidney, B.C. Descriptions of methodologies used for each different aspect of this research are provided, where appropriate in the chapters that follow.

Thesis structure

The thesis consists of the following five chapters and five appendices: "Introduction" (Chapter 1); "Paleogeography and glacially induced crustal displacement on the continental shelf of British Columbia (BC), Canada" (Chapter 2); "Malacological insights into the marine ecology and changing climate of the Late Pleistocene – Early Holocene northeastern Pacific" (Chapter 3); "Queen Charlotte Islands paleogeography and Americas' first humans" (Chapter 4); "Conclusions" (Chapter 5); "Southern Moresby Island (RH98) raised beach sample data" (Appendix A); "Northern Graham Island (RH99) raised beach sample data" (Appendix B); "Underwater grab (V98) sample data" (Appendix C); "Submarine sediment core sample data" (Appendix D); "Queen Charlotte Island/Hecate Strait region submarine sediment core analysis" (Appendix E). Chapters 2, 3, and 4 have been written in formats suitable for publication in peer reviewed scientific journals.

Chapter 2 deals with the geological and geophysical aspects of this research. Molluscs are used in conjunction with stratigraphy and geological surveys to determine the magnitude of glacially-induced crustal displacement. This information was then used to reconstruct Late Quaternary coastlines. Geo-statistical interpolation allowed inferences to be made about the sequential evolution of landscapes and the temporal changes in the magnitude and extent of crustal flexure associated with forebulge development. The wave-length and amplitude of the forebulge derived from the

modeling procedure supports previous thermal and refraction models of crustal displacement (Lewis *et al.*, 1991; Sweeney and Seeman, 1991; James *et al.*, 2000). The elucidation of emergent ice-free terrains and the development of a landbridge from the QCI to the BC mainland are two of the important insights resulting from this approach. One of the unanticipated outcomes that derives from the analysis of the distribution of molluscan species through time is support for a Younger Dryas cooling event in the northeast Pacific Ocean (Patterson *et al.*, 1995; Guilbault *et al.*, 1997).

Chapter 3 demonstrates how molluscs are of great value, not only as sea-level indicators, but as sensitive environmental indicators that permit one to chart changes in the environment, especially during the major climatic and sea-level changes of the Late Pleistocene and Early Holocene. The presence of intertidal molluscs indicates the absence of ice, the presence of habitable (for humans) shores, and the productivity of those environments. The character and extent of littoral and near-shore sedimentary environments is deciphered. Fossil mollusc species sampled indicate the ability of molluscan species to survive the cooling effects of glaciation as well as subsequent warming. Furthermore, this study illustrates how intertidal habitats and paleofaunistic zones migrated as sea-level and temperature changed, influencing the colonization and dispersion of temperate and Arctic molluscan species.

Chapter 4 focuses on how the geological, biological, and geographical findings of this research might have impacted early humans. Geophysical interpretations show how glacial ice potentially restricted the movement of coastal migrators and limited the development of productive coastlines. Molluscan interpretations and biomass calculations are used to identify productive coastal habitats. The interpretation of reconstructed paleocoastlines identifies the impact of emergent coastal plains on oceanographic conditions, the location of coastlines relative to today, the productivity of coastal zones, and the possible location of early coastal archaeological sites.

CONTEXT

Location of study area

The study area encompasses the northernmost section of BC's northeast Pacific continental shelf (Fig. 1). It is an archipelago consisting of the QCI, (located approximately 150 km west of mainland BC), the western margin of the BC mainland, Dixon Entrance, Hecate Strait and Queen Charlotte (QC) Sound. The study area extends between ~50 ° and 53.5 ° N latitude and 128 ° and 133.5 ° W longitude. Criteria used to determine the boundaries of the study area included availability of data and relevance of the region to the issue of peopling of the Americas. Detailed geologic and physiographic descriptions of the study area are presented in Chapter 2.

Fieldwork was undertaken on northwest Graham Island and on southern Moresby Island to obtain high-stand deposit samples. All other samples were gathered by researchers during previous, mainly marine, studies. Access to the region was gained by airplane to Masset, and thence by truck, small boat and helicopter.

Geology and geophysics

Sea-level fluctuations exert an important dynamic control on the form and rate of sedimentation, and on the location of shorelines. "Relative sea-level changes impact many marine and coastal depositional environments, their influence being most obvious in shoreline and shallow-marine areas" (Plint *et al.*, 1992:15). A change in relative sea-level is accompanied by a change in geographical environment (Walker, 1992). Thus, recognition must be made of the importance of sea-level change on models of the Late Quaternary environment and paleogeography (Walker, 1992). Models must incorporate changes in elevation relative to mean sea level (msl), which are associated with specific locations, referenced by latitude and longitude. Additionally, models must incorporate relative sea-level fluctuations through the fourth dimension – time.

Ocean water depth is influenced by both global and local factors, each of which is subject to geological mechanisms including volume changes, glacial accretion and wastage, lake, aquifer and reservoir holdings, crustal deformation, sea-floor spreading, and sedimentation (Revelle, 1990; Plint *et al.*, 1992). Global, or eustatic, sea-level change

is controlled by the volume of water in the ocean as a result of the following mechanisms:

1) *glacio-eustatic change* - the amount of water fixed as ice in glaciers; 2) *tectono-eustatic change* - the long-term changes in the volume of the ocean basins, as controlled by the shape and extent of oceanic spreading ridges and the deformation along continental margins. Local or isostatic sea-level change is a function of tectonic processes, sedimentation, and erosion (Plint *et al.*, 1992) and includes the following: 1) *Glacial-isostasy* - crustal uplift, or subsidence caused by crustal deformation in response to glacial loading, 2) *Hydro-isostasy* - crustal deformation in response to water loading, 3) *Sedimentation and erosion* - sea-floor aggradation and erosion that changes water depth while contributing to tectonic subsidence and uplift due to loading; and 4) *geoidal effects* - perturbations in sea-level caused by the mass of ice above mean sea-level (msl) that varies with distance from the ice sheet (Clark, 1976). Isostatic sea-level change can amplify, nullify, or reverse eustatic changes, and as a result relative sea-level is the consequence of an intricate interplay between eustasy, tectonics, and rates of sedimentation and erosion. Sea-level is also influenced by ocean temperatures, a result of thermal expansion particularly at coastal locations (Douglas and Peltier, 2002) and orbitally driven climate cycles. Milankovitch cycles have been identified in ocean cores spanning the last 2 Ma, influencing the expansion and retreat of glaciers, and resulting in significant changes in sea-level (Plint *et al.*, 1992). This research focuses on identifying and separating eustatic changes from isostatic variations, on assessing the changes in relative sea-level through time, and on ascertaining the impacts of these changes on paleogeography, paleoenvironment, coastal zone productivity, and the impacts of these changes on potential early human coastal peoples.

Wisconsinan glacio-isostatic effects

A cooler Late Pleistocene global climate resulted in expansion of mountain glaciers in British Columbia. Alpine glaciers extended down mountain valleys where they converged into piedmont glaciers that covered much of BC (Clague, 1983). Ice thickness exceeded 2500 m above msl (Stumpf, 2001) in central BC, between 1000 m and 1600 m on Vancouver Island, reached 500 m on the QCI, and continued to thin west and south-

west towards the continental shelf edge (Clague *et al.*, 1982a; Barrie and Conway, 1999; James *et al.*, 2000). Variations in ice extent, thickness, and duration resulted in diverse glacio-isostatic responses. Damming of glacial meltwater by ice and sediment influenced drainage patterns (Stumpf, 2001).

During the Wisconsinan glaciation coastal BC experienced glacio-isostatically driven vertical crustal uplift and subsidence rates that were significantly higher than today's rates (Fig. 4; Clague *et al.*, 1982a; Riddihough, 1982; Clague, 1983), because they were associated with ice-loading of the crust. The magnitude of displacement was dependent on the thickness and extent of surface ice, the duration of ice coverage, and the viscosity of the mantle. Displacement was greatest in mainland BC and diminished towards the continental shelf where ice was much thinner or non-existent. Marine high-stands in Kitimat and Port Simpson were up to 200 m and 50 m above msl respectively (Clague *et al.* 1982a; Archer, 1998), and indicate significant mainland isostatic depression – the reverse of what occurred farther west where uplift was manifest. Rapid isostatic uplift occurred during the waning stages of Wisconsinan glaciation and resulted in considerable variations in sea-level throughout coastal BC. These variations suggest deglaciation was rapid and discontinuous. In general, areas that were first to experience deglaciation were also first to experience tectonic uplift (Clague *et al.*, 1982a; Clague and James, 2002).

During the Late Glacial Maximum (LGM), between 21,000 and 15,000 ¹⁴C years BP (Blaise *et al.*, 1990), a 2 km thick Cordilleran ice sheet covered most of mainland BC and extended across Hecate Strait to the QCI where it coalesced with, and was deflected northward, into Dixon Entrance by mountain and piedmont glaciers on QCI (Sutherland-Brown, 1968; Barrie and Conway, 1999). Crustal subsidence beneath thick mainland ice was accompanied by uplift peripheral to it. Regional paleocoastlines were influenced by eustatic, glacio-isostatic, and to a lesser extent hydro-isostatic sea-level and crustal adjustments. Glacial ice, atop lithosphere that was relatively thin (Sweeney and Seeman, 1991) and flexible (Lewis *et al.*, 1991; James *et al.*, 2000), combined to produce a complex and rapidly changing pattern of uplift and subsidence. The weight of these ice

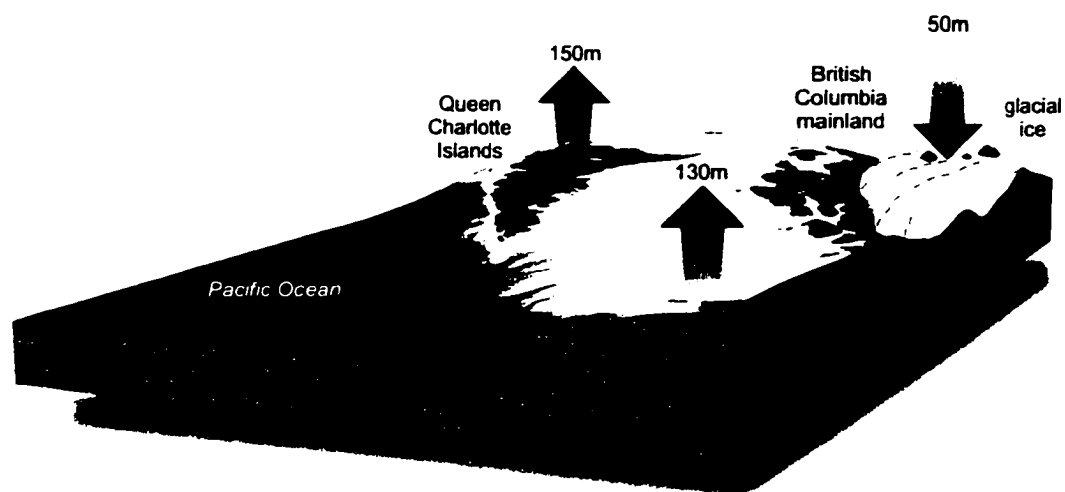


Figure 4, Schematic representation of relative eustatic and isostatic sea-level adjustments in the QCI region, showing ice atop a lithosphere that was relatively flexible, that combined to produce a complex and rapidly changing pattern of uplift and subsidence. The weight of ice sheets pushed the mainland down, while adjacent areas were uplifted, forming a peripheral bulge. Eustatic and isostatic adjustments resulted in relative sea-levels up to 120 m higher than present along the BC mainland, and more than 150 m lower than present in the adjacent QCI archipelago, located only 150 km offshore.

sheets pushed the mainland down, while adjacent areas were uplifted, forming a peripheral bulge. This uplift (forebulge) impacted Hecate Strait and the QCI, where ice was relatively thin or absent. Forebulge morphology varied directly with the thickness and lateral extent of the mainland ice sheet. Rapid ice retreat between 14,160 and 12,910 ^{14}C years BP (Luternauer *et al.*, 1989a; Blaise *et al.*, 1990; Barrie *et al.*, 1991; Barrie and Conway, 1999) was accompanied by subaerial exposure of large areas of the continental shelf beneath Hecate Strait and QC Sound. With the exception of remnant ice in mountain valleys and cirques, the QCI region was ice-free by 13,500 to 13,000 ^{14}C years BP (McKenzie and Goldwaith, 1971; Clague *et al.*, 1982b; Mann and Hamilton, 1995; Barrie and Conway, 1999).

Oceanography

Sea-surface temperature, salinity, tide, waves, winds, and currents

Waters of the QCI region consists of two layers. Horizontal sea-surface temperatures are relatively uniform, ranging from an average of 10 °C to 13 °C in August to a minimum of 4 °C to 8 °C in February and March, with temperatures in Dixon Entrance about 1 °C to 2 °C cooler than QC Sound (Thomson, 1989:38-43). Salinities maintain an east-west gradient, with a high salinity zone evident northwest of Rose Spit. Salinity ranges from a low of 31-32 ‰ near the surface to 34 ‰ at the base of the upper layer at approximately 150 to 200 m depth. Wind-induced vertical mixing during winter and early spring results in a near homogeneous surface layer to 100 m depth, maintaining surface salinities at 32 to 32.5 ‰ and temperatures between 8 °C and 10 °C (Thomson, 1989:44). Estuarine flow patterns in eastern Dixon Entrance result in freshwater dilution during summer and early fall run-off, lowering salinities to 30 ‰. Similar variability is experienced in eastern Hecate Strait and QC Sound, whereas northwest of Rose Spit, relatively high salinities have been recorded (Thomson, 1989:43-44).

Modern tides in the QCI maintain a mean range between 3.0 and 3.9 m on the north, west and south coasts, and greater than 5 m on the east coast and along the B.C. mainland (Clague and Bornhold, 1980). Wave energy in QC Sound and Dixon Entrance is slightly less than in the open ocean where wave heights, sporadically in summer and

regularly in winter, exceed 4 m, peaking to over 10 m during fall and winter storms (Canada Department of Environment, 1974; Canadian Hydrographic Service, 1976; Clague and Bornhold, 1980). Waves in Hecate Strait, though smaller than in either QC Sound or Dixon Entrance (Clague and Bornhold, 1980), have combined with strong tides to generate modern strandflat, spit platform, and strand plain features.

Seasonal wind patterns control two major semi-permanent atmospheric pressure cells: the Aleutian Low (AL) and the North Pacific High (NPH) (Kendrew and Kerr, 1955; Thomson, 1981). In the summer, the NPH combines with the coriolis effect, triggering upwelling of the relatively warm, high salinity California Undercurrent (Patterson *et al.*, 1995). During the winter, the NPH is pushed southward allowing the AL to influence the QCI region, causing downwelling and resulting in cold, low-salinity conditions over the shallower parts of the shelf (Patterson *et al.*, 1995).

Circulation and zoogeographic distribution

The counterclockwise circulation of the northeastern Pacific Alaska Gyre puts the QCI in close oceanic communication with all the coastal regions of the Aleutian Islands and the Alaskan mainland. A poleward flow of coastal surface currents generated by terrestrial runoff from lower latitudes from as far south as California, appears to reach QC Sound and Hecate Strait on the northwest continental margin of North America (Thomson, 1989). Thomson (1989:62) adds that in summer and fall seaward movement of brackish surface water from the mainland east of QC Sound and Hecate Strait can transport material the 80 km distance to the QCI. This coincides with a slow onshore movement of subsurface water, which could upwell to indirectly link the outershelf and slope benthic layer with the near-surface layer along the coast. Thus surface and subsurface drifting organisms from distant oceanic regions along the west coast could eventually reach the QCI.

Molluscs as a subsistence resource

As discussed above, molluscs are sensitive environmental indicators of salinity, temperature, water depth, sediment influx, substrate type, and ocean conditions. Molluscs are also a valuable subsistence resource. According to Gordon (1987), twenty-one

mineral elements are essential for living organisms, they include: Na, K, Mg, Ca, I, P, Cl, Cu, F, Fe, Ni, Mn, Mo, Se, Zn, As (essential in trace amounts only, toxic in higher amounts), Co, Cr, Si, Sn, and V. Minerals, as a class of essential nutrients, are equally as important as protein, fat or vitamins in human diets (Gordon, 1987). Compared to other food groups, molluscs and crustacea provide the greatest range in mineral content for human requirements, including very high concentrations of Fe, Zn, Cu, Mn, Se, F, and I (Gordon, 1987:517). Molluscs are a rich source of vitamin B₁₂ containing over 10 µg (cobalamin) per 100 g wet weight. This high concentration is attributed to filter feeding (Gordon, 1987:529).

Most seafood contains 60 to 70 % water, 12 to 18 % protein, and 1 to 10 % fat. Shellfish are low in fat, a little higher in sodium, and cholesterol content varies depending on feeding habits. All seafood contains the fatty acids EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), professed to be therapeutically beneficial in the prevention of cardiovascular disease (Kryznowek and Murphy, 1987:2).

Mollusc harvesting is a relatively easy task equating to a low-energy expenditure for a high-energy return. Edible gastropod and some edible bivalve species such as *Clinocardium nuttallii* can be plucked directly off the beach or from rocks. Other edible bivalves such as the butter clam (*Saxidomus giganteus*), littleneck (*Protothaca staminea* and *tenerrima*), and *Mya* species can be obtained by digging shallow holes in the beach using rakes, scrapers, or forks (Quayle and Bourne, 1972; Ellis and Swan, 1981; Ellis and Wilson, 1981; Harbo, 1997).

Common Northwest Pacific coast molluscs eaten by early humans include the following: Pacific Blue Mussel (*Mytilus edulis*) and California Mussel (*Mytilus californianus*) from the Order Mytilioida; the native Olympia oyster (*Ostrea conchaphila*) and the smooth, spiny, and giant rock scallops from the Order Ostreoida; Nuttall's cockle (*Clinocardium nuttallii*), Greenland cockle (*Serripes groenlandicus*), butter clam (*Saxidomus giganteus*), Pacific littleneck (*Protothaca staminea*) and thin-shell littleneck (*Protothaca tenerrima*), as well as the pointed, bent-nose, and white-sand *Macoma* (*M. inquinata*, *M. nasuta*, and *M. secta* respectively), and the fat gaper (*Tresus*

capax) and Pacific gaper (*Tresus nuttallii*) from the Order Veneroida; and the softshell-clam (*Mya arenaria*) and truncated softshell-clam (*Mya truncata*) from the Order Myoida (Harbo, 1997). Edible intertidal gastropods include Lewis' moonsnail (*Polinices lewisii*) from the Order Mesogastropoda, abalone (*Haliotis kamtschatkana*) from the Order Archaeogastropoda, and limpets (such as *Tectura persona*) from the Order Patellogastropoda (Harbo, 1997).

Harvesting strategies of early humans may have focused on one or two edible species. Campbell (1998) suggests that the pioneering harvesting strategy of the Lapita midden cultures of the South Pacific involved intensively collecting one or two favoured shellfish species and simultaneously and opportunistically collecting a high diversity of other species in very low numbers. Research done by an Argentinean archaeozoological team in 1975 at three locations in the Beagle Channel dating to 6500 ¹⁴C years BP, shows that humans began exploiting marine resources very soon after their arrival, with mussels being, by far, the most frequently collected animal (Estevez *et al.*, 1998).

An Interdisciplinary perspective

Geological, geographical, biological, and anthropological insights and methods, when used within the context of knowledge about our present environment, provide the framework to resolve the compelling interdisciplinary problem associated with reconstruction of the Late Quaternary environment of the Queen Charlotte Islands/Hecate Strait region, and its suitability for habitation by an early migrating coastal people. Our environment as we know it today is a temporary condition; the land and ocean surfaces, which we take for granted as fundamental and unchanging entities, when glimpsed through a broader time perspective, have changed significantly and at times very rapidly. To answer complex questions, such as the peopling of North America, it is imperative that we understand the environment into which early humans migrated. This understanding requires the utilization of research that seeks to go beyond individual disciplines utilizing methods, techniques, and data from disparate disciplines, to answer questions which are of a broad and holistic nature. Interdisciplinary researchers hope to realize a whole, which is greater than the sum of its parts.

References

- Archer D.J.W., 1998. Early Holocene Landscapes on the north coast of B.C. Paper presented at the 31st annual meeting Canadian Archaeological Association, Victoria, BC, 14 p.
- Barrie J.V., and Conway K.W., 1999. Late Quaternary glaciation and postglacial stratigraphy of the northern Pacific margin of Canada. *Quaternary Research* **51**, 113-123.
- Barrie J. V., and Conway K.W., 2002. Rapid sea level change and coastal evolution on the Pacific margin of Canada. *Journal of Sedimentary Geology* **150**, 171-183.
- Barrie J.V., Bornhold B.D., Conway K.W., and Luternauer J.L., 1991. Surficial geology of the northwestern Canadian continental shelf. *Continental Shelf Research* **11**, 701-715.
- Barrie J.V., Conway K.W., Mathewes R.W., Josenhans H.W., and Johns M.J., 1993. Submerged Late Quaternary terrestrial deposits and paleoenvironment of northern Hecate Strait, British Columbia continental shelf, Canada. *Quaternary International* **20**, 123-129.
- Bernard F.R., 1979. Bivalve mollusks of the western Beaufort Sea. *Contributions in Science*, Natural History Museum of Los Angeles County, Los Angeles, 80 p.
- Bernard F.R., 1983a. Catalogue of the living Bivalvia of the eastern Pacific Ocean: Bering Strait to Cape Horn. *Canadian Special Publication of Fisheries and Aquatic Sciences* **61**, Ottawa, 102 p.
- Bernard F.R., 1983b. Physiology and the mariculture of some northeastern Pacific bivalve molluscs. *Canadian Special Publication of Fisheries and Aquatic Sciences* **63**, Ottawa, 24 p.
- Bernard F.R., McKinnell S.M., and Jamieson G.S., 1991. Distribution and zoogeography of the Bivalvia of the eastern Pacific Ocean. *Canadian Special Publication of Fisheries and Aquatic Sciences* **112**, Ottawa, 60 p.
- Blaise B., Clague J.J., Mathewes R.W., 1990. Time of maximum Late Wisconsin glaciation, west coast of Canada. *Quaternary Research* **34**, 282-295.
- Bonnichsen, R., and Schneider, A.L., 1999. Breaking the impasse on the peopling of the Americas. In: *Ice Age People of North America: Environments, Origins, and Adaptations*, (R. Bonnichsen and K.L. Turnmire, Eds.), Oregon State University

Press, Corvallis, 497-519.

Campbell C.R., 1998. The distinction of 'Pioneering' and 'Homesteading' intertidal harvesting strategies. International Congress of the International Council for Archaeozoology, 8th, Victoria, 1998, 74.

Canada Department of Environment, 1974. Waves recorded off Tofino, B.C., Station 103, July 5, 1970 to August 22, 1974; Fisheries and Marine Service, Marine Environmental Data Service, Ottawa, File 103, 13 p.

Canadian Hydrographic Service, 1976. Sailing directions – British Columbia coast (south portion); Canada Department of Environment, Fisheries and Marine Service, Ottawa, 10th ed, 399 p.

Clague J.J., 1983. Glacio-isostatic effects of the Cordilleran Ice Sheet, British Columbia, Canada. In: Shorelines and Isostasy, (D.E. Smith and A.G. Dawson, Eds.), Institute of British Geographers Special Publication **16**, 321-343.

Clague J.J., and Bornhold B.D., 1980. Morphology and littoral processes of the Pacific coast of Canada. In: The Coastline of Canada, (S.B. McCann, Ed.), Geological Survey of Canada, **80-10**, pp. 339-380.

Clague J.J., and James, T.S., 2002. History and isostatic effects of the last ice sheet in southern British Columbia. *Quaternary Science Reviews* **21**, 71-87.

Clague J.J., Harper J.R., Hebda R.J., and Howes D.E., 1982a. Late Quaternary sea levels and crustal movements, coastal British Columbia. *Canadian Journal of Earth Sciences* **19**, 597-618.

Clague J.J., Mathewes R.W., and Warner B.G., 1982b. Late Quaternary geology of eastern Graham Island, Queen Charlotte Islands, British Columbia. *Canadian Journal of Earth Sciences* **19**, 1786-1795.

Conway H., Hall B.L., Denton G.H., Gades A.M., Waddington E.D., 1999. Past and future grounding-line retreat of the West Antarctic Ice Sheet. *Science* **286**, 280-283.

Cornwall I.E., 1955. Canadian Pacific Fauna, 10. Arthropoda, 10e Cirrepidea, Fisheries Research Board of Canada, Ottawa, 22-40.

Dillehay, T.D., 1989. Monte Verde: A Late Pleistocene settlement in Chile, Volume I, Palaeoenvironment and site context. Washington, Smithsonian Institution Press, 268 p.

- Dixon E.J., 2001. Human colonization of the Americas: timing, technology and process. *Quaternary Science Review* **20**, 277-299.
- Dixon E. J., Heaton T.H., Fifield T.E., Hamilton T.D., Putnam D.E., and Grady F., 1997. Late Quaternary regional geoarchaeology of southeast Alaska karst: A progress report. *Geoarchaeology: An International Journal*, **12**, 689-712.
- Douglas, B.C., and Peltier, W.R., 2002. The puzzle of global sea-level rise. *Physics Today*, **55**, 35-40.
- Dyke A.S., 1996. Preliminary paleogeographic maps of glaciated North America. Geological Survey of Canada, Open File **3296**, 6 map sheets.
- Dyke A.S., Dale J.E., and McNeely R.N., 1996. Marine molluscs as indicators of environmental change in glaciated North America and Greenland during the last 18,000 years. *Geographie physique et Quaternaire* **50**, 125-184.
- Easton N.A., 1992. Mal de mer above terra incognita, or, what ails the coastal migration theory. *Arctic Anthropology* **29**, 28-42.
- Ellis D.W., and Swan L., 1981. Teaching of the Tides: Uses of Marine Invertebrates by the Manhousat People. Theytus Books, Nanaimo, 118p.
- Ellis D.W., and Wilson S., 1981. The Knowledge and Usage of Marine Invertebrates by the Skidegate Haida People of the Queen Charlotte Islands, Queen Charlotte Islands Museum Society, 41p.
- Engstrom D.R., Hansen B.C.S., Wright H.E., Jr., 1990. A possible Younger Dryas record in southwestern Alaska. *Science* **250**, 1383-1385.
- Erlandson J.M., 1984. Faunal analysis of the invertebrate assemblage. In: The Hidden Falls Site, Baranof Island, Alaska, (S.D. Davis, Ed.), USDA Forest Service, Sitka, 151-179.
- Estevez J., Piano E., Schiavini A., and Juan-Muns N., 1998. Archaeozoological analysis of shell midden sites at the Beagle Channel in Tierra del Fuego Island: Environmental and economic evolution. International Congress of the International Council for Archaeozoology, 8th, Victoria, 1998, 113.
- Fedje D.W., 1993. Sea levels and prehistory in Gwaii Haanas. Unpublished M.A. thesis, University of Calgary, Alberta, 160 p.
- Fedje D.W., and Christensen T., 1999. Modeling paleoshorelines and locating early

- Holocene coastal sites in Haida Gwaii. *American Antiquity* **64**, 635-652.
- Fedje D.W., and Josenhans H., 2000. Drowned forests and archaeology on the continental shelf of British Columbia, Canada. *Geology* **28**, 99-102.
- Fedje D.W., McSporran J.B., and Mason A.R., 1996. Early Holocene archaeology and paleoecology at the Arrow Creek sites in Gwaii Haanas. *Arctic Anthropology* **33**, 116-142.
- Fedje D.W., Wigen R., Mackie Q., Lake C., and Sumpter I., 2001. Preliminary results from investigations at Kilgii Gwaay: An early Holocene archaeological site on Ellen Island, Haida Gwaii, British Columbia. *Canadian Journal of Archaeology* **25**, 98-120.
- Fladmark K.R., 1979. Routes: Alternate migration corridors for early man in North America. *American Antiquity* **44**, 55-69.
- Gordon D.T., 1987. Minerals in seafoods: Availability and interactions. In *Seafood Quality Determination*, (D.E. Kramer and J. Liston, Eds.), Proceedings of an International Symposium Coordinated by the University of Alaska Sea Grant College Program, Anchorage, Alaska, 10-14 November 1986, Elsevier Science, 541 p.
- Guilbault J.P., Patterson R.E., Thomson R.E., Barrie J.V., and Conway K.W., 1997. Late Quaternary paleoceanographic changes in Dixon Entrance, northwest British Columbia, Canada: Evidence from the foraminiferal faunal succession. *Journal of Foraminiferal Research* **27**, 151-174.
- Hamilton, T.D., and Goebel, T., 1999. Late Pleistocene peopling of Alaska. In: *Ice Age People of North America: Environments, Origins, and Adaptations*, (R. Bonnicksen and K.L. Turnmire, Eds.), Oregon State University Press, Corvallis, 156-199.
- Harbo R.M., 1997. *Shells & Shellfish of the Pacific northwest: A Field Guide*. Madeira Park, BC, Harbour Publishing, 270 p.
- Haynes Jr., C.V., 1969. The earliest Americans. *Science* **166**, 709-715.
- Heaton T.H., Talbot S.L., and Shields G.F., 1996. An ice age refugium for large mammals in the Alexander Archipelago, southeastern Alaska. *Quaternary Research* **46**, 186-192.
- Hopkins D.M., 1973. Sea level history in Beringia during the last 125,000 years.

Quaternary Research 3, 520-540.

Jackson Jr., L.E., and Duk-Rodkin, A., 1996. Quaternary geology of the ice-free corridor: glacial controls on the peopling of the New World. In *Prehistoric Mongoloid Dispersals* (T. Akazawa and E.J.E. Szathmáry, Eds.), Oxford University Press, Oxford, 214-227.

Jackson Jr., L.E., Phillips F.M., Shimamura K., and Little E.C., 1997. Cosmogenic ^{36}Cl dating of the Foothills erratics train, Alberta, Canada. *Geology* **25**, 195-198.

James T.S., Clague J.J., Wang, K., and Hutchinson I., 2000. Postglacial rebound at the northern Cascadia subduction zone. *Quaternary Science Reviews*, **19**, 1527-1541.

Josenhans H.W., Fedje D.W., Conway K.W., and Barrie J.V., 1995. Post glacial sea levels on the western Canadian continental shelf: Evidence for rapid change, extensive subaerial exposure, and early human habitation. *Marine Geology* **125**, 73-94.

Josenhans H.W., Fedje D., Pienitz R., and Southon J., 1997. Early humans and rapidly changing Holocene sea levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada. *Science* **277**, 71-74.

Kendrew W. and Kerr D., 1955. *The Climate of British Columbia and the Yukon Territory*. Queen's Printer, Ottawa, Ontario, 222 p.

Kryznowek J., and Murphy J., 1987. Proximate composition, energy, fatty acid, sodium, and cholesterol content of finfish, shellfish, and their products. NOAA Technical Report NMFS 55, U.S. Department of Commerce, 52 p.

Lewis T.J., Bentkowski W.H., and Wright J.A., 1991. Thermal state of the Queen Charlotte Basin, British Columbia: warm. In: *Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia*. Geological Survey of Canada Paper **90-10**, 489-506.

Luternauer J.L., Clague J., Conway K.W., Barrie J.V., Blaise B., and Mathewes R.W., 1989a. Late Pleistocene terrestrial deposits on the continental shelf of western Canada: Evidence for rapid sea-level change at the end of the last glaciation. *Geology* **17**, 357-360.

Luternauer J.L., Conway K.W., Clague J.J., and Blaise B., 1989b. Late Quaternary geology and geochronology of the central continental shelf of western Canada. *Marine Geology* **89**, 57-68.

- Mandryk C.A.S, Josenhans H., Fedje D.W., Mathewes R.W., 2001. Late Quaternary paleoenvironments of Northwestern North America: implications for inland versus coastal migration routes. *Quaternary Science Reviews* **20**, 301-314.
- Mann D.H., and Hamilton T.D., 1995. Late Pleistocene and Holocene paleoenvironments of the north Pacific coast. *Quaternary Science Reviews* **14**, 449-471.
- Mathewes R.W., 1989. Paleobotany of the Queen Charlotte Islands. In: *The Outer Shores* (G.G.E. Scudder, and N. Gessler, Eds.), Skidegate, British Columbia, Queen Charlotte Islands Museum Press, 75-90.
- Mathewes R.W., 1993. Evidence for Younger Dryas-Age cooling on the north Pacific coast of America. *Quaternary Science Reviews* **12**, 321-331.
- Mathewes R.W., Heusser L.E., and Patterson R.T., 1993. Evidence for a younger Dryas-like cooling event on the British Columbia coast. *Geology* **21**, 101-104.
- McKenzie G.D., and Goldwaith R.G., 1971. Glacial history of the last eleven thousand years in Adams Inlet, southeastern Alaska. *Geological Society of America Bulletin* **82**, 1767-1782.
- Patterson R.T., 1993. Late Quaternary benthic foraminiferal biofacies and paleoceanography of Queen Charlotte Sound and southern Hecate Strait, British Columbia. *Journal of Foraminiferal Research* **23**, 1-18.
- Patterson R.T., Guilbault J-P., Thomson R.E., and Luternauer J.L., 1995. Foraminiferal evidence of Younger Dryas age cooling on the British Columbia shelf. *Géographie physique et Quaternaire* **49**, 409-428.
- Plint A.G., Eyles N., Eyles, C.H., and Walker R. G., 1992. Control of sea level change. In: *Facies Models response to sea level change*. (R.G. Walker and N.P. James, Eds.), GEOText1, Geological Association of Canada, Gloucester, 15-25.
- Quayle, D.B., and Bourne, N. 1972. *The Clam Fisheries of British Columbia*. Fisheries Research Board of Canada, Bulletin **179**, Ottawa, Ontario, 70 p.
- Revelle R., ed., 1990. *Sea level change: National Research Council, Studies in Geophysics*, Washington, D.C., National Academy Press, 234 p.
- Riddihough R.P., 1982. One hundred million years of plate tectonics in western Canada. *Geoscience Canada* **9**, 28-34.
- Stumpf A.J., 2001. Late Quaternary ice flow, stratigraphy, and history of the Babine

- Lake - Bulkley River region, central British Columbia, Canada. Unpublished Ph.D. dissertation, University of New Brunswick, Fredericton, 234 p.
- Sutherland-Brown A., 1968. Geology of the Queen Charlotte Islands, British Columbia. British Columbia Department of Mines and Petroleum Resources, Bulletin **54**, 226 p.
- Sweeney J.F., and Seeman D.A., 1991. Crustal density structure of Queen Charlotte Islands and Hecate Strait, British Columbia. In: Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia, Geological Survey of Canada Paper **90-10**, 89-96.
- Thomson, R.E., 1981. Oceanography of the British Columbia Coasts. Can. Spec. Publ. Fisheries and Aquatic Sciences, Ottawa, **56**, 291 pp.
- Thomson R.E., 1989. The Queen Charlotte Islands Physical Oceanography. In: The Outer Shores (G.G.E. Scudder, and N. Gessler, Eds.), Skidegate, British Columbia, Queen Charlotte Islands Museum Press, 27-63.
- Thomson R.E., 1994. Physical oceanography of the Strait of Georgia-Puget Sound-Juan de Fuca Strait system. In: Review of the Marine Environment and Biota of Strait of Georgia, Puget Sound and Juan de Fuca Strait, (R. Wilson, R. Beamish, F. Aitkens, and J. Bell, Eds.), Canadian Technical Report of Fisheries and Aquatic Sciences, Ottawa, **1948**, 36-100.
- Walker R.G., 1992. Facies, facies models and modern stratigraphic concepts. In: Facies Models response to sea level change, (R.G. Walker and N.P. James, Eds.), GEOText1, Geological Association of Canada, Gloucester, 1-14.
- West F.H., 1981. The Archaeology of Beringia. Columbia University Press, New York.
- White J.M., Mathewes R.W., Mathews W.H., 1985. Late Pleistocene chronology and environment of the 'ice free corridor' of northwestern Alberta. Quaternary Research **24**, 173-186.
- Wilson, M.C., and Burns, J.A., 1999. Searching for the earliest Canadians: Wide corridors, narrow doorways, small windows. In: Ice Age People of North America: Environments, Origins, and Adaptations, (R. Bonnicksen and K.L. Turnmire, Eds.), Oregon State University Press, Corvallis, 213-248.

Chapter 2

PALEO GEOGRAPHY, GLACIALLY-INDUCED CRUSTAL DISPLACEMENT, AND LATE QUATERNARY COASTLINES ON THE CONTINENTAL SHELF OF BRITISH COLUMBIA, CANADA

Abstract

Subsequent to the Last Glacial Maximum (LGM), complex isostatic adjustments resulted from deglaciation, eustatic sea-level change, and a relatively thin, flexible lithosphere in the Queen Charlotte Islands (QCI) region. This interdisciplinary study uses geological, biological and geographical methods and data with geo-statistical interpolation to infer the temporal and spatial changes of the Late Quaternary coastline of the NE Pacific continental shelf. A series of paleogeographic maps and isostatic crustal displacement maps chart the sequence of evolving landscapes and display temporal changes in the magnitudes and extent of crustal flexure that accompanied forebulge development. The wavelength and amplitude of the forebulge agrees with thermal and refraction modeling of a thin (~25 km) lithosphere beneath Queen Charlotte (QC) Sound and Hecate Strait. Glacial ice at least 200 m thicker than present water depth began retreating from Dixon Entrance after 14,000 and prior to 12,640 ^{14}C years BP, generating 50 m of uplift in northern Hecate Strait. The position of the forebulge remained essentially constant after 12,750 ^{14}C years BP, implying a fixed ice-front, followed by rapid ice-sheet decay on the BC mainland ~10,000 ^{14}C years BP. Paleogeographic reconstructions show two emergent ice-free terrains; one extending eastward from the QCI, and the other located in QC Sound. By ~11,750 ^{14}C years BP a landbridge connected the BC mainland and QCI. Malacological evidence supports

paleoceanographic and palynological studies of a late-glacial Younger Dryas cooling event around the southern limits of 'Hecate Sea' and Cook Bank.

Keywords: paleogeography, Queen Charlotte Islands, isostasy, sea-level changes, land bridges, molluscs, last glacial maximum, continental shelf, crustal studies

INTRODUCTION

The purpose of this paper is to reconstruct the Late Pleistocene – Early Holocene (14,250 to 8,750 ^{14}C years BP) paleogeography and paleoenvironment of the Queen Charlotte Island (QCI) region, located on the northwest coast of British Columbia (BC), Canada (Fig. 1). Coastlines of the QCI archipelago and adjacent coastal mainland changed significantly and rapidly during this period. Subsequent to last glacial maximum (LGM), global warming caused the melting of extensive continental ice sheets, which precipitated eustatic changes and isostatic adjustments. This resulted in sea-levels rising up to 120 m along the BC mainland, and dropping more than 150 m in the adjacent QCI archipelago (Josenhans *et al.*, 1997), located only 100 km offshore (Fig. 2). These significant and spatially varying alterations in sea-level resulted from the elaborate interplay between ice thickness, ice extent, and the low flexural rigidity of a thin lithosphere. The combination of these factors produced a complex and rapidly changing pattern of glacio-isostatic – and to a lesser extent hydro-isostatic – crustal uplift and subsidence.

This study provides information about the morphological, geological, and environmental implications of these glacialogical events. A series of paleogeographic maps and isostatic crustal adjustment maps have been produced that chart the sequence of

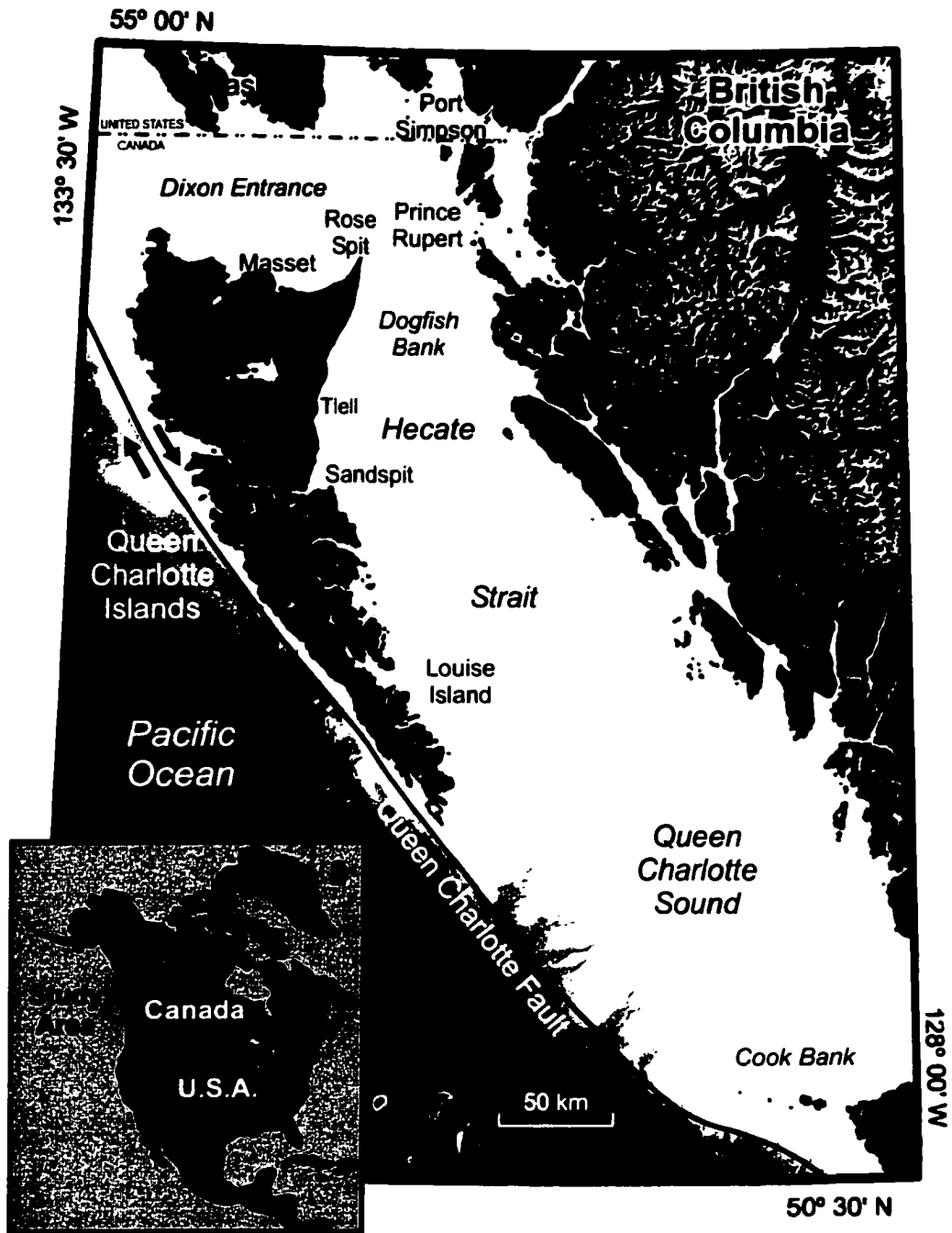


Figure 1. Present Queen Charlotte Island geography and tectonic configuration after Riddiough and Hyndman (1983), and Rohr and Dietrich (1992); arrows indicate relative plate motions.

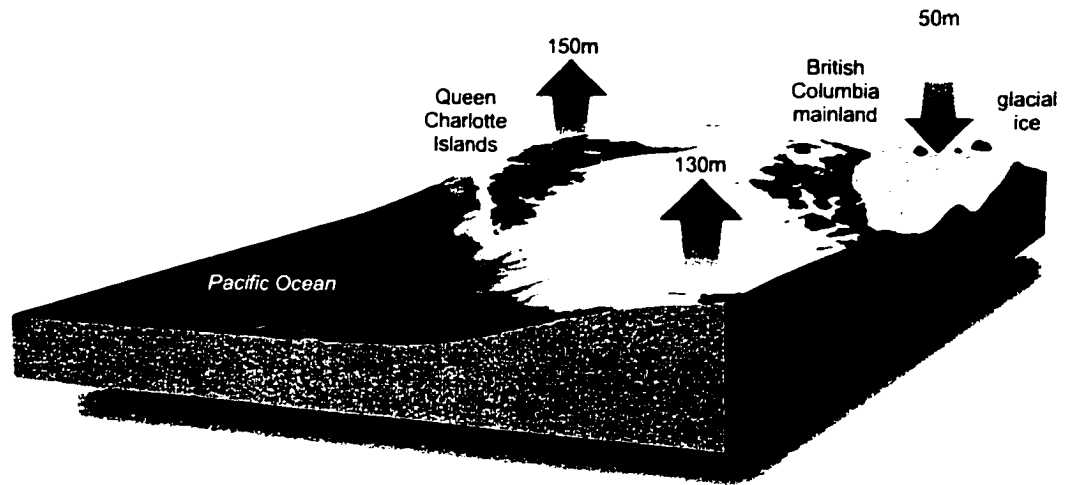


Figure 2. Schematic representation of relative eustatic and isostatic sea-level adjustments in the QCI region, showing ice atop a lithosphere that was relatively flexible, that combined to produce a complex and rapidly changing pattern of uplift and subsidence. The weight of ice sheets pushed the mainland down, while adjacent areas were uplifted, forming a peripheral bulge. Eustatic and isostatic adjustments resulted in relative sea-levels up to 120 m higher than present along the BC mainland, and more than 150 m lower than present in the adjacent QCI archipelago, located only 150 km offshore.

evolving landscapes as a glacially-induced forebulge developed in the region. These maps were derived from geo-statistical interpolation between known sample data interpreted from the habitat characteristics and age of molluscs collected from submarine grab samples (Fig. 3a), submarine cores (Fig. 3b) and raised beaches (Fig. 3a; high-stand deposits), sedimentological analysis of cores and high-stand deposits, published sub-bottom profiles, topographic and bathymetry records (Fig. 4). Geo-statistical interpolation modeling in 4-dimensional space was accomplished using a combination of geographic information systems (GIS) belonging to the ArcInfo® software family.

GEOLOGICAL AND PHYSIOGRAPHIC SETTING

The QCI archipelago is located at the western margin of the North American lithospheric plate (Fig. 1) where high heat-flow (averaging 70 mW m^{-2} ; Lewis *et al.*, 1991), implies low upper mantle viscosity, a relatively thin lithosphere (approximately 25 km, Sweeney and Seemann, 1991; Rohr and Currie, 1997), and hence short wave-length lithospheric response (Turcotte and Schubert, 1982). Rapid sea-level fall is observed at Kitimat and Hirsch Creek (Lowden and Blake, 1979), but postglacial rebound modeling for this region is not sufficiently complete to substantiate low upper mantle viscosity. However, an analogous region is the tectonically active southern British Columbia (BC), which is underlain by high heatflow, young oceanic lithosphere. Relative sea-level curves of Courtenay and Parksville, Vancouver Island, also indicate rapid sea-level fall – at least 100 m in only a few hundred years. Postglacial rebound modeling of these data indicates that a low upper mantle viscosity is required to explain the observations (James *et al.*, 2000). The implication is that the rapid sea-level fall experienced in the Kitimat –

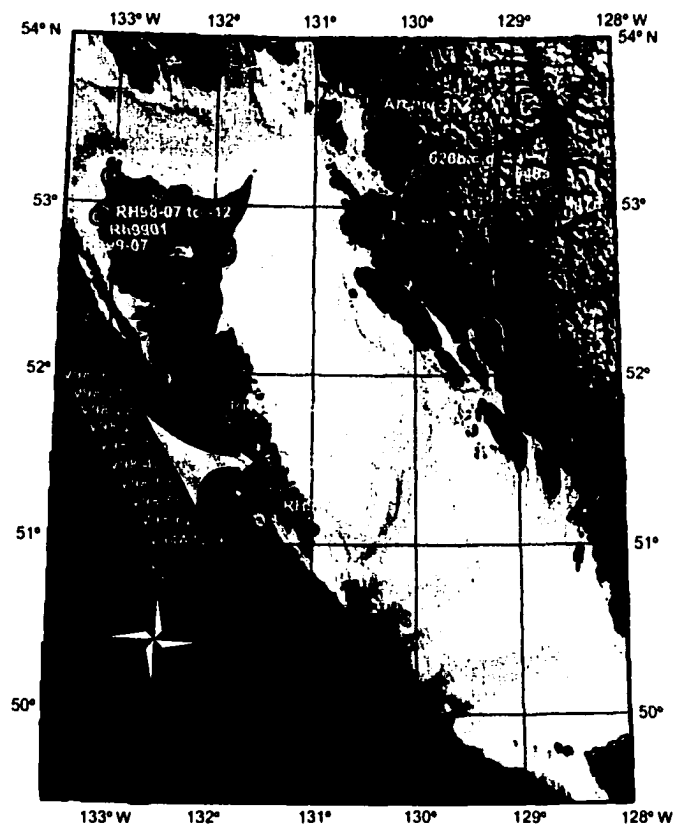


Figure 3a.

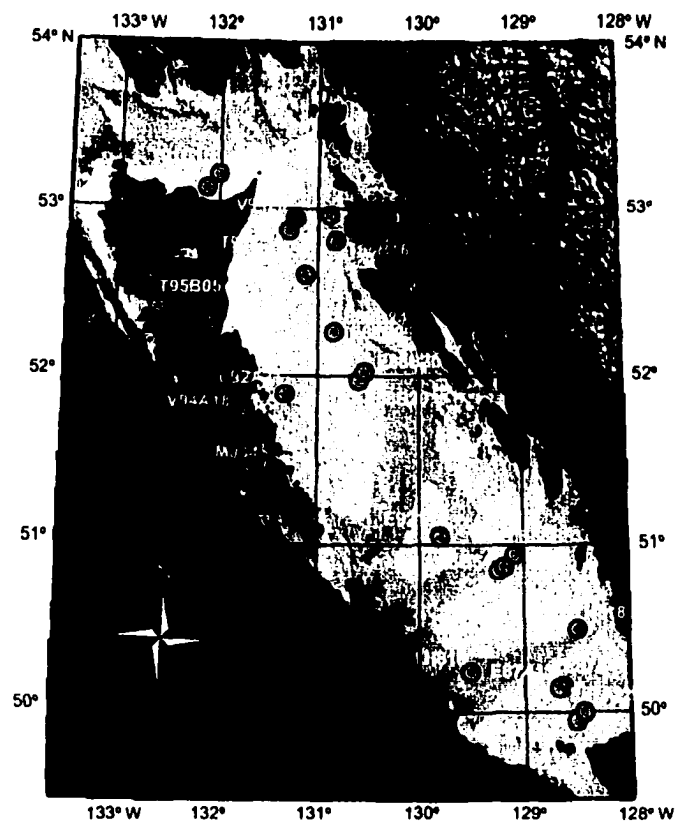


Figure 3b.

Figure 3a. Queen Charlotte Islands region high-stand and underwater grab sample locations.
 Figure 3b. Queen Charlotte Islands region submarine sediment core sample locations.

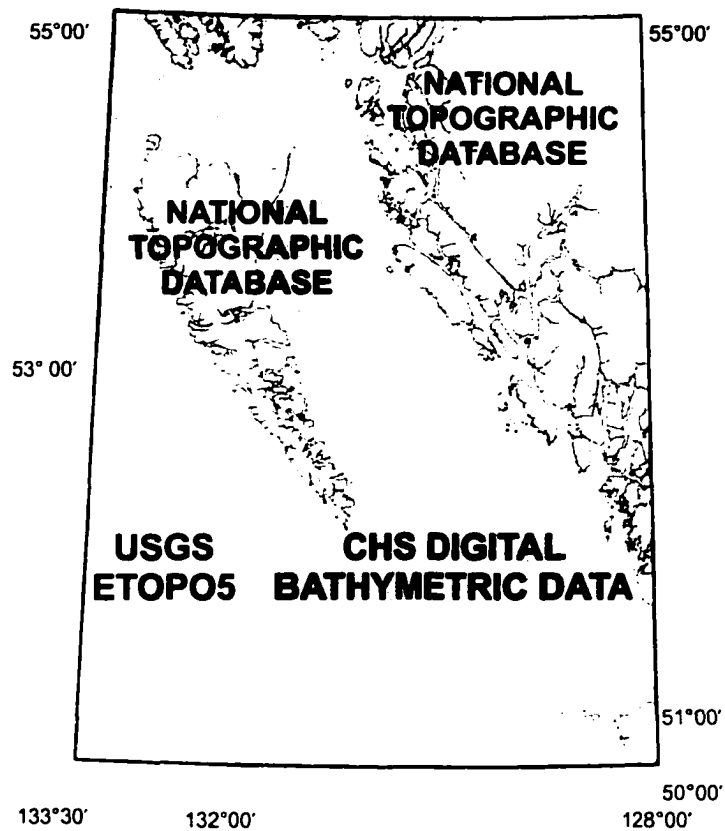


Figure 4. Digital elevation source data. National Topographic Data Base (NTDB) data provided topographic data, while Canadian Hydrographic Service (CHS) bathymetric digital data and USGS ETOPO5 provided sea-floor elevation data. NTDB data is accurate to between 25 and 100 m of true elevation, depending upon location, with a 90% probability. CHS data is vertically accurate to $\pm 1\%$ of depth to a maximum of ± 1 m, providing relatively high-resolution detail. However, because CHS data was limited at the onset of this research, missing areas were filled in with USGS ETOPO5. The resolution of USGS ETOPO5 is 5 arc-minutes in decimal degree latitude and longitude, which translates to between 9 and 10 km at the latitudes under study.

Hirsch Creek region, also indicates low upper mantle viscosity.

QCI are in a region of high seismicity caused by oblique, right lateral displacement of the Pacific plate along the bounding Queen Charlotte Fault (Fig. 1; Hyndman and Hamilton, 1993; Rohr *et al.*, 2000), a major transcurrent plate boundary extending from south of the QCI north-northwest along southeast Alaska to the Aleutian trench. Uplift and erosion of the western part of the islands is the result of compressive deformation associated with oblique convergence and underthrusting of the Pacific plate relative to the North American plate (Hyndman and Hamilton, 1991; Rohr and Dietrich, 1992; Hyndman and Hamilton, 1993; Rohr *et al.*, 2000).

The archipelago is separated from the mainland by a broad, shallow-water basin (Hecate Strait) 55 km to 155 km wide. Hecate Strait is floored by a thick succession (0 to 6 km) of clastic and volcanoclastic rocks of Tertiary age (Rohr and Dietrich, 1992) that accumulated in response to crustal thinning and subsidence during the Late Tertiary (Hyndman and Hamilton, 1991; Rohr and Dietrich, 1992; Hyndman and Hamilton, 1993).

A spine of Mesozoic plutonic rocks (Queen Charlotte Ranges) forms the western margin of Moresby Island (Anderson and Reichenbach, 1991; Fig. 1), the southernmost of the two major islands comprising QCI. The western shore is irregular, characterized by vertical sea cliffs more than 200 m high, rendering the littoral zone narrow to absent. Inlets are long, narrow, steep-sided and often sinuous. The adjacent continental shelf is extremely narrow, extending less than 5 km in the south to 30 km at the north end of the QCI (Barrie and Conway, 1996a).

The eastern side of Moresby Island is an archipelago of small islands having

sinuous shorelines with protected bays and estuaries and well-developed, low energy beaches. Relief is rugged but less precipitous than along the west coast, a function in part, of a change in bedrock geology to layered carbonate, volcanic and clastic rocks of Mesozoic age (Thompson *et al.*, 1991).

Late in the Tertiary, Graham Island, the northernmost island (Fig.1), was transected from southeast to northwest by a normal fault that dropped the eastern side of the island down, creating a sediment trap (basin) now filled by Late Tertiary, mainly non-marine clastic rocks. Today, the area east of the fault forms a broad “lowland” plain, within 150 m of sea-level, covered by a thick succession of unconsolidated fluvio-glacial sediments (Clague *et al.*, 1982a; Thompson *et al.*, 1991). In contrast to the steep, rugged coastline of western and northern Graham Island, the eastern coast, from Masset on the north coast to south of Tlell on the east coast, consists of over 120 km of broad, sand and gravel beaches (Clague and Bornhold, 1980).

During the LGM, between 21,000 and 15,000 ^{14}C years BP (Blaise *et al.*, 1990), valley glaciers, whose flow was controlled by underlying topography (Jackson and Duk-Rodkin, 1990), coalesced into a 2 km thick Cordilleran ice sheet that covered most of mainland BC and extended across Hecate Strait to the QCI where it coalesced with, and was deflected northward into Dixon Entrance, by mountain and piedmont glaciers on QCI (Sutherland-Brown, 1968; Barrie and Conway, 1999). Crustal subsidence beneath thick mainland ice was accompanied by uplift peripheral to it. This uplift (forebulge) affected Hecate Strait and the QCI, where ice was relatively thin or absent (Clague *et al.*, 1982b; Barrie *et al.*, 1993). Forebulge morphology varied directly with the thickness and lateral extent of the mainland ice sheet. Rapid ice retreat between 14,160 and 12,910 ^{14}C

years BP (Luternauer *et al.*, 1989a; Blaise *et al.*, 1990; Barrie *et al.*, 1991; Barrie and Conway, 1999) was accompanied by subaerial exposure of large areas of the continental shelf beneath southern Dixon Entrance, Hecate Strait, and QC Sound. With the exception of remnant ice in mountain valleys and cirques, the QCI region was ice-free by 13,500 to 13,000 ^{14}C years BP (McKenzie and Goldwaith, 1971; Mann and Hamilton, 1995; Clague *et al.*, 1982a; Barrie and Conway, 1999).

MATERIALS AND METHODS

Collecting methods

Key to this reconstruction modeling is the identification of intertidal molluscs. They are extremely sensitive indicators of sea-level change, salinity, temperature, sedimentation rate, and substrate type, making them valuable signatures of paleoenvironmental change. Molluscan fauna were sampled from submarine (drowned intertidal environments) and high-stand deposits.

Over 375 geo-referenced ^{14}C dates were obtained from high-stand beach deposits, underwater sediment cores and grab samples, and their fauna, flora, and lithology were analyzed in the context of published sub-bottom profiles for constraints on past sea-level. About 75 % of the marine cores showed evidence of uninterrupted benthic marine conditions or did not possess critical information, such as material sampled for dating. One raised beach sample (RH9901 – Kennecott Point) and four underwater grab samples (V98-24, V98-44-1, V98-44-2, V98-57) were ^{14}C dated recent or modern. Seventy-nine samples contained sufficiently well-constrained sea-level evidence to enable paleocoastline modeling for the period 14,250 to 8,750 ^{14}C years BP. However, three of those samples (T91C15-83, V94A15-133, V94A15-168) were not used in the final

iteration of the model because they were weakly constrained and implied crustal movement which contradicted that of other more rigorously constrained proximal data.

Submarine sediment cores (Fig. 3b) were sampled (4 cm^3) at regular intervals, screened using 0.71 mm mesh (medium sand) or 0.063 mm (silt/fine sand). Paleo-botanical and faunal material, if present, were collected, analyzed, identified, and paleoenvironmental habitat interpreted. Mollusc species were identified on the basis of hinge structure, characteristic lines and ridges on shell exterior, colour, thickness, curvature, fracture patterns, and comparison with mollusc shell collections and standard references (Cornwall, 1955; Dunnill, 1968; Abbott, 1974; Bernard, 1979; Morris *et al.*, 1980; Kozloff, 1996; Harbo, 1997). R.G.B. Reid (Department of Biology, University of Victoria) verified mollusc identification. Shell fragments too small or eroded to be identified by species were categorized as “undifferentiated bivalve” or “undifferentiated gastropod”. Shells were blotted and then weighed using an electronic digital scale to the nearest 0.1 gm. Selected intertidal mollusc specimens were chosen for ^{14}C AMS dating. Paleohabitat characteristics were based on present species’ habitat characteristics (Cornwall, 1955; Dunnill, 1968; Hart, 1973; Abbott, 1974; Bernard, 1979, 1983a, 1983b; Ricketts *et al.*, 1985; Bernard *et al.*, 1991; Coad, 1995; Kozloff, 1996; Harbo, 1997).

Sixty-five underwater grab samples, obtained by Josenhans *et al.*, (1998) from Juan Perez Sound, QCI (V98 grab samples; Fig. 3a) were wet-sieved using 6 and 3 mm mesh. Sample targets focused on fluvial features, river terraces, alluvial fans and deltas (Josenhans *et al.*, 1998:3-4). Shell material obtained from screening was provided to the author for analysis. Due to the nature of grab sampling, sedimentary records from individual sites were not available and samples included both living molluscs, shells of

those recently deceased, and shells of the same species dating back thousands of years. To ensure only non-modern molluscs were used in the study, all molluscan samples whose species depth range extended to, or beyond the sample depth, were considered modern – capable of living in the environment today, and therefore catalogued and weighed, but not utilized for further analysis. Intertidal species, which were sampled at depths beyond their normal range, but dated recent (the last few hundred years) or modern (e.g., V98-24, V98-44, V98-57), imply movement via biological (birds, hermit crabs) or geological (debris flow or slumping) means, and were removed from the study.

Twenty-three samples were taken from high-stand deposits located at Haines Creek, on west Graham Island, Mary Point on north Graham Island, Cape Ball on east Graham Island, Lockeport Estuary, upper Arrow Creek and George Bay on south Moresby Island, and McNeil River, Kitimat River, Hirsch Creek, and Port Simpson on the BC mainland (see Fig. 3a for sample site locations). Targeted sampling was based on a review of the literature, analysis of air photos, and discussion with individuals who had been in the region. The methods used were consistent with modern biomass survey methods sampled high-stand deposits at Haines Creek, Lockeport Estuary, Upper Arrow Creek, and George Bay. Bulk samples collected from these sites, with volumes ranging between 0.37 m^3 (Haines Creek) and 0.75 m^3 (Lockeport Estuary), were wet-sieved using 1 mm and 2 mm screens. All other high-stand deposit samples were obtained from previous research (see Table 1).

Estimations of sample elevation relative to current mean sea-level (msl) and used for paleogeographic reconstruction contain two components of sample elevation error, that associated with the present sample elevation and the error associated with accurately

Table 1: Radiocarbon dates and interpretations for Queen Charlotte Islands region

LAB NUMBER	SAMPLE NUMBER	LOCATION	ELEVATION	ELEVATION ERROR	DEPOSITION ELEVATION	RSL CHANGE	ISOSTATIC DISPLACEMENT	MATERIAL DATED	14C DATE	REFERENCE	MRC DATE	C14 SD
TO-4362	E9213-57	QC Sound	-109		0	-109		Terrestrial organics	7820	*	7820	70
GSC-2343	626d	McNeil River	3	+/-1m	-10	13	-49	<i>Clinocardium nuttalli</i>	9180	1	8780	150
TO-9312	RH98-04-150	Upper Arrow Creek	6	+/-1m	0	6	-42	<i>Protothaca staminea</i>	9600	*	8800	70
CAMS-18999	V94A12-93	Arrow Creek	12	sill @ +15m +/-1m	0	15	-51	spruce needle	8850	2	8850	70
CAMS-62537	RH9909-305	Haines Creek	2	+/-1m	0	2	-38	<i>Acmae mitra</i>	9390	*	8990	50
TO-9307	E88B29-121-1	Hecate Strait	-118	+/-5m	0	-118	82	<i>Olivella baetica</i>	9930	*	9130	90
GSC-3129	116e	Cape Ball River	5	+/-1m	18	-13	-23	terrestrial peat	9160	3	9160	90
RIDDL-1211	MP-1	Mary Point Location B	8	+/-3m	0	8	-44	<i>Saxidomus giganteus</i>	9560	4	9160	110
TO-9306	E88B29-74-1	Hecate Strait	-118	+/-5m	0	-118	82	<i>Saxidomus giganteus</i>	10000	*	9200	100
GSC-2425	548a	Kitimat River	30	+/-7m	-5	35	-82	coniferous wood	9300	1	9300	90
CAMS10836	M934-230	Matheson Inlet	-27	NA	0	-27	-20	<i>Pododesmus machrochisma</i>	9740	5	9340	60
RIDDL-1205	MP-2	Mary Point Location B	8	+/-3m	0	8	-55	<i>Saxidomus giganteus</i>	9850	4	9450	130
TO-4889	V9427-87	Hecate Strait	-68	+/-6m	-20	-48	1	wood	9480	*	9480	70
CAMS10834	M934-207	Matheson Inlet	-27	NA	0	-27	-20	<i>Pododesmus machrochisma</i>	9940	5	9540	70
TO-4890	V9427-142	Hecate Strait	-68	+/-6m	-20	-48	1	wood	9660	*	9660	70
CAMS10835	M934-219	Matheson Inlet	-27	NA	0	-27	-20	<i>Pododesmus machrochisma</i>	10070	5	9670	80
GSC-2492	447a	Hirsch Creek	98	+/-5m	-22	120	-167	wood	10100	1	9700	160
TO-1296	E88B29-91	Hecate Strait	-118	+/-5m	0	-118	71	<i>Olivella sp.</i>	10110	*	9710	70
TO-4405	T91C15-83	Dixon Entrance	-96	+/-5m	-20	-76	18	<i>Arthropoda cirrepedia</i>	10570	6	9770	90
CAMS10837	M934-238	Matheson Inlet	-27	NA	0	-27	-31	<i>Mytilus sp.</i>	10200	5	9800	60
TO-1256	E88B54-102	Goose Island Bank	-121	+/-1m	0	-121	63	<i>Spisula falcata</i>	10200	6	9800	80
TO-174	H818-245	Goose Island Trough	-192	+/-4m	-30	-162	104	<i>Balanus glandulus</i>	10230	7	9830	120
TO-1337	E88B30-118	Hecate Strait	-111	+/-1m	0	-111	53	<i>Modiolus rectus</i>	10240	*	9840	70
TO-3737	T91C20-217	Dixon Entrance	-33	+/-3m	0	-33	-25	unidentified marine bivalve	10250	*	9850	70
RIDDL-979	E87A23-25	Cook Bank	-94	+/-2m	0	-94	36	terrestrial peat	9940	8	9940	75
TO-173	H816-359	Outer Goose Island Trough	-284	+/-2m	-30	-254	196	<i>Nuculana cellulita</i>	10400	7	10000	80
CAMS9992	M934-246	Matheson Inlet	-27	NA	0	-27	-31	<i>Mytilus sp.</i>	10490	5	10090	80
CAMS-49628	V98-62-2	Juan Perez Sound	-55	+/-2	0	-55	-3	<i>Saxidomus giganteus</i>	10530	10	10130	40
CAMS-49629	V98-31-1	Juan Perez Sound	-65	+/-10	-5	-60	2	<i>Saxidomus giganteus</i>	10580	10	10180	40
GSC-3159	116f	Cape Ball	5	+/-1m	20	-15	-43	terrestrial peat	10200	3	10200	90
NA	E87A22-87	Cook Bank	-104	+/-6m	-10	-94	36	unidentified marine bivalve	10650	6	10250	80
RIDDL-983	E87A23-54	Cook Bank	-94	+/-2m	1	-95	32	wood	10290	8	10290	80
TO-3495	E92A21-142	Hecate Strait W	-116	sill @ -100 +/-2m	0	-100	-37	twig	10360	5	10360	80
NA	E87A22-121	Cook Bank	-104	+/-6m	0	-104	41	unidentified marine bivalve	10760	6	10360	140
NA	E87A13-172	Cook Bank	-140	+/-1m	-15	-125	62	unidentified marine bivalve	10760	9	10360	120
TO-3735	E92A21-123	Hecate Strait W	-116	sill @ -100 +/-2m	0	-100	37	unidentified marine bivalve	10780	*	10380	70
CAMS-49630	V98-40-1	Juan Perez Sound	-107	+/-2m	0	-107	44	<i>Saxidomus giganteus</i>	10780	10	10380	50
RIDDL-	E87A23-83	Cook Bank	-94	+/-2m	1	-95	32	wood	10400	8	10400	140
NA	E87A4-140	Cook Bank	-122	+/-2m	0	-122	59	wood	10430	9	10430	130
RIDDL-985	E87A23-93	Cook Bank	-94	+/-2m	1	-95	32	root	10470	11	10470	75
RIDDL-981	E87A23-40	Cook Bank	-94	+/-2m	0	-94	31	wood	10485	8	10485	70
NA	V94A18-481	Logan Inlet	-220	sill @ -80 +/-5m	0	-80	17	branchlet	10560	2	10560	70
CAMS-18602	V94A15-133	Huston Inlet	-85	sill @ -45m +/-5	0	-45	-18	wood	10630	2	10630	110
TO-1254	E88B53-87	Goose Island Bank	-133	+/-3m	-2	-131	68	<i>Macoma incongrua</i>	11030	6	10630	70
TO-1257	E88B54-179	Goose Island Bank	-121	+/-1m	0	-121	58	<i>Saxidomus giganteus</i>	11040	6	10640	80

Table 1 cont'd: Radiocarbon dates and interpretations for Queen Charlotte Islands region

LAB NUMBER	SAMPLE NUMBER	LOCATION	ELEVATION	ELEVATION ERROR	DEPOSITION ELEVATION	RSL CHANGE	ISOSTATIC DISPLACEMENT	MATERIAL DATED	14C DATE	REFERENCE	MRC DATE	C14 SD
RIDDL-984	E87A23-83	Cook Bank	-94	+/-2m	1	-95	32	wood	10650	8	10650	350
CAMS-18601	V94A11-88	Burnaby Strait	-111	+/-5m	0	-111	48	wood	10670	2	10670	60
TO-1342	E88B55-142	Goose Island Bank	-124	+/-1m	0	-124	61	<i>Zirfaea pilsbryi</i>	11120	6	10720	70
NA	V94A11-81	Burnaby Strait	-111	+/-5m	0	-111	48	<i>Mytilus sp</i>	11150	2	10750	60
CAMS-19005	V94A15-168	Huston Inlet	-85	sill @ -45m +/-5m	0	-45	-22	wood	10790	2	10790	80
CAMS-48155	V98-53-2	Juan Perez Sound	-120	+/-3m	0	-120	53	<i>Protothaca staminea</i>	11290	10	10890	50
CAMS-33932	T95B16-127	Hecate Strait	-114	+/-3m	-25	-89	22	wood	11030	6	11030	60
CAMS-54600	V98-21-1	Juan Perez Sound	-130	+/-1m	0	-130	63	<i>Saxidomus giganteus</i>	11450	#	11050	50
CAMS-47674	V98-22-1	Juan Perez Sound	-128	+/-1m	-2	-126	59	<i>Protothaca staminea</i>	11540	10	11140	50
CAMS-54601	V98-27-1	Juan Perez Sound	-122	+/-5m	0	-122	55	<i>Protothaca tenerrima</i>	11550	#	11150	50
CAMS-47675	V98-9-1	Juan Perez Sound	-125	+/-1m	0	-125	53	<i>Protothaca tenerrima</i>	11680	10	11280	50
CAMS-33927	T95B05-31	Rennell Sound	-152	+/-5m	-10	-142	70	wood	11290	6	11290	60
CAMS-49631	V98-55-1	Juan Perez Sound	-119	+/-5m	-2	-117	45	<i>Protothaca tenerrima</i>	11720	10	11320	50
TO-1336	E88B25-75	Hecate Strait	-109	+/-10m	0	-109	37	<i>Clinocandium nuttalli</i>	11750	6	11350	70
CAMS-26278	T95B16-136	Hecate Strait	-114	+/-3m	-25	-89	17	deciduous wood	11480	6	11480	60
CAMS-33928	T95B05-116	Rennell Sound	-152	+/-5m	-10	-142	55	wood	11820	6	11820	60
CAMS-33796	T95B05-244	Rennell Sound	-152	+/-5m	-10	-142	55	<i>Cooperella sp.</i>	12760	6	12360	60
TO-1255	E88B53-109	Goose Island Bank	-133	+/-3m	0	-133	37	worm tubes	12770	6	12370	90
CAMS-33929	T95B05-226	Rennell Sound	-152	+/-5m	0	-152	56	wood	12380	6	12380	60
GSC-3112	116g	Cape Ball	7	NA	20	-13	-83	terrestrial peat	12400	3	12400	100
TO-9308	E88B30-73-1	Hecate Strait	-111	+/-3m	0	-111	15	<i>Saxidomus giganteus</i>	13320	*	12520	100
TO-9309	E88B53-150-3	Goose Island Bank	-133	+/-3m	0	-133	37	<i>Balanus glandulus</i>	13340	*	12540	140
Beta-114464	Archer-1	Port Simpson	50	+/-2m	0	50	-146	<i>Saxidomus giganteus</i>	12970	12	12570	50
TO-77	H818-283	Goose Island Trough	-192	+/-4m	-30	-162	66	<i>Macoma nasuta</i>	13020	7	12620	80
Beta-114465	Archer-2	Port Simpson	50	+/-2m	0	50	-146	<i>Tresus nuttalli</i>	13040	12	12640	50
TO-9305	E88B54-80-43	Goose Island Bank	-121	+/-1m	0	-121	25	<i>Mytilus edulis</i>	13510	*	12710	100
CAMS-26282	T95B12-185	Hecate Strait	-77	NA	0	-77	-23	<i>Mytilus sp.</i>	13290	13	12890	60
TO-3492	T91C34-104	Dogfish Bank	-31	+/-2m	1	-32	-68	dwarf will plant	13190	14	13190	100
GSC-3711	H818-714	Goose Island Trough	-192	+/-4m	-30	-162	62	<i>Macoma nasuta</i>	13600	7	13200	150
TO-1335	E88B24-149	Hecate Strait	-144	+/-4m	0	-144	44	<i>Macoma nasuta</i>	13610	*	13210	80
GSC-3222	116h	Cape Ball	8	NA	20	-12	-94	organic	13700	3	13700	100
TO-3738	T91C34-119	Dogfish Bank	-31	+/-2m	1	-32	-74	terrestrial plant	13790	14	13790	150
TO-4888	V9423-126	Hecate Strait W.	-30	+/-7m	-25	-5	-101	<i>Cassidula reniforme</i>	14980	13	14180	110
GSC-3746	H818-271	Goose Island Trough	-192	+/-4m	-30	-162	56	unidentified marine bivalve	15200	7	15200	490

Note: Deposition Elevation refers to the elevation at which the sample was deposited, relative to sea-level at the time of deposition. RSL Change refers to the net change in the elevation of the sampled site relative to present mean sea-level (msl) and incorporates both isostatic and eustatic sea-level change. Sample locations whose elevation relative to present msl has risen subsequent to deposition, were allocated a negative RSL Change representing the amount sea-level must be dropped to reflect rsl at the time of deposition.

RSL change equals present elevation minus deposition elevation. Isostatic displacement equals RSL Change minus eustatic sea-level (Fairbanks, 1989) times (-1)

1 Lowden, J A and W. Blake, Jr., 1979, Geological Survey of Canada radiocarbon dates XIX: Geological Survey Paper 79-7, 58 p.

Table 1 cont'd: Radiocarbon dates and interpretations for Queen Charlotte Islands region

2. Josenhans, H.W., Fedje, D., Plenitz, R., and Southon, J., 1997, Early humans and rapidly changing Holocene sea levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada: *Science* 277, p. 71-74.
 3. Clague, J.J., Harper, J.R., Hebda, R.J., and Howes, D.E., 1982a, Late Quaternary sea levels and crustal movements, coastal British Columbia: *Canadian Journal of Earth Sciences* 19, p. 597-618.
 4. Southon, J.R., Nelson, D.E., Vogel, J.S., 1990, A record of past ocean-atmosphere radiocarbon differences from the northeast Pacific. *Paleoceanography* 5, p. 197-206.
 5. Josenhans, H.W., Fedje, D.W., Conway, K.W., Barrie, J.V., 1995, Post glacial sea levels on the western Canadian continental shelf. Evidence for rapid change, extensive subaerial exposure, and early human habitation: *Marine Geology* 125, p. 73-94.
 6. Barrie, J.V. and Conway, K.W., 2002, Rapid sea level change and coastal evolution on the Pacific margin of Canada, *Journal of Sedimentary Geology*, 150, p. 171-183.
 7. Lutemauer, J.L., Conway, K.W., Clague, J.J., Blaise, B., 1989b, Late Quaternary geology and geochronology of the central continental shelf of western Canada: *Marine Geology*, 89, p. 57-68.
 8. Lutemauer, J.L., Clague, J.J., Conway, K.W., Barrie, J.V., Blaise, B., and Mathewes, R.W., 1989a, Late Pleistocene terrestrial deposits on the continental shelf of western Canada: Evidence for rapid sea-level change at the end of the last glaciation: *Geology*, 17, p. 357-360.
 9. Barrie, J.V., 1991, Contemporary and relict titaniferous sand facies on the western Canadian continental shelf. *Continental Shelf Research*, 11, p. 67-79.
 10. Fedje, D.W. and Josenhans, H.W., 2000, Drowned forests and archaeology on the continental shelf of British Columbia, Canada: *Geology*, 28, p. 99-102.
 11. Barrie, J.V., Bornhold, B.D., Conway, K.W., Lutemauer, J.L., 1991, Surficial geology of the northwestern Canadian continental shelf. *Continental Shelf Research* 11, p. 701-715.
 12. Archer, D.J.W., 1998, Early Holocene landscapes on the northcoast of B.C. [abs.] 31st annual meeting Canadian Archaeological Association, Victoria, BC.
 13. Barrie, J.V. and Conway, K.W., Late Quaternary glaciation and postglacial stratigraphy of the northern Pacific margin of Canada. *Quaternary Research* 51, p. 113-123.
 14. Barrie, J.V., Conway, K.W., Mathewes, R.W., Josenhans, H.W., and Johns, M.J., 1993, Submerged Late Quaternary terrestrial deposits and paleoenvironment of northern Hecate Strait, British Columbia continental shelf, Canada: *Quaternary International*, 20, p. 123-129.
- * Previously unpublished, Geological Survey of Canada
- # Previously unpublished, Parks Canada

predicting the original elevation of sample deposition relative to msl. Recently sampled sites containing sample elevations based on differential GPS are the most accurate.

Submarine sediment core sample elevations include instrument and tidal range error (to a maximum of about 5 m; Clague and Bornhold, 1980). Prediction of sample deposition elevation relative to msl is constrained by geological and malacological evidence.

Mollusc species survive within restricted depth ranges relative to msl; the intersection of sampled molluscan depth tolerances within a given sample was used to constrain the deposition elevation relative to msl.

Dating methods

Radiocarbon dated samples used for paleogeographic reconstruction were restricted to those possessing a clear indication of deposition elevation relative to sea-level at that time. The intertidal zone encompasses four zones between lowest low tide and highest high tide. The uppermost horizon is located approximately 0.75 m above standard mean high water, the lowest zone, the low intertidal zone, is located at lowest low tide, approximately 0.5 m below stand mean lower low water. Many molluscs adhere to one particular zone. For example littorines, such as *Littorina sitkana*, and limpets including *Lottia digitalis*, and *Tectura persona*, as well as barnacles such as *Balanus glandulus* prefer the uppermost 'splash' zone (Ricketts *et al.*, 1985). The limpet *Acmaea mitra* prefers the intertidal zone between mean sea-level and -1 m. *Mytilus trossulus* inhabits the middle intertidal zone between mean sea-level and -5 m. The bivalves *Protothaca staminea* and *P. tenerrima* inhabit the middle intertidal to -10 m. Intertidal molluscan species, such as those listed above, that inhabit a narrow range within the intertidal zone, were chosen for ^{14}C AMS dating.

A number of errors are associated with radiocarbon dates, including: radiocarbon chronologies, marine reservoir correction factors, and plateaus in radiocarbon calibration curves. To ensure consistency between dates obtained from a variety of labs over the last thirty years, the dating methodology was reviewed for all dates and a marine reservoir correction factor (MRCF) of 800 years (Southon *et al.*, 1990; Clague, written communication, 2001) was applied to all ^{14}C shell dates. Shell dates that were corrected for natural-, sample preparation-, and sputtering-fractionation to a base of $\delta^{13}\text{C}=0$ o/oo have a built-in MRCF of about 410 years. Ages reported to a fractionization base of $\delta^{13}\text{C}=-25$ o/oo do not have a built-in MRCF and thus require the full 800-year adjustment. However, reservoir age varies both temporally and spatially along the BC coast, though how it varies is not yet known. Thus, although error is inevitably built into such an assumption, the same MRCF of 800 years has been used throughout the region. Further, plateaus in radiocarbon dates, particularly between 10,000 and 13,000 ^{14}C years BP (Stuiver *et al.*, 1998) are a source of error and have not been addressed in this paper.

Relative sea-level, eustatic sea-level, and crustal displacement

Relative sea-level observations were plotted against time for eight selected geographic areas (Fig. 5). Figure 6 shows Queen Charlotte Islands/Hecate Strait subregions corresponding to those depicted in relative sea-level plots. Relative sea-level curves were drawn for geographic subregions where sufficient data exists over the time interval studied. Relative sea-level plots depict differences in the sea-level data between subregions and also variations within subregions. For example, on the BC mainland relative sea-level fell rapidly between 9,000 and 10,000 ^{14}C years BP, whereas about 75 km to the west in northern Hecate Strait, relative sea-level rose during the same interval.

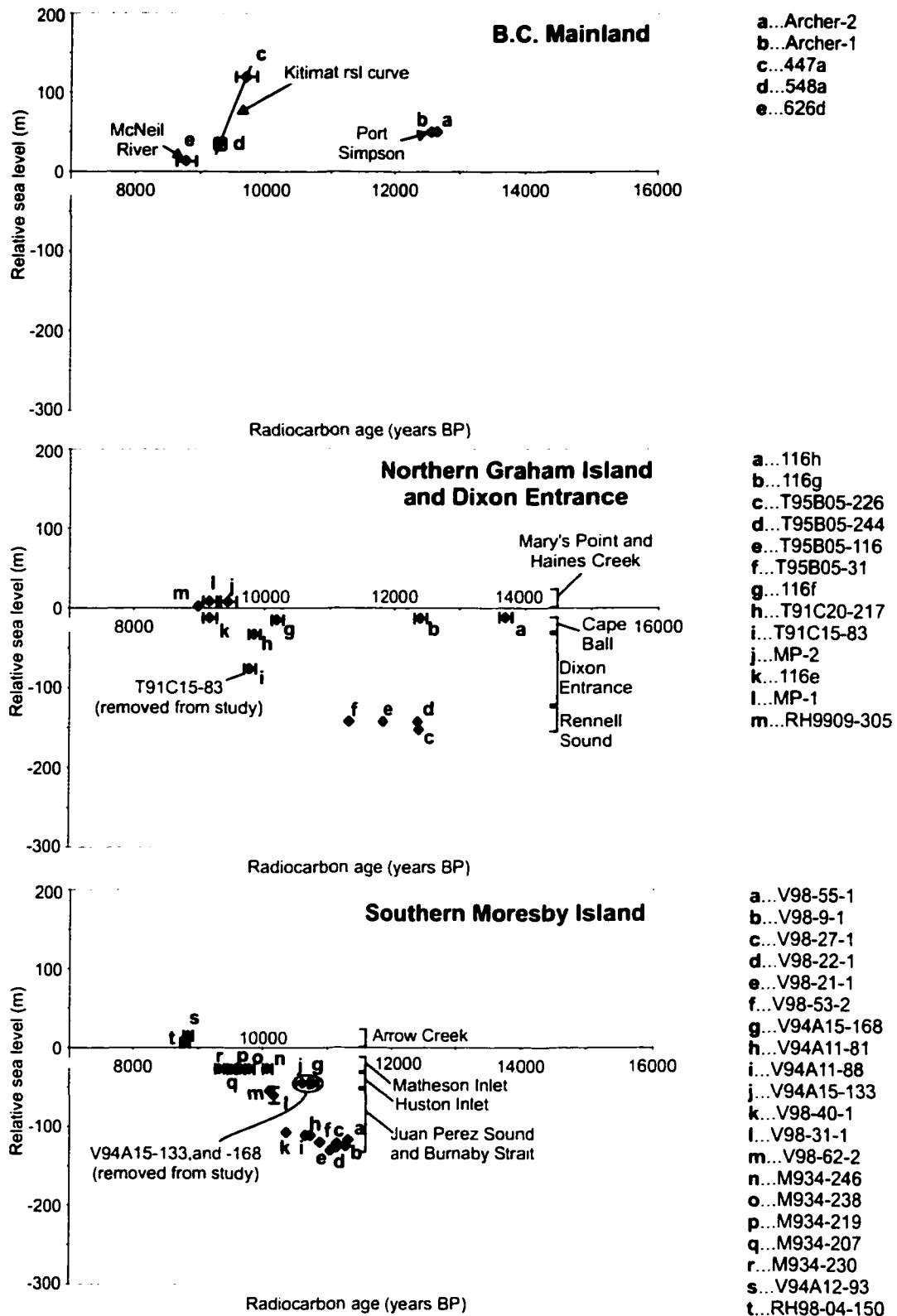


Figure 5a. Relative sea-level observations at northern Hecate Strait, western central Hecate Strait, and central Hecate Strait, with corresponding sample numbers. Observations whose error range falls outside the size of the data point are shown with error bars.

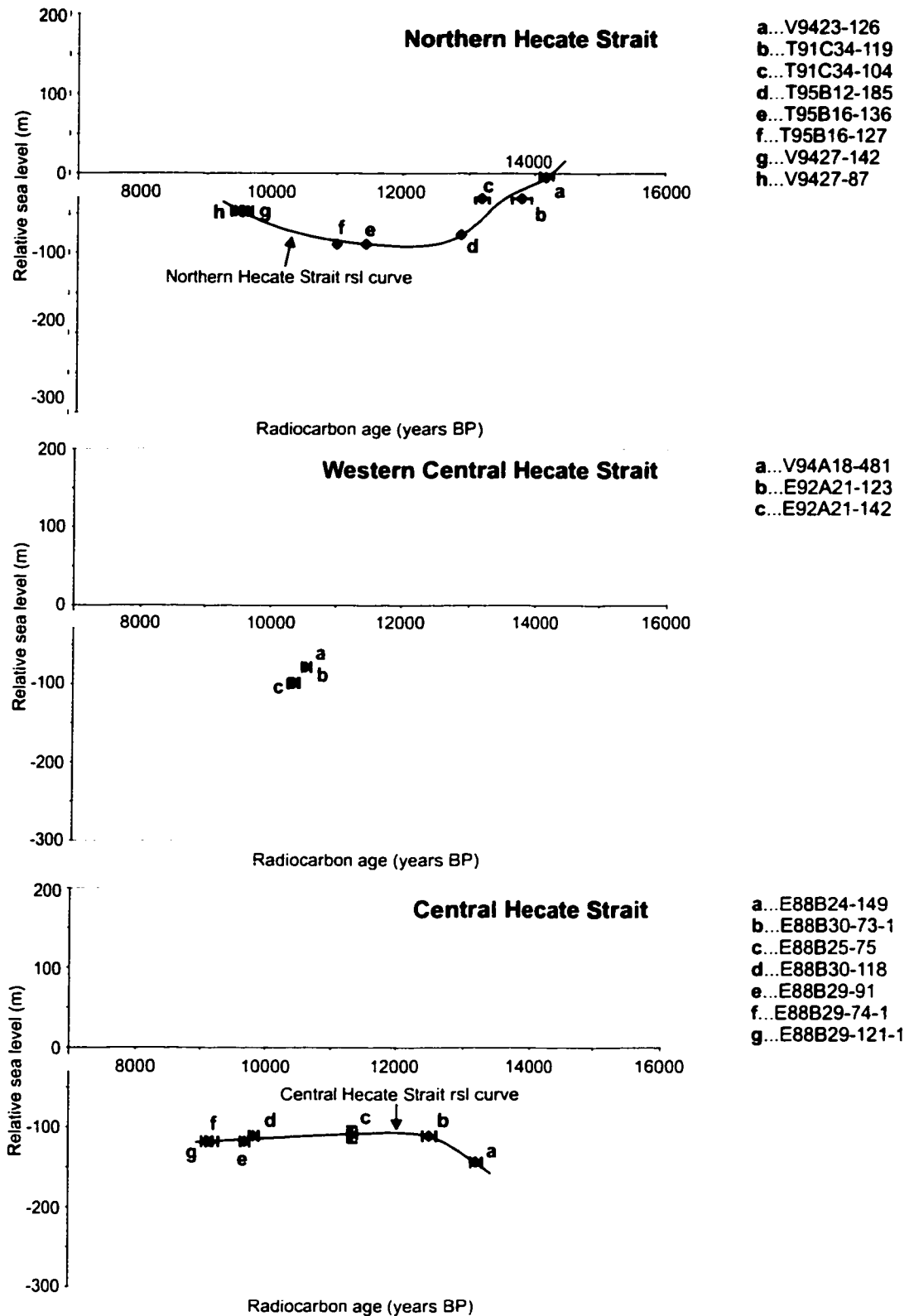


Figure 5b. Relative sea-level observations at BC mainland, northern Graham Island and Dixon Entrance, and southern Moresby Island with corresponding sample numbers. Data points that are inconsistent with other observations on northern Graham Island and southern Moresby Island are identified. Observations whose error range falls outside the size of the data point are shown with error bars.

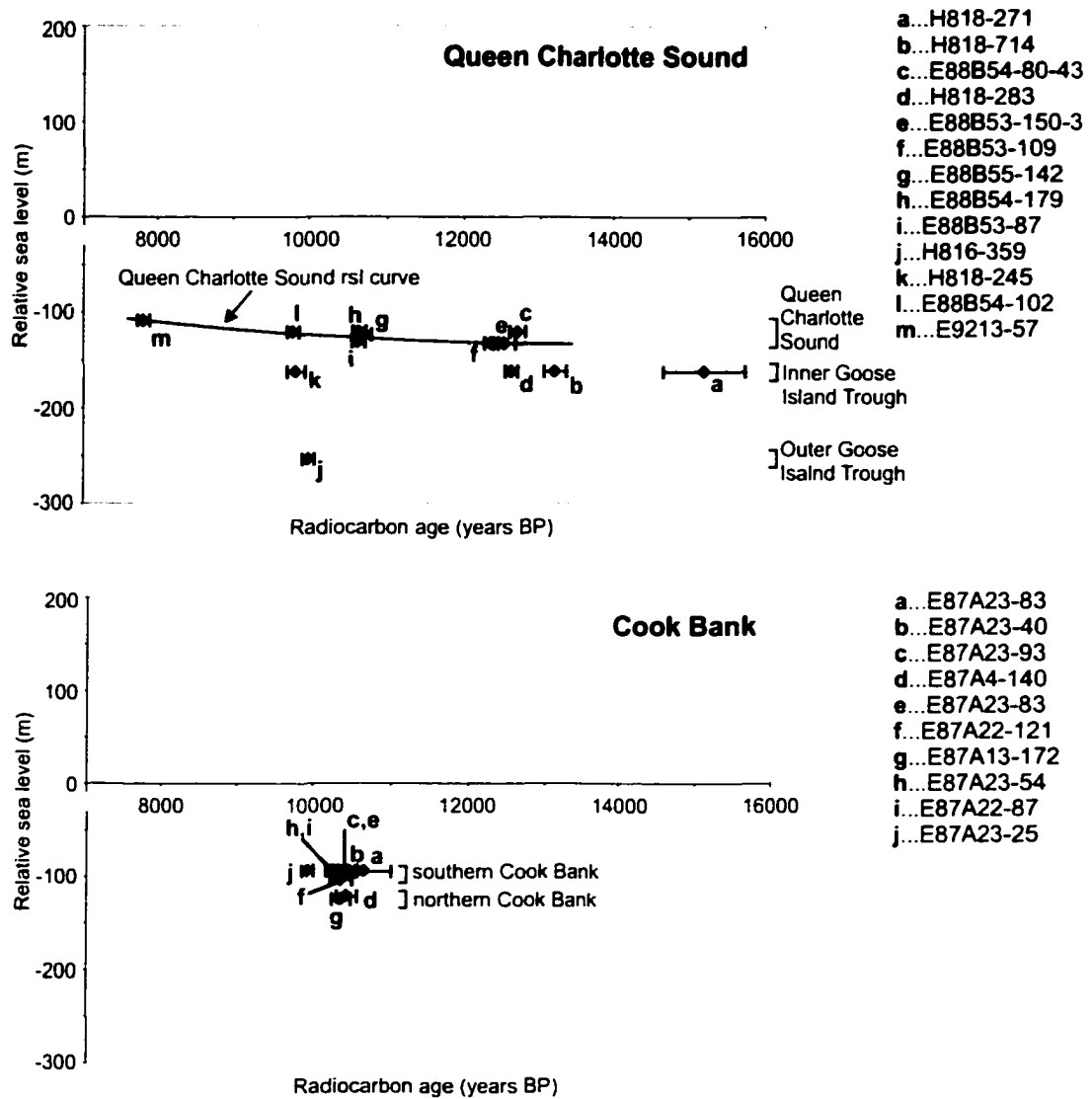


Figure 5c. Relative sea-level observations at Queen Charlotte Sound and Cook Bank with corresponding sample numbers. Observations whose error range falls outside the size of the data point are shown with error bars.

BC Mainland

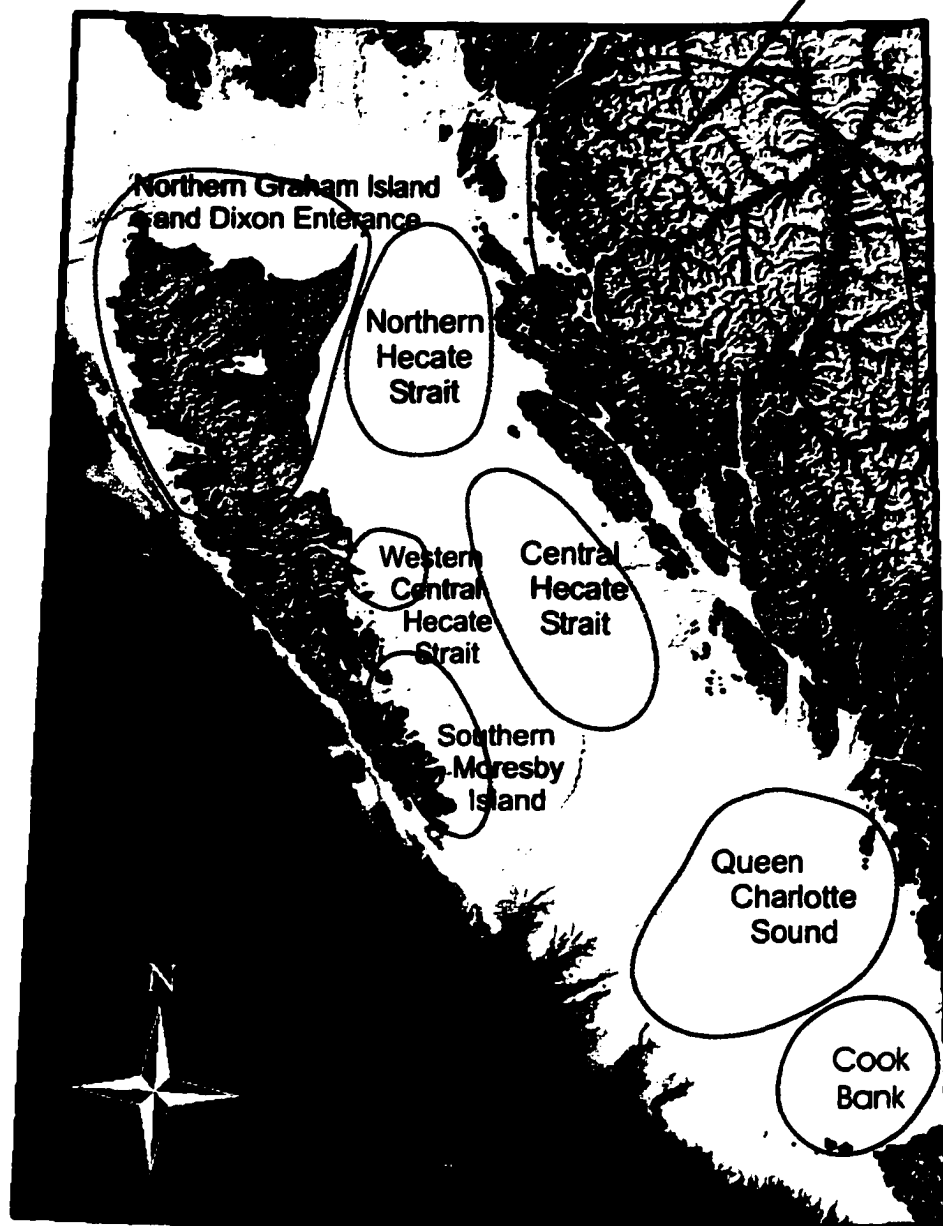


Figure 6, Queen Charlotte Islands/Hecate Strait region divided into subregions corresponding to relative sea-level plots in figure 5.

The relative sea-level plot for northern Hecate Strait shows falling sea-level subsequent to 14,000 ^{14}C years BP, followed by rising relative sea-level after $\sim 12,000$ ^{14}C years BP. The relative sea-level plot for central Hecate Strait demonstrates rising relative sea-level after 14,000 ^{14}C years BP followed by gradual relative sea-level fall. The relative sea-level plot for Queen Charlotte Sound, on the other hand, illustrates gradual relative sea-level rise over the same interval. Variations within subregions are also apparent, for example, the QC Sound subregion plot illustrates significant sea-level variation between Inner and Outer Goose Island Trough.

The Barbados sea-level curve (Fairbanks, 1989) is assumed to represent eustatic sea-level. The Barbados sea-level curve provides a continuous and detailed record of sea-level change during the last deglaciation based on radiocarbon dated Caribbean reef-crest coral *Acropora palmata*. Other far-field sites, including Bonaparte Gulf, Huon Peninsula and Tahiti provide estimates of eustatic sea-level change between 115 and 135 m (Milne *et al.*, 2002), implying an error in total eustatic sea-level change of up to 20 m during glacial maximum. However, during the time of study (between 8,000 and 14,000 ^{14}C years BP), far-field site sea-level observations are very similar. Despite errors associated with ambiguities resulting from calculating sea-level with a coral based record, the Barbados sea-level curve is considered a good approximation of eustatic sea-level change (Peltier, 2002).

Figures 7a and 7b illustrate two sea-level change scenarios; the first (Fig. 7a) depicts a falling relative sea-level curve, along with the Barbados sea-level curve. The resultant crustal displacement curve was produced by subtracting the Barbados sea-level curve from the relative sea-level curve, and taking its negative. Figure 7b illustrates the

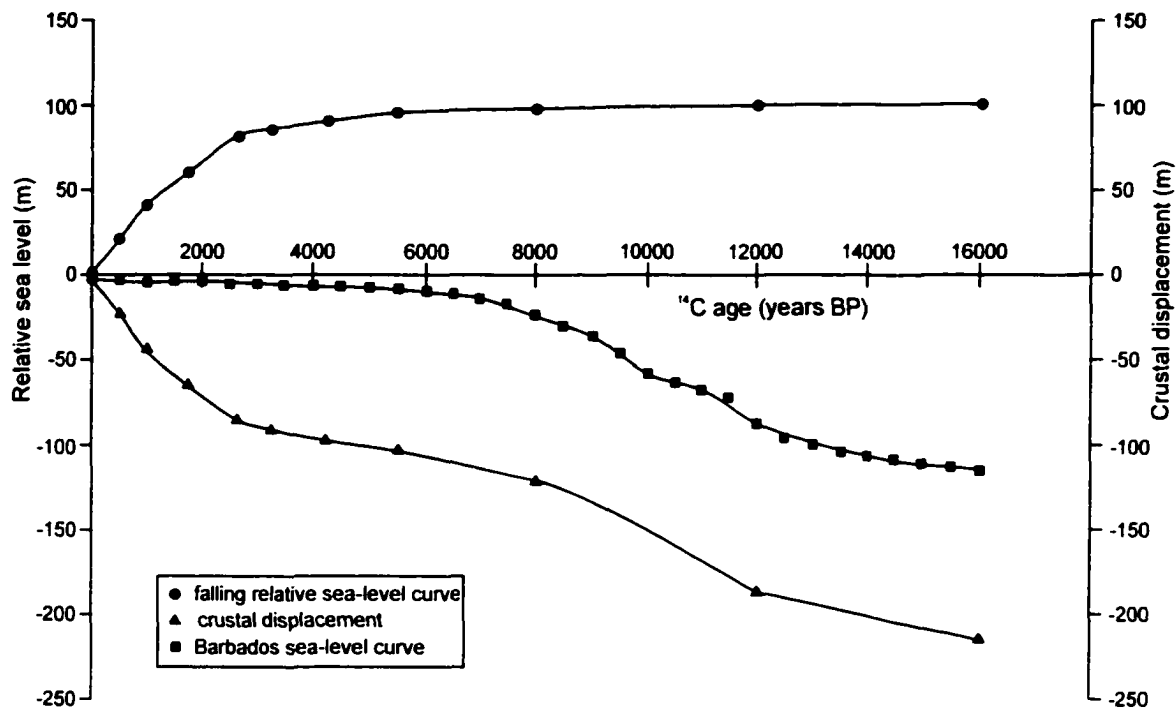


Figure 7a.

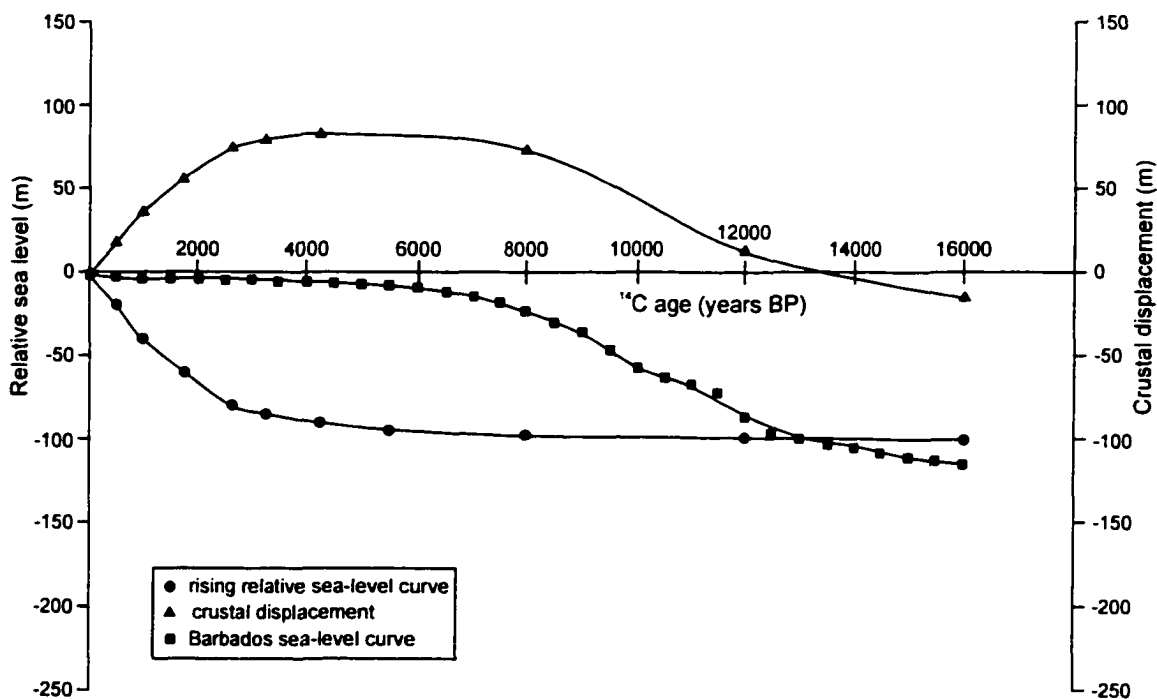


Figure 7b.

Figure 7a, Falling relative sea-level curve plotted with Barbados sea-level curve (Fairbanks, 1989), which is assumed to represent eustatic sea-level. The resultant crustal displacement curve was produced by subtracting the Barbados sea-level curve from the relative sea-level curve, and taking its negative.

Figure 7b, Rising relative sea-level curve plotted with Barbados sea-level curve (Fairbanks, 1989) and illustrates the same methodology to derive crustal displacement.

same methodology used to derive the crustal displacement from a rising sea-level curve. This methodology was used to derive crustal displacement data, which was used with geostatistical interpolation to generate isostatic crustal displacement maps. For example, positive crustal displacements correspond to a raised crust, or forebulge, in crustal displacement maps.

Geostatistical interpolation

A digital elevation model (DEM) was produced for present day QCI region generated from the most current CHS bathymetric and National Topographic Data Base (NTDB) topographic digital data (Fig. 4). Dated samples were used to indicate change in elevation relative to msl through time. Sample locations that have risen over time were given positive msl change values, while locations that have decreased in elevation were given negative msl change values. Geo-statistical interpolation techniques within ESRI's ArcGRID® GIS were used to infer elevation change over the entire mapped area between known sample data to generate *elevation change* surface grids for selected time intervals. A second surface grid, *current elevation*, was generated based on the present day DEM. Map algebra was used to overlay the two input surface grids – *elevation change* and *current elevation* to produce a third, output coverage called the *sum elevation* grid, which depicts the net change in relative sea-level and land-surface at selected time intervals. The resultant models, represented as paleogeographic reconstruction maps, were created at 500-year intervals from 14,250 to 9,750 ¹⁴C years BP, and over an 1,000-year interval from 8,750 to 9,750 ¹⁴C years BP.

In order to isolate isostatic crustal displacement, eustatic sea-level change (Fairbanks, 1989) was removed from sample “deposition elevation” to produce “isostatic

displacement". Geo-statistical interpolation was then performed on these data to infer isostatic crustal displacement between sample points, producing isostatic crustal displacement maps for each modeled time interval. Cross-sections of isostatic crustal displacement were created by drawing a line across the isostatic crustal displacement coverages from the northwest to the northeast corner of the region. The resulting profile of elevation change for each mapped interval provides a time series of portrayed changes in crustal elevation from Dixon Entrance to Cook Bank.

The *Spline* interpolator method was used to infer information around known sample points in 4-dimensional space. This method was chosen above the Inverse Distance Weighted (IDW) interpolation technique. IDW interpolation assumes that influence of each data point diminishes with distance. This method further assumes that sampling points are sufficiently dense to incorporate local variation throughout the region modeled. If sample points are limited or uneven, the method may insufficiently interpolate the modeled surface (Philip and Watson, 1992). Data used from the QCI region is relatively sparse, but is well constrained, in both space and time. For these reasons, the *Spline* interpolation technique was chosen. Further, the *Spline* interpolation method permitted tuning of the model to incorporate a relatively flexible lithosphere and varied surface topography (Franke, 1982; Mitrovica and Mitrovica, 1988), evident in the divergence of relative sea-levels throughout the region as ice loading varied during and subsequent to glaciation. The *Spline* interpolation technique requires that the modeled surface pass through all data points and possess a minimum curvature. It is conceptually similar to fitting a rubber sheet through a set of sample points. This method assumes sample data latitude, longitude and elevation are measured to a high degree of

confidence. Although sample data possess associated error in both space and time, these were minimized by comparing measurements with present DEM and using geological, biological, and geographical methods to constrain deposition elevation interpretations.

The *Spline* method requires that either a *tension* or *regularized* option be specified. The *tension* method modifies the minimum curvature criterion to alter the “stiffness” of the rubber sheet. The larger the value, the more reduced the stiffness of the rubber sheet. The amount of tension applied to the model in this research, which dictated the amount of surface flexure, was varied until a *weight* parameter of fifteen was selected. The relatively high weight value of fifteen implies an flexible surface (crust), and may substantiate suggestions by Sweeney and Seaman (1991) and Lewis *et al.* (1991) of a very thin lithosphere. When values near fifteen were used, the resulting landscape was consistent with sample data. For example, sampled molluscan assemblages that required sheltered water habitats, were situated in protected bays as opposed to open ocean conditions or isolated in paleolakes.

Erosion or sediment deposition in the QCI region subsequent to the LGM, which would significantly affect the accuracy of the DEM, is limited (Amos *et al.*, 1995; Barrie and Conway, 1996a, 1996b, 2002). Rapid erosion of about 2 m per year over approximately 9,000 years (Barrie and Conway, 2002) has been documented along the east-coast of Graham Island (Clague and Bornhold, 1980; Barrie and Conway, 1996b). To adjust for this erosion, the east-coast of Graham Island was extended eastward 18 km, by raising the elevation of terrestrial Cape Ball sample sites by 20 m (the present depth of the water 18 km seaward of Cape Ball). Limited deposition subsequent to the LGM is evident throughout most of the QCI region (Barrie *et al.*, 1991; Barrie and Conway,

2002) and does not affect the reconstructions to any great extent.

Geo-statistical interpolation using the Spline technique assumes a smooth surface curvature between known data points. Therefore, tectonic faulting which may have occurred subsequent to the time of sample deposition, as well as a rapidly plunging continental shelf off the west-coast of Moresby Island, is not manifest in the model. Further, it is assumed that data characteristics obtained from each sample accurately reflect the characteristics of the surrounding area. Modeled paleogeography was compared with geologically and biologically identified habitat characteristics of sampled data to ensure consistency and isolate evidence of transport. Because paleogeographic reconstruction between sample points has been interpolated, the greater the number of sample locations, the more accurately the map represents the paleogeography of the specified time interval. The confidence in the accuracy of mapped areas possessing no data points is limited; the model provides the best estimate of conditions within the constraints of available data. The validity of the model will be ascertained by its ability to predict paleotopography as more data becomes available. These data can be “plugged into” the existing model to improve accuracy.

Shell taphonomy

The use of mollusc shells to interpret paleoenvironments and productivity is based on the assumption that modern analogues of identified species provide a proxy for productivity and habitat characteristics of Late Pleistocene-Early Holocene species. However, veracity of interpretation is dependent on whether the sample is representative of the original environment; representation is dependent upon shell preservation, deposition and redistribution. During the deglaciation period following maximum

glaciation, low salinities caused by rapid melting of ice sheets combined with high sediment influx would have promoted shell preservation. However, during warm periods, when mean annual temperatures were higher than today, shell preservation would have lessened, especially in high-energy environments and during periods of rapid sea-level change (Flessa and Kowaleski, 1994; Claassen, 1998). In these cases, shell samples under-represent the true productivity of the sampled locale.

To ensure sampling of natural ‘life assemblage’ shell deposits, as opposed to ‘death or mixed assemblages’, careful attention was paid to shell articulation and orientation, and matrix composition. Preservation in ‘life position’ is the prime consideration for ruling out post-mortem transport, whereas, disarticulation, size sorting and significant wear and breakage are indicators of transport (Raup and Stanley, 1978). Shell deposit redistribution, evidence of slump deposits in some underwater grabs and cores, is probably the result of flash floods, earthquakes, storm surges, excessively high tides and bioturbation. Transported deposits were evident by the presence of spurious intertidal deposits within benthic assemblages. Sampled sites containing evidence of transport were not included in the modeling process. Further, due to the lack of sedimentological evidence, paleogeographic interpretation of underwater grabs was limited.

RESULTS

Relative sea-level observations

Table 1 lists the radiocarbon dates obtained for all samples used in this research from youngest to oldest, along with associated elevation and error data. Relative sea-level observations are plotted against time (Fig. 5) for eight geographic “areas” within the

region. Three areas contain sufficient data over the time interval studied to permit the derivation of sea-level curves. These are depicted in figure 8a. Data listed in Table 1 was used for geo-statistical interpolation to interpolate isostatic crustal displacement, create paleogeographic maps, and interpret regional paleocoastlines.

Regional paleocoastlines were influenced by eustatic, glacio-isostatic, and to a lesser extent hydro-isostatic sea-level and crustal adjustments during the modeled interval. Figure 2 provides a schematic representation of relative eustatic and isostatic sea-level adjustments in the QCI region. It shows the influences of glacial ice, atop lithosphere that was relatively thin (Sweeney and Seeman, 1991) and flexible (Lewis *et al.*, 1991; James *et al.*, 2000), all factors combining to produce a complex and rapidly changing pattern of uplift and subsidence. The weight of these ice sheets pushed the mainland down, while adjacent areas were uplifted, forming a peripheral bulge. Figures 9h through 9n are isostatic crustal displacement maps that illustrate temporal changes in the magnitude and extent of crustal displacement as a glacial forebulge developed in Hecate Strait and QC Sound. The forebulge occurs where crustal displacement is positive, and is delimited by a white line showing zero crustal displacement. Cross sections of isostatic crustal displacement are illustrated in figure 8b. They show ice retreat after 14,000 and prior to 12,640 ^{14}C years BP in Dixon Entrance generated 50 m of uplift in northern Hecate Strait, which is evidenced by a reduction in subsidence and a falling relative sea-level in northern Hecate Strait shown in figure 8a. Figure 8b further illustrates that the inflection point of the isostatic crustal adjustment curves remained essentially constant after 12,750 ^{14}C years BP implying a fixed ice-front position until at least 10,000 ^{14}C years BP.

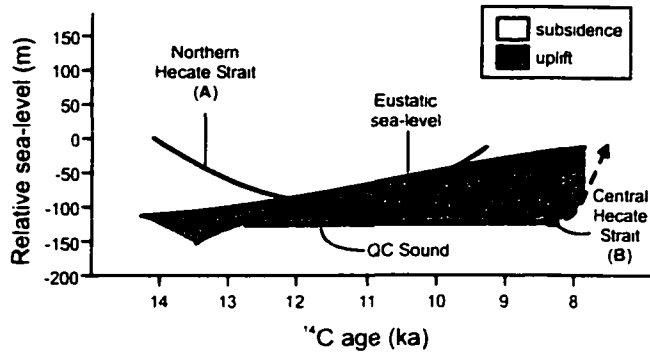


Figure 8a.

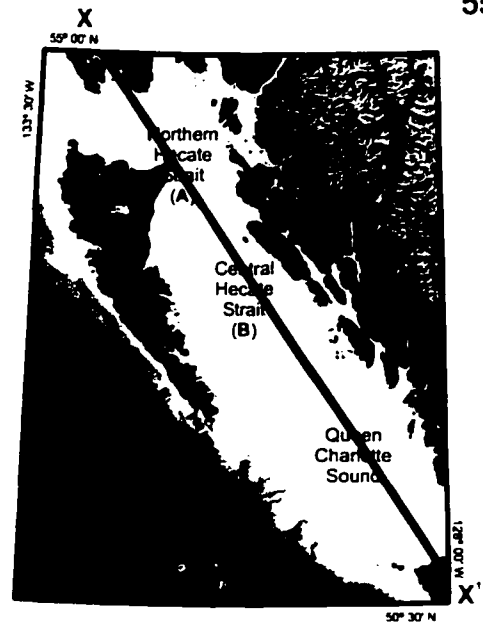


Figure 8c.

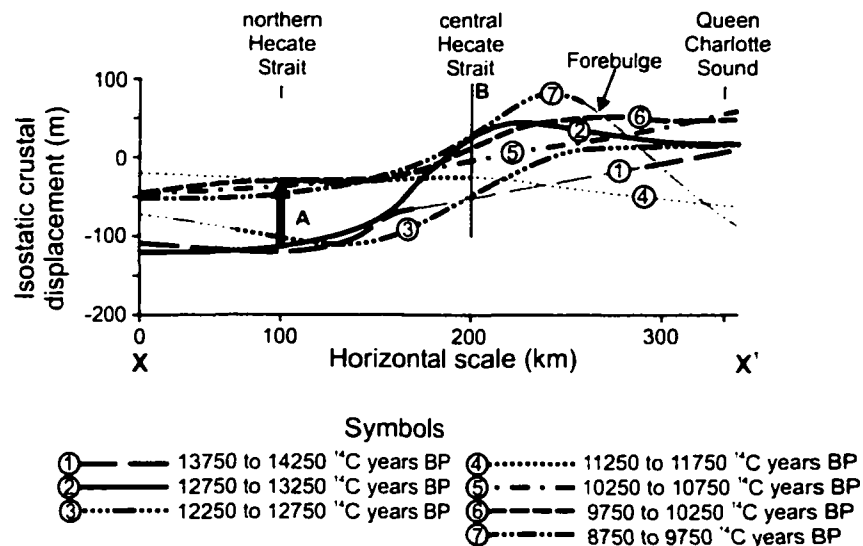


Figure 8b.

Figure 8a, Relative sea-level curves for northern and central Hecate Strait and the Barbados sea-level curve (Fairbanks, 1989), which is assumed to represent eustatic sea-level, derived from Table 2. Dashed lines are inferred from malacological and geological interpretations of samples.

8b, A time-series of cross-sections of isostatic crustal displacement curves, from northwest Dixon Entrance to southeast Queen Charlotte Sound for all mapped intervals (Figs. 7h through 7n) indicating forebulge position. Greyed lines indicate limited data. Glacial ice retreated from Dixon Entrance subsequent to the interval 12,750 to 13,250 ¹⁴C years BP illustrated by more than 50 m of uplift (line A) at northern Hecate Strait. The inflection point (line B) of the isostatic crustal displacement curves remained essentially constant after 12,750 ¹⁴C years BP, implying a fixed ice-front and continued ice presence on the BC mainland until at least 10,000 ¹⁴C years BP.

8c, Cross-section position, red line (X to X') shows the position of the cross-section used in figure 6b.

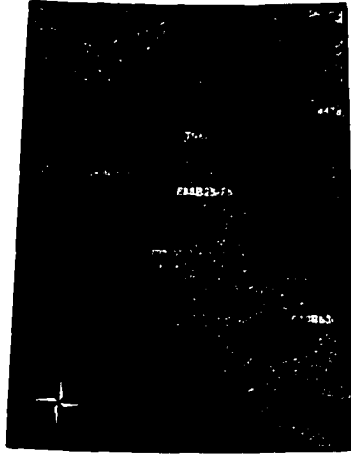


Figure 9d, Paleogeographic reconstruction of the QCI region between 11,250 and 11,750 ^{14}C years BP

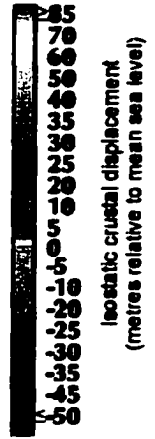


Figure 9k, Isostatic crustal displacement map of the QCI region between 11,250 and 11,750 ^{14}C years BP

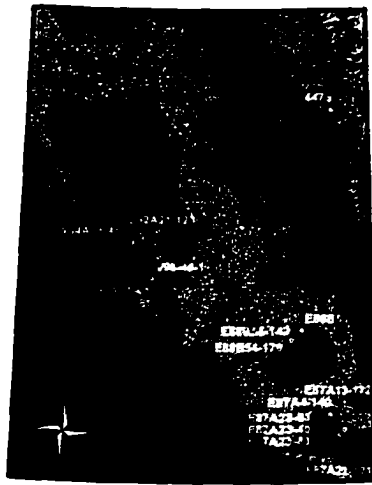


Figure 9e, Paleogeographic reconstruction of the QCI region between 10,250 and 10,750 ^{14}C years BP

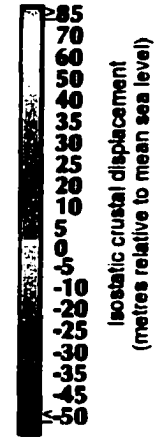


Figure 9l, Isostatic crustal displacement map of the QCI region between 10,250 and 10,750 ^{14}C years BP

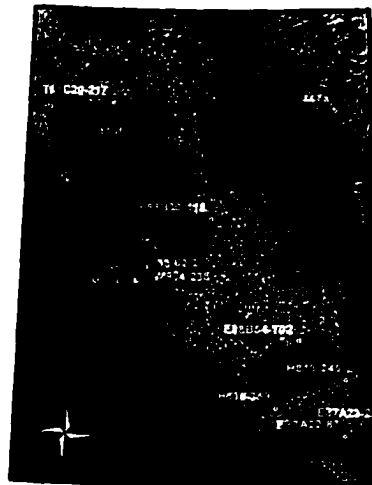


Figure 9f, Paleogeographic reconstruction of the QCI region between 9,750 and 10,250 ^{14}C years BP

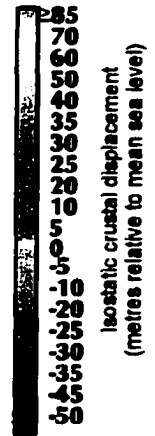


Figure 9m, Isostatic crustal displacement map of the QCI region between 9,750 and 10,250 ^{14}C years BP

Figures 9a through 9g illustrate paleogeographic reconstructions for mapped intervals. Lowered eustatic sea-level combined with uplift permitted terrestrial conditions to develop on two emergent coastal plains. One extended east from QCI and remained subaerially exposed until at least 9,130 ^{14}C years BP. A second southern coastal plain emerged in the QC Sound and Cook Bank region, and remained emergent until at least 7,820 ^{14}C years BP (Table 1). Despite rising eustatic sea-levels, deflection of ice to the north and east resulted in isostatic uplift, closing northern Hecate Strait by ~11,750 ^{14}C years BP, creating a narrow, elongate, shallow water embayment that opened southward into QC Sound (Fig. 9d). The resulting landbridge connected the BC mainland and QCI, likely facilitating faunal, floral and potential land-based human migration.

Paleoenvironmental results

Table 2 provides sedimentological, facies, sea surface and depositional environment interpretations based on geological and malacological sample analysis for all samples listed in table 1. These interpretations are described below on the basis of findings within each mapped interval, and used to support paleogeographic and crustal displacement interpretations.

13,750 to 14,250 ^{14}C years BP

The isostatic crustal displacement map (Fig. 9h) and crustal displacement cross-section (Fig. 8b) for this period illustrates the development of a forebulge in the QC Sound region. Terrestrial conditions appeared on two emergent coastal plains; one extended eastward from the QCI and the other developed in QC Sound. Crustal downwarping of 74 m on Dogfish Bank, 101 m in western Hecate Strait, and 94 m at

Table 2: Inferred Paleoenvironment of Radiocarbon dated samples

SAMPLE #	LONGITUDE	LATITUDE	DEPOSIT TYPE	SEDIMENT	FACIES	SEA-SURFACE TEMP (°C)	DEPOSITION ENVIRONMENT OF DEPOSITION ELEVATION
626d	-129.98	54.21 H		sandy mud	SM	-10	shallowing marine to intertidal
RH98-04-150	-131.46	52.46 H		shelly gravely sand	SM	+4 to +14	0 gravel, sand, protected bay/estuary, fresh water influx
V94A12-93	-131.45	52.46 L		soft gtyja	SM	0	marine transgression
RH9909-305	-133.10	53.94 H		sand coarse gravel	SM	+4 to +14	0 protected outer coast
E88B29-121-1	-130.59	52.97 S		laminated fine sand, shell	SM	+1 to +25	0 sandy, sheltered bay/estuary
116e	-131.88	53.70 H			T	18	terrestrial
MP-1	-132.57	54.05 H		gravel, cobbles, with shell lenses	SM	+2 to +21	0 mud gravel bay/estuary
E88B29-74-1	-130.59	52.97 S		fine bedded sand, heavy mineral-rich	SM	0	sandy mudflat estuary
548a	-128.64	54.10 H		foreset bedded silty sand & gravel	D	-5	deltaic shoreline
M934-230	-131.47	52.46 S		muddy shelly sandy gravel	SM	-2 to +14	0 sand, mud, rock intertidal
MP-2	-132.57	54.05 H		gravel, cobbles, with shell lenses	SM	+2 to +21	0 mud gravel bay/estuary
V9427-87	-131.12	53.60 S		coarse sand/shell	SM	+4 to +17	-20 sand, gravel low intertidal
M934-207	-131.47	52.46 S		muddy shelly sandy gravel	SM	-2 to +14	0 sand, mud, rock intertidal
V9427-142	-131.12	53.60 S		interbedded mud & fine sand	SM	+4 to +17	-20 protected low intertidal
M934-219	-131.47	52.46 S		muddy shelly sandy gravel	SM	-2 to +14	0 sand, mud, rock intertidal
447a	-128.60	54.05 H		foreset bedded sand & gravel	SM	-22	sand, mud low intertidal
E88B29-91	-130.59	52.97 S		laminated fine shelly sand	SM	+1 to +25	0 sand, sheltered intertidal
T91C15-83	-132.01	54.21 S		poorly sorted coarse sandy shelly gravel	SM	-20	drowned spit platform
M934-238	-131.47	52.46 S		muddy shelly sandy gravel	SM	-2 to +14	0 sand, mud, rock intertidal
E88B54-102	-129.19	51.87 S		well-sorted med. shelly sand	SM	+4 to +24	0 sandy protected intertidal
H818-245	-128.49	51.49 S		fine to med sandy mud	SM	+3 to +12	-30 shallow quiet-water bay
E88B30-118	-130.53	53.02 S		laminated fine sand, shell	SM	0	intertidal
T91C20-217	-132.13	54.12 S		sandy clast-supported coarse gravel, shell	SM	0	intertidal
E87A23-25	-128.44	51.00 S		well-sorted mineral-rich fine sand, minor shell	SM	+3 to +18	0 mud, sand, gravel exposed intertidal
H816-359	-129.51	51.24 S		silty mud bedded with fine sand & shell	SM	-1 to +14	-30 subtidal
M934-246	-131.47	52.46 S		gravely sandy mud	SM	0	brackish marine
V98-62-2	-131.46	52.49 U		fine gravel to coarse sand lag	SM	0	mud gravel intertidal
V98-31-1	-131.41	52.45 U		minor gravel lag, shell & cobbles	SM	+2 to +14	-5 mud gravel intertidal
116f	-131.88	53.74 H			T	20	terrestrial
E87A22-87	-128.52	50.95 S		irregular bedded gravel, mud, sand	SM	-1 to +6	-10 mud, rock intertidal, cool
E87A23-54	-128.44	51.00 S		well-sorted coarse sand & gravel	SM	+1 to +9	1 rocky heavy surf beach, cool
E92A21-142	-131.32	52.89 S		silty clay, mud, plant & wood	L	0	brackish lacustrine
E87A22-121	-128.52	50.95 S		gravely sand	SM	0	sand, mud, rock quiet bay/estuary
E87A13-172	-128.63	51.15 S		laminated mineral-rich fine silty sand, shell	SM	+1 to +7	-15 nearshore
E92A21-123	-131.32	52.89 S		med sandy silty, pebbles & shell	SM	-3 to +15	0 rock, sand, mud intertidal
V98-40-1	-131.40	52.46 U		subangular gravel, fine silty sand, organics	SM	0	mud, sand, gravel intertidal
E87A23-83	-128.44	51.00 S		well-sorted interbedded silt/sand, plant	T	1	terrestrial
E87A4-140	-128.67	51.14 S		well-sorted mineral-rich fine sand	SM	0	intertidal transition
E87A23-93	-128.44	51.00 S		fluvially deposited paleosol	T	1	terrestrial

Table 2 cont'd: Inferred Paleoenvironment of Radiocarbon dated samples

SAMPLE #	DEPOSIT TYPE	SEDIMENT	FACIES	SEA-SURFACE TEMP (°C)	DEPOSITION ENVIRONMENT OF DEPOSITION ELEVATION
E87A23-40	-128.4425	51.00 S	well-sorted coarse sandy gravel, charcoal, wood	T/SM	+1 to +9 0 rocky heavy surf beach, cool, land proximal
V94A18-481	-131.7064	52.78 S	interbedded fine sand, organic-rich silt	L/SM	0 brackish
V94A15-133	-131.28	52.29 S	dark-grey sandy mud	SM	0 brackish
E88B53-87	-129.08	51.94 S	coarse sandy gravel, shell	SM	-2 to +16 -2 rock, sand, gravel protected bay/estuary
E88B54-179	-129.19	51.87 S	pea gravel	SM	+4 to +24 0 sandy protected intertidal
E87A23-83	-128.44	51.00 S	well-sorted interbedded silt/sand, plant	T	1 terrestrial
V94A11-88	-131.40	52.44 S	muddy sandy gravel	SM/T	0 fluvial
E88B55-142	-129.25	51.85 S	indurated fissile, mudstone	SM	-1 to +25 0 low intertidal hard-packed clay
V94A11-81	-131.40	52.44 S	interbedded mud/sand	SM	0 fluvial to marine transgression
V94A15-168	-131.28	52.29 S	bedded silt	SM/L	0 brackish
V98-53-2	-131.40	52.49 U	muddy gravel	SM	+2 to +9 0 mud, sand, gravel protected bay
T95B16-127	-130.82	53.80 S	interbedded sand/mud	SM	-25 delta foreslope
V98-21-1	-131.40	52.49 U	muddy gravel	SM	+4 to +16 0 mud, sand, gravel protected bay/estuary
V98-22-1	-131.40	52.49 U	angular pebble, cobbles	SM	+4 to +14 -2 mud, sand, gravel low intertidal protected bay/estuary
V98-27-1	-131.40	52.49 U		SM	+4 to +14 0 mud, gravel protected bay
V98-9-1	-131.39	52.49 U	silty sandy gravel	SM	+4 to +14 0 sand, gravel intertidal
T95B05-31	-132.60	53.40 S	bioturbated sandy mud, laminations	SM	-10 alluvial to marine transgression
V98-55-1	-131.41	52.49 U	gravel lag, cobbles	SM	+4 to +19 -2 mud, sand, gravel intertidal
E88B25-75	-131.97	53.24 S	poorly sorted laminated gravel/sand	SM	+2 to +19 0 sand, gravel sheltered intertidal
T95B16-136	-130.82	53.80 S	interbedded muddy sand, terrestrial organics	SM	-25 delta foreslope
T95B05-116	-132.60	53.40 S	bioturbated sandy mud	SM	-10 alluvial to marine transgression
T95B05-244	-132.60	53.40 S	well-sorted laminated fine sand/silt	SM	-10 alluvial to marine transgression
E88B53-109	-129.08	51.94 S	laminated muddy sand, shell	SM	0 rocky low intertidal bay/estuary
T95B05-226	-132.60	53.40 S	bioturbated sandy mud	SM	0 alluvial to marine transgression
116g	-131.88	53.74 H		T	20 terrestrial
E88B30-73-1	-130.54	53.02 S	laminated fine sand, shell	SM	0 mudflat/estuary
E88B53-150-3	-129.08	51.94 S	fine sand/barnacle	SM	0 intertidal rocky shored bay/estuary
Archer-1	-130.43	54.54 H	silty shelly sand, gravel, cobbles	SM	+2 to +15 0 sand, mud, gravel intertidal protected bay/estuary
H818-283	-128.49	51.49 S	gravely muddy shelly sand	SM	-30 irregularly flushed sandy shallow water
Archer-2	-130.43	54.54 H	silty shelly sand, gravel, cobbles	SM	+2 to +15 0 sand, mud, gravel intertidal protected bay/estuary
E88B54-80-43	-129.19	51.87 S	well-sorted shelly sand	SM	+4 to +24 0 sand protected water
T95B12-185	-130.88	53.96 S	fine sand, subangular pebbles	SM	+1 to +20 0 sand, rock intertidal
T91C34-104	-131.30	53.87 S	organic-rich laminated fine sandy silt	T	1 treeless tundra-like landscape
H818-714	-128.49	51.49 S	muddy silt and fine sand, shell	SM	-30 irregularly flushed sandy shallow water
E88B24-149	-130.84	53.28 S	muddy fine laminated sand/shell	SM	+1 to +15 0 mudflat, high sediment influx
116h	-131.88	53.74 H	<i>in situ</i> bryophyte	T	20 terrestrial
T91C34-119	-131.30	53.87 S	organic-rich laminated fine sandy silt	T	1 treeless tundra-like landscape
V9423-126	-131.23	53.94 S	laminated fine-grained sediments		-25 cold-water, nearshore
H818-271	-128.49	51.49 S	gravely sandy mud, shell	SM	+1 to +16 -30 sand, silt shallow water

S submarine sediment core; U underwater grab; H highstand; SM shallow marine; T terrestrial; D deltaic; L lacustrine

Cape Ball on eastern Graham Island, was more than compensated by a eustatic sea-level drop of 106 m (Fairbanks, 1989) creating a coastal plain which extended to the middle of Hecate Strait, thereby significantly expanding the landmass of QCI (Fig.9a). Subaerial exposure of ice-free terrain is confirmed by cold-climate treeless tundra-like terrestrial evidence found in core T91C34, which dates to $13,790 \pm 150$ ^{14}C years BP (Barrie *et al.*, 1993; Table 1) and terrestrial bryophytes from Cape Ball which date to $13,700 \pm 100$ ^{14}C years BP (116h, GSC-3222; Clague *et al.*, 1982b). Sample deposition elevation of +20 m was used for Cape Ball terrestrial evidence; a higher elevation would result in the coastal plain extending farther and east. Foraminifera, found in laminated fine-grained sediments in core V94-23 suggest a cold-water, nearshore environment existed in northwest Hecate Strait at $14,180 \pm 110$ ^{14}C years BP (Barrie and Conway, 1999).

Farther south, sedimentological and malacological evidence from core H818, together with published sub-bottom profiles from the Goose Island Trough region, indicate sand was rapidly deposited to generate an irregularly flushed estuary or shallow lagoon (Table 2). Unlike northern Hecate Strait, which was undergoing crustal downwarping (Fig. 8b), this region experienced uplift of approximately 56 m (Fig. 9h); when combined with 106 m of eustatic sea-level fall, the net sea-level fall at this site was 162 m above msl at $15,200 \pm 490$ ^{14}C years BP (Luternauer *et al.*, 1989b).

12,750 to 13,250 ^{14}C years BP

Figure 8b illustrates northward migration of the forebulge into Hecate Strait by $12,750^{14}\text{C}$ years BP, while the BC mainland and Dixon Entrance remained subsided (Figs. 9b and 9i). This resulted in eastward expansion of the northern coastal plain almost to the BC mainland.

At Port Simpson on the BC mainland, glaciomarine clays deposited by retreating ice sheets (Clague, 1985; Archer, 1998) indicate the weight of ice sheets caused crustal subsidence to exceed the 100 m of eustatic sea-level fall (Fairbanks, 1989) resulting in relative sea-levels at least 50 m higher than present (Figs. 9b, 9i). Seventy-one km south southwest of Port Simpson, at site T95B12 in eastern Hecate Strait (now at 77 m water depth), eustatic sea-level fall of 100 m (Fairbanks, 1989) outstripped 23 m of crustal subsidence to generate a sand-rock intertidal environment by 12,890 $\pm$ 60 ^{14}C years BP (Barrie and Conway, 1999; Tables 1 and 2). Lithological and malacological evidence, including the presence of edible intertidal molluscan species *Macoma calcaria*, *Macoma inquinata* and *Mytilus* sp., supports this interpretation. Relatively cool sea-surface temperatures (-3 $^{\circ}\text{C}$ to +15 $^{\circ}\text{C}$) persisted along the mainland prior to 12,890 ^{14}C years BP, after which sea-surface temperatures warmed (+1 $^{\circ}\text{C}$ to +20 $^{\circ}\text{C}$) to levels more consistent with those of today (Richard E. Thomson, written communication, 2001; Table 2).

At Dogfish Bank (T91C34), 29 km to the southwest, terrestrial conditions persisted at 13,190 $\pm$ 100 ^{14}C years BP (Barrie *et al.*, 1993; Table 1); lowered eustatic sea-level combined with 68 m of crustal subsidence produced 32 m of relative sea-level fall. The coastline near Dogfish Bank probably extended more northeastward than that shown in figure 9b; subsequent erosion has likely consumed a coastal plain that extended north to Rose Spit on northeast Graham Island. A mudflat, conducive to colonization by edible molluscan species, developed in central Hecate Strait (E88B24-149; Table 2) as melting ice sheets deposited large quantities of sediment into an outwash plain as seas regressed. The presence of intertidal *Macoma nasuta*, which lives in muddy sand and possesses a high tolerance for stale, sediment-rich, irregularly flushed lagoonal water;

and intertidal *Mytilus* species, which is tolerant to high sediment influx, substantiate these interpretations.

In Goose Island Bank and Cook Bank, crustal uplift combined with eustatic sea-level fall maintained the southern coastal plain (Fig. 9b). In Goose Island Trough, core H818-714 (sampled at a present water depth of -192 m) provides evidence of 162 m of relative sea-level fall and 62 m of crustal uplift. *Macoma nasuta* is present, consistent with the development of a shallow-water sandy estuary or lagoon receiving meltwater sand and silt (Table 2; Fig. 9b). Core E88B54-80, sampled at a present water depth of 121 m from Goose Island Bank, 64 km to the south-southeast of core H818, supports this interpretation. The mollusc *Mytilus trossulus*, which dates to 12,710 $\pm$ 100 ^{14}C years BP (Table 1), colonized an intertidal, high sediment influx, well-sorted shelly-sand beach.

12,250 to 12,750 ^{14}C years BP

Northward migration of the forebulge is portrayed in figure 9j indicating ice retreat from Dixon Entrance prior to this interval. The two coastal plains persist (Fig. 9c), although a minimum terrestrial sample elevation input for Cape Ball results in a more limited coastal plain east of Graham Island than would be expected.

At Cape Ball, terrestrial peat (116g) and buried stumps demonstrate terrestrial conditions at 12,400 $\pm$ 100 ^{14}C years BP (Clague *et al.*, 1982b; Table 1); the consequence of continued crustal subsidence (83 m). At Port Simpson on the BC mainland continued crustal subsidence (146 m) maintained a productive intertidal beach environment within a quiet bay or estuary (50 m above current sea-level), colonized by numerous edible molluscan species.

The balance of the region experienced crustal uplift that exceeded 96 m of

eustatic sea-level fall (Fairbanks, 1989). The intertidal bivalve *Saxidomus giganteus*, and charcoal and wood found at a water depth of –111 m in central Hecate Strait (E88B30-73) suggest the presence of a mudflat-floored estuary there at 12,520 $\pm$ 100 ^{14}C years BP (Tables 1 and 2).

At Rennell Sound on the west coast of Graham Island, dated wood (12,380 $\pm$ 60 ^{14}C years BP; Barrie and Conway, 2002; Table 1) and the marine bivalve *Cooperella* sp. (12,360 $\pm$ 60 ^{14}C years BP; Barrie and Conway, 2002; Table 1) obtained from well-sorted fine sand with silt and mud laminations (T95B05), indicate relative sea-level fall of approximately 142 m.

On Goose Island Bank, malacological analysis of a fine sand containing abundant barnacle sampled at 133 m water depth, indicates the presence of an intertidal sand- and rock-shored bay or estuary from 12,540 $\pm$ 140 ^{14}C years BP (E88B53-150) to 12,370 $\pm$ 90 ^{14}C years BP (E88B53-109; Barrie and Conway, 2002; Tables 1 and 2). In Goose Island Trough, core H818-283 sampled at a present depth of –192 m, corroborates continued uplift with associated large sediment influx; presence of the intertidal mollusc species *Macoma nasuta*, supports the interpretation of an irregularly flushed, shallow water, sandy estuary or lagoon at 12,620 ^{14}C years BP (Luternauer *et al.*, 1989b; Tables 1 and 2).

11,250 to 11,750 ^{14}C years BP

Figures 9d and 9k show uplift in QCI, Hecate Strait and QC Sound combined with lowered eustatic sea-level (87 m; Fairbanks, 1989) to permit continued presence of the two coastal plains. Data for the BC mainland is limited, but subsidence is suggested in this region because of evidence of subsidence prior to 12,250 and subsequent to 10,250

^{14}C years BP. Hecate Strait closed (Fig. 9d), joining the QCI to mainland BC, creating a coastal basin, previously named “Hecate Sea” by Patterson *et al.* (1995). At the head of Hecate Sea, in 114 m of water, core T95B16-136 marks the foreslope of a post-glacial meltwater delta, constructed during sea-level low-stand and early transgression (Barrie and Conway, 2002). Deciduous wood and terrestrial organic matter concentrations sampled from dark-grey bedded to laminated fine-to-medium sandy mud, was AMS ^{14}C dated to $11,480 \pm 60$ ^{14}C years BP (Barrie and Conway, 2002; Table 1). These data together with published sub-bottom profiles from across the site area indicate deposition occurred along a delta foreslope in water depths of approximately 25 m (Barrie and Conway, 2002; Table 2).

South of core T95B16, in central Hecate Strait, poorly sorted gravel and sand in core E88B25, taken at a depth of 109 m, contains the intertidal mollusc *Clinocardium nuttallii*, evidence that an intertidal sand and gravel beach developed in central Hecate Strait by $11,350 \pm 70$ ^{14}C years BP (Barrie and Conway, 2002; Tables 1 and 2). Relict deltas and alluvial plains on the northeast coast of Graham Island (Clague and Bornhold, 1980; Barrie *et al.*, 1991), which formed during marine regression or early transgression when sediment loads overwhelmed coastal erosive processes, confirm the existence of a broad coastal plain north and east of QCI.

At Rennell Sound on the west-coast of Graham Island, isostatic uplift (70 m) resulted in a relative sea-level drop of 142 m. An alluvial to marine transgression is interpreted by Barrie and Conway (1996a) based on the presence of dark-grey, bioturbated, sandy-mud dating to $11,290 \pm 60$ ^{14}C years BP in core T95B05 (Table 1). On the east-coast of southern Moresby Island in Juan Perez Sound, isostatic uplift of 45

m to 53 m caused relative sea-levels to drop 117 m to 125 m (grab samples V98-55 and V98-9; Table 1). Beaches composed of sandy-gravel and muddy-sandy-gravel supported numerous intertidal molluscan species, including a variety of edible species; the molluscan fossil assemblages indicate sea-surface temperatures in Juan Perez Sound varied between +4 °C and +14 °C (Table 2), a somewhat narrower range than that presently observed at the Sandspit monitoring station (2.22 °C to 16.94 °C; Richard E. Thomson, written communication, 2001). The paleogeographic model for this period landlocks Juan Perez Sound (Fig. 9d), perhaps a consequence of combined elevation errors.

10,750 to 11,250 ¹⁴C years BP

Lack of regional data precluded the generation of paleogeographic maps for this period. Eustatic sea-level was rising, but remained approximately 67 m below present day levels (Fairbanks, 1989). Limited data indicates that 22 m of isostatic uplift occurred in Hecate Strait (core T95B16) placing it 89 m below today's msl, sufficient to maintain the coastal plain linking QCI with the BC mainland. These conditions also sustained the delta at the head of Hecate Sea through 11,030 +/-60 ¹⁴C years BP (core T95B16-127; Barrie and Conway 2002; Table 1).

Sea-level in Burnaby Strait, southern Moresby Island, was 111 m lower than today, reflecting 48 m of isostatic uplift (core V94A11-81; Table 1). These findings are supported by the presence of marine mussels in bioturbated, dark olive-grey mud interbedded with very dark-grey sand at 0.81 m in core V94A11-81; this stratigraphic interval is interpreted as the transition from fluvial to marine conditions at 10,750 +/-60 ¹⁴C years BP (Josenhans *et al.*, 1997; Tables 1 and 2). In Juan Perez Sound, on south

Moresby Island, isostatic uplift of 53 m to 63 m (grab samples: V98-21, -22, -27, -53) produced a 120 m to 130 m drop in sea-level relative to today, between 11,150 $\pm$ 50 ^{14}C years BP (grab sample V98-27-1; Table 1) and 10,890 $\pm$ 50 ^{14}C years BP (grab sample V98-53-2; Fedje and Josenhans, 2000; Table 1). Mollusc species sampled from green, muddy gravel are consistent with deposition in a protected, partly rocky, bay or estuary where mud, sand and gravel could accumulate (Table 2).

The appearance of molluscan species *Serripes groenlandicus* and *Clinocardium ciliatum* at 10,890 $\pm$ 50 ^{14}C years BP (Fedje and Josenhans, 2000; Table 1) in Juan Perez Sound, signify sea-surface temperatures less than 9 °C (Table 2), significantly cooler than today's temperatures (2.22 °C to 16.94 °C; Richard E. Thomson written communication, 2001). Cool water molluscs are also found in the Cook Bank region between 10,485 $\pm$ 70 ^{14}C years BP (core E87A23-40; Luternauer *et al.*, 1989a; Table 1) and 10,250 $\pm$ 80 ^{14}C years BP (core E87A22-87; Table 1). These findings are consistent with several paleoceanographic studies of the BC continental shelf (Mathewes *et al.*, 1993; Patterson, 1993; Patterson *et al.*, 1995; Guilbault *et al.*, 1997; Jean-Pierre Guilbault, written communication, 2001), which recognize a cold interval between ~11,000 and ~10,000 years BP, coeval with the Younger Dryas stadial (Patterson *et al.*, 1995). Impeded upwelling currents and intensified downwelling resulted in "quasi-glacial" (Patterson *et al.*, 1995; Guilbault *et al.*, 1997) marine conditions in the shallow Hecate Sea.

Cool sea-surface temperatures likely extended up into the head of Hecate Sea and south to Huston Inlet where the only mollusc present (core V94A15-168), *Mytilus trossolus*, can survive in temperatures less than -2 °C (Bernard, 1983b:18), withstand

brackish water, and tolerate high sediment influx rates. During this time, malacological evidence (cores E88B55-142; E88B54-179; E88B53-87; Table 2) indicates sea-surface temperatures at Goose Island Bank remained temperate, perhaps due to strong vertical tidal mixing in the presence of reduced coastal run-off and reduced upwelling in Goose Island Trough (R.E. Thomson personal communication, 2002).

10,250 to 10,750 ¹⁴C years BP

The isostatic crustal displacement map for the period 10,250 to 10,750 ¹⁴C years BP (Fig. 9l) illustrates persistence of the forebulge in central Hecate Strait and QC Sound, and although the landbridge no longer remains, the two coastal plains persist (Fig. 9e). Eustatic sea-level rose to 63m below present, but this rise was partially compensated by continued isostatic uplift.

In southwest Hecate Strait, adjacent to Moresby Island, transgressing seas spilled over a 100m sill, in the process inundating lacustrine conditions (core E92A21-123, -142; Josenhans *et al.*, 1995; Tables 1 and 2). Behind the sill, developed a sandy, silty and occasionally rocky protected bay, which was colonized by intertidal molluscan species *Mytilus trossulus* and *Acmaea mitra*, accompanied by *Hiatella pholadis*, *Neptunea lyrata*, *Petalaconchus compactus*, *Epitonium* species, *Balanus* species, and sea urchin, which are found from the intertidal to the shallow subtidal zone. Sea-surface temperatures ranged between - 3 °C to +15 °C (Table 2). Logan Inlet was lacustrine (core V94A18-481) at 10,560 +/-70 ¹⁴C years BP (Josenhans *et al.*, 1997, Tables 1 and 2); marine incursion was halted by 17 m of isostatic uplift, which exposed a sill (currently at 80 m water depth). In Burnaby Strait, 48 m of isostatic uplift promoted the development of a drowned river channel currently at 111 m water depth, from which a wood fragment dated to 10,670 +/-

60 ^{14}C years BP (core V94A11-88; Josenhans *et al.*, 1997; Tables 1 and 2) was recovered from dark grey-black muddy and sandy gravel. Josenhans *et al.* (1997) interpret the lithological change from gravel to overlying dark olive-grey mud interbedded with very dark-grey sand as a rapid transition from fluvial to marine conditions. Just to the north, in Juan Perez Sound at 107 m water depth, isostatic uplift of 44 m accompanied the formation of a silty, muddy and fine sand and gravel, colonized by the intertidal mollusc species *Polinices lewisii* and *Saxidomus giganteus* dating to 10,380 ^{14}C years BP (V98-40-1; Tables 1 and 2). These data imply transgression between 10,380 and 10,670 ^{14}C years BP (Josenhans *et al.*, 1997).

On Goose Island Bank to the southeast, three submarine sediment cores E88B53-87, E88B54-179, and E88B55-142 taken in close proximity, indicate crustal uplift of 58 m to 68 m, which precipitated a 121 m to 131 m relative sea-level drop (Table 1). Abundant intertidal molluscan species sampled from a coarse sand-and-gravel unit yielded AMS ^{14}C dates between 10,630 and 10,720 ^{14}C years BP (Barrie and Conway, 2002; Table 1). Molluscan species identified include the following: *Macoma incongrua*, *Balanus glandulus*, *Mya truncata*, *Modiolus* species, *Trichotropis cancellata* (core E88B53-87), *Saxidomus giganteus*, *Clinocardium* species (core E88B54-179), *Protothaca staminea*, *Platyodon cancellatus*, *Saxidomus giganteus*, *Mytilus trossulus*, *Acmaea mitra*, sea urchin and barnacle (core E88B55-142). This assemblage of molluscs suggests a variety of beach types, including low intertidal rocky shored bays or estuaries (core E88B53-87), protected sandy beaches (core E88B54-179), and gravel and hard-packed clay-bottomed beaches (core E88B55-142). Sea-surface temperatures ranged between +4 °C and +16 °C, similar to modern sea-surface temperatures of 3.0 °C to 17.4

°C taken at McInnes Island between January 1954 and December 2000 (Richard E. Thomson written communication, 2001).

Farther south, on Cook Bank, intertidal and terrestrial deposits obtained from submarine sediment cores demonstrate persistent uplift between 31 m and 62 m (Table 1). Wood taken from a grey, fine, well-sorted mineral-rich sand in core E87A4, currently in 122 m of water, dates to $10,430 \pm 130$ ^{14}C years BP (Barrie, 1991; Tables 1 and 2), implying deposition by tidal currents in a nearshore environment during sea-level low-stand. Cores E87A22 and E87A23, also taken at Cook Bank, support this interpretation. An intertidal quiet bay or estuary is evident at the site of core E87A22 sampled in 104 m of water, in which a dark-grey gravelly-sand containing intertidal marine molluscs date to $10,360 \pm 140$ ^{14}C years BP (Barrie and Conway, 2002; Table 1). Sedimentological and malacological analysis of core E87A23 taken in 94 m of water just east of E87A22, implies terrestrial conditions were present from at least 10,650 until approximately 10,290 ^{14}C years BP (Luternauer *et al.*, 1989a; Table 1) when a cool transgressing sea (+1 °C to +9 °C) and heavy surf pounded a rocky beach (Table 2). Also at Cook Bank, a laminated mineral-rich silty-sand unit was deposited during lowered sea-level along the near shore of the south side of an arcuate embayment at $10,360 \pm 120$ ^{14}C years BP (E87A13-172; Barrie, 1991; Table 1). Pacific herring and the molluscan species *Nuculana tenuis* and *Diplodonta impolita*, as well as plant and wood fragments found in core E87A13 indicate near shore deposition in cool (+1 °C and +7 °C), variably saline water (Table 2). These data infer sea-surface temperatures in the Cook Bank region must have warmed to modern values (+5.5 °C to +18.5 °C; Richard E. Thomson written communication, 2001) later than (after 10,360 ^{14}C years BP) areas farther north.

9,750 to 10,250 ^{14}C years BP

Figures 9m, 8a, and 8b illustrate continued uplift in central Hecate Strait and QC Sound. Paleogeographic reconstruction (Fig. 9f) shows persistence of the northern and southern coastal plain. Significant subsidence occurred on the BC mainland at Hirsch Creek (currently 167 m above msl); seas 120 m higher than today, deposited a foreset-bedded gravel unit that underlies a marine delta dating to 9,700 $\pm$ 160 ^{14}C years BP (GSC-2492, 447a; Lowdon and Blake, 1979; Tables 1 and 2).

In Dixon Entrance (core T91C15-83) a drowned spit platform was intersected at 96m water depth; the core sampled a dark olive-grey, poorly-sorted coarse sand containing pea gravel and shell fragments including a *Cirripedia* sp. fragment dating to 9,770 $\pm$ 90 ^{14}C years BP (Barrie and Conway, 2002; Tables 1 and 2). Since eustatic sea-level was 58 m lower than it is today (Fairbanks, 1989), 38 m of crustal uplift would have been required to account for spit development – assuming deposition at sea-level. Since spit platforms can be deposited below wave base to –20 m, a depth of 20 m was assumed in this study (Table 1). This reduced the magnitude of isostatic uplift at this site from 38 to 18 m, for a total sea-level fall of 76 m. Core T91C20 taken in a shallow 33 m deep basin 12 km southwest of core T91C15, sampled a 9,850 $\pm$ 70 ^{14}C years BP (Table 1) sandy-mud intertidal beach, containing the molluscs *Clinocardium* species, *Nutricula lordi*, *Diplodonta impolita*, *Olivella baetica*, *Olivella* species, as well as sea urchin, wood and plant. Given eustatic sea-level was 58 m below present, a paleobeach now at 33 m water depth would have required 25 m of crustal subsidence. It seems improbable that sites within 12 km of one another would exhibit an isostatic differential of 43 m. The interpretation of core T91C20-217 as a paleobeach is tightly constrained by geological,

lithological and malacological evidence; however, T91C15 is not. One explanation for the isostatic differential is that the shell fragment dated in core T91C15 was transported and redeposited at the spit location. The high-energy environment necessary for spit development would support this interpretation. A second explanation may be that the ^{14}C date is incorrect. Due to these inconsistencies, T91C15 was not used in the final iteration of the paleogeographic reconstruction.

Subsidence at Cape Ball and on Moresby Island, and uplift in Hecate Strait, QC Sound, and Cook Bank, further support the interpretation of subsidence in the north and west and emergence in the south. At Cape Ball drowned and preserved terrestrial peat and in-situ tree stumps collected at 20 m above msl implies approximately 43 m of subsidence at $10,200 \pm 90$ ^{14}C years BP (116f, GSC-3159; Clague *et al.*, 1982b; Table 1).

On southern Moresby Island, core (M934) indicates subsidence of 31 m. combined with 58 m of lowered eustatic sea-level, resulted in a relative sea-level 27 m lower than today's in which intertidal molluscs *Mytilus trossulus* (cf) dating to 9800 ± 60 ^{14}C years BP and $10,090 \pm 80$ ^{14}C years BP (Josenhans *et al.*, 1995; Table 1) colonized a dark grey muddy shelly- sandy- gravel beach (Table 2). Nearby in Juan Perez Sound in 65 m of water, grab V98-31 sampled a minor gravel lag and shell hash with a few rounded cobbles from which the intertidal species *Saxidomus giganteus* was AMS ^{14}C dated to $10,580 \pm 40$ ^{14}C years BP (Fedje and Josenhans, 2000) and MRC to $10,180$ ^{14}C years BP (Table 1). Intertidal molluscs sampled at this site denote a mud and gravel rocky paleohabitat with sea-surface temperatures that ranged between $+2$ °C to $+14$ °C (Table 2). Close by, core V98-62 sampled a fine gravel to coarse sand lag

containing the intertidal species *Saxidomus giganteus*, which was AMS ^{14}C dated to 10,530 $\pm$ 50 ^{14}C years BP (Fedje and Josenhans, 2000) and MRC to 10,130 ^{14}C years BP (Table 1).

To the east, uplift of 53 m (core E88B30) in central Hecate Strait maintained the coastal plain and 'Hecate Sea' became narrowly connected to Dixon Entrance. The core intersected an intertidal beach deposit at a depth of 111 m. Laminated, fine, grey shelly sand containing plant and charcoal debris, and colonized by the marine bivalve *Mytilus* species and *Modiolus rectus*, which date to 9,840 $\pm$ 70 ^{14}C years BP (Tables 1 and 2), implies the presence of an intertidal environment. Farther up the core, between 60 and 63 cm is a medium-grey muddy sand containing the bivalve *Thracia trapezoides*, a more benthic species, implying the termination of shallow water deposition.

On Goose Island Bank (core E88B54), 63 m of uplift occurred. Sea-levels 121 m lower than today deposited dark grey, well-sorted, medium grey sand in a protected, temperate water (+4 $^{\circ}\text{C}$ to +24 $^{\circ}\text{C}$) beach environment colonized by numerous large bivalves including *Spisula falcata*, that dates to 9,800 $\pm$ 80 ^{14}C years BP (Barrie and Conway, 2002; Tables 1 and 2). These conditions persisted on Goose Island Bank from prior to 10,640 until after 9,800 ^{14}C years BP (Barrie and Conway, 2002; Table 2). *Clupea harengus pallasii* (Pacific Herring) caudal vertebrae, *Balanus glandulus* terga, and wood and plant material taken from glacial, low-stand and Holocene deposits in Inner Goose Island Trough in 192 m of water (core H818-245; Luternauer *et al.*, 1989b) suggest the persistence of a temperate (+3 $^{\circ}\text{C}$ and +12.3 $^{\circ}\text{C}$) quiet, shallow, sand and mud bay until at least 9,830 ^{14}C years BP (Luternauer *et al.*, 1989b; Tables 1 and 2).

Farther west in Outer Goose Island Trough, core H816 sampled an upward fining,

dark sandy-mud in 284 m of water. The marine mollusc *Nuculana cellulita* sampled from 359 cm down in the core, dates to 10,000 $\pm$ 80 ^{14}C years BP (Luternauer *et al.*, 1989b; Table 1), implying cool water ($-1\text{ }^{\circ}\text{C}$ to $+14\text{ }^{\circ}\text{C}$; Table 2) to depths of 40 m. At Cook Bank (core E87A22), 76 km east-southeast of core site H816, 36 m of crustal uplift combined with lowered eustatic sea-level to maintain the southern coastal plain.

Irregular, bedded to massive, greyish-brown gravelly- muddy sand cored at 104 m below present msl, was deposited in cool shallow water; the marine molluscs *Saxidomus giganteus*, *Amphissa columbiana*, and *Nuculana minuta* date to 10,250 $\pm$ 80 ^{14}C years BP (Barrie and Conway, 2002; Tables 1 and 2). Additional support for the interpretation of uplift of Cook Bank includes terrestrial material sampled from the 25 cm level of core E87A23, located adjacent to core E87A22 in 94 m of water. This material dates to 9,940 $\pm$ 75 ^{14}C years BP (Luternauer *et al.*, 1989a; Table 1). Molluscan samples taken at the 13 cm, 14-17 cm, and 23-26 cm levels, include molluscan species *Macoma expansa*, *Pandora filosa*, *Acila castrensis*, *Olivella biplicata*, *Saxidomus giganteus*, *Mytilus* species, and *Balanus* species. These species indicate that warming seas ($+3^{\circ}\text{C}$ to $+18\text{ }^{\circ}\text{C}$) transgressed a terrestrial environment, creating a mud, and sandy gravel beach sometime after 10,290 ^{14}C years BP (Luternauer *et al.*, 1989a; Table 2).

8,750 to 9,750 ^{14}C years BP

Due to a lack of regional data, the final time interval was extended from 8,750 to 9,750 ^{14}C years BP. Figures 8a, 8b, and 9n show continued uplift in central Hecate Strait. Figure 9g illustrates decreased aerial extent of the coastal plain. Although data is lacking from the QC Sound region the authors surmise that the forebulge extended far enough south to maintain uplift at Cook Bank, an interpretation which is supported by terrestrial

material found in core E9213-57 dating to 7,820 ^{14}C years BP (Table 1).

On the mainland at McNeil River, presently 3 m above msl, 49 m of subsidence resulted in the development of a shallow marine environment dating to 8,780 $\pm$ 150 ^{14}C years BP (GSC-2343; 626d; Lowdon and Blake, 1979; Tables 1 and 2). Farther inland, reduced subsidence (82 m) is evident on the BC mainland at Kitimat where sea-levels were 35 m higher than today; a foreset-bedded gravel unit underlies a marine delta dating to 9,300 $\pm$ 90 ^{14}C years BP (GSC-2425, 548a; Lowdon and Blake, 1979; Tables 1 and 2).

Drainage from the uplifted (71 m to 82 m) coastal plain deposited a fine mineral-rich laminated sand into a sand- and mud-floored temperate (+1 $^{\circ}\text{C}$ and +25 $^{\circ}\text{C}$) estuary in Hecate Strait, which was colonized by the bivalve *Saxidomus giganteus*, the gastropod *Olivella baetica*, and *Olivella* sp. dating to 9,200 $\pm$ 100, 9,130 $\pm$ 90, and 9,710 $\pm$ 70 ^{14}C years BP respectively (E88B29; Tables 1 and 2). This succession is overlain by a massive, grey, medium sand (interval 37 cm to 67 cm in core E88B29) containing the bivalve *Tellina nukuloides*, implying a rise in sea-level and the onset of modern benthic conditions. Rapid sea-level rise in this area subsequent to 9,130 ^{14}C years BP is supported by core E88B30 previously discussed for the time interval 9,750 to 10,250. Eighty-two km north of core E88B29, wood in core V94-27 dating to 9,480 $\pm$ 70 and 9,660 $\pm$ 70 ^{14}C years BP (Table 1) implies a temperate (+4 $^{\circ}\text{C}$ to +17 $^{\circ}\text{C}$) protected, low intertidal sand and gravel (-20 m) beach in north central Hecate Strait (Table 2). Since the beach is now 48 m below present msl, which was within one meter of eustatic sea-level at the time of beach formation, there was no isostatic uplift at this location at that time.

On the east side of Graham Island at Cape Ball terrestrial peat dating to 9,160 $\pm$ -

90 ^{14}C years BP (116e, GSC-3129; Clague *et al.*, 1982b; Table 1) has been sampled 5 m above msl, implying 23 m of isostatic subsidence. At Mary's Point on northern Graham Island, between 44 m and 55 m of isostatic subsidence combined with a rise in eustatic sea-level to produce a mud and gravel, temperate (+2 °C and +21 °C) bay or estuary between 9,160 $\pm$ 110 ^{14}C years BP (MP-1) and 9,450 ^{14}C years BP (MP-2; Southon *et al.*, 1990; Tables 1 and 2) and colonized by bivalves *Saxidomus giganteus*, *Protothaca staminea* and *Schizothaerus nuttallii* (*Tresus nuttallii*). Sea-level at Haines Creek, on western Graham Island, was within +2 m of current msl at 8,990 $\pm$ 50 ^{14}C years BP (RH9909; Table 1); seas between +4 °C and +14 °C generated a very productive rocky, sand and gravel, protected outer coastal beach that was colonized by numerous edible mollusc species that include the following: *Saxidomus giganteus*, *Protothaca staminea*, *Tresus nuttallii*, *Tresus capax*, *Mytilus californianus*, *Clinocardium nuttallii*, *Mya truncata*, *Chlamys rubida*, *Tectura persona*, *Humilaria kennerleyi*, as well as chitons and sea urchins.

At Matheson Inlet on south Moresby Island, 20 m of subsidence is recorded in core M934, extracted from 27 m of water. A mud, shell, sand and gravel beach dates to between 9,340 $\pm$ 60 and 9,670 $\pm$ 80 ^{14}C years BP (M934-230, -207, -291; Josenhans *et al.*, 1995; Table 1), when sea-surface temperatures were -2 °C to +14 °C (Table 2). Close-by, transgressing seas breached a 15 m sill, inundating lacustrine sediments above Arrow Creek (V94A12-2) at 8,850 $\pm$ 70 ^{14}C years BP (V94A12-93; Josenhans *et al.*, 1997, Table 1). Below this site, erosion of the bank in Arrow Creek (RH98-04), 6 m above msl exposed a shelly and gravelly sand providing evidence of 42 m of subsidence. Freshwater flowed onto a gravelly sand beach colonized by *Clinocardium nuttallii*,

Macoma inquinata, *Mytilus trossulus*, *Pododesmus machrochisma*, *Protothaca staminea*, *Protothaca tenerrima*, *Saxidomus giganteus*, and *Tectura* species dated to 8,800 $\pm$ 70 ^{14}C years BP (RH98-04-150). The first caudal vertebrae of a *Phoca vitulina* (Harbour seal) was also obtained from this sample indicating access to open ocean conditions.

DISCUSSION

Forebulge position, shape and amplitude through time

The dynamic relationship between the subsidence caused by glacial ice and the uplift, or forebulge created beyond the ice front, requires that the amplitude of the forebulge increases or decreases in direct proportion to the amount of crustal subsidence caused by thinning or thickening of the ice. Position or inflection point of the forebulge will either retreat or advance in lock-step with a change in position of the ice-front. A decrease in ice thickness sufficient to cause the crust beneath the ice to uplift 10 m will reduce the height of the forebulge by 1 m to 10 m. Rapid crustal response to ice retreat is evidenced by 85 m of uplift at Kitimat River over 400 years (Table 1). The series of isostatic crustal adjustment maps (Figs. 9h to 9n), and the time-series cross-section plot (Fig. 8b) of isostatic crustal displacement along the axis of Hecate Strait and QC Sound provide a time-lapse image of the forebulge in the QCI region between 14,250 and 8,750 ^{14}C years BP.

In general, the position of the forebulge shown as the inflection point of each isostatic adjustment curve in figure 8b did not undergo significant lateral shifts. This implies continued ice presence on the BC mainland until $\sim$ 10,000 ^{14}C years BP, supporting studies by Clague (1981) and Clague and James (2002). Position of the ice

front and overall dimensions of the ice sheet must have remained constant in order that the forebulge maintain its position in northern QC Sound. Had the ice sheet north and east of Dixon Entrance receded, the curve representing the time interval 9,750 to 10,250 ^{14}C years BP in figure 8b would have moved north relative to the curve representing the time interval 12,750 to 13,250 ^{14}C years BP.

Amplitude, on the other hand, did change. There was 50 m of relative uplift in northern Hecate Strait between 12,250 and 9,750 ^{14}C years BP, whereas 250 km farther south atop the forebulge, there appears to have been little change in relative elevation (Figs. 8a and 8b). Position of the inflection points for the curves constraining this time interval shows a minor lateral shift. During this 2,500-year interval, ice located north and east of Dixon Entrance must have thinned to generate the uplift seen in northern Hecate Strait. The basic principle of isostasy requires that movement of mantle material acts to balance surface load in order to maintain a state of equilibrium. According to Archimedes' principle, in order to maintain equilibrium, the apparent mass of ice would have to be reduced by an amount equal to the mass of the liquid it displaced. This principle can be represented by the following equation:

$$\rho_i t_i = \rho_m t_m \text{ or } t_i = \frac{\rho_m t_m}{\rho_i}$$

where, ρ_i is ice density of 920 Kg/m^3 (Cathles, 1975); ρ_m is mantle density of 3300 Kg/m^3 (Turcotte and Schubert, 1982); and t_m is crustal uplift of 50 m. Solving for ice thickness results in t_i of 179 m. However, this equation does not account for present-day water load. The following equation incorporates this added dimension,

$$\rho_i t_i - \rho_w t_w = \rho_m t_m \text{ or } t_i = \frac{\rho_m t_m + \rho_w t_w}{\rho_i}$$

where ρ_w is water density of 1020 Kg/ m^3 , and t_w is present-day water depth of approximately 300 m. Solving for t_i results in an estimated ice thickness of 510 m. Thus the observed 50 m of crustal uplift would require removal of approximately 510 m of ice (or ice about 200 m thicker than present water depth).

Isostatic crustal displacement maps figures 9h and 9i illustrate the shape of the forebulge as it underwent early change between 14,250 and 12,750 ^{14}C years BP, as a consequence of the removal of alpine ice from the QCI proper, and the grounded mainland ice that covered Dixon Entrance. With removal of this ice, the forebulge advanced northward forming a north-facing concave arc that more or less paralleled the coastal mainland before bending west across northern Hecate Strait and Graham Island. In several of the isostatic crustal displacement maps (Figs. 9i, 9j, 9k, and 9l), crustal downwarping on the BC mainland appears to have had a southern limit. This is an artifact of insufficient data across the southern BC mainland region.

The short wave-length and high amplitude of crustal displacement illustrated in figure 8b is consistent with relatively thin, warm, and flexible continental shelf lithosphere, and contrasts with the much longer wave-length forebulge modeled by Peltier (1994, 1996) for the much thicker (~120 km) and more rigid lithosphere of the Canadian Shield.

Shorelines sampled in this study were originally deposited in a level environment, however they now show evidence of tilting. Shoreline tilts were calculated systematically throughout the study area within mapped time intervals. Shoreline tilts of between 0.32 and 0.64 m/Km were calculated for shorelines located on the forebulge. Whereas shoreline tilts ranging between 1.55 to 2.1 m/Km were calculated for shorelines

located on and off, or adjacent to the forebulge. High shoreline tilts support the interpretation of a thin lithosphere (James *et al.*, 2000). James *et al.* (2000) show shoreline tilts of 0.85 and 1.15 m/Km in the Puget Lowland during early retreat of the Cordilleran ice sheet and modeled them with lithospheric thicknesses of 30 to 40 Km. Tilts of between 1.36 and 1.65 m/Km are observed adjacent to the BC mainland where remnant ice is present and imply a thin lithosphere. The largest tilts observed in the QCI/Hecate Strait region are 2.1 m/Km and are located in the westernmost region of the study area adjacent to the Queen Charlotte Fault. These are significantly larger tilts than those observed in the Puget Lowland, and may imply that crustal response pertains to a warm, relatively thin lithosphere (<30 Km), combined with the tectonic influence of a decoupled North American plate at the QC Fault. This interpretation supports previous research indicating high heat-flow (Lewis *et al.*, 1991), low upper mantle viscosity, a relatively thin lithosphere (Sweeney and Seemann, 1991; Rohr and Currie, 1997) and short wave-length lithospheric response (Turcotte and Schubert, 1982) in the QCI/Hecate Strait region.

The gravitational attraction of the Cordilleran ice sheet may have caused oceans to rise locally relative to the land, thereby influencing interpretations of crustal rigidity. Clark (1976) calculates between 31 m and 27 m of sea-level fall, the result of a reduction in the ice mass (2×10^{18} kg) of the Greenland ice sheet acting as a point mass in the centre of the Greenland ice sheet. The perturbation of sea-level by the Cordilleran ice mass was not considered in this research because the mass of ice and the angular separation between the centre of the ice mass and the shoreline remain unknown for this region. However, the qualitative impact of ice-water gravitational attraction would imply

larger forebulge uplift and lower subsidence magnitudes than those depicted in crustal displacement maps.

Paleogeography and paleoenvironment

QCI region coastlines migrated in response to the interplay between locally specific changes in uplift and subsidence, combined with changing eustatic sea-level. The migration of coastlines and subaerially exposed ice-free terrain has implications to researchers seeking Late Pleistocene – Early Holocene glacial refugias (McCabe and Cowan, 1945; Foster, 1965; Calder and Taylor, 1968; Ogilvie, 1989; Reimchen, 1994; Byun *et al.*, 1997; Byun, 1999). Uplift persisted throughout eastern and central Hecate Strait, QC Sound, and Cook Bank, despite rising eustatic sea-level, preserving two coastal plains. The northern coastal plain, in central Hecate Strait, was present from ~14,000 until at least 9,130 ^{14}C years BP. The southern coastal plain persisted until as late as 7,820 ^{14}C years BP (E9213-57, Table 1), likely a consequence of persisting ice sheets in south central BC. Despite rising eustatic sea-levels, deflection of ice to the north and east promoted sufficient isostatic uplift to close northern Hecate Strait by ~11,750 ^{14}C years BP creating a landbridge between the mainland and QCI that would have facilitated faunal, floral and potentially human migration. In addition to the evidence detailed in this research, Nagorsen and Keddie (2002) recovered 12,000 year-old mountain goat (*Oreamnos americanus*) skeletal remains from two caves on northern Vancouver Island, implying the presence of ice-free conditions and the persistence of ice-free refugia on the continental shelf.

When the landbridge was present, Hecate Strait became Hecate Sea, a narrow,

elongate, shallow water embayment having reduced salinity and temperature, supported by evidence of sea-surface cooling coincident with the Younger Dryas stadial (10,890 ^{14}C years BP in Juan Perez Sound and 10,485 ^{14}C years BP in Cook Bank). Temperate sea-surface conditions reappeared in Juan Perez by 10,130 ^{14}C years BP and in Cook Bank by 9,940 ^{14}C years BP. Rapid crustal response to unloading of the crust (Clague and James, 2002) implies continued ice presence on the BC mainland until just prior to ~10,000 ^{14}C years BP. Rapid ice sheet decay on the BC mainland (Clague and James, 2002) resulted in reduced uplift, and transgressing seas in central Hecate Strait after 9130 $\pm$ 90 ^{14}C years BP (core E88B29).

Malacological evidence indicates cooler than modern sea-surface temperatures around the limits of Hecate Sea (Patterson *et al.*, 1995) and Cook Bank, coincident in timing with the late-glacial Younger Dryas cooling event. Edible molluscan resources were available from at least 13,200 ^{14}C years BP. Numerous resource-rich coastal zones were sampled and dated, and indicate rapid recolonization of edible molluscs after ice retreat.

Reduced shell preservation exists between 12,250 and 10,750 ^{14}C years. The presence of unconformable sediments in sub-marine cores in Hecate Strait and QCI between 12,250 and 10,750 ^{14}C years BP, suggests that beach surface erosion, probably caused by subaerial exposure followed by rapid sea-level transgression, may have led to reduced shell preservation.

CONCLUSION

Quantitative paleogeographic and paleoenvironmental models of the late Pleistocene - early Holocene illustrate the impact of rapid sea-level change on the QCI

region. Rates and magnitudes of isostatic uplift and depression are too large to be accounted for by processes other than the waxing and waning of ice sheets. The wavelength and amplitude of the ice-induced forebulge is consistent with thermal and refraction modeling of a thin (~25 km) lithosphere beneath QC Sound and Hecate Strait. Central Hecate Strait remained a region of isostatic uplift until at least 9,130 ^{14}C years BP, QC Sound remained uplifted until as late as 7,820 ^{14}C years BP, and forebulge position remained essentially constant after 12,750 ^{14}C years BP. This requires a fixed ice-front position and continued ice presence on the BC mainland until just prior to ~10,000 ^{14}C years. Ice, at least 200 m thicker than present water depth, began retreating from Dixon Entrance after 14,000 and prior to 12,640 ^{14}C years BP (Archer, 1998), generating 50 m of uplift. The closure of Hecate Strait and the formation of Hecate Sea resulted in the connection of the QCI archipelago to the North American continent and in significant changes to littoral dynamics, sea-surface temperatures and coastal habitats. The presence of molluscs whose sea-surface temperature tolerance is below 9 °C indicates cooling sea-surface temperatures coincident with the Younger Dryas stadial.

References Cited:

- Abbott, R.T., 1974, *American Seashells: The Marine Molluscs of the Atlantic and Pacific Coasts of North America* (2d ed.): New York, Van Nostrand Reinhold Company, 663 p.
- Alley, N.F., and Thomson, B., 1978. Aspects of environmental geology, parts of Graham Island, Queen Charlotte Islands: British Columbia Ministry of Environment, Resource Analysis Branch, Bulletin 2, 65 p.
- Amos, C.L., Barrie, J.V., and Judge, T.J., 1995, Storm-enhanced sand transport in macrotidal setting, Queen Charlotte Islands, British Columbia, Canada, *in* Flemming, B.W., and Bartolomä, A., eds., *Tidal Signatures in Modern and Ancient Sediments: Special Publication of the International Association of Sedimentologists* 24, p. 53-68.
- Anderson, R.G., and Reichenbach, I., 1991, U-Pb and K-Ar framework for Middle to Late Jurassic (172- $\geq$ 158 Ma) Tertiary (46-27 Ma) plutons in Queen Charlotte Islands, British Columbia, *in* *Evolution and Hydrocarbon Potential of the Queen Charlotte Basin*, British Columbia: Geological Survey of Canada Paper 90-10, Ottawa, p. 59-87.
- Archer, D.J.W., 1998, Early Holocene landscapes on the north coast of B.C.[abs]: 31st annual meeting Canadian Archaeological Association, Victoria, BC, p. 34.
- Barrie, J.V., 1991, Contemporary and relict titaniferous sand facies on the western Canadian continental shelf: *Continental Shelf Research*, 11, p. 67-79.
- Barrie, J.V. and Conway, K.W., 1996a, Sedimentary processes and surficial geology of the Pacific margin of the Queen Charlotte Islands, B.C., *in* *Current Research 1996-E: Geological Survey of Canada*, p. 1-6.
- Barrie, J.V., and Conway, K.W., 1996b, Evolution of a nearshore and coastal macrotidal sand transport system, Queen Charlotte Islands, Canada, *in* DeBatist, M., and Jacobs, J., eds., *Geology of Siliclastic Shelf Seas: London, Geological Society Special Publication* 117, p. 233-248.
- Barrie, J.V., and Conway, K.W., 1999, Late Quaternary glaciation and postglacial stratigraphy of the northern Pacific margin of Canada: *Quaternary Research* 51, p. 113-123.
- Barrie, J. V., and Conway, K.W., 2002, Rapid sea level change and coastal evolution on the Pacific margin of Canada: *Journal of Sedimentary Geology* 150, p. 171-183.
- Barrie, J.V., Bornhold, B.D., Conway, K.W., and Luternauer, J.L., 1991, Surficial geology of the northwestern Canadian continental shelf: *Continental Shelf*

Research 11, p. 701-715.

- Barrie, J.V., Conway, K.W., Mathewes, R.W., Josenhans, H.W., and Johns M.J., 1993, Submerged Late Quaternary terrestrial deposits and paleoenvironment of northern Hecate Strait, British Columbia continental shelf, Canada: *Quaternary International*, 20, p. 123-129.
- Bernard, F.R., 1979, Bivalve mollusks of the western Beaufort Sea: *Contributions in Science*, Los Angeles, Natural History Museum of Los Angeles County, 80 p.
- Bernard, F.R., 1983a, Catalogue of the living bivalvia of the eastern Pacific Ocean: Bering Strait to Cape Horn: Ottawa, Canadian Special Publication of Fisheries and Aquatic Sciences 61, 102 p.
- Bernard, F.R., 1983b, Physiology and the mariculture of some northeastern Pacific bivalve Molluscs: Ottawa, Canadian Special Publication of Fisheries and Aquatic Sciences 63, 24 p.
- Bernard, F.R., McKinnell, S.M., and Jamieson, G.S., 1991, Distribution and zoogeography of the bivalvia of the eastern Pacific Ocean: Ottawa, Canadian Special Publication of Fisheries and Aquatic Sciences 112, 60 p.
- Blaise, B., Clague, J.J., and Mathewes, R.W., 1990, Time of maximum Late Wisconsin glaciation, west coast of Canada: *Quaternary Research* 34, p. 282-295.
- Byun, S.A., 1999, Quaternary biogeography: Insights from mtDNA phylogeography of endemic vertebrates from Haida Gwaii: unpublished Ph.D. thesis, University of Victoria, Victoria, B.C.
- Byun, S.A., Koop, B.F., and Reimchen, T.E., 1997, North American black bear mtDNA phylogeography: Implications for morphology and the Haida Gwaii glacial refugium controversy: *Evolution*, 51, p. 1647-1653.
- Calder, J.A., and Taylor, R.L., 1968, Flora of the Queen Charlotte Islands, Part 1, *in* Systematics of the vascular plants: Research Branch, Canada Department of Agriculture monograph no. 4, Queen's Printer, Ottawa, ON, Canada.
- Cathles, L. M., III, 1975, *The Viscosity of the Earth's Mantle*: New Jersey, Princeton University Press, 390 p.
- Claassen, C., 1998, *Shells*, Cambridge Manuals in Archaeology: Cambridge, Cambridge University Press, 266 p.
- Clague, J.J., 1981, Late Quaternary geology and geochronology of British Columbia, Part 2: summary and discussion of radiocarbon-dated Quaternary history: Geological Survey of Canada, Paper 80-35, 41 p.

- Clague, J.J., 1983, Glacio-isostatic effects of the Cordilleran Ice Sheet, British Columbia, Canada, *in* Smith, D.E., and Dawson, A.G., eds., *Shorelines and Isostasy*: Institute of British Geographers Special Publication 16, p. 321-343.
- Clague, J.J., 1985, Deglaciation of the Prince Rupert-Kitimat area, British Columbia: *Canadian Journal of Earth Sciences* 22, p. 256-265.
- Clague, J.J., and Bornhold, B.D., 1980, Morphology and littoral processes of the Pacific coast of Canada, *in* McCann, S.B., ed., *The Coastline of Canada: Geological Survey of Canada, Paper 80-10*, p. 339-380.
- Clague, J.J. and James, T.S. 2002, History and isostatic effects of the last ice sheet in southern British Columbia: *Quaternary Science Reviews* 21, p. 71-87.
- Clague, J.J., Mathewes, R.W., and Warner, B.G., 1982a, Late Quaternary geology of eastern Graham Island, Queen Charlotte Islands, British Columbia: *Canadian Journal of Earth Sciences*, 19, p. 1786-1795.
- Clague, J.J., Harper, J.R., Hebda, R.J., and Howes D.E., 1982b, Late Quaternary sea levels and crustal movements, coastal British Columbia: *Canadian Journal of Earth Sciences*, 19, p. 597-618.
- Clarke, J.A., Farrell, W.E., and Peltier, W.R., 1978, Global changes in postglacial sea level: A numerical calculation: *Quaternary Research*, 9, p. 265-287.
- Coad B.W., 1995. *Encyclopedia of Canadian Fishes*. Canadian Museum of Nature and Canadian Sportfishing Productions Inc., Singapore.
- Cornwall, I.E., 1955, *Canadian Pacific Fauna*, 10. Arthropoda, 10e Cirripedia: Fisheries Research Board of Canada, Ottawa, p. 22-40.
- Dillehay, T.D., 1989, *Monte Verde: A Late Pleistocene settlement in Chile, Volume I, Palaeoenvironment and site context*: Washington, Smithsonian Institution Press, 268 p.
- Dixon, E. J., Heaton, T.H., Fifield, T.E., Hamilton, T.D., Putnam, D.E., and Grady, F., 1997, Late Quaternary regional geoarchaeology of southeast Alaska karst: A progress report: *Geoarchaeology*, 12, p. 689-712.
- Dunnill, R.M., 1968, A taxonomic and ecological investigation of the genus *Macoma* (Pelecypoda) in southern British Columbia: Master's thesis, University of Victoria, Victoria, B.C., 115 p.
- Engstrom, D.R., Hansen, B.C.S., Wright, H.E., Jr., 1990, A possible Younger Dryas record in southwestern Alaska: *Science*, 250, p. 1383-1385.

- Fairbanks, R.G., 1989, A 17,000-year glacio-eustatic sea level record: influence of glacial melting rates on the Younger Dryas event and deep-ocean circulation: *Nature*, 342, p. 637-642.
- Fedje, D.W., and Josenhans, H., 2000, Drowned forests and archaeology on the continental shelf of British Columbia, Canada: *Geology*, 28, p. 99-102.
- Fladmark, K.R., 1979, Routes: Alternate migration corridors for early man in North America: *American Antiquity* 44, p. 55-69.
- Flessa, K., and Kowaleski, M., 1994, Shell survival and time-averaging in nearshore and shelf environments: Estimates from the radiocarbon literature: *Lethaia*, 27, p. 153-165.
- Foster, J.B., 1965, The evolution of the mammals of the Queen Charlotte Islands, British Columbia: Occasional papers of the British Columbia Museum, no. 14, Victoria.
- Franke, R., 1982, Smooth interpolation of scattered data by local thin plate splines: *Computers and Mathematics with Applications* 8, p. 237-281.
- Gillespie, G.E., and Kronlund, A.R., 1998, A manual for intertidal clam surveys: Canadian Technical Report of Fisheries and Aquatic Sciences, no. 2270, Fisheries and Oceans Canada, Nanaimo, BC, 127 p.
- Guilbault, J.P., Patterson, R.E., Thomson, R.E., Barrie, J.V., Conway, K.W., 1997, Late Quaternary Paleooceanographic changes in Dixon Entrance, northwest British Columbia, Canada: Evidence from the foraminiferal faunal succession: *Journal of Foraminiferal Research* 27, p. 151-174.
- Harbo, R.M., 1997, Shells & Shellfish of the Pacific Northwest: A Field Guide: Madeira Park, BC, Harbour Publishing, 270 p.
- Hart, J.L., 1973, Pacific Fishes of Canada: Fisheries Research Board of Canada, Bulletin 180, 740 p.
- Heaton, T.H., Talbot, S.L., and Shields, G.F., 1996, An ice age refugium for large mammals in The Alexander Archipelago, southeastern Alaska: *Quaternary Research* 46, p. 186-192.
- Hyndman, R.D., and Hamilton, T.S., 1991, Cenozoic relative plate motions along the northeastern Pacific margin and their association with Queen Charlotte area tectonics and volcanism, *in* Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia: Geological Survey of Canada Paper 90-10, p. 107-126.

- Hyndman, R.D., and Hamilton, T.S., 1993, Queen Charlotte area Cenozoic tectonics and volcanism and their association with relative plate motions along the northeastern Pacific margin: *Journal of Geophysical Research*, 98, p. 14,257 – 14,277.
- Jackson, L.E., Jr., and Duk-Rodkin, A., 1990, Quaternary geology of the ice-free corridor: glacial controls on the peopling of the New World, *in* T. Akazawa and E.J.E. Szathmáry, eds., *Prehistoric Mongoloid Dispersals*: Oxford University Press, Oxford, p. 214-227.
- James, T.S., Clague, J.J., Wang, K., and Hutchinson, I., 2000, Postglacial rebound at the northern Cascadia subduction zone: *Quaternary Science Reviews*, 19, p. 1527-1541.
- Josenhans, H.W., 1994, Surficial geology, Quaternary stratigraphy and paleoenvironments of Queen Charlotte Basin: Geological Survey of Canada, Open File 2862 (map with abstr., references).
- Josenhans, H.W., Fedje, D.W., Conway, K.W., and Barrie, J.V., 1995, Post glacial sea levels on the western Canadian continental shelf: Evidence for rapid change, extensive subaerial exposure, and early human habitation: *Marine Geology* 125, p. 73-94.
- Josenhans, H.W., Fedje, D., Pienitz, R., and Southon, J., 1997, Early humans and rapidly changing Holocene sea levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada: *Science*, 277, p. 71-74.
- Josenhans, H.W., Harding, J., Lambert, P., Cowan, J., and Fedje, D.W., 1998, Cruise Report, C.S.S. Vector 98 and "Gwaii Haanas" 98: Geological Survey of Canada.
- Keefer, D.K., deFrance, S.D., Moseley, M.E., Richardson, III J.B., Satterlee, D.R., and Day-Lewis, A., 1998, Early maritime economy and El Niño events at Quebrada Tacahuay, Peru: *Science*, 281, p.1833-1835.
- Kozloff, E.N., 1996, *Marine Invertebrates of the Pacific Northwest*: Seattle, University of Washington Press, 539 p.
- Lewis, T.J., Bentkowski, W.H., and Wright, J.A., 1991, Thermal state of the Queen Charlotte Basin, British Columbia: warm, *in* *Evolution and hydrocarbon potential of the Queen Charlotte Basin*, British Columbia: Geological Survey of Canada Paper 90-10, p. 489-506.
- Lowden, J.A., and Blake, W. Jr., 1979, Geological Survey of Canada radiocarbon dates XIX: Geological Survey Paper 79-7, 58 p.
- Luternauer, J.L., Clague, J.J., Conway, K.W., Barrie, J.V., Blaise, B., and Mathewes, R.W., 1989a, Late Pleistocene terrestrial deposits on the continental shelf of

western Canada: Evidence for rapid sea-level change at the end of the last glaciation: *Geology*, 17, p. 357-360.

Lutemauer, J.L., Conway, K.W., Clague, J.J., and Blaise, B., 1989b, Late Quaternary geology and geochronology of the central continental shelf of western Canada: *Marine Geology*, 89, p. 57-68.

Mann, D.H., and Hamilton, T.D., 1995, Late Pleistocene and Holocene paleoenvironments of the north Pacific coast: *Quaternary Science Reviews*, 14, p. 449-471.

Mathewes, R.W., 1989, Paleobotany of the Queen Charlotte Islands, in G.G.E. Scudder, and N. Gessler, eds., *The Outer Shores: Skidegate*, British Columbia, Queen Charlotte Islands Museum Press, p. 75-90.

Mathewes, R.W., 1993, Evidence for Younger Dryas-Age cooling on the north Pacific coast of America: *Quaternary Science Reviews*, 12, p. 321-331.

Mathewes, R.W., Heusser, L.E., and Patterson, R.T., 1993. Evidence for a younger Dryas-like cooling event on the British Columbia coast: *Geology*, 21, p. 101-104.

McCabe, T.T., and Cowan, I.M., 1945, *Peromyscus maniculatus macrorhinus* and the problem of insularity: *Transactions of the Royal Canadian Institute* 25, p. 17-215.

McKenzie, G.D., and Goldwaith, R.G., 1971, Glacial history of the last eleven thousand years in Adams Inlet, southeastern Alaska: *Geological Society of America Bulletin* 82, p. 1767-1782.

Milne, G.A., Mitrovica, J.X., and Schrag, D.P., 2002. Estimating past continental ice volume from sea-level data: *Quaternary Science Reviews* 21, p. 361-376.

Mitas, L., and Mitsova, H., 1988, General variational approach to the interpolation Problem: *Computers and Mathematics with Applications*, 16, p. 983-992.

Morris, R.H., Abbott, D.P., and Haderlie, E.C., 1980, *Intertidal Invertebrates of California*: Stanford, Stanford University Press, 690 p.

Nagorsen, D.W. and Keddie, G., 2000, Late Pleistocene mountain goats (*Oreamnos americanus*) from Vancouver Island: Biogeographic implications: *Journal of Mammalogy*, 81, p. 666-675.

Ogilvie, R.T., 1989, Disjunct vascular flora of northwestern Vancouver Island in relation to Queen Charlotte Islands' endemism and Pacific coast refugia, in G.G.E. Scudder and N. Gessler eds., *The Outer Shores: Skidegate*, British Columbia, Queen Charlotte Island Museum Press, p. 127-130.

- Patterson, R.T., 1993, Late Quaternary benthic foraminiferal biofacies and paleoceanography of Queen Charlotte Sound and southern Hecate Strait, British Columbia: *Journal of Foraminiferal Research* 23, p. 1-18.
- Patterson R.T., Guilbault J-P., Thomson R.E., and Luternauer, J.L., 1995, Foraminiferal evidence of Younger Dryas age cooling on the British Columbia shelf: *Géographie physique et Quaternaire*, 49, p. 409-428.
- Peltier, W. R., 1994, Ice Age paleotopography: *Science*, 265, p. 195-201.
- Peltier, W.R., 1996, Mantle viscosity and Ice-Age ice sheet topography; *Science*, 273, p. 1359-1364.
- Peltier, W.R., 2002. On eustatic sea level history: Last Glacial Maximum to Holocene, *Quaternary Science Reviews*, 21, p. 377-396.
- Philip, G.M., and Watson, D.F., 1982, A precise method for determining contoured surfaces; *Australian Petroleum Exploration Association Journal* 22, p. 205-212.
- Quayle, D.B., and Bourne, N., 1972, The Clam Fisheries of British Columbia: Fisheries Research Board of Canada, Bulletin 179, 70 p.
- Raup, D.M., and Stanley, S.M., 1978, *Principles of Paleontology*, 2nd Edition: New York, W.H. Freeman and Company, p. 296-301.
- Reimchen, T.E., 1994, Predators and evolution in threespine stickleback, *in* M.A. Bell and S.A. Foster, eds., *Evolution of the threespine stickleback*. Oxford, Oxford University Press, p. 240-273.
- Ricketts, E.F., Calvin, J., and Hedgpeth, J.W., 1985, *Between Pacific Tides*, 5th Edition: Revised by D.W. Phillips, Stanford, Stanford University Press, 652 p.
- Riddihough, R., and Hyndman, R.D., 1989, Queen Charlotte Islands Margin, *in* E.L. Winterer, D.M. Hussong & R.W. Decker eds., *The Geology of North America*, Vol. N; *The Eastern Pacific Ocean and Hawaii*: Boulder, The Geological Society of America, p. 21-72.
- Rohr, K.M.M., and Currie, L., 1997, Queen Charlotte Basin and coast mountains: Paired belts of subsidence and uplift caused by a low-angle normal fault: *Geology*, 25, p. 819-822.
- Rohr, K.M.M., and Dietrich, J.R., 1992, Strike-slip tectonics and development of the Tertiary Queen Charlotte basin, offshore western Canada: Evidence from seismic reflection data: *Basin Research*, 4, p. 1-19.
- Rohr, K.M.M., Scheidhauer, M., and Trehu A.M., 2000, Transpression between two

warm mafic plates: The Queen Charlotte Fault revisited: *Journal of Geophysical Research*, 105, p. 8147-8172.

Sandweiss, D.H., McInnis, H., Burger, R.L., Cano, A., Ojeda, B., Paredes, R., Sandweiss, M. del C., and Glascock, M.D., 1998, Quebrada Jaguay: Early South American maritime adaptations: *Science*, 281, p. 1830-1832.

Southon, J.R., Nelson, D.E., and Vogel, J.S., 1990, A record of past ocean-atmosphere radiocarbon differences from the northeast Pacific: *Paleoceanography*, 5, p. 197-206.

Stuiver, M., Reimer, P.J., Bard, E., Beck, J.W., Burr, G.S., Hughen, K.A., Kromer, B., McCormac, G., van der Plicht, J., and Spurk, M., 1998, INTCAL98 radiocarbon age calibration, 24,000-0 cal BP: *Radiocarbon* 40, p. 1041-1083.

Stumpf, A.J., 2001, Late Quaternary ice flow, stratigraphy, and history of the Babine Lake – Bulkley River region, central British Columbia, Canada (Ph.D. thesis): University of New Brunswick, 234 p.

Sutherland-Brown, A., 1968, Geology of the Queen Charlotte Islands, British Columbia: British Columbia Department of Mines and Petroleum Resources, Bulletin 54, 226 p.

Sweeney, J.F., and Seeman, D.A., 1991, Crustal density structure of Queen Charlotte Islands and Hecate Strait, British Columbia, *in* Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia: Geological Survey of Canada Paper 90-10. p. 89-96.

Thompson, R.I., Haggart, J.W., and Lewis, P.D., 1991. Late Triassic through early Tertiary evolution of the Queen Charlotte Basin, British Columbia, with a perspective on hydrocarbon potential, *in* Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia: Geological Survey of Canada Paper 90-10, p. 3-29.

Turcotte, D.L., and Schubert, G., 1982, *Geodynamics: Applications of Continuum Physics to Geological Problems*: New York, John Wiley & Sons, 449 p.

Chapter 3

MALACOLOGICAL INSIGHTS INTO THE MARINE ECOLOGY AND CHANGING CLIMATE OF THE LATE PLEISTOCENE – EARLY HOLOCENE NORTHEASTERN PACIFIC

ABSTRACT

Mollusc distribution is used to deduce the nature of the changing of the northeast Pacific Late Quaternary coastline. A paucity of Arctic molluscan fauna during and subsequent to glaciation suggests shallow, narrowed straits and the presence of ice sheets may have effected ocean currents different from those that now pertain. Water temperatures, sedimentation rates, turbidity, and photoperiod limited invertebrate colonization subsequent to the Last Glacial Maximum, a period of rapid sea-level and climate change. The oldest dated mollusc and first intertidal species to colonize the region was *Macoma nasuta* at 13,210 ^{14}C years BP. Molluscan evidence indicates the onset of a short interval of cool sea-surface temperatures coincident with the Younger Dryas cooling event between ~11,000 and 10,000 ^{14}C years BP. Bivalve species previously categorized as possessing a Recent geologic range were collected in sediments dating older than 10,000 ^{14}C years BP. Fossil shells indicate molluscs were available as a subsistence resource for early humans from at least 13,210 ^{14}C years BP. Edible intertidal biomass densities reached present commercially harvested levels on southern Moresby Island by 8,800 ^{14}C years BP, and on northern Graham Island by 8,990 ^{14}C years BP.

INTRODUCTION

Wherever appropriate molluscan fossils are found, we can begin to describe their ancient environments from our knowledge of malacology. If those fossils are of species that survive to the present, what is known about their physiology and their environmental preferences make ecological inferences possible. For example, some species can be characterized by sediment type, degree of exposure to wave and storm action, vertical distribution, the range of temperatures in which they can survive, and the narrower range in which they can reproduce. The larger community structure can also be inferred from the molluscan assemblage and accompanying fossils of other types of organisms. Part of the goal of this study is the application of malacology to the marine ecology of the northeastern Pacific, Queen Charlotte Island (QCI) region of modern British Columbia (BC; Fig. 1), during the Late Pleistocene and Early Holocene.

If we have accurately dated molluscan fossils, we can deduce the sea-water levels of the past from what we know about living intertidal molluscs, and their characteristic communities (Conway et al., 1999). This is of great value not only for geomorphological purposes but also for mapping land that could be inhabited by plants and animals, including humans. The presence of intertidal molluscs indicates not only that the ice was gone (Conway et al., 1999), but also that an accessible food source was present. Adequate samples of fossil molluscan shells, which can be found in raised-beach deposits, make it also possible to quantify available biomass. Such analyses are part of the larger context of a project undertaken by the senior author to contribute to studies of the peopling of the Americas.

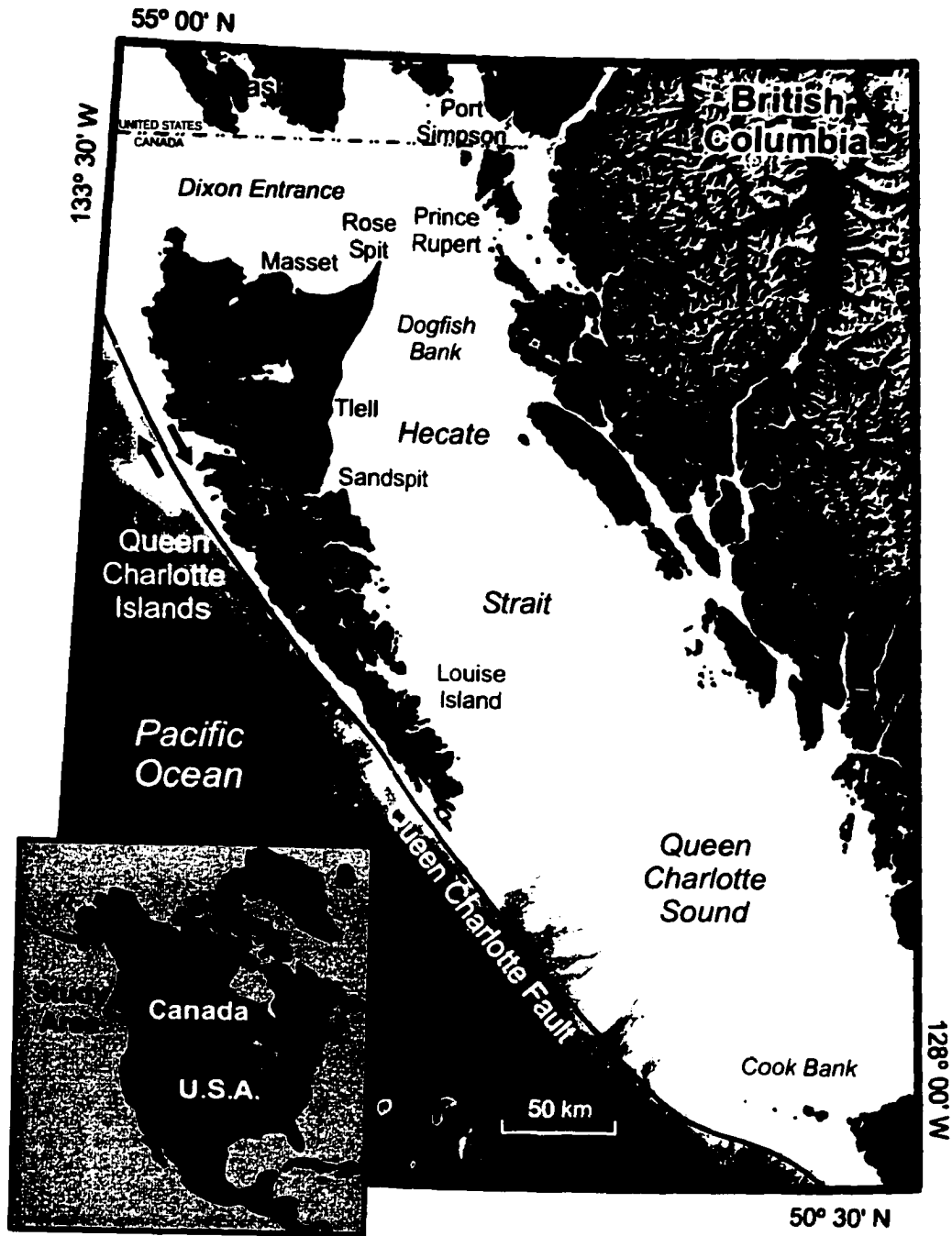


Figure 1. Present Queen Charlotte Island geography and tectonic configuration after Riddiough and Hyndman (1983), and Rohr and Dietrich (1992); arrows indicate relative plate motions.

The Last Glacial Maximum (LGM) and the subsequent sea-level rise during the Late Pleistocene and early Holocene resulted in a series of rapidly altered coastlines and coastal marine habitats along the northeastern Pacific continental shelf. Land-bridges emerged, straits were closed, and coastal basins were flooded. Changing ocean currents and temperatures had significant impact on the distribution of molluscs, and the ability of human and other faunal and floral populations to colonize coastal areas on QCI region of the North American continental shelf.

This project gathered information about dated molluscan fossils, the habitats of living molluscs, and additional faunal and floral data to decipher the character and extent of littoral and near-shore sedimentary environments, and the presence of molluscan species during and subsequent to LGM. Further evidence was obtained from sedimentological analysis, published sub-bottom profiles and bathymetry. Fossil mollusc samples that dated to the study time period were obtained from submarine sediment cores, underwater grab samples, and high-stand (raised-beach) deposits from the QCI region. Specimens were identified and quantified. This information intimates the ability of molluscan species to survive glacial conditions and subsequent warming. Furthermore, as a result of sea-level and temperature change, productive intertidal habitats migrated. Thus we can draw conclusions regarding the responsiveness of molluscs to such change, and their ability to colonize new environments made available by rising ocean temperatures and sea levels.

To understand the region's productivity during this period of rapid climatic and geomorphological change is to understand an important aspect of the viability of the QCI region as a home for North and South Americas' earliest humans. There is growing

support for the hypothesis that the first peoples of North and South America migrated via a coastal route (Fladmark, 1979; Josenhans et al., 1995; Heaton et al., 1996; Dixon et al., 1997; Barrie and Conway, 1999). It presumes that humans colonized the QCI region prior to early coastal sites dating to 12,500 ^{14}C years BP and earlier found in Chile and elsewhere in North and South America (Dillehay, 1989; Keefer et al., 1998; Sandweiss et al., 1998). It also presumes the QCI region had a suitable climate and the right combination of natural resources to make habitation possible. Early human occupation of the Pacific Northwest would have likely been limited to resource-rich coastal zones and estuaries (Barrie and Conway, 2002). The presence and productivity of nutritious intertidal molluscs indicate the subsistence potential of these regions.

CONTEXT

Geology

Global warming subsequent to LGM in the QCI region ($\sim 15,500$ ^{14}C years BP; Blaise et al., 1990), caused the melting of continental ice sheets up to two km thick which extended across Hecate Strait to the QCI (Fig. 1). Crustal subsidence under ice sheets, and crustal uplift peripheral to the ice, combined with falling eustatic sea-levels resulted in rapid and significant changes in sea-level, water-surface temperatures, sedimentation rates, substrate composition, and coastline position (work in preparation). Sea-levels rose up to 120 m along the BC mainland, and dropped more than 150 m in the adjacent QCI archipelago (Clague et al., 1982a; Josenhans et al., 1997), located only 100 km offshore (Fig. 2). Rapid ice retreat between 14,160 and 12,910 ^{14}C years BP (Luternauer et al., 1989a; Blaise et al., 1990; Barrie et al., 1991; Barrie and Conway, 1999) was accompanied by subaerial exposure of large areas of the continental shelf beneath Hecate

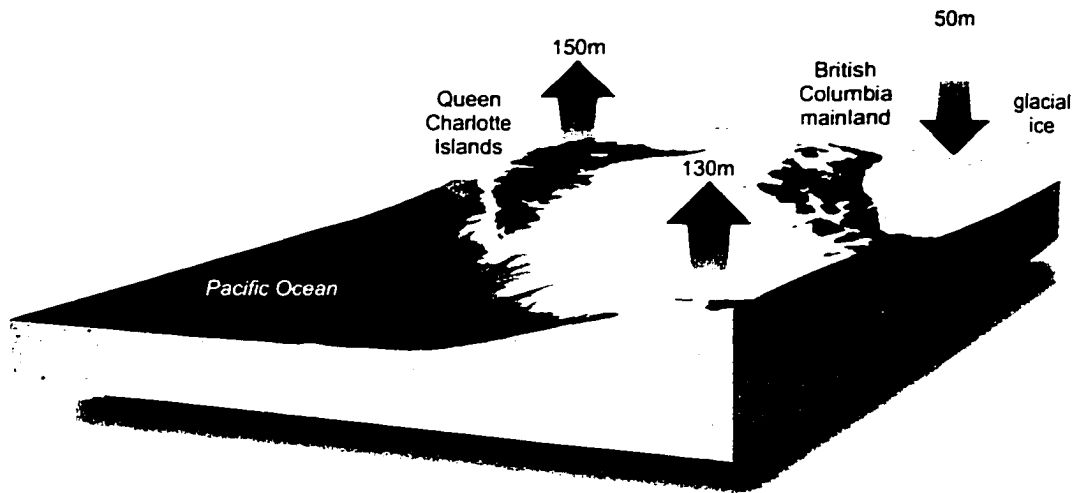


Figure 2. Diagrammatic representation of relative eustatic and isostatic sea-level adjustments in the QCI region, showing changing ice thickness and ice extent, atop a lithosphere that was relatively flexible, that combined to produce a complex and rapidly changing pattern of uplift and subsidence. The weight of ice sheets pushed the mainland down, while adjacent areas were uplifted, forming a peripheral bulge. Eustatic and isostatic adjustments resulted in relative sea-levels up to 120 m higher than present along the BC mainland, and more than 150 m lower than present in the adjacent QCI archipelago, located only 150 km offshore.

Strait and Queen Charlotte (QC) Sound. With the exception of remnant ice in mountain valleys and cirques, the QCI region was ice-free by 13,500 to 13,000 ^{14}C years BP (McKenzie and Goldwaith, 1971; Clague et al., 1982b; Mann and Hamilton, 1995; Barrie and Conway, 1999).

Present sea-surface temperature and salinity in QCI and the Canadian Arctic

Waters of the QCI region presently possess two layers and relatively uniform horizontal sea-surface temperatures ranging from 10 °C to 13 °C in August to a minimum of 4-8 °C in February-March. Temperatures in Dixon Entrance average about 1 °C to 2 °C cooler than QC Sound (Thomson, 1989:38-43). Salinities maintain an east-west gradient, with a low of 31-32 ‰ near the surface to 34 ‰ at the base of the upper layer at approximately 150 to 200 m water depth. Wind-induced vertical mixing during winter and early spring results in a near homogeneous surface layer to 100 m depth, maintaining surface salinities of 32 to 32.5 ‰ and temperatures of 8 °C to 10 °C (Thomson, 1989:44). Estuarine flow patterns in eastern Dixon Entrance result in freshwater dilution during summer and early fall run-off, lowering salinities to 30 ‰. Similar variability is experienced in eastern Hecate Strait and QC Sound, whereas northwest of Rose Spit, relatively high salinities have been recorded (Thomson, 1989:43-44).

Waters of the Western Canadian Arctic region and Beaufort Sea, used as a proxy for sea conditions in the QCI during LGM, possess two layers, a surface and a subsurface layer, identified by temperature and salinity fluctuations. These regional layers are important in constraining marine organism distribution (Lubinsky, 1980). The 50-70 m thick surface layer possesses low temperatures (<5 °C) and salinity (19 ‰ to 4 ‰), which fluctuate seasonally (Grainger, 1959, 1960; Ellis, 1960; Wacasey et al., 1976). The

more stable subsurface layer retains temperatures between 0 °C and -1.97 °C and salinity between 33-34 ‰ (Lubinsky, 1980:8).

QCI tide, wave, wind patterns, and currents

Modern tides in the QCI maintain a mean range between 3.0 and 3.9 m on the north, west and south coasts, and greater than 5 m on the east coast and along the BC mainland (Clague and Bornhold, 1980). Wave energy in QC Sound and Dixon Entrance is slightly less than in the open ocean where wave heights, sporadically in summer, and regularly in winter, exceed 4 m, peaking to over 10 m during fall and winter storms (Canadian Hydrographic Service, 1976; Canada Department of Environment, 1974; Clague and Bornhold, 1980). Waves in Hecate Strait, though smaller than either QC Sound or Dixon Entrance (Clague and Bornhold, 1980), have combined with strong tides to generate modern strandflat, spit platform, and strand plain features.

Wind patterns in the QCI region play an important role in influencing current, coastal drift, upwelling and water salinity. Seasonal wind patterns control two major semi-permanent atmospheric pressure cells: the Aleutian Low (AL) and the North Pacific High (NPH; Kendrew and Kerr, 1955; Thomson, 1981). Increased solar radiation in the summer causes a relatively hotter land surface than ocean surface resulting in a NPH. “a large-scale clockwise rotating wind pattern that moves up from the south”(Patterson et al., 1995:420). Patterson et al. (1995) have found that these north-eastward blowing winds, combined with the coriolis effect result in coastal drift and offshore Ekman transport, triggering upwelling along the continental margin, of the relatively warm high salinity California Undercurrent. Although the California Undercurrent does not extend north of QC Sound, upwelling is present, most notably in Dixon Entrance, as a result of

estuarine circulation and strong vertical tidal mixing, (Thomson, 1994; Guibault et al., 1997). Decreased solar radiation in the winter results in increased atmospheric pressure over the cold land and decreased pressure over the relatively warm ocean, pushing the NPH southward, allowing the AL to influence the QCI region. These south-blowing winds, combined with the coriolis effect result in northward coastal drift and onshore Ekman transport causing downwelling and resulting in cold, low salinity conditions over the shallower parts of the shelf (Patterson et al., 1995).

QCI circulation and zoogeographic distribution

Thomson (1989) proposed that prevailing eastward flowing currents and winds can carry marine organisms from the western Pacific. Moreover, the counterclockwise circulation of the northeastern Pacific Alaska Gyre puts the QCI in close oceanic communication with all the coastal regions of the Aleutian Islands and the Alaskan mainland. Other factors include a poleward flow of coastal surface currents generated by terrestrial runoff from lower latitudes. Water from as far south as California, modified by contributions from the Oregon, Washington and southern British Columbia coasts, appears to reach QC Sound and Hecate Strait. Thomson (1989) adds that in summer and fall seaward movement of brackish surface water from the mainland east of QC Sound and Hecate Strait can transport material the 80 km distance to the QCI. This coincides with a slow onshore movement of subsurface water, which could upwell to indirectly link the outershelf and slope benthic layer with the near-surface layer along the coast. Thus surface and subsurface drifting organisms from distant oceanic regions along the west coast could eventually reach the Islands. Table I lists the modern distribution and temperature ranges of key north Pacific molluscan species.

Table I: Modern Geographic & Temperature ranges of key North Pacific Mollusc species

Species	Geographic range	Median latitude	Minimum depth (m)	Maximum depth (m)	Minimum temp (°C)	Maximum temp (°C)	Geologic spatial range	Geologic time range
<i>Chlamys rubida</i>	33°N - 58°N	46°N	1	200	1	17	NW Pacific	Miocene
<i>Clinocardium californiense</i>	58°N - 80°N	59°N	10	100	1	9	NW Pacific	Pleistocene
<i>Clinocardium ciliatum</i>	57°N - 71°N	59°N	10	150	-2	9	Panarctic Circumboreal	Pleistocene
<i>Clinocardium nuttallii</i>	33°N - 80°N	45°N	0	30	2	19	NW Pacific	Miocene
<i>Diplodonta impolita</i>	33°N - 55°N	44°N	2	100	0	19		Recent
<i>Gari californica</i>	25°N - 80°N	43°N	0	175	6	27	NW Pacific	Pliocene
<i>Hiatella arctica</i>	10°N - 71°N	41°N	0	800	-1	19	Panarctic Circumboreal	Miocene
<i>Hiatella pholadis</i>	48°N - 68°N	58°N	0	10	-3	15	Circumboreal	Pliocene
<i>Humiliana kennerleyi</i>	37°N - 80°N	48°N	0	45	2	14		Pliocene
<i>Macoma calcarea</i>	47°N - 71°N	59°N	0	320	-2	15	Panarctic Circumboreal	?Oligocene
<i>Macoma incongrua</i>	46°N - 57°N	46°N	0	50	1	20	NW Pacific	Pleistocene
<i>Macoma inquinata</i>	34°N - 57°N	46°N	0	50	1	20	NW Pacific	Pleistocene
<i>Macoma nasuta</i>	27°N - 80°N	44°N	0	50	1	22		Miocene
<i>Macoma secta</i>	25°N - 54°N	40°N	0	50	2	23		Pleistocene
<i>Modiolus modiolus</i>	37°N - 80°N	48°N	5	200	-1	23	Circumboreal	Pleistocene
<i>Modiolus rectus</i>	5.1°S - 54°N		0	15	19	34		Miocene
<i>Musculus discors</i>	47°N - 71°N	59°N	5	150	-2	10	Panarctic Circumboreal	Pleistocene
<i>Musculus taylori</i>	48°N - 57°N	53°N	0	0				Recent
<i>Mya truncata</i>	48°N - 71°N	59°N	0	100	-2	16	Panarctic Circumboreal	Miocene
<i>Mytilus californianus</i>	19°N - 80°N	40°N	0	50	-2	31		Pliocene
<i>Mytilimeria nuttallii</i>	30°N - 57°N	44°N	0	45	4	17		Recent
<i>Mytilus trossulus</i>	23°N - 71°N	47°N	0	5	-4	30		Miocene
<i>Nemocardium centifilosum</i>	28°N - 58°N	43°N	2	150	6	23		Pleistocene
<i>Nuculana minuta</i>	53°N - 71°N	62°N	20	250	-1	6	Panarctic & North Atlantic	Pleistocene
<i>Nuculana perrula</i>	52°N - 71°N	62°N	20	1400	-1	7	Panarctic & circumboreal	Pliocene
<i>Nutricula lordi</i>	26°N - 59°N		0	70				
<i>Pododesmus machrochisma</i>	28°N - 58°N	64°N	0	90	-2	14		Miocene
<i>Protothaca staminea</i>	23°N - 80°N	42°N	0	10	2	27		Miocene
<i>Protothaca tenerima</i>	30°N - 54°N	42°N	0	10	4	19		Pliocene
<i>Saxidomus giganteus</i>	37°N - 80°N	48°N	0	40	-1	26	NW Pacific	Miocene
<i>Serripes groenlandicus</i>	47°N - 71°N	59°N	0	80	-2	10	Panarctic Circumboreal	Pliocene
<i>Simomactra falcata</i>	32°N - 57°N	43°N	0	50	4	24		Pliocene
<i>Tellina nukuloides</i>	32°N - 80°N	46°N	0	100	1	24		Recent
<i>Terebratalia transversa</i>	33°N - 57°N		0					
<i>Tresus capax</i>	37°N - 80°N	49°N	0	30	2	20		Pleistocene
<i>Tresus nuttallii</i>	28°N - 58°N	43°N	0	50	1	21	NW Pacific	Miocene
<i>Turtonia minuta</i>	40°N - 80°N	50°N	0	0	-3	20		Recent

adapted from Bernard, 1983a and Harbo, 1997

MATERIALS & METHODS

Collecting methods

Key to paleoenvironmental reconstruction modeling is the identification of intertidal molluscs. As sensitive indicators of sea-level change, salinity, temperature, sedimentation rate, and substrate type, they are valuable signatures of paleoenvironmental change. Molluscan fauna were sampled from submarine (drowned intertidal environments) and high-stand (raised beach) deposits. Their fauna, flora, and lithology were analyzed in the context of published sub-bottom profiles and bathymetry and ^{14}C dated. table II lists the sample ^{14}C dates used in this paper.

Thirty-five samples were taken from raised beaches located at Haines Creek, on west Graham Island, Mary Point on north Graham Island, Cape Ball on east Graham Island, Lockeport Estuary, upper Arrow Creek and George Bay on south Moresby Island, and McNeil River, Kitimat River, Hirsch Creek, and Port Simpson on the BC mainland (see Fig. 3a for sample site locations; Table II). Methods consistent with modern biomass survey methods (Quayle and Bourne, 1972) were used to sample high-stand deposits at Haines Creek, Lockeport Estuary, Upper Arrow Creek, and George Bay. Bulk samples collected from these sites, with volumes ranging between 0.37 m^3 (Haines Creek) and 0.75 m^3 (Lockeport Estuary), were wet-sieved using 1 mm and 2 mm screens, and minimum number of shells and dry shell weight of mollusc species determined (Appendix Tables A1 and A2). All other dated high-stand deposit samples were compiled from previous research (Table II).

Sixty-five underwater grab samples, obtained by H. Josenhans, D. Fedje and

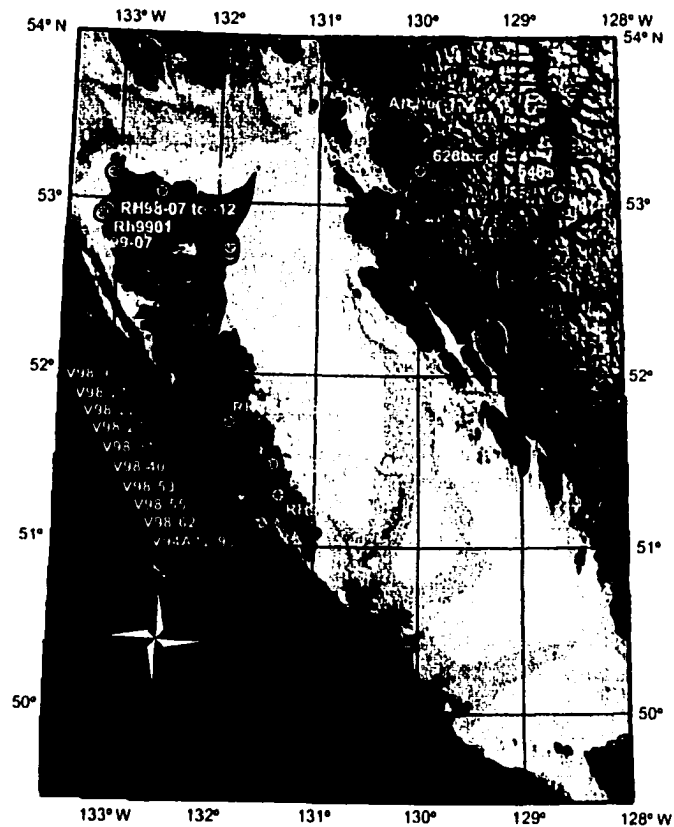


Figure 3a.

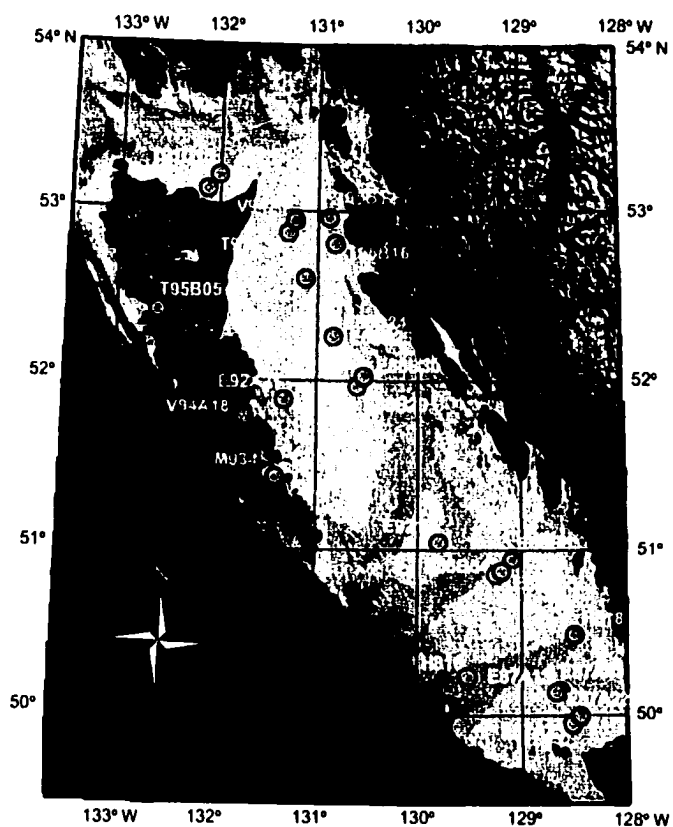


Figure 3b.

Figure 3a. Queen Charlotte Islands region high-stand and underwater grab sample locations.
Figure 3b. Queen Charlotte Islands region submarine sediment core sample locations.

Table II Radiocarbon dates and interpretations for Queen Charlotte Island region, Canada.

LAB NUMBER	SAMPLE NUMBER	LOCATION	PRESENT ELEVATION (m)	MRC Radiocarbon years BP	UNCERTAINTY (+/- years)	REFERENCE	MATERIAL DATED	SEA-SURFACE TEMPERATURE (°C)	ENVIRONMENT OF DEPOSITION
CAMS48153	V98-44	Juan Perez Sound	-53.0	>modern		12	intertidal barnacle	n/a	slump deposit
CAMS49633	V98-24-2	Juan Perez Sound	-137.0	>modern		#	<i>Amphissa columbiana</i>	n/a	slump deposit
CAMS62535	RH9901-4	Kennecott Point	18.0	>modern		*	marine shell	n/a	
CAMS49632	V98-24-1	Juan Perez Sound	-137.0	180	50	#	conifer cone	n/a	slump deposit
CAMS48154	V98-44	Juan Perez Sound	-53.4	380	50	12	<i>Nucella lamellosa</i>	n/a	slump deposit
CAMS-49627	V98-57	Juan Perez Sound	-55.0	450	50	12	<i>Protothaca staminea</i>	n/a	slump deposit
CAMS-62538	RH9913-3	Lepas Bay	7.5	1160	40	*	<i>Acmae mitra</i>	n/a	l
CAMS-62536	RH9907-5	Haines Creek	10.9	4190	50	*	<i>Tectura fenestrata</i>		l
GSC-2471	626b	McNeil River	4.0	7710	150	1	<i>Abies amabilis</i>	n/a	T
TO-4362	E9213-57	QC Sound	-109.0	7820	70	*	Terrestrial organics	n/a	T
TO-9313	RH98-08-118	Lockeport Estuary	7.0	8020	70	*	<i>Lottia digitalis</i>		l
GSC-2248	626c	McNeil River	3.0	8060	90	1	<i>Picea sp.</i>	n/a	SM/l ?
TJ-9304	T91C20-108-35	Dixon Entrance	-33.0	8070	70	*	<i>Olivella sp.</i>		
GSC-2738	116c	Cape Ball	7.0	8210	80	5	<i>Saxidomus giganteus</i>	n/a	l
GSC-242	116a	Cape Ball	7.0	8220	150	2	<i>Saxidomus giganteus</i>	n/a	
TO-9314	RH98-05-487	George Bay	7.0	8360	100	*	<i>Lottia digitalis</i>		l
GSC-2534	117a	Haines Creek	2.0	8450	90	3	<i>Protothaca tenerrima</i>	n/a	l
GSC-2734	116d	Cape Ball	8.0	8460	120	5	<i>Clinocardium nuttalli</i>	n/a	l
TO-9311	RH98-01-92	Upper Arrow Creek	7.0	8680	80	*	<i>Protothaca staminea</i>		l
GSC-2343	626d	McNeil River	3.0	8780	150	1	<i>Clinocardium nuttalli</i>	n/a	SM/l
TO-9312	RH98-04-150	Upper Arrow Creek	6.3	8800	70	*	<i>Protothaca staminea</i>	+4 to +14	l/fresh water influx
CAMS-18999	V94A12-93	Arrow Creek	12.0	8850	70	4	spruce needle	n/a	SM
CAMS-62537	RH9909-305	Haines Creek	2.0	8990	50	*	<i>Acmae mitra</i>	+4 to +14	SM/protected outer coast
TO-9307	E88B29-121-1	Hecate Strait	-118.0	9130	90	*	<i>Olivella baetica</i>	+1 to +25	l/estuary
GSC-3129	116e	Cape Ball River	5.0	9160	90	5	terrestrial peat	n/a	T
RIDDL-1211	MP-1	Mary Point Location B	8.0	9160	110	6	<i>Saxidomus giganteus</i>	+2 to +21	l/estuary
TO-9306	E88B29-74-1	Hecate Strait	-118.0	9200	100	*	<i>Saxidomus giganteus</i>	n/a	l/estuary
GSC-2425	548a	Kitimat River	30.0	9300	90	1	coniferous wood	n/a	SM/delta
CAMS10836	M934-230	Matheson Inlet	-27.0	9340	60	7	<i>Pododesmus machrochisma</i>	-2 to +14	l
RIDDL-1205	MP-2	Mary Point Location B	8.0	9450	130	6	<i>Saxidomus giganteus</i>	+2 to +21	l/estuary
TO-4889	V9427-87	Hecate Strait	-68.0	9480	70	*	wood	+4 to +17	l
CAMS10834	M934-207	Matheson Inlet	-27.0	9540	70	7	<i>Pododesmus machrochisma</i>	-2 to +14	l
TO-4890	V9427-142	Hecate Strait	-68.0	9660	70	*	wood	+4 to +17	l
CAMS10835	M934-219	Matheson Inlet	-27.0	9670	80	7	<i>Pododesmus machrochisma</i>	-2 to +14	l
GSC-2492	447a	Hirsch Creek	98.0	9700	160	1	wood	n/a	l
TO-1296	E88B29-91	Hecate Strait	-118.0	9710	70	*	<i>Olivella sp.</i>	+1 to +25	l
TO-4405	T91C15-83	Dixon Entrance	-96.0	9770	90	8	<i>Arthropoda cirrepedia</i>	n/a	SM/drowned spit
CAMS10837	M934-238	Matheson Inlet	-27.0	9800	60	7	<i>Mytilus sp.</i>	-2 to +14	l
TO-1256	E88B54-102	Goose Island Bank	-121.0	9800	80	8	<i>Spisula faicata</i>	+4 to +24	l
TO-174	H818-245	Goose Island Trough	-192.0	9830	120	9	<i>Balanus glandulus</i>	+3 to +12	l/quiet bay
TO-1337	E88B30-118	Hecate Strait	-111.0	9840	70	*	<i>Modiolus rectus</i>	n/a	l
TO-3737	T91C20-217	Dixon Entrance	-33.0	9850	70	*	unidentified marine bivalve	n/a	l
RIDDL-979	E87A23-25	Cook Bank	-94.0	9940	75	10	terrestrial peat	+3 to +18	l/exposed

Table II cont'd: Radiocarbon dates and interpretations for Queen Charlotte Island region, Canada.

LAB NUMBER	SAMPLE NUMBER	LOCATION	PRESENT ELEVATION (m)	MRC Radiocarbon years BP	UNCERTAINTY (+/- years)	REFERENCE	MATERIAL DATED	SEA-SURFACE TEMPERATURE (°C)	ENVIRONMENT OF DEPOSITION
TO-173	H816-359	Outer Goose Island Trough	-284.0	10000	80	9	<i>Nuculana cellulita</i>	-1 to +14	SM/subtidal
CAMS9992	M934-246	Matheson Inlet	-27.0	10090	80	7	<i>Mytilus</i> sp.	n/a	SM/brackish
CAMS-49628	V98-62-2	Juan Perez Sound	-55.0	10130	40	12	<i>Saxidomus giganteus</i>	n/a	I
CAMS-49629	V98-31-1	Juan Perez Sound	-65.0	10180	40	12	<i>Saxidomus giganteus</i>	+2 to +14	I
GSC-3159	116f	Cape Ball	5.0	10200	90	5	terrestrial peat	n/a	T
NA	E87A22-87	Cook Bank	-104.0	10250	80	8	unidentified marine bivalve	-1 to +6	I/cool
RIDDL-983	E87A23-54	Cook Bank	-94.0	10290	80	10	wood	+1 to +9	SM/heavy surf
TO-3495	E92A21-142	Hecate Strait W.	-116.0	10360	80	7	twig	n/a	L/brackish
NA	E87A22-121	Cook Bank	-104.0	10360	140	8	unidentified marine bivalve	n/a	I/estuary
NA	E87A13-172	Cook Bank	-140.0	10360	120	11	unidentified marine bivalve	+1 to +7	SM
TO-3735	E92A21-123	Hecate Strait W.	-116.0	10380	70	*	unidentified marine bivalve	-3 to +15	I
CAMS-49630	V98-40-1	Juan Perez Sound	-107.0	10380	50	12	<i>Saxidomus giganteus</i>	n/a	I
RIDDL-	E87A23-83	Cook Bank	-94.0	10400	140	10	wood	n/a	T
NA	E87A4-140	Cook Bank	-122.0	10430	130	11	wood	n/a	I/T
RIDDL-985	E87A23-93	Cook Bank	-94.0	10470	75	13	root	n/a	T
RIDDL-981	E87A23-40	Cook Bank	-94.0	10485	70	10	wood	+1 to +9	T/SM
NA	V94A18-481	Logan Inlet	-220.0	10560	70	4	branchlet	n/a	L/SM/brackish
TO-1254	E88B53-87	Goose Island Bank	-133.0	10630	70	8	<i>Macoma incongrua</i>	-2 to +16	I/estuary
TO-1257	E88B54-179	Goose Island Bank	-121.0	10640	80	8	<i>Saxidomus giganteus</i>	+4 to +24	I
RIDDL-984	E87A23-83	Cook Bank	-94.0	10650	350	10	wood	n/a	T
CAMS-18601	V94A11-88	Burnaby Strait	-111.0	10670	60	4	wood	n/a	SM/T/F
TO-1342	E88B55-142	Goose Island Bank	-124.0	10720	70	8	<i>Zirfaea pilsbryi</i>	-1 to +25	Low I
NA	V94A11-81	Burnaby Strait	-111.0	10750	60	4	<i>Mytilus</i> sp.	n/a	F/SM
CAMS-48155	V98-53-2	Juan Perez Sound	-120.0	10890	50	12	<i>Protothaca staminea</i>	+2 to +9	I
CAMS-33932	T95B16-127	Hecate Strait	-114.0	11030	60	8	wood	n/a	SM/delta
CAMS-54600	V98-21-1	Juan Perez Sound	-130.0	11050	50	#	<i>Saxidomus giganteus</i>	+4 to +16	I/estuary
CAMS-47674	V98-22-1	Juan Perez Sound	-128.0	11140	50	12	<i>Protothaca staminea</i>	+4 to +14	I/estuary
CAMS-54601	V98-27-1	Juan Perez Sound	-122.0	11150	50	#	<i>Protothaca tenerrima</i>	+4 to +14	I
CAMS-47675	V98-9-1	Juan Perez Sound	-125.0	11280	50	12	<i>Protothaca tenerrima</i>	+4 to +14	I
CAMS-33927	T95B05-31	Rennell Sound	-152.0	11290	60	8	wood	n/a	A/SM
CAMS-49631	V98-55-1	Juan Perez Sound	-119.0	11320	50	12	<i>Protothaca tenerrima</i>	+4 to +19	I
TO-1336	E88B25-75	Hecate Strait	-109.0	11350	70	8	<i>Clinocardium nuttalli</i>	+2 to +19	I/sheltered
CAMS-26278	T95B16-136	Hecate Strait	-114.0	11480	60	8	deciduous wood	n/a	SM/delta
CAMS-33928	T95B05-116	Rennell Sound	-152.0	11820	60	8	wood	n/a	A/SM
CAMS-33796	T95B05-244	Rennell Sound	-152.0	12360	60	8	<i>Cooperella</i> sp.	n/a	A/SM
TO-1255	E88B53-109	Goose Island Bank	-133.0	12370	90	8	worm tubes	n/a	I/estuary
CAMS-33929	T95B05-226	Rennell Sound	-152.0	12380	60	8	wood	n/a	A/SM
GSC-3112	116g	Cape Ball	7.0	12400	100	5	terrestrial peat	n/a	T
TO-9308	E88B30-73-1	Hecate Strait	-111.0	12520	100	*	<i>Saxidomus giganteus</i>	n/a	I/estuary
TO-9309	E88B53-150-3	Goose Island Bank	-133.0	12540	140	*	<i>Balanus glandulus</i>	n/a	I/estuary
Beta-114464	Archer-1	Port Simpson	50.0	12570	50	14	<i>Saxidomus giganteus</i>	+2 to +15	I/estuary
TO-77	H818-283	Goose Island Trough	-192.0	12620	80	9	<i>Macoma nasuta</i>	n/a	SM/irregularly flushed
Beta-114465	Archer-2	Port Simpson	50.0	12640	50	14	<i>Tresus nuttalli</i>	+2 to +15	I/estuary
TO-9305	E88B54-80-43	Goose Island Bank	-121.0	12710	100	*	<i>Mytilus edulis</i>	+4 to +24	I/protected
CAMS-26282	T95B12-185	Hecate Strait	-77.0	12890	60	15	<i>Mytilus</i> sp.	+1 to +20	I

Table II cont'd: Radiocarbon dates and interpretations for Queen Charlotte Island region, Canada.

LAB NUMBER	SAMPLE NUMBER	LOCATION	PRESENT ELEVATION (m)	MRC Radiocarbon years BP	UNCERTAINTY (+/- years)	REFERENCE	MATERIAL DATED	SEA-SURFACE TEMPERATURE (°C)	ENVIRONMENT OF DEPOSITION
TO-3492	T91C34-104	Dogfish Bank	-31.0	13190	100	16	dwarf will plant	n/a	T
GSC-3711	H818-714	Goose Island Trough	-192.0	13200	150	9	<i>Macoma nasuta</i>	n/a	SM/irregularly flushed
TO-1335	E88B24-149	Hecate Strait	-144.0	13210	80	*	<i>Macoma nasuta</i>	+1 to +15	SM/high sediment influx
GSC-3222	116h	Cape Ball	8.0	13700	100	5	organic	n/a	T
TO-3738	T91C34-119	Dogfish Bank	-31.0	13790	150	16	terrestrial plant	n/a	T
TO-4888	V9423-126	Hecate Strait W.	-30.0	14180	110	15	<i>Cassidula reniforme</i>	n/a	SM/cold
GSC-3746	H818-271	Goose Island Trough	-192.0	15200	490	9	unidentified marine bivalve	+1 to +16	SM/silty

Note: MRC - marine reservoir corrected; SM - shallow marine; I - intertidal; T - terrestrial; L - lacustrine; F - fluvial; A - alluvial.

The relative change in msl refers to the net change in the elevation of the sampled site relative to present mean sea-level (msl) and incorporates both isostatic and eustatic sea-level change.

Sample locations, whose elevation relative to present msl has risen subsequent to deposition, were allocated a positive msl change representing the amount sea-level must be raised to reflect msl

at the time of deposition. Sample locations, whose relative elevation has fallen subsequent to deposition, were allocated a negative msl change representing the amount sea-level must be

dropped to reflect msl at the time of deposition. Relative change in msl equals present elevation of site minus deposition elevation. Isostatic displacement equals relative change in msl minus

eustatic sea-level x (-1).

- Lowdon, J.A., and Blake, W., Jr. 1979. Geological Survey of Canada radiocarbon dates XIX. Geological Survey Paper 79-7.
- Lowdon, J.A., Robertson, I.M., and Blake, W., Jr. 1971. Geological Survey of Canada radiocarbon dates XI. Radiocarbon 13: 255-324, reprinted in 1971 as Geological Survey of Canada, Paper 71-7.
- Alley, N.F., and Thomson, B. 1978. Aspects of environmental geology, parts of Graham Island, Queen Charlotte Islands. British Columbia Ministry of Environment, Resource Analysis Branch, Bulletin 2.
- Josenhans, H.W., Fedje, D., Pienitz, R., and Southon, J. 1997. Early humans and rapidly changing Holocene sea levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada. Science 277: 71-74.
- Clague, J.J., Harper, J.R., Hebda, R.J., and Howes, D.E. 1982. Late Quaternary sea levels and crustal movements, coastal British Columbia. Can. J. Earth Sci. 19: 597-618.
- Southon, J.R., Nelson, D.E., and Vogel, J.S. 1990. A record of past ocean-atmosphere radiocarbon differences from the northeast Pacific. Paleoceanography 5: 197-206.
- Josenhans, H.W., Fedje, D.W., Conway, K.W., and Barrie, J.V. 1995. Post glacial sea levels on the western Canadian continental shelf: Evidence for rapid change, extensive subaerial exposure, and early human habitation. Mar. Geol. 125: 73-94.
- Barrie, J.V., and Conway, K.W. 2002. Rapid sea level change and coastal evolution on the Pacific margin of Canada. Sediment. Geol. 150: 171-183.
- Lutemauer, J.L., Conway, K.W., Clague, J.J., and Blaise, B. 1989b. Late Quaternary geology and geochronology of the central continental shelf of western Canada. Mar. Geol. 89: 57-68.
- Lutemauer, J.L., Clague, J.J., Conway, K.W., Barrie, J.V., Blaise, B., and Mathewes, R.W. 1989a. Late Pleistocene terrestrial deposits on the continental shelf of western Canada: Evidence for rapid sea-level change at the end of the last glaciation. Geology 17: 357-360.

Table II cont'd

11. Barrie, J.V. 1991. Contemporary and relict titaniferous sand facies on the western Canadian continental shelf. *Cont. Shelf Res.* 11: 67-79.
12. Fedje, D.W., Josenhans, H.W., 2000. Drowned forests and archaeology on the continental shelf of British Columbia, Canada. *Geology* 28: 99-102.
13. Barrie, J.V., Bornhold, B.D., Conway, K.W., and Lutemauer, J.L. 1991. Surficial geology of the northwestern Canadian continental shelf. *Cont. Shelf Res.* 11: 701-715.
14. Archer, D.J.W. 1998. Paper presented at the 31st annual meeting Canadian Archaeological Association, Victoria, BC, 6-10 May 1998.
15. Barrie, J.V., and Conway, K.W. 1999. Late Quaternary glaciation and postglacial stratigraphy of the northern Pacific margin of Canada. *Quat. Res.* 51: 113 - 123.
16. Barrie, J.V., Conway, K.W., Mathewes, R.W., Josenhans, H.W., and Johns, M.J. 1993. Submerged Late Quaternary terrestrial deposits and paleoenvironment of northern Hecate Strait, British Columbia continental shelf, Canada. *Quat. International* 20:123 - 129.

* previously unpublished, Geological Survey of Canada

previously unpublished, Parks Canada

others during the C.S.S. Vector 1998 cruise from Juan Perez Sound, QCI were wet-sieved using 3 and 6 mm mesh. Of these, forty contained molluscan fauna whose habitat depth range did not meet or exceed the sample depth; these data are compiled in Appendix table A3. Grab sampling targets focused on fluvial features, river terraces, alluvial fans and deltas (Fig. 3a). Due to the nature of grab sampling, sedimentary records from individual sites were not available and samples included both living molluscs, shells of those recently deceased (modern), and shells of the same species dating back thousands of years. To ensure only non-modern molluscs were used in the study, all molluscan samples whose species depth range extended to, or beyond the sample depth, were considered modern – capable of living in the environment today, and therefore catalogued and weighed, but not utilized for further analysis. Intertidal species, which were sampled at depths beyond their normal range, but dated recent (the last few hundred years; V98-24) or modern (today; V98-24, V98-44, V98-57), imply movement via biological (birds, hermit crabs) or geological (debris flow or slumping) means, and were removed from further study.

Submarine sediment cores obtained by the Geological Survey of Canada (GSC) between 1981 and 1995 were analyzed (Fig. 3b), and those containing lithologies, sedimentary structures, shell material, or radiocarbon dates of interest were sampled (4 cm³) at regular intervals and screened using 710 µm (gravel and sand) or 63 µm (fine silt). Paleobotanical and faunal data were collected, identified, and paleohabitat interpretations were based on present species' habitat characteristics (Cornwall, 1955; Dunnill, 1968; Hart, 1973; Abbott, 1974; Bernard, 1979, 1983a, 1983b; Ricketts et al., 1985; Bernard et al., 1991; Coad, 1995; Kozloff, 1996; Harbo, 1997). Mollusc species

were identified by the primary author on the basis of hinge structure, shell sculpture, colour, thickness, curvature, fracture patterns, and comparison with mollusc shell reference collections and standard references (Cornwall, 1955; Dunnill, 1968; Abbott, 1974; Bernard, 1979; Morris et al., 1980; Kozloff, 1996; Harbo, 1997). R.G.B. Reid (University of Victoria) verified identification of shells. Shell fragments too small or eroded to be identified by species were categorized as “undifferentiated bivalve” or “undifferentiated gastropod”. Shells were blotted and then weighed using an electronic digital scale to the nearest 0.1 g. Selected intertidal mollusc specimens were chosen for ^{14}C AMS dating. Faunal evidence found in close proximity or underlying (older than) dated samples within the cores are outlined in Appendix table A4.

Dating methods

Intertidal molluscan species having narrow depth tolerances were chosen for ^{14}C AMS dating. To ensure consistency between dates obtained from a variety of laboratories over the last thirty years, the dating methodology was reviewed for all dates and a marine reservoir correction factor of 800 years (Southon et al., 1990; Clague personal communication, 2001) was applied to normalized ^{14}C shell dates.

Shellfish Biomass

Identified shells were blotted and then weighed using an electronic digital scale to the nearest 0.1 g. Edible intertidal mollusc shell weights were multiplied by species specific biomass factors (Erlandson, 1984; Moss, 1989; Reid, unpublished) to determine what edible biomass levels they represented.

Shell taphonomy

The use of mollusc shells to interpret paleoenvironments and productivity is based on the assumption that modern specimens of identified species provide a proxy for productivity and habitat characteristics of Late Pleistocene-Early Holocene species. However, veracity of interpretation is dependent on whether the sample is representative of the original environment; representation is dependent on shell preservation, deposition and redistribution. During the deglaciation period following maximum glaciation, low salinities caused by rapid melting of ice sheets combined with high sediment influx would have promoted shell preservation. However, during warm periods, when mean annual temperatures were higher than today, shell preservation would have lessened, especially in high-energy environments and during periods of rapid sea-level change (Flessa and Kowaleski, 1994; Claassen, 1998). In these cases, shell samples under-represent the true productivity of the sampled locale.

Evidence of reduced shell preservation exists between 12,250 and 10,750 ^{14}C years BP. Unconformable sediments are also present in sub-marine cores in Hecate Strait and QCI between 12,250 and 10,750 ^{14}C years BP. Thus, one potential explanation may be that beach surface erosion, caused by subaerial exposure followed by rapid sea-level transgression, may have led to reduced shell preservation.

To ensure sampling of natural 'life assemblage' shell deposits, as opposed to 'death or mixed assemblages' careful attention was paid to shell articulation and orientation, and matrix composition. Preservation in 'life position' is the prime consideration for ruling out post-mortem transport, whereas, disarticulation, size sorting and significant wear and breakage are indicators of transport (Raup and Stanley, 1978).

Shell deposit redistribution, visible as slump deposits in some underwater grabs and cores, is probably the result of flash floods, earthquakes, storm surges, excessively high tides and bioturbation. Transported deposits were indicated by the presence of spurious intertidal deposits within benthic assemblages. Sampled sites containing evidence of transport were not included in the research.

Intertidal Assemblages

The majority of bivalves found in the intertidal are also distributed subtidally. The designation of an assemblage as intertidal, especially where the ancient shore is now submerged has to be approached with caution. Even the presence of key indicator intertidal molluscs and barnacles is not conclusive, since if their numbers are small they could have been washed down into subtidal sinks. Furthermore, some indicators, such as intertidal species of *Littorina*, do not appear in the fossil record until too late to be of much value for pinpointing sea water levels when major transgressions and regressions were occurring. *Mytilus* is a good general indicator, and present in many samples, having a subtidal range of less than 5 m. Thus, dependence on *Mytilus* alone would not introduce a significant error on the scales of vertical migration of the sea shore observed in this study. The approach was to identify assemblages dominated by species that would presently be typically, if not exclusively intertidal, and from which exclusively subtidal molluscs are absent. The malacological interpretations were substantiated with lithological, sedimentological, and published sub-bottom profiles.

RESULTS

Molluscan species identified

Appendix tables A1, A2, A3, and A4 outline the minimum number of shells and

dry shell weights for each molluscan species obtained from high-stand deposits on southeast Moresby Island and northeast Graham Island, from underwater grab samples in Juan Perez Sound, and from submarine sediment cores obtained from Dixon Entrance, Hecate Strait, and QC Sound. Sample localities are identified in figures 3a and 3b. Sites sampled in southern Moresby Island provided 27 molluscan species from high-stand deposits dating to between 8,020 $\pm$ 70 and 8,800 $\pm$ 70 ^{14}C years BP and 43 molluscan species from underwater grab samples dating between 10,180 $\pm$ 40 and 11,320 $\pm$ 50 ^{14}C years BP (Fedje and Josenhans, 2000). Fifty-two molluscan species are identified in northern Graham Island high-stand deposits dating to between 4,190 $\pm$ 50 and 8,990 $\pm$ 50 ^{14}C years BP (Table II) and 56 molluscan species have been identified in submarine sediment cores. Analysis of molluscan species found in submarine sediment cores provided evidence to interpret the timing of recolonization of identified molluscan species. The base of some cores contained abundant shell material and it is anticipated that shell-rich sediments may have underlain the core base. Thus, we suggest that the oldest ages provided for identified molluscan species are minimum dates. High-stand and underwater grab samples, despite containing fewer numbers of molluscan species, were larger, providing sufficient quantities of shell material to perform edible intertidal biomass calculations.

Timing of recolonization and oldest mollusc shells found

The oldest mollusc shells obtained from all samples were *Macoma nasuta* specimens collected from submarine sediment cores E88B24 and H818 dating to 13,210 $\pm$ 80 ^{14}C years BP² and 13,200 $\pm$ 150 ^{14}C years BP (Luternauer et al., 1989b) respectively. *Macoma nasuta* was first to recolonize massive to finely laminated muddy

sands in Hecate Strait and QC Sound (E88B24; H818; Table II). *Macoma nasuta* has a high tolerance for stale, sediment-rich, irregularly flushed lagoonal water, and was also frequently used as food by aboriginals (Ricketts et al., 1985). Shortly after the invasion by *Macoma nasuta*, *Macoma calcarea*, a common cold-tolerant mollusc, inhabited the fine muddy sands in Hecate Strait, along with *Theragra chalcogramma* (walleye pollock) and *Clupea harengus pallasii* (Pacific herring; E88B24). In QC Sound, molluscs *Nutricula lordi* and *Margarites beringensis*, and fish species *Mallotus villosus* (smelt) and Cottidae sp. (sculpin), occupied sandy mud following the initial colonization by *Macoma nasuta* (H818; Appendix E).

The oldest sampled *Mytilus* sp. dates to 12,890 $\pm$ 60 ^{14}C years BP (Barrie and Conway, 1999) in core T95B12, taken just west of the present B.C. mainland. However, *Mytilus* sp., potentially older than 12,890 $\pm$ 60 ^{14}C years BP, were sampled in underlying sediments in core T95B12 along with *Musculus taylori* (?) *Macoma incongrua*, *Hiatella pholadis*, and *Macoma inquinata* (?). Nearby at Port Simpson, along the BC mainland, *Tresus nuttallii* first appeared at 12,640 $\pm$ 50 ^{14}C years BP (Archer, 1998) in conjunction with *Saxidomus giganteus*, *Clinocardium nuttallii*, *Macoma irus* (*M. inquinata*), *Mytilus californianus*, *Hiatella arctica*, *Chlamys rubida*, *Lottia digitalis*, and barnacles *Balanus glandulus*, and *Balanus nubilis*. At 12,540 $\pm$ 140 ^{14}C years BP (Table II) *Modiolus rectus*, *Yoldia* sp. and *Balanus crenatus* first appear, along with *Balanus glandulus* in sandy gravel sediments in core E88B53 as well as bivalve *Simomactra falcata* in core E88B54 taken from Goose Island Bank, QC Sound. The presence of *Modiolus rectus* indicates a significant warming in sea-surface temperature in Goose Island Bank waters between 12,540 and 12,370 ^{14}C years BP. Sea-surface temperatures must have

occasionally reached at least 19 °C for *M. rectus* to reproduce. *Saxidomus giganteus* colonized the beaches of an emergent coastal plain in Hecate Strait at 12,520 +/-100 ¹⁴C years BP (Table II). The oldest sampled *Protothaca sp.* dates to 11,280 +/-50 ¹⁴C years BP (*P. tenerrima*) and 11,140 +/-50 ¹⁴C years BP (*P. staminea*) (Fedje and Josenhans, 2000) from underwater grab samples taken in Juan Perez Sound, southern Moresby Island. Bivalves *Serripes groenlandicus*, *Clinocardium ciliatum* appear briefly in Juan Perez Sound in grab samples V98-48, -54, and -53, dating to 10,890 +/-50 ¹⁴C years BP (Fedje and Josenhans, 2000). *Nuculana minuta* (core E87A22), *Clinocardium californiense* (E87A23), and *Nuculana pernula* (E87A13) are present in submarine core sediments dating between 10,250 and 10,485 ¹⁴C years BP.

Paleofaunistic zones

Table III outlines a comparison of Arctic and QCI bivalves presently inhabiting these regions and a list of bivalve species found in this study. Although there are a number of species common to the QCI, Beaufort Sea, and the Western Canadian Arctic Archipelago, many species differ, making the present QCI assemblage distinct from the more northerly assemblages. Table III illustrates that many species currently found in the QCI region lived in Late Pleistocene-Early Holocene QCI sampled localities, with the exception of *Clinocardium ciliatum*, which though present in a sample dating to 10,890 +/- 50 ¹⁴C years BP (V98-53), does not currently inhabit the QCI. Thus, despite cooler sea-surface temperatures during LGM, molluscan assemblages typical of more northerly regions did not shift south into the QCI region.

Biomass quantification

Critical to ascertaining productivity of early coastal zones, is the identification of

Table III: Synopsis of bivalvia in major collections from the western Canadian Arctic archipelago, the Beaufort Sea area, the Queen Charlotte Islands today, and Queen Charlotte Islands palaeo-bivalve localities

Name of Species	W. Cdn Arctic Archipelago	Beaufort Sea QCI today	QCI palaeolocalities
<i>Arctinula greenlandica</i>		X	
<i>Astarte borealis</i>		X	
<i>Astarte borealis</i>	X	X	
<i>Astarte crenata</i>	X	X	
<i>Astarte esquimalti</i>		X	X V98-24,-27,-32
<i>Astarte montagui et form.</i>		X	
<i>Astarte warhami</i>	X		
<i>Axinopsida orbiculata</i>	X	X	
<i>Axinulus careyi</i>		X	
<i>Batharca frielei</i>	X	X	
<i>Batharca glacialis</i>	X	X	
<i>Batharca ridentata</i>		X	
<i>Boreacola vadosa</i>		X	
<i>Cerastoderma echinatum</i>		X	
<i>Cerastoderma elegantulum</i>		X	
<i>Chlamys pseudislandica</i>		X	
<i>Clinocardium ciliatum</i>	X	X	V98-53
<i>Crenella decussata</i>		X	X
<i>Cuspidaria arctica</i>	X		
<i>Cuspidaria glacialis</i>		X	
<i>Cuspidaria suborta</i>		X	
<i>Cyclocardia crassidens</i>		X	
<i>Cyclocardia crebricostata</i>		X	X
<i>Cyrtodaria kuriana</i>	X	X	
<i>Dacrydium vitreum</i>	X	X	X
<i>Delectopecten greenlandicus</i>	X		
<i>Diplodonta aleutica</i>		X	
<i>Hiatella arctica</i>	X	X	X RH9805 (pholadis); V98-22,-27 (pholadis); V98-42,-59,-64, V98-53 (pholadis); E88B53(pholadis); E92A2(pholadis), T95B12 (pholadis)
<i>Limatula hyperborea</i>		X	
<i>Liocyma fluctuosa</i>	X	X	X
<i>Liocyma viridis</i>		X	
<i>Lyonsia arenosa</i>	X	X	
<i>Lyonsia norvegica</i>		X	
<i>Lyonsia schimkewitsci</i>		X	
<i>Lyonsiella sp.</i>		X	
<i>Lyonsiella uschakovi</i>		X	
<i>Macoma calcarea</i>	X	X	X V98-43, -60; E87A13; E88B24; E88B53; T95B12
<i>Macoma inconspicua/balthica</i>	X	X	X
<i>Macoma loveni</i>	X	X	
<i>Macoma moesta</i>	X	X	X T91C20
<i>Macoma obliqua/incongrua</i>		X	X RH98-01,-02,-03,-04,-05,V98-21,-27,-62,-63; E88B53; T95B12(cf)
<i>Macoma planiuscula/fama</i>	X		X
<i>Macoma torelli/crassula</i>	X	X	
<i>Malletia abyssopolaris</i>		X	
<i>Modiolus modiolus</i>		X	X V98-22,-27,-32; E88B53 (sp.), T95B12 (sp.)
<i>Montacuta dawsoni</i>		X	
<i>Montacuta maltzani</i>		X	
<i>Musculus corrugatus</i>	X	X	
<i>Musculus discors</i>	X	X	X V98-31
<i>Musculus nigers</i>	X	X	X
<i>Mya arenaria</i>		X	X
<i>Mya pseudoarenaria</i>		X	
<i>Mya truncata</i>	X	X	X RH9803.04.05, RH9909; V98-21,-22,-27,-29,-30,-31,-32,-33,-34,-35,-41,-42,-43,-44,-45,-46,-47,-48,-49,-53,-54,-57,-59,-61,-62,-63,-64
<i>Myseilla planata</i>		X	X
<i>Myseilla tumida</i>		X	X

Table III: cont'd

Name of Species	W. Cdn Arctic Archipelago	Beaufort Sea QCI today		QCI paleolocalities
<i>Mytilus edulis/trossulus</i>	X	X	X	RH9802, 03, 04, 05, 06, 07, 08; RH9908; V98-61; E88B54, E88B55, E92A21, M934, T95B12; V94A15 (cf.); E87A23 (sp), E88B29 (sp), E88B30 (sp), T91C20 (sp.)
<i>Nucula belloti</i>	X	X		
<i>Nucula zophos</i>		X		
<i>Nuculana minuta</i>	X	X	X	E87A22
<i>Nuculana perula</i>	X	X	X	E87A13
<i>Nuculana perula costigera</i>	X		X	
<i>Nuculana radiata</i>		X		
<i>Pandora glacialis</i>	X	X	X	V98-31(filosa); E87A23 (filosa); E87E87A13 (sp.)
<i>Panomya ampla</i>		X	X	V98-31(cf)
<i>Panomya arctica</i>		X	X	
<i>Periploma abyssorum</i>		X		
<i>Periploma aleutica</i>		X		
<i>Portlandia arctica</i>	X	X		
<i>Portlandia fraterna</i>		X		
<i>Portlandia frigida</i>		X		
<i>Portlandia intermedia</i>		X		
<i>Portlandia lenticula</i>		X		
<i>Portlandia sulcifera</i>	X			
<i>Portlandia tamara</i>		X		
<i>Pseudophythisa compressa</i>		X		
<i>Semipes groenlandicus</i>	X	X	X	V98-48, -53, -54
<i>Tellina lutea</i>		X		
<i>Tellina</i> sp.		X	nuculoides, modesta, carpenteri, bodegensis	RH9908, RH9909, RH9910, RH9911, RH9912 (nuculoides); E87A13; E87A4 (modesta); E88B29, E88B54, E88B55, T91C20 (nuculoides)
<i>Thracia adamsi</i>		X		
<i>Thracia devexa</i>	X	X		
<i>Thracia myopsis</i>		X		
<i>Thyasira dunbari</i>	X			
<i>Thyasira equalis</i>		X		
<i>Thyasira gouldi</i>	X	X		
<i>Yoldia hyperborea</i>	X	X		
<i>Yoldia myalis</i>		X		
<i>Yoldia scissurata</i>		X	X	
<i>Yoldiella fraterna</i>	X			
<i>Yoldiella frigida</i>	X			
<i>Yoldiella intermedia</i>	X			
<i>Yoldiella lenticula</i>	X			
<i>Yoldiella tamara</i>	X			

Note: adapted from Lubinsky 1980: Fig. 5, 52-53 and Bernard 1979: Table 1

Lubinsky I., 1980. Marine bivalve molluscs of the Canadian Central and Eastern Arctic: Faunal composition and zoogeography. Dept. of Fish. and Oceans Bull. 207.

Bernard F.R., 1979. Bivalve mollusks of the western Beaufort Sea. Contributions in Science, Natural History Museum of Los Angeles County, Los Angeles.

edible mollusc species. Since all molluscs are technically edible, we here imply species that are sufficiently large and accessible to represent an important subsistence resource for early people. Edible species first appear in submarine sediment cores from Hecate Strait and QC Sound at 13,210 $\pm$ 80 ^{14}C years BP (Table II) and 13,200 $\pm$ 150 ^{14}C years BP (Luternauer, 1989b) respectively. Edible intertidal mollusc shell weights were multiplied by species specific biomass factors (Erlandson, 1984; Moss, 1989; Reid, unpublished) to determine edible biomass levels represented. These calculations are shown for common edible species found in high-stand deposits (Tables IV and V) and in Table VI for Juan Perez Sound underwater grab samples. Shell material found in submarine sediment cores was not sufficient to calculate biomass densities.

The total edible biomass represented in samples from southern Moresby Island, Haines Creek, and Juan Perez Sound dating between 8,020 and 11,150 ^{14}C years BP, compares favorably with commercially viable modern beaches in the QCI and southern BC. The latter sustain an annual, average, edible biomass harvest (*Saxidomus giganteus*) of between 1.09 and 5.43 Kg/m^3 (Quayle and Bourne, 1972).

Intertidal molluscan biomass assessed in the Upper Arrow Creek, George Bay, and Lockeport Estuary high-stand deposits (Table IV) ranges from 0.19 to 19.80 Kg/m^3 , and, with the exception of (RH-98-06), are well within the biomass densities for *Saxidomus giganteus* species obtained from viable commercially harvested beaches in BC District two (north of QC Sound) and District 3 (South Coast) surveyed during the period 1942 to 1950 (Quayle and Bourne, 1972). RH98-06 had the lowest edible biomass density of all samples obtained from southern Moresby high-stand sites. It had an unusually heavy concentration of wood; organic decay likely released acids responsible

Table IV. Edible intertidal biomass of selected bivalve species found in southern Moresby Island high-stand deposits (grams)

	Site numbers MRC 14C date Site name	RH98-01 8680+/-80 UAC-top	RH98-02 8680<Age<8800 UAC-2nd	RH98-03 8680<Age<8800 UAC-3rd	RH98-04 8800+/-70 UAC-4th	RH98-05 8360+/-100 GB	RH-98-06 Age>8020 LP-low	RH98-07 Age>8020 LP-mid	RH98-08 8020+/-70 LP-top
Edible Intertidal Bivalves	Biomass factor								
<i>Clinocardium nuttallii</i>	0.5625*	8.72	1.13	3.21	3.09	83.93	0	0	3.038
<i>Gari californica</i>	1.3513*	0	0	0	0	0	0	0	0
<i>Macoma inquinata</i>	0.7257*	65.97	97.61	67.71	47.24	140.35	0	0.58	9.8
<i>Macoma nasuta</i>	0.4195*	0	3.19	7.05	0	0	0	6.08	0
<i>Macoma secta</i>	1.2577*	0	0	0	0	8.55	0	0	0
<i>Modiolus modiolus</i>	0.5696*	0	0	0	0	0	0	0	0
<i>Mya truncata</i>	1.9†	0	0	0.95	1.33	0.19	0	0	0
<i>Mytilus edulis</i>	0.55†	0	0.72	0.5	0.88	0.83	0.5	0.77	2.2
<i>Protothaca staminea</i>	0.3796*	283.45	262.23	304.89	166.3	318.18	0	67.27	73.68
<i>Protothaca tenerrima</i>	0.3796*	26.61	31.01	18.83	28.05	39.86	0	6.49	4.18
<i>Saxidomus giganteus</i>	0.5075*	303.79	482.94	384.03	316.53	645.84	14	161.08	237.76
Total Edible Biomass of sample (grams)		688.54	878.83	787.17	563.42	1237.73	14.5	242.27	330.658
Sample size		.062m³	.062m³	.062m³	.062m³	.0625m³	.075m³	.075m³	.075m³
Edible biomass per metre³ (grams)		11105.48	14174.68	12696.29	9087.42	19803.68	193.33	3230.27	4408.77

Note: MRC - marine reservoir corrected; UAC - Upper Arrow Creek; GB - George Bay; LP - Lockport

* Reid, previously unpublished

† Erlandson, 1984; Moss, 1989

Table V: Edible intertidal biomass of selected bivalve species found in northwestern Graham Island high-stand deposits (grams)

Site number Site name MRC 14C date		RH9901‡ KP >modern	RH9907‡ HC 4190+/-50	RH9908 HC 4190<Age<8990	RH9909 HC 8990+/-50	RH9910 HC 4190<Age<8990	RH9911 HC 4190<Age<8990	RH9912 HC 4190<Age<8990	RH9913‡ LB 1160+/-40
Edible Intertidal Bivalves	Biomass factor								
<i>Clinocardium nuttallii</i>	0.5625*	0	0	16.65	17.38	14.74	24.8	52.76	0
<i>Gari californica</i>	1.3513*	0	0	0	0	0	0	0	0
<i>Macoma inquinata</i>	0.7257*	0	0	0	0.29	0	0	0	0
<i>Macoma nasuta</i>	0.4195*	0	0	0	0	0	0	0	0
<i>Macoma secta</i>	1.2577*	0	0	0	0	0	0	0	0
<i>Modiolus modiolus</i>	0.5696*	0	0	0	0	0	0	0	0
<i>Mya truncata</i>	1.9†	0	0	0	64.98	0	0	0	0
<i>Mytilus trossulus</i>	0.55†	0	0	22.06	0	0	0	0	0
<i>Mytilus californianus</i>	0.29†		1.31	9.72	141.2	18.21	33.32	43.59	
<i>Protothaca staminea</i>	0.3796*	0	0	6.38	30.79	0.42	8.92	4.82	0
<i>Protothaca tenerrima</i>	0.3796*	0	0	0	0	0	0	0	0
<i>Saxidomus giganteus</i>	0.5075*	0	0	72.57	379.38	242.99	781.36	131.43	22.96
<i>Tresus capax</i>	0.985†				1002.53	102.78	387.3	194.44	
<i>Tresus nuttallii</i>	0.81†				205.82		252.07	109.92	
<i>Tresus</i> sp.	0.9§						7.83		
Total Edible Biomass of sample (grams)		0	1.31	127.38	1842.37	379.14	1495.6	536.96	22.96
Sample size		‡	‡	.37m³	.37m³	.37m³	.37m³	.37m³	‡
Edible biomass per metre³ (grams)				344.27	4979.38	1024.7	4042.16	1451.24	

Note: KP - Kennecott Point; HC - Haines Creek; LP - Lepas Bay

* Erlandson, 1984; Moss, 1989

† Reid, previously unpublished

‡ Site sampled for dating purposes only

Table VI: Edible intertidal biomass of selected bivalve species found in Juan Perez Sound, Moresby Island underwater grab samples (grams)

	Site number	V98-7	V98-9	V98-21	V98-22	V98-25	V98-27	V98-29	V98-30	V98-31	V98-32	V98-33
	Site elevation (m)	-125	-125	-130	-128	-131	-122	-122	-65	-65	-65.4	-50
	MRC 14C data		11,280+/-50	11,050+/-50	11,140+/-50		11,150+/-50			10,180+/-40		
Edible Intertidal Bivalves												
	Max Depth (m)	Biomass factor ^a										
<i>Clinocardium nuttallii</i>	-30	0.5625*	0	0	0	0	1.18	0	0	0	0	0
<i>Gari californica</i>	-170	1.3513*	0	0	0	0	0	0	0	2.7	0	0
<i>Macoma inquinata</i>	-165	0.7257*	0	0	0	8.2	0	1.52	0	0	0	0
<i>Macoma nasuta</i>	-50	0.4195*	0	0	0	0	0	0	0	0	0	0
<i>Macoma secta</i>	-50	1.2577*	0	0	11.07	0	0	8.05	0	0	0	0
<i>Modiolus modiolus</i>	-200	0.5696*	0	0	0	0.68	0	267.88	0	0	0.34	0
<i>Mya truncata</i>	-100	1.9†	0	0	16.53	55.29	0	345.04	7.22	15.39	5.7	25.65
<i>Mytilus edulis</i>	-5	0.55†	0	0	0	0	0	0	0	0	0	0
<i>Protothaca staminea</i>	-10	0.3796*	0	0	0	2.32	0	9.19	0	0	0	0
<i>Protothaca tenerima</i>	-10	0.3796*	0	2.16	3.68	90.84	0	60.55	0	0	0	0
<i>Saxidomus giganteus</i>	-40	0.5075*	30.35	5.23	69.07	248.37	0	40.6	0	0	3.45	0
Total Edible Biomass of sample (grams)			30.35	7.39	100.35	405.7	0	725.96	15.27	15.39	11.85	25.99
Sample size			1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³
Edible biomass per metre³ (grams)			30.35	7.39	100.35	405.7	0	725.96	15.27	15.39	11.85	25.99

Note: MRC - marine reservoir corrected date

* Reid, previously unpublished

† Erlandson, 1984; Moss, 1989

Table VI cont'd: Edible intertidal molluscan biomass of selected molluscan species found in Juan Perez Sound, Moresby Island underwater grab samples (grams)

	Site number	V98-34	V98-35	V98-40	V98-41	V98-42	V98-43	V98-45	V98-46	V98-47	V98-48	V98-49	V98-53
	Site elevation (m)	-35	-55.4	-107	-53.5	-53.5	-54.2	-53.5	-50.7	-50.7	-52.1	-52.8	-120
	MRC 14C date			10,380 $\pm$ 50									10,890 $\pm$ 50
Edible Intertidal Bivalves													
	Max Depth (m)	Biomass factor ^a											
<i>Cinocardium nuttallii</i>	-30	0.5625 ^a	0	0	0	0	0	0	0	0	0	0	0
<i>Gari californica</i>	-170	1.3513 ^a	0	0	0	0	0	0	0	0	0	0	0
<i>Macoma inquinata</i>	-165	0.7257 ^a	0	0	0.87	0	0	0	0	0	0	0	0
<i>Macoma nasuta</i>	-50	0.4195 ^a	0	0	0	0	0	0	0	0	0	0	0
<i>Macoma secta</i>	-50	1.2577 ^a	0	0	0	0	0	0	0	0	0	0	0
<i>Modiolus modiolus</i>	-200	0.5696 ^a	0	0	0	0	0	0	0	0	0	0	0
<i>Mya truncata</i>	-100	1.9 ^a	3.42	84.17	0	36.48	15.39	4.37	14.82	58.52	19.95	36.1	3.31
<i>Mytilus edulis</i>	-5	0.55 ^a	0	0	0	0	0	0	0	0	0	0	0
<i>Protothaca staminea</i>	-10	0.3796 ^a	0	0	0	0	0	0	0	0	0	0	1.48
<i>Protothaca tenerrima</i>	-10	0.3796 ^a	0	0	0	0	5.16	0	0	0	0	0	0
<i>Saxidomus giganteus</i>	-40	0.5075 ^a	0	0	38.01	7.97	0	0	0	7.21	0	0	0.81
Total Edible Biomass of sample (grams)			3.42	84.17	38.88	44.45	15.39	9.53	14.82	58.52	27.16	36.1	19.2
Sample size			1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³	1m ³
Edible biomass per metre³ (grams)			3.42	84.17	38.88	44.45	15.39	9.53	14.82	58.52	27.16	36.1	19.2

Note: MRC - marine reservoir corrected date

^a Reid, previously unpublished

[†] Erlandson, 1984; Moss, 1989

Table VI cont'd: Edible intertidal molluscan biomass of selected molluscan species found in Juan Perez Sound, Moresby Island underwater grab samples (grams)

	Site number	V98-54	V98-55	V98-59	V98-61	V98-62	V98-64
	Site elevation (m)	-121	-119	-55.7	-55	-55.7	-53.5
	MRC 14C date		11,320+/-50			10,130+/-40	
Edible Intertidal Bivalves							
	Max Depth (m)	Biomass factor*					
<i>Clinocardium nuttallii</i>	-30	0.5625*	0	0	0	0	0
<i>Gari californica</i>	-170	1.3513*	0	0	0	0	0
<i>Macoma inquinata</i>	-165	0.7257*	0	1.23	0	0	0
<i>Macoma nasuta</i>	-50	0.4195*	0	0	0	0	0
<i>Macoma secta</i>	-50	1.2577*	0	0	0	0	0
<i>Modiolus modiolus</i>	-200	0.5696*	0	0	0	0	0
<i>Mya truncata</i>	-100	1.9†	7.22	0	6.65	11.97	25.46
<i>Mytilus edulis</i>	-5	0.55†	0	0	0.22	0	0
<i>Protothaca staminea</i>	-10	0.3796*	1.82	0	0	0	0
<i>Protothaca tenerrima</i>	-10	0.3796*	22.24	8.16	2.28	0	0
<i>Saxidomus giganteus</i>	-40	0.5075*	90.49	9.29	0	0	92.01
Total Edible Biomass of sample (grams)		121.77	18.68	8.93	12.19	117.47	15.96
Sample size		1m³	1m³	1m³	1m³	1m³	1m³
Edible biomass per metre³ (grams)		121.77	18.68	8.93	12.19	117.47	15.96

Note: MRC - marine reservoir corrected date

* Reid, previously unpublished

† Erlandson, 1984; Moss, 1989

for eroding shell material leaving large butter clam casts evident. Thus, the taphonomic preservation of sample RH98-06 is considered poor. We suggest the weight of sampled mollusc material may underestimate original mollusc weight. The edible intertidal biomass represented in samples taken from the Upper Arrow Creek Site is 11.11 Kg/m^3 at $8,680 \pm 80 \text{ }^{14}\text{C}$ years BP and 9.09 Kg/m^3 at $8,800 \pm 70 \text{ }^{14}\text{C}$ years BP, and reaches 14.17 and 12.7 Kg/m^3 at intervals in between. The edible intertidal biomass represented in the sample taken from the George Bay site is 19.8 Kg/m^3 and dates to $8,360 \pm 100 \text{ }^{14}\text{C}$ years BP. The total edible biomass represented in samples from the Lockeport Estuary site ranges from 0.19 to 4.41 Kg/m^3 , and dates to $8020 \pm 70 \text{ }^{14}\text{C}$ years BP. *Saxidomus giganteus*, *Protothaca staminea*, *Macoma inquinata*, and *Protothaca tenerrima* provide the bulk of the intertidal edible biomass. The significant reduction in biomass seen in RH98-06 is a result of a decrease in numbers of all represented species.

Edible intertidal biomass from Haines Creek high-stand deposit is 4.98 Kg/m^3 at $8,990 \text{ }^{14}\text{C}$ years BP (Table II; Fig. 4; Table V; RH9909). It subsequently increased to 4.04 Kg/m^3 (RH9911) and then progressively decreased to a low of 0.34 Kg/m^3 (RH9908), just prior to $4190 \text{ }^{14}\text{C}$ years BP. The primary molluscan species contributing to edible biomass are *Tresus capax*, *Tresus nuttallii*, *Clinocardium nuttallii* and *Saxidomus giganteus*. The disappearance of *Tresus spp.* and a drop in the number of *Saxidomus giganteus* resulted in a sharp decline in edible intertidal biomass experienced prior to $4,190 \text{ }^{14}\text{C}$ years BP.

Edible intertidal biomass calculated for underwater grab samples taken in Juan Perez Sound exceeded 0.10 Kg/m^3 in six samples (Table VI; V98-21, -22, -27, -33, -54, -62). However, edible molluscan biomass for all dated samples does not compare

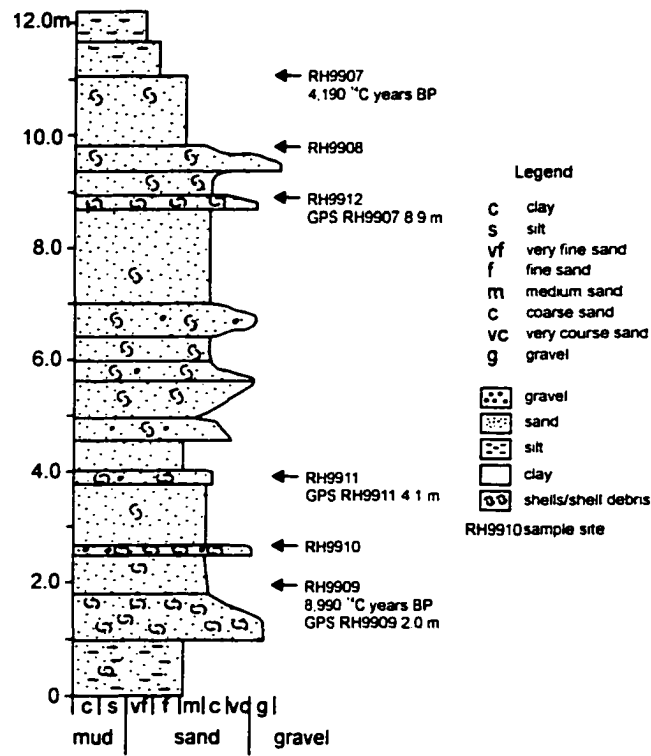


Figure 4 . Stratigraphy and lithology of Haines Creek site.

favorably with commercially viable beaches, with the exception of V98-27 (0.73 Kg/m³). *Mya truncata* forms a strong component of most samples. *Modiolus modiolus* is also a major contributor to biomass in sample V98-27. *Protothaca sp.* and *Saxidomus giganteus* contribute to biomass, particularly in sample V98-22, which dates to 11,050 +/- 50 ¹⁴C years BP⁶. A decline to less than 0.020 Kg/m³ of edible biomass is recorded in Juan Perez Sound between 10,890 +/- 50 and 10,180 +/- 40 ¹⁴C years BP, coincident with cooler sea-surface temperatures (Patterson et al., 1995). During this time *Protothaca sp.* and *Saxidomus giganteus* are either not evident, or extremely reduced in numbers. *Mya truncata* remains evident, though reduced in numbers.

DISCUSSION

Environment

During the initial stages of climate warming subsequent to LGM, shorelines were relatively barren, with few species of bivalves. When glaciers were rapidly melting (prior to ~13,000 ¹⁴C years BP), they deposited large quantities of sediment into the nearshore environment. The organic content of the sediment, in the form of detritus and associated bacterial food was limited. Moreover, high turbidity would have clogged the filtration mechanisms of suspension feeding bivalves without offering any nutritional compensation. By ~13,000 ¹⁴C years BP the intertidal zone was beginning to resemble the modern environment. In all probability caribou, brown and to a lesser extent black bear, and other beach-combing mammals such as ringed seal, and otters, along with gulls and crows, scavenged the beach and shallow subtidal for herring, bivalves, and stranded marine mammals (Fedje, 1996; Fedje et al., 1996; Heaton et al., 1996). Fossil remains of herring suggest the presence of kelp beds suitable for spawning, and a diversity of marine

organisms such as those presently found in kelp communities.

Minimum sea-surface temperatures on Goose Island Bank between 12,370 and 12,540 ^{14}C years BP reached 19 °C, 1 °C or 2 °C less than present maximum temperatures. Between 10,000 and 11,000 ^{14}C years BP the paucity of molluscs in the sediments, and the presence of only a few cold-tolerant species supports the hypothesis that the Younger Dryas cooling event affected the northern Pacific (Mathewes et al., 1993; Patterson, 1993; Patterson et al., 1995; Guilbault et al., 1997). When temperatures began to rise again, the region was rapidly recolonized by temperate molluscan species with planktonic larvae. Favorable conditions generated high levels of edible intertidal biomass.

During this period world-wide sea-levels rose, but the position of the intertidal zone was locally strongly influenced by crustal uplift and subsidence. For example, on the BC mainland sea-levels rose up to 120 m above present, but in the adjacent QCI archipelago they fell over 150 m (Clague et al., 1982a; Josenhans et al., 1997). Vast coastal plains emerged out of the ocean depths of Hecate Strait and QC Sound.

Although temperatures during and subsequent to maximum glaciation were at times cooler than present, the malacofauna, though cold-tolerant, was not typically Arctic. We forward two possible explanations for the paucity of Arctic fauna in the QCI during this period. Firstly, Arctic shores are often permanently covered with ice, and where they are exposed they are subject to scouring by sea ice. Further, in the Arctic, photoperiod is distinctly different, as is the consequent pattern of phytoplankton bloom. Arctic bivalve survival depends on food availability for the larvae, and ambient temperature must be high enough to maintain feeding activity (Bernard, 1979). Therefore,

Arctic filter feeding bivalves must depend upon a brief concentration of suspended food, or upon deposit food. Some Arctic bivalves are brooders that produce a small number of large eggs, and precocious development of larvae that have a brief planktonic existence or develop directly into juveniles (Bernard, 1979). Consequently, they do not rapidly disperse. Nevertheless, *Mya truncata* and *Hiattella arctica*, which are typical of Arctic environments (Dyke et al., 1996) do have planktonic larvae, as does cold-tolerant *Serripes groenlandicus*. Subtidal populations of these species might therefore be expected to have extended southwards during cooling periods. Former inhabitants that could no longer reproduce at lower temperatures would simply have died out, leaving room for the newcomers.

Secondly, during glaciation the Strait opening to the Bering Sea was narrow and shallow, and at times closed (Hopkins, 1973), restricting the outflow of Arctic molluscan species. Ice sheets extended into Dixon Entrance, limiting the flow of cold, low salinity waters into Dixon Entrance and Hecate Strait, further blocking the flow of Arctic migrants into the QCI region. Similar circumstances restricted the colonization of the Arctic by Pacific species, and favoured the colonization of the Arctic by Atlantic migrants, via the massive influx of the Gulf Stream over the Faroe Island-Greenland Ridge (Bernard, 1979). Warming temperatures would favour the migration of southern molluscan species into QCI as soon as the warm California Current once again influenced the region.

Timing of recolonization

The distribution of bivalves is dependent upon the distribution of planktonic larvae. Changes in climate gave rise to fluctuating sea levels and geographic features in

the QCI region. These changes resulted in periods of migration and the temporary absence of some intertidal invertebrates. Faunal interchange between the northern and southern waters appears to have occurred and was dependent on winds and ocean currents, as well as local sea-surface temperatures, sedimentation rates and photoperiod. An additional factor was the contrary flow of ocean currents, or their blockage by ice sheets and water level change. During peak periods of glaciation, little open water remained, restricting habitat and altering coastlines and ocean currents. Subsequent to LGM, ice sheets melted, depositing large quantities of sediment into outwash plains and prograding deltas. High sedimentation rates appear to have constrained the number of molluscan species that were able to recolonize. The first to colonize after LGM was sediment tolerant *Macoma nasuta*. This clam is a facultative suspension/deposit feeder that can enrich the surface deposits with its faeces, and inject surplus food as pseudofaeces at depths in the sediment down to 0.75 m (Reid and Reid, 1969). During sea-level regression two emergent coastal plains developed, one east of QCI, the other in QC Sound, north of Vancouver Island. The northern plain intermittently connected the QCI and the BC mainland, restricting the flow of water between Dixon Entrance and Hecate Strait. Once habitat and sea-surface temperatures were conducive, rates of recolonization appear to have been limited only by the availability of ocean currents to bring pelagic larvae into the region from adjacent temperate regions. During a cool interval, coincident with the Younger Dryas period of climate cooling, sea-surface temperatures dropped; cold-water tolerant northern species with planktonic larvae colonized the region, accompanied by a reduction in temperate species. When temperatures subsequently warmed, seas rapidly transgressed the two emergent coastal

plains and temperate species quickly recolonized the region.

Geological range of molluscs

Bernard (1983) provides a catalogue of the living Bivalvia of the eastern Pacific Ocean, including species' geological range based on standard Pacific coast provincial megafossil chronology. Five molluscan species, which Bernard has categorized as possessing a Recent geologic range – colonized after ~10,000 ^{14}C years BP – were found in sediments dating older than 10,000 ^{14}C years BP. *Macoma incongrua* was sampled in sediments dating to 11,280 ^{14}C years BP in underwater grab V98-09, 11,150 ^{14}C years BP in underwater grab V98-27, older than 10,630 ^{14}C years BP in core E88B53, and 12,890 ^{14}C years BP in core T95B12. *Musculus taylori* (?) was also uncovered in core T95B12 underlying sediments dating to 12,890 ^{14}C years BP. *Mytilimeria nuttallii* and *Tellina nukuloides* were recovered in sediments dating between 9,800 and 12,710 ^{14}C years BP in core E88B54. It is not possible to detect the difference between *Mytilus trossulus* and *Mytilus edulis* without microscopic analysis; thus we have identified all samples of these species as *Mytilus trossulus* due to the Recent geological range of *Mytilus edulis*.

Younger Dryas

The appearance of molluscs *Serripes groenlandicus* (-2 °C to +10 °C) and *Clinocardium ciliatum* (-2 °C to +9 °C; Bernard, 1983) in underwater grab sample V98-53 and *Nuculana minuta* (1 °C to +6 °C; Bernard, 1983) in core E87A22, *Clinocardium californiense* (+1 °C to +9 °C; Bernard, 1983) in core E87A23, and *Nuculana pernula* (-1 °C to +7 °C; Bernard, 1983) in core E87A13 indicate the onset of a short interval (10,890 to 10,250 ^{14}C years BP) of cool sea-surface temperatures in Juan Perez Sound and Cook Bank. Sea-surface cooling is supported by paleoceanographic studies (Patterson, 1993;

Patterson et al., 1995) and palynological evidence (Mathewes, 1993) of the late-glacial Younger Dryas cooling event between 10,700 and 10,000 ^{14}C years BP in the QCI and southeastern Alaska (Engstrom et al., 1990). During this time, sea-surface temperatures at Goose Island Bank remained temperate, perhaps due to upwelling in Goose Island Trough. Malacological evidence indicates temperate sea-surface conditions reappeared in Juan Perez Sound, southern Moresby Island, by 10,180 $\pm$ 40 ^{14}C years BP (Table II) and in Cook Bank by 9,940 $\pm$ 75 ^{14}C years BP (Luternauer et al., 1989a).

The appearance of *Clinocardium ciliatum* in Juan Perez Sound is coincident not only with cooler sea-surface temperatures, but also the disappearance or significant reduction of *Protothaca* spp. and *Saxidomus giganteus*. *Mya truncata* remains evident, though at a reduced level. *Clinocardium ciliatum* does not presently inhabit the QCI; it maintains a more northerly geographic range encompassing the Western Canadian Arctic Archipelago and the Beaufort Sea (Table III). *Mya truncata*, also a cold-tolerant species, has a range that extends into the Arctic and Beaufort Seas. The presence of northern cold-tolerant species may indicate that a cooler Younger Dryas climate resulted in an intensified influence of the Aleutian Low (AL) south-blowing winds, which restricted the upwelling California Current (Patterson et al., 1995) and caused a southward shift of the Alaska Current (Thomson, 1981). The Alaska Current may be responsible for bringing pelagic *Clinocardium ciliatum* larvae into the cooler QCI region waters allowing it to briefly colonize southern Moresby Island. Alternatively, geographic paleofaunistic zones likely shifted southward during cool intervals, and northward during deglaciation (Dyke et al., 1996). *Clinocardium ciliatum* and the few other cold-tolerant species found in the QCI region during the Younger Dryas may have already been there in small numbers at

the southern limit of a more southerly glacial distribution. Subsequent to the Younger Dryas cooling event, climate warmed, sea levels rose, paleofaunistic zones shifted northward, and the QCI region was likely once again influenced by the North Pacific High (NPH), which induced onshore transport of California Currents transporting pelagic temperate molluscan larvae, facilitating rapid recolonization of species presently found in the region.

Biomass

Analysis of edible intertidal molluscs, indicates that the edible intertidal biomass from all samples taken from Upper Arrow Creek, George Bay, and Lockeport Estuary, with the possible exception of RH-98-06, was sufficient to provide subsistence at modern commercial harvest levels for early peoples between 8,020 and 8,800 ^{14}C years BP. Relatively high edible intertidal biomass calculations for Haines Creek high-stand deposit, located on the outer coast of Graham Island, is somewhat surprising – given the open continental shelf environment. Numerous edible intertidal species appear to have been prolific in this area at, and subsequent to 8,990 ^{14}C years BP. These data indicate that this presently turbulent outer coast region was highly productive (up to almost 5.0 Kg/m^3 edible intertidal molluscan biomass), suggesting early humans and sea mammals could have exploited relatively abundant subsistence resources. However, by 4,190 ^{14}C years BP, that productivity had declined by over 93%.

Despite being unable to calculate biomass for submarine sediment cores, geological and malacological data indicate the presence of a number of productive estuaries, quiet water bays, and deltas that were home to many edible intertidal species (Table II). These environments were present dating to at least 13,210 ^{14}C years BP.

The presence of intertidal molluscs indicates ice had retreated from Dixon Entrance by 12,640 ^{14}C years BP. Terrestrial conditions were present on two emerged coastal plains, one extending east of QCI, by at least 13,790 ^{14}C years BP, the other extending north of Vancouver Island into QC Sound, as early as 15,200 ^{14}C years.

The paucity of Arctic molluscan fauna prior to ~13,000 may be the result of limited dispersion of brooding Arctic molluscs and the consequence of shallow, narrowed straits and the presence of ice sheets that blocked the flow of Arctic molluscan migrants into the QCI region. Other factors limiting invertebrate colonization included: water temperature, sedimentation rates, turbidity, and photoperiod. Once habitat and sea-surface temperatures were conducive, pelagic temperate molluscs rapidly colonized the QCI region.

Subsequent to glacial maximum, relatively barren shorelines gave way to initial colonization by *Macoma nasuta* in sediment laden waters in Hecate Strait and at the head of Goose Island Trough. Soon after 13,000 ^{14}C years BP, despite rapidly changing sea levels and migrating shorelines, an extensive intertidal zone, resembling the modern QCI environment, was inhabited by bivalves including *Mytilus sp.*, *Musculus taylori*, *Macoma incongrua*, *Hiatella pholadis*, *Macoma inquinata*, *Tresus nuttallii*, *Modiolus rectus*, *Simomactra falcata*, *Saxidomus giganteus*, *Protothaca staminea*, *Protothaca tenerrima*, and barnacles *Balanus crenatus* and *Balanus glandulus*. Between 12,540 and 12,370 ^{14}C years BP sea-surface temperatures on Goose Island Bank warmed to at least 19 °C, reaching the upper limit of present average sea-surface temperatures. Between ~11,000 and 10,000 ^{14}C years BP the presence of only a few cold-tolerant species supports the hypothesis that the Younger Dryas affected the northern Pacific. By 10,180 ^{14}C years BP

in southern Moresby Island, and by 9,940 ^{14}C years BP in Cook Bank, temperate conditions resumed. During this time, sea-surface temperatures remained temperate at Goose Island Bank, perhaps due to strong vertical tidal mixing in the presence of reduced coastal run-off and reduce upwelling in Goose Island Trough (R.E. Thomson, personal communication, 2002).

Early human occupation of the Pacific Northwest would have likely been limited to resource-rich coastal zones and estuaries. Adequate samples of fossil mollusc shells, found in raised-beach deposits and underwater grab samples indicate edible intertidal biomass densities were well within viable commercially harvested levels in the southern Moresby Island region by 8,800 ^{14}C years BP and by 8,990 ^{14}C years BP on western Graham Island. Prior to this time, edible intertidal molluscs inhabited Hecate Strait (by 13,210 ^{14}C years BP), Goose Island Trough (by 13,200 ^{14}C years BP) and Port Simpson on the BC mainland (by 12,640 ^{14}C years BP). This shows not only that the ice was gone, but also that an accessible food source was present. The presence and productivity of nutritious intertidal molluscs, indicate the QCI region had a suitable climate, possessed open ocean conditions and provided subsistence potential for early humans, making habitation possible subsequent to at least 13,210 ^{14}C years BP. Furthermore, malacological studies provide a foundation for inferences regarding the paleoecology of the Queen Charlotte Islands region.

References

- Abbott, R.T. 1974. *American Seashells: The marine molluscs of the Atlantic and Pacific coasts of North America*, 2nd ed. Van Nostrand Reinhold Company, New York.
- Alley, N.F. and Thomson, B. 1978. Aspects of environmental geology, parts of Graham Island, Queen Charlotte Islands. British Columbia Ministry of Environment, Resource Analysis Branch, Bulletin 2.
- Archer, D.J.W. 1998. Early Holocene Landscapes on the north coast of B.C. Paper presented at the 31st annual meeting Canadian Archaeological Association, Victoria, BC.
- Barrie, J.V. 1991. Contemporary and relict titaniferous sand facies on the western Canadian continental shelf. *Cont. Shelf Res.* **11**: 67-79.
- Barrie, J.V. and Conway, K.W. 1999. Late Quaternary glaciation and postglacial stratigraphy of the northern Pacific margin of Canada. *Quat. Res.* **51**: 113-123.
- Barrie, J.V. and Conway, K.W. 2002. Rapid sea-level change and coastal evolution on the Pacific margin of Canada. *Sediment. Geol.* **150**: 171-183.
- Barrie, J.V., Bornhold, B.D., Conway, K.W., and Luternauer, J.L. 1991. Surficial geology of the northwestern Canadian continental shelf. *Cont. Shelf Res.* **11**: 701-715.
- Barrie, J.V., Conway, K.W., Mathewes, R.W., Josenhans, H.W., and Johns, M.J. 1993. Submerged Late Quaternary terrestrial deposits and paleoenvironment of northern Hecate Strait, British Columbia continental shelf, Canada. *Quat. International* **20**: 123-129.
- Bernard, F.R. 1979. Bivalve mollusks of the western Beaufort Sea. Contributions in Science, Natural History Museum of Los Angeles County, Los Angeles.
- Bernard, F.R. 1983a. Catalogue of the living Bivalvia of the eastern Pacific Ocean: Bering Strait to Cape Horn. *Can. Spec. Publ. Fish. Aquat. Sci.* **61**, Ottawa, Ont.
- Bernard, F.R. 1983b. Physiology and the mariculture of some northeastern Pacific bivalve molluscs. *Can. Spec. Publ. Fish. Aquat. Sci.* **63**, Ottawa, Ont.
- Bernard, F.R., McKinnell, S.M., and Jamieson, G.S. 1991. Distribution and zoogeography of the Bivalvia of the eastern Pacific Ocean. *Can. Spec. Publ. Fish. Aquat. Sci.* **112**, Ottawa, Ont.

- Blaise, B., Clague, J.J., and Mathewes, R.W. 1990. Time of maximum Late Wisconsin glaciation, west coast of Canada. *Quat. Res.* **34**: 282-295.
- Canada Department of Environment, 1974. Waves recorded off Tofino, B.C., Station 103, July 5, 1970 to August 22, 1974. Fisheries and Marine Service, Mar. Environ. Data Serv. File **103**, Ottawa, Ont.
- Canadian Hydrographic Service, 1976. Sailing directions – British Columbia coast (south portion), 10th ed. Canada Department of Environment, Fisheries and Marine Service, Ottawa, Ont.
- Claassen, C. 1998. Shells. Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.
- Clague, J.J., and Bornhold, B.D. 1980. Morphology and littoral processes of the Pacific coast of Canada. *In* The Coastline of Canada. *Edited by* S.B. McCann. Geological Survey of Canada, Paper **80-10**, Ottawa. pp. 339-380.
- Clague, J.J., Harper, J.R., Hebda, R.J., and Howes, D.E. 1982a. Late Quaternary sea levels and crustal movements, coastal British Columbia. *Can. J. Earth Sci.* **19**: 597-618.
- Clague, J.J., Mathewes, R.W., and Warner, B.G. 1982b. Late Quaternary geology of eastern Graham Island, Queen Charlotte Islands, British Columbia. *Can. J. Earth Sci.* **19**: 1786-1795.
- Coad B.W. 1995. Encyclopedia of Canadian Fishes. Canadian Museum of Nature and Canadian Sportfishing Productions Inc., Singapore.
- Conway, H., Hall, B.L., Denton, G.H., Gades, A.M., and Waddington, E.D. 1999. Past and future grounding-line retreat of the West Antarctic Ice Sheet. *Science* **286**: 280-283.
- Cornwall, I.E. 1955. Canadian Pacific Fauna, 10. Arthropoda, 10e Cirrepideia, Fisheries Research Board of Canada, Ottawa. pp. 22-40.
- Dillehay, T.D. 1989. Monte Verde: A Late Pleistocene Settlement in Chile, Volume I, Palaeoenvironment and site context. Smithsonian Institution Press, Washington.
- Dixon, E. J., Heaton, T.H., Fifield, T.E., Hamilton, T.D., Putnam, D.E., and Grady, F. 1997. Late Quaternary regional geoarchaeology of southeast Alaska karst: A progress report. *Geoarchaeology* **12**: 689-712.
- Dunnill, R.M. 1968. A taxonomic and ecological investigation of the genus *Macoma* (Pelecypoda) in southern British Columbia. Master's thesis, University of Victoria, Victoria.

- Dyke, A.S., Dale, J.E., and McNeely, R.N. 1996. Marine molluscs as indicators of environmental change in glaciated North America and Greenland during the last 18,000 years. *Géographie physique et Quaternaire*, 50: 125-184.
- Ellis, D.V. 1960. Marine infaunal benthos in Arctic North America. *Arct. Inst. N. America Tech. Paper 5*: 53 p.
- Engstrom, D.R., Hansen, B.C.S., and Wright, H.E., Jr. 1990. A possible Younger Dryas record in southwestern Alaska. *Science* **250**: 1383-1385.
- Erlandson, J.M. 1984. Faunal analysis of the invertebrate assemblage. *In* The Hidden Falls Site, Baranof Island, Alaska. *Edited by* S.D. Davis, Ms. on file, USDA Forest Service, Sitka. pp.151-179.
- Fedje, D.W. 1996. Early Holocene Archaeology at Richardson Island, Haida Gwaii. Paper presented at the 29th Annual Meeting of the Canadian Archaeological Association, Halifax.
- Fedje, D.W., and Josenhans, H. 2000. Drowned forests and archaeology on the continental shelf of British Columbia, Canada. *Geology* **28**: 99-102.
- Fedje, D.W., McSporran, J.B., and Mason, A.R. 1996. Early Holocene Archaeology and Paleoecology at the Arrow Creek sites in Gwaii Haanas. *Arctic Anthropol.* **33**: 116-142.
- Fladmark, K.R. 1979. Routes: Alternate migration corridors for early man in North America. *Am. Antiquity* **44**: 55-69.
- Flessa, K., and Kowaleski, M. 1994. Shell survival and time-averaging in nearshore and shelf environments: Estimates from the radiocarbon literature. *Lethaia* **27**: 153-165.
- Gillespie, G.E., and Kronlund, A.R. 1998. A manual for intertidal clam surveys: Canadian Technical Report Of Fisheries and Aquatic Sciences, no. 2270, Fisheries and Oceans Canada, Nanaimo, BC.
- Grainger, E.H. 1959. The annual oceanographic cycle at Igloolik in the Canadian Arctic, 1. The zooplankton and physical and chemical observations. *J. Fish. Res. Board Can.* **16**: 453-501.
- Grainger, E.H. 1960. Some physical oceanographic features of southeast Hudson Bay and James Bay. *Fish. Res. Board Can. MS Rep. Serv. (Oceanogr. Limnol.)* **71**.
- Guilbault, J.P., Patterson, R.E., Thomson, R.E., Barrie, J.V., and Conway, K.W. 1997. Late Quaternary Paleoceanographic changes in Dixon Entrance, northwest British

- Columbia, Canada: Evidence from the foraminiferal faunal succession. *J. Foram. Res.* **27**: 151-174.
- Harbo, R.M. 1997. *Shells & Shellfish of the Pacific Northwest: A field guide*. Harbour Publishing, Madeira Park.
- Hart, J.L. 1973. *Pacific Fishes of Canada*. Fish. Res. Board Can., Bulletin **180**, Ottawa.
- Heaton, T.H., Talbot, S.L., and Shields, G.F. 1996. An ice age refugium for large mammals in the Alexander Archipelago, southeastern Alaska. *Quat. Res.* **46**: 186-192.
- Hopkins, D.M. 1973. Sea level history in Beringia during the past 250,000 years. *Quat. Res.* **3**: 520-540.
- Josenhans, H.W., Fedje, D.W., Conway, K.W., and Barrie, J.V. 1995. Post glacial sea levels on the western Canadian continental shelf: Evidence for rapid change, extensive subaerial exposure, and early human habitation. *Mar. Geol.* **125**: 73-94.
- Josenhans, H.W., Fedje, D., Pienitz, R., and Southon, J. 1997. Early humans and rapidly changing Holocene sea levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada. *Science* **277**: 71-74.
- Keefer, D.K., deFrance, S.D., Moseley, M.E., Richardson, III J.B., Satterlee, D.R., and Day-Lewis, A. 1998. Early maritime economy and El Niño events at Quebrada Tacahuay, Peru. *Science* **281**: 1833-1835.
- Kendrew, W. and Kerr, D. 1955. *The Climate of British Columbia and the Yukon Territory*. Queen's Printer, Ottawa.
- Kozloff, E.N. 1996. *Marine Invertebrates of the Pacific northwest*. University of Washington Press, Seattle.
- Lowdon, J.A. and Blake W., Jr. 1979. Geological Survey of Canada radiocarbon dates XIX. Geological Survey Paper **79-7**.
- Lowdon, J.A., Robertson, I.M. and Blake W., Jr. 1971. Geological Survey of Canada radiocarbon dates XI. *Radiocarbon* **13**: 255-324, reprinted in 1971 as Geological Survey of Canada, Paper **71-7**.
- Lubinsky, I. 1980. Marine bivalve molluscs of the Canadian Central and Eastern Arctic: Faunal composition and zoogeography. *Can. B. Fish. Aquat. Sci.* **207**.
- Luternauer, J.L., Clague, J., Conway, K.W., Barrie, J.V., Blaise, B., and Mathewes, R.W. 1989a. Late Pleistocene terrestrial deposits on the continental shelf of western

- Canada: Evidence for rapid sea-level change at the end of the last glaciation. *Geology* **17**: 357-360.
- Luternauer, J.L., Conway, K.W., Clague, J.J., and Blaise, B. 1989b. Late Quaternary geology and geochronology of the central continental shelf of western Canada. *Mar. Geol.* **89**: 57-68.
- Mann, D.H., and Hamilton, T.D. 1995. Late Pleistocene and Holocene paleoenvironments of the north Pacific coast. *Quat. Sci. Rev.* **14**: 449-471.
- Mathewes, R.W. 1993. Evidence for Younger Dryas-Age cooling on the north Pacific coast of America. *Quat. Sci. Rev.* **12**: 321-331.
- Mathewes, R.W., Heusser, L.E., and Patterson, R.T. 1993. Evidence for a younger Dryas-like cooling event on the British Columbia coast. *Geology* **21**: 101-104.
- McKenzie, G.D., and Goldwaith, R.G. 1971. Glacial history of the last eleven thousand years in Adams Inlet, southeastern Alaska. *Geol. Soc. Am. Bull.* **82**: 1767-1782.
- Morris, R.H., Abbott, D.P., and Haderlie, E.C. 1980. *Intertidal Invertebrates of California*. Stanford University Press, Stanford.
- Moss, M.L. 1989. *Archaeology and cultural ecology of the Prehistoric Angoon Tlingit*. Ph.D. thesis, University of California, Santa Barbara.
- Patterson, R.T. 1993. Late Quaternary benthic foraminiferal biofacies and paleoceanography of Queen Charlotte Sound and southern Hecate Strait, British Columbia. *J. Foram. Res.* **23**: 1-18.
- Patterson, R.T., Guilbault, J.-P., Thomson, R.E., and Luternauer, J.L. 1995. Foraminiferal evidence of Younger Dryas age cooling on the British Columbia shelf. *Géographie physique et Quaternaire* **49**: 409-428.
- Quayle, D.B., and Bourne, N. 1972. *The Clam Fisheries of British Columbia*. Fish. Res. Board Can. Bulletin **179**, Ottawa.
- Raup, D.M., and Stanley, S.M. 1978. *Principles of Paleontology*, 2nd Edition. W.H. Freeman and Company, New York. pp. 296-301.
- Reid, R.G.B., and Reid, A. 1969. Feeding processes in members of the genus *Macoma* (Mollusca: Bivalvia). *Can. J. Zool.* **47**: 649-657.
- Ricketts, E.F., Calvin J., and Hedgpeth, J.W. 1985. *Between Pacific Tides*, 5th Edition. Revised by D.W. Phillips. Stanford University Press, Stanford.

- Sandweiss, D.H., McInnis, H., Burger, R.L., Cano, A., Ojeda, B., Paredes, R., Sandweiss, M. del C., and Glascock, M.D. 1998. Quebrada Jaguay: Early South American maritime adaptations. *Science* **281**: 1830-1832.
- Southon, J.R., Nelson, D.E., and Vogel, J.S. 1990. A record of past ocean-atmosphere radiocarbon differences from the northeast Pacific. *Paleoceanography* **5**: 197-206.
- Thomson, R.E. 1981. Oceanography of the British Columbia Coasts. Can. Spec. Publ. Fish. Aquat. Sci. **56**, Ottawa, Ont.
- Thomson, R.E. 1989. The Queen Charlotte Islands Physical Oceanography. *In* The Outer Shores. *Edited by* G.G.E. Scudder, and N. Gessler. Queen Charlotte Islands Museum Press, Skidegate, BC pp. 27-63.
- Thomson, R.E. 1994. Physical oceanography of the Strait of Georgia-Puget Sound-Juan de Fuca Strait system. *In* Review of the Marine Environment and Biota of Strait of Georgia, Puget Sound and Juan de Fuca Strait. *Edited by* R. Wilson, R. Beamish, F. Aitkens, and J. Bell. Can. Tech. Rep. Fish. Aquat. Sci. **1948** pp. 36-100.
- Wacasey, J.W., Watkinson, E.G., and Kinlough, L. 1976. Zoobenthos data from James Bay, 1959, 1974. Fish. Mar. Serv. Tech. Rep. **661**.

Table A1: Species identified from southern Moresby Island
high-stand deposits by sample number.

Site number	RH98-01	RH98-02	RH98-03	RH98-04	RH98-05	RH98-06	RH98-07	RH98-08
Site name	UAC-top	UAC-2nd	UAC-3rd	UAC-4th	GB	LP-low	LP-mid	LP-top
MRC Radiocarbon years BP	8680+/-80	8680<Age<8800	8680<Age<8800	8800+/-70	8360+/-100	Age>8020	Age>8020	8020+/-70
Species name								
<i>Bittium eschrichtii</i>	2 / 0.4			4 / 0.6				
<i>Calyptrea fastigiata</i>					7 / 1.9			
<i>Clinocardium nuttallii</i>	3 / 15.5	2 / 2	3 / 5.7	3 / 5.5	10 / 149.2			1 / 5.4
<i>Crepidula adunca</i>	49 / 7.1	74 / 12.5	78 / 13.1	67 / 11.2	47 / 10.2			
<i>Diplodonta impolita</i>		1 / 0.2						
<i>Hiatella pholadis</i>					3 / 0.5			
<i>Lacuna vanegata</i>	1 / 0.2							4 / 0.4
<i>Lirabuccinum dirum</i>		1 / 2.5	1 / 3.4					
<i>Littorina scutulata</i>				10 / 1.4				
<i>Littorina sitkana</i>				5 / 1	2 / 0.2		24 / 3.6	22 / 4.6
<i>Lottia digitalis</i>					1 / 0.2			11 / 1.9
<i>Lottia pelta</i>	1 / 0.1							
<i>Macoma incongrua</i>	17/19.3	19/23.8	13/12.7	9/10.2	9/7.7			
<i>Macoma inquinata</i>	42 / 90.9	54 / 134.5	46 / 93.3	34 / 65.1	68 / 193.4		1 / 0.8	5 / 13.5
<i>Macoma nasuta</i>		2 / 7.6	2 / 16.8				6 / 14.5	
<i>Macoma secta</i>					6 / 6.8			
<i>Margarites beringensis</i>							3 / 0.6	
<i>Margarites pupillus</i>					1 / 0.1			
<i>Mya truncata</i>			3 / 0.5	3 / 0.7	1 / 0.1			
<i>Mytilus trossulus</i>		3 / 1.3	3 / 0.9	6 / 1.6	2 / 1.5	1 / 0.9	2 / 1.4	7 / 4
<i>Nassarius mendicus</i>	25 / 3.7	27 / 4.9	81 / 16.9	112 / 21	30 / 4.6		5 / 0.9	6 / 0.7
<i>Nucella lamellosa</i>					3 / 64.7			
<i>Pododesmus machrochisma</i>	24 / 130.2	57 / 386.7	60 / 299.1	70 / 230	50 / 327.9		2 / 10.6	2 / 9.1
<i>Protothaca staminea</i>	179 / 746.7	164 / 690.8	145 / 803.2	170 / 438.1	108 / 830.3		16 / 177.2	13 / 194.1
<i>Protothaca tenerrima</i>	7 / 70.1	12 / 81.7	10 / 49.6	15 / 73.9	7 / 105		1 / 17.1	4 / 11
<i>Saxidomus gigantea</i>	89 / 598.6	125 / 951.6	146 / 756.7	146 / 623.7	97 / 1272.6	11 / 27.6	25 / 317.4	39 / 468.5
<i>Tectura persona</i>			1 / 1	3 / 0.3	3 / 0.3		3 / 0.7	
unidentified bivalve fragments	146.1	215.1	230.4	162.5	125.3	11.2	56	38.6
unidentified gastropod fragments			0.4					
Total min. # shells/weight (g)	439/1828.9	416/2515.2	592/2302.8	657/1646.8	455/3102.5	12 / 39.7	88 / 600.8	232 / 751.8

Note: MRC - marine reservoir corrected; UAC - Upper Arrow Creek; GB - George Bay; LP - Lockport

Table A2: Species identified from northern Graham Island
high-stand deposits by sample number.

Species name	Site number Site name	RH9901* KP	RH9907* HC	RH9908 HC	RH9909 HC	RH9910 HC	RH9911 HC	RH9912 HC	RH9913* LB
MRC Radiocarbon years BP	>modern	4190±150	4190<Age<8990	8990±150	4190<Age<8990	4190<Age<8990	4190<Age<8990	4190<Age<8990	1160±140
<i>Acmaea mitra</i>				8 / 4		6 / 4.4		4 / 1.2	1 / 2.2
<i>Amphissa columbiana</i>			3 / 0.4	9 / 2.5		6 / 1.4		2 / 0.7	
<i>Astysis gausapata</i>				2 / 0.2					
<i>Balanus sp.</i>		1 / 0.7	178.7	307.6	48	60.4		279.4	2.3
<i>Balanus canosus</i>				1 / 0.9					
<i>Balanus crenatus</i>	1 / 0.1								
<i>Balanus nebulus</i>				1 / 2.4	1 / 474.8				
<i>Bittium eschrichtii</i>			3 / 0.5	4 / 0.6				1 / 0.2	
<i>Callostoma ligatum</i>								2 / 0.3	
<i>Calyptraea fastigiata</i>			1 / 0.1						
<i>Chiton sp.</i>			1 / 0.3	1 / 1.6	1 / 0.2	1 / 0.4			
<i>Chlamys rubida</i>			1 / 0.1	6 / 2.2		3 / 1			
<i>Chlamys sp.</i>				1 / 0.5					
<i>Clinocardium nuttallii</i>			4 / 29.6	13 / 30.9	3 / 26.2	2 / 44.1		7 / 93.8	
Coral				1					
<i>Crassodoma gigantea</i>		1 / 0.9		2 / 4.6		1 / 42.3			
<i>Crepidula nummaria</i>				1 / 0.3					
<i>Diplodonta imposita</i>				2 / 0.8					
<i>Euspira pallida</i>				2 / 0.7					
<i>Fissurellidea bimaculata</i>				3 / 0.3	2 / 0.2				
<i>Fusitron oregonensis</i>						1 / 1.6			
<i>Glycymeris septentrionalis</i>			15 / 2.1	40 / 8.1	39 / 7.7	31 / 5.8		4 / 2.3	
<i>Humularia kennebecensis</i>				1 / 2	2 / 17.2				
<i>Lacuna variegata</i>			2 / 0.2					2 / 0.2	
<i>Lirabuccinum dirum</i>			4 / 0.7	5 / 4.2					
<i>Littorina sitkana</i>			62 / 6.8			3 / 0.3		19 / 1.9	
<i>Lottia digitalis</i>			9 / 1	3 / 0.5				3 / 0.3	
<i>Lottia instabilis</i>				1 / 0.8				1 / 0.2	
<i>Lottia pelta</i>			18 / 2.1			5 / 0.8			
<i>Macoma inquinata</i>				1 / 0.4					
<i>Macoma lama</i>				2 / 4.2					
<i>Macoma sp.</i>								2 / 1.3	
<i>Mactromens polymya</i>						7 / 151.8			
<i>Mya truncata</i>				4 / 34.2					
<i>Mytilus californianus</i>		2 / 4.5	4 / 33.5	59 / 486.9	7 / 62.8	24 / 114.9		69 / 150.3	
<i>Mytilus trossulus</i>			58 / 40.1						
<i>Nassarius mendiculus</i>				4 / 0.4				1 / 0.1	
<i>Neptunea lyrata</i>			2 / 1.1	2 / 1					
<i>Nemocardium centifolium</i>	1 / 0.1								
<i>Nucella lamellosa</i>			3 / 2.6	1 / 1.3		2 / 1.5			1 / 2.5
<i>Nucella lima</i>				1 / 0.3					
<i>Olivella baetica</i>			2 / 0.6	3 / 1					
<i>Olivella biplicata</i>						3 / 3.2		2 / 3.5	
<i>Petalonchus compactus</i>				1 / 18.9					
<i>Pododesmus machrochisma</i>				4 / 29.6		2 / 6.2		2 / 2.3	
<i>Protothaca staminea</i>			18 / 16.8	43 / 81.1	1 / 1.1	2 / 23.5		13 / 12.7	
sand dollar				1 / 2.1	1 / 8.9	1 / 4			
<i>Saxidomus giganteus</i>			26 / 143.5	52 / 750.2	12 / 480.5	39 / 1545.1		13 / 259.9	3 / 45.4
Sea urchin			1 / 0.1	1 / 0.4					
<i>Siliqua patula</i>						1 / 8.7			
<i>Simomactra falcata</i>				1 / 1.1	1 / 2.4				
Sponge								1.4	
<i>Tectura fenestrata</i>	1 / 0.1	1 / 0.1							
<i>Tectura persona</i>			7 / 0.7	15 / 2.7	1 / 0.1	1 / 0.1		17 / 1.9	
<i>Tellina nukuloides</i>			21 / 3.4	63 / 7.1	67 / 8.2	32 / 4		9 / 1.3	
<i>Terebratalia transversa</i>				2 / 0.2					
<i>Tresus capax</i>				8 / 1017.8	2 / 114.2	5 / 393.2		2 / 197.4	
<i>Tresus nuttallii</i>				9 / 254.1		3 / 311.2		2 / 135.7	
<i>Tresus species</i>						2 / 8.7			
<i>Velutina prolata</i>			1 / 0.1						
unidentified clam shell frag's	0.1		121.3	98.9	31.6	66.7		27.9	
unidentified gastropod frag's			1.2	1.9	0.7	0.4			
Total min. # of shells/weight (grams)	3 / 0.4	5 / 6.2	266 / 587.6	384 / 3172.5	140 / 1284.8	183 / 2805.7		177 / 1176.2	5 / 52.4

Note: *site sampled for dating purposes only; MRC - marine reservoir corrected; KP - Kennecott Point; HC - Haines Creek; LP - Lepas Bay

Table A3: Species identified from Juan Perez Sound underwater grab samples by sample number.

Site number	V98-07	V98-09	V98-21	V98-22	V98-24*	V98-26	V98-27	V98-28	V98-30	V98-31	V98-32	V98-33	V98-34
MRC Radiocarbon years BP		11,280+/-50	11,050+/-50	11,140+/-50	>modern		11,150+/-50			10,180+/-40			
Species name													
<i>Amphissa columbiana</i>					1/01		3/03			2/04		5/11	
<i>Astarte esquamata</i>					4/09		29/58				2/04		
<i>Ceratostoma foliatum</i>													
<i>Clinocardium cikatun</i>													
<i>Clinocardium nuttalli</i>							1/21						
<i>Cranopsis cucullata</i>				1/02			8/13					1/02	1/01
<i>Crepipatella dorsata</i>													
<i>Diplodonta imposita</i>													1/03
<i>Fusititon oregonensis</i>												5/37	
<i>Gan californica</i>										8/2			
<i>Hiatella arctica</i>													
<i>Hiatella pholadis</i>				6/37			635/2858						
<i>Humilana kennerleyi</i>										9/1172	2/158		7/963
<i>Limpet Species</i>							56/61						
<i>Lirulana hrulata</i>				1/04			2/03						
<i>Lotia instabilis</i>													
<i>Lyonsia californica</i>						1/01							
<i>Macoma calcarea</i>													
<i>Macoma incongrua</i>			4/54				32/7						
<i>Macoma inquinata</i>				14/113			14/21						
<i>Macoma secta</i>			3/88					1/64					
<i>Margarites pupillus</i>							12/13						
<i>Modiolus modiolus</i>				2/12			5/4703				1/06		
<i>Musculus discors</i>										4/07			
<i>Mya truncata</i>			2/87	11/291			277/1816	2/38	2/81	2/3	5/135	25/597	5/18
<i>Mytilus trossulus</i>													
<i>Neptunea lyrata</i>													
<i>Nemocardium centifolium</i>				2/06									
<i>Nucella lamellosa</i>							1/62	2/156	2/95		1/1		2/13
<i>Olivella baetica</i>							1/01						
<i>Pandora filosa</i>										2/13			
<i>Panomya ampla</i>										1/22 (d)			
<i>Pododesmus machrochisma</i>	9/455	6/794		15/523			92/1426			3/09	1/16		1/01
<i>Polinices lewisi</i>													
<i>Protothaca staminea</i>				5/61			34/242						
<i>Protothaca tenerima</i>		2/57	2/97	60/2393			160/1595						
<i>Saxidomus giganteus</i>	12/598	2/103	19/1361	54/4894			73/80			1/68			
<i>Scabrotrophon maltzani</i>													
<i>Serpis groenlandicus</i>													
<i>Tectura persona</i>											1/02		
<i>Tegula pulligo</i>													
<i>Terebratalia transversa</i>				2/24			2/133						
<i>Turtonia minuta</i>									2/02	6/11			
Total min. # shells/weight (g)	21/1053	10/954	30/1687	173/836	5/1	1/01	1437/13895/258	6/178	38/1356	13/331	38/647	17/999	

Note: *Sample dated recent or modern implying sediments were not in-situ. MRC - marine reservoir corrected

Table A3 cont'd: Species identified from Juan Perez Sound underwater grab samples by sample number.

Site number	V98-35	V98-36	V98-38	V98-39	V98-40	V98-41	V98-42	V98-43	V98-44*	V98-45	V98-46	V98-47	V98-48
MRC Radiocarbon years BP					10,380 ± 50				380 & >modern				
Species name													
<i>Amphissa columbiana</i>	3 / 0 6	1 / 0 3					1 / 0 3			2 / 0 5			1 / 0 2
<i>Astarte esquima</i>													
<i>Ceratostoma foliatum</i>													
<i>Clinocardium ciliatum</i>													
<i>Clinocardium nuttalli</i>													
<i>Cranopsis cucullata</i>						1 / 0 3							
<i>Crepidula dorsata</i>							3 / 0 3						
<i>Diplodonta impolita</i>													
<i>Fusitonta oregonensis</i>													1 / 0 7
<i>Gari californica</i>									1 / 1 2				
<i>Hiatella archica</i>							13 / 1 9						
<i>Hiatella pholads</i>													
<i>Humana kennerleyi</i>	2 / 44 5					1 / 9 9		3 / 49 5	1 / 27 6				1 / 1 5
<i>Limpet Species</i>								1 / 0 1					
<i>Lirulana lirulata</i>													
<i>Lotta instabilis</i>													1 / 0 3
<i>Lyonsia californica</i>													
<i>Macoma calcarea</i>								1 / 1 4					
<i>Macoma incongrua</i>													
<i>Macoma inquinata</i>					2 / 1 2								
<i>Macoma secta</i>													
<i>Margarites pupillus</i>													
<i>Modiolus modiolus</i>													
<i>Musculus discors</i>													
<i>Mya truncata</i>	14 / 44 3					8 / 19 2	5 / 8 1	1 / 2 3	2 / 3 3	3 / 7 8	16 / 30 8	5 / 10 5	10 / 19
<i>Mytilus trossulus</i>													
<i>Neptunea lyrata</i>													
<i>Nemocardium centifolium</i>													
<i>Nucella lamellosa</i>	1 / 3 3		1 / 7 4	1 / 24 5			9 / 27 7	2 / 19 6	18 / 46	3 / 6 5	4 / 5 2	2 / 6 6	1 / 3 7
<i>Olivella baetica</i>													
<i>Pandora flosa</i>													
<i>Panomya ampla</i>													
<i>Pododesmus machrochisma</i>							3 / 1		3 / 1 8				
<i>Polinices lewisii</i>					1 / 3 4		1 / 2 3						
<i>Protothaca staminea</i>													
<i>Protothaca tenemma</i>							2 / 13 6						
<i>Saxidomus giganteus</i>					6 / 74 9	1 / 15 7						1 / 14 2	
<i>Scabrotrophon maltzani</i>												1 / 0 5	
<i>Sempe groenlandicus</i>													1 / 2 9
<i>Tectura persona</i>													
<i>Tegula pullio</i>	1 / 0 1												
<i>Terebratalia transversa</i>													
<i>Turtonia minuta</i>													
Total min. # shells/weight (g)	21 / 92 8	1 / 0 3	1 / 7 4	1 / 24 5	9 / 79 5	11 / 45 1	37 / 55 2	8 / 72 9	25 / 79 9	8 / 14 8	20 / 36	9 / 31 8	16 / 28 3

Note: *Sample dated recent or modern implying sediments were not in-situ. MRC - marine reservoir corrected

Table A3 cont'd: Species identified from Juan Perez Sound underwater grab samples by sample number.

Species name	Site number V98-49 MRC Radiocarbon years BP	V98-50	V98-53 10,890 +/- 50	V98-54	V98-55 11,320 +/- 50	V98-57* 450 +/- 50	V98-58	V98-59	V98-60	V98-61	V98-62 10,130 +/- 40	V98-63	V98-64	V98-65
<i>Amphissa columbiana</i>	3 / 0 7	1 / 0 3								1 / 0 9				
<i>Astarte esquamata</i>														
<i>Ceratostoma foliatum</i>													1 / 5 7	
<i>Cinocardium ciliatum</i>			2 / 2 4											
<i>Cinocardium nuttalli</i>														
<i>Granopsis cucullata</i>	1 / 0 1		1 / 0 1					1 / 0 8						
<i>Crepidula dorsata</i>														
<i>Diplodonta impolita</i>														
<i>Fusitonta oregonensis</i>			1 / 0 8			1 / 0 4						1 / 1		
<i>Gan californica</i>														
<i>Hiatella arctica</i>								4 / 0 2					2 / 0 3	
<i>Hiatella pholadis</i>			2 / 1 1											
<i>Humana kennerleyi</i>	3 / 49 7													
<i>Limpet Species</i>														
<i>Lirulana lirulata</i>														
<i>Lotha instabilis</i>														
<i>Lyonsia californica</i>														
<i>Macoma calcarea</i>									9 / 2 8					
<i>Macoma incongrua</i>											1 / 3	1 / 7		
<i>Macoma inquinata</i>					1 / 1 7									
<i>Macoma secta</i>														
<i>Margantes pupillus</i>								1 / 0 1						
<i>Modiolus modiolus</i>														
<i>Musculus discors</i>														
<i>Mya truncata</i>	1 / 0 6		2 / 8 9	2 / 3 8		11 / 32 5		1 / 3 5		3 / 6 3	7 / 13 4	3 / 3 9	4 / 8 4	
<i>Mytilus trossulus</i>										1 / 0 4				
<i>Neptunea lyrata</i>			1 / 0 5											
<i>Nemocardium centhiosum</i>				1 / 0 7	2 / 0 2									
<i>Nucella lamellosa</i>	10 / 12 8					1 / 0 7	1 / 2 3	5 / 9 5	3 / 25 6				14 / 51 9	5 / 31 2
<i>Olivella baetica</i>								1 / 0 3						
<i>Pandora filosa</i>														
<i>Panomya ampla</i>														
<i>Pododesmus machrochisma</i>				1 / 1 1						3 / 1 2			1 / 0 4	1 / 0 6
<i>Polinices lewisii</i>					1 / 0 9				2 / 2 5					
<i>Protothaca staminea</i>			2 / 3 9	1 / 4 6										
<i>Protothaca tenerima</i>				10 / 58 6	6 / 21 5			1 / 6						
<i>Saxidomus giganteus</i>			1 / 1 6	27 / 178 3	9 / 18 3						4 / 181 3			
<i>Scabrotrophon maltzanii</i>														
<i>Sempeles groenlandicus</i>			5 / 9	4 / 1 8										
<i>Tectura persona</i>														
<i>Tegula pulligo</i>	1 / 1 5				1 / 2 6									
<i>Terebratalia transversa</i>														
<i>Turtonia minuta</i>														
Total min. # shells/weight (g)	19 / 65 4	1 / 0 3	17 / 28 3	46 / 249 1	20 / 45 2	13 / 33 6	1 / 2 3	14 / 20 4	14 / 30 9	8 / 8 8	12 / 195	5 / 5 6	22 / 66 7	6 / 31 8

Note: *Sample dated recent or modern implying sediments were not in-situ. MRC - marine reservoir corrected

Table A4: Species identified from submarine sediment cores by sample number.

Site number	E87A13	E87A22	E87A23	E87A4	E88B24	E88B29	E88B30	E88B53	E88B54	E88B55
Elevation in core	171cm+	84cm+	14cm+	140cm+	67cm+	74cm+	60cm+	85cm+	80cm+	135cm+
		10,250- 10,360	9,940- 10,650			9,130- 9710	9,840- 12,520	10,630- 12,540	9,800- 12,710	
MRC 14C date	@ 172cm	@ 87.121 cm	@ 25 to 93cm	10,430 @ 140cm	13,210 @ 149cm	121cm	@ 74 to 118cm	@ 73 to 150cm	@ 87 to 179cm	@ 80 to 10,720 @ 142cm
Species name										
<i>Acila castrensis</i>			3 / 3							
<i>Acræa mitra</i>									1 / 1	
<i>Amphisca columbiana</i>		2 / 2								
<i>Antalis perosum</i>										
<i>Balanus</i> sp. fragments		35 / 0.9	3 / 3			68 / 1		77 / 4.3	34 / 1.1	12 / 4
<i>Balanus canosus</i>		1 / 2								
<i>Balanus crenatus</i>								1 / 1	1 / 2	
<i>Balanus glandulus</i>		1 / 1						2 / 6	1 / 1	
<i>Capelin Malofus</i>										
Charcoal fragments		4 / 2				3 / 3	73 / 7			
<i>Chlamys rubida</i>										
<i>Chlamys</i> sp.		1 / 1								
<i>Clinocardium</i> sp.									1 / 4	
<i>Clupea harengus pallasi</i>										
<i>Cottidae</i> sp.										
<i>Cottidae gymnocanthus</i> (cf)										
Coral fragments								8 / 1		
<i>Crepidula adunca</i>										
<i>Cychna alba</i>										
<i>Cychna attonsa</i>										
<i>Diplodonta imposita</i>	2 / 2									
<i>Epitonium</i> sp.										
<i>Euspira pallida</i>			1 / 1							
foraminifera	6 / 2					1 / 1				
<i>Glycymeris septentrionalis</i>										
<i>Hiatella arctica</i>										
<i>Hiatella pholads</i>								1 / 3		
<i>Hiatella</i> sp.		1 / 1								
<i>Lucinoma annulatum</i>			1 / 2							
<i>Macoma calcarea</i>					3 / 6			3 / 7.6		
<i>Macoma elmata</i>										
<i>Macoma incongrua</i>								3 / 2.1		
<i>Macoma inquina</i>										
<i>Macoma moesta</i>										
<i>Macoma</i> sp.					1 / 7	1 / 7		1 / 7		
<i>Macridae</i> sp.										
<i>Macromis</i> sp.										
<i>Margarites benngensis</i>										
<i>Margarites helcinus</i>									2 / 2	
<i>Margarites</i> sp.										
<i>Modiolus rectus</i>								> 1 / 14.3		
<i>Modiolus</i> sp. fragments								25 / 1.4		
<i>Musculus taylori</i>										
<i>Mya</i> sp.										
<i>Mya truncata</i>								2 / 11.1		
<i>Mytilimena nuttalli</i>									3 / 3	
<i>Mytilus trossulus</i>									1 / 2	1 / 1
<i>Mytilus</i> sp.			1 / 1			1 / 1	1 / 1			
<i>Nassarius mendicus</i>										
<i>Neptunea lyrata</i>		1 / 1								
<i>Nuculana minuta</i>		2 / 2								
<i>Nuculana perula</i>	2 / 2									
<i>Nuculana tenuis</i>	1 / 1									
<i>Nuculana</i> sp.										
<i>Nutricula fodi</i>		2 / 2								
<i>Olivella baetica</i>						4 / 9				
<i>Olivella bipicata</i>			1 / 1							
<i>Olivella</i> sp.										
<i>Pandora filosa</i>			1 / 1							
Plant & wood fragments	28 / 0.4	50 / 6	6 / 3	31 / 2	2 / 1	8 / 2	101 / 9	12 / 1	1 / 1	
<i>Petaloconchus compactus</i>								7.4		
<i>Platydont cancellatus</i>										2 / 7
<i>Pododermus machrochisma</i>								1 / 1		
<i>Polinices lewisii</i>						1 / 1.8				
<i>Prototheca staminea</i>		1 / 1								1 / 2
<i>Saxidomus giganteus</i>		3 / 4.5				3 / 1.2	1 / 1.6		2 / 21.3	1 / 3
Sea urchin								1 / 0.5		1 / 1
<i>Sebastes</i> sp.										
<i>Simomactra falcata</i>									5 / 7.4	
<i>Solanella perambilis</i>										
<i>Tellina nuculoides</i>						23 / 2.7			52 / 5.6	
<i>Tellina modesta</i>				1 / 1						
<i>Thyasira flexuosa</i>										
<i>Trichotropis cancellata</i>								3 / 5		
unidentified bivalve frag's	35 / 0.8	48 / 8	7 / 7	11 / 2	41 / 3.6	2 / 1	15 / 4	82 / 2.8	58 / 6.2	54 / 2.9
unidentified gastropod frag's			6 / 2		1 / 1			1 / 1	1 / 1	5 / 3
<i>Veneridae</i> sp.										
wood, coniferous cones										
<i>Yoldia</i> sp.			1 / 1					1 / 2		
Total min. # shells/weight (g)	11 / 1.9	16 / 8.4	8 / 2.4	1 / 0.5	4 / 10.5	343 / 9.1	2 / 3.7	20 / 56.1	68 / 43.2	7 / 5.1

Note: MRC - marine reservoir corrected

Table A4 cont'd: Species identified from submarine sediment cores by sample number.

Site number	E92A21	H818	M934	T91C20	T91C34	T95B12	V94A11	V94A12
Elevation in core	117cm+	246cm+	205cm+	217cm+	102cm+	133cm+	70cm+	79cm+
	10,360- 10,380	9,830- 15,200	9,340- 10,090		13,190- 13,790		10,670- 10,750	
MRC 14C date	@123 to 142cm	@245 to 714cm	@207 to 246cm	@9,850 to 217cm	@104 to 119cm	@12,890 to @185cm	@81 to 88cm	@8,850 to @93cm
Species name								
<i>Acle castrensis</i>				2 / 2				
<i>Acmea mitra</i>	1 / 1							
<i>Amphissa columbiana</i>				1 / 1				
<i>Antalis pertosum</i>				5 / 7				
<i>Balanus</i> sp. fragments	23 / 7	1 / 1	2 / 1	4 / 4		9 / 5		
<i>Balanus canosus</i>								
<i>Balanus crenatus</i>								
<i>Balanus glandulus</i>		1 / 1						
<i>Capelin Mallotus</i>		1 / 1						
Charcoal fragments				1 / 1				
<i>Chlamys rubida</i>			1 / 3					
<i>Chlamys</i> sp.				1 / 1				
<i>Cinocardium</i> sp.			1 / 2	3 / 6				
<i>Clupea harengus pallas</i>		1 / 2						
<i>Cotidae</i> sp.		1 / 1 (cf)						
<i>Cotidae gymnocanthus</i> (cf)		1 / 1						
Coral fragments								
<i>Crepidula adunca</i>			1 / 1					
<i>Cylichna alba</i>				4 / 4				
<i>Cylichna altosa</i>				1 / 1				
<i>Diplodonta impolita</i>				45 / 45				
<i>Epitonium</i> sp.	1 / 1							
<i>Euspira pallida</i>								
foraminifera		4 / 3						
<i>Glycymeris septentrionalis</i>				5 / 8				
<i>Hiatella arctica</i>								
<i>Hiatella pholadis</i>	3 / 4					7 / 7		
<i>Hiatella</i> sp.								
<i>Lucinoma annulatum</i>			1 / 1					
<i>Macoma calcarea</i>						1 / 12		
<i>Macoma elmata</i>		1 / 3						
<i>Macoma incongrua</i>						1 / 6 (cf)		
<i>Macoma inquinata</i>						1 / 12 (cf)		
<i>Macoma moesta</i>				1 / 1				
<i>Macoma</i> sp.		5 / 19				2 / 5		
<i>Mactridae</i> sp.				1 / 1				
<i>Mactromens</i> sp.				3 / 3				
<i>Margarites benngensis</i>		1 / 1						
<i>Margarites helcinus</i>				1 / 1				
<i>Margarites</i> sp.								
<i>Modiolus rectus</i>								
<i>Modiolus</i> sp. fragments						2 / 4		
<i>Musculus taylor</i>						3 / 3 (cf)		
<i>Mya</i> sp.				1 / 2 1				
<i>Mya truncata</i>				1 / 1				
<i>Mytilmena nuttalli</i>								
<i>Mytilus trossulus</i>	9 / 1		1 / 4			1 / 18		
<i>Mytilus</i> sp.				1 / 1		3 / 4		
<i>Nassarius mendicus</i>			2 / 2					
<i>Neptunea lyrata</i>	1 / 1							
<i>Nuculana minuta</i>								
<i>Nuculana pennula</i>								
<i>Nuculana tenuis</i>								
<i>Nuculana</i> sp.		5 / 1						
<i>Nutricula lordi</i>		122 / 6		124 / 12 6				
<i>Olivella baetica</i>				1 / 1				
<i>Olivella biplicata</i>				3 / 4				
<i>Olivella</i> sp.				1 / 2				
<i>Pandora flosa</i>								
Plant & wood fragments	9 / 5	16 / 4	13 / 14	>53 / 1	>120 / 1	10 / 2	>24 / 3	16 / 2
<i>Petalonchus compactus</i>	0.1							
<i>Platydora cancellatus</i>								
<i>Pododesmus mechochisma</i>			1 / 1					
<i>Polinices lewisii</i>								
<i>Prototheca staminea</i>			2 / 2	1 / 1				
<i>Saxidomus giganteus</i>			5 / 28 6					
Sea urchin	1 / 0 1	1 / 1		1 / 4		1 / 6		
<i>Sebastes</i> sp.		1 / 1						
<i>Simonectra falcata</i>				5 / 6				
<i>Solenella perambilis</i>				1 / 1				
<i>Tellina nukulodes</i>				17 / 1 7				
<i>Tellina modesta</i>								
<i>Thyasira flexuosa</i>			1 / 1					
<i>Trichotropus cancellata</i>								
unidentified bivalve fragments	3 / 1	118 / 2 9	29 / 1 6	97 / 2 9		74 / 2 3		
unidentified gastropod fragments	2 / 1		1 / 1	8 / 5				
<i>Veneridae</i> sp.	2 / 2							
wood, coniferous cones			2 / 8					
<i>Yoldia</i> sp.		2 / 5		7 / 8				
Total min. # shells/weight (g)	18/3 5	143/8 9	16/34 3	237/33 2		1 21/10 7	0 3	0 2

Note: MRC - marine reservoir corrected

Chapter 4

QUEEN CHARLOTTE ISLANDS PALEOGEOGRAPHY AND THE AMERICAS' FIRST HUMANS

Molluscs, lithology, and published sub-bottom profiles are used to deduce sea-levels, outline the influence of glacially-induced crustal displacement, and reconstruct the paleoenvironment of the northeast Pacific Late Quaternary coastline. Geo-spatial modeling shows subaerially exposed land that could have been inhabited by plants and animals, including coastally migrating early humans. Ice-free terrain, present by at least 13,790 ^{14}C years BP, a landbridge, and edible molluscs are identified. Early coastlines that have not been drowned and which may harbour early archaeological sites are identified along the western Queen Charlotte Islands and the British Columbia mainland.

INTRODUCTION

The traditional “Clovis First” (Haynes, 1969; West, 1981) hypothesis suggests that the first Americans were large game hunters who migrated from northeast Asia across the Beringian landbridge ca. 12,000 ^{14}C years BP, spreading southward via a continental “ice-free corridor” located east of the Canadian Rockies (Fig. 1). However, research into the timing and extent of Wisconsinan glaciation (White et al., 1985; Dyke, 1996; Jackson et al., 1997) precludes this possibility between 11,500 and 20,000 ^{14}C years BP. Further,

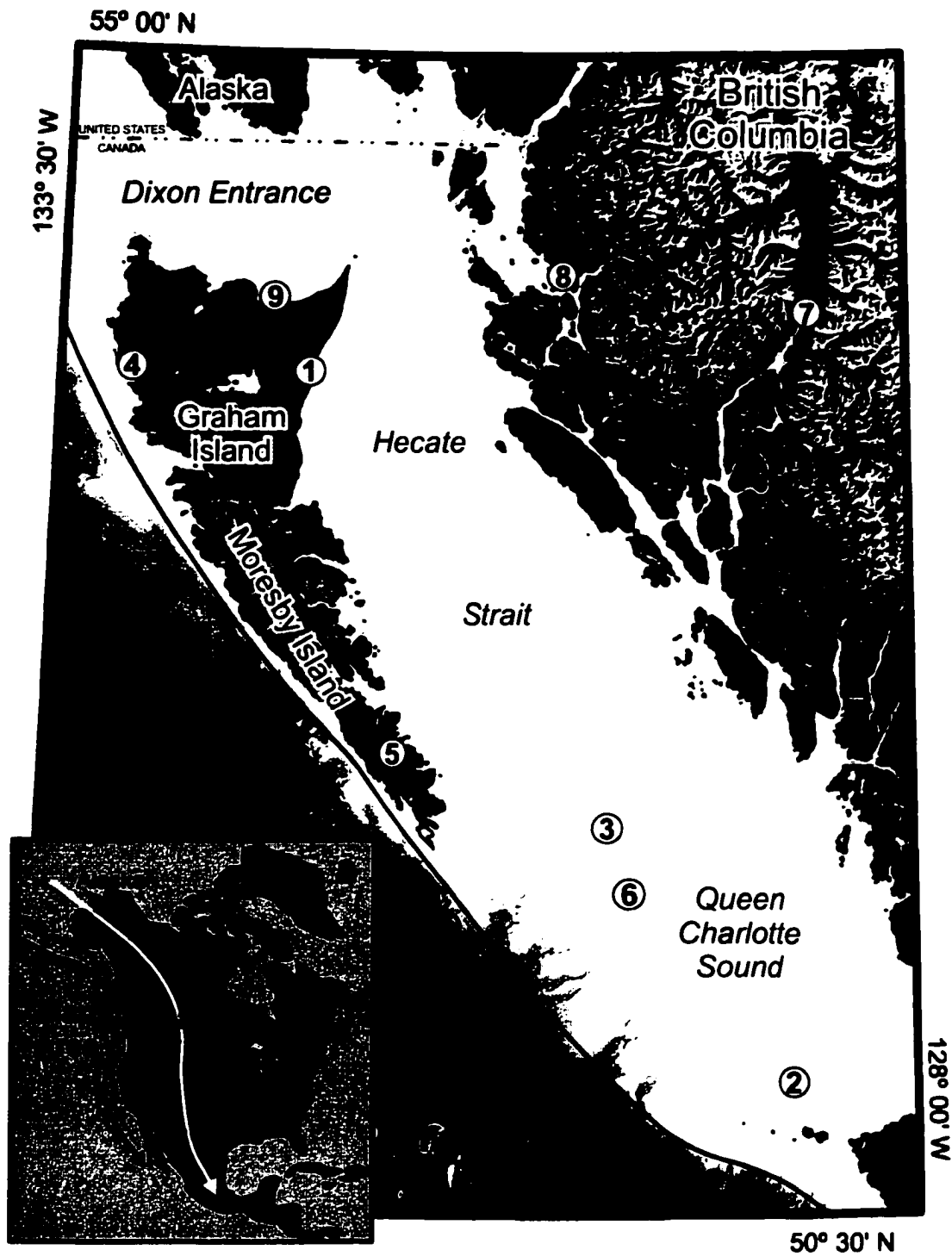


Figure 1. Map of study area in Queen Charlotte Islands, Canada with inset of North America showing Traditional migration route in yellow and Coastal migration route in red. Localities identified: 1. Cape Ball, 2. Cook Bank, 3. Goose Island Bank, 4. Haines Creek, 5. Juan Perez Sound, 6. Goose Island Trough, 7. Kitimat, 8. Prince Rupert, 9. Masset.

archaeological finds in North and South America predate 11,500 ^{14}C years BP, and although most remain controversial, the Monte Verde site in Chile, dated to at least 12,500 ^{14}C years BP, is generally accepted as a pre-Clovis site (Dillehay, 1989). These findings have led various researchers to propose an alternate migration route for early humans -- a water route along Pacific North and South America that passed by the Queen Charlotte Islands (QCI), British Columbia (BC) (Fradmark, 1979; Josenhans et al., 1995; Heaton et al., 1996; Mandryk et al., 2001; Fig. 1). At present, the earliest archaeological evidence for human occupation of the BC - Alaskan coast is 10,300 ^{14}C years BP (Dixon, 2001).

The hypothesis that the first peoples of North and South America migrated via a coastal route carries with it the presumption that the QCI region had a suitable climate and sufficient natural resources to make habitation possible. Early coastal inhabitants were influenced by shifting glacial ice and changes in sea-level, and their sites were likely located in close proximity to resource-rich coastal zones and estuaries. Here I present the temporal and spatial dimensions of the Late Quaternary coastline along the northeast Pacific continental shelf and ascertain the role that glacially-induced crustal displacements played in the creation of a viable early human coastal migration route.

The QCI are located 150 km west of mainland British Columbia (BC; Fig. 1), across a shallow continental shelf. During the Wisconsin glacialiation the paleogeography of the QCI was noticeably different (Josenhans et al, 1997). Regional paleocoastlines were

markedly influenced by eustatic sea-level and glacio-isostatic crustal adjustments during and subsequent to the Last Glacial Maximum (LGM). These adjustments varied both temporally and spatially due to variations in ice thickness, a relatively thin lithosphere (Sweeney and Seemann, 1991), and low mantle viscosity (Lewis et al., 1991; James et al., 2000), allowing steep crustal tilting and a rapid crustal response. Subsequent to the LGM, sea-level was up to 120 m higher on the BC mainland, and more than 150 m lower in the adjacent QCI archipelago (Clague et al., 1982; Josenhans et al., 1997; Appendix Table 1; Fig. 2a).

MATERIAL, METHODS, AND SHELLFISH BIOMASS

Over 375 geo-referenced ^{14}C dates from raised beach deposits, underwater sediment cores, and grab samples were obtained and analyzed for fauna, flora, and lithology in the context of bathymetric, published sub-bottom profiles for constraints on past sea-level. About 75% of the marine cores showed evidence of uninterrupted benthic marine conditions or did not possess critical information, such as the identification of material sampled for dating, and thus were not useful for paleocoastline reconstruction. One raised beach sample (RH9901 – Kennecott Point) and four underwater grab samples (V98-24, V98-44-1, V98-44-2, V98-57) were ^{14}C dated recent or modern. Seventy-six samples contained sufficiently well-constrained sea-level evidence to enable paleocoastline modeling for the period 14,250 to 8,750 ^{14}C years BP (Appendix Table 1).

Bulk samples collected from high-stand deposits were wet-sieved using 1 and 2 mm

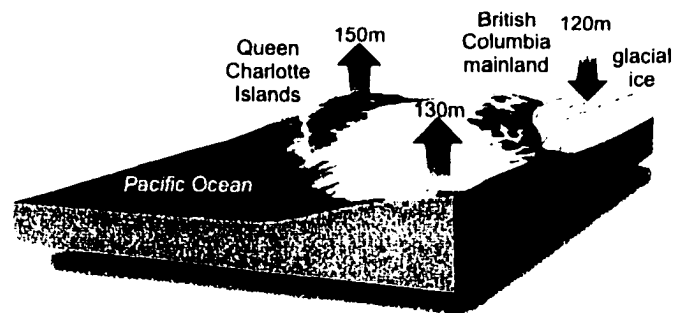


Figure 2a

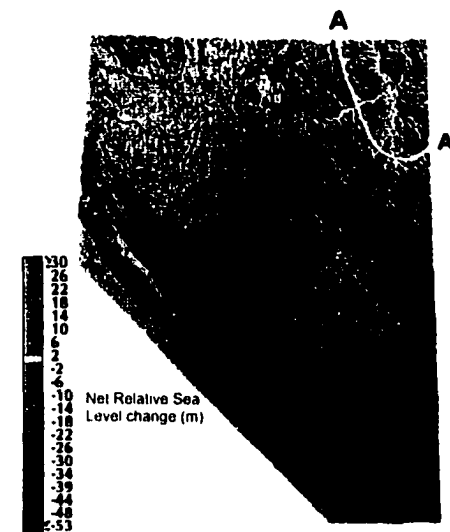


Figure 2b

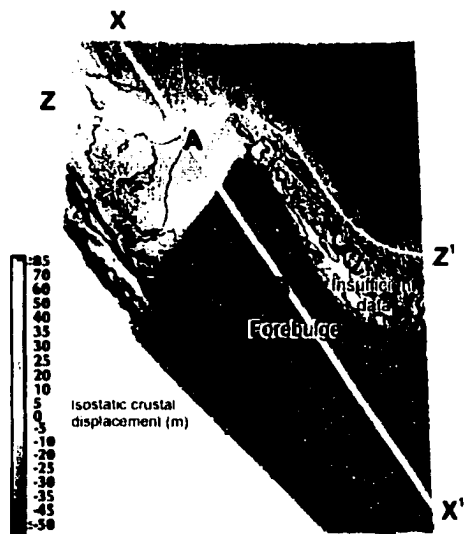


Figure 2c

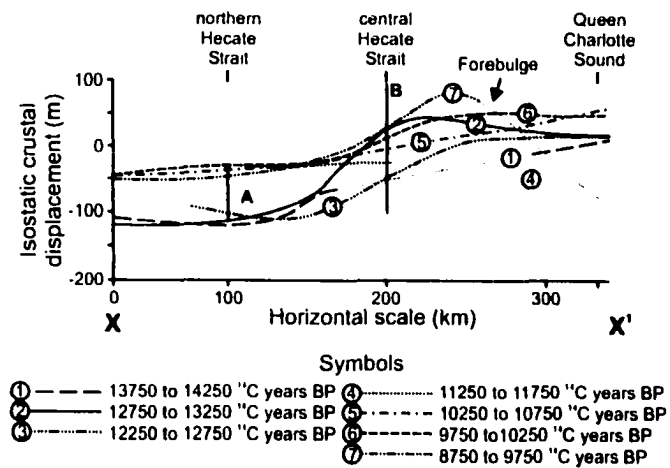


Figure 2d

Figure 2a, Schematic representation of the amount (m) of relative sea level adjustment in the QCI region. The weight of ice pushed the mainland down, while adjacent areas were uplifted, forming a peripheral bulge.

2b, Net relative sea level change for the interval 12,750 to 13,250 ¹⁴C years BP, showing change in net relative sea level compared to present elevation in metres (see colour bar). The white line (A to A') indicates where no net relative sea level change occurred, a result of crustal displacement exactly offsetting eustatic sea level change. Areas of dark blue indicate regions where net relative sea level was lower than present. Areas of green indicate regions where net relative sea level was higher than present.

2c, Isostatic crustal displacement for the interval 12,750 to 13,250 ¹⁴C years BP, showing change in crustal elevation relative to present day elevation in metres (see colour bar). The observed sea level change at Barbados (Fairbanks, 1989) is used as a proxy for eustatic sea level change. Isostatic crustal displacement was generated by removing Barbados sea level curve (estimated to be between 106 m below msl at 14,000 ¹⁴C years BP to 36 m below msl at 9,000 ¹⁴C years BP) from figure 2b. The white line (Z to Z') indicates the line along which no crustal displacement occurred. Areas of dark blue indicate subsidence under substantial glacial ice within the preceding 1,000 years. Areas of red, orange, yellow, and green indicate uplifted areas where little to no ice was present. The yellow line (X to X') locates the cross-section shown in figure 2d. Geophysical and geological surveying for sea level and glacial evidence along the BC mainland where insufficient data exists would improve the model's resolution and assist in more accurately predicting accessible archaeological sites.

2d, A time series of isostatic crustal displacement cross-sections from Dixon Entrance southeast to QC Sound for all mapped intervals indicates forebulge position. Greyed lines indicated limited data. Glacial ice retreated from Dixon Entrance subsequent to the interval 12,750 to 13,250 ¹⁴C years BP illustrated by more than 50 m of uplift at northern Hecate Strait (A). The inflection point (B) of the isostatic displacement curves remained essentially constant after 12,750 ¹⁴C years BP, implying a fixed ice-front and continued ice presence on the BC mainland until at least 10,000 ¹⁴C years BP.

screens. Sixty-five underwater grab samples, focusing on fluvial features, river terraces, alluvial fans and deltas, obtained by H. Josenhans, D. Fedje and others during the C.S.S. Vector 1998 cruise from Juan Perez Sound, QCI were wet-sieved using 3 and 6 mm mesh. Submarine sediment cores obtained by the Geological Survey of Canada (GSC) between 1981 and 1995 were analyzed, and those containing lithologies, sedimentary structures, shell material, or radiocarbon dates of interest were sampled (4 cm³) at regular intervals and screened using 710 µm (gravel and sand) or 63 µm (fine silt).

Paleobotanical and faunal data were collected, identified, and paleohabitat interpretations were based on present species' habitat characteristics.

Radiocarbon dated samples used for paleogeographic reconstruction were restricted to those possessing a clear indication of deposition elevation relative to sea level at that time. Intertidal molluscan species having narrow depth tolerances were chosen for ¹⁴C AMS dating. To ensure consistency between dates obtained from a variety of laboratories over the last thirty years, the dating methodology was reviewed for all dates and a marine reservoir correction factor of 800 years (Southon et al., 1990; J.J. Clague, personal communication, 2001) was applied to all normalized ¹⁴C shell dates.

Using ESRI's ArcGRID® GIS module, a raster grid was generated for the study area detailing the trend of relative sea level change for the selected time interval, based on observations at each sample site. A crustal displacement change grid was then created by subtracting eustatic sea level change (Fairbanks, 1989) from the relative sea level change

grid. A present-day digital elevation model was produced from the most current Canadian Hydrographic Service (CHS) bathymetric and National Topographic Data Base (NTDB) topographic digital data for the region. These grids were combined to form *sum-sea level* and *sum-elevation* change models, which depict the net change in relative sea level and land-surface at selected time intervals. *Spline-tension* interpolation was used to infer relative sea-level change and crustal displacement in four-dimensional space. The *Spline-tension* interpolation technique requires that the modeled surface pass through all data points (^{14}C dated sample localities) and possess a minimum surface curvature. This method permitted tuning of the model to incorporate a relatively flexible lithosphere, evident in the divergence of relative sea levels throughout the region as ice loading varied during and subsequent to glaciation. The amount of tension applied to the model, which dictated the amount of crustal flexure, was varied until a *weight* parameter of fifteen was selected. The relatively high weight value of fifteen reflects a very thin lithosphere as suggested by Sweeney and Seaman (1991) and Lewis et al. (1991).

Mollusc species were identified by the primary author on the basis of shell exterior, colour, thickness, curvature, fracture patterns, and comparison with shellfish collections and standard references. Shells were blotted and then weighed using an electronic digital scale to the nearest 0.1 grams. Edible intertidal mollusc shell weights were multiplied by species specific biomass factors (Erlandson, 1984; Moss, 1989) to determine edible biomass levels represented. Selected intertidal mollusc specimens were chosen for ^{14}C AMS dating.

RESULTS

Sea-level change and crustal displacement

Relative sea-level maps generated from these data show the magnitude of sea-level change throughout the region relative to present (Fig. 2b). The inflection point on figure 2b indicates zero relative sea-level change – the point where eustatic sea-level change was completely offset by crustal displacement. Isostatic crustal displacement was isolated by removing global eustatic sea-level (Fairbanks, 1989) from paleosea-level data. Isostatic crustal displacement maps illustrate temporal changes in the magnitudes and extent of crustal flexure, relative to present crustal elevation, as a glacial forebulge developed (Fig. 2c).

Ice Extent

Glacial ice attained its maximum extent at ~15,500 ¹⁴C years BP. After ~14,000 ¹⁴C years BP, and prior to 12,640 +/- 50 ¹⁴C years BP (Archer, 1998), glacial ice began retreating from eastern Dixon Entrance generating 50 m of uplift (Fig. 2d). Cross-sections from northwest Dixon Entrance to southeast QC Sound for all mapped intervals indicate a relatively constant forebulge position persisted between 12,750 and 8,750 ¹⁴C years BP. This stillstand required a fixed ice-front and continued ice presence on the BC mainland until at least 10,000 ¹⁴C years BP (Clague et al., 1982). By 12,640 ¹⁴C years BP (Archer, 1998), Dixon Entrance was ice-free, providing clear navigation east to the BC mainland where edible molluscs *Tresus nuttallii*, *Clinocardium nuttallii*, *Saxidomus giganteus*, and *Mytilus californianus* colonized a productive gravel and cobble beach.

Paleogeographic reconstructions

Lowered eustatic sea-level combined with crustal uplift permitted terrestrial conditions to develop on two emergent coastal plains; one extended eastward from the QCI and the other developed in QC Sound extending northward from Vancouver Island (Fig. 3a).

Terrestrial plant material from Dogfish Bank and Cape Ball (Appendix Table 1; core T91C34, high-stand 116h) suggest a treeless tundra-like environment extended east from QCI from at least 13,790 $\pm$ 150 ^{14}C years BP (Clague et al., 1982; Mathewes, 1989; Barrie et al., 1993). Eighteen submarine sediment cores from Hecate Strait and Dixon Entrance, and high-stand deposits at Cape Ball indicate the subaerial exposure of this now drowned northeastern coastal plain until at least 9130 $\pm$ 90 ^{14}C years BP (Appendix Table 1). Molluscan and sedimentological evidence (Appendix Table 1; core H818) indicates lowered eustatic sea-level combined with isostatic uplift resulted in the subaerial exposure of a southern coastal plain (Fig. 3a) from 15,200 $\pm$ 490 ^{14}C years BP (Luternauer et al., 1989a). Nineteen samples from submarine sediment cores recovered terrestrial or intertidal beach deposits in the QC Sound and Cook Bank region (Appendix Table 1) and imply persistence of the southern coastal plain until at least 7,820 $\pm$ 70 ^{14}C years BP (Clague et al., 1982; Luternauer et al., 1989a).

Downwasting of ice to the north and east resulted in isostatic uplift, and despite rising eustatic sea-levels, northern Hecate Strait closed by $\sim$ 11,750 ^{14}C years BP (Fig. 3b), creating a narrow, elongate, shallow water embayment (the “Hecate Sea”; Patterson et al., 1995) that opened southward into QC Sound. The resulting landbridge connected the BC mainland and

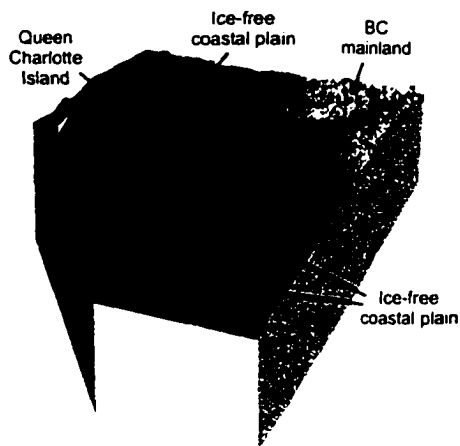


Figure 3a

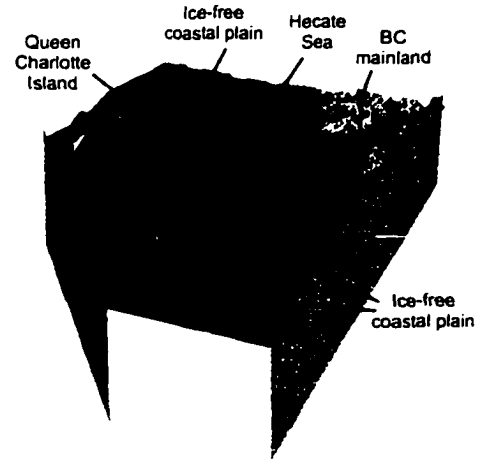


Figure 3b

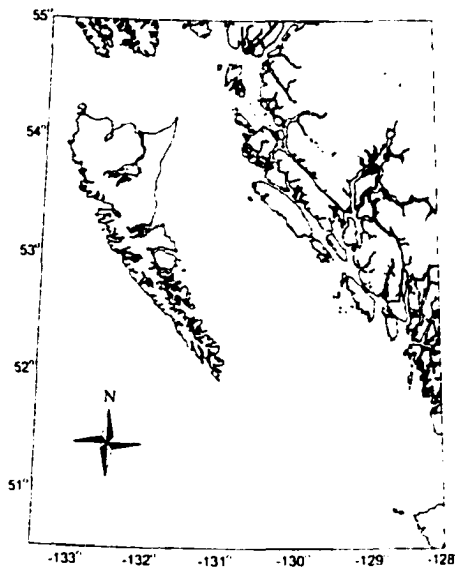


Figure 3c

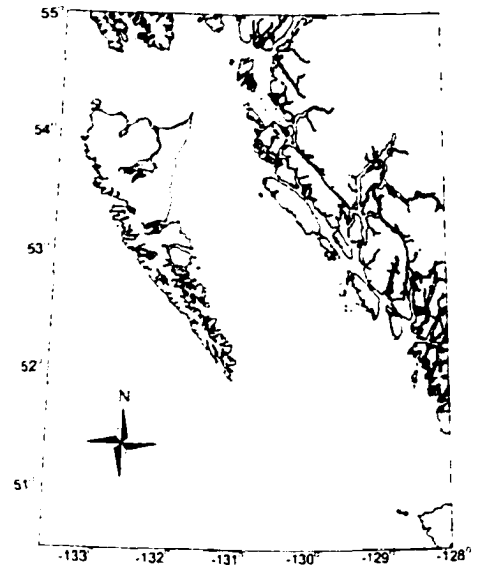


Figure 3d

Figure 3a, Paleogeography of QCI region between 12,750 and 13,250 ^{14}C years BP.

3b, Paleogeography of QCI region between 11,250 and 11,750 ^{14}C years BP.

3c, Paleocoastlines persisting from 10,250 to 12,750 ^{14}C years BP that intersect present subaerial topography. Westernmost paleocoastlines along the BC mainland are less likely to have been influenced by glacial ice than more inland sites.

3d, Paleocoastlines persisting from 12,750 to ~14,250 ^{14}C years BP that intersect present topography. Paleocoastlines located along the west coast of QCI provide the greatest archaeological site potential. Dixon Entrance would have been ice-free only late in this time interval. Westernmost paleocoastlines along the BC mainland are less likely to have been influenced by glacial ice than more inland sites.

the QCI, facilitating faunal, floral and potential land-based human migration. Separation of 'Hecate Sea' from the open marine waters of Dixon Entrance and fresh water from melting glacial ice led to a reduction in salinity and sea-surface temperature in Hecate Sea.

Paleoenvironment and Younger Dryas

The appearance of molluscs *Serripes groenlandicus* and *Clinocardium ciliatum* signify the onset of a short interval (10,890 to 10,250 ^{14}C years BP) of cool (maximum $<9^{\circ}\text{C}$) sea-surface temperatures around the southern limits of Hecate Sea and Cook Bank (Appendix Table 1). Sea-surface cooling is supported by paleoceanographic studies (Patterson, 1993; Patterson et al., 1995) and palynological evidence (Mathewes, 1993) of the late-glacial Younger Dryas cooling event between 10,700 and 10,000 ^{14}C years BP in the QCI and southeastern Alaska (Engstrom et al., 1990). During this time, sea-surface temperatures at Goose Island Bank remained temperate, perhaps due to strong vertical tidal mixing in the presence of reduced coastal run-off and/or reduced upwelling in Goose Island Trough (R.E. Thomson, personal communication, 2002). Malacological evidence indicates temperate sea-surface conditions reappeared in Juan Perez Sound, southern Moresby Island, by 10,180 $\pm$ 40 ^{14}C years BP (Appendix Table 1) and in Cook Bank by 9,940 $\pm$ 75 ^{14}C years BP (Luternauer et al., 1989b).

Edible resources and productivity of the intertidal zone

Critical to ascertaining productive early coastal zones is the identification of edible molluscs, which potentially represent an important subsistence resource for early people.

Edible species first appear in submarine sediment cores from Hecate Strait and QC Sound at 13,210 $\pm$ 80 and 13,200 $\pm$ 150 ^{14}C years BP (Appendix Table 1; Luternauer et al., 1989a) respectively. A *Clupea harengus pallasii* (edible Pacific Herring) caudal vertebrae and a sculpin, possibly *Gymnocanthus* (Cottidae) pre-operculum spine were found overlying intertidal samples dating to 13,200 $\pm$ 150 ^{14}C years BP (Luternauer et al., 1989a). The molluscs *Macoma nasuta* and *Mytilus trossulus* were the first to recolonize after ice retreat, a function of their ability to withstand low sea-surface temperatures and high sediment influx. Edible molluscs *Saxidomus giganteus*, *Tresus nuttallii*, *Clinocardium nuttallii*, and *Simomactra falcata* appeared shortly afterward. The total edible biomass represented in samples from southern Moresby Island, Haines Creek, and Juan Perez Sound, dating between 8,020 and 11,150 ^{14}C years BP, compare favorably with commercially viable modern beaches in the QCI and southern BC, which sustain an annual average edible biomass harvest (*Saxidomus giganteus*) of between 1,085 and 5,425 g/m³ (Quayle and Bourne, 1972). A decline of edible intertidal biomass is recorded in Juan Perez Sound between 10,890 $\pm$ 50 and 10,180 $\pm$ 40 ^{14}C years BP, coincident with cooler sea-surface temperatures (Hetherington and Reid, 2002 submitted).

Early Human Dispersal Routes

Humans were prevented from navigating northern QCI and Dixon Entrance until sometime after 14,000 ^{14}C years BP due to presence of ice. Prior to this any migrators would have skirted the outer QCI, where limited evidence (Barrie and Conway, 2002) indicates lowered sea-level. Although glacial ice was present, and in places extremely

thick, ice-free conditions persisted on two coastal plains, and open ocean conditions were present from at least ~13,210 ^{14}C years BP in Hecate Strait, and 12,640 ^{14}C years BP in Dixon Entrance (Fig. 3a). Edible molluscs, quick to recolonize once sedimentation rates and sea-surface temperatures were conducive, and pelagic marine fish such as *Clupea harengus pallasii*, and potentially other edible fish and sea mammals, were available to provide subsistence resources for potential early inhabitants. Between ~11,750 and ~10,750 ^{14}C years BP, an emergent landbridge required any migrators to travel along the uplifted west coast of QCI or to portage overland (Fig. 3b). Between 10,890 ^{14}C years BP and 10,250 ^{14}C years BP, cooler sea-surface temperatures reduced edible molluscan biomass (Hetherington and Reid, 2002 submitted) in the “Hecate Sea”, potentially requiring early peoples to migrate greater distances to collect coastal resources and increase their reliance on land-based resources.

Potential Archaeological Site Locations

Numerous resource-rich coastal zones and estuaries in Hecate Strait and QC Sound have been cored and dated (Appendix Table 1), and although these would make excellent potential early archaeological site locations, they are now drowned and difficult to access. Identification of potential early coastal archaeological sites that are not drowned would aid future archaeological investigations. The intersection between paleocoastlines obtained from paleogeographic reconstruction maps (see Figs. 3a and 3b) and present-day subaerial topography gives the location of potential early archaeological sites. Figures 3c and 3d illustrate the locations of accessible paleocoastlines that persisted throughout the

period 12,750 to 10,250 ^{14}C years BP and between $\sim 14,250$ and 12,750 ^{14}C years BP, respectively. Paleocoastlines of particular archaeological interest lie along the west coast of QCI, where early migrators likely first traveled and the westernmost sites along the BC mainland, where the effects of glacial ice are reduced. Paleocoastlines that appear on both figures 3c and 3d, persisted from $\sim 14,250$ to 10,250 ^{14}C years BP, offering the greatest opportunity for long-term colonization and archaeological deposition.

References

- Archer, D.J.W., 1998, Early Holocene landscapes on the north coast of B.C.[abs]: 31st annual meeting Canadian Archaeological Association, Victoria, BC, p. 34.
- Barrie, J. V., and Conway, K.W., 2002, Rapid sea level change and coastal evolution on the Pacific margin of Canada: *Journal of Sedimentary Geology*, in press.
- Barrie, J.V., Conway, K.W., Mathewes, R.W., Josenhans, H.W., and Johns M.J., 1993, Submerged Late Quaternary terrestrial deposits and paleoenvironment of northern Hecate Strait, British Columbia continental shelf, Canada: *Quaternary International*, 20, p. 123-129.
- Clague, J.J., Harper, J.R., Hebda, R.J., and Howes D.E., 1982, Late Quaternary sea levels and crustal movements, coastal British Columbia: *Canadian Journal of Earth Sciences*, 19, p. 597-618.
- Dillehay, T.D., 1989, Monte Verde: A Late Pleistocene settlement in Chile, Volume I. Palaeoenvironment and site context: Washington, Smithsonian Institution Press, 268 p.
- Dixon, E.J., 2001, Human Colonization of the Americas: timing, technology and process: *Quaternary Science Reviews*, 20, p. 277-299.
- Dyke, A.S., 1996, Preliminary paleogeographic maps of glaciated North America: Geological Survey of Canada, Open File 3296.
- Engstrom, D.R., Hansen, B.C.S., Wright, H.E., Jr., 1990, A possible Younger Dryas record in southwestern Alaska: *Science*, 250, p. 1383-1385.
- Erlandson, J.M., 1984, Faunal analysis of the invertebrate assemblage, *in* Davis, S.D., eds., *The Hidden Falls Site, Baranof Island, Alaska*: Sitka, USDA Forest Service, p.151-179.
- Fairbanks, R.G., 1989, A 17,000-year glacio-eustatic sea level record: influence of glacial melting rates on the Younger Dryas event and deep-ocean circulation: *Nature*, 342, p. 637-642.
- Fladmark, K.R., 1979, Routes: Alternate migration corridors for early man in North America: *American Antiquity* 44, p. 55-69.

- Haynes, C.V., Jr., 1989, The earliest Americans: *Science*, 166, p. 709-715.
- Heaton, T.H., Talbot, S.L., and Shields, G.F., 1996, An ice age refugium for large mammals in The Alexander Archipelago, southeastern Alaska: *Quaternary Research* 46, p. 186-192.
- Hetherington, R., and Reid, R.G.B. Molluscan insights into the marine ecology and changing climate of the Late Pleistocene - Early Holocene northeastern Pacific: submitted to *Canadian Journal of Zoology*, 2002.
- Jackson, L.E., Jr., F.M. Phillips, K. Shimamura, and E.C. Little, 1997, Cosmogenic ^{36}Cl dating of the Foothills erratics train, Alberta, Canada: *Geology*, 25, p. 195-198.
- James, T.S., Clague, J.J., Wang, K., Hutchinson, I., 2000, Postglacial rebound at the northern Cascadia subduction zone: *Quaternary Science Review*, 19, p. 1527-1541.
- Josenhans, H.W., Fedje, D., Pienitz, R., and Southon, J., 1997, Early humans and rapidly Changing Holocene sea levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada: *Science*, 277, p. 71-74.
- Josenhans, H.W., Fedje, D.W., Conway, K.W., and Barrie, J.V., 1995, Post glacial sea levels on the western Canadian continental shelf: Evidence for rapid change, extensive subaerial exposure, and early human habitation: *Marine Geology* 125, p. 73-94.
- Lewis, T.J., Bentkowski, W.H., Wright, J.A., 1991, Thermal state of the Queen Charlotte Basin, British Columbia: warm. *in* Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia: Geological Survey of Canada Paper 90-10, p. 489-506.
- Luternauer, J.L., Clague, J.J., Conway, K.W., Barrie, J.V., Blaise, B., and Mathewes, R.W., 1989a, Late Pleistocene terrestrial deposits on the continental shelf of western Canada: Evidence for rapid sea-level change at the end of the last glaciation: *Geology*, 17, p. 357-360.
- Luternauer, J.L., Conway, K.W., Clague, J.J., and Blaise, B., 1989b, Late Quaternary geology and geochronology of the central continental shelf of western Canada: *Marine Geology*, 89, p. 57-68.
- Mandryk, C.A.S., Josenhans, H., Fedje, D.W., and Mathewes, R.W., 2001, Late Quaternary paleoenvironments of Northwestern North America: implications for

- inland versus coastal migration routes: *Quaternary Science Reviews*, 20, p. 301-314.
- Mathewes, R.W., 1993, Evidence for Younger Dryas-Age cooling on the north Pacific coast of America: *Quaternary Science Reviews*, 12, p. 321-331.
- Mathewes, R.W., 1989, Paleobotany of the Queen Charlotte Islands, *in* G.G.E. Scudder, and N. Gessler, eds., *The Outer Shores: Skidegate, British Columbia*, Queen Charlotte Islands Museum Press, p. 75-90.
- Moss, M.L., 1989, *Archaeology and Cultural Ecology of the Prehistoric Angoon Tlingit* [Ph.D. thesis]: Santa Barbara, Cal., University of California, 490 p.
- Patterson, R.T., 1993, Late Quaternary benthic foraminiferal biofacies and paleoceanography of Queen Charlotte Sound and southern Hecate Strait, British Columbia: *Journal of Foraminiferal Research* 23, p. 1-18.
- Patterson R.T., Guilbault J-P., Thomson R.E., and Luternauer, J.L., 1995, Foraminiferal evidence of Younger Dryas age cooling on the British Columbia shelf: *Géographie physique et Quaternaire*, 49, p. 409-28.
- Quayle, D.B., and Bourne, N., 1972, *The Clam Fisheries of British Columbia*: Fisheries Research Board of Canada, Bulletin 179, 70 p.
- Southon, J.R., Nelson, D.E., and Vogel, J.S., 1990, A record of past ocean-atmosphere radiocarbon differences from the northeast Pacific: *Paleoceanography*, 5, p. 197-206.
- Sweeney, J.F., and Seeman, D.A., 1991, Crustal density structure of Queen Charlotte Islands and Hecate Strait, British Columbia, *in* *Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia*: Geological Survey of Canada Paper 90-10, p. 89-96.
- West, F.H., 1981, *The Archaeology of Beringia*: New York, Columbia University Press.
- White, J.M., Mathewes, R.W., and Mathews, W.H., 1985, Late Pleistocene chronology and environment of the 'ice free corridor' of northwestern Alberta: *Quaternary Research*, 24, p. 173-186.

Appendix Table A1: Radiocarbon dates and interpretations for Queen Charlotte Island region, Canada.

LAB NUMBER	SAMPLE NUMBER	LOCATION	PRESENT ELEVATION (m)	MRC 14C Date	UNCERTAINTY (years)	REFERENCE	MATERIAL DATED	SEA-SURFACE TEMPERATURE (°C)	ENVIRONMENT OF DEPOSITION
TO-4362	E9213-57	QC Sound	-109	7820	70	1	Terrestrial organics	n/a	T
GSC-2343	626d	McNeil River	3	8780	150	2	<i>Clinocanidium nuttallii</i>	n/a	SM/I
TO-9312	RH98-04-150	Upper Arrow Creek	6	8800	70	*	<i>Protothaca staminea</i>	+4 to +14	I/fresh water influx
CAMS-18999	V94A12-93	Arrow Creek	12	8850	70	3	spruce needle	n/a	SM
CAMS-62537	RH9909-305	Haines Creek	2	8990	50	*	<i>Acmae mitra</i>	+4 to +14	SM/protected outer coast
TO-9307	E88B29-121-1	Hecate Strait	-118	9130	90	*	<i>Olivella baetica</i>	+1 to +25	I/estuary
GSC-3129	116e	Cape Ball River	5	9160	90	4	terrestrial peat	n/a	T
RIDDL-1211	MP-1	Mary Point Location B	8	9160	110	5	<i>Saxidomus giganteus</i>	+2 to +21	I/estuary
TO-9306	E88B29-74-1	Hecate Strait	-118	9200	100	*	<i>Saxidomus giganteus</i>	n/a	I/estuary
GSC-2425	548a	Kitimat River	30	9300	90	2	coniferous wood	n/a	SM/delta
CAMS10836	M934-230	Matheson Inlet	-27	9340	60	6	<i>Pododesmus machrochisma</i>	-2 to +14	I
RIDDL-1205	MP-2	Mary Point Location B	8	9450	130	5	<i>Saxidomus giganteus</i>	+2 to +21	I/estuary
TO-4889	V9427-87	Hecate Strait	-68	9480	70	*	wood	+4 to +17	I
CAMS10834	M934-207	Matheson Inlet	-27	9540	70	6	<i>Pododesmus machrochisma</i>	-2 to +14	I
TO-4890	V9427-142	Hecate Strait	-68	9660	70	*	wood	+4 to +17	I
CAMS10835	M934-219	Matheson Inlet	-27	9670	80	6	<i>Pododesmus machrochisma</i>	-2 to +14	I
GSC-2492	447a	Hirsch Creek	98	9700	160	2	wood	n/a	I
TO-1296	E88B29-91	Hecate Strait	-118	9710	70	*	<i>Olivella</i> sp.	+1 to +25	I
TO-4405	T91C15-83	Dixon Entrance	-96	9770	90	7	<i>Arthropoda cirrepedia</i>	n/a	SM/drowned spit
CAMS10837	M934-238	Matheson Inlet	-27	9800	60	6	<i>Mytilus</i> sp.	-2 to +14	I
TO-1256	E88B54-102	Goose Island Bank	-121	9800	80	7	<i>Spisula faicata</i>	+4 to +24	I
TO-174	H818-245	Goose Island Trough	-192	9830	120	8	<i>Balanus glandulus</i>	+3 to +12	I/quiet bay
TO-1337	E88B30-118	Hecate Strait	-111	9840	70	*	<i>Modiolus rectus</i>	n/a	I
TO-3737	T91C20-217	Dixon Entrance	-33	9850	70	*	unidentified marine bivalve	n/a	I
RIDDL-979	E87A23-25	Cook Bank	-94	9940	75	9	terrestrial peat	+3 to +18	I/exposed
TO-173	H816-359	Outer Goose Island Trough	-284	10000	80	8	<i>Nuculana cellulita</i>	-1 to +14	SM/subtidal
CAMS9992	M934-246	Matheson Inlet	-27	10090	80	6	<i>Mytilus</i> sp.	n/a	SM/brackish
CAMS-49628	V98-62-2	Juan Perez Sound	-55	10130	40	11	<i>Saxidomus giganteus</i>	n/a	I
CAMS-49629	V98-31-1	Juan Perez Sound	-65	10180	40	11	<i>Saxidomus giganteus</i>	+2 to +14	I
GSC-3159	116f	Cape Ball	5	10200	90	4	terrestrial peat	n/a	T
NA	E87A22-87	Cook Bank	-104	10250	80	7	unidentified marine bivalve	-1 to +6	I/cool
RIDDL-983	E87A23-54	Cook Bank	-94	10290	80	9	wood	+1 to +9	SM/heavy surf
TO-3495	E92A21-142	Hecate Strait W.	-116	10360	80	6	twig	n/a	L/brackish
NA	E87A22-121	Cook Bank	-104	10360	140	7	unidentified marine bivalve	n/a	I/estuary
NA	E87A13-172	Cook Bank	-140	10360	120	10	unidentified marine bivalve	+1 to +7	SM
TO-3735	E92A21-123	Hecate Strait W.	-116	10380	70	*	unidentified marine bivalve	-3 to +15	I
CAMS-49630	V98-40-1	Juan Perez Sound	-107	10380	50	11	<i>Saxidomus giganteus</i>	n/a	I
RIDDL-	E87A23-83	Cook Bank	-94	10400	140	9	wood	n/a	T
NA	E87A4-140	Cook Bank	-122	10430	130	10	wood	n/a	I/T
RIDDL-985	E87A23-93	Cook Bank	-94	10470	75	12	root	n/a	T
RIDDL-981	E87A23-40	Cook Bank	-94	10485	70	9	wood	+1 to +9	T/SM
NA	V94A18-481	Logan Inlet	-220	10560	70	3	branchlet	n/a	L/SM/brackish
TO-1254	E88B53-87	Goose Island Bank	-133	10630	70	7	<i>Macoma incongrua</i>	-2 to +16	I/estuary

Appendix Table A1 cont'd: Radiocarbon dates and interpretations for Queen Charlotte Island region, Canada.

LAB NUMBER	SAMPLE NUMBER	LOCATION	PRESENT ELEVATION (m)	MRC 14C Date	UNCERTAINTY (years)	REFERENCE	MATERIAL DATED	SEA-SURFACE TEMPERATURE (°C)	ENVIRONMENT OF DEPOSITION
TO-1257	E88B54-179	Goose Island Bank	-121	10640	80	7	<i>Saxidomus giganteus</i>	+4 to +24	I
RIDDL-984	E87A23-83	Cook Bank	-94	10650	350	9	wood	n/a	T
CAMS-18601	V94A11-88	Burnaby Strait	-111	10670	60	3	wood	n/a	SM/T/F
TO-1342	E88B55-142	Goose Island Bank	-124	10720	70	7	<i>Zirfaea pilsbryi</i>	-1 to +25	Low I
NA	V94A11-81	Burnaby Strait	-111	10750	60	3	<i>Mytilus</i> sp.	n/a	F/SM
CAMS-48155	V98-53-2	Juan Perez Sound	-120	10890	50	11	<i>Protothaca staminea</i>	+2 to +9	I
CAMS-33932	T95B16-127	Hecate Strait	-114	11030	60	7	wood	n/a	SM/delta
CAMS-54600	V98-21-1	Juan Perez Sound	-130	11050	50	#	<i>Saxidomus giganteus</i>	+4 to +16	I/estuary
CAMS-47674	V98-22-1	Juan Perez Sound	-128	11140	50	11	<i>Protothaca staminea</i>	+4 to +14	I/estuary
CAMS-54601	V98-27-1	Juan Perez Sound	-122	11150	50	#	<i>Protothaca tenerrima</i>	+4 to +14	I
CAMS-47675	V98-9-1	Juan Perez Sound	-125	11280	50	11	<i>Protothaca tenerrima</i>	+4 to +14	I
CAMS-33927	T95B05-31	Rennell Sound	-152	11290	60	7	wood	n/a	A/SM
CAMS-49631	V98-55-1	Juan Perez Sound	-119	11320	50	11	<i>Protothaca tenerrima</i>	+4 to +19	I
TO-1336	E88B25-75	Hecate Strait	-109	11350	70	7	<i>Clinocardium nuttalli</i>	+2 to +19	I/sheltered
CAMS-26278	T95B16-136	Hecate Strait	-114	11480	60	7	deciduous wood	n/a	SM/delta
CAMS-33928	T95B05-116	Rennell Sound	-152	11820	60	7	wood	n/a	A/SM
CAMS-33796	T95B05-244	Rennell Sound	-152	12360	60	7	<i>Cooperella</i> sp.	n/a	A/SM
TO-1255	E88B53-109	Goose Island Bank	-133	12370	90	7	worm tubes	n/a	I/estuary
CAMS-33929	T95B05-226	Rennell Sound	-152	12380	60	7	wood	n/a	A/SM
GSC-3112	116g	Cape Ball	7	12400	100	4	terrestrial peat	n/a	T
TO-9308	E88B30-73-1	Hecate Strait	-111	12520	100	*	<i>Saxidomus giganteus</i>	n/a	I/estuary
TO-9309	E88B53-150-3	Goose Island Bank	-133	12540	140	*	<i>Balanus glandulus</i>	n/a	I/estuary
Beta-114464	Archer-1	Port Simpson	50	12570	50	13	<i>Saxidomus giganteus</i>	+2 to +15	I/estuary
TO-77	H818-283	Goose Island Trough	-192	12620	80	8	<i>Macoma nasuta</i>	n/a	SM/irregularly flushed
Beta-114465	Archer-2	Port Simpson	50	12640	50	13	<i>Tresus nuttalli</i>	+2 to +15	I/estuary
TO-9305	E88B54-80-43	Goose Island Bank	-121	12710	100	*	<i>Mytilus edulis</i>	+4 to +24	I/protected
CAMS-26282	T95B12-185	Hecate Strait	-77	12890	60	14	<i>Mytilus</i> sp.	+1 to +20	I
TO-3492	T91C34-104	Dogfish Bank	-31	13190	100	15	dwarf will plant	n/a	T
GSC-3711	H818-714	Goose Island Trough	-192	13200	150	8	<i>Macoma nasuta</i>	n/a	SM/irregularly flushed
TO-1335	E88B24-149	Hecate Strait	-144	13210	80	*	<i>Macoma nasuta</i>	+1 to +15	SM/delta/high sediment influx
GSC-3222	116h	Cape Ball	8	13700	100	4	organic	n/a	T
TO-3738	T91C34-119	Dogfish Bank	-31	13790	150	15	terrestrial plant	n/a	T
TO-4888	V9423-126	Hecate Strait W.	-30	14180	110	14	<i>Cassidula reniforme</i>	n/a	SM/cold
GSC-3746	H818-271	Goose Island Trough	-192	15200	490	8	unidentified marine bivalve	+1 to +16	SM/silty

Note: MRC - marine reservoir corrected 14C years before present, T - terrestrial, SM - shallow marine, I - intertidal, F - fluvial, A - alluvial

1 GSC, unpublished data, collected by H.J. Josenhans

2 Lowden, J.A. and Blake, W., Jr., 1979, Geological Survey of Canada radiocarbon dates XIX: Geological Survey Paper, 79-7, 58 p.

3. Josenhans, H.W., Fedje, D., Pienitz, R., Southon, J., 1997, Early humans and rapidly changing Holocene sea levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada: Science, 277, p. 71-74.

Appendix Table A1 cont'd: Radiocarbon dates and interpretations for Queen Charlotte Island region, Canada.

4. Clague, J.J., Harper, J.R., Hebda, R.J., and Howes, D.E., 1982, Late Quaternary sea levels and crustal movements, coastal British Columbia: *Canadian Journal of Earth Sciences*, 19, p. 597-618.

5. Southon, J.R., Nelson, D.E., and Vogel, J.S., 1990, A record of past ocean-atmosphere radiocarbon differences from the northeast Pacific: *Paleoceanography*, 5, p. 197-206.

6. Josenhans, H.W., Fedje, D.W., Conway, K.W., and Barrie, J.V., 1995, Post glacial sea levels on the western Canadian continental shelf. Evidence for rapid change, extensive subaerial exposure, and early human habitation: *Marine Geology*, 125, p. 73-94

7. Barrie, J.V. and Conway, K.W., 2002, Rapid sea level change and coastal evolution on the Pacific margin of Canada: *Journal of Sedimentary Geology*, 150, p. 171-183.

8. Luternauer, J.L., Conway, K.W., Clague, J.J., and Blaise, B., 1989b, Late Quaternary geology and geochronology of the central continental shelf of western Canada: *Marine Geology*, 89, p. 57-68.

9. Luternauer, J.L., Clague, J.J., Conway, K.W., Barrie, J.V., Blaise, B., and Mathewes, R.W., 1989a, Late Pleistocene terrestrial deposits on the continental shelf of western Canada: Evidence for rapid sea-level change at the end of the last glaciation: *Geology*, 17, p. 357-360.

10. Barrie, J.V., Contemporary and relict titaniferous sand facies on the western Canadian continental shelf: *Continental Shelf Research*, 11, p. 67-79.

11. Fedje, D.W. and Josenhans, H.W., 2000, Drowned forests and archaeology on the continental shelf of British Columbia, Canada: *Geology*, 28, p. 99-102.

12. Barrie, J.V., Bornhold, B.D., Conway, K.W., and Luternauer, J.L., 1991, Surficial geology of the northwestern Canadian continental shelf: *Continental Shelf Research*, 11, p. 701-715.

13. Archer, D.J.W., 1998, Early Holocene landscapes on the north coast of B.C. [abs.] 31st annual meeting Canadian Archaeological Association, Victoria, BC, p. 34.

14. Barrie, J.V., and Conway, K.W., 1999, Late Quaternary glaciation and postglacial stratigraphy of the northern Pacific margin of Canada: *Quaternary Research*, 51, p. 113-123.

15. Barrie, J.V., Conway, K.W., Mathewes, R.W., Josenhans, H.W., and Johns, M.J., 1993, Submerged Late Quaternary terrestrial deposits and paleoenvironment of northern Hecate Strait, British Columbia continental shelf, Canada: *Quaternary International*, 20, p. 123-129.

* previously unpublished, Geological Survey of Canada

previously unpublished, Parks Canada

Chapter 5

CONCLUSIONS

The recognition of impending climate warming and its potential impact on sea-level has precipitated renewed interest in research focused on understanding the impact of past climate change on coastal zones. Rapid climate change, which precipitated changes in eustatic sea-level and isostatic adjustments during the Late Quaternary along Canada's north Pacific continental shelf, have made reconstruction of the paleoenvironment and paleogeography of this region complex. Speculation about early human habitation of the region during the Late Pleistocene has stimulated interest in deciphering the region's paleoenvironment and paleogeography. Speculation regarding removal of the moratorium on oil exploration in the Queen Charlotte Islands (QCI) region has revived interest in land-use issues including land-claims and the ecological, economic, and environmental impacts of resource exploitation. These problems are of a complex and interdisciplinary nature. Insights gained through modeling the Late Pleistocene and Early Holocene environment and geography of the northeast Pacific continental shelf provides information and insights useful for scientists and policy makers seeking to address climate-change, land and resource issues.

This research addresses the compelling interdisciplinary problems regarding how the coastlines along Canada's north Pacific continental shelf were impacted by rapid changes in sea-level and climate during the Late Quaternary, what effect these changes had on extent, morphology, character and molluscan productivity of the near-shore

environment, and whether or not the coastal zone was suitable for habitation by an early migrating coastal people. The main concepts, observations and conclusions are summarized below.

A principal result of paleogeographic and paleoenvironmental geo-spatial modeling is the illustration that rapid sea-level change impacted both biological and physical habitat of the Late Pleistocene - Early Holocene QCI. Thermal and refraction modeling by Sweeney and Seamann (1991) and Lewis *et al.* (1991) implies a thin (~25 km) lithosphere beneath Queen Charlotte (QC) Sound and Hecate Strait. Geo-spatial interpolation modeling of isostatic crustal uplift and depression, and relative sea-level observations support this interpretation. Uplift, too large to be accounted for by processes other than waxing and waning of ice-sheets, generated approximately 50 m of uplift in Dixon Entrance. This amount of uplift implies ice, at least 200 m thicker than present water depth, began retreating from Dixon Entrance after 14,000 ^{14}C years BP and prior to 12,640 ^{14}C years BP. Isostatic uplift is also recorded in central Hecate Strait and QC Sound, where terrestrial and intertidal biological evidence implies these areas remained subaerially exposed until as late as 9,130 ^{14}C years BP and 7,820 ^{14}C years BP respectively. Uplift combined with a lowering of eustatic sea-level resulted in the emergence of two coastal plains, one extending east of QCI beginning by at least 13,790 ^{14}C years BP, and the other extending north of Vancouver Island into QC Sound, as early as 15,200 ^{14}C years BP.

The oldest dated mollusc, *Macoma nasuta*, to colonize the QCI region at 13,210 ^{14}C years BP is a temperate species, and there is a paucity of Arctic molluscan fauna observed in samples dating to before $\sim 13,000$ ^{14}C years BP. The limited dispersion of brooding Arctic molluscs is not well understood; however, it may have been influenced by the presence of ice sheets, and the shallowing and narrowing of straits, thereby blocking the flow of migrant Arctic molluscs into the QCI region. This interpretation is supported by paleogeographic reconstructions showing a subaerially exposed coastal plain east of QCI, which extended to the BC mainland, resulting in the formation of “Hecate Sea”. Closure of Hecate Strait would have resulted in significant changes to littoral dynamics, sea-surface temperatures and coastal habitats. Grounded ice sheets that extended across the continental shelf may have further restricted the flow of ocean currents that carried pelagic Arctic molluscan migrant larvae. Molluscan evidence also implies that water temperature, sedimentation rates, turbidity, and photoperiod limited invertebrate colonization. Once habitat and sea-surface temperatures were conducive, pelagic temperate molluscs rapidly colonized the region.

The rise in temperature associated with Late Quaternary climate change was neither linear nor consistent across the region. By between 12,540 and 12,370 ^{14}C years BP, sea-surface temperatures on Goose Island Bank warmed to at least 19 °C, reaching the upper limit of present average sea-surface temperatures. Although temperatures at Goose Island Bank remained temperate throughout the time interval studied, perhaps due to strong tidal mixing in Goose Island Trough, this was not the case near Moresby Island

and at Cook Bank. By ~11,000 ^{14}C years BP, at these latter localities, the appearance of *Clinocardium ciliatum* and *Serripes groenlandicus*, whose sea-surface temperature tolerance is below 9°C, concurrent with the disappearance or significant reduction in number and productivity of temperate intertidal molluscs, indicates sea-surface temperatures rapidly cooled. These findings support the hypothesis that a Younger Dryas cooling event affected the northern Pacific. By 10,180 ^{14}C years BP near southern Moresby Island, and by 9,940 ^{14}C years BP at Cook Bank, temperate conditions resumed.

This analysis and interpretation is based on a late Pleistocene - early Holocene mollusc database that was rigorously and systematically collected during the course of this research. Five species obtained from sediments that date to and beyond 12,890 ^{14}C years BP were previously thought to have colonized the region in Recent times (after 10,000 ^{14}C years BP). They are the following: *Macoma incongrua*, *Musculus taylori* (cf), *Mytilimeria nuttallii*, *Tellina nukuloides*, *Mytilus edulis*/*Mytilus trossulus*. *Mytilus edulis* is classified as a Recent colonizer, whereas *Mytilus trossulus* colonized in the Miocene. It is not possible to detect the difference between the two without microscopic analysis; thus it is incumbent on future researchers to determine the taxonomic classification of these early *Mytilus* sp.

Molluscan biomass interpretations provide insights into the physical and biological impacts of climate change on molluscan productivity and whether or not the coastal zone provided a suitable habitat for early migrating coastal peoples. Fossil

molluscan shells indicate edible intertidal biomass densities well within commercially harvested levels on southern Moresby Island by 8,800 ^{14}C years BP, and on northern Graham Island by 8,990 ^{14}C years BP. Edible molluscs, quick to recolonize once sedimentation rates and sea-surface temperatures were conducive, and pelagic marine fish such as *Clupea harengus pallasii*, and potentially other edible fish and sea mammals, were available to provide subsistence resources for potential early inhabitants subsequent to at least 13,210 ^{14}C years BP.

Paleoreconstructions indicate that early coastal migrators were likely impeded from navigating northern QCI and Dixon Entrance until sometime after 14,000 ^{14}C years BP, due to the presence of ice. Prior to this time, any early coastal migrators would have skirted the west coast of QCI. Archaeological evidence of early coastal migrators would most likely be found along productive, unglaciated paleocoastlines. However, many identified early productive coastlines are currently under water, severely limiting the opportunity for archaeological excavation. Nevertheless, paleogeographic reconstructions show the intersection between paleocoastlines obtained from paleogeographic reconstruction maps and present-day subaerial topography. This intersection estimates the location of potential and accessible early (prior to 10,000 ^{14}C years BP) coastal archaeological sites. Paleocoastlines of particular archaeological interest lie along the west coast of QCI, where early migrators likely first traveled, and along the westernmost BC mainland, where the effects of glacial ice were reduced.

FUTURE RESEARCH

The speculations and findings made by this research lead naturally to questions that may concern future research on paleoenvironmental and paleogeographic reconstructions. Reconstructions reflect advancements in understanding within the constraints of currently available research methods and data. Relative sea-level observations are especially limited on the BC mainland, particularly in the southern area. Advancements in geo-spatial interpolation has permitted four-dimensional modeling; however models are limited by the paucity of relative sea-level observations and by modeling assumptions. The spline-tension interpolation method requires that the modeled surface pass through sample points; thus the veracity of the model is limited by how well the spatial parameters of the sample data are constrained. Although methods from geography, geology and malacology were used to constrain these interpretations, they remain estimates. As more data becomes available it is hoped they can be “plugged into” the existing model to provide improved accuracy. However, it is anticipated that future relative sea-level data collection will progress slowly due to the cost associated with collection and the limitations imposed by preservation.

Research methods did not incorporate tectonic faulting that may have occurred subsequent to the time of sample deposition, or the impact of a rapidly plunging continental shelf off the west-coast of Moresby Island. The edge of the shelf may have behaved in a “hinge-like” manner to rapid loading and unloading of the shelf. Limited data is available from the shelf edge, however it is hoped that future evidence obtained from sea mounts west of the QCI can provide additional insights.

Submarine sediment coring in Juan Perez Sound may provide sedimentological evidence to assist in resolving the contradiction involving the presence of marine molluscs in an area that models as an enclosed paleolake. Future coring, deeper into the sediments beneath Hecate Strait, QC Sound, and Cook Bank may provide evidence of sea-level regression, and with it new insights into the environment and sea-level record prior to 13,500 ^{14}C years BP.

Future reconstructions should further address the impact of postglacial erosion and sedimentation on bathymetry and topography. Complementing this research with high-precision sea-floor mapping and seismic surveying will hopefully reveal more about the bottom of the basin and sediment transport trends that may help constrain future reconstructions.

Hetherington, R.

Appendix A: Southern Moresby Island (RH98) raised beach sample data

Sample #	Sample Group	Species name	Shell weight (grams)	Number of shells
RH98-03-1	RH98-03	<i>Saxidomus giganteus</i>	8.2	-1
RH98-03-2	RH98-03	<i>Saxidomus giganteus</i>	0.7	1
RH98-03-3	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-4	RH98-03	<i>Saxidomus giganteus</i>	0.5	1
RH98-03-5	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-6	RH98-03	<i>Saxidomus giganteus</i>	0.5	1
RH98-03-7	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-8	RH98-03	<i>Saxidomus giganteus</i>	0.8	-1
RH98-03-9	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-10	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-11	RH98-03	<i>Saxidomus giganteus</i>	5.7	-1
RH98-03-12	RH98-03	<i>Saxidomus giganteus</i>	13.1	-1
RH98-03-13	RH98-03	<i>Saxidomus giganteus</i>	1	1
RH98-03-14	RH98-03	<i>Saxidomus giganteus</i>	4.8	-1
RH98-03-15	RH98-03	<i>Saxidomus giganteus</i>	4.7	-1
RH98-03-16	RH98-03	<i>Saxidomus giganteus</i>	2	-1
RH98-03-17	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-18	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-19	RH98-03	<i>Saxidomus giganteus</i>	0.4	1
RH98-03-20	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-21	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-22	RH98-03	<i>Saxidomus giganteus</i>	2.1	-1
RH98-03-23	RH98-03	<i>Saxidomus giganteus</i>	1.2	-1
RH98-03-24	RH98-03	<i>Saxidomus giganteus</i>	1.1	-1
RH98-03-25	RH98-03	<i>Saxidomus giganteus</i>	0.4	-1
RH98-03-26	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-27	RH98-03	<i>Saxidomus giganteus</i>	0.6	-1
RH98-03-28	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-29	RH98-03	<i>Saxidomus giganteus</i>	0.1	-1
RH98-03-30	RH98-03	<i>Saxidomus giganteus</i>	0.7	-1
RH98-03-31	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-32	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-33	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-34	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-35	RH98-03	<i>Saxidomus giganteus</i>	0.4	-1
RH98-03-36	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-37	RH98-03	<i>Saxidomus giganteus</i>	0.4	-1
RH98-03-38	RH98-03	<i>Saxidomus giganteus</i>	2.2	1
RH98-03-39	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-40	RH98-03	<i>Saxidomus giganteus</i>	0.1	1
RH98-03-41	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-42	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-43	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-44	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-45	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-46	RH98-03	<i>Saxidomus giganteus</i>	3.8	-1
RH98-03-47	RH98-03	<i>Saxidomus giganteus</i>	0.7	-1
RH98-03-48	RH98-03	<i>Saxidomus giganteus</i>	1	-1
RH98-03-49	RH98-03	<i>Saxidomus giganteus</i>	0.7	-1
RH98-03-50	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-51	RH98-03	<i>Saxidomus giganteus</i>	0.8	-1
RH98-03-52	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-53	RH98-03	<i>Saxidomus giganteus</i>	0.9	-1
RH98-03-54	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-55	RH98-03	<i>Saxidomus giganteus</i>	1.9	1
RH98-03-56	RH98-03	<i>Saxidomus giganteus</i>	22.5	21 frag's
RH98-03-57	RH98-03	<i>Saxidomus giganteus</i>	0.7	-1
RH98-03-58	RH98-03	<i>Saxidomus giganteus</i>	0.6	-1

RH98-03-59	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-60	RH98-03	<i>Saxidomus giganteus</i>	64.4	41 frag's
RH98-03-61	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-62	RH98-03	<i>Saxidomus giganteus</i>	21.2	-1
RH98-03-63	RH98-03	<i>Saxidomus giganteus</i>	8.2	1
RH98-03-64	RH98-03	<i>Saxidomus giganteus</i>	13.3	1
RH98-03-65	RH98-03	<i>Saxidomus giganteus</i>	14.1	1
RH98-03-66	RH98-03	<i>Saxidomus giganteus</i>	4.4	-1
RH98-03-67	RH98-03	<i>Saxidomus giganteus</i>	14.3	-1
RH98-03-68	RH98-03	<i>Saxidomus giganteus</i>	21.7	1
RH98-03-69	RH98-03	<i>Saxidomus giganteus</i>	24.8	-1
RH98-03-70	RH98-03	<i>Saxidomus giganteus</i>	5.8	-1
RH98-03-71	RH98-03	<i>Saxidomus giganteus</i>	1.5	-1
RH98-03-72	RH98-03	<i>Saxidomus giganteus</i>	9.6	-1
RH98-03-73	RH98-03	<i>Saxidomus giganteus</i>	1	-1
RH98-03-74	RH98-03	<i>Saxidomus giganteus</i>	0.8	-1
RH98-03-75	RH98-03	<i>Saxidomus giganteus</i>	0.1	-1
RH98-03-76	RH98-03	<i>Saxidomus giganteus</i>	0.4	1
RH98-03-77	RH98-03	<i>Saxidomus giganteus</i>	2.7	-1
RH98-03-78	RH98-03	<i>Saxidomus giganteus</i>	3.1	-1
RH98-03-79	RH98-03	<i>Saxidomus giganteus</i>	2	-1
RH98-03-80	RH98-03	<i>Saxidomus giganteus</i>	5.1	1
RH98-03-81	RH98-03	<i>Saxidomus giganteus</i>	1.1	-1
RH98-03-82	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-83	RH98-03	<i>Saxidomus giganteus</i>	0.3	1
RH98-03-84	RH98-03	<i>Saxidomus giganteus</i>	0.6	-1
RH98-03-85	RH98-03	<i>Saxidomus giganteus</i>	2.5	1
RH98-03-86	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-87	RH98-03	<i>Saxidomus giganteus</i>	0.7	-1
RH98-03-88	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-89	RH98-03	<i>Saxidomus giganteus</i>	0.1	-1
RH98-03-90	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-91	RH98-03	<i>Saxidomus giganteus</i>	0.4	-1
RH98-03-92	RH98-03	<i>Saxidomus giganteus</i>	2.7	-1
RH98-03-93	RH98-03	<i>Saxidomus giganteus</i>	0.7	-1
RH98-03-94	RH98-03	<i>Saxidomus giganteus</i>	1.1	-1
RH98-03-95	RH98-03	<i>Saxidomus giganteus</i>	0.9	-1
RH98-03-96	RH98-03	<i>Saxidomus giganteus</i>	1.2	-1
RH98-03-97	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-98	RH98-03	<i>Saxidomus giganteus</i>	0.4	-1
RH98-03-99	RH98-03	<i>Saxidomus giganteus</i>	0.6	-1
RH98-03-100	RH98-03	<i>Saxidomus giganteus</i>	4.7	1
RH98-03-101	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-102	RH98-03	<i>Saxidomus giganteus</i>	0.1	1
RH98-03-103	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-104	RH98-03	<i>Saxidomus giganteus</i>	1.5	-1
RH98-03-105	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-106	RH98-03	<i>Saxidomus giganteus</i>	2.7	-1
RH98-03-107	RH98-03	<i>Saxidomus giganteus</i>	7.3	-1
RH98-03-108	RH98-03	<i>Saxidomus giganteus</i>	1.1	-1
RH98-03-109	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-110	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-111	RH98-03	<i>Saxidomus giganteus</i>	1.1	-1
RH98-03-112	RH98-03	<i>Saxidomus giganteus</i>	0.6	-1
RH98-03-113	RH98-03	<i>Saxidomus giganteus</i>	0.8	-1
RH98-03-114	RH98-03	<i>Saxidomus giganteus</i>	2.1	-1
RH98-03-115	RH98-03	<i>Saxidomus giganteus</i>	0.4	-1
RH98-03-116	RH98-03	<i>Saxidomus giganteus</i>	0.3	-1
RH98-03-117	RH98-03	<i>Saxidomus giganteus</i>	151.5	75 frag's
RH98-03-118	RH98-03	<i>Saxidomus giganteus</i>	17.7	1
RH98-03-119	RH98-03	<i>Saxidomus giganteus</i>	0.3	1
RH98-03-120	RH98-03	<i>Saxidomus giganteus</i>	3.4	-1
RH98-03-121	RH98-03	<i>Saxidomus giganteus</i>	3	-1
RH98-03-122	RH98-03	<i>Saxidomus giganteus</i>	18.7	1

RH98-03-123	RH98-03	<i>Saxidomus giganteus</i>	14.5	1
RH98-03-124	RH98-03	<i>Saxidomus giganteus</i>	5.8	-1
RH98-03-125	RH98-03	<i>Saxidomus giganteus</i>	8.3	-1
RH98-03-126	RH98-03	<i>Saxidomus giganteus</i>	2.6	-1
RH98-03-127	RH98-03	<i>Saxidomus giganteus</i>	4.4	-1
RH98-03-128	RH98-03	<i>Saxidomus giganteus</i>	9.8	-1
RH98-03-129	RH98-03	<i>Saxidomus giganteus</i>	5.1	-1
RH98-03-130	RH98-03	<i>Saxidomus giganteus</i>	1.7	-1
RH98-03-131	RH98-03	<i>Saxidomus giganteus</i>	4.7	-1
RH98-03-132	RH98-03	<i>Saxidomus giganteus</i>	2.4	-1
RH98-03-133	RH98-03	<i>Saxidomus giganteus</i>	0.8	-1
RH98-03-134	RH98-03	<i>Saxidomus giganteus</i>	0.2	-1
RH98-03-135	RH98-03	<i>Saxidomus giganteus</i>	1.2	-1
RH98-03-136	RH98-03	<i>Saxidomus giganteus</i>	0.9	-1
RH98-03-137	RH98-03	<i>Saxidomus giganteus</i>	1	-1
RH98-03-138	RH98-03	<i>Saxidomus giganteus</i>	0.9	-1
RH98-03-139	RH98-03	<i>Saxidomus giganteus</i>	5.4	-1
RH98-03-140	RH98-03	<i>Saxidomus giganteus</i>	6.4	-1
RH98-03-141	RH98-03	<i>Saxidomus giganteus</i>	9.2	-1
RH98-03-142	RH98-03	<i>Saxidomus giganteus</i>	0.2	1
RH98-03-143	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-144	RH98-03	<i>Saxidomus giganteus</i>	0.6	-1
RH98-03-145	RH98-03	<i>Saxidomus giganteus</i>	1.1	-1
RH98-03-146	RH98-03	<i>Saxidomus giganteus</i>	0.7	-1
RH98-03-147	RH98-03	<i>Saxidomus giganteus</i>	116.1	32 frag's
RH98-03-148	RH98-03	<i>Saxidomus giganteus</i>	1.3	-1
RH98-03-149	RH98-03	<i>Saxidomus giganteus</i>	1	-1
RH98-03-150	RH98-03	<i>Saxidomus giganteus</i>	0.5	-1
RH98-03-151	RH98-03	<i>Saxidomus giganteus</i>	3.6	1 frag
RH98-03-152	RH98-03	<i>Protothaca staminea</i>	0.4	1
RH98-03-153	RH98-03	<i>Protothaca staminea</i>	1.9	-1
RH98-03-154	RH98-03	<i>Protothaca staminea</i>	0.8	-1
RH98-03-155	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-156	RH98-03	<i>Protothaca staminea</i>	0.5	1
RH98-03-157	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-158	RH98-03	<i>Protothaca staminea</i>	2.3	-1
RH98-03-159	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-160	RH98-03	<i>Protothaca staminea</i>	1.4	-1
RH98-03-161	RH98-03	<i>Protothaca staminea</i>	0.3	1
RH98-03-162	RH98-03	<i>Protothaca staminea</i>	0.3	1
RH98-03-163	RH98-03	<i>Protothaca staminea</i>	0.2	-1
RH98-03-164	RH98-03	<i>Protothaca staminea</i>	0.6	-1
RH98-03-165	RH98-03	<i>Protothaca staminea</i>	2.1	1
RH98-03-166	RH98-03	<i>Protothaca staminea</i>	0.7	-1
RH98-03-167	RH98-03	<i>Protothaca staminea</i>	0.1	-1
RH98-03-168	RH98-03	<i>Protothaca staminea</i>	1.4	-1
RH98-03-169	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-170	RH98-03	<i>Protothaca staminea</i>	0.8	-1
RH98-03-171	RH98-03	<i>Protothaca staminea</i>	0.2	1
RH98-03-172	RH98-03	<i>Protothaca staminea</i>	1.4	-1
RH98-03-173	RH98-03	<i>Protothaca staminea</i>	36.1	36 frag's
RH98-03-174	RH98-03	<i>Protothaca staminea</i>	2.9	-1
RH98-03-175	RH98-03	<i>Protothaca staminea</i>	0.6	1
RH98-03-176	RH98-03	<i>Protothaca staminea</i>	1.5	-1
RH98-03-177	RH98-03	<i>Protothaca staminea</i>	1.6	1
RH98-03-178	RH98-03	<i>Protothaca staminea</i>	1.1	1
RH98-03-179	RH98-03	<i>Protothaca staminea</i>	0.2	1
RH98-03-180	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-181	RH98-03	<i>Protothaca staminea</i>	0.3	1
RH98-03-182	RH98-03	<i>Protothaca staminea</i>	0.7	-1
RH98-03-183	RH98-03	<i>Protothaca staminea</i>	0.4	1
RH98-03-184	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-185	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-186	RH98-03	<i>Protothaca staminea</i>	0.5	-1

RH98-03-187	RH98-03	<i>Protothaca staminea</i>	0.1	1
RH98-03-188	RH98-03	<i>Protothaca staminea</i>	0.8	-1
RH98-03-189	RH98-03	<i>Protothaca staminea</i>	0.7	-1
RH98-03-190	RH98-03	<i>Protothaca staminea</i>	1.1	-1
RH98-03-191	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-192	RH98-03	<i>Protothaca staminea</i>	0.6	-1
RH98-03-193	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-194	RH98-03	<i>Protothaca staminea</i>	0.5	-1
RH98-03-195	RH98-03	<i>Protothaca staminea</i>	1.1	-1
RH98-03-196	RH98-03	<i>Protothaca staminea</i>	0.5	-1
RH98-03-197	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-198	RH98-03	<i>Protothaca staminea</i>	0.8	-1
RH98-03-199	RH98-03	<i>Protothaca staminea</i>	0.9	-1
RH98-03-200	RH98-03	<i>Protothaca staminea</i>	0.2	-1
RH98-03-201	RH98-03	<i>Protothaca staminea</i>	2.9	-1
RH98-03-202	RH98-03	<i>Protothaca staminea</i>	1.1	-1
RH98-03-203	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-204	RH98-03	<i>Protothaca staminea</i>	0.5	-1
RH98-03-205	RH98-03	<i>Protothaca staminea</i>	0.6	-1
RH98-03-206	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-207	RH98-03	<i>Protothaca staminea</i>	2.5	1
RH98-03-208	RH98-03	<i>Protothaca staminea</i>	0.1	1
RH98-03-209	RH98-03	<i>Protothaca staminea</i>	0.1	1
RH98-03-210	RH98-03	<i>Protothaca staminea</i>	0.1	-1
RH98-03-211	RH98-03	<i>Protothaca staminea</i>	0.1	-1
RH98-03-212	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-213	RH98-03	<i>Protothaca staminea</i>	91.9	123 frag's
RH98-03-214	RH98-03	<i>Protothaca staminea</i>	2	-1
RH98-03-215	RH98-03	<i>Protothaca staminea</i>	1.1	1
RH98-03-216	RH98-03	<i>Protothaca staminea</i>	0.8	1
RH98-03-217	RH98-03	<i>Protothaca staminea</i>	0.6	1
RH98-03-218	RH98-03	<i>Protothaca staminea</i>	0.9	1
RH98-03-219	RH98-03	<i>Protothaca staminea</i>	0.5	1
RH98-03-220	RH98-03	<i>Protothaca staminea</i>	8.5	-1
RH98-03-221	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-222	RH98-03	<i>Protothaca staminea</i>	2.3	-1
RH98-03-223	RH98-03	<i>Protothaca staminea</i>	4.5	-1
RH98-03-224	RH98-03	<i>Protothaca staminea</i>	2.4	-1
RH98-03-225	RH98-03	<i>Protothaca staminea</i>	3.3	-1
RH98-03-226	RH98-03	<i>Protothaca staminea</i>	2.3	-1
RH98-03-227	RH98-03	<i>Protothaca staminea</i>	0.8	-1
RH98-03-228	RH98-03	<i>Protothaca staminea</i>	0.9	-1
RH98-03-229	RH98-03	<i>Protothaca staminea</i>	0.5	-1
RH98-03-230	RH98-03	<i>Protothaca staminea</i>	0.6	-1
RH98-03-231	RH98-03	<i>Protothaca staminea</i>	3.2	-1
RH98-03-232	RH98-03	<i>Protothaca staminea</i>	1.5	-1
RH98-03-233	RH98-03	<i>Protothaca staminea</i>	1.1	-1
RH98-03-234	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-235	RH98-03	<i>Protothaca staminea</i>	0.2	-1
RH98-03-236	RH98-03	<i>Protothaca staminea</i>	17.3	-1
RH98-03-237	RH98-03	<i>Protothaca staminea</i>	19	1
RH98-03-238	RH98-03	<i>Protothaca staminea</i>	14.7	1
RH98-03-239	RH98-03	<i>Protothaca staminea</i>	13.8	1
RH98-03-240	RH98-03	<i>Protothaca staminea</i>	1.1	1
RH98-03-241	RH98-03	<i>Protothaca staminea</i>	0.5	-1
RH98-03-242	RH98-03	<i>Protothaca staminea</i>	1.2	-1
RH98-03-243	RH98-03	<i>Protothaca staminea</i>	8.3	-1
RH98-03-244	RH98-03	<i>Protothaca staminea</i>	0.4	1
RH98-03-245	RH98-03	<i>Protothaca staminea</i>	0.8	-1
RH98-03-246	RH98-03	<i>Protothaca staminea</i>	0.2	1
RH98-03-247	RH98-03	<i>Protothaca staminea</i>	0.1	1
RH98-03-248	RH98-03	<i>Protothaca staminea</i>	0.2	-1
RH98-03-249	RH98-03	<i>Protothaca staminea</i>	2	1
RH98-03-250	RH98-03	<i>Protothaca staminea</i>	2.1	-1

RH98-03-251	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-252	RH98-03	<i>Protothaca staminea</i>	1.6	-1
RH98-03-253	RH98-03	<i>Protothaca staminea</i>	0.2	1
RH98-03-254	RH98-03	<i>Protothaca staminea</i>	0.5	-1
RH98-03-255	RH98-03	<i>Protothaca staminea</i>	0.5	1
RH98-03-256	RH98-03	<i>Protothaca staminea</i>	3.2	-1
RH98-03-257	RH98-03	<i>Protothaca staminea</i>	0.5	1
RH98-03-258	RH98-03	<i>Protothaca staminea</i>	1.2	-1
RH98-03-259	RH98-03	<i>Protothaca staminea</i>	0.3	1
RH98-03-260	RH98-03	<i>Protothaca staminea</i>	1.1	-1
RH98-03-261	RH98-03	<i>Protothaca staminea</i>	0.5	-1
RH98-03-262	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-263	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-264	RH98-03	<i>Protothaca staminea</i>	0.7	-1
RH98-03-265	RH98-03	<i>Protothaca staminea</i>	0.6	-1
RH98-03-266	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-267	RH98-03	<i>Protothaca staminea</i>	121.5	109 frag's
RH98-03-268	RH98-03	<i>Protothaca staminea</i>	15.2	1
RH98-03-269	RH98-03	<i>Protothaca staminea</i>	13.9	1
RH98-03-270	RH98-03	<i>Protothaca staminea</i>	12.3	1
RH98-03-271	RH98-03	<i>Protothaca staminea</i>	13.3	1
RH98-03-272	RH98-03	<i>Protothaca staminea</i>	7.7	1
RH98-03-273	RH98-03	<i>Protothaca staminea</i>	14.2	1
RH98-03-274	RH98-03	<i>Protothaca staminea</i>	5.7	-1
RH98-03-275	RH98-03	<i>Protothaca staminea</i>	0.5	1
RH98-03-276	RH98-03	<i>Protothaca staminea</i>	2	-1
RH98-03-277	RH98-03	<i>Protothaca staminea</i>	10	-1
RH98-03-278	RH98-03	<i>Protothaca staminea</i>	5	-1
RH98-03-279	RH98-03	<i>Protothaca staminea</i>	0.6	-1
RH98-03-280	RH98-03	<i>Protothaca staminea</i>	0.9	-1
RH98-03-281	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-282	RH98-03	<i>Protothaca staminea</i>	0.7	-1
RH98-03-283	RH98-03	<i>Protothaca staminea</i>	0.4	-1
RH98-03-284	RH98-03	<i>Protothaca staminea</i>	3.6	1
RH98-03-285	RH98-03	<i>Protothaca staminea</i>	0.9	-1
RH98-03-286	RH98-03	<i>Protothaca staminea</i>	0.7	-1
RH98-03-287	RH98-03	<i>Protothaca staminea</i>	2.6	-1
RH98-03-288	RH98-03	<i>Protothaca staminea</i>	0.3	-1
RH98-03-289	RH98-03	<i>Protothaca staminea</i>	32.3	1
RH98-03-290	RH98-03	<i>Protothaca staminea</i>	13.9	1
RH98-03-291	RH98-03	<i>Protothaca staminea</i>	22.8	1
RH98-03-292	RH98-03	<i>Protothaca staminea</i>	20.7	1
RH98-03-293	RH98-03	<i>Protothaca staminea</i>	22	1
RH98-03-294	RH98-03	<i>Protothaca staminea</i>	32.9	1
RH98-03-295	RH98-03	<i>Protothaca staminea</i>	22.5	1
RH98-03-296	RH98-03	<i>Protothaca staminea</i>	8.5	-1
RH98-03-297	RH98-03	<i>Protothaca staminea</i>	0.6	-1
RH98-03-298	RH98-03	<i>Protothaca staminea</i>	0.8	1
RH98-03-299	RH98-03	<i>Protothaca staminea</i>	0.8	-1
RH98-03-300	RH98-03	<i>Protothaca staminea</i>	87.1	71 frag's
RH98-03-301	RH98-03	<i>Macoma incongrua</i>	1.5	1
RH98-03-302	RH98-03	<i>Macoma incongrua</i>	0.9	1
RH98-03-303	RH98-03	<i>Macoma incongrua</i>	1.5	1
RH98-03-304	RH98-03	<i>Macoma incongrua</i>	0.3	1
RH98-03-305	RH98-03	<i>Macoma incongrua</i>	0.4	-1
RH98-03-306	RH98-03	<i>Macoma incongrua</i>	1.5	-1
RH98-03-307	RH98-03	<i>Macoma incongrua</i>	1.6	1
RH98-03-308	RH98-03	<i>Macoma incongrua</i>	0.6	1
RH98-03-309	RH98-03	<i>Macoma incongrua</i>	1.2	1
RH98-03-310	RH98-03	<i>Macoma incongrua</i>	0.6	1
RH98-03-311	RH98-03	<i>Macoma incongrua</i>	1.3	1
RH98-03-312	RH98-03	<i>Macoma incongrua</i>	0.8	1
RH98-03-313	RH98-03	<i>Macoma incongrua</i>	0.5	-1
RH98-03-314	RH98-03	<i>Macoma nasuta</i>	10.8	1

RH98-03-315	RH98-03	<i>Macoma nasuta</i>	6	-1
RH98-03-316	RH98-03	<i>Macoma inquinata</i>	3.3	1
RH98-03-317	RH98-03	<i>Macoma inquinata</i>	2.8	1
RH98-03-318	RH98-03	<i>Macoma inquinata</i>	0.9	1
RH98-03-319	RH98-03	<i>Macoma inquinata</i>	1.8	1
RH98-03-320	RH98-03	<i>Macoma inquinata</i>	0.5	1
RH98-03-321	RH98-03	<i>Macoma inquinata</i>	1.3	-1
RH98-03-322	RH98-03	<i>Macoma inquinata</i>	1.1	1
RH98-03-323	RH98-03	<i>Macoma inquinata</i>	2.3	-1
RH98-03-324	RH98-03	<i>Macoma inquinata</i>	3.3	1
RH98-03-325	RH98-03	<i>Macoma inquinata</i>	1.7	1
RH98-03-326	RH98-03	<i>Macoma inquinata</i>	0.4	1
RH98-03-327	RH98-03	<i>Macoma inquinata</i>	0.4	1
RH98-03-328	RH98-03	<i>Macoma inquinata</i>	0.5	-1
RH98-03-329	RH98-03	<i>Macoma inquinata</i>	2	1
RH98-03-330	RH98-03	<i>Macoma inquinata</i>	1	1
RH98-03-331	RH98-03	<i>Macoma inquinata</i>	1.2	-1
RH98-03-332	RH98-03	<i>Macoma inquinata</i>	0.5	-1
RH98-03-333	RH98-03	<i>Macoma inquinata</i>	0.2	1
RH98-03-334	RH98-03	<i>Macoma inquinata</i>	1.4	1
RH98-03-335	RH98-03	<i>Macoma inquinata</i>	7.2	1
RH98-03-336	RH98-03	<i>Macoma inquinata</i>	5.3	1
RH98-03-337	RH98-03	<i>Macoma inquinata</i>	5.5	1
RH98-03-338	RH98-03	<i>Macoma inquinata</i>	3.1	-1
RH98-03-339	RH98-03	<i>Macoma inquinata</i>	4.7	1
RH98-03-340	RH98-03	<i>Macoma inquinata</i>	3.5	-1
RH98-03-341	RH98-03	<i>Macoma inquinata</i>	1.4	-1
RH98-03-342	RH98-03	<i>Macoma inquinata</i>	1.7	-1
RH98-03-343	RH98-03	<i>Macoma inquinata</i>	0.7	1
RH98-03-344	RH98-03	<i>Macoma inquinata</i>	0.3	1
RH98-03-345	RH98-03	<i>Macoma inquinata</i>	0.2	1
RH98-03-346	RH98-03	<i>Macoma inquinata</i>	0.3	1
RH98-03-347	RH98-03	<i>Macoma inquinata</i>	4.7	1
RH98-03-348	RH98-03	<i>Macoma inquinata</i>	3.2	1
RH98-03-349	RH98-03	<i>Macoma inquinata</i>	0.6	-1
RH98-03-350	RH98-03	<i>Macoma inquinata</i>	3	2 frag's
RH98-03-351	RH98-03	<i>Macoma inquinata</i>	4	1
RH98-03-352	RH98-03	<i>Macoma inquinata</i>	2.7	-1
RH98-03-353	RH98-03	<i>Macoma inquinata</i>	1.7	1
RH98-03-354	RH98-03	<i>Macoma inquinata</i>	1.2	1
RH98-03-355	RH98-03	<i>Macoma inquinata</i>	3.2	1
RH98-03-356	RH98-03	<i>Macoma inquinata</i>	1.1	1
RH98-03-357	RH98-03	<i>Macoma inquinata</i>	1.7	1
RH98-03-358	RH98-03	<i>Macoma inquinata</i>	1	1
RH98-03-359	RH98-03	<i>Macoma inquinata</i>	0.6	1
RH98-03-360	RH98-03	<i>Macoma inquinata</i>	0.2	1
RH98-03-361	RH98-03	<i>Macoma inquinata</i>	3.6	-1
RH98-03-362	RH98-03	<i>Macoma inquinata</i>	0.3	1
RH98-03-363	RH98-03	<i>Protothaca tenerrima</i>	2.6	4 frag's
RH98-03-364	RH98-03	<i>Protothaca tenerrima</i>	7.4	1
RH98-03-365	RH98-03	<i>Protothaca tenerrima</i>	4.2	-1
RH98-03-366	RH98-03	<i>Protothaca tenerrima</i>	4	6 frag's
RH98-03-367	RH98-03	<i>Protothaca tenerrima</i>	0.8	1
RH98-03-368	RH98-03	<i>Protothaca tenerrima</i>	1.9	-1
RH98-03-369	RH98-03	<i>Protothaca tenerrima</i>	6.1	7 frag's
RH98-03-370	RH98-03	<i>Protothaca tenerrima</i>	2.6	1
RH98-03-371	RH98-03	<i>Protothaca tenerrima</i>	3.5	-1
RH98-03-372	RH98-03	<i>Protothaca tenerrima</i>	7.2	1
RH98-03-373	RH98-03	<i>Protothaca tenerrima</i>	3.9	1
RH98-03-374	RH98-03	<i>Protothaca tenerrima</i>	1	1
RH98-03-375	RH98-03	<i>Protothaca tenerrima</i>	1.2	1
RH98-03-376	RH98-03	<i>Protothaca tenerrima</i>	3.2	4 frag's
RH98-03-377	RH98-03	<i>Pododesmus machrochisma</i>	1.7	1
RH98-03-378	RH98-03	<i>Pododesmus machrochisma</i>	0.7	1

RH98-03-379	RH98-03	<i>Pododesmus machrochisma</i>	0.3	1
RH98-03-380	RH98-03	<i>Pododesmus machrochisma</i>	1.7	-1
RH98-03-381	RH98-03	<i>Pododesmus machrochisma</i>	0.1	1
RH98-03-382	RH98-03	<i>Pododesmus machrochisma</i>	7.4	8 frag's
RH98-03-383	RH98-03	<i>Pododesmus machrochisma</i>	0.8	1
RH98-03-384	RH98-03	<i>Pododesmus machrochisma</i>	4.1	1
RH98-03-385	RH98-03	<i>Pododesmus machrochisma</i>	0.5	1
RH98-03-386	RH98-03	<i>Pododesmus machrochisma</i>	2.7	1
RH98-03-387	RH98-03	<i>Pododesmus machrochisma</i>	2.8	-1
RH98-03-388	RH98-03	<i>Pododesmus machrochisma</i>	3.6	-1
RH98-03-389	RH98-03	<i>Pododesmus machrochisma</i>	0.7	1
RH98-03-390	RH98-03	<i>Pododesmus machrochisma</i>	0.4	1
RH98-03-391	RH98-03	<i>Pododesmus machrochisma</i>	1.1	1
RH98-03-392	RH98-03	<i>Pododesmus machrochisma</i>	0.1	1
RH98-03-393	RH98-03	<i>Pododesmus machrochisma</i>	1.3	1
RH98-03-394	RH98-03	<i>Pododesmus machrochisma</i>	0.3	1
RH98-03-395	RH98-03	<i>Pododesmus machrochisma</i>	1.6	1
RH98-03-396	RH98-03	<i>Pododesmus machrochisma</i>	0.9	1
RH98-03-397	RH98-03	<i>Pododesmus machrochisma</i>	0.4	1
RH98-03-398	RH98-03	<i>Pododesmus machrochisma</i>	0.2	1
RH98-03-399	RH98-03	<i>Pododesmus machrochisma</i>	18.9	32 frag's
RH98-03-400	RH98-03	<i>Pododesmus machrochisma</i>	2	1
RH98-03-401	RH98-03	<i>Pododesmus machrochisma</i>	6.8	1
RH98-03-402	RH98-03	<i>Pododesmus machrochisma</i>	6.1	1
RH98-03-403	RH98-03	<i>Pododesmus machrochisma</i>	2.6	1
RH98-03-404	RH98-03	<i>Pododesmus machrochisma</i>	1.3	1
RH98-03-405	RH98-03	<i>Pododesmus machrochisma</i>	0.6	1
RH98-03-406	RH98-03	<i>Pododesmus machrochisma</i>	4.8	-1
RH98-03-407	RH98-03	<i>Pododesmus machrochisma</i>	10.9	1
RH98-03-408	RH98-03	<i>Pododesmus machrochisma</i>	9.9	1
RH98-03-409	RH98-03	<i>Pododesmus machrochisma</i>	1.6	1
RH98-03-410	RH98-03	<i>Pododesmus machrochisma</i>	4.7	1
RH98-03-411	RH98-03	<i>Pododesmus machrochisma</i>	3.2	-1
RH98-03-412	RH98-03	<i>Pododesmus machrochisma</i>	1.7	-1
RH98-03-413	RH98-03	<i>Pododesmus machrochisma</i>	4	1
RH98-03-414	RH98-03	<i>Pododesmus machrochisma</i>	1.9	1
RH98-03-415	RH98-03	<i>Pododesmus machrochisma</i>	1.6	1
RH98-03-416	RH98-03	<i>Pododesmus machrochisma</i>	0.8	1
RH98-03-417	RH98-03	<i>Pododesmus machrochisma</i>	0.5	1
RH98-03-418	RH98-03	<i>Pododesmus machrochisma</i>	0.4	1
RH98-03-419	RH98-03	<i>Pododesmus machrochisma</i>	0.3	1
RH98-03-420	RH98-03	<i>Pododesmus machrochisma</i>	40.9	31 frag's
RH98-03-421	RH98-03	<i>Pododesmus machrochisma</i>	0.3	1
RH98-03-422	RH98-03	<i>Pododesmus machrochisma</i>	0.2	1
RH98-03-423	RH98-03	<i>Pododesmus machrochisma</i>	4	1
RH98-03-424	RH98-03	<i>Pododesmus machrochisma</i>	6.8	1
RH98-03-425	RH98-03	<i>Pododesmus machrochisma</i>	4.1	1
RH98-03-426	RH98-03	<i>Pododesmus machrochisma</i>	2.9	1
RH98-03-427	RH98-03	<i>Pododesmus machrochisma</i>	10.2	1
RH98-03-428	RH98-03	<i>Pododesmus machrochisma</i>	15.7	1
RH98-03-429	RH98-03	<i>Pododesmus machrochisma</i>	8.8	1
RH98-03-430	RH98-03	<i>Pododesmus machrochisma</i>	12.8	1
RH98-03-431	RH98-03	<i>Pododesmus machrochisma</i>	5.9	1
RH98-03-432	RH98-03	<i>Pododesmus machrochisma</i>	1.1	1
RH98-03-433	RH98-03	<i>Pododesmus machrochisma</i>	1.2	1
RH98-03-434	RH98-03	<i>Pododesmus machrochisma</i>	5.4	1
RH98-03-435	RH98-03	<i>Pododesmus machrochisma</i>	0.5	1
RH98-03-436	RH98-03	<i>Pododesmus machrochisma</i>	0.1	1
RH98-03-437	RH98-03	<i>Pododesmus machrochisma</i>	0.3	1
RH98-03-438	RH98-03	<i>Pododesmus machrochisma</i>	44.4	2 artic'd
RH98-03-439	RH98-03	<i>Pododesmus machrochisma</i>	15.5	14 frag's
RH98-03-440	RH98-03	<i>Clinocardium nuttallii</i>	1	2 frag's
RH98-03-441	RH98-03	<i>Clinocardium nuttallii</i>	0.5	1 frag
RH98-03-442	RH98-03	<i>Clinocardium nuttallii</i>	3.5	4 frag's

RH98-03-443	RH98-03	<i>Clinocardium nuttallii</i>	0.1	-1
RH98-03-444	RH98-03	<i>Clinocardium nuttallii</i>	0.2	1
RH98-03-445	RH98-03	<i>Clinocardium nuttallii</i>	0.4	1 frag
RH98-03-446	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-447	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-448	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-449	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-450	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-451	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-452	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-453	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-454	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-455	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-456	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-457	RH98-03	<i>Crepidula adunca</i>	0.5	1
RH98-03-458	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-459	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-460	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-461	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-462	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-463	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-464	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-465	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-466	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-467	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-468	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-469	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-470	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-471	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-472	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-473	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-474	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-475	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-476	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-477	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-478	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-479	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-480	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-481	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-482	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-483	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-484	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-485	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-486	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-487	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-488	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-489	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-490	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-491	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-492	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-493	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-494	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-495	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-496	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-497	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-498	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-499	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-500	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-501	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-502	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-503	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-504	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-505	RH98-03	<i>Crepidula adunca</i>	0.2	-1
RH98-03-506	RH98-03	<i>Crepidula adunca</i>	0.1	1

RH98-03-507	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-508	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-509	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-510	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-511	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-512	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-513	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-514	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-515	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-516	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-517	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-518	RH98-03	<i>Crepidula adunca</i>	0.1	1
RH98-03-519	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-520	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-521	RH98-03	<i>Crepidula adunca</i>	0.2	~1
RH98-03-522	RH98-03	<i>Crepidula adunca</i>	0.2	1
RH98-03-523	RH98-03	<i>Crepidula adunca</i>	0.3	1
RH98-03-524	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-525	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-526	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-527	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-528	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-529	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-530	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-531	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-532	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-533	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-534	RH98-03	<i>Nassarius mendicus</i>	0.1	~1
RH98-03-535	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-536	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-537	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-538	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-539	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-540	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-541	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-542	RH98-03	<i>Nassarius mendicus</i>	0.1	~1
RH98-03-543	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-544	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-545	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-546	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-547	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-548	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-549	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-550	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-551	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-552	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-553	RH98-03	<i>Nassarius mendicus</i>	0.2	~1
RH98-03-554	RH98-03	<i>Nassarius mendicus</i>	0.2	~1
RH98-03-555	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-556	RH98-03	<i>Nassarius mendicus</i>	0.4	1
RH98-03-557	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-558	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-559	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-560	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-561	RH98-03	<i>Nassarius mendicus</i>	0.4	1
RH98-03-562	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-563	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-564	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-565	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-566	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-567	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-568	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-569	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-570	RH98-03	<i>Nassarius mendicus</i>	0.2	~1

RH98-03-571	RH98-03	<i>Nassarius mendicus</i>	0.2	~1
RH98-03-572	RH98-03	<i>Nassarius mendicus</i>	0.2	~1
RH98-03-573	RH98-03	<i>Nassarius mendicus</i>	0.1	~1
RH98-03-574	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-575	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-576	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-577	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-578	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-579	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-580	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-581	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-582	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-583	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-584	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-585	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-586	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-587	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-588	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-589	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-590	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-591	RH98-03	<i>Nassarius mendicus</i>	0.2	~1
RH98-03-592	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-593	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-594	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-595	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-596	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-597	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-598	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-599	RH98-03	<i>Nassarius mendicus</i>	0.1	1
RH98-03-600	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-601	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-602	RH98-03	<i>Nassarius mendicus</i>	0.3	1
RH98-03-603	RH98-03	<i>Nassarius mendicus</i>	0.2	1
RH98-03-604	RH98-03	<i>Nassarius mendicus</i>	0.1	~1
RH98-03-605	RH98-03	<i>Nassarius mendicus</i>	0.1	~1
RH98-03-606	RH98-03	<i>Lirabuccinum dirum</i>	3.4	1
RH98-03-607	RH98-03	<i>Euspira pallida</i>	0.7	~1
RH98-03-608	RH98-03	<i>Mya truncata</i>	0.3	1
RH98-03-609	RH98-03	<i>Mya truncata</i>	0.1	1
RH98-03-610	RH98-03	<i>Mya truncata</i>	0.1	1
RH98-03-611	RH98-03	<i>Mytilus trossulus</i>	0.4	~1
RH98-03-612	RH98-03	<i>Mytilus trossulus</i>	0.1	~1
RH98-03-613	RH98-03	<i>Mytilus trossulus</i>	0.4	~1
RH98-03-614	RH98-03	<i>Petaliconchus compactus</i>	0.3	1
RH98-03-615	RH98-03	Tubeworm	0.7	1
RH98-03-616	RH98-03	<i>Tectura persona</i>	0.1	1
RH98-03-617	RH98-03	<i>Chiton sp.</i>	0.7	2 plates
RH98-03-618	RH98-03	<i>Balanus spp.</i>	1.9	12 frag's
RH98-03-619	RH98-03	<i>Balanus spp.</i>	4.3	24 frag's
RH98-03-620	RH98-03	<i>Balanus spp.</i>	4.3	29 frag's
RH98-03-621	RH98-03	<i>Balanus spp.</i>	4.4	22 frag's
RH98-03-622	RH98-03	Unidentified gastropods	0.1	~1
RH98-03-623	RH98-03	Unidentified gastropods	0.1	1
RH98-03-624	RH98-03	Unidentified gastropods	0.2	1
RH98-03-625	RH98-03	Unidentified clam shell frag's	1	~1
RH98-03-626	RH98-03	Unidentified clam shell frag's	0.5	~1
RH98-03-627	RH98-03	Unidentified clam shell frag's	3.1	~1
RH98-03-628	RH98-03	Unidentified clam shell frag's	1	~1
RH98-03-629	RH98-03	Unidentified clam shell frag's	22	56 frag's
RH98-03-630	RH98-03	Unidentified clam shell frag's	71.4	165 frag's
RH98-03-631	RH98-03	Unidentified clam shell frag's	73.2	131 frag's
RH98-03-632	RH98-03	Unidentified clam shell frag's	58.1	103 frag's
RH98-03-633	RH98-03	Wood	2.7	1
RH98-03-634	RH98-03	Wood	0.7	1

RH98-03-635	RH98-03	Wood	2	1
RH98-03-636	RH98-03	Wood	0.1	1
RH98-03-637	RH98-03	Wood	33.8	1
RH98-03-638	RH98-03	Wood	0.7	1
RH98-03-639	RH98-03	Charcoal	0.9	1
RH98-03-640	RH98-03	Charcoal	1	1
RH98-03-641	RH98-03	Coniferous cone	0.7	1
RH98-03-642	RH98-03	Coniferous cone	1.5	1
RH98-03-643	RH98-03	Coniferous cone	0.5	1
RH98-03-644	RH98-03	Coniferous cone	0.4	1
RH98-03-645	RH98-03	Coniferous cone	0.5	1
RH98-03-646	RH98-03	Coniferous cone	0.2	1
Total weight (grams) RH98-03			2365.7	
RH98-01-1	RH98-01	<i>Saxidomus giganteus</i>	22.5	1
RH98-01-2	RH98-01	<i>Saxidomus giganteus</i>	23.4	1
RH98-01-3	RH98-01	<i>Saxidomus giganteus</i>	13.9	1
RH98-01-4	RH98-01	<i>Saxidomus giganteus</i>	17.3	1
RH98-01-5	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-6	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-7	RH98-01	<i>Saxidomus giganteus</i>	8.9	-1
RH98-01-8	RH98-01	<i>Saxidomus giganteus</i>	3	1
RH98-01-9	RH98-01	<i>Saxidomus giganteus</i>	2.5	-1
RH98-01-10	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-11	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-12	RH98-01	<i>Saxidomus giganteus</i>	6.4	-1
RH98-01-13	RH98-01	<i>Saxidomus giganteus</i>	1.2	-1
RH98-01-14	RH98-01	<i>Saxidomus giganteus</i>	2.9	-1
RH98-01-15	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-16	RH98-01	<i>Saxidomus giganteus</i>	0.2	1
RH98-01-17	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-18	RH98-01	<i>Saxidomus giganteus</i>	0.2	1
RH98-01-19	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-20	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-21	RH98-01	<i>Saxidomus giganteus</i>	1	-1
RH98-01-22	RH98-01	<i>Saxidomus giganteus</i>	14.3	1
RH98-01-23	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-24	RH98-01	<i>Saxidomus giganteus</i>	0.9	1
RH98-01-25	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-26	RH98-01	<i>Saxidomus giganteus</i>	0.8	-1
RH98-01-27	RH98-01	<i>Saxidomus giganteus</i>	2.3	1
RH98-01-28	RH98-01	<i>Saxidomus giganteus</i>	1.9	-1
RH98-01-29	RH98-01	<i>Saxidomus giganteus</i>	4.9	-1
RH98-01-30	RH98-01	<i>Saxidomus giganteus</i>	4.1	-1
RH98-01-31	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-32	RH98-01	<i>Saxidomus giganteus</i>	1.2	-1
RH98-01-33	RH98-01	<i>Saxidomus giganteus</i>	29.5	1
RH98-01-34	RH98-01	<i>Saxidomus giganteus</i>	0.5	-1
RH98-01-35	RH98-01	<i>Saxidomus giganteus</i>	0.1	-1
RH98-01-36	RH98-01	<i>Saxidomus giganteus</i>	0.2	1
RH98-01-37	RH98-01	<i>Saxidomus giganteus</i>	23.8	-1
RH98-01-38	RH98-01	<i>Saxidomus giganteus</i>	1.7	-1
RH98-01-39	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-40	RH98-01	<i>Saxidomus giganteus</i>	0.5	-1
RH98-01-41	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-42	RH98-01	<i>Saxidomus giganteus</i>	119.4	36 frag's
RH98-01-43	RH98-01	<i>Saxidomus giganteus</i>	40.5	1
RH98-01-44	RH98-01	<i>Saxidomus giganteus</i>	28	1
RH98-01-45	RH98-01	<i>Saxidomus giganteus</i>	31.6	1
RH98-01-46	RH98-01	<i>Saxidomus giganteus</i>	2.1	-1
RH98-01-47	RH98-01	<i>Saxidomus giganteus</i>	2.6	-1
RH98-01-48	RH98-01	<i>Saxidomus giganteus</i>	4.1	-1
RH98-01-49	RH98-01	<i>Saxidomus giganteus</i>	1.1	1
RH98-01-50	RH98-01	<i>Saxidomus giganteus</i>	3.3	1

RH98-01-51	RH98-01	<i>Saxidomus giganteus</i>	0.3	1
RH98-01-52	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-53	RH98-01	<i>Saxidomus giganteus</i>	1.5	-1
RH98-01-54	RH98-01	<i>Saxidomus giganteus</i>	1.6	-1
RH98-01-55	RH98-01	<i>Saxidomus giganteus</i>	0.9	-1
RH98-01-56	RH98-01	<i>Saxidomus giganteus</i>	0.9	-1
RH98-01-57	RH98-01	<i>Saxidomus giganteus</i>	0.7	-1
RH98-01-58	RH98-01	<i>Saxidomus giganteus</i>	0.3	1
RH98-01-59	RH98-01	<i>Saxidomus giganteus</i>	0.4	1
RH98-01-60	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-61	RH98-01	<i>Saxidomus giganteus</i>	0.6	-1
RH98-01-62	RH98-01	<i>Saxidomus giganteus</i>	2.7	-1
RH98-01-63	RH98-01	<i>Saxidomus giganteus</i>	0.4	1
RH98-01-64	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-65	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-66	RH98-01	<i>Saxidomus giganteus</i>	0.7	-1
RH98-01-67	RH98-01	<i>Saxidomus giganteus</i>	0.3	1
RH98-01-68	RH98-01	<i>Saxidomus giganteus</i>	1.4	-1
RH98-01-69	RH98-01	<i>Saxidomus giganteus</i>	1.2	-1
RH98-01-70	RH98-01	<i>Saxidomus giganteus</i>	0.2	1
RH98-01-71	RH98-01	<i>Saxidomus giganteus</i>	1	-1
RH98-01-72	RH98-01	<i>Saxidomus giganteus</i>	0.8	-1
RH98-01-73	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-74	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-75	RH98-01	<i>Saxidomus giganteus</i>	0.7	-1
RH98-01-76	RH98-01	<i>Saxidomus giganteus</i>	0.4	-1
RH98-01-77	RH98-01	<i>Saxidomus giganteus</i>	1.7	-1
RH98-01-78	RH98-01	<i>Saxidomus giganteus</i>	1.6	-1
RH98-01-79	RH98-01	<i>Saxidomus giganteus</i>	0.5	-1
RH98-01-80	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-81	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-82	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-83	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-84	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-85	RH98-01	<i>Saxidomus giganteus</i>	0.1	-1
RH98-01-86	RH98-01	<i>Saxidomus giganteus</i>	0.5	-1
RH98-01-87	RH98-01	<i>Saxidomus giganteus</i>	0.2	-1
RH98-01-88	RH98-01	<i>Saxidomus giganteus</i>	0.3	-1
RH98-01-89	RH98-01	<i>Saxidomus giganteus</i>	145.5	47 frag's
RH98-01-90	RH98-01	<i>Saxidomus giganteus</i>	0.6	-1
RH98-01-91	RH98-01	<i>Saxidomus giganteus</i>	0.6	1
RH98-01-92	RH98-01	<i>Protothaca staminea</i>	22.4	1
RH98-01-93	RH98-01	<i>Protothaca staminea</i>	22	1
RH98-01-94	RH98-01	<i>Protothaca staminea</i>	15.5	1
RH98-01-95	RH98-01	<i>Protothaca staminea</i>	6.9	-1
RH98-01-96	RH98-01	<i>Protothaca staminea</i>	9.6	-1
RH98-01-97	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-98	RH98-01	<i>Protothaca staminea</i>	7.2	-1
RH98-01-99	RH98-01	<i>Protothaca staminea</i>	2.6	1
RH98-01-100	RH98-01	<i>Protothaca staminea</i>	4.7	1
RH98-01-101	RH98-01	<i>Protothaca staminea</i>	11.8	-1
RH98-01-102	RH98-01	<i>Protothaca staminea</i>	3.2	-1
RH98-01-103	RH98-01	<i>Protothaca staminea</i>	2.7	-1
RH98-01-104	RH98-01	<i>Protothaca staminea</i>	1	-1
RH98-01-105	RH98-01	<i>Protothaca staminea</i>	8.6	-1
RH98-01-106	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-107	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-108	RH98-01	<i>Protothaca staminea</i>	0.7	-1
RH98-01-109	RH98-01	<i>Protothaca staminea</i>	1.3	-1
RH98-01-110	RH98-01	<i>Protothaca staminea</i>	7.7	1
RH98-01-111	RH98-01	<i>Protothaca staminea</i>	2.3	1
RH98-01-112	RH98-01	<i>Protothaca staminea</i>	0.9	-1
RH98-01-113	RH98-01	<i>Protothaca staminea</i>	2.5	-1
RH98-01-114	RH98-01	<i>Protothaca staminea</i>	0.4	1

RH98-01-115	RH98-01	<i>Protothaca staminea</i>	0.4	~1
RH98-01-116	RH98-01	<i>Protothaca staminea</i>	0.2	1
RH98-01-117	RH98-01	<i>Protothaca staminea</i>	3.4	~1
RH98-01-118	RH98-01	<i>Protothaca staminea</i>	0.3	1
RH98-01-119	RH98-01	<i>Protothaca staminea</i>	18	~1
RH98-01-120	RH98-01	<i>Protothaca staminea</i>	0.5	~1
RH98-01-121	RH98-01	<i>Protothaca staminea</i>	0.5	1
RH98-01-122	RH98-01	<i>Protothaca staminea</i>	0.1	1
RH98-01-123	RH98-01	<i>Protothaca staminea</i>	0.5	~1
RH98-01-124	RH98-01	<i>Protothaca staminea</i>	17.1	1
RH98-01-125	RH98-01	<i>Protothaca staminea</i>	14.1	1
RH98-01-126	RH98-01	<i>Protothaca staminea</i>	1.1	~1
RH98-01-127	RH98-01	<i>Protothaca staminea</i>	10.6	1
RH98-01-128	RH98-01	<i>Protothaca staminea</i>	1.7	~1
RH98-01-129	RH98-01	<i>Protothaca staminea</i>	1.2	~1
RH98-01-130	RH98-01	<i>Protothaca staminea</i>	0.3	~1
RH98-01-131	RH98-01	<i>Protothaca staminea</i>	1.5	~1
RH98-01-132	RH98-01	<i>Protothaca staminea</i>	0.3	~1
RH98-01-133	RH98-01	<i>Protothaca staminea</i>	0.4	~1
RH98-01-134	RH98-01	<i>Protothaca staminea</i>	1.5	~1
RH98-01-135	RH98-01	<i>Protothaca staminea</i>	1.8	~1
RH98-01-136	RH98-01	<i>Protothaca staminea</i>	8	~1
RH98-01-137	RH98-01	<i>Protothaca staminea</i>	0.5	~1
RH98-01-138	RH98-01	<i>Protothaca staminea</i>	0.1	1
RH98-01-139	RH98-01	<i>Protothaca staminea</i>	1	~1
RH98-01-140	RH98-01	<i>Protothaca staminea</i>	1.2	~1
RH98-01-141	RH98-01	<i>Protothaca staminea</i>	0.7	~1
RH98-01-142	RH98-01	<i>Protothaca staminea</i>	0.9	~1
RH98-01-143	RH98-01	<i>Protothaca staminea</i>	0.3	1
RH98-01-144	RH98-01	<i>Protothaca staminea</i>	0.1	~1
RH98-01-145	RH98-01	<i>Protothaca staminea</i>	0.8	~1
RH98-01-146	RH98-01	<i>Protothaca staminea</i>	0.1	1
RH98-01-147	RH98-01	<i>Protothaca staminea</i>	0.1	~1
RH98-01-148	RH98-01	<i>Protothaca staminea</i>	0.1	~1
RH98-01-149	RH98-01	<i>Protothaca staminea</i>	0.7	~1
RH98-01-150	RH98-01	<i>Protothaca staminea</i>	0.8	~1
RH98-01-151	RH98-01	<i>Protothaca staminea</i>	3.9	~1
RH98-01-152	RH98-01	<i>Protothaca staminea</i>	0.1	1
RH98-01-153	RH98-01	<i>Protothaca staminea</i>	0.2	~1
RH98-01-154	RH98-01	<i>Protothaca staminea</i>	10	1
RH98-01-155	RH98-01	<i>Protothaca staminea</i>	1.5	1
RH98-01-156	RH98-01	<i>Protothaca staminea</i>	0.6	~1
RH98-01-157	RH98-01	<i>Protothaca staminea</i>	0.4	~1
RH98-01-158	RH98-01	<i>Protothaca staminea</i>	1.8	1
RH98-01-159	RH98-01	<i>Protothaca staminea</i>	1.4	~1
RH98-01-160	RH98-01	<i>Protothaca staminea</i>	0.4	~1
RH98-01-161	RH98-01	<i>Protothaca staminea</i>	0.9	~1
RH98-01-162	RH98-01	<i>Protothaca staminea</i>	167.6	132 frag's
RH98-01-163	RH98-01	<i>Protothaca staminea</i>	0.6	~1
RH98-01-164	RH98-01	<i>Protothaca staminea</i>	0.3	~1
RH98-01-165	RH98-01	<i>Protothaca staminea</i>	0.8	~1
RH98-01-166	RH98-01	<i>Protothaca staminea</i>	1.5	~1
RH98-01-167	RH98-01	<i>Protothaca staminea</i>	2.6	~1
RH98-01-168	RH98-01	<i>Protothaca staminea</i>	7.5	1
RH98-01-169	RH98-01	<i>Protothaca staminea</i>	8	1
RH98-01-170	RH98-01	<i>Protothaca staminea</i>	6.6	1
RH98-01-171	RH98-01	<i>Protothaca staminea</i>	3.6	~1
RH98-01-172	RH98-01	<i>Protothaca staminea</i>	1.3	~1
RH98-01-173	RH98-01	<i>Protothaca staminea</i>	1.6	~1
RH98-01-174	RH98-01	<i>Protothaca staminea</i>	4.5	~1
RH98-01-175	RH98-01	<i>Protothaca staminea</i>	2.1	~1
RH98-01-176	RH98-01	<i>Protothaca staminea</i>	0.2	1
RH98-01-177	RH98-01	<i>Protothaca staminea</i>	1.3	~1
RH98-01-178	RH98-01	<i>Protothaca staminea</i>	0.6	~1

RH98-01-179	RH98-01	<i>Protothaca staminea</i>	1	-1
RH98-01-180	RH98-01	<i>Protothaca staminea</i>	1.9	-1
RH98-01-181	RH98-01	<i>Protothaca staminea</i>	1	-1
RH98-01-182	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-183	RH98-01	<i>Protothaca staminea</i>	0.6	-1
RH98-01-184	RH98-01	<i>Protothaca staminea</i>	2.1	-1
RH98-01-185	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-186	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-187	RH98-01	<i>Protothaca staminea</i>	2.9	1
RH98-01-188	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-189	RH98-01	<i>Protothaca staminea</i>	4.1	-1
RH98-01-190	RH98-01	<i>Protothaca staminea</i>	1.3	-1
RH98-01-191	RH98-01	<i>Protothaca staminea</i>	0.7	-1
RH98-01-192	RH98-01	<i>Protothaca staminea</i>	6.1	1
RH98-01-193	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-194	RH98-01	<i>Protothaca staminea</i>	0.1	-1
RH98-01-195	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-196	RH98-01	<i>Protothaca staminea</i>	6.6	-1
RH98-01-197	RH98-01	<i>Protothaca staminea</i>	0.3	1
RH98-01-198	RH98-01	<i>Protothaca staminea</i>	0.2	1
RH98-01-199	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-200	RH98-01	<i>Protothaca staminea</i>	0.4	1
RH98-01-201	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-202	RH98-01	<i>Protothaca staminea</i>	0.2	1
RH98-01-203	RH98-01	<i>Protothaca staminea</i>	0.4	-1
RH98-01-204	RH98-01	<i>Protothaca staminea</i>	2.4	-1
RH98-01-205	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-206	RH98-01	<i>Protothaca staminea</i>	0.6	1
RH98-01-207	RH98-01	<i>Protothaca staminea</i>	0.9	-1
RH98-01-208	RH98-01	<i>Protothaca staminea</i>	2	-1
RH98-01-209	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-210	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-211	RH98-01	<i>Protothaca staminea</i>	0.6	-1
RH98-01-212	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-213	RH98-01	<i>Protothaca staminea</i>	0.4	-1
RH98-01-214	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-215	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-216	RH98-01	<i>Protothaca staminea</i>	2.2	-1
RH98-01-217	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-218	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-219	RH98-01	<i>Protothaca staminea</i>	0.1	-1
RH98-01-220	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-221	RH98-01	<i>Protothaca staminea</i>	0.6	-1
RH98-01-222	RH98-01	<i>Protothaca staminea</i>	1.1	-1
RH98-01-223	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-224	RH98-01	<i>Protothaca staminea</i>	1.5	1
RH98-01-225	RH98-01	<i>Protothaca staminea</i>	2.1	-1
RH98-01-226	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-227	RH98-01	<i>Protothaca staminea</i>	8.4	-1
RH98-01-228	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-229	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-230	RH98-01	<i>Protothaca staminea</i>	0.6	-1
RH98-01-231	RH98-01	<i>Protothaca staminea</i>	2.3	-1
RH98-01-232	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-233	RH98-01	<i>Protothaca staminea</i>	0.4	-1
RH98-01-234	RH98-01	<i>Protothaca staminea</i>	0.6	3 frag's
RH98-01-235	RH98-01	<i>Protothaca staminea</i>	1.3	-1
RH98-01-236	RH98-01	<i>Protothaca staminea</i>	0.2	1
RH98-01-237	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-238	RH98-01	<i>Protothaca staminea</i>	0.9	-1
RH98-01-239	RH98-01	<i>Protothaca staminea</i>	0.6	1
RH98-01-240	RH98-01	<i>Protothaca staminea</i>	0.6	1
RH98-01-241	RH98-01	<i>Protothaca staminea</i>	0.3	1
RH98-01-242	RH98-01	<i>Protothaca staminea</i>	1	-1

RH98-01-243	RH98-01	<i>Protothaca staminea</i>	2.7	-1
RH98-01-244	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-245	RH98-01	<i>Protothaca staminea</i>	0.6	-1
RH98-01-246	RH98-01	<i>Protothaca staminea</i>	0.2	1
RH98-01-247	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-248	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-249	RH98-01	<i>Protothaca staminea</i>	1.1	-1
RH98-01-250	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-251	RH98-01	<i>Protothaca staminea</i>	1.3	-1
RH98-01-252	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-253	RH98-01	<i>Protothaca staminea</i>	0.1	1
RH98-01-254	RH98-01	<i>Protothaca staminea</i>	0.6	-1
RH98-01-255	RH98-01	<i>Protothaca staminea</i>	0.7	-1
RH98-01-256	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-257	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-258	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-259	RH98-01	<i>Protothaca staminea</i>	0.3	1
RH98-01-260	RH98-01	<i>Protothaca staminea</i>	0.4	-1
RH98-01-261	RH98-01	<i>Protothaca staminea</i>	0.4	-1
RH98-01-262	RH98-01	<i>Protothaca staminea</i>	1.1	1
RH98-01-263	RH98-01	<i>Protothaca staminea</i>	1.2	-1
RH98-01-264	RH98-01	<i>Protothaca staminea</i>	0.8	-1
RH98-01-265	RH98-01	<i>Protothaca staminea</i>	0.2	-1
RH98-01-266	RH98-01	<i>Protothaca staminea</i>	0.1	-1
RH98-01-267	RH98-01	<i>Protothaca staminea</i>	0.4	-1
RH98-01-268	RH98-01	<i>Protothaca staminea</i>	0.3	-1
RH98-01-269	RH98-01	<i>Protothaca staminea</i>	0.9	-1
RH98-01-270	RH98-01	<i>Protothaca staminea</i>	1.2	-1
RH98-01-271	RH98-01	<i>Protothaca staminea</i>	0.5	-1
RH98-01-272	RH98-01	<i>Protothaca staminea</i>	0.9	-1
RH98-01-273	RH98-01	<i>Protothaca staminea</i>	197.4	20 frag's
RH98-01-274	RH98-01	<i>Protothaca tenerrima</i>	4.5	1
RH98-01-275	RH98-01	<i>Protothaca tenerrima</i>	2.9	-1
RH98-01-276	RH98-01	<i>Protothaca tenerrima</i>	1.2	1
RH98-01-277	RH98-01	<i>Protothaca tenerrima</i>	4.1	1
RH98-01-278	RH98-01	<i>Protothaca tenerrima</i>	21.4	25 frag's
RH98-01-279	RH98-01	<i>Protothaca tenerrima</i>	8	1
RH98-01-280	RH98-01	<i>Protothaca tenerrima</i>	4.7	-1
RH98-01-281	RH98-01	<i>Protothaca tenerrima</i>	19.9	22 frag's
RH98-01-282	RH98-01	<i>Protothaca tenerrima</i>	3.4	1
RH98-01-283	RH98-01	<i>Clinocardium nuttallii</i>	0.7	1
RH98-01-284	RH98-01	<i>Clinocardium nuttallii</i>	11.5	4 frag's
RH98-01-285	RH98-01	<i>Clinocardium nuttallii</i>	0.6	-1
RH98-01-286	RH98-01	<i>Clinocardium nuttallii</i>	2.7	5 frag's
RH98-01-287	RH98-01	<i>Macoma inquinata</i>	4.4	1
RH98-01-288	RH98-01	<i>Macoma inquinata</i>	3.8	1
RH98-01-289	RH98-01	<i>Macoma inquinata</i>	1.7	-1
RH98-01-290	RH98-01	<i>Macoma inquinata</i>	1.2	1
RH98-01-291	RH98-01	<i>Macoma inquinata</i>	4.6	1
RH98-01-292	RH98-01	<i>Macoma inquinata</i>	1.1	1
RH98-01-293	RH98-01	<i>Macoma inquinata</i>	0.8	1
RH98-01-294	RH98-01	<i>Macoma inquinata</i>	1.1	1
RH98-01-295	RH98-01	<i>Macoma inquinata</i>	0.4	1
RH98-01-296	RH98-01	<i>Macoma inquinata</i>	1.1	-1
RH98-01-297	RH98-01	<i>Macoma inquinata</i>	1.1	-1
RH98-01-298	RH98-01	<i>Macoma inquinata</i>	6.2	1
RH98-01-299	RH98-01	<i>Macoma inquinata</i>	5.3	1
RH98-01-300	RH98-01	<i>Macoma inquinata</i>	2.5	-1
RH98-01-301	RH98-01	<i>Macoma inquinata</i>	2.7	-1
RH98-01-302	RH98-01	<i>Macoma inquinata</i>	2.3	-1
RH98-01-303	RH98-01	<i>Macoma inquinata</i>	1.6	1
RH98-01-304	RH98-01	<i>Macoma inquinata</i>	0.8	1
RH98-01-305	RH98-01	<i>Macoma inquinata</i>	0.5	-1
RH98-01-306	RH98-01	<i>Macoma inquinata</i>	3.7	-1

RH98-01-307	RH98-01	<i>Macoma inquinata</i>	3.3	1
RH98-01-308	RH98-01	<i>Macoma inquinata</i>	2.7	~1
RH98-01-309	RH98-01	<i>Macoma inquinata</i>	4.8	1
RH98-01-310	RH98-01	<i>Macoma inquinata</i>	3.8	1
RH98-01-311	RH98-01	<i>Macoma inquinata</i>	1.3	~1
RH98-01-312	RH98-01	<i>Macoma inquinata</i>	2.8	1
RH98-01-313	RH98-01	<i>Macoma inquinata</i>	2.1	1
RH98-01-314	RH98-01	<i>Macoma inquinata</i>	1.8	~1
RH98-01-315	RH98-01	<i>Macoma inquinata</i>	1.9	~1
RH98-01-316	RH98-01	<i>Macoma inquinata</i>	0.9	~1
RH98-01-317	RH98-01	<i>Macoma inquinata</i>	1	~1
RH98-01-318	RH98-01	<i>Macoma inquinata</i>	2.7	1
RH98-01-319	RH98-01	<i>Macoma inquinata</i>	2.8	1
RH98-01-320	RH98-01	<i>Macoma inquinata</i>	3.1	1
RH98-01-321	RH98-01	<i>Macoma inquinata</i>	1.5	1
RH98-01-322	RH98-01	<i>Macoma inquinata</i>	2.3	~1
RH98-01-323	RH98-01	<i>Macoma inquinata</i>	1.5	~1
RH98-01-324	RH98-01	<i>Macoma inquinata</i>	1.5	~1
RH98-01-325	RH98-01	<i>Macoma inquinata</i>	0.7	~1
RH98-01-326	RH98-01	<i>Macoma inquinata</i>	0.5	~1
RH98-01-327	RH98-01	<i>Macoma inquinata</i>	0.9	~1
RH98-01-328	RH98-01	<i>Macoma inquinata</i>	0.1	1
RH98-01-329	RH98-01	<i>Macoma incongrua</i>	0.5	1
RH98-01-330	RH98-01	<i>Macoma incongrua</i>	1.8	1
RH98-01-331	RH98-01	<i>Macoma incongrua</i>	0.9	1
RH98-01-332	RH98-01	<i>Macoma incongrua</i>	1.4	1
RH98-01-333	RH98-01	<i>Macoma incongrua</i>	0.5	1
RH98-01-334	RH98-01	<i>Macoma incongrua</i>	0.5	1
RH98-01-335	RH98-01	<i>Macoma incongrua</i>	2.4	1
RH98-01-336	RH98-01	<i>Macoma incongrua</i>	3.2	1
RH98-01-337	RH98-01	<i>Macoma incongrua</i>	1.2	~1
RH98-01-338	RH98-01	<i>Macoma incongrua</i>	0.3	~1
RH98-01-339	RH98-01	<i>Macoma incongrua</i>	0.7	1
RH98-01-340	RH98-01	<i>Macoma incongrua</i>	1.1	~1
RH98-01-341	RH98-01	<i>Macoma incongrua</i>	1.1	1
RH98-01-342	RH98-01	<i>Macoma incongrua</i>	1.2	1
RH98-01-343	RH98-01	<i>Macoma incongrua</i>	1.1	1
RH98-01-344	RH98-01	<i>Macoma incongrua</i>	0.9	1
RH98-01-345	RH98-01	<i>Macoma incongrua</i>	0.5	~1
RH98-01-346	RH98-01	<i>Pododesmus machrochisma</i>	12.2	1
RH98-01-347	RH98-01	<i>Pododesmus machrochisma</i>	4.5	1
RH98-01-348	RH98-01	<i>Pododesmus machrochisma</i>	1.8	1
RH98-01-349	RH98-01	<i>Pododesmus machrochisma</i>	1.9	1
RH98-01-350	RH98-01	<i>Pododesmus machrochisma</i>	3.3	1
RH98-01-351	RH98-01	<i>Pododesmus machrochisma</i>	0.5	1
RH98-01-352	RH98-01	<i>Pododesmus machrochisma</i>	0.7	1
RH98-01-353	RH98-01	<i>Pododesmus machrochisma</i>	12.4	1
RH98-01-354	RH98-01	<i>Pododesmus machrochisma</i>	0.5	1
RH98-01-355	RH98-01	<i>Pododesmus machrochisma</i>	54.6	1
RH98-01-356	RH98-01	<i>Pododesmus machrochisma</i>	0.1	1
RH98-01-357	RH98-01	<i>Pododesmus machrochisma</i>	14.7	16 frag's
RH98-01-358	RH98-01	<i>Pododesmus machrochisma</i>	1.8	1
RH98-01-359	RH98-01	<i>Pododesmus machrochisma</i>	0.4	1
RH98-01-360	RH98-01	<i>Pododesmus machrochisma</i>	0.3	1
RH98-01-361	RH98-01	<i>Pododesmus machrochisma</i>	0.6	1
RH98-01-362	RH98-01	<i>Pododesmus machrochisma</i>	0.8	1
RH98-01-363	RH98-01	<i>Pododesmus machrochisma</i>	0.4	1
RH98-01-364	RH98-01	<i>Pododesmus machrochisma</i>	5	~1
RH98-01-365	RH98-01	<i>Pododesmus machrochisma</i>	0.5	1
RH98-01-366	RH98-01	<i>Pododesmus machrochisma</i>	0.6	1
RH98-01-367	RH98-01	<i>Pododesmus machrochisma</i>	0.3	1
RH98-01-368	RH98-01	<i>Pododesmus machrochisma</i>	0.9	1
RH98-01-369	RH98-01	<i>Pododesmus machrochisma</i>	0.2	1
RH98-01-370	RH98-01	<i>Pododesmus machrochisma</i>	0.1	1

RH98-01-371	RH98-01	<i>Pododesmus machrochisma</i>	11.1	12 frag's
RH98-01-372	RH98-01	<i>Crepidula adunca</i>	0.7	1
RH98-01-373	RH98-01	<i>Crepidula adunca</i>	0.2	1
RH98-01-374	RH98-01	<i>Crepidula adunca</i>	0.2	1
RH98-01-375	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-376	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-377	RH98-01	<i>Crepidula adunca</i>	0.2	1
RH98-01-378	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-379	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-380	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-381	RH98-01	<i>Crepidula adunca</i>	0.2	1
RH98-01-382	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-383	RH98-01	<i>Crepidula adunca</i>	0.3	1
RH98-01-384	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-385	RH98-01	<i>Crepidula adunca</i>	0.3	1
RH98-01-386	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-387	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-388	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-389	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-390	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-391	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-392	RH98-01	<i>Crepidula adunca</i>	0.4	1
RH98-01-393	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-394	RH98-01	<i>Crepidula adunca</i>	0.2	1
RH98-01-395	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-396	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-397	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-398	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-399	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-400	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-401	RH98-01	<i>Crepidula adunca</i>	0.2	~1
RH98-01-402	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-403	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-404	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-405	RH98-01	<i>Crepidula adunca</i>	0.2	1
RH98-01-406	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-407	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-408	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-409	RH98-01	<i>Crepidula adunca</i>	0.3	1
RH98-01-410	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-411	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-412	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-413	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-414	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-415	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-416	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-417	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-418	RH98-01	<i>Crepidula adunca</i>	0.1	~1
RH98-01-419	RH98-01	<i>Crepidula adunca</i>	0.1	~1
RH98-01-420	RH98-01	<i>Crepidula adunca</i>	0.1	1
RH98-01-421	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-422	RH98-01	<i>Nassarius mendicus</i>	0.2	1
RH98-01-423	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-424	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-425	RH98-01	<i>Nassarius mendicus</i>	0.2	~1
RH98-01-426	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-427	RH98-01	<i>Nassarius mendicus</i>	0.3	1
RH98-01-428	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-429	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-430	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-431	RH98-01	<i>Nassarius mendicus</i>	0.2	1
RH98-01-432	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-433	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-434	RH98-01	<i>Nassarius mendicus</i>	0.2	1

RH98-01-435	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-436	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-437	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-438	RH98-01	<i>Nassarius mendicus</i>	0.2	1
RH98-01-439	RH98-01	<i>Nassarius mendicus</i>	0.2	1
RH98-01-440	RH98-01	<i>Nassarius mendicus</i>	0.2	1
RH98-01-441	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-442	RH98-01	<i>Nassarius mendicus</i>	0.2	1
RH98-01-443	RH98-01	<i>Nassarius mendicus</i>	0.2	1
RH98-01-444	RH98-01	<i>Nassarius mendicus</i>	0.1	1
RH98-01-445	RH98-01	<i>Nassarius mendicus</i>	0.2	~1
RH98-01-446	RH98-01	<i>Bittium eschrichtii</i>	0.1	1
RH98-01-447	RH98-01	<i>Bittium eschrichtii</i>	0.3	1
RH98-01-448	RH98-01	<i>Lacuna variegata</i>	0.2	1
RH98-01-449	RH98-01	<i>Euspira pallida</i>	0.9	~1
RH98-01-450	RH98-01	<i>Euspira pallida</i>	0.2	1 frag
RH98-01-451	RH98-01	<i>Euspira pallida</i>	0.1	1
RH98-01-452	RH98-01	<i>Balanus sp.</i>	2.2	1
RH98-01-453	RH98-01	<i>Balanus spp.</i>	6.4	21 frag's
RH98-01-454	RH98-01	<i>Balanus sp.</i>	0.3	1
RH98-01-455	RH98-01	<i>Balanus spp.</i>	10.7	51 frag's
RH98-01-455	RH98-01	<i>Lottia pelta</i>	0.1	1
RH98-01-455	RH98-01	<i>Chiton sp.</i>	1.4	3 plates
RH98-01-455	RH98-01	Unidentified clam shell frag's	62.5	119 frag's
RH98-01-455	RH98-01	Unidentified clam shell frag's	83.6	185 frag's
RH98-01-456	RH98-01	Coniferous cones	0.2	1
RH98-01-457	RH98-01	Coniferous cones	0.6	1
Total weight (grams) RH98-01			1851.9	
RH98-02-1	RH98-02	<i>Saxidomus giganteus</i>	17.3	1
RH98-02-2	RH98-02	<i>Saxidomus giganteus</i>	25.4	1
RH98-02-3	RH98-02	<i>Saxidomus giganteus</i>	8.2	1
RH98-02-4	RH98-02	<i>Saxidomus giganteus</i>	16.1	1
RH98-02-5	RH98-02	<i>Saxidomus giganteus</i>	7.7	1
RH98-02-6	RH98-02	<i>Saxidomus giganteus</i>	6.3	1
RH98-02-7	RH98-02	<i>Saxidomus giganteus</i>	1.2	1
RH98-02-8	RH98-02	<i>Saxidomus giganteus</i>	17.3	1
RH98-02-9	RH98-02	<i>Saxidomus giganteus</i>	16.3	1
RH98-02-10	RH98-02	<i>Saxidomus giganteus</i>	4.2	~1
RH98-02-11	RH98-02	<i>Saxidomus giganteus</i>	1	~1
RH98-02-12	RH98-02	<i>Saxidomus giganteus</i>	2.7	~1
RH98-02-13	RH98-02	<i>Saxidomus giganteus</i>	0.7	1
RH98-02-14	RH98-02	<i>Saxidomus giganteus</i>	0.5	~1
RH98-02-15	RH98-02	<i>Saxidomus giganteus</i>	1.3	~1
RH98-02-16	RH98-02	<i>Saxidomus giganteus</i>	1.2	~1
RH98-02-17	RH98-02	<i>Saxidomus giganteus</i>	0.5	1
RH98-02-18	RH98-02	<i>Saxidomus giganteus</i>	0.3	1
RH98-02-19	RH98-02	<i>Saxidomus giganteus</i>	0.2	~1
RH98-02-20	RH98-02	<i>Saxidomus giganteus</i>	1.5	~1
RH98-02-21	RH98-02	<i>Saxidomus giganteus</i>	2.4	~1
RH98-02-22	RH98-02	<i>Saxidomus giganteus</i>	0.7	~1
RH98-02-23	RH98-02	<i>Saxidomus giganteus</i>	0.7	~1
RH98-02-24	RH98-02	<i>Saxidomus giganteus</i>	0.7	~1
RH98-02-25	RH98-02	<i>Saxidomus giganteus</i>	0.5	~1
RH98-02-26	RH98-02	<i>Saxidomus giganteus</i>	0.3	~1
RH98-02-27	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-28	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-29	RH98-02	<i>Saxidomus giganteus</i>	0.2	1
RH98-02-30	RH98-02	<i>Saxidomus giganteus</i>	19.1	~1
RH98-02-31	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-32	RH98-02	<i>Saxidomus giganteus</i>	48.8	~1
RH98-02-33	RH98-02	<i>Saxidomus giganteus</i>	112.2	42 frag's
RH98-02-34	RH98-02	<i>Saxidomus giganteus</i>	0.1	~1
RH98-02-35	RH98-02	<i>Saxidomus giganteus</i>	28.6	1

RH98-02-36	RH98-02	<i>Saxidomus giganteus</i>	4.9	1
RH98-02-37	RH98-02	<i>Saxidomus giganteus</i>	7.9	~1
RH98-02-38	RH98-02	<i>Saxidomus giganteus</i>	22.4	~1
RH98-02-39	RH98-02	<i>Saxidomus giganteus</i>	7.8	~1
RH98-02-40	RH98-02	<i>Saxidomus giganteus</i>	21.7	1
RH98-02-41	RH98-02	<i>Saxidomus giganteus</i>	0.9	~1
RH98-02-42	RH98-02	<i>Saxidomus giganteus</i>	28.4	1
RH98-02-43	RH98-02	<i>Saxidomus giganteus</i>	17.5	~1
RH98-02-44	RH98-02	<i>Saxidomus giganteus</i>	4.7	~1
RH98-02-45	RH98-02	<i>Saxidomus giganteus</i>	19.3	~1
RH98-02-46	RH98-02	<i>Saxidomus giganteus</i>	0.5	1
RH98-02-47	RH98-02	<i>Saxidomus giganteus</i>	8.6	~1
RH98-02-48	RH98-02	<i>Saxidomus giganteus</i>	21.4	1
RH98-02-49	RH98-02	<i>Saxidomus giganteus</i>	19.8	~1
RH98-02-50	RH98-02	<i>Saxidomus giganteus</i>	19.9	~1
RH98-02-51	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-52	RH98-02	<i>Saxidomus giganteus</i>	24.3	1
RH98-02-53	RH98-02	<i>Saxidomus giganteus</i>	24	1
RH98-02-54	RH98-02	<i>Saxidomus giganteus</i>	18.6	~1
RH98-02-55	RH98-02	<i>Saxidomus giganteus</i>	5.1	1
RH98-02-56	RH98-02	<i>Saxidomus giganteus</i>	3.9	~1
RH98-02-57	RH98-02	<i>Saxidomus giganteus</i>	0.3	1
RH98-02-58	RH98-02	<i>Saxidomus giganteus</i>	5.1	~1
RH98-02-59	RH98-02	<i>Saxidomus giganteus</i>	10.3	1
RH98-02-60	RH98-02	<i>Saxidomus giganteus</i>	8.7	~1
RH98-02-61	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-62	RH98-02	<i>Saxidomus giganteus</i>	2	~1
RH98-02-63	RH98-02	<i>Saxidomus giganteus</i>	0.9	1
RH98-02-64	RH98-02	<i>Saxidomus giganteus</i>	1.5	~1
RH98-02-65	RH98-02	<i>Saxidomus giganteus</i>	1.5	1
RH98-02-66	RH98-02	<i>Saxidomus giganteus</i>	0.6	~1
RH98-02-67	RH98-02	<i>Saxidomus giganteus</i>	0.3	1
RH98-02-68	RH98-02	<i>Saxidomus giganteus</i>	0.6	~1
RH98-02-69	RH98-02	<i>Saxidomus giganteus</i>	0.2	1
RH98-02-70	RH98-02	<i>Saxidomus giganteus</i>	0.1	~1
RH98-02-71	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-72	RH98-02	<i>Saxidomus giganteus</i>	1.4	~1
RH98-02-73	RH98-02	<i>Saxidomus giganteus</i>	8.5	1
RH98-02-74	RH98-02	<i>Saxidomus giganteus</i>	1	~1
RH98-02-75	RH98-02	<i>Saxidomus giganteus</i>	1.4	~1
RH98-02-76	RH98-02	<i>Saxidomus giganteus</i>	6.7	~1
RH98-02-77	RH98-02	<i>Saxidomus giganteus</i>	16.6	~1
RH98-02-78	RH98-02	<i>Saxidomus giganteus</i>	1	~1
RH98-02-79	RH98-02	<i>Saxidomus giganteus</i>	25.2	1
RH98-02-80	RH98-02	<i>Saxidomus giganteus</i>	0.3	~1
RH98-02-81	RH98-02	<i>Saxidomus giganteus</i>	1.4	1
RH98-02-82	RH98-02	<i>Saxidomus giganteus</i>	3.5	~1
RH98-02-83	RH98-02	<i>Saxidomus giganteus</i>	3.6	~1
RH98-02-84	RH98-02	<i>Saxidomus giganteus</i>	0.5	~1
RH98-02-85	RH98-02	<i>Saxidomus giganteus</i>	0.3	~1
RH98-02-86	RH98-02	<i>Saxidomus giganteus</i>	0.2	1
RH98-02-87	RH98-02	<i>Saxidomus giganteus</i>	3	~1
RH98-02-88	RH98-02	<i>Saxidomus giganteus</i>	0.7	~1
RH98-02-89	RH98-02	<i>Saxidomus giganteus</i>	0.8	~1
RH98-02-90	RH98-02	<i>Saxidomus giganteus</i>	0.6	~1
RH98-02-91	RH98-02	<i>Saxidomus giganteus</i>	2	~1
RH98-02-92	RH98-02	<i>Saxidomus giganteus</i>	0.6	~1
RH98-02-93	RH98-02	<i>Saxidomus giganteus</i>	0.2	~1
RH98-02-94	RH98-02	<i>Saxidomus giganteus</i>	12.5	~1
RH98-02-95	RH98-02	<i>Saxidomus giganteus</i>	8.3	~1
RH98-02-96	RH98-02	<i>Saxidomus giganteus</i>	168.2	48 frag's
RH98-02-97	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-98	RH98-02	<i>Saxidomus giganteus</i>	1.2	~1
RH98-02-99	RH98-02	<i>Saxidomus giganteus</i>	1.5	~1

RH98-02-100	RH98-02	<i>Saxidomus giganteus</i>	0.3	~1
RH98-02-101	RH98-02	<i>Saxidomus giganteus</i>	1	~1
RH98-02-102	RH98-02	<i>Saxidomus giganteus</i>	0.9	~1
RH98-02-103	RH98-02	<i>Saxidomus giganteus</i>	0.7	~1
RH98-02-104	RH98-02	<i>Saxidomus giganteus</i>	0.6	~1
RH98-02-105	RH98-02	<i>Saxidomus giganteus</i>	0.8	~1
RH98-02-106	RH98-02	<i>Saxidomus giganteus</i>	0.7	~1
RH98-02-107	RH98-02	<i>Saxidomus giganteus</i>	0.4	~1
RH98-02-108	RH98-02	<i>Saxidomus giganteus</i>	0.3	~1
RH98-02-109	RH98-02	<i>Saxidomus giganteus</i>	3	~1
RH98-02-110	RH98-02	<i>Saxidomus giganteus</i>	0.8	~1
RH98-02-111	RH98-02	<i>Saxidomus giganteus</i>	1.6	1
RH98-02-112	RH98-02	<i>Saxidomus giganteus</i>	1.1	~1
RH98-02-113	RH98-02	<i>Saxidomus giganteus</i>	0.5	1
RH98-02-114	RH98-02	<i>Saxidomus giganteus</i>	0.6	~1
RH98-02-115	RH98-02	<i>Saxidomus giganteus</i>	0.2	~1
RH98-02-116	RH98-02	<i>Saxidomus giganteus</i>	1.3	1
RH98-02-117	RH98-02	<i>Saxidomus giganteus</i>	0.7	~1
RH98-02-118	RH98-02	<i>Saxidomus giganteus</i>	0.3	~1
RH98-02-119	RH98-02	<i>Saxidomus giganteus</i>	0.1	~1
RH98-02-120	RH98-02	<i>Saxidomus giganteus</i>	0.6	~1
RH98-02-121	RH98-02	<i>Saxidomus giganteus</i>	1	~1
RH98-02-122	RH98-02	<i>Saxidomus giganteus</i>	1.3	~1
RH98-02-123	RH98-02	<i>Saxidomus giganteus</i>	0.3	~1
RH98-02-124	RH98-02	<i>Saxidomus giganteus</i>	0.2	~1
RH98-02-125	RH98-02	<i>Saxidomus giganteus</i>	0.2	~1
RH98-02-126	RH98-02	<i>Saxidomus giganteus</i>	0.1	~1
RH98-02-127	RH98-02	<i>Saxidomus giganteus</i>	0.1	~1
RH98-02-128	RH98-02	<i>Protothaca staminea</i>	110.5	37 frag's
RH98-02-129	RH98-02	<i>Protothaca staminea</i>	1.2	~1
RH98-02-130	RH98-02	<i>Protothaca staminea</i>	4.6	~1
RH98-02-131	RH98-02	<i>Protothaca staminea</i>	3.1	~1
RH98-02-132	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-133	RH98-02	<i>Protothaca staminea</i>	1.4	~1
RH98-02-134	RH98-02	<i>Protothaca staminea</i>	1.4	~1
RH98-02-135	RH98-02	<i>Protothaca staminea</i>	0.4	1
RH98-02-136	RH98-02	<i>Protothaca staminea</i>	1.4	1
RH98-02-137	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-138	RH98-02	<i>Protothaca staminea</i>	0.8	1
RH98-02-139	RH98-02	<i>Protothaca staminea</i>	2.5	~1
RH98-02-140	RH98-02	<i>Protothaca staminea</i>	1.2	~1
RH98-02-141	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-142	RH98-02	<i>Protothaca staminea</i>	1.7	~1
RH98-02-143	RH98-02	<i>Protothaca staminea</i>	0.2	~1
RH98-02-144	RH98-02	<i>Protothaca staminea</i>	4	~1
RH98-02-145	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-146	RH98-02	<i>Protothaca staminea</i>	1.7	~1
RH98-02-147	RH98-02	<i>Protothaca staminea</i>	1.3	~1
RH98-02-148	RH98-02	<i>Protothaca staminea</i>	1.5	~1
RH98-02-149	RH98-02	<i>Protothaca staminea</i>	0.2	1
RH98-02-150	RH98-02	<i>Protothaca staminea</i>	0.6	1
RH98-02-151	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-152	RH98-02	<i>Protothaca staminea</i>	0.8	~1
RH98-02-153	RH98-02	<i>Protothaca staminea</i>	1.7	~1
RH98-02-154	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-155	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-156	RH98-02	<i>Protothaca staminea</i>	1.1	~1
RH98-02-157	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-158	RH98-02	<i>Protothaca staminea</i>	1.4	~1
RH98-02-159	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-160	RH98-02	<i>Protothaca staminea</i>	2.4	~1
RH98-02-161	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-162	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-163	RH98-02	<i>Protothaca staminea</i>	1.6	~1

RH98-02-164	RH98-02	<i>Protothaca staminea</i>	0.4	-1
RH98-02-165	RH98-02	<i>Protothaca staminea</i>	0.6	-1
RH98-02-166	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-167	RH98-02	<i>Protothaca staminea</i>	0.5	-1
RH98-02-168	RH98-02	<i>Protothaca staminea</i>	0.9	-1
RH98-02-169	RH98-02	<i>Protothaca staminea</i>	0.3	1
RH98-02-170	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-171	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-172	RH98-02	<i>Protothaca staminea</i>	0.5	-1
RH98-02-173	RH98-02	<i>Protothaca staminea</i>	0.6	-1
RH98-02-174	RH98-02	<i>Protothaca staminea</i>	0.4	-1
RH98-02-175	RH98-02	<i>Protothaca staminea</i>	0.9	-1
RH98-02-176	RH98-02	<i>Protothaca staminea</i>	83.7	87 frag's
RH98-02-177	RH98-02	<i>Protothaca staminea</i>	0.9	-1
RH98-02-178	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-179	RH98-02	<i>Protothaca staminea</i>	0.9	-1
RH98-02-180	RH98-02	<i>Protothaca staminea</i>	2.2	-1
RH98-02-181	RH98-02	<i>Protothaca staminea</i>	1.2	-1
RH98-02-182	RH98-02	<i>Protothaca staminea</i>	0.8	-1
RH98-02-183	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-184	RH98-02	<i>Protothaca staminea</i>	0.3	1
RH98-02-185	RH98-02	<i>Protothaca staminea</i>	0.8	-1
RH98-02-186	RH98-02	<i>Protothaca staminea</i>	4.7	-1
RH98-02-187	RH98-02	<i>Protothaca staminea</i>	1	-1
RH98-02-188	RH98-02	<i>Protothaca staminea</i>	1.9	-1
RH98-02-189	RH98-02	<i>Protothaca staminea</i>	0.3	-1
RH98-02-190	RH98-02	<i>Protothaca staminea</i>	0.4	-1
RH98-02-191	RH98-02	<i>Protothaca staminea</i>	18.1	-1
RH98-02-192	RH98-02	<i>Protothaca staminea</i>	1.2	-1
RH98-02-193	RH98-02	<i>Protothaca staminea</i>	1.3	-1
RH98-02-194	RH98-02	<i>Protothaca staminea</i>	0.2	-1
RH98-02-195	RH98-02	<i>Protothaca staminea</i>	9.6	-1
RH98-02-196	RH98-02	<i>Protothaca staminea</i>	0.6	-1
RH98-02-197	RH98-02	<i>Protothaca staminea</i>	0.6	-1
RH98-02-198	RH98-02	<i>Protothaca staminea</i>	0.3	-1
RH98-02-199	RH98-02	<i>Protothaca staminea</i>	0.8	-1
RH98-02-200	RH98-02	<i>Protothaca staminea</i>	2.7	-1
RH98-02-201	RH98-02	<i>Protothaca staminea</i>	10.9	1
RH98-02-202	RH98-02	<i>Protothaca staminea</i>	1.4	-1
RH98-02-203	RH98-02	<i>Protothaca staminea</i>	0.4	-1
RH98-02-204	RH98-02	<i>Protothaca staminea</i>	1.6	-1
RH98-02-205	RH98-02	<i>Protothaca staminea</i>	3.2	-1
RH98-02-206	RH98-02	<i>Protothaca staminea</i>	2.5	-1
RH98-02-207	RH98-02	<i>Protothaca staminea</i>	1.4	-1
RH98-02-208	RH98-02	<i>Protothaca staminea</i>	1.7	-1
RH98-02-209	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-210	RH98-02	<i>Protothaca staminea</i>	0.3	-1
RH98-02-211	RH98-02	<i>Protothaca staminea</i>	1.2	-1
RH98-02-212	RH98-02	<i>Protothaca staminea</i>	1.3	-1
RH98-02-213	RH98-02	<i>Protothaca staminea</i>	1	-1
RH98-02-214	RH98-02	<i>Protothaca staminea</i>	1	-1
RH98-02-215	RH98-02	<i>Protothaca staminea</i>	0.4	1
RH98-02-216	RH98-02	<i>Protothaca staminea</i>	4.4	1
RH98-02-217	RH98-02	<i>Protothaca staminea</i>	1.9	-1
RH98-02-218	RH98-02	<i>Protothaca staminea</i>	0.4	1
RH98-02-219	RH98-02	<i>Protothaca staminea</i>	0.3	-1
RH98-02-220	RH98-02	<i>Protothaca staminea</i>	0.4	-1
RH98-02-221	RH98-02	<i>Protothaca staminea</i>	0.4	-1
RH98-02-222	RH98-02	<i>Protothaca staminea</i>	0.8	-1
RH98-02-223	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-224	RH98-02	<i>Protothaca staminea</i>	0.7	-1
RH98-02-225	RH98-02	<i>Protothaca staminea</i>	0.6	-1
RH98-02-226	RH98-02	<i>Protothaca staminea</i>	0.6	-1
RH98-02-227	RH98-02	<i>Protothaca staminea</i>	0.7	-1

RH98-02-228	RH98-02	<i>Protothaca staminea</i>	2	~1
RH98-02-229	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-230	RH98-02	<i>Protothaca staminea</i>	0.8	~1
RH98-02-231	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-232	RH98-02	<i>Protothaca staminea</i>	1.2	~1
RH98-02-233	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-234	RH98-02	<i>Protothaca staminea</i>	0.2	~1
RH98-02-235	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-236	RH98-02	<i>Protothaca staminea</i>	0.4	~1
RH98-02-237	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-238	RH98-02	<i>Protothaca staminea</i>	0.1	~1
RH98-02-239	RH98-02	<i>Protothaca staminea</i>	0.2	1
RH98-02-240	RH98-02	<i>Protothaca staminea</i>	131.3	1.9 frag's
RH98-02-241	RH98-02	<i>Protothaca staminea</i>	0.8	1
RH98-02-242	RH98-02	<i>Protothaca staminea</i>	5.4	~1
RH98-02-243	RH98-02	<i>Protothaca staminea</i>	0.9	~1
RH98-02-244	RH98-02	<i>Protothaca staminea</i>	3	~1
RH98-02-245	RH98-02	<i>Protothaca staminea</i>	1.2	~1
RH98-02-246	RH98-02	<i>Protothaca staminea</i>	1.1	~1
RH98-02-247	RH98-02	<i>Protothaca staminea</i>	3.4	~1
RH98-02-248	RH98-02	<i>Protothaca staminea</i>	0.1	1
RH98-02-249	RH98-02	<i>Protothaca staminea</i>	0.3	1
RH98-02-250	RH98-02	<i>Protothaca staminea</i>	1.3	~1
RH98-02-251	RH98-02	<i>Protothaca staminea</i>	3.9	~1
RH98-02-252	RH98-02	<i>Protothaca staminea</i>	0.8	~1
RH98-02-253	RH98-02	<i>Protothaca staminea</i>	0.6	1
RH98-02-254	RH98-02	<i>Protothaca staminea</i>	1.9	~1
RH98-02-255	RH98-02	<i>Protothaca staminea</i>	2.1	~1
RH98-02-256	RH98-02	<i>Protothaca staminea</i>	1	1
RH98-02-257	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-258	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-259	RH98-02	<i>Protothaca staminea</i>	1.3	~1
RH98-02-260	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-261	RH98-02	<i>Protothaca staminea</i>	0.4	~1
RH98-02-262	RH98-02	<i>Protothaca staminea</i>	0.8	~1
RH98-02-263	RH98-02	<i>Protothaca staminea</i>	1	~1
RH98-02-264	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-265	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-266	RH98-02	<i>Protothaca staminea</i>	0.4	~1
RH98-02-267	RH98-02	<i>Protothaca staminea</i>	1.6	~1
RH98-02-268	RH98-02	<i>Protothaca staminea</i>	1.2	~1
RH98-02-269	RH98-02	<i>Protothaca staminea</i>	0.2	1
RH98-02-270	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-271	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-272	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-273	RH98-02	<i>Protothaca staminea</i>	0.9	~1
RH98-02-274	RH98-02	<i>Protothaca staminea</i>	0.1	~1
RH98-02-275	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-276	RH98-02	<i>Protothaca staminea</i>	3.2	~1
RH98-02-277	RH98-02	<i>Protothaca staminea</i>	3.7	~1
RH98-02-278	RH98-02	<i>Protothaca staminea</i>	3	~1
RH98-02-279	RH98-02	<i>Protothaca staminea</i>	3.7	~1
RH98-02-280	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-281	RH98-02	<i>Protothaca staminea</i>	0.7	~1
RH98-02-282	RH98-02	<i>Protothaca staminea</i>	1.4	~1
RH98-02-283	RH98-02	<i>Protothaca staminea</i>	0.4	~1
RH98-02-284	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-285	RH98-02	<i>Protothaca staminea</i>	0.4	~1
RH98-02-286	RH98-02	<i>Protothaca staminea</i>	0.3	~1
RH98-02-287	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-288	RH98-02	<i>Protothaca staminea</i>	0.2	~1
RH98-02-289	RH98-02	<i>Protothaca staminea</i>	0.2	~1
RH98-02-290	RH98-02	<i>Protothaca staminea</i>	0.6	~1
RH98-02-291	RH98-02	<i>Protothaca staminea</i>	1	~1

RH98-02-292	RH98-02	<i>Protothaca staminea</i>	4.8	~1
RH98-02-293	RH98-02	<i>Protothaca staminea</i>	0.2	~1
RH98-02-294	RH98-02	<i>Protothaca staminea</i>	0.5	~1
RH98-02-295	RH98-02	<i>Protothaca staminea</i>	147.2	134 frag's
RH98-02-296	RH98-02	<i>Protothaca tenerrima</i>	7.6	1
RH98-02-297	RH98-02	<i>Protothaca tenerrima</i>	9.3	~1
RH98-02-298	RH98-02	<i>Protothaca tenerrima</i>	3.9	~1
RH98-02-299	RH98-02	<i>Protothaca tenerrima</i>	1.1	1
RH98-02-300	RH98-02	<i>Protothaca tenerrima</i>	13.8	16 frag's
RH98-02-301	RH98-02	<i>Protothaca tenerrima</i>	0.8	~1
RH98-02-302	RH98-02	<i>Protothaca tenerrima</i>	0.3	1
RH98-02-303	RH98-02	<i>Protothaca tenerrima</i>	0.4	~1
RH98-02-304	RH98-02	<i>Protothaca tenerrima</i>	1.2	~1
RH98-02-305	RH98-02	<i>Protothaca tenerrima</i>	1.8	~1
RH98-02-306	RH98-02	<i>Protothaca tenerrima</i>	26	22 frag's
RH98-02-307	RH98-02	<i>Protothaca tenerrima</i>	0.9	~1
RH98-02-308	RH98-02	<i>Protothaca tenerrima</i>	1.1	~1
RH98-02-309	RH98-02	<i>Protothaca tenerrima</i>	1.1	~1
RH98-02-310	RH98-02	<i>Protothaca tenerrima</i>	12.4	17 frag's
RH98-02-311	RH98-02	<i>Pododesmus machrochisma</i>	17.1	1
RH98-02-312	RH98-02	<i>Pododesmus machrochisma</i>	8.9	1
RH98-02-313	RH98-02	<i>Pododesmus machrochisma</i>	8.4	1
RH98-02-314	RH98-02	<i>Pododesmus machrochisma</i>	0.6	1
RH98-02-315	RH98-02	<i>Pododesmus machrochisma</i>	1.3	1
RH98-02-316	RH98-02	<i>Pododesmus machrochisma</i>	0.6	1
RH98-02-317	RH98-02	<i>Pododesmus machrochisma</i>	0.8	1
RH98-02-318	RH98-02	<i>Pododesmus machrochisma</i>	6.2	1
RH98-02-319	RH98-02	<i>Pododesmus machrochisma</i>	10.1	1
RH98-02-320	RH98-02	<i>Pododesmus machrochisma</i>	18	2 art'd
RH98-02-321	RH98-02	<i>Pododesmus machrochisma</i>	5	1
RH98-02-322	RH98-02	<i>Pododesmus machrochisma</i>	16.5	1
RH98-02-323	RH98-02	<i>Pododesmus machrochisma</i>	2.4	~1
RH98-02-324	RH98-02	<i>Pododesmus machrochisma</i>	7.9	~1
RH98-02-325	RH98-02	<i>Pododesmus machrochisma</i>	4.7	1
RH98-02-326	RH98-02	<i>Pododesmus machrochisma</i>	3.2	~1
RH98-02-327	RH98-02	<i>Pododesmus machrochisma</i>	2.6	1
RH98-02-328	RH98-02	<i>Pododesmus machrochisma</i>	5	1
RH98-02-329	RH98-02	<i>Pododesmus machrochisma</i>	0.6	1
RH98-02-330	RH98-02	<i>Pododesmus machrochisma</i>	5.6	1
RH98-02-331	RH98-02	<i>Pododesmus machrochisma</i>	39.1	1
RH98-02-332	RH98-02	<i>Pododesmus machrochisma</i>	54.6	~1
RH98-02-333	RH98-02	<i>Pododesmus machrochisma</i>	21.3	36 frag's
RH98-02-334	RH98-02	<i>Pododesmus machrochisma</i>	1.2	~1
RH98-02-335	RH98-02	<i>Pododesmus machrochisma</i>	7.6	~1
RH98-02-336	RH98-02	<i>Pododesmus machrochisma</i>	5.4	1
RH98-02-337	RH98-02	<i>Pododesmus machrochisma</i>	4	1
RH98-02-338	RH98-02	<i>Pododesmus machrochisma</i>	2.4	1
RH98-02-339	RH98-02	<i>Pododesmus machrochisma</i>	8.3	1
RH98-02-340	RH98-02	<i>Pododesmus machrochisma</i>	4.3	1
RH98-02-341	RH98-02	<i>Pododesmus machrochisma</i>	1.1	1
RH98-02-342	RH98-02	<i>Pododesmus machrochisma</i>	21	1
RH98-02-343	RH98-02	<i>Pododesmus machrochisma</i>	1.5	~1
RH98-02-344	RH98-02	<i>Pododesmus machrochisma</i>	2.2	~1
RH98-02-345	RH98-02	<i>Pododesmus machrochisma</i>	3	1
RH98-02-346	RH98-02	<i>Pododesmus machrochisma</i>	10.9	1
RH98-02-347	RH98-02	<i>Pododesmus machrochisma</i>	0.6	1
RH98-02-348	RH98-02	<i>Pododesmus machrochisma</i>	0.7	1
RH98-02-349	RH98-02	<i>Pododesmus machrochisma</i>	0.4	1
RH98-02-350	RH98-02	<i>Pododesmus machrochisma</i>	1.7	~1
RH98-02-351	RH98-02	<i>Pododesmus machrochisma</i>	4.6	~1
RH98-02-352	RH98-02	<i>Pododesmus machrochisma</i>	7.5	~1
RH98-02-353	RH98-02	<i>Pododesmus machrochisma</i>	15.5	20 frag's
RH98-02-354	RH98-02	<i>Pododesmus machrochisma</i>	7.2	~1
RH98-02-355	RH98-02	<i>Pododesmus machrochisma</i>	3.8	1

RH98-02-356	RH98-02	<i>Pododesmus machrochisma</i>	3	1
RH98-02-357	RH98-02	<i>Pododesmus machrochisma</i>	0.3	1
RH98-02-358	RH98-02	<i>Pododesmus machrochisma</i>	1	1
RH98-02-359	RH98-02	<i>Pododesmus machrochisma</i>	1.6	1
RH98-02-360	RH98-02	<i>Pododesmus machrochisma</i>	1.9	1
RH98-02-361	RH98-02	<i>Pododesmus machrochisma</i>	0.5	1
RH98-02-362	RH98-02	<i>Pododesmus machrochisma</i>	1.1	1
RH98-02-363	RH98-02	<i>Pododesmus machrochisma</i>	1	~1
RH98-02-364	RH98-02	<i>Pododesmus machrochisma</i>	1.3	1
RH98-02-365	RH98-02	<i>Pododesmus machrochisma</i>	0.4	~1
RH98-02-366	RH98-02	<i>Pododesmus machrochisma</i>	0.1	1
RH98-02-367	RH98-02	<i>Pododesmus machrochisma</i>	3.7	~1
RH98-02-368	RH98-02	<i>Pododesmus machrochisma</i>	0.1	1
RH98-02-369	RH98-02	<i>Pododesmus machrochisma</i>	15.3	28 frag's
RH98-02-370	RH98-02	<i>Macoma inquinata</i>	3.5	~1
RH98-02-371	RH98-02	<i>Macoma inquinata</i>	1	1
RH98-02-372	RH98-02	<i>Macoma inquinata</i>	3.8	~1
RH98-02-373	RH98-02	<i>Macoma inquinata</i>	4	1
RH98-02-374	RH98-02	<i>Macoma inquinata</i>	2.5	~1
RH98-02-375	RH98-02	<i>Macoma inquinata</i>	0.8	1
RH98-02-376	RH98-02	<i>Macoma inquinata</i>	1	~1
RH98-02-377	RH98-02	<i>Macoma inquinata</i>	1.5	1
RH98-02-378	RH98-02	<i>Macoma inquinata</i>	3.3	~1
RH98-02-379	RH98-02	<i>Macoma inquinata</i>	0.6	~1
RH98-02-380	RH98-02	<i>Macoma inquinata</i>	1	~1
RH98-02-381	RH98-02	<i>Macoma inquinata</i>	2.5	~1
RH98-02-382	RH98-02	<i>Macoma inquinata</i>	1.6	~1
RH98-02-383	RH98-02	<i>Macoma inquinata</i>	1.9	~1
RH98-02-384	RH98-02	<i>Macoma inquinata</i>	4.7	1
RH98-02-385	RH98-02	<i>Macoma inquinata</i>	2.6	~1
RH98-02-386	RH98-02	<i>Macoma inquinata</i>	1.9	1
RH98-02-387	RH98-02	<i>Macoma inquinata</i>	2.6	~1
RH98-02-388	RH98-02	<i>Macoma inquinata</i>	3.9	1
RH98-02-389	RH98-02	<i>Macoma inquinata</i>	1.5	~1
RH98-02-390	RH98-02	<i>Macoma inquinata</i>	0.7	~1
RH98-02-391	RH98-02	<i>Macoma inquinata</i>	2.3	~1
RH98-02-392	RH98-02	<i>Macoma inquinata</i>	1.4	~1
RH98-02-393	RH98-02	<i>Macoma inquinata</i>	2.5	~1
RH98-02-394	RH98-02	<i>Macoma inquinata</i>	3.9	~1
RH98-02-395	RH98-02	<i>Macoma inquinata</i>	1.7	~1
RH98-02-396	RH98-02	<i>Macoma inquinata</i>	1.5	~1
RH98-02-397	RH98-02	<i>Macoma inquinata</i>	4.8	1
RH98-02-398	RH98-02	<i>Macoma inquinata</i>	5.6	1
RH98-02-399	RH98-02	<i>Macoma inquinata</i>	2.7	1
RH98-02-400	RH98-02	<i>Macoma inquinata</i>	4.5	1
RH98-02-401	RH98-02	<i>Macoma inquinata</i>	4.1	~1
RH98-02-402	RH98-02	<i>Macoma inquinata</i>	2.2	~1
RH98-02-403	RH98-02	<i>Macoma inquinata</i>	4.4	~1
RH98-02-404	RH98-02	<i>Macoma inquinata</i>	2.6	1
RH98-02-405	RH98-02	<i>Macoma inquinata</i>	1.3	~1
RH98-02-406	RH98-02	<i>Macoma inquinata</i>	1	1
RH98-02-407	RH98-02	<i>Macoma inquinata</i>	1.2	~1
RH98-02-408	RH98-02	<i>Macoma inquinata</i>	2	~1
RH98-02-409	RH98-02	<i>Macoma inquinata</i>	1.4	~1
RH98-02-410	RH98-02	<i>Macoma inquinata</i>	0.4	~1
RH98-02-411	RH98-02	<i>Macoma inquinata</i>	5.8	1
RH98-02-412	RH98-02	<i>Macoma inquinata</i>	5.9	1
RH98-02-413	RH98-02	<i>Macoma inquinata</i>	2.7	1
RH98-02-414	RH98-02	<i>Macoma inquinata</i>	2.4	1
RH98-02-415	RH98-02	<i>Macoma inquinata</i>	2.6	~1
RH98-02-416	RH98-02	<i>Macoma inquinata</i>	2.9	1
RH98-02-417	RH98-02	<i>Macoma inquinata</i>	0.8	1
RH98-02-418	RH98-02	<i>Macoma inquinata</i>	1.5	~1
RH98-02-419	RH98-02	<i>Macoma inquinata</i>	1.5	~1

RH98-02-420	RH98-02	<i>Macoma inquinata</i>	0.9	~1
RH98-02-421	RH98-02	<i>Macoma inquinata</i>	3.2	1
RH98-02-422	RH98-02	<i>Macoma inquinata</i>	3.1	1
RH98-02-423	RH98-02	<i>Macoma inquinata</i>	1	1
RH98-02-424	RH98-02	<i>Macoma inquinata</i>	1.8	~1
RH98-02-425	RH98-02	<i>Clinocardium nuttallii</i>	0.5	~1
RH98-02-426	RH98-02	<i>Clinocardium nuttallii</i>	1.5	~1
RH98-02-427	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-428	RH98-02	<i>Crepidula adunca</i>	0.3	1
RH98-02-429	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-430	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-431	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-432	RH98-02	<i>Crepidula adunca</i>	0.6	1
RH98-02-433	RH98-02	<i>Crepidula adunca</i>	0.4	1
RH98-02-434	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-435	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-436	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-437	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-438	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-439	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-440	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-441	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-442	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-443	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-444	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-445	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-446	RH98-02	<i>Crepidula adunca</i>	0.4	1
RH98-02-447	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-448	RH98-02	<i>Crepidula adunca</i>	0.3	1
RH98-02-449	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-450	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-451	RH98-02	<i>Crepidula adunca</i>	0.6	1
RH98-02-452	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-453	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-454	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-455	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-456	RH98-02	<i>Crepidula adunca</i>	0.1	~1
RH98-02-457	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-458	RH98-02	<i>Crepidula adunca</i>	0.6	1
RH98-02-459	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-460	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-461	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-462	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-463	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-464	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-465	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-466	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-467	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-468	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-469	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-470	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-471	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-472	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-473	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-474	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-475	RH98-02	<i>Crepidula adunca</i>	0.4	1
RH98-02-476	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-477	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-478	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-479	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-480	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-481	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-482	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-483	RH98-02	<i>Crepidula adunca</i>	0.2	1

RH98-02-484	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-485	RH98-02	<i>Crepidula adunca</i>	0.3	1
RH98-02-486	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-487	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-488	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-489	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-490	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-491	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-492	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-493	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-494	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-495	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-496	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-497	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-498	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-499	RH98-02	<i>Crepidula adunca</i>	0.2	1
RH98-02-500	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-501	RH98-02	<i>Crepidula adunca</i>	0.1	1
RH98-02-502	RH98-02	<i>Lirabuccinum dirum</i>	2.5	1
RH98-02-503	RH98-02	<i>Nassarius mendicus</i>	0.3	1
RH98-02-504	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-505	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-506	RH98-02	<i>Nassarius mendicus</i>	0.1	~1
RH98-02-507	RH98-02	<i>Nassarius mendicus</i>	0.1	1
RH98-02-508	RH98-02	<i>Nassarius mendicus</i>	0.2	~1
RH98-02-509	RH98-02	<i>Nassarius mendicus</i>	0.1	~1
RH98-02-510	RH98-02	<i>Nassarius mendicus</i>	0.1	1
RH98-02-511	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-512	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-513	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-514	RH98-02	<i>Nassarius mendicus</i>	0.1	1
RH98-02-515	RH98-02	<i>Nassarius mendicus</i>	0.2	~1
RH98-02-516	RH98-02	<i>Nassarius mendicus</i>	0.1	1
RH98-02-517	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-518	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-519	RH98-02	<i>Nassarius mendicus</i>	0.2	~1
RH98-02-520	RH98-02	<i>Nassarius mendicus</i>	0.1	~1
RH98-02-521	RH98-02	<i>Nassarius mendicus</i>	0.1	1
RH98-02-522	RH98-02	<i>Nassarius mendicus</i>	0.3	1
RH98-02-523	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-524	RH98-02	<i>Nassarius mendicus</i>	0.4	1
RH98-02-525	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-526	RH98-02	<i>Nassarius mendicus</i>	0.1	1
RH98-02-527	RH98-02	<i>Nassarius mendicus</i>	0.1	1
RH98-02-528	RH98-02	<i>Nassarius mendicus</i>	0.2	1
RH98-02-529	RH98-02	<i>Nassarius mendicus</i>	0.2	~1
RH98-02-530	RH98-02	<i>Nassarius mendicus</i>	0.1	~1
RH98-02-531	RH98-02	<i>Mytilus trossulus</i>	0.6	~1
RH98-02-532	RH98-02	<i>Mytilus trossulus</i>	0.5	~1
RH98-02-533	RH98-02	<i>Mytilus trossulus</i>	0.2	~1
RH98-02-534	RH98-02	<i>Petalaconchus compactus</i>	0.3	1
RH98-02-535	RH98-02	<i>Diplodonta impolita</i>	0.2	1
RH98-02-536	RH98-02	<i>Macoma incongrua</i>	1.1	~1
RH98-02-537	RH98-02	<i>Macoma incongrua</i>	1.6	1
RH98-02-538	RH98-02	<i>Macoma incongrua</i>	0.8	~1
RH98-02-539	RH98-02	<i>Macoma incongrua</i>	1.2	1
RH98-02-540	RH98-02	<i>Macoma incongrua</i>	2.1	1
RH98-02-541	RH98-02	<i>Macoma incongrua</i>	2.2	1
RH98-02-542	RH98-02	<i>Macoma incongrua</i>	2.6	1
RH98-02-543	RH98-02	<i>Macoma incongrua</i>	1.4	~1
RH98-02-544	RH98-02	<i>Macoma incongrua</i>	2	1
RH98-02-545	RH98-02	<i>Macoma incongrua</i>	2.1	1
RH98-02-546	RH98-02	<i>Macoma incongrua</i>	0.5	~1
RH98-02-547	RH98-02	<i>Macoma incongrua</i>	0.5	~1

RH98-02-548	RH98-02	<i>Macoma incongrua</i>	0.3	-1
RH98-02-549	RH98-02	<i>Macoma incongrua</i>	0.6	-1
RH98-02-550	RH98-02	<i>Macoma incongrua</i>	1.1	1
RH98-02-551	RH98-02	<i>Macoma incongrua</i>	1.7	1
RH98-02-552	RH98-02	<i>Macoma incongrua</i>	1.1	-1
RH98-02-553	RH98-02	<i>Macoma incongrua</i>	0.8	1
RH98-02-554	RH98-02	<i>Macoma incongrua</i>	0.1	1
RH98-02-555	RH98-02	<i>Macoma nasuta</i>	5.6	1
RH98-02-556	RH98-02	<i>Macoma nasuta</i>	2	-1
RH98-02-557	RH98-02	<i>Balanus spp.</i>	4.4	26 frag's
RH98-02-558	RH98-02	<i>Balanus spp.</i>	3.2	27 frag's
RH98-02-559	RH98-02	<i>Balanus spp.</i>	5.5	51 frag's
RH98-02-560	RH98-02	<i>Balanus spp.</i>	0.2	1
RH98-02-561	RH98-02	Unidentified clam shell frag's	57.5	112 frag's
RH98-02-562	RH98-02	Unidentified clam shell frag's	51	71 frag's
RH98-02-563	RH98-02	Unidentified clam shell frag's	15.2	35 frag's
RH98-02-564	RH98-02	Unidentified clam shell frag's	91.4	159 frag's
Total weight (grams) RH98-02			2528.8	
RH98-04-1	RH98-04	<i>Saxidomus giganteus</i>	14.9	-1
RH98-04-2	RH98-04	<i>Saxidomus giganteus</i>	33.9	1
RH98-04-3	RH98-04	<i>Saxidomus giganteus</i>	54.1	1
RH98-04-4	RH98-04	<i>Saxidomus giganteus</i>	11.5	1
RH98-04-5	RH98-04	<i>Saxidomus giganteus</i>	12.5	-1
RH98-04-6	RH98-04	<i>Saxidomus giganteus</i>	8.5	-1
RH98-04-7	RH98-04	<i>Saxidomus giganteus</i>	35.4	1
RH98-04-8	RH98-04	<i>Saxidomus giganteus</i>	8	-1
RH98-04-9	RH98-04	<i>Saxidomus giganteus</i>	2.4	-1
RH98-04-10	RH98-04	<i>Saxidomus giganteus</i>	1.4	-1
RH98-04-11	RH98-04	<i>Saxidomus giganteus</i>	1.3	1
RH98-04-12	RH98-04	<i>Saxidomus giganteus</i>	1.4	-1
RH98-04-13	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-14	RH98-04	<i>Saxidomus giganteus</i>	2.8	1
RH98-04-15	RH98-04	<i>Saxidomus giganteus</i>	7.6	-1
RH98-04-16	RH98-04	<i>Saxidomus giganteus</i>	12.1	-1
RH98-04-17	RH98-04	<i>Saxidomus giganteus</i>	2.6	-1
RH98-04-18	RH98-04	<i>Saxidomus giganteus</i>	2.4	-1
RH98-04-19	RH98-04	<i>Saxidomus giganteus</i>	0.6	-1
RH98-04-20	RH98-04	<i>Saxidomus giganteus</i>	0.4	-1
RH98-04-21	RH98-04	<i>Saxidomus giganteus</i>	8.3	1
RH98-04-22	RH98-04	<i>Saxidomus giganteus</i>	11.2	-1
RH98-04-23	RH98-04	<i>Saxidomus giganteus</i>	8.3	1
RH98-04-24	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-25	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1
RH98-04-26	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-27	RH98-04	<i>Saxidomus giganteus</i>	0.3	-1
RH98-04-28	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1
RH98-04-29	RH98-04	<i>Saxidomus giganteus</i>	6	-1
RH98-04-30	RH98-04	<i>Saxidomus giganteus</i>	1	-1
RH98-04-31	RH98-04	<i>Saxidomus giganteus</i>	4.9	-1
RH98-04-32	RH98-04	<i>Saxidomus giganteus</i>	0.7	-1
RH98-04-33	RH98-04	<i>Saxidomus giganteus</i>	0.4	-1
RH98-04-34	RH98-04	<i>Saxidomus giganteus</i>	0.9	-1
RH98-04-35	RH98-04	<i>Saxidomus giganteus</i>	0.9	-1
RH98-04-36	RH98-04	<i>Saxidomus giganteus</i>	1.1	-1
RH98-04-37	RH98-04	<i>Saxidomus giganteus</i>	0.1	1
RH98-04-38	RH98-04	<i>Saxidomus giganteus</i>	0.7	-1
RH98-04-39	RH98-04	<i>Saxidomus giganteus</i>	0.1	-1
RH98-04-40	RH98-04	<i>Saxidomus giganteus</i>	0.3	-1
RH98-04-41	RH98-04	<i>Saxidomus giganteus</i>	0.6	-1
RH98-04-42	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-43	RH98-04	<i>Saxidomus giganteus</i>	1.8	-1
RH98-04-44	RH98-04	<i>Saxidomus giganteus</i>	1.5	-1
RH98-04-45	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1

RH98-04-46	RH98-04	<i>Saxidomus giganteus</i>	0.3	~1
RH98-04-47	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-48	RH98-04	<i>Saxidomus giganteus</i>	0.4	~1
RH98-04-49	RH98-04	<i>Saxidomus giganteus</i>	0.5	~1
RH98-04-50	RH98-04	<i>Saxidomus giganteus</i>	0.6	~1
RH98-04-51	RH98-04	<i>Saxidomus giganteus</i>	0.5	~1
RH98-04-52	RH98-04	<i>Saxidomus giganteus</i>	0.1	1
RH98-04-53	RH98-04	<i>Saxidomus giganteus</i>	2.7	~1
RH98-04-54	RH98-04	<i>Saxidomus giganteus</i>	0.2	~1
RH98-04-55	RH98-04	<i>Saxidomus giganteus</i>	3.8	~1
RH98-04-56	RH98-04	<i>Saxidomus giganteus</i>	1.7	~1
RH98-04-57	RH98-04	<i>Saxidomus giganteus</i>	0.2	~1
RH98-04-58	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-59	RH98-04	<i>Saxidomus giganteus</i>	0.3	~1
RH98-04-60	RH98-04	<i>Saxidomus giganteus</i>	0.6	1
RH98-04-61	RH98-04	<i>Saxidomus giganteus</i>	1.1	~1
RH98-04-62	RH98-04	<i>Saxidomus giganteus</i>	0.6	~1
RH98-04-63	RH98-04	<i>Saxidomus giganteus</i>	0.1	1
RH98-04-64	RH98-04	<i>Saxidomus giganteus</i>	0.5	~1
RH98-04-65	RH98-04	<i>Saxidomus giganteus</i>	1.2	1
RH98-04-66	RH98-04	<i>Saxidomus giganteus</i>	0.9	~1
RH98-04-67	RH98-04	<i>Saxidomus giganteus</i>	0.3	~1
RH98-04-68	RH98-04	<i>Saxidomus giganteus</i>	0.5	~1
RH98-04-69	RH98-04	<i>Saxidomus giganteus</i>	0.3	1
RH98-04-70	RH98-04	<i>Saxidomus giganteus</i>	0.2	~1
RH98-04-71	RH98-04	<i>Saxidomus giganteus</i>	0.2	~1
RH98-04-72	RH98-04	<i>Saxidomus giganteus</i>	0.4	~1
RH98-04-73	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-74	RH98-04	<i>Saxidomus giganteus</i>	0.4	1
RH98-04-75	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-76	RH98-04	<i>Saxidomus giganteus</i>	1	~1
RH98-04-77	RH98-04	<i>Saxidomus giganteus</i>	1	~1
RH98-04-78	RH98-04	<i>Saxidomus giganteus</i>	0.1	1
RH98-04-79	RH98-04	<i>Saxidomus giganteus</i>	123.4	55 frag's
RH98-04-80	RH98-04	<i>Saxidomus giganteus</i>	0.3	~1
RH98-04-81	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-82	RH98-04	<i>Saxidomus giganteus</i>	0.6	~1
RH98-04-83	RH98-04	<i>Saxidomus giganteus</i>	0.2	~1
RH98-04-84	RH98-04	<i>Saxidomus giganteus</i>	0.2	~1
RH98-04-85	RH98-04	<i>Saxidomus giganteus</i>	0.4	~1
RH98-04-86	RH98-04	<i>Saxidomus giganteus</i>	0.5	~1
RH98-04-87	RH98-04	<i>Saxidomus giganteus</i>	1.1	~1
RH98-04-88	RH98-04	<i>Saxidomus giganteus</i>	0.5	1
RH98-04-89	RH98-04	<i>Saxidomus giganteus</i>	0.1	1
RH98-04-90	RH98-04	<i>Saxidomus giganteus</i>	0.9	~1
RH98-04-91	RH98-04	<i>Saxidomus giganteus</i>	1.5	~1
RH98-04-92	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-93	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-94	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-95	RH98-04	<i>Saxidomus giganteus</i>	0.1	1
RH98-04-96	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-97	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-98	RH98-04	<i>Saxidomus giganteus</i>	0.1	~1
RH98-04-99	RH98-04	<i>Saxidomus giganteus</i>	120	48 frag's
RH98-04-100	RH98-04	<i>Saxidomus giganteus</i>	0.5	~1
RH98-04-101	RH98-04	<i>Saxidomus giganteus</i>	33.2	1
RH98-04-102	RH98-04	<i>Saxidomus giganteus</i>	3.4	~1
RH98-04-103	RH98-04	<i>Saxidomus giganteus</i>	2.4	1
RH98-04-104	RH98-04	<i>Saxidomus giganteus</i>	0.2	~1
RH98-04-105	RH98-04	<i>Saxidomus giganteus</i>	1.1	~1
RH98-04-106	RH98-04	<i>Saxidomus giganteus</i>	0.5	~1
RH98-04-107	RH98-04	<i>Saxidomus giganteus</i>	0.5	1
RH98-04-108	RH98-04	<i>Saxidomus giganteus</i>	4.9	1
RH98-04-109	RH98-04	<i>Saxidomus giganteus</i>	2.6	1

RH98-04-110	RH98-04	<i>Saxidomus giganteus</i>	1	-1
RH98-04-111	RH98-04	<i>Saxidomus giganteus</i>	1.9	-1
RH98-04-112	RH98-04	<i>Saxidomus giganteus</i>	6.2	-1
RH98-04-113	RH98-04	<i>Saxidomus giganteus</i>	6.1	-1
RH98-04-114	RH98-04	<i>Saxidomus giganteus</i>	1.2	-1
RH98-04-115	RH98-04	<i>Saxidomus giganteus</i>	2.8	-1
RH98-04-116	RH98-04	<i>Saxidomus giganteus</i>	0.1	-1
RH98-04-117	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-118	RH98-04	<i>Saxidomus giganteus</i>	0.9	1
RH98-04-119	RH98-04	<i>Saxidomus giganteus</i>	0.1	-1
RH98-04-120	RH98-04	<i>Saxidomus giganteus</i>	0.4	-1
RH98-04-121	RH98-04	<i>Saxidomus giganteus</i>	0.3	-1
RH98-04-122	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1
RH98-04-123	RH98-04	<i>Saxidomus giganteus</i>	2.7	-1
RH98-04-124	RH98-04	<i>Saxidomus giganteus</i>	0.2	-1
RH98-04-125	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-126	RH98-04	<i>Saxidomus giganteus</i>	0.6	-1
RH98-04-127	RH98-04	<i>Saxidomus giganteus</i>	1	1
RH98-04-128	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1
RH98-04-129	RH98-04	<i>Saxidomus giganteus</i>	0.3	-1
RH98-04-130	RH98-04	<i>Saxidomus giganteus</i>	1.1	1
RH98-04-131	RH98-04	<i>Saxidomus giganteus</i>	0.3	1
RH98-04-132	RH98-04	<i>Saxidomus giganteus</i>	0.1	-1
RH98-04-133	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1
RH98-04-134	RH98-04	<i>Saxidomus giganteus</i>	0.3	1
RH98-04-135	RH98-04	<i>Saxidomus giganteus</i>	0.2	1
RH98-04-136	RH98-04	<i>Saxidomus giganteus</i>	1.3	-1
RH98-04-137	RH98-04	<i>Saxidomus giganteus</i>	0.9	-1
RH98-04-138	RH98-04	<i>Saxidomus giganteus</i>	0.3	-1
RH98-04-139	RH98-04	<i>Saxidomus giganteus</i>	0.6	-1
RH98-04-140	RH98-04	<i>Saxidomus giganteus</i>	0.2	-1
RH98-04-141	RH98-04	<i>Saxidomus giganteus</i>	0.6	-1
RH98-04-142	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1
RH98-04-143	RH98-04	<i>Saxidomus giganteus</i>	0.5	1
RH98-04-144	RH98-04	<i>Saxidomus giganteus</i>	0.8	-1
RH98-04-145	RH98-04	<i>Saxidomus giganteus</i>	0.7	-1
RH98-04-146	RH98-04	<i>Saxidomus giganteus</i>	0.4	-1
RH98-04-147	RH98-04	<i>Saxidomus giganteus</i>	0.5	-1
RH98-04-148	RH98-04	<i>Saxidomus giganteus</i>	0.2	-1
RH98-04-149	RH98-04	<i>Saxidomus giganteus</i>	0.3	1
RH98-04-150	RH98-04	<i>Protothaca staminea</i>	44.5	2 art'd
RH98-04-151	RH98-04	<i>Protothaca staminea</i>	7	1
RH98-04-152	RH98-04	<i>Protothaca staminea</i>	9.4	1
RH98-04-153	RH98-04	<i>Protothaca staminea</i>	3.1	-1
RH98-04-154	RH98-04	<i>Protothaca staminea</i>	8	1
RH98-04-155	RH98-04	<i>Protothaca staminea</i>	1.3	-1
RH98-04-156	RH98-04	<i>Protothaca staminea</i>	2.2	-1
RH98-04-157	RH98-04	<i>Protothaca staminea</i>	0.4	1
RH98-04-158	RH98-04	<i>Protothaca staminea</i>	0.4	-1
RH98-04-159	RH98-04	<i>Protothaca staminea</i>	0.7	-1
RH98-04-160	RH98-04	<i>Protothaca staminea</i>	1.5	-1
RH98-04-161	RH98-04	<i>Protothaca staminea</i>	1.9	1
RH98-04-162	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-163	RH98-04	<i>Protothaca staminea</i>	0.7	-1
RH98-04-164	RH98-04	<i>Protothaca staminea</i>	0.4	-1
RH98-04-165	RH98-04	<i>Protothaca staminea</i>	0.3	-1
RH98-04-166	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-167	RH98-04	<i>Protothaca staminea</i>	0.2	-1
RH98-04-168	RH98-04	<i>Protothaca staminea</i>	2.2	-1
RH98-04-169	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-170	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-171	RH98-04	<i>Protothaca staminea</i>	2.7	-1
RH98-04-172	RH98-04	<i>Protothaca staminea</i>	0.9	-1
RH98-04-173	RH98-04	<i>Protothaca staminea</i>	2.6	-1

RH98-04-174	RH98-04	<i>Protothaca staminea</i>	1.3	~1
RH98-04-175	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-176	RH98-04	<i>Protothaca staminea</i>	0.2	~1
RH98-04-177	RH98-04	<i>Protothaca staminea</i>	0.5	~1
RH98-04-178	RH98-04	<i>Protothaca staminea</i>	1.4	~1
RH98-04-179	RH98-04	<i>Protothaca staminea</i>	0.8	~1
RH98-04-180	RH98-04	<i>Protothaca staminea</i>	0.8	~1
RH98-04-181	RH98-04	<i>Protothaca staminea</i>	4.7	1
RH98-04-182	RH98-04	<i>Protothaca staminea</i>	0.4	1
RH98-04-183	RH98-04	<i>Protothaca staminea</i>	1.9	~1
RH98-04-184	RH98-04	<i>Protothaca staminea</i>	0.2	~1
RH98-04-185	RH98-04	<i>Protothaca staminea</i>	0.9	~1
RH98-04-186	RH98-04	<i>Protothaca staminea</i>	1	~1
RH98-04-187	RH98-04	<i>Protothaca staminea</i>	0.5	~1
RH98-04-188	RH98-04	<i>Protothaca staminea</i>	0.8	1
RH98-04-189	RH98-04	<i>Protothaca staminea</i>	0.2	~1
RH98-04-190	RH98-04	<i>Protothaca staminea</i>	0.6	~1
RH98-04-191	RH98-04	<i>Protothaca staminea</i>	0.3	~1
RH98-04-192	RH98-04	<i>Protothaca staminea</i>	0.3	~1
RH98-04-193	RH98-04	<i>Protothaca staminea</i>	0.1	~1
RH98-04-194	RH98-04	<i>Protothaca staminea</i>	1.1	~1
RH98-04-195	RH98-04	<i>Protothaca staminea</i>	0.4	~1
RH98-04-196	RH98-04	<i>Protothaca staminea</i>	2	~1
RH98-04-197	RH98-04	<i>Protothaca staminea</i>	1	~1
RH98-04-198	RH98-04	<i>Protothaca staminea</i>	2.8	~1
RH98-04-199	RH98-04	<i>Protothaca staminea</i>	0.9	~1
RH98-04-200	RH98-04	<i>Protothaca staminea</i>	0.3	~1
RH98-04-201	RH98-04	<i>Protothaca staminea</i>	0.6	~1
RH98-04-202	RH98-04	<i>Protothaca staminea</i>	1	~1
RH98-04-203	RH98-04	<i>Protothaca staminea</i>	0.9	~1
RH98-04-204	RH98-04	<i>Protothaca staminea</i>	1	~1
RH98-04-205	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-206	RH98-04	<i>Protothaca staminea</i>	0.9	~1
RH98-04-207	RH98-04	<i>Protothaca staminea</i>	0.3	~1
RH98-04-208	RH98-04	<i>Protothaca staminea</i>	1.3	~1
RH98-04-209	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-210	RH98-04	<i>Protothaca staminea</i>	0.5	1
RH98-04-211	RH98-04	<i>Protothaca staminea</i>	0.1	1
RH98-04-212	RH98-04	<i>Protothaca staminea</i>	0.1	~1
RH98-04-213	RH98-04	<i>Protothaca staminea</i>	0.1	~1
RH98-04-214	RH98-04	<i>Protothaca staminea</i>	0.3	~1
RH98-04-215	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-216	RH98-04	<i>Protothaca staminea</i>	0.2	~1
RH98-04-217	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-218	RH98-04	<i>Protothaca staminea</i>	0.6	1
RH98-04-219	RH98-04	<i>Protothaca staminea</i>	6.1	1
RH98-04-220	RH98-04	<i>Protothaca staminea</i>	0.6	1
RH98-04-221	RH98-04	<i>Protothaca staminea</i>	0.6	1
RH98-04-222	RH98-04	<i>Protothaca staminea</i>	2.9	1
RH98-04-223	RH98-04	<i>Protothaca staminea</i>	0.3	~1
RH98-04-224	RH98-04	<i>Protothaca staminea</i>	0.8	~1
RH98-04-225	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-226	RH98-04	<i>Protothaca staminea</i>	0.6	1
RH98-04-227	RH98-04	<i>Protothaca staminea</i>	0.3	~1
RH98-04-228	RH98-04	<i>Protothaca staminea</i>	1	~1
RH98-04-229	RH98-04	<i>Protothaca staminea</i>	0.4	~1
RH98-04-230	RH98-04	<i>Protothaca staminea</i>	0.4	~1
RH98-04-231	RH98-04	<i>Protothaca staminea</i>	0.5	~1
RH98-04-232	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-233	RH98-04	<i>Protothaca staminea</i>	0.4	~1
RH98-04-234	RH98-04	<i>Protothaca staminea</i>	1.2	~1
RH98-04-235	RH98-04	<i>Protothaca staminea</i>	0.5	1
RH98-04-236	RH98-04	<i>Protothaca staminea</i>	0.4	~1
RH98-04-237	RH98-04	<i>Protothaca staminea</i>	0.1	~1

RH98-04-238	RH98-04	<i>Protothaca staminea</i>	99.2	128 frag's
RH98-04-239	RH98-04	<i>Protothaca staminea</i>	1	-1
RH98-04-240	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-241	RH98-04	<i>Protothaca staminea</i>	0.5	-1
RH98-04-242	RH98-04	<i>Protothaca staminea</i>	0.5	1
RH98-04-243	RH98-04	<i>Protothaca staminea</i>	1.2	-1
RH98-04-244	RH98-04	<i>Protothaca staminea</i>	2.3	-1
RH98-04-245	RH98-04	<i>Protothaca staminea</i>	4.6	1
RH98-04-246	RH98-04	<i>Protothaca staminea</i>	9.2	-1
RH98-04-247	RH98-04	<i>Protothaca staminea</i>	2.7	-1
RH98-04-248	RH98-04	<i>Protothaca staminea</i>	1	-1
RH98-04-249	RH98-04	<i>Protothaca staminea</i>	0.7	-1
RH98-04-250	RH98-04	<i>Protothaca staminea</i>	7.3	1
RH98-04-251	RH98-04	<i>Protothaca staminea</i>	16.6	1
RH98-04-252	RH98-04	<i>Protothaca staminea</i>	1.5	-1
RH98-04-253	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-254	RH98-04	<i>Protothaca staminea</i>	0.4	1
RH98-04-255	RH98-04	<i>Protothaca staminea</i>	3.5	-1
RH98-04-256	RH98-04	<i>Protothaca staminea</i>	1.3	-1
RH98-04-257	RH98-04	<i>Protothaca staminea</i>	0.5	-1
RH98-04-258	RH98-04	<i>Protothaca staminea</i>	1.5	1
RH98-04-259	RH98-04	<i>Protothaca staminea</i>	0.7	-1
RH98-04-260	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-261	RH98-04	<i>Protothaca staminea</i>	1.5	-1
RH98-04-262	RH98-04	<i>Protothaca staminea</i>	1.9	-1
RH98-04-263	RH98-04	<i>Protothaca staminea</i>	0.8	-1
RH98-04-264	RH98-04	<i>Protothaca staminea</i>	1	-1
RH98-04-265	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-266	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-267	RH98-04	<i>Protothaca staminea</i>	0.9	-1
RH98-04-268	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-269	RH98-04	<i>Protothaca staminea</i>	0.5	-1
RH98-04-270	RH98-04	<i>Protothaca staminea</i>	2.1	-1
RH98-04-271	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-272	RH98-04	<i>Protothaca staminea</i>	0.5	-1
RH98-04-273	RH98-04	<i>Protothaca staminea</i>	0.5	1
RH98-04-274	RH98-04	<i>Protothaca staminea</i>	0.4	-1
RH98-04-275	RH98-04	<i>Protothaca staminea</i>	2.6	-1
RH98-04-276	RH98-04	<i>Protothaca staminea</i>	0.4	1
RH98-04-277	RH98-04	<i>Protothaca staminea</i>	0.9	1
RH98-04-278	RH98-04	<i>Protothaca staminea</i>	0.7	-1
RH98-04-279	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-280	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-281	RH98-04	<i>Protothaca staminea</i>	0.6	1
RH98-04-282	RH98-04	<i>Protothaca staminea</i>	1.7	-1
RH98-04-283	RH98-04	<i>Protothaca staminea</i>	1.9	1
RH98-04-284	RH98-04	<i>Protothaca staminea</i>	1.5	-1
RH98-04-285	RH98-04	<i>Protothaca staminea</i>	9.8	-1
RH98-04-286	RH98-04	<i>Protothaca staminea</i>	1.7	1
RH98-04-287	RH98-04	<i>Protothaca staminea</i>	1.2	-1
RH98-04-288	RH98-04	<i>Protothaca staminea</i>	0.9	1
RH98-04-289	RH98-04	<i>Protothaca staminea</i>	2.1	-1
RH98-04-290	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-291	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-292	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-293	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-294	RH98-04	<i>Protothaca staminea</i>	1.3	-1
RH98-04-295	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-296	RH98-04	<i>Protothaca staminea</i>	0.4	-1
RH98-04-297	RH98-04	<i>Protothaca staminea</i>	0.4	-1
RH98-04-298	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-299	RH98-04	<i>Protothaca staminea</i>	0.8	-1
RH98-04-300	RH98-04	<i>Protothaca staminea</i>	0.2	-1
RH98-04-301	RH98-04	<i>Protothaca staminea</i>	0.8	1

RH98-04-302	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-303	RH98-04	<i>Protothaca staminea</i>	0.6	-1
RH98-04-304	RH98-04	<i>Protothaca staminea</i>	0.4	-1
RH98-04-305	RH98-04	<i>Protothaca staminea</i>	0.8	1
RH98-04-306	RH98-04	<i>Protothaca staminea</i>	0.5	-1
RH98-04-307	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-308	RH98-04	<i>Protothaca staminea</i>	0.2	-1
RH98-04-309	RH98-04	<i>Protothaca staminea</i>	0.4	1
RH98-04-310	RH98-04	<i>Protothaca staminea</i>	0.2	1
RH98-04-311	RH98-04	<i>Protothaca staminea</i>	0.1	-1
RH98-04-312	RH98-04	<i>Protothaca staminea</i>	1.1	-1
RH98-04-313	RH98-04	<i>Protothaca staminea</i>	0.2	-1
RH98-04-314	RH98-04	<i>Protothaca staminea</i>	0.4	1
RH98-04-315	RH98-04	<i>Protothaca staminea</i>	0.3	1
RH98-04-316	RH98-04	<i>Protothaca staminea</i>	0.3	-1
RH98-04-317	RH98-04	<i>Protothaca staminea</i>	1.3	-1
RH98-04-318	RH98-04	<i>Protothaca staminea</i>	0.1	-1
RH98-04-319	RH98-04	<i>Protothaca staminea</i>	0.1	-1
RH98-04-320	RH98-04	<i>Protothaca staminea</i>	83.7	121 frag's
RH98-04-321	RH98-04	<i>Protothaca tenerrima</i>	2.7	1
RH98-04-322	RH98-04	<i>Protothaca tenerrima</i>	7.2	1
RH98-04-323	RH98-04	<i>Protothaca tenerrima</i>	1.8	1
RH98-04-324	RH98-04	<i>Protothaca tenerrima</i>	0.7	-1
RH98-04-325	RH98-04	<i>Protothaca tenerrima</i>	2.1	1
RH98-04-326	RH98-04	<i>Protothaca tenerrima</i>	19.8	31 frag's
RH98-04-327	RH98-04	<i>Protothaca tenerrima</i>	0.5	1
RH98-04-328	RH98-04	<i>Protothaca tenerrima</i>	2.4	1
RH98-04-329	RH98-04	<i>Protothaca tenerrima</i>	1.1	-1
RH98-04-330	RH98-04	<i>Protothaca tenerrima</i>	1.2	-1
RH98-04-331	RH98-04	<i>Protothaca tenerrima</i>	1.5	-1
RH98-04-332	RH98-04	<i>Protothaca tenerrima</i>	2.7	1
RH98-04-333	RH98-04	<i>Protothaca tenerrima</i>	1.3	1
RH98-04-334	RH98-04	<i>Protothaca tenerrima</i>	0.4	1
RH98-04-335	RH98-04	<i>Protothaca tenerrima</i>	0.8	-1
RH98-04-336	RH98-04	<i>Protothaca tenerrima</i>	27.7	39 frag's
RH98-04-337	RH98-04	<i>Macoma inquinata</i>	2.4	1
RH98-04-338	RH98-04	<i>Macoma inquinata</i>	0.7	1
RH98-04-339	RH98-04	<i>Macoma inquinata</i>	3.8	1
RH98-04-340	RH98-04	<i>Macoma inquinata</i>	5	1
RH98-04-341	RH98-04	<i>Macoma inquinata</i>	3.4	1
RH98-04-342	RH98-04	<i>Macoma inquinata</i>	1.2	1
RH98-04-343	RH98-04	<i>Macoma inquinata</i>	0.5	1
RH98-04-344	RH98-04	<i>Macoma inquinata</i>	0.4	1
RH98-04-345	RH98-04	<i>Macoma inquinata</i>	3.7	1
RH98-04-346	RH98-04	<i>Macoma inquinata</i>	3.9	1
RH98-04-347	RH98-04	<i>Macoma inquinata</i>	1.6	-1
RH98-04-348	RH98-04	<i>Macoma inquinata</i>	0.3	1
RH98-04-349	RH98-04	<i>Macoma inquinata</i>	1.4	-1
RH98-04-350	RH98-04	<i>Macoma inquinata</i>	3.4	-1
RH98-04-351	RH98-04	<i>Macoma inquinata</i>	3	1
RH98-04-352	RH98-04	<i>Macoma inquinata</i>	2.2	-1
RH98-04-353	RH98-04	<i>Macoma inquinata</i>	3.9	1
RH98-04-354	RH98-04	<i>Macoma inquinata</i>	5.3	1
RH98-04-355	RH98-04	<i>Macoma inquinata</i>	1	1
			0.5	1
			0.2	1
			0.3	1
			1.7	1
			1.8	1
			0.3	1
			1.8	-1
			0.5	1
			0.5	-1
			0.9	1

RH98-04-356	RH98-04	<i>Macoma inquinata</i>	0.8	~1
RH98-04-357	RH98-04	<i>Macoma inquinata</i>	0.2	~1
RH98-04-358	RH98-04	<i>Macoma inquinata</i>	2	1
RH98-04-359	RH98-04	<i>Macoma inquinata</i>	1.3	~1
RH98-04-360	RH98-04	<i>Macoma inquinata</i>	1.6	1
RH98-04-361	RH98-04	<i>Macoma inquinata</i>	3.6	1
RH98-04-362	RH98-04	<i>Macoma incongrua</i>	2.1	1
RH98-04-363	RH98-04	<i>Macoma incongrua</i>	1.3	1
RH98-04-364	RH98-04	<i>Macoma incongrua</i>	0.5	~1
RH98-04-365	RH98-04	<i>Macoma incongrua</i>	0.3	1
RH98-04-366	RH98-04	<i>Macoma incongrua</i>	0.2	1
RH98-04-367	RH98-04	<i>Macoma incongrua</i>	2.1	1
RH98-04-368	RH98-04	<i>Macoma incongrua</i>	0.7	1
RH98-04-369	RH98-04	<i>Macoma incongrua</i>	1.8	1
RH98-04-370	RH98-04	<i>Macoma incongrua</i>	1.2	1
RH98-04-371	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-372	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-373	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-374	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-375	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-376	RH98-04	<i>Crepidula adunca</i>	0.4	1
RH98-04-377	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-378	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-379	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-380	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-381	RH98-04	<i>Crepidula adunca</i>	0.8	1
RH98-04-382	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-383	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-384	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-385	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-386	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-387	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-388	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-389	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-390	RH98-04	<i>Crepidula adunca</i>	0.1	~1
RH98-04-391	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-392	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-393	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-394	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-395	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-396	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-397	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-398	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-399	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-400	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-401	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-402	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-403	RH98-04	<i>Crepidula adunca</i>	0.4	1
RH98-04-404	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-405	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-406	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-407	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-408	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-409	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-410	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-411	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-412	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-413	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-414	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-415	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-416	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-417	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-418	RH98-04	<i>Crepidula adunca</i>	0.4	1
RH98-04-419	RH98-04	<i>Crepidula adunca</i>	0.1	1

RH98-04-420	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-421	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-422	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-423	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-424	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-425	RH98-04	<i>Crepidula adunca</i>	0.3	1
RH98-04-426	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-427	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-428	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-429	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-430	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-431	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-432	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-433	RH98-04	<i>Crepidula adunca</i>	0.2	1
RH98-04-434	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-435	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-436	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-437	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-438	RH98-04	<i>Crepidula adunca</i>	0.1	1
RH98-04-439	RH98-04	<i>Mytilus trossulus</i>	0.4	~1
RH98-04-440	RH98-04	<i>Mytilus trossulus</i>	0.2	~1
RH98-04-441	RH98-04	<i>Mytilus trossulus</i>	0.1	~1
RH98-04-442	RH98-04	<i>Mytilus trossulus</i>	0.2	2 frag's
RH98-04-443	RH98-04	<i>Mytilus trossulus</i>	0.4	~1
RH98-04-444	RH98-04	<i>Mytilus trossulus</i>	0.1	~1
RH98-04-445	RH98-04	<i>Mytilus trossulus</i>	0.2	6 frag's
RH98-04-446	RH98-04	<i>Nassarius mendicus</i>	0.1	~1
RH98-04-447	RH98-04	<i>Nassarius mendicus</i>	0.1	~1
RH98-04-448	RH98-04	<i>Nassarius mendicus</i>	0.1	~1
RH98-04-449	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-450	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-451	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-452	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-453	RH98-04	<i>Nassarius mendicus</i>	0.1	1
RH98-04-454	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-455	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-456	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-457	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-458	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-459	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-460	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-461	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-462	RH98-04	<i>Nassarius mendicus</i>	0.2	~1
RH98-04-463	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-464	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-465	RH98-04	<i>Nassarius mendicus</i>	0.2	~1
RH98-04-466	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-467	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-468	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-469	RH98-04	<i>Nassarius mendicus</i>	0.1	1
RH98-04-470	RH98-04	<i>Nassarius mendicus</i>	0.1	1
RH98-04-471	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-472	RH98-04	<i>Nassarius mendicus</i>	0.1	1
RH98-04-473	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-474	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-475	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-476	RH98-04	<i>Nassarius mendicus</i>	0.3	1
RH98-04-477	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-478	RH98-04	<i>Nassarius mendicus</i>	0.2	~1
RH98-04-479	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-480	RH98-04	<i>Nassarius mendicus</i>	0.1	~1
RH98-04-481	RH98-04	<i>Nassarius mendicus</i>	0.2	~1
RH98-04-482	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-483	RH98-04	<i>Nassarius mendicus</i>	0.2	1

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RH98-04-548	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-549	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-550	RH98-04	<i>Nassarius mendicus</i>	0.1	1
RH98-04-551	RH98-04	<i>Nassarius mendicus</i>	0.1	1
RH98-04-552	RH98-04	<i>Nassarius mendicus</i>	0.2	1
RH98-04-553	RH98-04	<i>Nassarius mendicus</i>	0.2	~1
RH98-04-554	RH98-04	<i>Nassarius mendicus</i>	0.1	~1
RH98-04-555	RH98-04	<i>Nassarius mendicus</i>	0.2	~1
RH98-04-556	RH98-04	<i>Nassarius mendicus</i>	0.2	~1
RH98-04-557	RH98-04	<i>Nassarius mendicus</i>	0.1	~1
RH98-04-558	RH98-04	<i>Nassarius mendicus</i>	0.1	~1
RH98-04-559	RH98-04	<i>Tectura persona</i>	0.1	1
RH98-04-560	RH98-04	<i>Tectura persona</i>	0.1	1
RH98-04-561	RH98-04	<i>Tectura persona</i>	0.1	1
RH98-04-562	RH98-04	<i>Mya truncata</i>	0.1	1
RH98-04-563	RH98-04	<i>Mya truncata</i>	0.2	1
RH98-04-564	RH98-04	<i>Mya truncata</i>	0.3	1
RH98-04-565	RH98-04	<i>Mya truncata</i>	0.1	~1
RH98-04-566	RH98-04	<i>Clinocardium nuttallii</i>	0.6	~1
RH98-04-567	RH98-04	<i>Clinocardium nuttallii</i>	1.2	5 frag's
RH98-04-568	RH98-04	<i>Clinocardium nuttallii</i>	0.9	1
RH98-04-569	RH98-04	<i>Clinocardium nuttallii</i>	0.2	~1
RH98-04-570	RH98-04	<i>Clinocardium nuttallii</i>	2.6	7 frag's
RH98-04-571	RH98-04	<i>Littorina sitkana</i>	0.2	1
RH98-04-572	RH98-04	<i>Littorina sitkana</i>	0.1	1
RH98-04-573	RH98-04	<i>Littorina sitkana</i>	0.2	1
RH98-04-574	RH98-04	<i>Littorina sitkana</i>	0.2	1
RH98-04-575	RH98-04	<i>Littorina sitkana</i>	0.3	~1
RH98-04-576	RH98-04	<i>Littorina scutulata</i>	0.1	1
RH98-04-577	RH98-04	<i>Littorina scutulata</i>	0.1	1
RH98-04-578	RH98-04	<i>Littorina scutulata</i>	0.2	1
RH98-04-579	RH98-04	<i>Littorina scutulata</i>	0.1	1
RH98-04-580	RH98-04	<i>Littorina scutulata</i>	0.1	1
RH98-04-581	RH98-04	<i>Littorina scutulata</i>	0.2	1
RH98-04-582	RH98-04	<i>Littorina scutulata</i>	0.1	~1
RH98-04-583	RH98-04	<i>Littorina scutulata</i>	0.1	1
RH98-04-584	RH98-04	<i>Littorina scutulata</i>	0.2	1
RH98-04-585	RH98-04	<i>Littorina scutulata</i>	0.2	~1
RH98-04-586	RH98-04	<i>Pododesmus machrochisma</i>	15.6	1
RH98-04-587	RH98-04	<i>Pododesmus machrochisma</i>	28.2	~1
RH98-04-588	RH98-04	<i>Pododesmus machrochisma</i>	21	1
RH98-04-589	RH98-04	<i>Pododesmus machrochisma</i>	5.4	1
RH98-04-590	RH98-04	<i>Pododesmus machrochisma</i>	8	1
RH98-04-591	RH98-04	<i>Pododesmus machrochisma</i>	9.5	1
RH98-04-592	RH98-04	<i>Pododesmus machrochisma</i>	1.5	1
RH98-04-593	RH98-04	<i>Pododesmus machrochisma</i>	0.9	1
RH98-04-594	RH98-04	<i>Pododesmus machrochisma</i>	1	1
RH98-04-595	RH98-04	<i>Pododesmus machrochisma</i>	0.6	1
RH98-04-596	RH98-04	<i>Pododesmus machrochisma</i>	1.8	1
RH98-04-597	RH98-04	<i>Pododesmus machrochisma</i>	1.7	1
RH98-04-598	RH98-04	<i>Pododesmus machrochisma</i>	3.5	1
RH98-04-599	RH98-04	<i>Pododesmus machrochisma</i>	1.8	1
RH98-04-600	RH98-04	<i>Pododesmus machrochisma</i>	1.6	~1
RH98-04-601	RH98-04	<i>Pododesmus machrochisma</i>	0.5	1
RH98-04-602	RH98-04	<i>Pododesmus machrochisma</i>	0.2	1
RH98-04-603	RH98-04	<i>Pododesmus machrochisma</i>	0.8	~1
RH98-04-604	RH98-04	<i>Pododesmus machrochisma</i>	0.3	1
RH98-04-605	RH98-04	<i>Pododesmus machrochisma</i>	0.4	1
RH98-04-606	RH98-04	<i>Pododesmus machrochisma</i>	0.5	~1
RH98-04-607	RH98-04	<i>Pododesmus machrochisma</i>	2.6	~1
RH98-04-608	RH98-04	<i>Pododesmus machrochisma</i>	7.4	1
RH98-04-609	RH98-04	<i>Pododesmus machrochisma</i>	14.2	1
RH98-04-610	RH98-04	<i>Pododesmus machrochisma</i>	1.2	~1
RH98-04-611	RH98-04	<i>Pododesmus machrochisma</i>	1.4	~1

RH98-04-612	RH98-04	<i>Pododesmus machrochisma</i>	0.5	~1
RH98-04-613	RH98-04	<i>Pododesmus machrochisma</i>	0.7	~1
RH98-04-614	RH98-04	<i>Pododesmus machrochisma</i>	0.6	~1
RH98-04-615	RH98-04	<i>Pododesmus machrochisma</i>	18.6	40 frag's
RH98-04-616	RH98-04	<i>Pododesmus machrochisma</i>	0.8	1
RH98-04-617	RH98-04	<i>Pododesmus machrochisma</i>	0.3	1
RH98-04-618	RH98-04	<i>Pododesmus machrochisma</i>	2.2	1
RH98-04-619	RH98-04	<i>Pododesmus machrochisma</i>	6.4	1
RH98-04-620	RH98-04	<i>Pododesmus machrochisma</i>	8.6	1
RH98-04-621	RH98-04	<i>Pododesmus machrochisma</i>	5.3	1
RH98-04-622	RH98-04	<i>Pododesmus machrochisma</i>	3.4	1
RH98-04-623	RH98-04	<i>Pododesmus machrochisma</i>	0.4	1
RH98-04-624	RH98-04	<i>Pododesmus machrochisma</i>	0.1	1
RH98-04-625	RH98-04	<i>Pododesmus machrochisma</i>	0.2	1
RH98-04-626	RH98-04	<i>Pododesmus machrochisma</i>	1.2	~1
RH98-04-627	RH98-04	<i>Pododesmus machrochisma</i>	0.7	1
RH98-04-628	RH98-04	<i>Pododesmus machrochisma</i>	0.6	1
RH98-04-629	RH98-04	<i>Pododesmus machrochisma</i>	0.8	1
RH98-04-630	RH98-04	<i>Pododesmus machrochisma</i>	3.6	1
RH98-04-631	RH98-04	<i>Pododesmus machrochisma</i>	1	1
RH98-04-632	RH98-04	<i>Pododesmus machrochisma</i>	2	~1
RH98-04-633	RH98-04	<i>Pododesmus machrochisma</i>	7	1
RH98-04-634	RH98-04	<i>Pododesmus machrochisma</i>	2.5	~1
RH98-04-635	RH98-04	<i>Pododesmus machrochisma</i>	0.9	~1
RH98-04-636	RH98-04	<i>Pododesmus machrochisma</i>	3.9	~1
RH98-04-637	RH98-04	<i>Pododesmus machrochisma</i>	0.3	1
RH98-04-638	RH98-04	<i>Pododesmus machrochisma</i>	25.8	40 frag's
RH98-04-639	RH98-04	<i>Bittium eschrichtii</i>	0.2	1
RH98-04-640	RH98-04	<i>Bittium eschrichtii</i>	0.2	1
RH98-04-641	RH98-04	<i>Bittium eschrichtii</i>	0.1	1
RH98-04-642	RH98-04	<i>Bittium eschrichtii</i>	0.1	~1
RH98-04-643	RH98-04	<i>Balanus sp.</i>	1.8	1
RH98-04-644	RH98-04	<i>Balanus spp.</i>	9.1	60 frag's
RH98-04-645	RH98-04	<i>Balanus spp.</i>	10.5	61 frag's
RH98-04-646	RH98-04	Unidentified clam shell frag's	52.1	111 frag's
RH98-04-647	RH98-04	Unidentified clam shell frag's	25.1	72 frag's
RH98-04-648	RH98-04	Unidentified clam shell frag's	85.3	192 frag's
RH98-04-649	RH98-04	Tubeworm	0.1	~1
RH98-04-650	RH98-04	Tubeworm	1.3	1
RH98-04-651	RH98-04	Wood	2.1	1
RH98-04-652	RH98-04	Wood	0.1	1
RH98-04-653	RH98-04	Wood	0.8	1
RH98-04-654	RH98-04	Wood	0.3	1
RH98-04-655	RH98-04	Wood	0.5	1
RH98-04-656	RH98-04	Wood	0.1	1
RH98-04-657	RH98-04	Wood (needle)	0.1	1
RH98-04-658	RH98-04	Wood	12.4	1
RH98-04-659	RH98-04	Wood	2.6	1
RH98-04-660	RH98-04	Wood	0.6	1
RH98-04-661	RH98-04	Wood	0.7	1
RH98-04-662	RH98-04	Wood	0.5	1
RH98-04-663	RH98-04	Wood	0.2	1
RH98-04-664	RH98-04	Wood	0.2	10 frag's
RH98-04-665	RH98-04	Wood	0.2	1
RH98-04-666	RH98-04	Coniferous cones	0.3	1
RH98-04-667	RH98-04	Coniferous cones	0.7	1
RH98-04-668	RH98-04	Coniferous cones	0.7	1
RH98-04-669	RH98-04	Coniferous cones	1.2	1
RH98-04-670	RH98-04	Coniferous cones	1	1
RH98-04-671	RH98-04	Coniferous cones	0.2	1
RH98-04-672	RH98-04	Coniferous cones	0.4	1
RH98-04-673	RH98-04	Lithic	13.8	12 frag's
RH98-04-674	RH98-04	<i>Phoca vitulina</i>		1
Total weight (grams) RH98-04			1709.3	

RH98-06-1	RH98-06	<i>Saxidomus giganteus</i>	4.8	-1
RH98-06-2	RH98-06	<i>Saxidomus giganteus</i>	0.1	-1
RH98-06-3	RH98-06	<i>Saxidomus giganteus</i>	0.6	-1
RH98-06-4	RH98-06	<i>Saxidomus giganteus</i>	0.3	-1
RH98-06-5	RH98-06	<i>Saxidomus giganteus</i>	0.2	-1
RH98-06-6	RH98-06	<i>Saxidomus giganteus</i>	0.2	-1
RH98-06-7	RH98-06	<i>Saxidomus giganteus</i>	0.3	-1
RH98-06-8	RH98-06	<i>Saxidomus giganteus</i>	0.3	-1
RH98-06-9	RH98-06	<i>Saxidomus giganteus</i>	0.1	-1
RH98-06-10	RH98-06	<i>Saxidomus giganteus</i>	0.1	-1
RH98-06-11	RH98-06	<i>Saxidomus giganteus</i>	0.1	-1
RH98-06-12	RH98-06	<i>Saxidomus giganteus</i>	20.5	44 frag's
RH98-06-13	RH98-06	<i>Mytilus trossulus</i>	0.9	17 frag's
RH98-06-14	RH98-06	Tubeworm	0.7	11 frag's
RH98-06-15	RH98-06	Unidentified clam shell frag's	11.2	95 frag's
RH98-06-16	RH98-06	Wood	3.5	32 frag's
Total weight (grams) RH98-06			43.9	
RH98-07-1	RH98-07	<i>Saxidomus giganteus</i>	70.9	-1
RH98-07-2	RH98-07	<i>Saxidomus giganteus</i>	26.3	-1
RH98-07-3	RH98-07	<i>Saxidomus giganteus</i>	1.6	-1
RH98-07-4	RH98-07	<i>Saxidomus giganteus</i>	0.1	-1
RH98-07-5	RH98-07	<i>Saxidomus giganteus</i>	0.3	-1
RH98-07-6	RH98-07	<i>Saxidomus giganteus</i>	0.9	-1
RH98-07-7	RH98-07	<i>Saxidomus giganteus</i>	0.6	-1
RH98-07-8	RH98-07	<i>Saxidomus giganteus</i>	1.6	-1
RH98-07-9	RH98-07	<i>Saxidomus giganteus</i>	0.4	-1
RH98-07-10	RH98-07	<i>Saxidomus giganteus</i>	1.8	-1
RH98-07-11	RH98-07	<i>Saxidomus giganteus</i>	0.2	1
RH98-07-12	RH98-07	<i>Saxidomus giganteus</i>	0.2	-1
RH98-07-13	RH98-07	<i>Saxidomus giganteus</i>	0.6	-1
RH98-07-14	RH98-07	<i>Saxidomus giganteus</i>	2.4	-1
RH98-07-15	RH98-07	<i>Saxidomus giganteus</i>	7.3	-1
RH98-07-16	RH98-07	<i>Saxidomus giganteus</i>	2.4	-1
RH98-07-17	RH98-07	<i>Saxidomus giganteus</i>	4.1	-1
RH98-07-18	RH98-07	<i>Saxidomus giganteus</i>	0.2	1
RH98-07-19	RH98-07	<i>Saxidomus giganteus</i>	0.2	-1
RH98-07-20	RH98-07	<i>Saxidomus giganteus</i>	0.3	-1
RH98-07-21	RH98-07	<i>Saxidomus giganteus</i>	0.8	-1
RH98-07-22	RH98-07	<i>Saxidomus giganteus</i>	0.1	-1
RH98-07-23	RH98-07	<i>Saxidomus giganteus</i>	0.1	-1
RH98-07-24	RH98-07	<i>Saxidomus giganteus</i>	0.5	-1
RH98-07-25	RH98-07	<i>Saxidomus giganteus</i>	24.9	1
RH98-07-26	RH98-07	<i>Saxidomus giganteus</i>	0.1	1
RH98-07-27	RH98-07	<i>Saxidomus giganteus</i>	168.5	73 frag's
RH98-07-28	RH98-07	<i>Protothaca staminea</i>	0.1	1
RH98-07-29	RH98-07	<i>Protothaca staminea</i>	0.1	-1
RH98-07-30	RH98-07	<i>Protothaca staminea</i>	2.2	-1
RH98-07-31	RH98-07	<i>Protothaca staminea</i>	2.5	-1
RH98-07-32	RH98-07	<i>Protothaca staminea</i>	1.1	-1
RH98-07-33	RH98-07	<i>Protothaca staminea</i>	1.7	-1
RH98-07-34	RH98-07	<i>Protothaca staminea</i>	0.6	-1
RH98-07-35	RH98-07	<i>Protothaca staminea</i>	1.8	-1
RH98-07-36	RH98-07	<i>Protothaca staminea</i>	1.3	-1
RH98-07-37	RH98-07	<i>Protothaca staminea</i>	1.9	-1
RH98-07-38	RH98-07	<i>Protothaca staminea</i>	0.9	-1
RH98-07-39	RH98-07	<i>Protothaca staminea</i>	1.4	-1
RH98-07-40	RH98-07	<i>Protothaca staminea</i>	0.4	-1
RH98-07-41	RH98-07	<i>Protothaca staminea</i>	1.1	-1
RH98-07-42	RH98-07	<i>Protothaca staminea</i>	0.6	-1
RH98-07-43	RH98-07	<i>Protothaca staminea</i>	0.6	-1
RH98-07-44	RH98-07	<i>Protothaca staminea</i>	1	-1
RH98-07-45	RH98-07	<i>Protothaca staminea</i>	157.9	176 frag's

RH98-07-46	RH98-07	<i>Protothaca tenerrima</i>	17.1	14 frag's
RH98-07-47	RH98-07	<i>Mytilus trossulus</i>	0.1	-1
RH98-07-48	RH98-07	<i>Mytilus trossulus</i>	1.3	32 frag's
RH98-07-49	RH98-07	<i>Macoma nasuta</i>	5.7	1
RH98-07-50	RH98-07	<i>Macoma nasuta</i>	1.9	1
RH98-07-51	RH98-07	<i>Macoma nasuta</i>	1.2	-1
RH98-07-52	RH98-07	<i>Macoma nasuta</i>	2.6	-1
RH98-07-53	RH98-07	<i>Macoma nasuta</i>	1.3	-1
RH98-07-54	RH98-07	<i>Macoma nasuta</i>	0.8	-1
RH98-07-55	RH98-07	<i>Macoma nasuta</i>	1	1 frag
RH98-07-56	RH98-07	<i>Macoma inquinata</i>	0.8	-1
RH98-07-57	RH98-07	<i>Pododesmus machrochisma</i>	2.7	-1
RH98-07-58	RH98-07	<i>Pododesmus machrochisma</i>	7.9	30 frag's
RH98-07-59	RH98-07	<i>Nassarius mendicus</i>	0.2	1
RH98-07-60	RH98-07	<i>Nassarius mendicus</i>	0.2	1
RH98-07-61	RH98-07	<i>Nassarius mendicus</i>	0.2	1
RH98-07-62	RH98-07	<i>Nassarius mendicus</i>	0.1	1
RH98-07-63	RH98-07	<i>Nassarius mendicus</i>	0.1	1
RH98-07-64	RH98-07	<i>Nassarius mendicus</i>	0.1	1
RH98-07-65	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-66	RH98-07	<i>Littorina sitkana</i>	0.3	1
RH98-07-67	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-68	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-69	RH98-07	<i>Littorina sitkana</i>	0.1	-1
RH98-07-70	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-71	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-72	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-73	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-74	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-75	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-76	RH98-07	<i>Littorina sitkana</i>	0.2	1
RH98-07-77	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-78	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-79	RH98-07	<i>Littorina sitkana</i>	0.1	-1
RH98-07-80	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-81	RH98-07	<i>Littorina sitkana</i>	0.2	-1
RH98-07-82	RH98-07	<i>Littorina sitkana</i>	0.1	-1
RH98-07-83	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-84	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-85	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-86	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-87	RH98-07	<i>Littorina sitkana</i>	0.1	1
RH98-07-88	RH98-07	<i>Littorina sitkana</i>	0.1	-1
RH98-07-89	RH98-07	<i>Littorina sitkana</i>	0.1	-1
RH98-07-90	RH98-07	<i>Tectura persona</i>	0.4	1
RH98-07-91	RH98-07	<i>Tectura persona</i>	0.1	1
RH98-07-92	RH98-07	<i>Tectura persona</i>	0.2	1
RH98-07-93	RH98-07	<i>Margarites beringensis</i>	0.2	1
RH98-07-94	RH98-07	<i>Margarites beringensis</i>	0.1	1
RH98-07-95	RH98-07	<i>Margarites beringensis</i>	0.3	1
RH98-07-96	RH98-07	<i>Balanus spp.</i>	1.1	8 frag's
RH98-07-97	RH98-07	Unidentified clam shell frag's	56	148 frag's
RH98-07-98	RH98-07	Wood	2.8	55 frag's
RH98-07-99	RH98-07	Coniferous cones	0.2	1
RH98-07-100	RH98-07	Coniferous cones	0.1	1
RH98-07-101	RH98-07	Coniferous cones	0.1	1
RH98-07-102	RH98-07	Coniferous cones	0.1	1
Total weight (grams) RH98-07			605.2	
RH98-08-1	RH98-08	<i>Saxidomus giganteus</i>	31.3	1
RH98-08-2	RH98-08	<i>Saxidomus giganteus</i>	4.7	-1
RH98-08-3	RH98-08	<i>Saxidomus giganteus</i>	14.5	-1
RH98-08-4	RH98-08	<i>Saxidomus giganteus</i>	2.6	-1
RH98-08-5	RH98-08	<i>Saxidomus giganteus</i>	1.1	-1

RH98-08-6	RH98-08	<i>Saxidomus giganteus</i>	12	1
RH98-08-7	RH98-08	<i>Saxidomus giganteus</i>	0.2	1
RH98-08-8	RH98-08	<i>Saxidomus giganteus</i>	4.1	-1
RH98-08-9	RH98-08	<i>Saxidomus giganteus</i>	8.6	-1
RH98-08-10	RH98-08	<i>Saxidomus giganteus</i>	3.3	-1
RH98-08-11	RH98-08	<i>Saxidomus giganteus</i>	1	-1
RH98-08-12	RH98-08	<i>Saxidomus giganteus</i>	0.3	1
RH98-08-13	RH98-08	<i>Saxidomus giganteus</i>	0.2	1
RH98-08-14	RH98-08	<i>Saxidomus giganteus</i>	0.2	-1
RH98-08-15	RH98-08	<i>Saxidomus giganteus</i>	0.1	1
RH98-08-16	RH98-08	<i>Saxidomus giganteus</i>	0.2	1
RH98-08-17	RH98-08	<i>Saxidomus giganteus</i>	0.2	1
RH98-08-18	RH98-08	<i>Saxidomus giganteus</i>	1.2	-1
RH98-08-19	RH98-08	<i>Saxidomus giganteus</i>	24.6	-1
RH98-08-20	RH98-08	<i>Saxidomus giganteus</i>	1	-1
RH98-08-21	RH98-08	<i>Saxidomus giganteus</i>	0.1	1
RH98-08-22	RH98-08	<i>Saxidomus giganteus</i>	1	-1
RH98-08-23	RH98-08	<i>Saxidomus giganteus</i>	0.4	-1
RH98-08-24	RH98-08	<i>Saxidomus giganteus</i>	0.1	1
RH98-08-25	RH98-08	<i>Saxidomus giganteus</i>	0.2	1
RH98-08-26	RH98-08	<i>Saxidomus giganteus</i>	0.2	1
RH98-08-27	RH98-08	<i>Saxidomus giganteus</i>	5.3	-1
RH98-08-28	RH98-08	<i>Saxidomus giganteus</i>	0.2	-1
RH98-08-29	RH98-08	<i>Saxidomus giganteus</i>	5.9	-1
RH98-08-30	RH98-08	<i>Saxidomus giganteus</i>	25.2	1
RH98-08-31	RH98-08	<i>Saxidomus giganteus</i>	20.9	1
RH98-08-32	RH98-08	<i>Saxidomus giganteus</i>	41.5	-1
RH98-08-33	RH98-08	<i>Saxidomus giganteus</i>	0.4	-1
RH98-08-34	RH98-08	<i>Saxidomus giganteus</i>	0.1	1
RH98-08-35	RH98-08	<i>Saxidomus giganteus</i>	32.7	1
RH98-08-36	RH98-08	<i>Saxidomus giganteus</i>	0.3	-1
RH98-08-37	RH98-08	<i>Saxidomus giganteus</i>	0.1	-1
RH98-08-38	RH98-08	<i>Saxidomus giganteus</i>	0.2	1
RH98-08-39	RH98-08	<i>Saxidomus giganteus</i>	44.1	1
RH98-08-40	RH98-08	<i>Saxidomus giganteus</i>	175.4	74 frag's
RH98-08-41	RH98-08	<i>Saxidomus giganteus</i>	0.1	-1
RH98-08-42	RH98-08	<i>Saxidomus giganteus</i>	2.7	2 frag's
RH98-08-43	RH98-08	<i>Protothaca staminea</i>	10.4	1
RH98-08-44	RH98-08	<i>Protothaca staminea</i>	0.9	-1
RH98-08-45	RH98-08	<i>Protothaca staminea</i>	1.6	-1
RH98-08-46	RH98-08	<i>Protothaca staminea</i>	0.1	-1
RH98-08-47	RH98-08	<i>Protothaca staminea</i>	1.4	-1
RH98-08-48	RH98-08	<i>Protothaca staminea</i>	1.6	-1
RH98-08-49	RH98-08	<i>Protothaca staminea</i>	3.2	-1
RH98-08-50	RH98-08	<i>Protothaca staminea</i>	0.7	-1
RH98-08-51	RH98-08	<i>Protothaca staminea</i>	0.5	-1
RH98-08-52	RH98-08	<i>Protothaca staminea</i>	0.2	1
RH98-08-53	RH98-08	<i>Protothaca staminea</i>	0.8	-1
RH98-08-54	RH98-08	<i>Protothaca staminea</i>	0.6	-1
RH98-08-55	RH98-08	<i>Protothaca staminea</i>	0.7	-1
RH98-08-56	RH98-08	<i>Protothaca staminea</i>	0.7	-1
RH98-08-57	RH98-08	<i>Protothaca staminea</i>	170.7	171 frag's
RH98-08-58	RH98-08	<i>Protothaca tenerrima</i>	11	-4
RH98-08-59	RH98-08	<i>Pododesmus machrochisma</i>	8.6	1
RH98-08-60	RH98-08	<i>Pododesmus machrochisma</i>	0.5	6 frag's
RH98-08-61	RH98-08	<i>Mytilus trossulus</i>	0.2	-1
RH98-08-62	RH98-08	<i>Mytilus trossulus</i>	0.2	-1
RH98-08-63	RH98-08	<i>Mytilus trossulus</i>	0.3	-1
RH98-08-64	RH98-08	<i>Mytilus trossulus</i>	0.1	-1
RH98-08-65	RH98-08	<i>Mytilus trossulus</i>	0.3	-1
RH98-08-66	RH98-08	<i>Mytilus trossulus</i>	0.1	-1
RH98-08-67	RH98-08	<i>Mytilus trossulus</i>	0.1	-1
RH98-08-68	RH98-08	<i>Mytilus trossulus</i>	2.7	48 frag's
RH98-08-69	RH98-08	<i>Clinocardium nuttallii</i>	4.9	13 frag's

RH98-08-70	RH98-08	<i>Clinocardium nuttallii</i>	0.5	~1
RH98-08-71	RH98-08	<i>Macoma inquinata</i>	7.5	1
RH98-08-72	RH98-08	<i>Macoma inquinata</i>	2.3	~1
RH98-08-73	RH98-08	<i>Macoma inquinata</i>	0.3	1
RH98-08-74	RH98-08	<i>Macoma inquinata</i>	0.5	1
RH98-08-75	RH98-08	<i>Macoma inquinata</i>	2.9	~1
RH98-08-76	RH98-08	<i>Macoma lipara</i>	0.7	1
RH98-08-77	RH98-08	<i>Nassarius mendicus</i>	0.1	1
RH98-08-78	RH98-08	<i>Nassarius mendicus</i>	0.1	1
RH98-08-79	RH98-08	<i>Nassarius mendicus</i>	0.1	1
RH98-08-80	RH98-08	<i>Nassarius mendicus</i>	0.1	1
RH98-08-81	RH98-08	<i>Nassarius mendicus</i>	0.1	1
RH98-08-82	RH98-08	<i>Nassarius mendicus</i>	0.2	1
RH98-08-83	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-84	RH98-08	<i>Littorina sitkana</i>	0.3	1
RH98-08-85	RH98-08	<i>Littorina sitkana</i>	0.3	1
RH98-08-86	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-87	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-88	RH98-08	<i>Littorina sitkana</i>	0.3	1
RH98-08-89	RH98-08	<i>Littorina sitkana</i>	0.3	1
RH98-08-90	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-91	RH98-08	<i>Littorina sitkana</i>	0.8	1
RH98-08-92	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-93	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-94	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-95	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-96	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-97	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-98	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-99	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-100	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-101	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-102	RH98-08	<i>Littorina sitkana</i>	0.2	1
RH98-08-103	RH98-08	<i>Littorina sitkana</i>	0.1	1
RH98-08-104	RH98-08	<i>Littorina sitkana</i>	0.1	~1
RH98-08-105	RH98-08	<i>Littorina sitkana</i>	0.1	~1
RH98-08-106	RH98-08	<i>Lacuna variegata</i>	0.1	1
RH98-08-107	RH98-08	<i>Lacuna variegata</i>	0.1	1
RH98-08-108	RH98-08	<i>Lacuna variegata</i>	0.1	1
RH98-08-109	RH98-08	<i>Lacuna variegata</i>	0.1	1
RH98-08-110	RH98-08	<i>Euspira pallida</i>	0.3	1
RH98-08-111	RH98-08	<i>Euspira pallida</i>	0.3	1
RH98-08-112	RH98-08	<i>Euspira pallida</i>	0.3	1
RH98-08-113	RH98-08	<i>Lottia digitalis</i>	0.5	1
RH98-08-114	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-115	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-116	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-117	RH98-08	<i>Lottia digitalis</i>	0.2	1
RH98-08-118	RH98-08	<i>Lottia digitalis</i>	0.4	1
RH98-08-119	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-120	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-121	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-122	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-123	RH98-08	<i>Lottia digitalis</i>	0.1	1
RH98-08-124	RH98-08	Unidentified clam shell frag's	38.6	75 frag's
RH98-08-124	RH98-08	<i>Balanus spp.</i>	2.7	25 frag's
RH98-08-124	RH98-08	<i>Chiton sp.</i>	0.2	1
RH98-08-124	RH98-08	Wood	3	51 frag's
Total weight (grams) RH98-08			759.3	
RH98-05-1	RH98-05	<i>Protothaca staminea</i>	16.4	2 art'd
RH98-05-2	RH98-05	<i>Protothaca staminea</i>	19.3	~1
RH98-05-3	RH98-05	<i>Protothaca staminea</i>	8.4	1
RH98-05-4	RH98-05	<i>Protothaca staminea</i>	8.6	1

RH98-05-5	RH98-05	<i>Protothaca staminea</i>	4	-1
RH98-05-6	RH98-05	<i>Protothaca staminea</i>	0.1	-1
RH98-05-7	RH98-05	<i>Protothaca staminea</i>	3.9	-1
RH98-05-8	RH98-05	<i>Protothaca staminea</i>	13.3	1
RH98-05-9	RH98-05	<i>Protothaca staminea</i>	11.1	-1
RH98-05-10	RH98-05	<i>Protothaca staminea</i>	0.4	1
RH98-05-11	RH98-05	<i>Protothaca staminea</i>	1.7	-1
RH98-05-12	RH98-05	<i>Protothaca staminea</i>	4.6	1
RH98-05-13	RH98-05	<i>Protothaca staminea</i>	1	1
RH98-05-14	RH98-05	<i>Protothaca staminea</i>	0.6	-1
RH98-05-15	RH98-05	<i>Protothaca staminea</i>	0.4	1
RH98-05-16	RH98-05	<i>Protothaca staminea</i>	56.1	74 frag's
RH98-05-17	RH98-05	<i>Protothaca staminea</i>	11.3	1
RH98-05-18	RH98-05	<i>Protothaca staminea</i>	0.7	-1
RH98-05-19	RH98-05	<i>Protothaca staminea</i>	0.2	2 art'd
RH98-05-20	RH98-05	<i>Protothaca staminea</i>	0.3	1
RH98-05-21	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-22	RH98-05	<i>Protothaca staminea</i>	0.8	-1
RH98-05-23	RH98-05	<i>Protothaca staminea</i>	0.1	-1
RH98-05-24	RH98-05	<i>Protothaca staminea</i>	10.6	1
RH98-05-25	RH98-05	<i>Protothaca staminea</i>	0.4	-1
RH98-05-26	RH98-05	<i>Protothaca staminea</i>	0.2	-1
RH98-05-27	RH98-05	<i>Protothaca staminea</i>	0.2	1
RH98-05-28	RH98-05	<i>Protothaca staminea</i>	0.7	-1
RH98-05-29	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-30	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-31	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-32	RH98-05	<i>Protothaca staminea</i>	11.6	-1
RH98-05-33	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-34	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-35	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-36	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-37	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-38	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-39	RH98-05	<i>Protothaca staminea</i>	0.9	-1
RH98-05-40	RH98-05	<i>Protothaca staminea</i>	4.6	-1
RH98-05-41	RH98-05	<i>Protothaca staminea</i>	79.5	53 frag's
RH98-05-42	RH98-05	<i>Protothaca staminea</i>	9.3	1
RH98-05-43	RH98-05	<i>Protothaca staminea</i>	22.4	1
RH98-05-44	RH98-05	<i>Protothaca staminea</i>	9.4	1
RH98-05-45	RH98-05	<i>Protothaca staminea</i>	7.1	-1
RH98-05-46	RH98-05	<i>Protothaca staminea</i>	1.4	1
RH98-05-47	RH98-05	<i>Protothaca staminea</i>	0.1	-1
RH98-05-48	RH98-05	<i>Protothaca staminea</i>	6.6	-1
RH98-05-49	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-50	RH98-05	<i>Protothaca staminea</i>	1.6	-1
RH98-05-51	RH98-05	<i>Protothaca staminea</i>	0.5	-1
RH98-05-52	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-53	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-54	RH98-05	<i>Protothaca staminea</i>	42.2	22 frag's
RH98-05-55	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-56	RH98-05	<i>Protothaca staminea</i>	6.4	1
RH98-05-57	RH98-05	<i>Protothaca staminea</i>	5.4	1
RH98-05-58	RH98-05	<i>Protothaca staminea</i>	24	1
RH98-05-59	RH98-05	<i>Protothaca staminea</i>	7.9	-1
RH98-05-60	RH98-05	<i>Protothaca staminea</i>	33.3	1
RH98-05-61	RH98-05	<i>Protothaca staminea</i>	13.4	1
RH98-05-62	RH98-05	<i>Protothaca staminea</i>	0.1	-1
RH98-05-63	RH98-05	<i>Protothaca staminea</i>	0.2	1
RH98-05-64	RH98-05	<i>Protothaca staminea</i>	22.9	1
RH98-05-65	RH98-05	<i>Protothaca staminea</i>	0.4	-1
RH98-05-66	RH98-05	<i>Protothaca staminea</i>	3.4	-1
RH98-05-67	RH98-05	<i>Protothaca staminea</i>	2.9	-1
RH98-05-68	RH98-05	<i>Protothaca staminea</i>	0.5	-1

RH98-05-69	RH98-05	<i>Protothaca staminea</i>	0.6	~1
RH98-05-70	RH98-05	<i>Protothaca staminea</i>	0.7	~1
RH98-05-71	RH98-05	<i>Protothaca staminea</i>	0.2	1
RH98-05-72	RH98-05	<i>Protothaca staminea</i>	12.5	1
RH98-05-73	RH98-05	<i>Protothaca staminea</i>	2.3	~1
RH98-05-74	RH98-05	<i>Protothaca staminea</i>	0.2	1
RH98-05-75	RH98-05	<i>Protothaca staminea</i>	0.2	2 art'd
RH98-05-76	RH98-05	<i>Protothaca staminea</i>	0.2	1
RH98-05-77	RH98-05	<i>Protothaca staminea</i>	0.3	~1
RH98-05-78	RH98-05	<i>Protothaca staminea</i>	0.1	~1
RH98-05-79	RH98-05	<i>Protothaca staminea</i>	0.3	1
RH98-05-80	RH98-05	<i>Protothaca staminea</i>	16.5	1
RH98-05-81	RH98-05	<i>Protothaca staminea</i>	0.3	~1
RH98-05-82	RH98-05	<i>Protothaca staminea</i>	0.2	1
RH98-05-83	RH98-05	<i>Protothaca staminea</i>	0.2	~1
RH98-05-84	RH98-05	<i>Protothaca staminea</i>	1.1	~1
RH98-05-85	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-86	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-87	RH98-05	<i>Protothaca staminea</i>	0.6	~1
RH98-05-88	RH98-05	<i>Protothaca staminea</i>	8.9	1
RH98-05-89	RH98-05	<i>Protothaca staminea</i>	0.1	1
RH98-05-90	RH98-05	<i>Protothaca tenerrima</i>	15.8	1
RH98-05-91	RH98-05	<i>Protothaca tenerrima</i>	18	13 frag's
RH98-05-92	RH98-05	<i>Protothaca tenerrima</i>	2.2	~1
RH98-05-93	RH98-05	<i>Protothaca tenerrima</i>	7.1	2 frag's
RH98-05-94	RH98-05	<i>Protothaca tenerrima</i>	23.3	15 frag's
RH98-05-95	RH98-05	<i>Protothaca tenerrima</i>	7.6	1
RH98-05-96	RH98-05	<i>Protothaca tenerrima</i>	5.2	1
RH98-05-97	RH98-05	<i>Protothaca tenerrima</i>	0.9	1
RH98-05-98	RH98-05	<i>Protothaca tenerrima</i>	3.1	~1
RH98-05-99	RH98-05	<i>Protothaca tenerrima</i>	6.2	1
RH98-05-100	RH98-05	<i>Protothaca tenerrima</i>	15.6	8 frag's
RH98-05-101	RH98-05	<i>Saxidomus giganteus</i>	32	1
RH98-05-102	RH98-05	<i>Saxidomus giganteus</i>	22.9	1
RH98-05-103	RH98-05	<i>Saxidomus giganteus</i>	31.4	1
RH98-05-104	RH98-05	<i>Saxidomus giganteus</i>	9.1	1
RH98-05-105	RH98-05	<i>Saxidomus giganteus</i>	1	~1
RH98-05-106	RH98-05	<i>Saxidomus giganteus</i>	1.3	~1
RH98-05-107	RH98-05	<i>Saxidomus giganteus</i>	5.1	~1
RH98-05-108	RH98-05	<i>Saxidomus giganteus</i>	4.3	~1
RH98-05-109	RH98-05	<i>Saxidomus giganteus</i>	26.5	1
RH98-05-110	RH98-05	<i>Saxidomus giganteus</i>	11.9	1
RH98-05-111	RH98-05	<i>Saxidomus giganteus</i>	0.7	1
RH98-05-112	RH98-05	<i>Saxidomus giganteus</i>	3.1	~1
RH98-05-113	RH98-05	<i>Saxidomus giganteus</i>	0.7	1
RH98-05-114	RH98-05	<i>Saxidomus giganteus</i>	0.8	~1
RH98-05-115	RH98-05	<i>Saxidomus giganteus</i>	1.1	1
RH98-05-116	RH98-05	<i>Saxidomus giganteus</i>	0.4	1
RH98-05-117	RH98-05	<i>Saxidomus giganteus</i>	0.8	~1
RH98-05-118	RH98-05	<i>Saxidomus giganteus</i>	0.3	~1
RH98-05-119	RH98-05	<i>Saxidomus giganteus</i>	18.7	1
RH98-05-120	RH98-05	<i>Saxidomus giganteus</i>	7.1	~1
RH98-05-121	RH98-05	<i>Saxidomus giganteus</i>	122.2	53 frag's
RH98-05-122	RH98-05	<i>Saxidomus giganteus</i>	8.7	1
RH98-05-123	RH98-05	<i>Saxidomus giganteus</i>	0.6	~1
RH98-05-124	RH98-05	<i>Saxidomus giganteus</i>	0.4	~1
RH98-05-125	RH98-05	<i>Saxidomus giganteus</i>	0.5	~1
RH98-05-126	RH98-05	<i>Saxidomus giganteus</i>	0.1	~1
RH98-05-127	RH98-05	<i>Saxidomus giganteus</i>	0.1	1
RH98-05-128	RH98-05	<i>Saxidomus giganteus</i>	0.1	1
RH98-05-129	RH98-05	<i>Saxidomus giganteus</i>	28.4	1
RH98-05-130	RH98-05	<i>Saxidomus giganteus</i>	6.3	~1
RH98-05-131	RH98-05	<i>Saxidomus giganteus</i>	1.2	~1
RH98-05-132	RH98-05	<i>Saxidomus giganteus</i>	0.6	~1

RH98-05-133	RH98-05	<i>Saxidomus giganteus</i>	0.9	~1
RH98-05-134	RH98-05	<i>Saxidomus giganteus</i>	0.2	1
RH98-05-135	RH98-05	<i>Saxidomus giganteus</i>	0.1	1
RH98-05-136	RH98-05	<i>Saxidomus giganteus</i>	0.2	~1
RH98-05-137	RH98-05	<i>Saxidomus giganteus</i>	0.1	~1
RH98-05-138	RH98-05	<i>Saxidomus giganteus</i>	0.1	1
RH98-05-139	RH98-05	<i>Saxidomus giganteus</i>	9.1	~1
RH98-05-140	RH98-05	<i>Saxidomus giganteus</i>	1.5	~1
RH98-05-141	RH98-05	<i>Saxidomus giganteus</i>	63.7	26 frag's
RH98-05-142	RH98-05	<i>Saxidomus giganteus</i>	0.2	~1
RH98-05-143	RH98-05	<i>Saxidomus giganteus</i>	19.7	1
RH98-05-144	RH98-05	<i>Saxidomus giganteus</i>	8.4	1
RH98-05-145	RH98-05	<i>Saxidomus giganteus</i>	29.4	1
RH98-05-146	RH98-05	<i>Saxidomus giganteus</i>	8.6	1
RH98-05-147	RH98-05	<i>Saxidomus giganteus</i>	29.9	1
RH98-05-148	RH98-05	<i>Saxidomus giganteus</i>	45.3	~1
RH98-05-149	RH98-05	<i>Saxidomus giganteus</i>	0.6	1
RH98-05-150	RH98-05	<i>Saxidomus giganteus</i>	29.3	1
RH98-05-151	RH98-05	<i>Saxidomus giganteus</i>	21.6	1
RH98-05-152	RH98-05	<i>Saxidomus giganteus</i>	26.9	1
RH98-05-153	RH98-05	<i>Saxidomus giganteus</i>	4.9	~1
RH98-05-154	RH98-05	<i>Saxidomus giganteus</i>	3.2	~1
RH98-05-155	RH98-05	<i>Saxidomus giganteus</i>	24.8	~1
RH98-05-156	RH98-05	<i>Saxidomus giganteus</i>	20.6	~1
RH98-05-157	RH98-05	<i>Saxidomus giganteus</i>	5.6	1
RH98-05-158	RH98-05	<i>Saxidomus giganteus</i>	1.1	~1
RH98-05-159	RH98-05	<i>Saxidomus giganteus</i>	19.7	1
RH98-05-160	RH98-05	<i>Saxidomus giganteus</i>	15.5	1
RH98-05-161	RH98-05	<i>Saxidomus giganteus</i>	27.3	13 frag's
RH98-05-162	RH98-05	<i>Saxidomus giganteus</i>	25.5	1
RH98-05-163	RH98-05	<i>Saxidomus giganteus</i>	1.1	1
RH98-05-164	RH98-05	<i>Saxidomus giganteus</i>	0.5	1
RH98-05-165	RH98-05	<i>Saxidomus giganteus</i>	1.7	~1
RH98-05-166	RH98-05	<i>Saxidomus giganteus</i>	5.8	~1
RH98-05-167	RH98-05	<i>Saxidomus giganteus</i>	9.8	~1
RH98-05-168	RH98-05	<i>Saxidomus giganteus</i>	3	~1
RH98-05-169	RH98-05	<i>Saxidomus giganteus</i>	0.4	1
RH98-05-170	RH98-05	<i>Saxidomus giganteus</i>	6.2	~1
RH98-05-171	RH98-05	<i>Saxidomus giganteus</i>	0.4	~1
RH98-05-172	RH98-05	<i>Saxidomus giganteus</i>	0.9	~1
RH98-05-173	RH98-05	<i>Saxidomus giganteus</i>	0.1	1
RH98-05-174	RH98-05	<i>Saxidomus giganteus</i>	1.9	~1
RH98-05-175	RH98-05	<i>Saxidomus giganteus</i>	20.5	~1
RH98-05-176	RH98-05	<i>Saxidomus giganteus</i>	6.2	~1
RH98-05-177	RH98-05	<i>Saxidomus giganteus</i>	0.3	~1
RH98-05-178	RH98-05	<i>Saxidomus giganteus</i>	0.7	~1
RH98-05-179	RH98-05	<i>Saxidomus giganteus</i>	0.2	~1
RH98-05-180	RH98-05	<i>Saxidomus giganteus</i>	1.2	~1
RH98-05-181	RH98-05	<i>Saxidomus giganteus</i>	0.3	~1
RH98-05-182	RH98-05	<i>Saxidomus giganteus</i>	0.1	1
RH98-05-183	RH98-05	<i>Saxidomus giganteus</i>	0.3	~1
RH98-05-184	RH98-05	<i>Saxidomus giganteus</i>	10.9	~1
RH98-05-185	RH98-05	<i>Saxidomus giganteus</i>	9.1	~1
RH98-05-186	RH98-05	<i>Saxidomus giganteus</i>	0.1	~1
RH98-05-187	RH98-05	<i>Saxidomus giganteus</i>	48.4	28 frag's
RH98-05-188	RH98-05	<i>Saxidomus giganteus</i>	25.6	1
RH98-05-189	RH98-05	<i>Saxidomus giganteus</i>	4.5	1
RH98-05-190	RH98-05	<i>Saxidomus giganteus</i>	13.9	~1
RH98-05-191	RH98-05	<i>Saxidomus giganteus</i>	11.3	1
RH98-05-192	RH98-05	<i>Saxidomus giganteus</i>	19.8	~1
RH98-05-193	RH98-05	<i>Saxidomus giganteus</i>	24	~1
RH98-05-194	RH98-05	<i>Saxidomus giganteus</i>	8.1	1
RH98-05-195	RH98-05	<i>Saxidomus giganteus</i>	59.4	1
RH98-05-196	RH98-05	<i>Saxidomus giganteus</i>	45.6	1

RH98-05-197	RH98-05	<i>Saxidomus giganteus</i>	59.7	1
RH98-05-198	RH98-05	<i>Saxidomus giganteus</i>	38.9	1
RH98-05-199	RH98-05	<i>Saxidomus giganteus</i>	11.5	1
RH98-05-200	RH98-05	<i>Saxidomus giganteus</i>	16.8	-1
RH98-05-201	RH98-05	<i>Saxidomus giganteus</i>	3.1	-1
RH98-05-202	RH98-05	<i>Saxidomus giganteus</i>	7.9	1
RH98-05-203	RH98-05	<i>Protothaca staminea</i>	23.7	1
RH98-05-204	RH98-05	<i>Protothaca staminea</i>	19.2	-1
RH98-05-205	RH98-05	<i>Protothaca staminea</i>	22.6	1
RH98-05-206	RH98-05	<i>Protothaca staminea</i>	23.6	1
RH98-05-207	RH98-05	<i>Protothaca staminea</i>	7.9	-1
RH98-05-208	RH98-05	<i>Protothaca staminea</i>	24.2	1
RH98-05-209	RH98-05	<i>Protothaca staminea</i>	13.8	1
RH98-05-210	RH98-05	<i>Protothaca staminea</i>	6.3	-1
RH98-05-211	RH98-05	<i>Protothaca staminea</i>	5.4	-1
RH98-05-212	RH98-05	<i>Protothaca staminea</i>	3.7	-1
RH98-05-213	RH98-05	<i>Protothaca staminea</i>	0.9	1
RH98-05-214	RH98-05	<i>Protothaca staminea</i>	1.6	1
RH98-05-215	RH98-05	<i>Protothaca staminea</i>	1.2	1
RH98-05-216	RH98-05	<i>Protothaca staminea</i>	10.5	-1
RH98-05-217	RH98-05	<i>Protothaca staminea</i>	6.4	1
RH98-05-218	RH98-05	<i>Protothaca staminea</i>	0.8	-1
RH98-05-219	RH98-05	<i>Protothaca staminea</i>	0.2	1
RH98-05-220	RH98-05	<i>Protothaca staminea</i>	1.1	-1
RH98-05-221	RH98-05	<i>Protothaca staminea</i>	2.6	-1
RH98-05-222	RH98-05	<i>Protothaca staminea</i>	3.2	-1
RH98-05-223	RH98-05	<i>Protothaca staminea</i>	3.9	-1
RH98-05-224	RH98-05	<i>Protothaca staminea</i>	107	139 frag's
RH98-05-225	RH98-05	<i>Pododesmus machrochisma</i>	26	1
RH98-05-226	RH98-05	<i>Pododesmus machrochisma</i>	9.7	1
RH98-05-227	RH98-05	<i>Pododesmus machrochisma</i>	7.6	1
RH98-05-228	RH98-05	<i>Pododesmus machrochisma</i>	12.8	1
RH98-05-229	RH98-05	<i>Pododesmus machrochisma</i>	8.1	-1
RH98-05-230	RH98-05	<i>Pododesmus machrochisma</i>	2	1
RH98-05-231	RH98-05	<i>Pododesmus machrochisma</i>	2.3	-1
RH98-05-232	RH98-05	<i>Pododesmus machrochisma</i>	1.6	1
RH98-05-233	RH98-05	<i>Pododesmus machrochisma</i>	6	-1
RH98-05-234	RH98-05	<i>Pododesmus machrochisma</i>	10.4	-1
RH98-05-235	RH98-05	<i>Pododesmus machrochisma</i>	1.2	1
RH98-05-236	RH98-05	<i>Pododesmus machrochisma</i>	1.2	1
RH98-05-237	RH98-05	<i>Pododesmus machrochisma</i>	1.3	1
RH98-05-238	RH98-05	<i>Pododesmus machrochisma</i>	0.6	1
RH98-05-239	RH98-05	<i>Pododesmus machrochisma</i>	0.8	-1
RH98-05-240	RH98-05	<i>Pododesmus machrochisma</i>	0.1	1
RH98-05-241	RH98-05	<i>Pododesmus machrochisma</i>	0.4	1
RH98-05-242	RH98-05	<i>Pododesmus machrochisma</i>	11.8	26 frag's
RH98-05-243	RH98-05	<i>Pododesmus machrochisma</i>	27.1	1
RH98-05-244	RH98-05	<i>Pododesmus machrochisma</i>	1.8	1
RH98-05-245	RH98-05	<i>Pododesmus machrochisma</i>	1.4	1
RH98-05-246	RH98-05	<i>Pododesmus machrochisma</i>	6.3	1
RH98-05-247	RH98-05	<i>Pododesmus machrochisma</i>	6.8	1
RH98-05-248	RH98-05	<i>Pododesmus machrochisma</i>	13.4	1
RH98-05-249	RH98-05	<i>Pododesmus machrochisma</i>	4.1	1
RH98-05-250	RH98-05	<i>Pododesmus machrochisma</i>	0.2	1
RH98-05-251	RH98-05	<i>Pododesmus machrochisma</i>	0.8	-1
RH98-05-252	RH98-05	<i>Pododesmus machrochisma</i>	1.6	4 frag's
RH98-05-253	RH98-05	<i>Pododesmus machrochisma</i>	13.5	1
RH98-05-254	RH98-05	<i>Pododesmus machrochisma</i>	1	1
RH98-05-255	RH98-05	<i>Pododesmus machrochisma</i>	0.7	1
RH98-05-256	RH98-05	<i>Pododesmus machrochisma</i>	4	1
RH98-05-257	RH98-05	<i>Pododesmus machrochisma</i>	2.4	1
RH98-05-258	RH98-05	<i>Pododesmus machrochisma</i>	0.4	1
RH98-05-259	RH98-05	<i>Pododesmus machrochisma</i>	0.5	1
RH98-05-260	RH98-05	<i>Pododesmus machrochisma</i>	0.5	1

RH98-05-261	RH98-05	<i>Pododesmus machrochisma</i>	4.5	9 frag's
RH98-05-262	RH98-05	<i>Pododesmus machrochisma</i>	0.7	~1
RH98-05-263	RH98-05	<i>Pododesmus machrochisma</i>	6.2	1
RH98-05-264	RH98-05	<i>Pododesmus machrochisma</i>	11	1
RH98-05-265	RH98-05	<i>Pododesmus machrochisma</i>	11.9	1
RH98-05-266	RH98-05	<i>Pododesmus machrochisma</i>	11.2	1
RH98-05-267	RH98-05	<i>Pododesmus machrochisma</i>	4.6	1
RH98-05-268	RH98-05	<i>Pododesmus machrochisma</i>	4.3	1
RH98-05-269	RH98-05	<i>Pododesmus machrochisma</i>	1.7	1
RH98-05-270	RH98-05	<i>Pododesmus machrochisma</i>	10.5	1
RH98-05-271	RH98-05	<i>Pododesmus machrochisma</i>	1.4	1
RH98-05-272	RH98-05	<i>Pododesmus machrochisma</i>	6.2	1
RH98-05-273	RH98-05	<i>Pododesmus machrochisma</i>	3.4	1
RH98-05-274	RH98-05	<i>Pododesmus machrochisma</i>	1	1
RH98-05-275	RH98-05	<i>Pododesmus machrochisma</i>	1.2	1
RH98-05-276	RH98-05	<i>Pododesmus machrochisma</i>	5.3	10 frag's
RH98-05-277	RH98-05	<i>Pododesmus machrochisma</i>	20.8	1
RH98-05-278	RH98-05	<i>Pododesmus machrochisma</i>	20.4	1
RH98-05-279	RH98-05	<i>Pododesmus machrochisma</i>	11.2	1
RH98-05-280	RH98-05	<i>Macoma inquinata</i>	6.2	1
RH98-05-281	RH98-05	<i>Macoma inquinata</i>	5.1	1
RH98-05-282	RH98-05	<i>Macoma inquinata</i>	3.8	1
RH98-05-283	RH98-05	<i>Macoma inquinata</i>	7.6	1
RH98-05-284	RH98-05	<i>Macoma inquinata</i>	2.7	~1
RH98-05-285	RH98-05	<i>Macoma inquinata</i>	5.8	1
RH98-05-286	RH98-05	<i>Macoma inquinata</i>	2.4	1
RH98-05-287	RH98-05	<i>Macoma inquinata</i>	1.3	~1
RH98-05-288	RH98-05	<i>Macoma inquinata</i>	0.4	1
RH98-05-289	RH98-05	<i>Macoma inquinata</i>	0.2	1
RH98-05-290	RH98-05	<i>Macoma inquinata</i>	1.4	1
RH98-05-291	RH98-05	<i>Macoma inquinata</i>	5.9	1
RH98-05-292	RH98-05	<i>Macoma inquinata</i>	3.3	~1
RH98-05-293	RH98-05	<i>Macoma inquinata</i>	4.9	1
RH98-05-294	RH98-05	<i>Macoma inquinata</i>	3.6	~1
RH98-05-295	RH98-05	<i>Macoma inquinata</i>	1.2	~1
RH98-05-296	RH98-05	<i>Macoma inquinata</i>	1.4	~1
RH98-05-297	RH98-05	<i>Macoma inquinata</i>	0.3	~1
RH98-05-298	RH98-05	<i>Macoma inquinata</i>	0.4	1
RH98-05-299	RH98-05	<i>Macoma inquinata</i>	11.6	6 frag's
RH98-05-300	RH98-05	<i>Macoma inquinata</i>	11.7	1
RH98-05-301	RH98-05	<i>Macoma inquinata</i>	3.1	~1
RH98-05-302	RH98-05	<i>Macoma inquinata</i>	6.2	~1
RH98-05-303	RH98-05	<i>Macoma inquinata</i>	3.4	1
RH98-05-304	RH98-05	<i>Macoma inquinata</i>	3.8	1
RH98-05-305	RH98-05	<i>Macoma inquinata</i>	1.3	1
RH98-05-306	RH98-05	<i>Macoma inquinata</i>	4.9	1
RH98-05-307	RH98-05	<i>Macoma inquinata</i>	2	~1
RH98-05-308	RH98-05	<i>Macoma inquinata</i>	3	1
RH98-05-309	RH98-05	<i>Macoma inquinata</i>	0.7	~1
RH98-05-310	RH98-05	<i>Macoma inquinata</i>	1.8	~1
RH98-05-311	RH98-05	<i>Macoma inquinata</i>	0.1	1
RH98-05-312	RH98-05	<i>Macoma inquinata</i>	5.9	1
RH98-05-313	RH98-05	<i>Macoma inquinata</i>	1.3	~1
RH98-05-314	RH98-05	<i>Macoma inquinata</i>	1.6	~1
RH98-05-315	RH98-05	<i>Macoma inquinata</i>	1.6	1
RH98-05-316	RH98-05	<i>Macoma inquinata</i>	2.7	~1
RH98-05-317	RH98-05	<i>Macoma inquinata</i>	4.3	~1
RH98-05-318	RH98-05	<i>Macoma inquinata</i>	0.6	1
RH98-05-319	RH98-05	<i>Macoma inquinata</i>	3.2	~1
RH98-05-320	RH98-05	<i>Macoma inquinata</i>	0.7	1
RH98-05-321	RH98-05	<i>Macoma inquinata</i>	0.9	1
RH98-05-322	RH98-05	<i>Macoma inquinata</i>	2.7	1
RH98-05-323	RH98-05	<i>Macoma inquinata</i>	3.1	~1
RH98-05-324	RH98-05	<i>Macoma inquinata</i>	2	1

RH98-05-325	RH98-05	<i>Macoma inquinata</i>	1.8	~1
RH98-05-326	RH98-05	<i>Macoma inquinata</i>	0.8	~1
RH98-05-327	RH98-05	<i>Macoma inquinata</i>	0.8	1
RH98-05-328	RH98-05	<i>Macoma inquinata</i>	0.7	1
RH98-05-329	RH98-05	<i>Macoma inquinata</i>	0.7	1
RH98-05-330	RH98-05	<i>Macoma inquinata</i>	1.6	~1
RH98-05-331	RH98-05	<i>Macoma inquinata</i>	3.2	~1
RH98-05-332	RH98-05	<i>Macoma inquinata</i>	4.2	~1
RH98-05-333	RH98-05	<i>Macoma inquinata</i>	4.2	~1
RH98-05-334	RH98-05	<i>Macoma inquinata</i>	2.8	~1
RH98-05-335	RH98-05	<i>Macoma inquinata</i>	1.1	~1
RH98-05-336	RH98-05	<i>Macoma inquinata</i>	2.4	1
RH98-05-337	RH98-05	<i>Macoma inquinata</i>	0.4	~1
RH98-05-338	RH98-05	<i>Macoma inquinata</i>	4.3	~1
RH98-05-339	RH98-05	<i>Macoma inquinata</i>	2.2	~1
RH98-05-340	RH98-05	<i>Macoma inquinata</i>	6.8	1
RH98-05-341	RH98-05	<i>Macoma inquinata</i>	1	~1
RH98-05-342	RH98-05	<i>Macoma inquinata</i>	1.3	~1
RH98-05-343	RH98-05	<i>Macoma inquinata</i>	1.2	1
RH98-05-344	RH98-05	<i>Macoma inquinata</i>	3.9	~1
RH98-05-345	RH98-05	<i>Macoma inquinata</i>	2	~1
RH98-05-346	RH98-05	<i>Macoma inquinata</i>	0.2	1
RH98-05-347	RH98-05	<i>Macoma inquinata</i>	1.1	~1
RH98-05-348	RH98-05	<i>Macoma inquinata</i>	0.8	1
RH98-05-349	RH98-05	<i>Macoma inquinata</i>	1.8	~1
RH98-05-350	RH98-05	<i>Macoma secta</i>	1.2	1
RH98-05-351	RH98-05	<i>Macoma secta</i>	0.4	1
RH98-05-352	RH98-05	<i>Macoma secta</i>	0.9	1
RH98-05-353	RH98-05	<i>Macoma secta</i>	1.1	1
RH98-05-354	RH98-05	<i>Macoma secta</i>	1.2	1
RH98-05-355	RH98-05	<i>Macoma secta</i>	2	1
RH98-05-356	RH98-05	<i>Macoma incongrua</i>	1.1	1
RH98-05-357	RH98-05	<i>Macoma incongrua</i>	0.6	1
RH98-05-358	RH98-05	<i>Macoma incongrua</i>	0.6	~1
RH98-05-359	RH98-05	<i>Macoma incongrua</i>	0.9	1
RH98-05-360	RH98-05	<i>Macoma incongrua</i>	1.9	1
RH98-05-361	RH98-05	<i>Macoma incongrua</i>	0.5	1
RH98-05-362	RH98-05	<i>Macoma incongrua</i>	0.9	~1
RH98-05-363	RH98-05	<i>Macoma incongrua</i>	0.8	~1
RH98-05-364	RH98-05	<i>Macoma incongrua</i>	0.4	~1
RH98-05-365	RH98-05	<i>Acila castrensis</i>	0.6	1
RH98-05-366	RH98-05	<i>Acila castrensis</i>	0.3	~1
RH98-05-367	RH98-05	<i>Acila castrensis</i>	0.4	1
RH98-05-368	RH98-05	<i>Lucinoma annulatum</i>	0.3	1
RH98-05-369	RH98-05	<i>Parvalucina tenuisculpta</i>	0.1	1
RH98-05-370	RH98-05	<i>Parvalucina tenuisculpta</i>	0.2	1
RH98-05-371	RH98-05	<i>Parvalucina tenuisculpta</i>	0.2	1
RH98-05-372	RH98-05	<i>Parvalucina tenuisculpta</i>	0.1	~1
RH98-05-373	RH98-05	<i>Parvalucina tenuisculpta</i>	0.3	1
RH98-05-374	RH98-05	<i>Parvalucina tenuisculpta</i>	0.2	1
RH98-05-375	RH98-05	<i>Parvalucina tenuisculpta</i>	0.3	1
RH98-05-376	RH98-05	<i>Parvalucina tenuisculpta</i>	0.1	~1
RH98-05-377	RH98-05	<i>Parvalucina tenuisculpta</i>	0.1	~1
RH98-05-378	RH98-05	<i>Parvalucina tenuisculpta</i>	0.1	~1
RH98-05-379	RH98-05	<i>Parvalucina tenuisculpta</i>	0.2	1
RH98-05-380	RH98-05	<i>Clinocardium nuttallii</i>	5.2	11 frag's
RH98-05-381	RH98-05	<i>Clinocardium nuttallii</i>	0.3	1 frag
RH98-05-382	RH98-05	<i>Clinocardium nuttallii</i>	1.2	~1
RH98-05-383	RH98-05	<i>Clinocardium nuttallii</i>	29.3	~1
RH98-05-384	RH98-05	<i>Clinocardium nuttallii</i>	0.1	~1
RH98-05-385	RH98-05	<i>Clinocardium nuttallii</i>	0.3	~1
RH98-05-386	RH98-05	<i>Clinocardium nuttallii</i>	0.3	~1
RH98-05-387	RH98-05	<i>Clinocardium nuttallii</i>	0.2	~1
RH98-05-388	RH98-05	<i>Clinocardium nuttallii</i>	8.9	14 frag's

RH98-05-389	RH98-05	<i>Clinocardium nuttallii</i>	0.8	2 frag's
RH98-05-390	RH98-05	<i>Clinocardium nuttallii</i>	2.8	1 frag
RH98-05-391	RH98-05	<i>Clinocardium nuttallii</i>	43.1	1
RH98-05-392	RH98-05	<i>Clinocardium nuttallii</i>	23.6	1
RH98-05-393	RH98-05	<i>Clinocardium nuttallii</i>	22.5	~1
RH98-05-394	RH98-05	<i>Clinocardium nuttallii</i>	10.6	~1
RH98-05-395	RH98-05	<i>Nassarius mendicus</i>	0.2	1
RH98-05-396	RH98-05	<i>Nassarius mendicus</i>	0.3	1
RH98-05-397	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-398	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-399	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-400	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-401	RH98-05	<i>Nassarius mendicus</i>	0.2	1
RH98-05-402	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-403	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-404	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-405	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-406	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-407	RH98-05	<i>Nassarius mendicus</i>	0.2	1
RH98-05-408	RH98-05	<i>Nassarius mendicus</i>	0.3	1
RH98-05-409	RH98-05	<i>Nassarius mendicus</i>	0.2	1
RH98-05-410	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-411	RH98-05	<i>Nassarius mendicus</i>	0.3	1
RH98-05-412	RH98-05	<i>Nassarius mendicus</i>	0.3	1
RH98-05-413	RH98-05	<i>Nassarius mendicus</i>	0.2	1
RH98-05-414	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-415	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-416	RH98-05	<i>Nassarius mendicus</i>	0.2	1
RH98-05-417	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-418	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-419	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-420	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-421	RH98-05	<i>Nassarius mendicus</i>	0.2	1
RH98-05-422	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-423	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-424	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-425	RH98-05	<i>Nassarius mendicus</i>	0.1	1
RH98-05-426	RH98-05	<i>Nucella lamellosa</i>	34	1
RH98-05-427	RH98-05	<i>Nucella lamellosa</i>	25.1	1
RH98-05-428	RH98-05	<i>Nucella lamellosa</i>	5.6	~1
RH98-05-429	RH98-05	<i>Calyptrea fastigiata</i>	0.8	1
RH98-05-430	RH98-05	<i>Calyptrea fastigiata</i>	0.4	1
RH98-05-431	RH98-05	<i>Calyptrea fastigiata</i>	0.2	1
RH98-05-432	RH98-05	<i>Calyptrea fastigiata</i>	0.1	1
RH98-05-433	RH98-05	<i>Calyptrea fastigiata</i>	0.2	1
RH98-05-434	RH98-05	<i>Calyptrea fastigiata</i>	0.1	1
RH98-05-435	RH98-05	<i>Calyptrea fastigiata</i>	0.1	1
RH98-05-436	RH98-05	<i>Crepidula adunca</i>	0.4	1
RH98-05-437	RH98-05	<i>Crepidula adunca</i>	0.8	1
RH98-05-438	RH98-05	<i>Crepidula adunca</i>	0.4	1
RH98-05-439	RH98-05	<i>Crepidula adunca</i>	0.3	1
RH98-05-440	RH98-05	<i>Crepidula adunca</i>	0.2	1
RH98-05-441	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-442	RH98-05	<i>Crepidula adunca</i>	0.6	1
RH98-05-443	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-444	RH98-05	<i>Crepidula adunca</i>	0.2	1
RH98-05-445	RH98-05	<i>Crepidula adunca</i>	0.6	1
RH98-05-446	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-447	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-448	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-449	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-450	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-451	RH98-05	<i>Crepidula adunca</i>	0.2	1
RH98-05-452	RH98-05	<i>Crepidula adunca</i>	0.1	1

RH98-05-453	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-454	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-455	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-456	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-457	RH98-05	<i>Crepidula adunca</i>	0.2	-1
RH98-05-458	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-459	RH98-05	<i>Crepidula adunca</i>	0.3	1
RH98-05-460	RH98-05	<i>Crepidula adunca</i>	0.3	1
RH98-05-461	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-462	RH98-05	<i>Crepidula adunca</i>	0.4	1
RH98-05-463	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-464	RH98-05	<i>Crepidula adunca</i>	0.7	1
RH98-05-465	RH98-05	<i>Crepidula adunca</i>	0.3	1
RH98-05-466	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-467	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-468	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-469	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-470	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-471	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-472	RH98-05	<i>Crepidula adunca</i>	0.2	1
RH98-05-473	RH98-05	<i>Crepidula adunca</i>	0.2	1
RH98-05-474	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-475	RH98-05	<i>Crepidula adunca</i>	0.3	1
RH98-05-476	RH98-05	<i>Crepidula adunca</i>	0.2	1
RH98-05-477	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-478	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-479	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-480	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-481	RH98-05	<i>Crepidula adunca</i>	0.3	1
RH98-05-482	RH98-05	<i>Crepidula adunca</i>	0.4	1
RH98-05-483	RH98-05	<i>Crepidula adunca</i>	0.1	1
RH98-05-484	RH98-05	<i>Hiatella pholadis</i>	0.3	1
RH98-05-485	RH98-05	<i>Hiatella pholadis</i>	0.1	1
RH98-05-486	RH98-05	<i>Hiatella pholadis</i>	0.1	1
RH98-05-487	RH98-05	<i>Lottia digitalis</i>	0.2	1
RH98-05-488	RH98-05	<i>Tectura persona</i>	0.1	1
RH98-05-489	RH98-05	<i>Tectura persona</i>	0.1	1
RH98-05-490	RH98-05	<i>Tectura persona</i>	0.1	1
RH98-05-491	RH98-05	<i>Mytilus trossulus</i>	0.1	-1
RH98-05-492	RH98-05	<i>Mytilus trossulus</i>	0.7	3 frag's
RH98-05-493	RH98-05	<i>Mytilus trossulus</i>	0.2	-1
RH98-05-494	RH98-05	<i>Mytilus trossulus</i>	0.4	2 frag's
RH98-05-495	RH98-05	<i>Mytilus trossulus</i>	0.1	1 frag
RH98-05-496	RH98-05	<i>Littorina sitkana</i>	0.1	1
RH98-05-497	RH98-05	<i>Littorina sitkana</i>	0.1	1
RH98-05-498	RH98-05	<i>Mya truncata</i>	0.1	-1
RH98-05-499	RH98-05	<i>Petalaoconchus compactus</i>	0.8	4 frag's
RH98-05-500	RH98-05	<i>Margarites pupillus</i>	0.1	1
RH98-05-501	RH98-05	Unidentified clam shell frag's	39.9	126 frag's
RH98-05-502	RH98-05	Unidentified clam shell frag's	6.7	22 frag's
RH98-05-503	RH98-05	Unidentified clam shell frag's	59	140 frag's
RH98-05-504	RH98-05	Unidentified clam shell frag's	19.7	37 frag's
RH98-05-505	RH98-05	<i>Balanus spp.</i>	50.3	150 frag's
RH98-05-506	RH98-05	<i>Balanus spp.</i>	8.5	36 frag's
RH98-05-507	RH98-05	<i>Balanus spp.</i>	27.8	89 frag's
RH98-05-508	RH98-05	<i>Balanus spp.</i>	2.7	5 frag's
RH98-05-509	RH98-05	Wood	3.5	8 frag's
RH98-05-510	RH98-05	Wood	0.4	7 frag's
RH98-05-511	RH98-05	Cone	1	1
Total weight (grams) RH98-05			3201	

Hetherington, R.

Appendix B: Northern Graham Island (RH99) raised beach sample data

Sample #	Sample Group	Species name	Shell weight (grams)	Number of shells
RH99-01-1	RH99-01	<i>Tectura fenestrata</i>	0.1	1
RH99-01-2	RH99-01	<i>Nemocardium centifilosum</i>	0.1	1
RH99-01-3	RH99-01	bivalve shell frag	0.1	1
RH99-01-4	RH99-01	<i>Balanus crenatus</i>	0.1	1
Total weight (grams) RH99-01			0.4	
RH99-04-1	RH99-04	unidentified bivalve	0.1	1
RH99-07-1	RH99-07	<i>Mytilus californianus</i>	2.1	1
RH99-07-2	RH99-07	<i>Mytilus californianus</i>	0.2	3 frag's
RH99-07-3	RH99-07	<i>Mytilus californianus</i>	2.2	1 frag
RH99-07-4	RH99-07	<i>Crassadoma gigantea</i>	0.9	1 frag
RH99-07-5	RH99-07	<i>Tectura fenestrata</i>	0.1	1
RH99-07-6	RH99-07	<i>Balanus sp.</i>	0.7	3 frag's
Total weight (grams) RH99-07			6.2	
RH99-08-1	RH99-08	<i>Saxidomus giganteus</i>	26.4	1
RH99-08-2	RH99-08	<i>Saxidomus giganteus</i>	53.3	1
RH99-08-3	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-4	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-5	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-6	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-7	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-8	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-9	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-10	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-11	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-12	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-13	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-14	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-15	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-16	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-17	RH99-08	<i>Saxidomus giganteus</i>	0.1	1
RH99-08-18	RH99-08	<i>Saxidomus giganteus</i>	0.5	~1
RH99-08-19	RH99-08	<i>Saxidomus giganteus</i>	0.4	~1
RH99-08-20	RH99-08	<i>Saxidomus giganteus</i>	2.8	~1
RH99-08-21	RH99-08	<i>Saxidomus giganteus</i>	0.6	~1
RH99-08-22	RH99-08	<i>Saxidomus giganteus</i>	0.9	~1
RH99-08-23	RH99-08	<i>Saxidomus giganteus</i>	0.2	~1
RH99-08-24	RH99-08	<i>Saxidomus giganteus</i>	0.1	~1
RH99-08-25	RH99-08	<i>Saxidomus giganteus</i>	0.1	~1
RH99-08-26	RH99-08	<i>Saxidomus giganteus</i>	56.7	24 frag's
RH99-08-27	RH99-08	<i>Protothaca staminea</i>	2.3	1
RH99-08-28	RH99-08	<i>Protothaca staminea</i>	0.1	1
RH99-08-29	RH99-08	<i>Protothaca staminea</i>	0.1	1
RH99-08-30	RH99-08	<i>Protothaca staminea</i>	0.1	1
RH99-08-31	RH99-08	<i>Protothaca staminea</i>	0.1	1
RH99-08-32	RH99-08	<i>Protothaca staminea</i>	0.1	1
RH99-08-33	RH99-08	<i>Protothaca staminea</i>	0.1	1
RH99-08-34	RH99-08	<i>Protothaca staminea</i>	0.1	~1
RH99-08-35	RH99-08	<i>Protothaca staminea</i>	0.3	~1
RH99-08-36	RH99-08	<i>Protothaca staminea</i>	3.2	~1
RH99-08-37	RH99-08	<i>Protothaca staminea</i>	0.1	~1
RH99-08-38	RH99-08	<i>Protothaca staminea</i>	0.2	~1
RH99-08-39	RH99-08	<i>Protothaca staminea</i>	0.5	~1
RH99-08-40	RH99-08	<i>Protothaca staminea</i>	0.7	~1

RH99-08-41	RH99-08	<i>Protothaca staminea</i>	0.2	-1
RH99-08-42	RH99-08	<i>Protothaca staminea</i>	0.1	-1
RH99-08-43	RH99-08	<i>Protothaca staminea</i>	0.1	-1
RH99-08-45	RH99-08	<i>Protothaca staminea</i>	8.4	19 frag's
RH99-08-46	RH99-08	<i>Clinocardium nuttallii</i>	0.5	1
RH99-08-47	RH99-08	<i>Clinocardium nuttallii</i>	1.8	-1
RH99-08-48	RH99-08	<i>Clinocardium nuttallii</i>	0.3	-1
RH99-08-49	RH99-08	<i>Clinocardium nuttallii</i>	27	43 frag's
RH99-08-50	RH99-08	<i>Mytilus californianus</i>	7.6	-1
RH99-08-51	RH99-08	<i>Mytilus californianus</i>	6	-1
RH99-08-52	RH99-08	<i>Mytilus californianus</i>	0.5	-1
RH99-08-53	RH99-08	<i>Mytilus californianus</i>	19.4	35 frag's
RH99-08-54	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-55	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-56	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-57	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-58	RH99-08	<i>Mytilus trossulus</i>	0.3	-1
RH99-08-59	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-60	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-61	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-62	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-63	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-64	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-65	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-66	RH99-08	<i>Mytilus trossulus</i>	0.3	-1
RH99-08-67	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-68	RH99-08	<i>Mytilus trossulus</i>	0.3	-1
RH99-08-69	RH99-08	<i>Mytilus trossulus</i>	0.4	-1
RH99-08-70	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-71	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-72	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-73	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-74	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-75	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-76	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-77	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-78	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-79	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-80	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-81	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-82	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-83	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-84	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-85	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-86	RH99-08	<i>Mytilus trossulus</i>	0.7	-1
RH99-08-87	RH99-08	<i>Mytilus trossulus</i>	0.5	-1
RH99-08-88	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-89	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-90	RH99-08	<i>Mytilus trossulus</i>	0.3	-1
RH99-08-91	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-92	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-93	RH99-08	<i>Mytilus trossulus</i>	0.7	-1
RH99-08-94	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-95	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-96	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-97	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-98	RH99-08	<i>Mytilus trossulus</i>	0.2	-1
RH99-08-99	RH99-08	<i>Mytilus trossulus</i>	0.4	-1
RH99-08-100	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-101	RH99-08	<i>Mytilus trossulus</i>	0.1	-1
RH99-08-102	RH99-08	<i>Mytilus trossulus</i>	0.1	-1

RH99-08-103	RH99-08	<i>Mytilus trossulus</i>	0.1	~1
RH99-08-104	RH99-08	<i>Mytilus trossulus</i>	0.1	~1
RH99-08-105	RH99-08	<i>Mytilus trossulus</i>	29.4	308 frag's
RH99-08-106	RH99-08	<i>Mytilus trossulus</i>	0.2	~1
RH99-08-107	RH99-08	<i>Mytilus trossulus</i>	0.1	~1
RH99-08-108	RH99-08	<i>Mytilus trossulus</i>	0.2	~1
RH99-08-109	RH99-08	<i>Mytilus trossulus</i>	0.2	~1
RH99-08-110	RH99-08	<i>Mytilus trossulus</i>	0.1	~1
RH99-08-111	RH99-08	<i>Mytilus trossulus</i>	0.1	~1
RH99-08-112	RH99-08	<i>Mytilus trossulus</i>	0.1	~1
RH99-08-113	RH99-08	<i>Tellina nukuloides</i>	0.5	1
RH99-08-114	RH99-08	<i>Tellina nukuloides</i>	0.2	1
RH99-08-115	RH99-08	<i>Tellina nukuloides</i>	0.2	1
RH99-08-116	RH99-08	<i>Tellina nukuloides</i>	0.2	1
RH99-08-117	RH99-08	<i>Tellina nukuloides</i>	0.2	1
RH99-08-118	RH99-08	<i>Tellina nukuloides</i>	0.4	1
RH99-08-119	RH99-08	<i>Tellina nukuloides</i>	0.1	1
RH99-08-120	RH99-08	<i>Tellina nukuloides</i>	0.1	1
RH99-08-121	RH99-08	<i>Tellina nukuloides</i>	0.1	1
RH99-08-122	RH99-08	<i>Tellina nukuloides</i>	0.1	1
RH99-08-123	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-124	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-125	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-126	RH99-08	<i>Tellina nukuloides</i>	0.2	~1
RH99-08-127	RH99-08	<i>Tellina nukuloides</i>	0.2	~1
RH99-08-128	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-129	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-130	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-131	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-132	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-133	RH99-08	<i>Tellina nukuloides</i>	0.1	~1
RH99-08-134	RH99-08	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-08-135	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-08-136	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-08-137	RH99-08	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-08-138	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-08-139	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-08-140	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-08-141	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-08-142	RH99-08	<i>Glycymeris septentrionalis</i>	0.4	~1
RH99-08-143	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-08-144	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-08-145	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-08-146	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-08-147	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-08-148	RH99-08	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-08-149	RH99-08	<i>Lacuna variegata</i>	0.1	1
RH99-08-150	RH99-08	<i>Lacuna variegata</i>	0.1	1
RH99-08-151	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-152	RH99-08	<i>Littorina sitkana</i>	0.2	1
RH99-08-153	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-154	RH99-08	<i>Littorina sitkana</i>	0.3	1
RH99-08-155	RH99-08	<i>Littorina sitkana</i>	0.2	1
RH99-08-156	RH99-08	<i>Littorina sitkana</i>	0.2	1
RH99-08-157	RH99-08	<i>Littorina sitkana</i>	0.2	1
RH99-08-158	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-159	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-160	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-161	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-162	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-163	RH99-08	<i>Littorina sitkana</i>	0.1	1

RH99-08-164	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-165	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-166	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-167	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-168	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-169	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-170	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-171	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-172	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-173	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-174	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-175	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-176	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-177	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-178	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-179	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-180	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-181	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-182	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-183	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-184	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-185	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-186	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-187	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-188	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-189	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-190	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-191	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-192	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-193	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-194	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-195	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-196	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-197	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-198	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-199	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-200	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-201	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-202	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-203	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-204	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-205	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-206	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-207	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-208	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-209	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-210	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-211	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-212	RH99-08	<i>Littorina sitkana</i>	0.1	1
RH99-08-213	RH99-08	<i>Bittium eschrichtii</i>	0.2	1
RH99-08-214	RH99-08	<i>Bittium eschrichtii</i>	0.2	1
RH99-08-215	RH99-08	<i>Bittium eschrichtii</i>	0.1	1
RH99-08-216	RH99-08	<i>Lirabuccinum dirum</i>	0.2	1
RH99-08-217	RH99-08	<i>Lirabuccinum dirum</i>	0.2	1
RH99-08-218	RH99-08	<i>Lirabuccinum dirum</i>	0.2	1
RH99-08-219	RH99-08	<i>Lirabuccinum dirum</i>	0.1	1
RH99-08-220	RH99-08	<i>Nucella lamellosa</i>	1.8	-1
RH99-08-221	RH99-08	<i>Nucella lamellosa</i>	0.5	1
RH99-08-222	RH99-08	<i>Nucella lamellosa</i>	0.3	-1
RH99-08-223	RH99-08	<i>Amphissa columbiana</i>	0.2	-1
RH99-08-224	RH99-08	<i>Amphissa columbiana</i>	0.1	-1

RH99-08-225	RH99-08	<i>Amphissa columbiana</i>	0.1	~1
RH99-08-226	RH99-08	<i>Velutina prolongata</i>	0.1	1
RH99-08-227	RH99-08	<i>Neptunea lyrata</i>	0.3	~1
RH99-08-228	RH99-08	<i>Neptunea lyrata</i>	0.8	~1
RH99-08-229	RH99-08	<i>Olivella baetica</i>	0.2	1
RH99-08-230	RH99-08	<i>Olivella baetica</i>	0.4	1
RH99-08-231	RH99-08	<i>Lottia pelta</i>	0.2	1
RH99-08-232	RH99-08	<i>Lottia pelta</i>	0.2	1
RH99-08-233	RH99-08	<i>Lottia pelta</i>	0.2	1
RH99-08-234	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-235	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-236	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-237	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-238	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-239	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-240	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-241	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-242	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-243	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-244	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-245	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-246	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-247	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-248	RH99-08	<i>Lottia pelta</i>	0.1	1
RH99-08-249	RH99-08	<i>Tectura persona</i>	0.1	1
RH99-08-250	RH99-08	<i>Tectura persona</i>	0.1	1
RH99-08-251	RH99-08	<i>Tectura persona</i>	0.1	1
RH99-08-252	RH99-08	<i>Tectura persona</i>	0.1	1
RH99-08-253	RH99-08	<i>Tectura persona</i>	0.1	1
RH99-08-254	RH99-08	<i>Tectura persona</i>	0.1	1
RH99-08-255	RH99-08	<i>Tectura persona</i>	0.1	1
RH99-08-256	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-257	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-258	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-259	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-260	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-261	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-262	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-263	RH99-08	<i>Lottia digitalis</i>	0.1	1
RH99-08-264	RH99-08	<i>Lottia digitalis</i>	0.2	1
RH99-08-265	RH99-08	<i>Calyptrea fastigiata</i>	0.1	1
RH99-08-266	RH99-08	<i>Chlamys rubida</i>	0.1	~1
RH99-08-267	RH99-08	<i>Chiton sp.</i>	0.3	4 frag's
RH99-08-268	RH99-08	Sea anenome	1	0.1
RH99-08-269	RH99-08	<i>Balanus spp.</i>	178.7	1113 frag's
RH99-08-270	RH99-08	Unidentified bivalve frag's	121.3	254
RH99-08-271	RH99-08	Unidentified gastropod frag's	1.2	4
Total weight (grams) RH99-08			588.5	

RH99-09-01	RH99-09	<i>Saxidomus giganteus</i>	24.2	1
RH99-09-02	RH99-09	<i>Saxidomus giganteus</i>	32.5	1
RH99-09-03	RH99-09	<i>Saxidomus giganteus</i>	26.1	1
RH99-09-04	RH99-09	<i>Saxidomus giganteus</i>	33.7	1
RH99-09-05	RH99-09	<i>Saxidomus giganteus</i>	4.2	~1
RH99-09-06	RH99-09	<i>Saxidomus giganteus</i>	4	1
RH99-09-07	RH99-09	<i>Saxidomus giganteus</i>	2	1
RH99-09-08	RH99-09	<i>Saxidomus giganteus</i>	2.3	~1
RH99-09-09	RH99-09	<i>Saxidomus giganteus</i>	0.8	1
RH99-09-10	RH99-09	<i>Saxidomus giganteus</i>	1.3	~1
RH99-09-11	RH99-09	<i>Saxidomus giganteus</i>	0.5	~1
RH99-09-12	RH99-09	<i>Saxidomus giganteus</i>	0.2	1

RH99-09-13	RH99-09	<i>Saxidomous giganteus</i>	0.1	1
RH99-09-14	RH99-09	<i>Saxidomous giganteus</i>	0.3	~1
RH99-09-15	RH99-09	<i>Saxidomous giganteus</i>	0.1	1
RH99-09-16	RH99-09	<i>Saxidomous giganteus</i>	0.6	~1
RH99-09-17	RH99-09	<i>Saxidomous giganteus</i>	0.7	~1
RH99-09-18	RH99-09	<i>Saxidomous giganteus</i>	0.2	~1
RH99-09-19	RH99-09	<i>Saxidomous giganteus</i>	0.4	~1
RH99-09-20	RH99-09	<i>Saxidomous giganteus</i>	0.2	~1
RH99-09-21	RH99-09	<i>Saxidomous giganteus</i>	0.1	~1
RH99-09-22	RH99-09	<i>Saxidomous giganteus</i>	1.5	2 frag's
RH99-09-23	RH99-09	<i>Protothaca staminea</i>	6.4	1
RH99-09-24	RH99-09	<i>Protothaca staminea</i>	2.7	1
RH99-09-25	RH99-09	<i>Protothaca staminea</i>	3.3	1
RH99-09-26	RH99-09	<i>Protothaca staminea</i>	0.3	1
RH99-09-27	RH99-09	<i>Protothaca staminea</i>	0.3	1
RH99-09-28	RH99-09	<i>Protothaca staminea</i>	0.2	1
RH99-09-29	RH99-09	<i>Protothaca staminea</i>	0.1	1
RH99-09-30	RH99-09	<i>Protothaca staminea</i>	0.2	~1
RH99-09-31	RH99-09	<i>Protothaca staminea</i>	0.7	~1
RH99-09-32	RH99-09	<i>Protothaca staminea</i>	0.1	
RH99-09-33	RH99-09	<i>Protothaca staminea</i>	4.1	10
RH99-09-34	RH99-09	<i>Clinocardium nuttallii</i>	4.5	5 frag's
RH99-09-35	RH99-09	<i>Tresus nuttallii</i>	41.8	1
RH99-09-36	RH99-09	<i>Tresus nuttallii</i>	9.6	1
RH99-09-37	RH99-09	<i>Tresus nuttallii</i>	3.2	1
RH99-09-38	RH99-09	<i>Glycymeris septentrionalis</i>	0.8	1
RH99-09-39	RH99-09	<i>Glycymeris septentrionalis</i>	0.4	1
RH99-09-40	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-41	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-42	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-43	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-44	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-45	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-46	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	~1
RH99-09-47	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-09-48	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1 frag
RH99-09-49	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-50	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-51	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-52	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-53	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-54	RH99-09	<i>Tellina nukuloides</i>	0.2	1
RH99-09-55	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-56	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-57	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-58	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-59	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-60	RH99-09	<i>Tellina nukuloides</i>	0.2	~1
RH99-09-61	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-62	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-63	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-64	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-65	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-66	RH99-09	<i>Tellina nukuloides</i>	0.2	1
RH99-09-67	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-68	RH99-09	<i>Mya truncata</i>	18.7	1
RH99-09-69	RH99-09	<i>Crassodoma gigantea</i>	2.3	1
RH99-09-70	RH99-09	<i>Chlamys sp.</i>	0.5	4 frag's
RH99-09-71	RH99-09	<i>Pododesmus machrochisma</i>	3.5	1
RH99-09-72	RH99-09	<i>Pododesmus machrochisma</i>	1.4	~1
RH99-09-73	RH99-09	<i>Mytilus californianus</i>	4.1	1

RH99-09-74	RH99-09	<i>Mytilus californianus</i>	1.4	1
RH99-09-75	RH99-09	<i>Mytilus californianus</i>	3.1	1
RH99-09-76	RH99-09	<i>Mytilus californianus</i>	47	1
RH99-09-77	RH99-09	<i>Mytilus californianus</i>	3	~1
RH99-09-78	RH99-09	<i>Mytilus californianus</i>	2.2	~1
RH99-09-79	RH99-09	<i>Mytilus californianus</i>	13.1	1
RH99-09-80	RH99-09	<i>Mytilus californianus</i>	7.3	~1
RH99-09-81	RH99-09	<i>Mytilus californianus</i>	2.1	~1
RH99-09-82	RH99-09	<i>Mytilus californianus</i>	3.4	~1
RH99-09-83	RH99-09	<i>Mytilus californianus</i>	1.1	~1
RH99-09-84	RH99-09	<i>Mytilus californianus</i>	0.3	~1
RH99-09-85	RH99-09	<i>Mytilus californianus</i>	12.3	~1
RH99-09-86	RH99-09	<i>Mytilus californianus</i>	85.3	50
RH99-09-87	RH99-09	<i>Bittium eschrichtii</i>	0.1	1
RH99-09-88	RH99-09	<i>Bittium eschrichtii</i>	0.1	1
RH99-09-89	RH99-09	<i>Astysis gausapata</i>	0.1	1
RH99-09-90	RH99-09	<i>Astysis gausapata</i>	0.1	1
RH99-09-91	RH99-09	<i>Nassarius mendicus</i>	0.1	1
RH99-09-92	RH99-09	<i>Nassarius mendicus</i>	0.1	1
RH99-09-93	RH99-09	<i>Amphissa columbiana</i>	0.1	~1
RH99-09-94	RH99-09	<i>Amphissa columbiana</i>	0.3	~1
RH99-09-95	RH99-09	<i>Lirabuccinum dirum</i>	1.2	~1
RH99-09-96	RH99-09	<i>Lirabuccinum dirum</i>	0.7	1 frag
RH99-09-97	RH99-09	<i>Olivella baetica</i>	0.3	1
RH99-09-98	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-99	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-100	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-101	RH99-09	<i>Lottia digitalis</i>	0.1	1
RH99-09-102	RH99-09	<i>Acmaea mitra</i>	0.3	1
RH99-09-103	RH99-09	<i>Fissurellidea bimaculata</i>	0.1	1
RH99-09-104	RH99-09	<i>Chiton sp.</i>	0.6	3 plates
RH99-09-105	RH99-09	Coral	0.3	6 frag's
RH99-09-106	RH99-09	Sea urchin	0.4	4 frag's
RH99-09-107	RH99-09	<i>Balanus spp.</i>	111.5	113 frag's
RH99-09-108	RH99-09	Unidentified clam shell frag's	36.4	32 frag's
RH99-09-109	RH99-09	Unidentified gastropod frag's	1.3	5 frag's
RH99-09-110	RH99-09	<i>Saxidomus giganteus</i>	18.6	1
RH99-09-111	RH99-09	<i>Saxidomus giganteus</i>	31.2	1
RH99-09-112	RH99-09	<i>Saxidomus giganteus</i>	50.1	1
RH99-09-113	RH99-09	<i>Saxidomus giganteus</i>	30.2	1
RH99-09-114	RH99-09	<i>Saxidomus giganteus</i>	41.1	1
RH99-09-115	RH99-09	<i>Saxidomus giganteus</i>	16.3	~1
RH99-09-116	RH99-09	<i>Saxidomus giganteus</i>	56.4	1
RH99-09-117	RH99-09	<i>Saxidomus giganteus</i>	48.4	1
RH99-09-118	RH99-09	<i>Saxidomus giganteus</i>	38.2	1
RH99-09-119	RH99-09	<i>Saxidomus giganteus</i>	50.8	1
RH99-09-120	RH99-09	<i>Saxidomus giganteus</i>	31.3	1
RH99-09-121	RH99-09	<i>Saxidomus giganteus</i>	11.9	~1
RH99-09-122	RH99-09	<i>Saxidomus giganteus</i>	1.3	~1
RH99-09-123	RH99-09	<i>Saxidomus giganteus</i>	4.5	~1
RH99-09-124	RH99-09	<i>Saxidomus giganteus</i>	1.6	~1
RH99-09-125	RH99-09	<i>Saxidomus giganteus</i>	0.3	~1
RH99-09-126	RH99-09	<i>Saxidomus giganteus</i>	8.2	~1
RH99-09-127	RH99-09	<i>Saxidomus giganteus</i>	0.7	~1
RH99-09-128	RH99-09	<i>Saxidomus giganteus</i>	0.3	~1
RH99-09-129	RH99-09	<i>Saxidomus giganteus</i>	3.2	~1
RH99-09-130	RH99-09	<i>Saxidomus giganteus</i>	0.6	~1
RH99-09-131	RH99-09	<i>Saxidomus giganteus</i>	0.6	~1
RH99-09-132	RH99-09	<i>Saxidomus giganteus</i>	1.1	1
RH99-09-133	RH99-09	<i>Saxidomus giganteus</i>	0.4	~1
RH99-09-134	RH99-09	<i>Saxidomus giganteus</i>	0.8	~1

RH99-09-135	RH99-09	<i>Saxidomous giganteus</i>	0.7	-1
RH99-09-136	RH99-09	<i>Saxidomous giganteus</i>	2.2	-1
RH99-09-137	RH99-09	<i>Saxidomous giganteus</i>	0.1	-1
RH99-09-138	RH99-09	<i>Saxidomous giganteus</i>	0.1	-1
RH99-09-139	RH99-09	<i>Saxidomous giganteus</i>	0.1	-1
RH99-09-140	RH99-09	<i>Saxidomous giganteus</i>	162.9	38 frag's
RH99-09-141	RH99-09	<i>Protothaca staminea</i>	9	1
RH99-09-142	RH99-09	<i>Protothaca staminea</i>	1.4	1
RH99-09-143	RH99-09	<i>Protothaca staminea</i>	3.9	1
RH99-09-144	RH99-09	<i>Protothaca staminea</i>	1.9	1
RH99-09-145	RH99-09	<i>Protothaca staminea</i>	0.2	1
RH99-09-146	RH99-09	<i>Protothaca staminea</i>	0.2	1
RH99-09-147	RH99-09	<i>Protothaca staminea</i>	0.1	1
RH99-09-148	RH99-09	<i>Protothaca staminea</i>	0.1	1
RH99-09-149	RH99-09	<i>Protothaca staminea</i>	1.4	1
RH99-09-150	RH99-09	<i>Protothaca staminea</i>	2.2	1
RH99-09-151	RH99-09	<i>Protothaca staminea</i>	0.4	1
RH99-09-152	RH99-09	<i>Protothaca staminea</i>	0.7	1
RH99-09-153	RH99-09	<i>Protothaca staminea</i>	0.1	1
RH99-09-154	RH99-09	<i>Protothaca staminea</i>	0.3	1
RH99-09-155	RH99-09	<i>Protothaca staminea</i>	0.2	1
RH99-09-156	RH99-09	<i>Protothaca staminea</i>	0.1	1
RH99-09-157	RH99-09	<i>Protothaca staminea</i>	0.2	1
RH99-09-158	RH99-09	<i>Protothaca staminea</i>	0.1	1
RH99-09-159	RH99-09	<i>Protothaca staminea</i>	0.2	1
RH99-09-160	RH99-09	<i>Protothaca staminea</i>	0.1	1
RH99-09-161	RH99-09	<i>Protothaca staminea</i>	0.2	-1
RH99-09-162	RH99-09	<i>Protothaca staminea</i>	0.3	-1
RH99-09-163	RH99-09	<i>Protothaca staminea</i>	0.8	-1
RH99-09-164	RH99-09	<i>Protothaca staminea</i>	0.6	-1
RH99-09-165	RH99-09	<i>Protothaca staminea</i>	3.2	-1
RH99-09-166	RH99-09	<i>Protothaca staminea</i>	1.5	-1
RH99-09-167	RH99-09	<i>Protothaca staminea</i>	12.4	-1
RH99-09-168	RH99-09	<i>Protothaca staminea</i>	0.3	-1
RH99-09-169	RH99-09	<i>Protothaca staminea</i>	0.3	-1
RH99-09-170	RH99-09	<i>Protothaca staminea</i>	0.7	-1
RH99-09-171	RH99-09	<i>Protothaca staminea</i>	0.1	-1
RH99-09-172	RH99-09	<i>Protothaca staminea</i>	0.3	-1
RH99-09-173	RH99-09	<i>Protothaca staminea</i>	19.2	33 frag's
RH99-09-174	RH99-09	<i>Clinocardium nuttallii</i>	0.1	1
RH99-09-175	RH99-09	<i>Clinocardium nuttallii</i>	0.1	1
RH99-09-176	RH99-09	<i>Clinocardium nuttallii</i>	0.3	-1
RH99-09-177	RH99-09	<i>Clinocardium nuttallii</i>	0.3	-1
RH99-09-178	RH99-09	<i>Clinocardium nuttallii</i>	0.4	-1
RH99-09-1793	RH99-09	<i>Clinocardium nuttallii</i>	0.5	-1
RH99-09-180	RH99-09	<i>Clinocardium nuttallii</i>	0.2	-1
RH99-09-181	RH99-09	<i>Clinocardium nuttallii</i>	24.5	22 frag's
RH99-09-182	RH99-09	<i>Glycymeris septentrionalis</i>	1.3	1
RH99-09-183	RH99-09	<i>Glycymeris septentrionalis</i>	0.5	1
RH99-09-184	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-09-185	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-186	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-187	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-188	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-09-189	RH99-09	<i>Glycymeris septentrionalis</i>	0.5	1
RH99-09-190	RH99-09	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-09-191	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-09-192	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-09-193	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-09-194	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-09-195	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1

RH99-09-196	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-197	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-198	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-199	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-200	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-201	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-202	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-203	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-204	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-205	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-206	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-207	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-208	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-209	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-210	RH99-09	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-09-211	RH99-09	<i>Glycymeris septentrionalis</i>	0.2	2 frag's
RH99-09-212	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-213	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-214	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-215	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-216	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-217	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-218	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-219	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-220	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-221	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-222	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-223	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-224	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-225	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-226	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-227	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-228	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-229	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-230	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-231	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-232	RH99-09	<i>Tellina nukuloides</i>	0.2	1
RH99-09-233	RH99-09	<i>Tellina nukuloides</i>	0.2	1
RH99-09-234	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-235	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-236	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-237	RH99-09	<i>Tellina nukuloides</i>	0.2	1
RH99-09-238	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-239	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-240	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-241	RH99-09	<i>Tellina nukuloides</i>	0.2	1
RH99-09-242	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-243	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-244	RH99-09	<i>Tellina nukuloides</i>	0.2	1
RH99-09-245	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-246	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-247	RH99-09	<i>Tellina nukuloides</i>	0.1	1
RH99-09-248	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-249	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-250	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-251	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-252	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-253	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-254	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-255	RH99-09	<i>Tellina nukuloides</i>	0.1	~1
RH99-09-256	RH99-09	<i>Mya truncata</i>	11.7	1

RH99-09-257	RH99-09	<i>Mya truncata</i>	0.7	~1
RH99-09-258	RH99-09	<i>Mya truncata</i>	3.1	~1
RH99-09-259	RH99-09	<i>Chlamys rubida</i>	0.4	1
RH99-09-260	RH99-09	<i>Chlamys rubida</i>	0.1	1
RH99-09-261	RH99-09	<i>Chlamys rubida</i>	0.2	1
RH99-09-262	RH99-09	<i>Chlamys rubida</i>	0.4	~1
RH99-09-263	RH99-09	<i>Chlamys rubida</i>	0.1	~1
RH99-09-264	RH99-09	<i>Chlamys rubida</i>	1	5 frag's
RH99-09-265	RH99-09	<i>Diplodonta impolita</i>	0.4	1
RH99-09-2665	RH99-09	<i>Diplodonta impolita</i>	0.4	1
RH99-09-267	RH99-09	<i>Humilaria kennerleyi</i>	2	1
RH99-09-268	RH99-09	<i>Pododesmus machrochisma</i>	23.5	1
RH99-09-269	RH99-09	<i>Pododesmus machrochisma</i>	1.2	~1
RH99-09-270	RH99-09	<i>Bittium eschrichtii</i>	0.2	1
RH99-09-271	RH99-09	<i>Bittium eschrichtii</i>	0.2	1
RH99-09-272	RH99-09	<i>Nassarius mendicus</i>	0.1	1
RH99-09-273	RH99-09	<i>Nassarius mendicus</i>	0.1	1
RH99-09-274	RH99-09	<i>Amphissa columbiana</i>	0.3	~1
RH99-09-275	RH99-09	<i>Amphissa columbiana</i>	0.3	~1
RH99-09-276	RH99-09	<i>Amphissa columbiana</i>	0.4	~1
RH99-09-277	RH99-09	<i>Amphissa columbiana</i>	0.5	~1
RH99-09-278	RH99-09	<i>Amphissa columbiana</i>	0.2	~1
RH99-09-279	RH99-09	<i>Amphissa columbiana</i>	0.2	~1
RH99-09-280	RH99-09	<i>Amphissa columbiana</i>	0.2	~1
RH99-09-281	RH99-09	<i>Lirabuccinum dirum</i>	1.4	1
RH99-09-282	RH99-09	<i>Lirabuccinum dirum</i>	0.4	~1
RH99-09-283	RH99-09	<i>Lirabuccinum dirum</i>	0.5	~1
RH99-09-284	RH99-09	<i>Olivella baetica</i>	0.3	1
RH99-09-285	RH99-09	<i>Olivella baetica</i>	0.4	~1
RH99-09-286	RH99-09	<i>Tectura persona</i>	0.4	1
RH99-09-287	RH99-09	<i>Tectura persona</i>	0.2	1
RH99-09-288	RH99-09	<i>Tectura persona</i>	0.2	1
RH99-09-289	RH99-09	<i>Tectura persona</i>	0.2	1
RH99-09-290	RH99-09	<i>Tectura persona</i>	0.2	1
RH99-09-291	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-292	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-293	RH99-09	<i>Tectura persona</i>	0.6	1
RH99-09-2940	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-295	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-296	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-297	RH99-09	<i>Tectura persona</i>	0.1	1
RH99-09-298	RH99-09	<i>Lottia digitalis</i>	0.2	1
RH99-09-299	RH99-09	<i>Lottia digitalis</i>	0.2	1
RH99-09-300	RH99-09	<i>Acmaea mitra</i>	1.6	1
RH99-09-301	RH99-09	<i>Acmaea mitra</i>	0.3	1
RH99-09-302	RH99-09	<i>Acmaea mitra</i>	0.2	1
RH99-09-303	RH99-09	<i>Acmaea mitra</i>	0.3	1
RH99-09-3047	RH99-09	<i>Acmaea mitra</i>	0.4	1
RH99-09-3057	RH99-09	<i>Acmaea mitra</i>	0.8	1
RH99-09-3067	RH99-09	<i>Acmaea mitra</i>	0.1	1
RH99-09-3077	RH99-09	<i>Lottia instabilis</i>	0.8	1
RH99-09-308	RH99-09	<i>Fissurellidea bimaculata</i>	0.1	1
RH99-09-309	RH99-09	<i>Fissurellidea bimaculata</i>	0.1	1
RH99-09-310	RH99-09	<i>Tresus nuttallii</i>	1.7	1
RH99-09-311	RH99-09	<i>Tresus nuttallii</i>	20	~1
RH99-09-312	RH99-09	<i>Tresus nuttallii</i>	2.7	~1
RH99-09-313	RH99-09	<i>Tresus nuttallii</i>	84.7	1
RH99-09-314	RH99-09	<i>Tresus nuttallii</i>	71.6	~1
RH99-09-315	RH99-09	<i>Tresus nuttallii</i>	18.8	3 frag's
RH99-09-316	RH99-09	<i>Tresus capax</i>	248.5	1
RH99-09-317	RH99-09	<i>Tresus capax</i>	157	1

RH99-09-3189	RH99-09	<i>Tresus capax</i>	99	1
RH99-09-3199	RH99-09	<i>Tresus capax</i>	92.6	1
RH99-09-320	RH99-09	<i>Tresus capax</i>	111.8	1
RH99-09-321	RH99-09	<i>Tresus capax</i>	224	2 artic'd
RH99-09-322	RH99-09	<i>Tresus capax</i>	84.9	3 frag's
RH99-09-323	RH99-09	<i>Crassodoma gigantea</i>	2.3	~1
RH99-09-324	RH99-09	<i>Chiton sp.</i>	1	5 plates
RH99-09-325	RH99-09	<i>Mytilus californianus</i>	5.4	~1
RH99-09-326	RH99-09	<i>Mytilus californianus</i>	1.9	~1
RH99-09-327	RH99-09	<i>Mytilus californianus</i>	3.8	~1
RH99-09-328	RH99-09	<i>Mytilus californianus</i>	8.6	~1
RH99-09-329	RH99-09	<i>Mytilus californianus</i>	7.6	~1
RH99-09-330	RH99-09	<i>Mytilus californianus</i>	2.8	~1
RH99-09-331	RH99-09	<i>Mytilus californianus</i>	4.9	~1
RH99-09-332	RH99-09	<i>Mytilus californianus</i>	8.1	~1
RH99-09-333	RH99-09	<i>Mytilus californianus</i>	5	~1
RH99-09-334	RH99-09	<i>Mytilus californianus</i>	2.9	~1
RH99-09-335	RH99-09	<i>Mytilus californianus</i>	6.2	~1
RH99-09-336	RH99-09	<i>Mytilus californianus</i>	20.7	1
RH99-09-337	RH99-09	<i>Mytilus californianus</i>	17.2	~
RH99-09-338	RH99-09	<i>Mytilus californianus</i>	3.8	~1
RH99-09-339	RH99-09	<i>Mytilus californianus</i>	1.5	1
RH99-09-340	RH99-09	<i>Mytilus californianus</i>	3.6	~1
RH99-09-341	RH99-09	<i>Mytilus californianus</i>	4.7	~1
RH99-09-342	RH99-09	<i>Mytilus californianus</i>	11.3	~1
RH99-09-343	RH99-09	<i>Mytilus californianus</i>	7.2	~1
RH99-09-344	RH99-09	<i>Mytilus californianus</i>	0.6	1
RH99-09-345	RH99-09	<i>Mytilus californianus</i>	1.5	1
RH99-09-346	RH99-09	<i>Mytilus californianus</i>	0.7	~1
RH99-09-347	RH99-09	<i>Mytilus californianus</i>	2.4	~1
RH99-09-348	RH99-09	<i>Mytilus californianus</i>	2.1	~1
RH99-09-349	RH99-09	<i>Mytilus californianus</i>	0.7	~1
RH99-09-350	RH99-09	<i>Mytilus californianus</i>	1	~1
RH99-09-351	RH99-09	<i>Mytilus californianus</i>	7.3	~1
RH99-09-352	RH99-09	<i>Mytilus californianus</i>	0.2	~1
RH99-09-353	RH99-09	<i>Mytilus californianus</i>	0.2	~1
RH99-09-354	RH99-09	<i>Mytilus californianus</i>	6.4	1
RH99-09-355	RH99-09	<i>Mytilus californianus</i>	1.1	~1
RH99-09-356	RH99-09	<i>Mytilus californianus</i>	1.6	~1
RH99-09-3574	RH99-09	<i>Mytilus californianus</i>	0.2	~1
RH99-09-358	RH99-09	<i>Mytilus californianus</i>	1.1	~1
RH99-09-359	RH99-09	<i>Mytilus californianus</i>	0.7	~1
RH99-09-3604	RH99-09	<i>Mytilus californianus</i>	1.3	~1
RH99-09-361	RH99-09	<i>Mytilus californianus</i>	1.5	~1
RH99-09-362	RH99-09	<i>Mytilus californianus</i>	1.4	~1
RH99-09-363	RH99-09	<i>Mytilus californianus</i>	0.7	~1
RH99-09-364	RH99-09	<i>Mytilus californianus</i>	0.1	1
RH99-09-365	RH99-09	<i>Mytilus californianus</i>	0.1	1
RH99-09-366	RH99-09	<i>Mytilus californianus</i>	0.3	~1
RH99-09-367	RH99-09	<i>Mytilus californianus</i>	1.2	~1
RH99-09-368	RH99-09	<i>Mytilus californianus</i>	138.4	89 frag's
RH99-09-369	RH99-09	<i>Mytilus californianus</i>	1	~1
RH99-09-370	RH99-09	<i>Mytilus californianus</i>	0.2	~1
RH99-09-371	RH99-09	<i>Macoma inquinata</i>	0.4	1
RH99-09-372	RH99-09	<i>Crepidula nummaria</i>	0.3	1
RH99-09-373	RH99-09	<i>Euspira pallida</i>	0.4	~1
RH99-09-374	RH99-09	<i>Euspira pallida</i>	0.3	~1
RH99-09-375	RH99-09	<i>Neptunea lyrata</i>	0.8	~1
RH99-09-376	RH99-09	<i>Neptunea lyrata</i>	0.2	2 frag's
RH99-09-377	RH99-09	<i>Nucella lima</i>	0.3	1
RH99-09-378	RH99-09	<i>Nucella lamellosa</i>	1.3	~1

RH99-09-379	RH99-09	<i>Terebratalia transversa</i>	0.2	2 artic'd
RH99-09-380	RH99-09	Coral	0.7	8 frag's
RH99-09-381	RH99-09	<i>Petalaeonchus compactus</i>	18.9	16 frag's
RH99-09-382	RH99-09	<i>Balanus spp.</i>	196.1	234 frag's
RH99-09-383	RH99-09	unidentified clam shell frag's	62.5	41 frag's
RH99-09-384	RH99-09	unidentified gastropod frag's	0.6	3 frag's
RH99-09-385	RH99-09	<i>Simomactra falcata</i>	1.1	1
RH99-09-386	RH99-09	<i>Macoma lama</i>	2.1	1
RH99-09-387	RH99-09	<i>Macoma lama</i>	2.1	1 (3 frag's)
RH99-09-388	RH99-09	<i>Balanus nubilus</i>	2.4	9 frag's
RH99-09-389	RH99-09	<i>Balanus cariosus</i>	0.9	3 frag's
RH99-09-390	RH99-09	sand dollar	2.1	1 frag
Total weight (grams) RH99-09			3172.5	
RH99-10-01	RH99-10	<i>Saxidomus giganteus</i>	43.3	1
RH99-10-02	RH99-10	<i>Saxidomus giganteus</i>	0.6	~1
RH99-10-03	RH99-10	<i>Saxidomus giganteus</i>	14.8	~1
RH99-10-04	RH99-10	<i>Saxidomus giganteus</i>	0.7	~1
RH99-10-05	RH99-10	<i>Saxidomus giganteus</i>	0.7	~1
RH99-10-06	RH99-10	<i>Saxidomus giganteus</i>	0.2	1
RH99-10-07	RH99-10	<i>Saxidomus giganteus</i>	0.4	~1
RH99-10-08	RH99-10	<i>Saxidomus giganteus</i>	19.4	~1
RH99-10-09	RH99-10	<i>Saxidomus giganteus</i>	24.7	1
RH99-10-10	RH99-10	<i>Saxidomus giganteus</i>	0.2	1
RH99-10-11	RH99-10	<i>Saxidomus giganteus</i>	0.3	~1
RH99-10-12	RH99-10	<i>Saxidomus giganteus</i>	375.2	35 frag's
RH99-10-13	RH99-10	<i>Protothaca staminea</i>	1.1	4 frag's
RH99-10-14	RH99-10	<i>Humiliaria kennerteyi</i>	17.2	2 articul'd
RH99-10-15	RH99-10	<i>Tresus capax</i>	52.1	~1
RH99-10-16	RH99-10	<i>Tresus capax</i>	62.1	3 rags
RH99-10-17	RH99-10	<i>Clinocardium nuttallii</i>	2.2	~1
RH99-10-18	RH99-10	<i>Clinocardium nuttallii</i>	0.4	~1
RH99-10-19	RH99-10	<i>Clinocardium nuttallii</i>	23.6	11 frag's
RH99-10-20	RH99-10	<i>Mytilus californianus</i>	9.4	1
RH99-10-21	RH99-10	<i>Mytilus californianus</i>	15.7	~1
RH99-10-22	RH99-10	<i>Mytilus californianus</i>	1.4	~1
RH99-10-23	RH99-10	<i>Mytilus californianus</i>	7.8	~
RH99-10-24	RH99-10	<i>Mytilus californianus</i>	0.4	~1
RH99-10-25	RH99-10	<i>Mytilus californianus</i>	0.2	~1
RH99-10-26	RH99-10	<i>Mytilus californianus</i>	27.9	31 frag's
RH99-10-27	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-28	RH99-10	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-10-29	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-30	RH99-10	<i>Glycymeris septentrionalis</i>	0.4	1
RH99-10-31	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-32	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-33	RH99-10	<i>Glycymeris septentrionalis</i>	0.6	1
RH99-10-34	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-35	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-36	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-37	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-38	RH99-10	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-10-39	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-40	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-41	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-42	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-43	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-44	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-45	RH99-10	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-10-46	RH99-10	<i>Glycymeris septentrionalis</i>	0.4	1
RH99-10-47	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1

RH99-10-48	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-49	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-50	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-51	RH99-10	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-10-52	RH99-10	<i>Glycymeris septentrionalis</i>	0.6	1
RH99-10-53	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-54	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-55	RH99-10	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-10-56	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-57	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-58	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-59	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-60	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-61	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-62	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-63	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-64	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-10-65	RH99-10	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-10-66	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-67	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-68	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-69	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-70	RH99-10	<i>Tellina nukuloides</i>	0.3	~1
RH99-10-71	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-72	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-73	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-74	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-75	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-76	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-77	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-78	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-79	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-80	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-81	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-82	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-83	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-84	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-85	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-86	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-87	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-88	RH99-10	<i>Tellina nukuloides</i>	0.1	~1
RH99-10-89	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-90	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-91	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-92	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-93	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-94	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-95	RH99-10	<i>Tellina nukuloides</i>	0.3	~1
RH99-10-96	RH99-10	<i>Tellina nukuloides</i>	0.2	1
RH99-10-97	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-98	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-99	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-100	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-101	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-102	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-103	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-104	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-105	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-106	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-107	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-108	RH99-10	<i>Tellina nukuloides</i>	0.1	1

RH99-10-109	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-110	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-111	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-112	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-113	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-114	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-115	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-116	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-117	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-118	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-119	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-120	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-121	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-122	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-123	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-124	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-125	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-126	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-127	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-128	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-129	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-130	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-131	RH99-10	<i>Tellina nukuloides</i>	0.1	1
RH99-10-132	RH99-10	<i>Tectura persona</i>	0.1	1
RH99-10-133	RH99-10	<i>Fissurellidea bimaculata</i>	0.1	1
RH99-10-134	RH99-10	<i>Fissurellidea bimaculata</i>	0.1	1
RH99-10-135	RH99-10	unidentified gastropod frag's	0.7	~3
RH99-10-136	RH99-10	<i>Chiton sp.</i>	0.2	1 plate
RH99-10-137	RH99-10	<i>Balanus spp.</i>	48	44 frag's
RH99-10-138	RH99-10	<i>Balanus nebulus</i>	474.8	1 piece
RH99-10-139	RH99-10	unidentified clam shell frag's	31.6	69 frag's
RH99-10-140	RH99-10	<i>Simomactra falcata</i>	2.4	1
RH99-10-141	RH99-10	sand dollar	8.9	6 frag's
Total weight (grams) RH99-10			1284.8	
RH99-11-1	RH99-11	<i>Saxidomus giganteus</i>	34.4	1
RH99-11-2	RH99-11	<i>Saxidomus giganteus</i>	37.9	1
RH99-11-3	RH99-11	<i>Saxidomus giganteus</i>	16.3	1
RH99-11-4	RH99-11	<i>Saxidomus giganteus</i>	44.8	1
RH99-11-5	RH99-11	<i>Saxidomus giganteus</i>	15.2	1
RH99-11-6	RH99-11	<i>Saxidomus giganteus</i>	17.2	1
RH99-11-7	RH99-11	<i>Saxidomus giganteus</i>	19.3	1
RH99-11-8	RH99-11	<i>Saxidomus giganteus</i>	60.2	1
RH99-11-9	RH99-11	<i>Saxidomus giganteus</i>	36.1	1
RH99-11-10	RH99-11	<i>Saxidomus giganteus</i>	24.2	1
RH99-11-11	RH99-11	<i>Saxidomus giganteus</i>	34.9	1
RH99-11-12	RH99-11	<i>Saxidomus giganteus</i>	57.7	1
RH99-11-13	RH99-11	<i>Saxidomus giganteus</i>	64.1	1
RH99-11-14	RH99-11	<i>Saxidomus giganteus</i>	56.6	1
RH99-11-15	RH99-11	<i>Saxidomus giganteus</i>	35.8	1
RH99-11-16	RH99-11	<i>Saxidomus giganteus</i>	39.4	1
RH99-11-17	RH99-11	<i>Saxidomus giganteus</i>	2.9	1
RH99-11-18	RH99-11	<i>Saxidomus giganteus</i>	0.9	~1
RH99-11-19	RH99-11	<i>Saxidomus giganteus</i>	1	~1
RH99-11-20	RH99-11	<i>Saxidomus giganteus</i>	0.6	~1
RH99-11-21	RH99-11	<i>Saxidomus giganteus</i>	0.8	~1
RH99-11-22	RH99-11	<i>Saxidomus giganteus</i>	0.8	~1
RH99-11-23	RH99-11	<i>Saxidomus giganteus</i>	0.5	~1
RH99-11-24	RH99-11	<i>Saxidomus giganteus</i>	0.2	~1
RH99-11-25	RH99-11	<i>Saxidomus giganteus</i>	0.3	~1
RH99-11-26	RH99-11	<i>Saxidomus giganteus</i>	0.5	~1

RH99-11-27	RH99-11	<i>Saxidomus giganteus</i>	0.7	~1
RH99-11-28	RH99-11	<i>Saxidomus giganteus</i>	15.9	~1
RH99-11-29	RH99-11	<i>Saxidomus giganteus</i>	11.3	~1
RH99-11-30	RH99-11	<i>Saxidomus giganteus</i>	8.1	~1
RH99-11-31	RH99-11	<i>Saxidomus giganteus</i>	26.9	~1
RH99-11-32	RH99-11	<i>Saxidomus giganteus</i>	7.8	~1
RH99-11-33	RH99-11	<i>Saxidomus giganteus</i>	3.6	~1
RH99-11-34	RH99-11	<i>Saxidomus giganteus</i>	1.1	~1
RH99-11-35	RH99-11	<i>Saxidomus giganteus</i>	7.9	~1
RH99-11-36	RH99-11	<i>Saxidomus giganteus</i>	3.3	~1
RH99-11-37	RH99-11	<i>Saxidomus giganteus</i>	20.5	~1
RH99-11-38	RH99-11	<i>Saxidomus giganteus</i>	24.7	~1
RH99-11-39	RH99-11	<i>Saxidomus giganteus</i>	265.5	27 frag's
RH99-11-40	RH99-11	<i>Saxidomus giganteus</i>	312.5	26 frag's
RH99-11-41	RH99-11	<i>Saxidomus giganteus</i>	232.7	24 frag's
RH99-11-42	RH99-11	<i>Protothaca staminea</i>	1.7	1
RH99-11-43	RH99-11	<i>Protothaca staminea</i>	21.8	10 frag's
RH99-11-44	RH99-11	<i>Clinocardium nuttallii</i>	1.6	1
RH99-11-45	RH99-11	<i>Clinocardium nuttallii</i>	42.5	15 frag's
RH99-11-46	RH99-11	<i>Tresus species</i>	2.9	~1
RH99-11-47	RH99-11	<i>Tresus species</i>	5.8	3 frag's
RH99-11-48	RH99-11	<i>Mactromeris polynyma</i>	87.5	1
RH99-11-49	RH99-11	<i>Mactromeris polynyma</i>	16.3	1
RH99-11-50	RH99-11	<i>Mactromeris polynyma</i>	8.5	1
RH99-11-51	RH99-11	<i>Mactromeris polynyma</i>	15.8	1
RH99-11-52	RH99-11	<i>Mactromeris polynyma</i>	14.7	1
RH99-11-53	RH99-11	<i>Mactromeris polynyma</i>	0.6	~1
RH99-11-54	RH99-11	<i>Mactromeris polynyma</i>	8.4	3 frag's
RH99-11-55	RH99-11	<i>Mytilus californianus</i>	6.8	1
RH99-11-56	RH99-11	<i>Mytilus californianus</i>	19	1
RH99-11-57	RH99-11	<i>Mytilus californianus</i>	8.5	~1
RH99-11-58	RH99-11	<i>Mytilus californianus</i>	7.2	~1
RH99-11-59	RH99-11	<i>Mytilus californianus</i>	3.1	~1
RH99-11-60	RH99-11	<i>Mytilus californianus</i>	0.7	~1
RH99-11-61	RH99-11	<i>Mytilus californianus</i>	1.4	~1
RH99-11-62	RH99-11	<i>Mytilus californianus</i>	3.7	~1
RH99-11-63	RH99-11	<i>Mytilus californianus</i>	1.9	~1
RH99-11-64	RH99-11	<i>Mytilus californianus</i>	1	~1
RH99-11-65	RH99-11	<i>Mytilus californianus</i>	0.9	~1
RH99-11-66	RH99-11	<i>Mytilus californianus</i>	1.7	~1
RH99-11-67	RH99-11	<i>Mytilus californianus</i>	2.9	~1
RH99-11-68	RH99-11	<i>Mytilus californianus</i>	1.3	~1
RH99-11-69	RH99-11	<i>Mytilus californianus</i>	4.6	~1
RH99-11-70	RH99-11	<i>Mytilus californianus</i>	5	~1
RH99-11-71	RH99-11	<i>Mytilus californianus</i>	0.2	~1
RH99-11-72	RH99-11	<i>Mytilus californianus</i>	0.1	~1
RH99-11-73	RH99-11	<i>Mytilus californianus</i>	0.9	~1
RH99-11-74	RH99-11	<i>Mytilus californianus</i>	0.5	~1
RH99-11-75	RH99-11	<i>Mytilus californianus</i>	0.4	~1
RH99-11-76	RH99-11	<i>Mytilus californianus</i>	0.2	~1
RH99-11-77	RH99-11	<i>Mytilus californianus</i>	0.1	~1
RH99-11-78	RH99-11	<i>Mytilus californianus</i>	42.8	7 frag's
RH99-11-79	RH99-11	<i>Crassodoma gigantea</i>	42.3	1
RH99-11-80	RH99-11	<i>Chlamys rubida</i>	0.4	1
RH99-11-81	RH99-11	<i>Chlamys rubida</i>	0.5	1
RH99-11-82	RH99-11	<i>Chlamys rubida</i>	0.1	1 frag
RH99-11-83	RH99-11	<i>Siliqua patula</i>	8.7	1
RH99-11-84	RH99-11	<i>Nucella lamellosa</i>	0.8	1
RH99-11-85	RH99-11	<i>Nucella lamellosa</i>	0.7	1
RH99-11-86	RH99-11	<i>Amphissa columbiana</i>	0.4	1
RH99-11-87	RH99-11	<i>Amphissa columbiana</i>	0.4	1

RH99-11-88	RH99-11	<i>Amphissa columbiana</i>	0.1	~1
RH99-11-89	RH99-11	<i>Amphissa columbiana</i>	0.3	~1
RH99-11-90	RH99-11	<i>Amphissa columbiana</i>	0.1	1
RH99-11-91	RH99-11	<i>Amphissa columbiana</i>	0.1	~1
RH99-11-92	RH99-11	<i>Olivella biplicata</i>	2.6	~1
RH99-11-93	RH99-11	<i>Olivella biplicata</i>	0.3	~1
RH99-11-94	RH99-11	<i>Olivella biplicata</i>	0.3	~1
RH99-11-95	RH99-11	<i>Fusitriton oregonensis</i>	1.6	~1
RH99-11-96	RH99-11	<i>Glycymeris septentrionalis</i>	0.5	1
RH99-11-97	RH99-11	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-11-98	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-99	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-100	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-101	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-102	RH99-11	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-11-103	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-104	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-105	RH99-11	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-11-106	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-107	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-108	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-109	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-110	RH99-11	<i>Glycymeris septentrionalis</i>	0.5	1
RH99-11-111	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-112	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-113	RH99-11	<i>Glycymeris septentrionalis</i>	0.5	1
RH99-11-114	RH99-11	<i>Glycymeris septentrionalis</i>	0.2	1
RH99-11-115	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-116	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-117	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-118	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-119	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-120	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-121	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-122	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-123	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-124	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-11-125	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-11-126	RH99-11	<i>Glycymeris septentrionalis</i>	0.1	~1
RH99-11-127	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-128	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-129	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-130	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-131	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-132	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-133	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-134	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-135	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-136	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-137	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-138	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-139	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-140	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-141	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-142	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-143	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-144	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-145	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-146	RH99-11	<i>Tellina nukuloides</i>	0.2	1
RH99-11-147	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-148	RH99-11	<i>Tellina nukuloides</i>	0.1	~1

RH99-11-149	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-150	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-151	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-152	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-153	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-154	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-155	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-156	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-157	RH99-11	<i>Tellina nukuloides</i>	0.1	1
RH99-11-158	RH99-11	<i>Tellina nukuloides</i>	0.1	~1
RH99-11-159	RH99-11	<i>Acmaea mitra</i>	2.5	1
RH99-11-160	RH99-11	<i>Acmaea mitra</i>	0.7	1
RH99-11-161	RH99-11	<i>Acmaea mitra</i>	0.5	1
RH99-11-162	RH99-11	<i>Acmaea mitra</i>	0.1	~1
RH99-11-163	RH99-11	<i>Acmaea mitra</i>	0.1	1
RH99-11-164	RH99-11	<i>Acmaea mitra</i>	0.5	~1
RH99-11-165	RH99-11	<i>Lottia pelta</i>	0.4	1
RH99-11-166	RH99-11	<i>Lottia pelta</i>	0.1	1
RH99-11-167	RH99-11	<i>Lottia pelta</i>	0.1	1
RH99-11-168	RH99-11	<i>Lottia pelta</i>	0.1	1
RH99-11-169	RH99-11	<i>Lottia pelta</i>	0.1	1
RH99-11-170	RH99-11	<i>Tectura persona</i>	0.1	1
RH99-11-171	RH99-11	<i>Littorina sitkana</i>	0.1	1
RH99-11-172	RH99-11	<i>Littorina sitkana</i>	0.1	1
RH99-11-173	RH99-11	<i>Littorina sitkana</i>	0.1	1
RH99-11-174	RH99-11	<i>Chiton sp.</i>	0.3	1 plate
RH99-11-175	RH99-11	<i>Chiton sp.</i>	0.1	1 plate
RH99-11-176	RH99-11	<i>Balanus spp.</i>	60.4	103 frag's
RH99-11-177	RH99-11	unidentified clam shell frag's	66.7	102 frag's
RH99-11-178	RH99-11	unidentified gastropod frag's	0.4	2 frag's
RH99-11-179	RH99-11	<i>Tresus capax</i>	219.2	1
RH99-11-180	RH99-11	<i>Tresus capax</i>	54.2	~1
RH99-11-181	RH99-11	<i>Tresus capax</i>	45.2	~1
RH99-11-182	RH99-11	<i>Tresus capax</i>	29.5	~1
RH99-11-183	RH99-11	<i>Tresus capax</i>	45.1	2 frag's
RH99-11-184	RH99-11	<i>Tresus nuttallii</i>	58.6	~1
RH99-11-185	RH99-11	<i>Tresus nuttallii</i>	108.3	1
RH99-11-186	RH99-11	<i>Tresus nuttallii</i>	144.3	4 frag's
RH99-11-187	RH99-11	<i>Pododesmus machrochisma</i>	5.3	1
RH99-11-188	RH99-11	<i>Pododesmus machrochisma</i>	0.9	1
RH99-11-189	RH99-11	sand dollar	4	6 frag's
Total weight (grams) Rh99-11			2805.7	
RH99-12-1	RH99-12	<i>Saxidomus giganteus</i>	1.6	1
RH99-12-2	RH99-12	<i>Saxidomus giganteus</i>	14.7	~1
RH99-12-3	RH99-12	<i>Saxidomus giganteus</i>	0.1	1
RH99-12-4	RH99-12	<i>Saxidomus giganteus</i>	0.4	~1
RH99-12-5	RH99-12	<i>Saxidomus giganteus</i>	0.7	~1
RH99-12-6	RH99-12	<i>Saxidomus giganteus</i>	0.2	~1
RH99-12-7	RH99-12	<i>Saxidomus giganteus</i>	0.1	1
RH99-12-8	RH99-12	<i>Saxidomus giganteus</i>	0.1	1
RH99-12-9	RH99-12	<i>Saxidomus giganteus</i>	20.6	8 frag's
RH99-12-10	RH99-12	<i>Protothaca staminea</i>	4.5	1
RH99-12-11	RH99-12	<i>Protothaca staminea</i>	1.4	1
RH99-12-12	RH99-12	<i>Protothaca staminea</i>	0.5	1
RH99-12-13	RH99-12	<i>Protothaca staminea</i>	0.3	1
RH99-12-14	RH99-12	<i>Protothaca staminea</i>	0.3	~1
RH99-12-15	RH99-12	<i>Protothaca staminea</i>	2.2	~1
RH99-12-16	RH99-12	<i>Protothaca staminea</i>	0.2	~1
RH99-12-17	RH99-12	<i>Protothaca staminea</i>	0.3	~1
RH99-12-18	RH99-12	<i>Protothaca staminea</i>	0.1	1

RH99-12-19	RH99-12	<i>Protothaca staminea</i>	0.1	~1
RH99-12-20	RH99-12	<i>Protothaca staminea</i>	0.6	~1
RH99-12-21	RH99-12	<i>Protothaca staminea</i>	0.1	1
RH99-12-22	RH99-12	<i>Protothaca staminea</i>	2.1	6 frag's
RH99-12-23	RH99-12	<i>Clinocardium nuttallii</i>	18.3	~1
RH99-12-24	RH99-12	<i>Clinocardium nuttallii</i>	1.5	~1
RH99-12-25	RH99-12	<i>Clinocardium nuttallii</i>	0.8	~1
RH99-12-26	RH99-12	<i>Clinocardium nuttallii</i>	1	1
RH99-12-27	RH99-12	<i>Clinocardium nuttallii</i>	2.1	~1
RH99-12-28	RH99-12	<i>Clinocardium nuttallii</i>	0.4	~1
RH99-12-29	RH99-12	<i>Clinocardium nuttallii</i>	69.7	62 frag's
RH99-12-30	RH99-12	<i>Macoma</i> sp.	1.1	~1
RH99-12-31	RH99-12	<i>Macoma</i> sp.	0.2	1
RH99-12-32	RH99-12	<i>Mytilus californianus</i>	0.3	1
RH99-12-33	RH99-12	<i>Mytilus californianus</i>	8.4	~1
RH99-12-34	RH99-12	<i>Mytilus californianus</i>	1.8	~1
RH99-12-35	RH99-12	<i>Mytilus californianus</i>	0.8	~1
RH99-12-36	RH99-12	<i>Mytilus californianus</i>	1	1
RH99-12-37	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-38	RH99-12	<i>Mytilus californianus</i>	0.7	~1
RH99-12-39	RH99-12	<i>Mytilus californianus</i>	0.1	~1
RH99-12-40	RH99-12	<i>Mytilus californianus</i>	2.2	~1
RH99-12-41	RH99-12	<i>Mytilus californianus</i>	0.1	~1
RH99-12-42	RH99-12	<i>Mytilus californianus</i>	0.9	~
RH99-12-43	RH99-12	<i>Mytilus californianus</i>	6.5	~1
RH99-12-44	RH99-12	<i>Mytilus californianus</i>	2.9	1
RH99-12-45	RH99-12	<i>Mytilus californianus</i>	1.3	1
RH99-12-46	RH99-12	<i>Mytilus californianus</i>	0.6	~
RH99-12-47	RH99-12	<i>Mytilus californianus</i>	0.9	~1
RH99-12-48	RH99-12	<i>Mytilus californianus</i>	3.6	~1
RH99-12-49	RH99-12	<i>Mytilus californianus</i>	1.6	~1
RH99-12-50	RH99-12	<i>Mytilus californianus</i>	4.5	~1
RH99-12-51	RH99-12	<i>Mytilus californianus</i>	0.5	~1
RH99-12-52	RH99-12	<i>Mytilus californianus</i>	0.5	~1
RH99-12-53	RH99-12	<i>Mytilus californianus</i>	0.2	1
RH99-12-54	RH99-12	<i>Mytilus californianus</i>	0.3	1
RH99-12-55	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-56	RH99-12	<i>Mytilus californianus</i>	2.6	~1
RH99-12-57	RH99-12	<i>Mytilus californianus</i>	0.6	~1
RH99-12-58	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-59	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-60	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-61	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-62	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-63	RH99-12	<i>Mytilus californianus</i>	0.2	
RH99-12-64	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-65	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-66	RH99-12	<i>Mytilus californianus</i>	1.2	~1
RH99-12-67	RH99-12	<i>Mytilus californianus</i>	0.5	~1
RH99-12-68	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-69	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-70	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-71	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-72	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-73	RH99-12	<i>Mytilus californianus</i>	0.5	~1
RH99-12-74	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-75	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-76	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-77	RH99-12	<i>Mytilus californianus</i>	0.1	~1
RH99-12-78	RH99-12	<i>Mytilus californianus</i>	0.1	~1
RH99-12-79	RH99-12	<i>Mytilus californianus</i>	0.5	~1

RH99-12-80	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-81	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-82	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-83	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-84	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-85	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-86	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-87	RH99-12	<i>Mytilus californianus</i>	2.4	~1
RH99-12-88	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-89	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-90	RH99-12	<i>Mytilus californianus</i>	0.1	~1
RH99-12-91	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-92	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-93	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-94	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-95	RH99-12	<i>Mytilus californianus</i>	0.4	~1
RH99-12-96	RH99-12	<i>Mytilus californianus</i>	0.3	~1
RH99-12-97	RH99-12	<i>Mytilus californianus</i>	0.2	~1
RH99-12-98	RH99-12	<i>Mytilus californianus</i>	0.1	~1
RH99-12-99	RH99-12	<i>Mytilus californianus</i>	0.1	~1
RH99-12-100	RH99-12	<i>Mytilus californianus</i>	92	257 frag's
RH99-12-101	RH99-12	<i>Pododesmus machrochisma</i>	1.3	~1
RH99-12-102	RH99-12	<i>Pododesmus machrochisma</i>	1	1 frag
RH99-12-103	RH99-12	<i>Glycymeris septentrionalis</i>	1.5	1
RH99-12-104	RH99-12	<i>Glycymeris septentrionalis</i>	0.4	1
RH99-12-105	RH99-12	<i>Glycymeris septentrionalis</i>	0.3	1
RH99-12-106	RH99-12	<i>Glycymeris septentrionalis</i>	0.1	1
RH99-12-107	RH99-12	<i>Tellina nukuloides</i>	0.1	1
RH99-12-108	RH99-12	<i>Tellina nukuloides</i>	0.1	1
RH99-12-109	RH99-12	<i>Tellina nukuloides</i>	0.3	1
RH99-12-110	RH99-12	<i>Tellina nukuloides</i>	0.2	1
RH99-12-111	RH99-12	<i>Tellina nukuloides</i>	0.1	1
RH99-12-112	RH99-12	<i>Tellina nukuloides</i>	0.1	1
RH99-12-113	RH99-12	<i>Tellina nukuloides</i>	0.1	1
RH99-12-114	RH99-12	<i>Tellina nukuloides</i>	0.2	1
RH99-12-115	RH99-12	<i>Tellina nukuloides</i>	0.1	1
RH99-12-116	RH99-12	<i>Olivella biplicata</i>	1.5	1
RH99-12-117	RH99-12	<i>Olivella biplicata</i>	2	1
RH99-12-118	RH99-12	<i>Nassarius mendicus</i>	0.1	1
RH99-12-119	RH99-12	<i>Amphissa columbiana</i>	0.3	~1
RH99-12-120	RH99-12	<i>Amphissa columbiana</i>	0.4	~1
RH99-12-121	RH99-12	<i>Bittium eschrichtii</i>	0.2	1
RH99-12-122	RH99-12	<i>Lottia digitalis</i>	0.1	1
RH99-12-123	RH99-12	<i>Lottia digitalis</i>	0.1	1
RH99-12-124	RH99-12	<i>Lottia digitalis</i>	0.1	1
RH99-12-125	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-126	RH99-12	<i>Tectura persona</i>	0.2	1
RH99-12-127	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-128	RH99-12	<i>Tectura persona</i>	0.2	1
RH99-12-129	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-130	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-131	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-132	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-133	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-134	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-135	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-136	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-137	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-138	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-139	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-140	RH99-12	<i>Tectura persona</i>	0.1	1

RH99-12-141	RH99-12	<i>Tectura persona</i>	0.1	1
RH99-12-142	RH99-12	<i>Lottia instabilis</i>	0.2	1
RH99-12-143	RH99-12	<i>Acmaea mitra</i>	0.4	1
RH99-12-144	RH99-12	<i>Acmaea mitra</i>	0.6	1
RH99-12-145	RH99-12	<i>Acmaea mitra</i>	0.1	1
RH99-12-146	RH99-12	<i>Acmaea mitra</i>	0.1	1
RH99-12-147	RH99-12	<i>Lacuna variegata</i>	0.1	1
RH99-12-148	RH99-12	<i>Lacuna variegata</i>	0.1	1
RH99-12-149	RH99-12	<i>Littorina sitkana</i>	0.1	~1
RH99-12-150	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-151	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-152	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-153	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-154	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-155	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-156	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-157	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-158	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-159	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-160	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-161	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-162	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-163	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-164	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-165	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-166	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-167	RH99-12	<i>Littorina sitkana</i>	0.1	1
RH99-12-168	RH99-12	<i>Calliostoma ligatum</i>	0.2	1
RH99-12-169	RH99-12	<i>Calliostoma ligatum</i>	0.1	1
RH99-12-170	RH99-12	Sponge	0.8	~1
RH99-12-171	RH99-12	Sponge	0.4	~1
RH99-12-172	RH99-12	Sponge	0.2	~1
RH99-12-173	RH99-12	<i>Balanus</i> spp.	171.3	214 frag's
RH99-12-174	RH99-12	<i>Balanus</i> spp.	108.1	387 frag's
RH99-12-175	RH99-12	<i>Saxidomus giganteus</i>	37.2	1
RH99-12-176	RH99-12	<i>Saxidomus giganteus</i>	66.4	~1
RH99-12-177	RH99-12	<i>Saxidomus giganteus</i>	63.9	1
RH99-12-178	RH99-12	<i>Saxidomus giganteus</i>	53.9	1
RH99-12-178	RH99-12	<i>Tresus capax</i>	39.6	~1
RH99-12-178	RH99-12	<i>Tresus capax</i>	157.8	1
RH99-12-178	RH99-12	<i>Tresus nuttallii</i>	90.1	1
RH99-12-178	RH99-12	<i>Tresus nuttallii</i>	45.6	~1
RH99-12-178	RH99-12	unidentifid bivalve frag's	27.9	52 frag's
Total weight (grams) RH99-12			1176.2	
RH99-13-1	RH99-13	<i>Saxidomus giganteus</i>	44.3	2 artic'd
RH99-13-2	RH99-13	<i>Saxidomus giganteus</i>	1.1	1 frag
RH99-13-3	RH99-13	<i>Acmaea mitra</i>	2.2	1
RH99-13-4	RH99-13	<i>Nucella lamellosa</i>	2.5	1 frag
RH99-13-5	RH99-13	barncacle	2.3	4 frag's
Total weight (grams) RH99-13			52.4	

Hetherington, R.

Appendix C: Underwater grabs (V98) sample data

Sample #	Sample Group	Species name	Shell weight (grams)	Number of shells
V98-63-1	V98-63	<i>Fusitriton oregonensis</i>	1	1
V98-63-2	V98-63	<i>Cidarina cidaris</i>	0.9	1
V98-63-3	V98-63	<i>Chlamys rubida</i>	0.7	1
V98-63-4	V98-63	<i>Mya truncata</i>	1.8	1
V98-63-5	V98-63	<i>Mya truncata</i>	0.7	~1
V98-63-6	V98-63	<i>Mya truncata</i>	1.4	1
V98-63-7	V98-63	<i>Thracia trapezoides</i>	2.3	1
V98-63-8	V98-63	<i>Thracia trapezoides</i>	0.7	~1
V98-63-9	V98-63	<i>Macoma incongrua</i>	0.7	1
Total weight (grams) V98-63			10.2	
V98-53-1	V98-53	<i>Cidarina cidaris</i>	6.3	~4
V98-53-2	V98-53	<i>Euspira pallida</i>	2.7	1
V98-53-3	V98-53	<i>Euspira pallida</i>	3	1
V98-53-4	V98-53	<i>Boreotrophon stuarti</i>	1.7	1
V98-53-5	V98-53	<i>Neptunea tabulata</i>	0.8	1
V98-53-6	V98-53	<i>Fusitriton oregonensis</i>	0.8	1
V98-53-7	V98-53	<i>Chlamys rubida</i>	3	1
V98-53-8	V98-53	<i>Chlamys rubida</i>	1.9	~1
V98-53-9	V98-53	<i>Chlamys rubida</i>	0.4	1
V98-53-10	V98-53	<i>Chlamys rubida</i>	1.2	1
V98-53-11	V98-53	<i>Chlamys rubida</i>	0.3	1
V98-53-12	V98-53	<i>Chlamys rubida</i>	0.6	1
V98-53-13	V98-53	<i>Chlamys rubida</i>	0.7	1
V98-53-14	V98-53	<i>Chlamys rubida</i>	1	1
V98-53-15	V98-53	<i>Chlamys fragments</i>	0.8	<1
V98-53-16	V98-53	<i>Chlamys fragments</i>	0.4	<1
V98-53-17	V98-53	<i>Serripes groenlandicus</i>	3.9	1
V98-53-18	V98-53	<i>Serripes groenlandicus</i>	4.3	1
V98-53-19	V98-53	<i>Serripes groenlandicus</i>	0.4	<2
V98-53-20	V98-53	<i>Serripes groenlandicus</i>	0.4	~1
V98-53-21	V98-53	<i>Clinocardium ciliatum</i>	1.8	1
V98-53-22	V98-53	<i>Clinocardium ciliatum</i>	0.6	1
V98-53-23	V98-53	<i>Protothaca staminea</i>	2.6	1
V98-53-24	V98-53	<i>Protothaca staminea</i>	1.3	<1
V98-53-25	V98-53	<i>Saxidomus giganteus</i>	1.6	1
V98-53-26	V98-53	<i>Mya truncata</i>	5.3	1
V98-53-27	V98-53	<i>Mya truncata</i>	3.6	1
V98-53-28	V98-53	<i>Macoma brota</i>	1.5	1
V98-53-29	V98-53	<i>Hiatella pholadis</i>	0.9	1
V98-53-30	V98-53	<i>Hiatella pholadis</i>	0.2	1
V98-53-31	V98-53	<i>Macoma brota</i>	0.8	1
V98-53-32	V98-53	<i>Macoma brota</i>	0.7	1
V98-53-33	V98-53	<i>Cranopsis cucullata</i>	0.1	1
V98-53-34	V98-53	Unidentified clam shell frag's	5.3	~1
V98-53-35	V98-53	Unidentified clam shell frag's	11.3	1
V98-53-36	V98-53	Unidentified clam shell frag's	2.4	2
V98-53-37	V98-53	Unidentified clam shell frag's	0.5	1
V98-53-38	V98-53	<i>Neptunea lyrata</i>	0.5	~1
Total weight (grams) V98-53			75.6	
V98-62-1	V98-62	<i>Saxidomus giganteus</i>	47	1
V98-62-2	V98-62	<i>Saxidomus giganteus</i>	46	~1
V98-62-3	V98-62	<i>Saxidomus giganteus</i>	43	1
V98-62-4	V98-62	<i>Saxidomus giganteus</i>	45.3	1
V98-62-5	V98-62	<i>Mya truncata</i>	2.5	1

V98-62-6	V98-62	<i>Mya truncata</i>	2.8	1
V98-62-7	V98-62	<i>Mya truncata</i>	2.8	1
V98-62-8	V98-62	<i>Mya truncata</i>	1.7	~1
V98-62-9	V98-62	<i>Mya truncata</i>	1.1	~1
V98-62-10	V98-62	<i>Thracia trapezoides</i>	3.3	1
V98-62-11	V98-62	<i>Macoma brota</i>	0.7	1
V98-62-12	V98-62	<i>Macoma lipara</i>	1.2	1
V98-62-13	V98-62	<i>Macoma incongrua</i>	0.3	1
V98-62-14	V98-62	<i>Mya truncata</i>	1	~1
V98-62-15	V98-62	<i>Mya truncata</i>	1.5	~1
Total weight (grams) V98-62			200.2	
V98-61-1	V98-61	<i>Macoma brota</i>	2.5	1
V98-61-2	V98-61	<i>Macoma brota</i>	3.1	1
V98-61-3	V98-61	<i>Macoma brota</i>	3	1
V98-61-4	V98-61	<i>Macoma brota</i>	1.6	1
V98-61-5	V98-61	<i>Macoma brota</i>	1.5	1
V98-61-6	V98-61	<i>Macoma brota</i>	2.3	1
V98-61-7	V98-61	<i>Macoma brota</i>	1.9	1
V98-61-8	V98-61	<i>Macoma brota</i>	1.1	1
V98-61-9	V98-61	<i>Macoma brota</i>	1.8	1
V98-61-10	V98-61	<i>Macoma brota</i>	0.7	1
V98-61-11	V98-61	<i>Macoma brota</i>	1.1	1
V98-61-12	V98-61	<i>Macoma brota</i>	2.1	1
V98-61-13	V98-61	<i>Macoma brota</i>	0.9	1
V98-61-14	V98-61	<i>Macoma brota</i>	1.2	~1
V98-61-15	V98-61	<i>Macoma brota</i>	3.1	1
V98-61-16	V98-61	<i>Macoma brota</i>	3.2	1
V98-61-17	V98-61	<i>Macoma brota</i>	1.3	1
V98-61-18	V98-61	<i>Macoma brota</i>	1.8	1
V98-61-19	V98-61	<i>Macoma brota</i>	2.2	1
V98-61-20	V98-61	<i>Macoma brota</i>	0.8	1
V98-61-21	V98-61	<i>Macoma brota</i>	2.9	1
V98-61-22	V98-61	<i>Macoma brota</i>	2.3	1
V98-61-23	V98-61	<i>Macoma brota</i>	0.3	~1
V98-61-24	V98-61	<i>Macoma brota</i>	3.1	1
V98-61-25	V98-61	<i>Macoma brota</i>	2.3	1
V98-61-26	V98-61	<i>Macoma brota</i>	1.5	1
V98-61-27	V98-61	<i>Macoma brota</i>	2.1	1
V98-61-28	V98-61	<i>Macoma brota</i>	0.5	~1
V98-61-29	V98-61	<i>Macoma brota</i>	1.6	1
V98-61-30	V98-61	<i>Macoma brota</i>	2.8	1
V98-61-31	V98-61	<i>Pododesmus machrochisma</i>	1	1
V98-61-32	V98-61	<i>Pododesmus machrochisma</i>	0.2	2 articulated
V98-61-33	V98-61	<i>Mya truncata</i>	2.1	1
V98-61-34	V98-61	<i>Mya truncata</i>	2	1
V98-61-35	V98-61	<i>Mya truncata</i>	2.2	1
V98-61-36	V98-61	<i>Macoma brota</i>	0.1	2 articulated
V98-61-37	V98-61	<i>Macoma brota</i>	0.1	1
V98-61-38	V98-61	<i>Macoma brota</i>	0.1	1
V98-61-39	V98-61	<i>Lucinoma annulatum</i>	5.4	2 articulated
V98-61-40	V98-61	<i>Lucinoma annulatum</i>	10.3	2 articulated
V98-61-41	V98-61	<i>Lucinoma annulatum</i>	7.1	2 articulated
V98-61-42	V98-61	<i>Lucinoma annulatum</i>	3.5	1
V98-61-43	V98-61	<i>Lucinoma annulatum</i>	2	2 articulated
V98-61-44	V98-61	<i>Lucinoma annulatum</i>	1.1	1
V98-61-45	V98-61	<i>Lucinoma annulatum</i>	0.9	1
V98-61-46	V98-61	<i>Mytilus trossulus</i>	0.4	1
V98-61-47	V98-61	<i>Amphissa columbiana</i>	0.9	1
V98-61-48	V98-61	<i>Turbonilla species</i>	0.1	1
V98-61-49	V98-61	Unidentified clam shell frag's	1	~1

V98-61-50	V98-61	Unidentified clam shell frag's	0.7	~1
V98-61-51	V98-61	Unidentified clam shell frag's	0.1	~3 small
Total weight (grams) V98-61			97.9	
V98-44-1	V98-44	<i>Macoma lipara</i>	10.9	1
V98-44-2	V98-44	<i>Macoma lipara</i>	13.2	1
V98-44-3	V98-44	<i>Macoma lipara</i>	10.6	1
V98-44-4	V98-44	<i>Macoma lipara</i>	14.1	2 articulated
V98-44-5	V98-44	<i>Macoma lipara</i>	2	~1
V98-44-6	V98-44	<i>Macoma brota</i>	2	1
V98-44-7	V98-44	<i>Macoma brota</i>	2.2	1
V98-44-8	V98-44	<i>Macoma brota</i>	1	1
V98-44-9	V98-44	<i>Macoma brota</i>	0.6	1
V98-44-10	V98-44	<i>Macoma brota</i>	0.6	1
V98-44-11	V98-44	<i>Macoma brota</i>	2.5	1
V98-44-12	V98-44	<i>Macoma brota</i>	2.2	1
V98-44-13	V98-44	<i>Macoma brota</i>	1.5	1
V98-44-14	V98-44	<i>Macoma brota</i>	1.3	1
V98-44-15	V98-44	<i>Macoma brota</i>	0.6	1
V98-44-16	V98-44	<i>Macoma brota</i>	1.8	1
V98-44-17	V98-44	<i>Macoma brota</i>	1.4	1
V98-44-18	V98-44	<i>Macoma brota</i>	1	1
V98-44-19	V98-44	<i>Macoma brota</i>	0.6	1
V98-44-20	V98-44	<i>Macoma brota</i>	1.5	1
V98-44-21	V98-44	<i>Macoma brota</i>	0.8	1
V98-44-22	V98-44	<i>Macoma brota</i>	2.2	2 articulated
V98-44-23	V98-44	<i>Macoma brota</i>	1.3	1
V98-44-24	V98-44	<i>Macoma brota</i>	1	1
V98-44-25	V98-44	<i>Macoma brota</i>	1.3	1
V98-44-26	V98-44	<i>Macoma brota</i>	1.1	1
V98-44-27	V98-44	<i>Macoma brota</i>	0.8	1
V98-44-28	V98-44	<i>Macoma brota</i>	0.8	1
V98-44-29	V98-44	<i>Macoma brota</i>	1.1	1
V98-44-30	V98-44	<i>Macoma brota</i>	1.4	1
V98-44-31	V98-44	<i>Macoma brota</i>	1.3	1
V98-44-32	V98-44	<i>Macoma brota</i>	1.8	1
V98-44-33	V98-44	<i>Macoma brota</i>	1.4	1
V98-44-34	V98-44	<i>Macoma brota</i>	0.4	1
V98-44-35	V98-44	<i>Macoma brota</i>	1.3	1
V98-44-36	V98-44	<i>Macoma brota</i>	0.6	1
V98-44-37	V98-44	<i>Macoma brota</i>	0.7	1
V98-44-38	V98-44	<i>Macoma brota</i>	1	1
V98-44-39	V98-44	<i>Macoma brota</i>	0.8	1
V98-44-40	V98-44	<i>Macoma brota</i>	0.6	1
V98-44-41	V98-44	<i>Macoma brota</i>	0.4	1
V98-44-42	V98-44	<i>Macoma brota</i>	0.4	1
V98-44-43	V98-44	<i>Macoma brota</i>	0.5	~1
V98-44-44	V98-44	<i>Macoma brota</i>	0.2	~1
V98-44-45	V98-44	<i>Macoma brota</i>	0.3	2 articulated
V98-44-46	V98-44	<i>Pododesmus machrochisma</i>	0.5	1
V98-44-47	V98-44	<i>Pododesmus machrochisma</i>	0.5	1
V98-44-48	V98-44	<i>Pododesmus machrochisma</i>	0.8	1
V98-44-49	V98-44	<i>Chlamys rubida</i>	0.2	1
V98-44-50	V98-44	<i>Chlamys rubida</i>	0.5	1
V98-44-51	V98-44	<i>Chlamys rubida</i>	0.2	1
V98-44-52	V98-44	<i>Chlamys rubida</i>	0.6	1
V98-44-53	V98-44	<i>Chlamys rubida</i>	0.6	1
V98-44-54	V98-44	<i>Chlamys rubida</i>	0.1	1
V98-44-55	V98-44	<i>Chlamys rubida</i>	0.2	1
V98-44-56	V98-44	<i>Chlamys hastata</i>	0.7	1
V98-44-57	V98-44	<i>Chlamys hastata</i>	0.9	1

V98-44-58	V98-44	<i>Chlamys hastata</i>	0.8	1
V98-44-59	V98-44	<i>Chlamys hastata</i>	0.5	1
V98-44-60	V98-44	<i>Chlamys hastata</i>	0.1	1
V98-44-61	V98-44	<i>Chlamys hastata</i>	0.6	1
V98-44-62	V98-44	<i>Gari californica</i>	1.2	1
V98-44-63	V98-44	<i>Lucinoma annulatum</i>	1.3	1
V98-44-64	V98-44	<i>Lucinoma annulatum</i>	0.9	1
V98-44-65	V98-44	<i>Lucinoma annulatum</i>	1.6	1
V98-44-66	V98-44	<i>Lucinoma annulatum</i>	1.2	2 articulated
V98-44-67	V98-44	<i>Lucinoma annulatum</i>	1	2 articulated
V98-44-68	V98-44	<i>Lucinoma annulatum</i>	1.4	1
V98-44-69	V98-44	<i>Lucinoma annulatum</i>	0.6	1
V98-44-70	V98-44	<i>Lucinoma annulatum</i>	0.5	1
V98-44-71	V98-44	<i>Lucinoma annulatum</i>	0.7	2 articulated
V98-44-72	V98-44	<i>Lucinoma annulatum</i>	0.8	~1
V98-44-73	V98-44	<i>Lucinoma annulatum</i>	3.1	2 articulated
V98-44-74	V98-44	<i>Lucinoma annulatum</i>	1.8	2 articulated
V98-44-75	V98-44	<i>Humilaria kennerleyi</i>	27.6	1
V98-44-76	V98-44	<i>Mya truncata</i>	3	1
V98-44-77	V98-44	<i>Mya truncata</i>	0.3	~1
V98-44-78	V98-44	<i>Cyclocardia ventricosa</i>	0.2	1
V98-44-79	V98-44	<i>Nucella lamellosa</i>	2.6	1
V98-44-80	V98-44	<i>Nucella lamellosa</i>	6.3	1
V98-44-81	V98-44	<i>Nucella lamellosa</i>	3	~1
V98-44-82	V98-44	<i>Nucella lamellosa</i>	8.8	~1
V98-44-83	V98-44	<i>Nucella lamellosa</i>	12.3	1
V98-44-84	V98-44	<i>Nucella lamellosa</i>	3.7	~1
V98-44-85	V98-44	<i>Nucella lamellosa</i>	1.3	1
V98-44-86	V98-44	<i>Nucella lamellosa</i>	0.9	1
V98-44-87	V98-44	<i>Nucella lamellosa</i>	0.7	1
V98-44-88	V98-44	<i>Nucella lamellosa</i>	0.7	2 articulated
V98-44-89	V98-44	<i>Nucella lamellosa</i>	1	1
V98-44-90	V98-44	<i>Nucella lamellosa</i>	1.2	1
V98-44-91	V98-44	<i>Nucella lamellosa</i>	0.6	~1
V98-44-92	V98-44	<i>Nucella lamellosa</i>	0.9	1
V98-44-93	V98-44	<i>Nucella lamellosa</i>	0.6	1
V98-44-94	V98-44	<i>Nucella lamellosa</i>	0.7	1
V98-44-95	V98-44	<i>Nucella lamellosa</i>	0.6	1
V98-44-96	V98-44	<i>Nucella lamellosa</i>	0.1	1
V98-44-97	V98-44	<i>Parvalucina tenuisculpta</i>	0.1	~1
V98-44-98	V98-44	<i>Macoma brota</i>	12.1	~32frag's
Total weight (grams) V98-44			208.3	
V98-60-1	V98-60	<i>Lucinoma annulatum</i>	0.4	1
V98-60-2	V98-60	<i>Lucinoma annulatum</i>	0.8	1
V98-60-3	V98-60	<i>Lucinoma annulatum</i>	0.4	1
V98-60-4	V98-60	<i>Lucinoma annulatum</i>	0.4	1
V98-60-5	V98-60	<i>Lucinoma annulatum</i>	0.5	1
V98-60-6	V98-60	<i>Lucinoma annulatum</i>	0.3	1
V98-60-7	V98-60	<i>Lucinoma annulatum</i>	0.1	1
V98-60-8	V98-60	<i>Lucinoma annulatum</i>	0.6	1
V98-60-9	V98-60	<i>Lucinoma annulatum</i>	1.4	2 articulated
V98-60-10	V98-60	<i>Lucinoma annulatum</i>	0.1	1
V98-60-11	V98-60	<i>Lucinoma annulatum</i>	0.8	2 articulated
V98-60-12	V98-60	<i>Acila castrensis</i>	0.2	1
V98-60-13	V98-60	<i>Acila castrensis</i>	0.3	1
V98-60-14	V98-60	<i>Acila castrensis</i>	0.2	1
V98-60-15	V98-60	<i>Acila castrensis</i>	0.3	1
V98-60-16	V98-60	<i>Acila castrensis</i>	0.3	1
V98-60-17	V98-60	<i>Acila castrensis</i>	0.4	1
V98-60-18	V98-60	<i>Acila castrensis</i>	0.4	1

V98-60-19	V98-60	<i>Acila castrensis</i>	0.2	1
V98-60-20	V98-60	<i>Acila castrensis</i>	0.4	1
V98-60-21	V98-60	<i>Acila castrensis</i>	0.3	1
V98-60-22	V98-60	<i>Acila castrensis</i>	0.4	1
V98-60-23	V98-60	<i>Compsomyax subdiaphana</i>	3.6	1
V98-60-24	V98-60	<i>Compsomyax subdiaphana</i>	5.5	1
V98-60-25	V98-60	<i>Compsomyax subdiaphana</i>	5.6	1
V98-60-26	V98-60	<i>Compsomyax subdiaphana</i>	5.1	1
V98-60-27	V98-60	<i>Compsomyax subdiaphana</i>	4.8	2 articulated
V98-60-28	V98-60	<i>Compsomyax subdiaphana</i>	4.8	1
V98-60-29	V98-60	<i>Compsomyax subdiaphana</i>	2.9	2 articulated
V98-60-30	V98-60	<i>Compsomyax subdiaphana</i>	3.4	~1
V98-60-31	V98-60	<i>Compsomyax subdiaphana</i>	1.2	~1
V98-60-32	V98-60	<i>Compsomyax subdiaphana</i>	5	2 frag's
V98-60-33	V98-60	<i>Compsomyax subdiaphana</i>	1.1	1
V98-60-34	V98-60	<i>Compsomyax subdiaphana</i>	0.5	1
V98-60-35	V98-60	<i>Compsomyax subdiaphana</i>	0.3	2 articulated
V98-60-36	V98-60	<i>Compsomyax subdiaphana</i>	0.2	1
V98-60-37	V98-60	<i>Compsomyax subdiaphana</i>	2.6	1
V98-60-38	V98-60	<i>Compsomyax subdiaphana</i>	0.5	1
V98-60-39	V98-60	<i>Compsomyax subdiaphana</i>	0.4	1
V98-60-40	V98-60	<i>Compsomyax subdiaphana</i>	2.6	1
V98-60-41	V98-60	<i>Compsomyax subdiaphana</i>	0.5	1
V98-60-42	V98-60	<i>Compsomyax subdiaphana</i>	3.4	2 articulated
V98-60-43	V98-60	<i>Compsomyax subdiaphana</i>	0.6	1
V98-60-44	V98-60	<i>Compsomyax subdiaphana</i>	1.2	~1
V98-60-45	V98-60	<i>Compsomyax subdiaphana</i>	7.3	1
V98-60-46	V98-60	<i>Macoma calcarea</i>	0.6	2 articulated
V98-60-47	V98-60	<i>Macoma calcarea</i>	0.2	1
V98-60-48	V98-60	<i>Macoma calcarea</i>	0.7	2 articulated
V98-60-49	V98-60	<i>Macoma calcarea</i>	0.3	1
V98-60-50	V98-60	<i>Macoma calcarea</i>	0.5	2 articulated
V98-60-51	V98-60	<i>Macoma calcarea</i>	0.5	fragments
V98-60-52	V98-60	<i>Thracia trapezoides</i>	0.7	2 articulated
V98-60-53	V98-60	<i>Thracia trapezoides</i>	0.5	1
V98-60-54	V98-60	<i>Polinices lewisii</i>	0.7	1
V98-60-55	V98-60	<i>Polinices lewisii</i>	1.8	~1
V98-60-56	V98-60	<i>Solariella peramabilis</i>	0.2	~1
V98-60-57	V98-60	<i>Nucella lamellosa</i>	11.6	1
V98-60-58	V98-60	<i>Nucella lamellosa</i>	9.7	1
V98-60-59	V98-60	<i>Nucella lamellosa</i>	4.3	1
V98-60-60	V98-60	Unidentified clam shell frag's	2.6	~1
V98-60-61	V98-60	Unidentified clam shell frag's	0.4	~1
V98-60-62	V98-60	Unidentified clam shell frag's	0.5	~1
V98-60-63	V98-60	Unidentified clam shell frag's	0.1	~1
V98-60-64	V98-60	Unidentified clam shell frag's	0.6	~1
V98-60-65	V98-60	Unidentified clam shell frag's	0.1	~1
V98-60-66	V98-60	Unidentified clam shell frag's	0.2	~1
V98-60-67	V98-60	Unidentified clam shell frag's	0.1	~1
V98-60-68	V98-60	Unidentified gastropod frag's	0.2	~1
Total weight (grams) V98-60			109.4	
V98-48-1	V98-48	<i>Macoma brota</i>	2.5	1
V98-48-2	V98-48	<i>Macoma brota</i>	1.1	1
V98-48-3	V98-48	<i>Macoma brota</i>	1.1	1
V98-48-4	V98-48	<i>Macoma brota</i>	2.1	1
V98-48-5	V98-48	<i>Macoma brota</i>	1.1	1
V98-48-6	V98-48	<i>Macoma brota</i>	2	1
V98-48-7	V98-48	<i>Macoma brota</i>	1.2	1
V98-48-8	V98-48	<i>Macoma brota</i>	0.6	1
V98-48-9	V98-48	<i>Humilaria kennerleyi</i>	1.5	1

V98-48-10	V98-48	<i>Nucella lamellosa</i>	3.7	1
V98-48-11	V98-48	<i>Mya truncata</i>	1.4	1
V98-48-12	V98-48	<i>Mya truncata</i>	1.5	~1
V98-48-13	V98-48	<i>Mya truncata</i>	1.1	~1
V98-48-14	V98-48	<i>Mya truncata</i>	1	~1
V98-48-15	V98-48	<i>Mya truncata</i>	2.5	1
V98-48-16	V98-48	<i>Mya truncata</i>	2.8	1
V98-48-17	V98-48	<i>Mya truncata</i>	2.5	1
V98-48-18	V98-48	<i>Mya truncata</i>	1.6	1
V98-48-19	V98-48	<i>Mya truncata</i>	4.6	2 articulated
V98-48-20	V98-48	<i>Lucinoma annulatum</i>	4.3	2 articulated
V98-48-21	V98-48	<i>Amphissa columbiana</i>	0.2	1
V98-48-22	V98-48	<i>Fusitriton oregonensis</i>	0.7	1
V98-48-23	V98-48	<i>Lottia instabilis</i>	0.3	1
V98-48-24	V98-48	<i>Serripes groenlandicus</i>	2.9	~1
Total weight (grams) V98-48			44.3	
V98-41-1	V98-41	<i>Macoma brota</i>	2.8	1
V98-41-2	V98-41	<i>Macoma brota</i>	2.1	1
V98-41-3	V98-41	<i>Macoma brota</i>	1.9	1
V98-41-4	V98-41	<i>Macoma brota</i>	1.4	1
V98-41-5	V98-41	<i>Macoma brota</i>	3.3	1
V98-41-6	V98-41	<i>Macoma brota</i>	1.9	1
V98-41-7	V98-41	<i>Macoma brota</i>	1.4	1
V98-41-8	V98-41	<i>Macoma brota</i>	1.5	1
V98-41-9	V98-41	<i>Macoma brota</i>	1.7	1
V98-41-10	V98-41	<i>Macoma brota</i>	1.4	1
V98-41-11	V98-41	<i>Macoma brota</i>	2.7	1
V98-41-12	V98-41	<i>Macoma brota</i>	2.4	1
V98-41-13	V98-41	<i>Macoma brota</i>	1.4	1
V98-41-14	V98-41	<i>Macoma brota</i>	0.8	1
V98-41-15	V98-41	<i>Macoma brota</i>	0.8	1
V98-41-16	V98-41	<i>Macoma brota</i>	2	1
V98-41-17	V98-41	<i>Macoma brota</i>	2.8	1
V98-41-18	V98-41	<i>Macoma brota</i>	2.5	1
V98-41-19	V98-41	<i>Macoma brota</i>	2.9	1
V98-41-20	V98-41	<i>Macoma brota</i>	2.3	1
V98-41-21	V98-41	<i>Macoma brota</i>	1.6	1
V98-41-22	V98-41	<i>Macoma brota</i>	1.4	~1
V98-41-23	V98-41	<i>Macoma brota</i>	1.4	1
V98-41-24	V98-41	<i>Macoma brota</i>	1.5	1
V98-41-25	V98-41	<i>Macoma brota</i>	1.6	1
V98-41-26	V98-41	<i>Macoma brota</i>	0.8	1
V98-41-27	V98-41	<i>Macoma brota</i>	1	1
V98-41-28	V98-41	<i>Macoma brota</i>	1.3	1
V98-41-29	V98-41	<i>Macoma brota</i>	1.6	1
V98-41-30	V98-41	<i>Macoma brota</i>	1.5	1
V98-41-31	V98-41	<i>Macoma brota</i>	1.6	1
V98-41-32	V98-41	<i>Macoma brota</i>	1.2	1
V98-41-33	V98-41	<i>Macoma brota</i>	1.5	1
V98-41-34	V98-41	<i>Macoma brota</i>	1.3	1
V98-41-35	V98-41	<i>Macoma brota</i>	0.5	1
V98-41-36	V98-41	<i>Macoma brota</i>	0.4	1
V98-41-37	V98-41	<i>Macoma brota</i>	0.5	1
V98-41-38	V98-41	<i>Macoma brota</i>	0.6	1
V98-41-39	V98-41	<i>Macoma brota</i>	0.5	1
V98-41-40	V98-41	<i>Macoma brota</i>	1.2	1
V98-41-41	V98-41	<i>Macoma brota</i>	0.6	1
V98-41-42	V98-41	<i>Macoma brota</i>	0.1	~1
V98-41-43	V98-41	<i>Mya truncata</i>	1.2	~1
V98-41-44	V98-41	<i>Mya truncata</i>	1.2	1

V98-41-45	V98-41	<i>Mya truncata</i>	13.7	2 articulated
V98-41-46	V98-41	<i>Mya truncata</i>	1.2	1
V98-41-47	V98-41	<i>Mya truncata</i>	0.6	1
V98-41-48	V98-41	<i>Mya truncata</i>	0.6	1
V98-41-49	V98-41	<i>Mya truncata</i>	0.7	1
V98-41-50	V98-41	<i>Cidarina cidaris</i>	1.3	~1
V98-41-51	V98-41	<i>Humilaria kennerleyi</i>	9.9	1
V98-41-52	V98-41	<i>Lucinoma annulatum</i>	7.2	2 articulated
V98-41-53	V98-41	<i>Cranopsis cucullata</i>	0.3	1
V98-41-54	V98-41	<i>Saxidomus giganteus</i>	15.7	1
V98-41-55	V98-41	Unidentified clam shell frag's	1.5	~1
V98-41-56	V98-41	Unidentified clam shell frag's	1.9	~1
V98-41-57	V98-41	Unidentified clam shell frag's	3.6	~1
V98-41-58	V98-41	Unidentified clam shell frag's	0.4	~1
V98-41-59	V98-41	Unidentified clam shell frag's	0.3	~1
Total weight (grams) V98-41			125	
V98-42-1	V98-42	<i>Macoma brota</i>	4.9	1
V98-42-2	V98-42	<i>Macoma brota</i>	1.6	1
V98-42-3	V98-42	<i>Macoma brota</i>	0.7	1
V98-42-4	V98-42	<i>Macoma brota</i>	8.8	1
V98-42-5	V98-42	<i>Macoma brota</i>	8.5	1
V98-42-6	V98-42	<i>Macoma brota</i>	4.8	1
V98-42-7	V98-42	<i>Macoma brota</i>	1.4	1
V98-42-8	V98-42	<i>Macoma brota</i>	1.8	1
V98-42-9	V98-42	<i>Macoma brota</i>	5.1	1
V98-42-10	V98-42	<i>Macoma brota</i>	4.6	1
V98-42-11	V98-42	<i>Macoma brota</i>	1.8	1
V98-42-12	V98-42	<i>Macoma brota</i>	1.8	1
V98-42-13	V98-42	<i>Macoma brota</i>	1	1
V98-42-14	V98-42	<i>Macoma brota</i>	1	1
V98-42-15	V98-42	<i>Macoma brota</i>	0.8	1
V98-42-16	V98-42	<i>Macoma brota</i>	1.6	1
V98-42-17	V98-42	<i>Macoma brota</i>	0.9	1
V98-42-18	V98-42	<i>Macoma brota</i>	1	1
V98-42-19	V98-42	<i>Macoma brota</i>	0.5	1
V98-42-20	V98-42	<i>Macoma brota</i>	1.6	2 articulated
V98-42-21	V98-42	<i>Macoma brota</i>	2.2	2 articulated
V98-42-22	V98-42	<i>Macoma brota</i>	1	1
V98-42-23	V98-42	<i>Macoma brota</i>	0.5	1
V98-42-24	V98-42	<i>Protothaca tenerrima</i>	8.9	1 (2 frag's)
V98-42-25	V98-42	<i>Macoma lipara</i>	22.3	1
V98-42-26	V98-42	<i>Macoma sp.</i>	0.6	1
V98-42-27	V98-42	<i>Macoma sp.</i>	0.8	1 (frag's)
V98-42-28	V98-42	<i>Macoma sp.</i>	0.8	1
V98-42-29	V98-42	<i>Macoma sp.</i>	0.3	1
V98-42-30	V98-42	<i>Macoma sp.</i>	0.1	1
V98-42-31	V98-42	<i>Lucinoma annulatum</i>	2.6	2 articulated
V98-42-32	V98-42	<i>Lucinoma annulatum</i>	1.4	~1
V98-42-33	V98-42	<i>Mya truncata</i>	1.8	1
V98-42-34	V98-42	<i>Mya truncata</i>	1.5	1
V98-42-35	V98-42	<i>Mya truncata</i>	1.6	1
V98-42-36	V98-42	<i>Mya truncata</i>	1.7	1
V98-42-37	V98-42	<i>Mya truncata</i>	1.5	1
V98-42-38	V98-42	<i>Chlamys rubida</i>	0.1	1
V98-42-39	V98-42	<i>Chlamys rubida</i>	0.4	1
V98-42-40	V98-42	<i>Chlamys rubida</i>	0.3	1
V98-42-41	V98-42	<i>Chlamys rubida</i>	0.1	1
V98-42-42	V98-42	<i>Chlamys rubida</i>	0.1	1
V98-42-43	V98-42	<i>Chlamys rubida</i>	0.1	1
V98-42-44	V98-42	<i>Chlamys rubida</i>	0.1	1

V98-42-45	V98-42	<i>Chlamys rubida</i>	0.3	1
V98-42-46	V98-42	<i>Chlamys hastata</i>	0.1	1
V98-42-47	V98-42	<i>Pododesmus machrochisma</i>	0.3	1
V98-42-48	V98-42	<i>Pododesmus machrochisma</i>	0.5	1
V98-42-49	V98-42	<i>Pododesmus machrochisma</i>	0.2	1
V98-42-50	V98-42	<i>Euspira pallida</i>	5.9	1
V98-42-51	V98-42	<i>Polinices lewisii</i>	2.3	1
V98-42-52	V98-42	<i>Nucella lamellosa</i>	14.6	1 (4 frag's)
V98-42-53	V98-42	<i>Nucella lamellosa</i>	3.6	1 (3 frag's)
V98-42-54	V98-42	<i>Nucella lamellosa</i>	2.2	~1
V98-42-55	V98-42	<i>Nucella lamellosa</i>	1.6	1
V98-42-56	V98-42	<i>Nucella lamellosa</i>	0.9	1
V98-42-57	V98-42	<i>Nucella lamellosa</i>	0.6	1
V98-42-58	V98-42	<i>Nucella lamellosa</i>	1.7	1
V98-42-59	V98-42	<i>Nucella lamellosa</i>	1.3	1
V98-42-60	V98-42	<i>Nucella lamellosa</i>	1.2	1
V98-42-61	V98-42	<i>Neptunea tabulata</i>	0.6	1
V98-42-62	V98-42	<i>Amphissa columbiana</i>	0.3	1
V98-42-63	V98-42	<i>Hiatella arctica</i>	1.9	13
V98-42-64	V98-42	<i>Acila castrensis</i>	0.1	1
V98-42-65	V98-42	<i>Cyclocardia ventricosa</i>	0.1	1
V98-42-66	V98-42	<i>Balanus spp.</i>	6.5	many
V98-42-67	V98-42	<i>Protothaca tenerrima</i>	0.1	~1
V98-42-68	V98-42	Unidentified clam shell frag's	0.7	~1
V98-42-69	V98-42	Unidentified clam shell frag's	1.1	1
V98-42-70	V98-42	Unidentified clam shell frag's	8.4	~1
V98-42-71	V98-42	Unidentified clam shell frag's	2.5	18 frag's
V98-42-72	V98-42	<i>Crepidatella dorsata</i>	0.1	1
V98-42-73	V98-42	<i>Crepidatella dorsata</i>	0.1	1
V98-42-74	V98-42	<i>Crepidatella dorsata</i>	0.1	1
Total weight (grams) V98-42			164.9	
V98-43-1	V98-43	<i>Humilaria kennerleyi</i>	19.8	1
V98-43-2	V98-43	<i>Humilaria kennerleyi</i>	18.8	1
V98-43-3	V98-43	<i>Humilaria kennerleyi</i>	10.9	1
V98-43-4	V98-43	<i>Lucinoma annulatum</i>	2.2	2 articulated
V98-43-5	V98-43	<i>Nucella lamellosa</i>	7.7	1
V98-43-6	V98-43	<i>Nucella lamellosa</i>	11.9	1
V98-43-7	V98-43	<i>Macoma brota</i>	1.3	1
V98-43-8	V98-43	<i>Macoma brota</i>	3.7	1
V98-43-9	V98-43	<i>Macoma brota</i>	2.6	1
V98-43-10	V98-43	<i>Macoma brota</i>	2.2	1
V98-43-11	V98-43	<i>Macoma brota</i>	1.7	2 articulated
V98-43-12	V98-43	<i>Macoma brota</i>	2.3	1
V98-43-13	V98-43	<i>Macoma calcarea</i>	1.4	1
V98-43-14	V98-43	<i>Mya truncata</i>	2.3	1
V98-43-15	V98-43	<i>Thracia trapezoides</i>	1.4	~1
V98-43-16	V98-43	<i>Clinocardium species</i>	0.4	1
V98-43-17	V98-43	<i>Clinocardium species</i>	0.5	~1
V98-43-18	V98-43	<i>Clinocardium species</i>	0.1	1
V98-43-19	V98-43	<i>Limpet sp.</i>	0.1	1
Total weight (grams) V98-43			91.3	
V98-49-1	V98-49	<i>Humilaria kennerleyi</i>	21.4	1
V98-49-2	V98-49	<i>Humilaria kennerleyi</i>	28.3	2 articulated
V98-49-3	V98-49	<i>Macoma brota</i>	0.5	1
V98-49-4	V98-49	<i>Macoma brota</i>	0.3	1
V98-49-5	V98-49	<i>Macoma brota</i>	1.4	1
V98-49-6	V98-49	<i>Macoma brota</i>	2.3	1
V98-49-7	V98-49	<i>Macoma brota</i>	0.5	1
V98-49-8	V98-49	<i>Macoma brota</i>	0.5	1

V98-49-9	V98-49	<i>Macoma brota</i>	0.5	1
V98-49-10	V98-49	<i>Macoma brota</i>	1	1
V98-49-11	V98-49	<i>Macoma brota</i>	0.6	1
V98-49-12	V98-49	<i>Macoma lipara</i>	2.7	~1
V98-49-13	V98-49	<i>Lucinoma annulatum</i>	1.7	3 frag's
V98-49-14	V98-49	<i>Lucinoma annulatum</i>	1.1	~2 articulated
V98-49-15	V98-49	<i>Lucinoma annulatum</i>	0.9	2 articulated
V98-49-16	V98-49	<i>Mya truncata</i>	0.6	~1
V98-49-17	V98-49	<i>Chlamys rubida</i>	1.6	1
V98-49-18	V98-49	<i>Chlamys rubida</i>	0.1	1
V98-49-19	V98-49	<i>Cranopsis cucullata</i>	0.1	1
V98-49-20	V98-49	<i>Euspira pallida</i>	2	1
V98-49-21	V98-49	<i>Tegula pulligo</i>	1.5	~1
V98-49-22	V98-49	<i>Amphissa columbiana</i>	0.2	1
V98-49-23	V98-49	<i>Amphissa columbiana</i>	0.3	1
V98-49-24	V98-49	<i>Amphissa columbiana</i>	0.2	1
V98-49-25	V98-49	<i>Nucella lamellosa</i>	3.5	1
V98-49-26	V98-49	<i>Nucella lamellosa</i>	1.2	1
V98-49-27	V98-49	<i>Nucella lamellosa</i>	1.2	1
V98-49-28	V98-49	<i>Nucella lamellosa</i>	1.6	1
V98-49-29	V98-49	<i>Nucella lamellosa</i>	2.9	1
V98-49-30	V98-49	<i>Nucella lamellosa</i>	0.6	1
V98-49-31	V98-49	<i>Nucella lamellosa</i>	0.4	1
V98-49-32	V98-49	<i>Nucella lamellosa</i>	0.5	1
V98-49-33	V98-49	<i>Nucella lamellosa</i>	0.6	1
V98-49-34	V98-49	<i>Nucella lamellosa</i>	0.3	1
V98-49-35	V98-49	<i>Boreotrophon stuarti</i>	0.9	~1
V98-49-36	V98-49	Unidentified clam shell frag's	0.4	~1
V98-49-37	V98-49	Unidentified clam shell frag's	1.2	~1
V98-49-38	V98-49	Unidentified clam shell frag's	0.2	~1
V98-49-39	V98-49	Unidentified clam shell frag's	0.4	~1
V98-49-40	V98-49	Unidentified clam shell frag's	0.4	~1
V98-49-41	V98-49	Unidentified clam shell frag's	0.4	~1
V98-49-42	V98-49	Unidentified clam shell frag's	0.1	~1
V98-49-43	V98-49	Unidentified clam shell frag's	0.4	5 frag's
V98-49-44	V98-49	Unidentified gastropod frag's	0.5	~1
V98-49-45	V98-49	<i>Balanus</i> spp.	2	7
Total weight (grams) V98-49			90	
V98-64-1	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-2	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-3	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-4	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-5	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-6	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-7	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-8	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-9	V98-64	<i>Macoma lipara</i>	0.1	
V98-64-10	V98-64	<i>Macoma brota</i>	0.1	
V98-64-11	V98-64	<i>Macoma brota</i>	0.1	
V98-64-12	V98-64	<i>Macoma brota</i>	0.1	
V98-64-13	V98-64	<i>Macoma brota</i>	0.1	
V98-64-14	V98-64	<i>Macoma brota</i>	0.1	
V98-64-15	V98-64	<i>Macoma brota</i>	0.1	
V98-64-16	V98-64	<i>Macoma brota</i>	0.1	
V98-64-17	V98-64	<i>Macoma brota</i>	0.1	
V98-64-18	V98-64	<i>Macoma brota</i>	0.1	
V98-64-19	V98-64	<i>Macoma brota</i>	0.1	
V98-64-20	V98-64	<i>Macoma brota</i>	0.1	
V98-64-21	V98-64	<i>Macoma brota</i>	0.1	
V98-64-22	V98-64	<i>Macoma brota</i>	0.1	

V98-64-23	V98-64	<i>Macoma brota</i>	0.1	
V98-64-24	V98-64	<i>Macoma brota</i>	0.1	
V98-64-25	V98-64	<i>Macoma brota</i>	0.1	
V98-64-26	V98-64	<i>Macoma brota</i>	0.1	
V98-64-27	V98-64	<i>Macoma brota</i>	0.1	
V98-64-28	V98-64	<i>Macoma brota</i>	0.1	
V98-64-29	V98-64	<i>Macoma brota</i>	0.1	
V98-64-30	V98-64	<i>Macoma brota</i>	0.1	
V98-64-31	V98-64	<i>Macoma brota</i>	0.1	
V98-64-32	V98-64	<i>Macoma brota</i>	0.1	
V98-64-33	V98-64	<i>Lucinoma annulatum</i>	1.5	1
V98-64-34	V98-64	<i>Lucinoma annulatum</i>	2.1	2 articulated
V98-64-35	V98-64	<i>Lucinoma annulatum</i>	1.6	1
V98-64-36	V98-64	<i>Lucinoma annulatum</i>	1.5	1
V98-64-37	V98-64	<i>Lucinoma annulatum</i>	2	2 articulated
V98-64-38	V98-64	<i>Chlamys rubida</i>	0.8	1
V98-64-39	V98-64	<i>Chlamys rubida</i>	2.5	2 articulated
V98-64-40	V98-64	<i>Chlamys rubida</i>	0.1	1
V98-64-41	V98-64	<i>Mya truncata</i>	1.7	-1
V98-64-42	V98-64	<i>Mya truncata</i>	3.2	1
V98-64-43	V98-64	<i>Mya truncata</i>	2.2	1
V98-64-44	V98-64	<i>Mya truncata</i>	1.3	1
V98-64-45	V98-64	<i>Ceratostoma foliatum</i>	5.7	1
V98-64-46	V98-64	<i>Cidarina cidaris</i>	1.2	1
V98-64-47	V98-64	<i>Thracia trapezoides</i>	1.1	1
V98-64-48	V98-64	<i>Pododesmus machrochisma</i>	0.4	1
V98-64-49	V98-64	<i>Nucella lamellosa</i>	4.4	1
V98-64-50	V98-64	<i>Nucella lamellosa</i>	4.2	1
V98-64-51	V98-64	<i>Nucella lamellosa</i>	1.7	-1
V98-64-52	V98-64	<i>Nucella lamellosa</i>	5.7	-1
V98-64-53	V98-64	<i>Nucella lamellosa</i>	3	-1
V98-64-54	V98-64	<i>Nucella lamellosa</i>	15.6	1
V98-64-55	V98-64	<i>Nucella lamellosa</i>	1.2	1
V98-64-56	V98-64	<i>Nucella lamellosa</i>	2.8	-1
V98-64-57	V98-64	<i>Nucella lamellosa</i>	2.7	1
V98-64-58	V98-64	<i>Nucella lamellosa</i>	1.1	-1
V98-64-59	V98-64	<i>Nucella lamellosa</i>	4.6	1
V98-64-60	V98-64	<i>Nucella lamellosa</i>	1.6	1
V98-64-61	V98-64	<i>Nucella lamellosa</i>	0.8	1
V98-64-62	V98-64	<i>Nucella lamellosa</i>	2.5	1
V98-64-63	V98-64	Unidentified gastropod frag's	0.6	-1
V98-64-64	V98-64	Unidentified gastropod frag's	1.3	-1
V98-64-65	V98-64	Unidentified gastropod frag's	2	-1
V98-64-66	V98-64	Unidentified gastropod frag's	3.5	-1
V98-64-67	V98-64	Unidentified gastropod frag's	0.5	-1
V98-64-68	V98-64	Unidentified gastropod frag's	3.7	-1
V98-64-69	V98-64	Unidentified gastropod frag's	0.9	-1
V98-64-70	V98-64	Unidentified gastropod frag's	1.6	-1
V98-64-71	V98-64	Unidentified gastropod frag's	0.3	-1
V98-64-72	V98-64	Unidentified gastropod frag's	1.3	3 frag's
V98-64-73	V98-64	Unidentified gastropod frag's	1.4	-1
V98-64-74	V98-64	Unidentified gastropod frag's	2.3	-1
V98-64-75	V98-64	Unidentified gastropod frag's	1.1	-1
V98-64-76	V98-64	Unidentified gastropod frag's	1	-1
V98-64-77	V98-64	Unidentified gastropod frag's	0.8	-1
V98-64-78	V98-64	Unidentified gastropod frag's	0.8	-1
V98-64-79	V98-64	Unidentified clam shell frag's	2.7	-1
V98-64-80	V98-64	Unidentified clam shell frag's	0.9	-1
V98-64-81	V98-64	Unidentified clam shell frag's	0.5	-1
V98-64-82	V98-64	Unidentified clam shell frag's	0.1	-1
V98-64-83	V98-64	Unidentified clam shell frag's	0.2	-1

V98-64-84	V98-64	Unidentified clam shell frag's	0.3	~1
V98-64-85	V98-64	Unidentified clam shell frag's	0.2	~1
V98-64-86	V98-64	Unidentified clam shell frag's	0.1	~1
V98-64-87	V98-64	<i>Balanus sp.</i>	0.1	2 frag's
V98-64-88	V98-64	<i>Balanus sp.</i>	0.2	1
V98-64-89	V98-64	<i>Hiatella arctica</i>	0.2	1
V98-64-90	V98-64	<i>Hiatella arctica</i>	0.1	1
Total weight (grams) V98-64			112.7	
V98-65-1	V98-65	<i>Pododesmus machrochisma</i>	0.6	1
V98-65-2	V98-65	<i>Nucella lamellosa</i>	3	1
V98-65-3	V98-65	<i>Nucella lamellosa</i>	2.5	~1
V98-65-4	V98-65	<i>Nucella lamellosa</i>	3.8	1
V98-65-5	V98-65	<i>Nucella lamellosa</i>	17.3	~1
V98-65-6	V98-65	<i>Nucella lamellosa</i>	4.6	~1
V98-65-7	V98-65	Unidentified gastropod frag's	1.2	~1
V98-65-8	V98-65	Unidentified clam shell frag's	1.9	~1
V98-65-9	V98-65	Unidentified clam shell frag's	4.2	~1
V98-65-10	V98-65	Tubeworm	1	~1
Total weight (grams) V98-65			40.1	
V98-35-1	V98-35	<i>Humilaria kennerleyi</i>	26.1	1
V98-35-2	V98-35	<i>Humilaria kennerleyi</i>	18.4	1
V98-35-3	V98-35	<i>Mya truncata</i>	4.1	1
V98-35-4	V98-35	<i>Mya truncata</i>	4	1
V98-35-5	V98-35	<i>Mya truncata</i>	6.4	1
V98-35-6	V98-35	<i>Mya truncata</i>	3.1	1
V98-35-7	V98-35	<i>Mya truncata</i>	4.7	1
V98-35-8	V98-35	<i>Mya truncata</i>	3.8	1
V98-35-9	V98-35	<i>Mya truncata</i>	1.9	1
V98-35-10	V98-35	<i>Mya truncata</i>	3.7	1
V98-35-11	V98-35	<i>Mya truncata</i>	5.4	1
V98-35-12	V98-35	<i>Mya truncata</i>	0.6	~1
V98-35-13	V98-35	<i>Mya truncata</i>	0.4	~1
V98-35-14	V98-35	<i>Mya truncata</i>	1.2	~1
V98-35-15	V98-35	<i>Mya truncata</i>	0.8	~1
V98-35-16	V98-35	<i>Mya truncata</i>	4.2	1
V98-35-17	V98-35	<i>Lucinoma annulatum</i>	0.4	1
V98-35-18	V98-35	<i>Lucinoma annulatum</i>	0.2	2 articulated
V98-35-19	V98-35	<i>Lucinoma annulatum</i>	1.3	2 articulated
V98-35-20	V98-35	<i>Clinocardium sp.</i>	0.5	1
V98-35-21	V98-35	<i>Clinocardium sp.</i>	0.4	1
V98-35-22	V98-35	<i>Clinocardium sp.</i>	0.2	1
V98-35-23	V98-35	<i>Clinocardium sp.</i>	0.1	1
V98-35-24	V98-35	<i>Acila castrensis</i>	0.3	1
V98-35-25	V98-35	<i>Acila castrensis</i>	0.2	1
V98-35-26	V98-35	<i>Macoma brota</i>	1.9	1
V98-35-27	V98-35	<i>Macoma brota</i>	1.4	1
V98-35-28	V98-35	<i>Macoma brota</i>	2	1
V98-35-29	V98-35	<i>Macoma brota</i>	1.7	1
V98-35-30	V98-35	<i>Macoma brota</i>	1.2	1
V98-35-31	V98-35	<i>Macoma brota</i>	1.2	1
V98-35-32	V98-35	<i>Macoma brota</i>	1.1	1
V98-35-33	V98-35	<i>Macoma brota</i>	1.1	1
V98-35-34	V98-35	<i>Macoma brota</i>	0.7	1
V98-35-35	V98-35	<i>Macoma brota</i>	1.1	1
V98-35-36	V98-35	<i>Macoma brota</i>	0.7	1
V98-35-37	V98-35	<i>Macoma brota</i>	0.7	1
V98-35-38	V98-35	<i>Macoma brota</i>	0.4	1
V98-35-39	V98-35	<i>Macoma brota</i>	0.2	1
V98-35-40	V98-35	<i>Macoma brota</i>	0.3	1

V98-35-41	V98-35	<i>Macoma brota</i>	0.2	~1
V98-35-42	V98-35	<i>Macoma sp.</i>	0.2	1
V98-35-43	V98-35	<i>Chlamys rubida</i>	0.3	1
V98-35-44	V98-35	<i>Chlamys rubida</i>	0.2	1
V98-35-45	V98-35	<i>Chlamys rubida</i>	0.6	1
V98-35-46	V98-35	<i>Chlamys rubida</i>	1.1	1
V98-35-47	V98-35	<i>Chlamys rubida</i>	0.1	1
V98-35-48	V98-35	<i>Chlamys rubida</i>	0.2	1
V98-35-49	V98-35	<i>Chlamys rubida</i>	0.3	1
V98-35-50	V98-35	<i>Chlamys rubida</i>	0.3	1
V98-35-51	V98-35	<i>Chlamys rubida</i>	0.1	1
V98-35-52	V98-35	<i>Chlamys rubida</i>	0.2	1
V98-35-53	V98-35	<i>Chlamys rubida</i>	0.1	1
V98-35-54	V98-35	<i>Chlamys hastata</i>	0.4	1
V98-35-55	V98-35	<i>Clinocardium sp.</i>	0.1	1
V98-35-56	V98-35	<i>Amphissa columbiana</i>	0.1	1
V98-35-57	V98-35	<i>Amphissa columbiana</i>	0.3	1
V98-35-58	V98-35	<i>Amphissa columbiana</i>	0.2	1
V98-35-59	V98-35	<i>Tegula pulligo</i>	0.1	1
V98-35-60	V98-35	<i>Turbonilla species</i>	0.1	1
V98-35-61	V98-35	<i>Nucella lamellosa</i>	3.3	~1
V98-35-62	V98-35	Unidentified clam shell frag's	0.8	12+
Total weight (grams) V98-35			117.4	
V98-36-1	V98-36	<i>Cidarina cidaris</i>	2.7	1
V98-36-2	V98-36	<i>Chlamys rubida</i>	1	1
V98-36-3	V98-36	<i>Chlamys rubida</i>	0.2	1
V98-36-4	V98-36	<i>Chlamys rubida</i>	0.2	1
V98-36-5	V98-36	<i>Chlamys rubida</i>	1.5	1
V98-36-6	V98-36	<i>Chlamys rubida</i>	0.2	1
V98-36-7	V98-36	<i>Chlamys rubida</i>	0.1	1
V98-36-8	V98-36	<i>Chlamys rubida</i>	0.1	1
V98-36-9	V98-36	<i>Chlamys rubida</i>	0.3	1
V98-36-10	V98-36	<i>Amphissa columbiana</i>	0.3	1
V98-36-11	V98-36	<i>Acila castrensis</i>	0.3	1
V98-36-12	V98-36	Unidentified clam shell frag's	6.2	6 frag's of 1
V98-36-13	V98-36	Unidentified clam shell frag's	0.6	~1
Total weight (grams) V98-36			13.7	
V98-31-1	V98-31	<i>Humilaria kennerleyi</i>	26.3	2 articulated
V98-31-2	V98-31	<i>Humilaria kennerleyi</i>	10.6	1
V98-31-3	V98-31	<i>Humilaria kennerleyi</i>	12.3	1
V98-31-4	V98-31	<i>Humilaria kennerleyi</i>	23.8	1
V98-31-5	V98-31	<i>Humilaria kennerleyi</i>	23.2	~1
V98-31-6	V98-31	<i>Humilaria kennerleyi</i>	3.6	1
V98-31-7	V98-31	<i>Humilaria kennerleyi</i>	8.7	1
V98-31-8	V98-31	<i>Humilaria kennerleyi</i>	8.7	1
V98-31-9	V98-31	<i>Saxidomus giganteus</i>	6.8	1
V98-31-10	V98-31	<i>Gari californica</i>	0.9	2 articulated
V98-31-11	V98-31	<i>Gari californica</i>	0.5	2 articulated
V98-31-12	V98-31	<i>Gari californica</i>	0.5	2 articulated
V98-31-13	V98-31	<i>Gari californica</i>	0.1	2 articulated
V98-31-14	V98-31	<i>Astarte elliptica?</i>	0.7	1
V98-31-15	V98-31	<i>Acila castrensis</i>	0.6	2 articulated
V98-31-16	V98-31	<i>Acila castrensis</i>	0.8	2 articulated
V98-31-17	V98-31	<i>Acila castrensis</i>	0.9	2 articulated
V98-31-18	V98-31	<i>Clinocardium sp.</i>	1.4	2 articulated
V98-31-19	V98-31	<i>Clinocardium sp.</i>	0.9	2 articulated
V98-31-20	V98-31	<i>Cyclocardia ventricosa</i>	0.5	2 articulated
V98-31-21	V98-31	<i>Pododesmus machrochisma</i>	0.5	1
V98-31-22	V98-31	<i>Pododesmus machrochisma</i>	0.3	1

V98-31-23	V98-31	<i>Pododesmus machrochisma</i>	0.1	1
V98-31-24	V98-31	<i>Panomya ampla</i> ?	2.2	1
V98-31-25	V98-31	<i>Musculus discors</i>	0.3	2 articulated
V98-31-26	V98-31	<i>Musculus discors</i>	0.2	
V98-31-27	V98-31	<i>Musculus discors</i>	0.2	
V98-31-28	V98-31	<i>Mya truncata</i>	0.9	~1
V98-31-29	V98-31	<i>Mya truncata</i>	0.7	~1
V98-31-30	V98-31	<i>Mya truncata</i>	1.4	4 frag's
V98-31-31	V98-31	<i>Chlamys rubida</i>	0.1	1
V98-31-32	V98-31	<i>Chlamys rubida</i>	0.8	~1
V98-31-33	V98-31	<i>Chlamys rubida</i>	1.8	~1
V98-31-34	V98-31	<i>Chlamys rubida</i>	0.8	~1
V98-31-35	V98-31	<i>Chlamys rubida</i>	0.7	~1
V98-31-36	V98-31	<i>Chlamys rubida</i>	0.1	~1
V98-31-37	V98-31	<i>Chlamys rubida</i>	0.1	~1
V98-31-38	V98-31	<i>Chlamys rubida</i>	0.1	~1
V98-31-39	V98-31	<i>Chlamys rubida</i>	0.2	~1
V98-31-40	V98-31	<i>Chlamys rubida</i>	2.6	1
V98-31-41	V98-31	<i>Chlamys rubida</i>	2.8	1
V98-31-42	V98-31	<i>Chlamys rubida</i>	0.8	~1
V98-31-43	V98-31	<i>Chlamys rubida</i>	0.2	1
V98-31-44	V98-31	<i>Chlamys rubida</i>	0.4	1
V98-31-45	V98-31	<i>Chlamys rubida</i>	0.1	~1
V98-31-46	V98-31	<i>Macoma lipara</i>	10.7	1
V98-31-47	V98-31	<i>Macoma lipara</i>	7.8	1
V98-31-48	V98-31	<i>Macoma lipara</i>	7.8	1
V98-31-49	V98-31	<i>Macoma brota</i>	1	~1
V98-31-50	V98-31	<i>Macoma brota</i>	1.2	~1
V98-31-51	V98-31	<i>Pandora filosa</i>	1.3	2 articulated
V98-31-52	V98-31	<i>Nemocardium centifilosum</i>	0.2	2 articulated
V98-31-53	V98-31	<i>Nemocardium centifilosum</i>	0.4	2 articulated
V98-31-54	V98-31	<i>Nemocardium centifilosum</i>	0.5	2 articulated
V98-31-55	V98-31	<i>Solamen columbianum</i>	0.1	2 articulated
V98-31-56	V98-31	<i>Macoma sp.</i>	0.1	1
V98-31-57	V98-31	<i>Euspira pallida</i>	1.7	1
V98-31-58	V98-31	<i>Amphissa columbiana</i>	0.3	1
V98-31-59	V98-31	<i>Amphissa columbiana</i>	0.1	1
V98-31-60	V98-31	Unidentified clam shell frag's	2.2	~1
V98-31-61	V98-31	Unidentified gastropod frag's	1.5	~1
V98-31-62	V98-31	starfish creature	0.1	1
V98-31-63	V98-31	tubeworm	7.6	1
V98-31-64	V98-31	tubeworm	4.8	1
Total weight (grams) V98-31			199.6	
V98-34-1	V98-34	<i>Humilaria kennerleyi</i>	60.4	2 articulated
V98-34-2	V98-34	<i>Humilaria kennerleyi</i>	1.6	1
V98-34-3	V98-34	<i>Humilaria kennerleyi</i>	1.7	3 frag's of 1
V98-34-4	V98-34	<i>Humilaria kennerleyi</i>	5.2	~1
V98-34-5	V98-34	<i>Humilaria kennerleyi</i>	12.9	~1
V98-34-6	V98-34	<i>Humilaria kennerleyi</i>	14.5	1
V98-34-7	V98-34	<i>Diplodonta impolita</i>	0.3	1
V98-34-8	V98-34	<i>Cyclocardia ventricosa</i>	0.3	1
V98-34-9	V98-34	<i>Clinocardium sp.</i>	0.7	1
V98-34-10	V98-34	<i>Clinocardium sp.</i>	0.5	1
V98-34-11	V98-34	<i>Clinocardium sp.</i>	0.9	1
V98-34-12	V98-34	<i>Clinocardium sp.</i>	0.9	1
V98-34-13	V98-34	<i>Clinocardium sp.</i>	0.9	1
V98-34-14	V98-34	<i>Clinocardium sp.</i>	0.7	1
V98-34-15	V98-34	<i>Chlamys hastata</i>	3	1
V98-34-16	V98-34	<i>Chlamys hastata</i>	0.8	2 articulated
V98-34-17	V98-34	<i>Chlamys rubida</i>	0.3	1

V98-34-18	V98-34	<i>Chlamys rubida</i>	0.1	1
V98-34-19	V98-34	<i>Chlamys rubida</i>	1	1
V98-34-20	V98-34	<i>Chlamys rubida</i>	0.1	1
V98-34-21	V98-34	<i>Chlamys rubida</i>	1.4	1
V98-34-22	V98-34	<i>Chlamys rubida</i>	0.4	1
V98-34-23	V98-34	<i>Chlamys rubida</i>	1.5	1
V98-34-24	V98-34	<i>Mya truncata</i>	0.4	1
V98-34-25	V98-34	<i>Mya truncata</i>	0.2	~1
V98-34-26	V98-34	<i>Mya truncata</i>	0.4	~1
V98-34-27	V98-34	<i>Mya truncata</i>	0.5	1
V98-34-28	V98-34	<i>Mya truncata</i>	0.3	1
V98-34-29	V98-34	<i>Thracia trapezoides</i>	1.2	1
V98-34-30	V98-34	<i>Thracia trapezoides</i>	0.7	3 frag's of 1
V98-34-31	V98-34	<i>Thracia trapezoides</i>	0.2	~1
V98-34-32	V98-34	<i>Pododesmus machrochisma</i>	0.1	1
V98-34-33	V98-34	<i>Lucinoma annulatum</i>	0.3	3 frag's of 1
V98-34-34	V98-34	<i>Cranopsis cucullata</i>	0.1	1
V98-34-35	V98-34	<i>Nucella lamellosa</i>	0.4	1
V98-34-36	V98-34	<i>Nucella lamellosa</i>	0.9	1
V98-34-37	V98-34	Unidentified clam shell frag's	1	many frag's
V98-34-38	V98-34	coral ?	1	1
V98-34-39	V98-34	coral ?	0.9	1
V98-34-40	V98-34	coral ?	1	1
V98-34-41	V98-34	coral ?	1.3	1
V98-34-42	V98-34	tubeworm, sea anenome, etc	0.3	
Total weight (grams) V98-34			121.3	
V98-33-1	V98-33	<i>Mya truncata</i>	3.1	~1
V98-33-2	V98-33	<i>Mya truncata</i>	0.9	1
V98-33-3	V98-33	<i>Mya truncata</i>	4.9	1
V98-33-4	V98-33	<i>Mya truncata</i>	3	1
V98-33-5	V98-33	<i>Mya truncata</i>	3.6	1
V98-33-6	V98-33	<i>Mya truncata</i>	3.4	1
V98-33-7	V98-33	<i>Mya truncata</i>	4.8	1
V98-33-8	V98-33	<i>Mya truncata</i>	2.3	1
V98-33-9	V98-33	<i>Mya truncata</i>	3.7	1
V98-33-10	V98-33	<i>Mya truncata</i>	2.1	1
V98-33-11	V98-33	<i>Mya truncata</i>	2.2	1
V98-33-12	V98-33	<i>Mya truncata</i>	2.4	1
V98-33-13	V98-33	<i>Mya truncata</i>	3.3	1
V98-33-14	V98-33	<i>Mya truncata</i>	3.3	1
V98-33-15	V98-33	<i>Mya truncata</i>	2.5	1
V98-33-16	V98-33	<i>Mya truncata</i>	1.9	1
V98-33-17	V98-33	<i>Mya truncata</i>	0.8	1
V98-33-18	V98-33	<i>Mya truncata</i>	0.5	1
V98-33-19	V98-33	<i>Mya truncata</i>	0.7	1
V98-33-20	V98-33	<i>Mya truncata</i>	0.8	~1
V98-33-21	V98-33	<i>Mya truncata</i>	3	1
V98-33-22	V98-33	<i>Mya truncata</i>	2.5	1
V98-33-23	V98-33	<i>Mya truncata</i>	0.6	~1
V98-33-24	V98-33	<i>Mya truncata</i>	0.8	~1
V98-33-25	V98-33	<i>Mya truncata</i>	0.5	1
V98-33-26	V98-33	<i>Mya truncata</i>	2.1	7 frag's
V98-33-27	V98-33	<i>Macoma brota</i>	0.8	1
V98-33-28	V98-33	<i>Macoma brota</i>	0.5	1
V98-33-29	V98-33	<i>Macoma brota</i>	0.6	1
V98-33-30	V98-33	<i>Macoma brota</i>	0.6	1
V98-33-31	V98-33	<i>Macoma brota</i>	0.8	1
V98-33-32	V98-33	<i>Lucinoma annulatum</i>	0.9	1
V98-33-33	V98-33	<i>Clinocardium sp.</i>	1.8	1
V98-33-34	V98-33	<i>Clinocardium sp.</i>	0.6	1

V98-33-35	V98-33	<i>Clinocardium sp.</i>	0.7	1
V98-33-36	V98-33	<i>Fusitriton oregonensis</i>	1.5	1
V98-33-37	V98-33	<i>Fusitriton oregonensis</i>	0.9	1
V98-33-38	V98-33	<i>Fusitriton oregonensis</i>	0.4	1
V98-33-39	V98-33	<i>Fusitriton oregonensis</i>	0.2	~1
V98-33-40	V98-33	<i>Fusitriton oregonensis ?</i>	0.7	1
V98-33-41	V98-33	<i>Chlamys rubida</i>	0.4	1
V98-33-42	V98-33	<i>Chlamys rubida</i>	1.2	1
V98-33-43	V98-33	<i>Chlamys rubida</i>	1.4	1
V98-33-44	V98-33	<i>Chlamys rubida</i>	0.6	1
V98-33-45	V98-33	<i>Chlamys rubida</i>	0.5	1
V98-33-46	V98-33	<i>Chlamys rubida</i>	0.5	1
V98-33-47	V98-33	<i>Chlamys rubida</i>	0.3	1
V98-33-48	V98-33	<i>Chlamys rubida</i>	0.2	1
V98-33-49	V98-33	<i>Chlamys rubida</i>	0.4	1
V98-33-50	V98-33	<i>Chlamys rubida</i>	0.1	1
V98-33-51	V98-33	<i>Chlamys rubida</i>	0.1	1
V98-33-52	V98-33	<i>Chlamys rubida</i>	0.1	1
V98-33-53	V98-33	<i>Chlamys rubida</i>	0.2	1
V98-33-54	V98-33	<i>Clinocardium sp.</i>	0.4	2 articulated
V98-33-55	V98-33	<i>Clinocardium sp.</i>	0.1	1
V98-33-56	V98-33	<i>Acila castrensis</i>	0.6	2 articulated
V98-33-57	V98-33	<i>Acila castrensis</i>	0.3	1
V98-33-58	V98-33	<i>Solamen columbianum</i>	0.3	1
V98-33-59	V98-33	<i>Cidarina cidaris</i>	1.1	1
V98-33-60	V98-33	<i>Cidarina cidaris</i>	0.6	1
V98-33-61	V98-33	<i>Cidarina cidaris</i>	1	1
V98-33-62	V98-33	<i>Cidarina cidaris</i>	1.1	1
V98-33-63	V98-33	<i>Cidarina cidaris</i>	0.9	~1
V98-33-64	V98-33	<i>Cidarina cidaris</i>	0.4	1
V98-33-65	V98-33	<i>Euspira pallida</i>	0.8	1
V98-33-66	V98-33	<i>Euspira pallida</i>	1.5	1
V98-33-67	V98-33	<i>Euspira pallida</i>	2.4	1
V98-33-68	V98-33	<i>Euspira pallida</i>	1.1	1
V98-33-69	V98-33	<i>Euspira pallida</i>	0.6	1
V98-33-70	V98-33	<i>Amphissa columbiana</i>	0.2	1
V98-33-71	V98-33	<i>Amphissa columbiana</i>	0.2	1
V98-33-72	V98-33	<i>Amphissa columbiana</i>	0.2	1
V98-33-73	V98-33	<i>Amphissa columbiana</i>	0.2	1
V98-33-74	V98-33	<i>Amphissa columbiana</i>	0.3	1
V98-33-75	V98-33	<i>Tegula pulligo</i>	2.1	~1
V98-33-76	V98-33	<i>Cranopsis cucullata</i>	0.2	1
V98-33-77	V98-33	Unidentified bivalves	0.1	1
V98-33-78	V98-33	Unidentified bivalves	0.1	1
V98-33-79	V98-33	Unidentified bivalves	0.3	1
V98-33-80	V98-33	Unidentified clam shell frag's	0.4	4 frag's
V98-33-81	V98-33	<i>Balanus sp.</i>	0.4	1
V98-33-82	V98-33	tubeworm	0.5	1
Total weight (grams) V98-33			95.1	
V98-39-1	V98-39	<i>Macoma brota</i>	2.5	1
V98-39-2	V98-39	<i>Macoma brota</i>	2.1	1
V98-39-3	V98-39	<i>Macoma brota</i>	2.1	1
V98-39-4	V98-39	<i>Macoma brota</i>	2.4	1
V98-39-5	V98-39	<i>Macoma brota</i>	2.5	1
V98-39-6	V98-39	<i>Macoma brota</i>	1.7	1
V98-39-7	V98-39	<i>Macoma brota</i>	1.4	1
V98-39-8	V98-39	<i>Macoma brota</i>	1.2	3 frag's
V98-39-9	V98-39	<i>Macoma brota</i>	2.2	1
V98-39-10	V98-39	<i>Macoma brota</i>	2.5	1
V98-39-11	V98-39	<i>Macoma brota</i>	2.4	1

V98-39-12	V98-39	<i>Macoma brota</i>	2.7	1
V98-39-13	V98-39	<i>Macoma brota</i>	2	1
V98-39-14	V98-39	<i>Macoma brota</i>	1.4	1
V98-39-15	V98-39	<i>Macoma lipara</i>	13.2	2 articulated
V98-39-16	V98-39	<i>Macoma lipara</i>	7.9	1
V98-39-17	V98-39	<i>Macoma lipara</i>	7.3	1
V98-39-18	V98-39	<i>Macoma lipara</i>	5.8	1
V98-39-19	V98-39	<i>Macoma lipara</i>	9.2	1
V98-39-20	V98-39	<i>Macoma lipara</i>	9.9	1
V98-39-21	V98-39	<i>Macoma lipara</i>	10	1
V98-39-22	V98-39	<i>Macoma lipara</i>	9.5	1
V98-39-23	V98-39	<i>Macoma lipara</i>	3.7	1
V98-39-24	V98-39	<i>Macoma lipara</i>	14.8	2 articulated
V98-39-25	V98-39	<i>Macoma lipara</i>	14.3	2 articulated
V98-39-26	V98-39	<i>Compsomyax subdiaphana</i>	9.3	1
V98-39-27	V98-39	<i>Compsomyax subdiaphana</i>	5.8	1
V98-39-28	V98-39	<i>Compsomyax subdiaphana</i>	2.2	~1
V98-39-29	V98-39	<i>Compsomyax subdiaphana</i>	9.3	1
V98-39-30	V98-39	<i>Compsomyax subdiaphana</i>	2.6	~1
V98-39-31	V98-39	<i>Compsomyax subdiaphana</i>	0.9	~1
V98-39-32	V98-39	<i>Compsomyax subdiaphana</i>	0.7	~1
V98-39-33	V98-39	<i>Compsomyax subdiaphana</i>	0.8	~1
V98-39-34	V98-39	<i>Compsomyax subdiaphana</i>	0.6	1
V98-39-35	V98-39	<i>Compsomyax subdiaphana</i>	1.8	~1
V98-39-36	V98-39	<i>Compsomyax subdiaphana</i>	0.5	~1
V98-39-37	V98-39	<i>Compsomyax subdiaphana</i>	12.7	11 frag's
V98-39-38	V98-39	<i>Thracia trapezoides</i>	0.6	~1
V98-39-39	V98-39	<i>Clinocardium</i> sp.	0.5	1
V98-39-40	V98-39	<i>Lucinoma annulatum</i>	1.7	~1
V98-39-41	V98-39	<i>Lucinoma annulatum</i>	2.3	~1
V98-39-42	V98-39	<i>Lucinoma annulatum</i>	0.8	2 articulated
V98-39-43	V98-39	<i>Lucinoma annulatum</i>	0.9	1
V98-39-44	V98-39	<i>Lucinoma annulatum</i>	1.3	1
V98-39-45	V98-39	<i>Lucinoma annulatum</i>	1.7	~1
V98-39-46	V98-39	<i>Lucinoma annulatum</i>	0.1	~1
V98-39-47	V98-39	<i>Lucinoma annulatum</i>	0.2	~1
V98-39-48	V98-39	<i>Chlamys rubida</i>	1.3	~1
V98-39-49	V98-39	<i>Chlamys rubida</i>	0.8	~1
V98-39-50	V98-39	<i>Chlamys rubida</i>	0.9	~1
V98-39-51	V98-39	<i>Chlamys rubida</i>	0.3	1
V98-39-52	V98-39	<i>Chlamys rubida</i>	1.7	1
V98-39-53	V98-39	<i>Chlamys rubida</i>	0.5	~1
V98-39-54	V98-39	<i>Chlamys rubida</i>	3.2	1
V98-39-55	V98-39	<i>Chlamys rubida</i>	0.4	~1
V98-39-56	V98-39	Unidentified clam shell frag's	0.1	1
V98-39-57	V98-39	Unidentified clam shell frag's	6.3	20+ frag's
V98-39-58	V98-39	<i>Euspira pallida</i>	2.6	1
V98-39-59	V98-39	<i>Nucella lamellosa</i>	24.5	1
Total weight (grams) V98-39			234.6	
V98-37-1	V98-37	<i>Compsomyax subdiaphana</i>	3.6	2 articulated
V98-37-2	V98-37	<i>Compsomyax subdiaphana</i>	8	2 articulated
V98-37-3	V98-37	<i>Compsomyax subdiaphana</i>	12.3	2 articulated
V98-37-4	V98-37	<i>Compsomyax subdiaphana</i>	15.3	1
V98-37-5	V98-37	<i>Compsomyax subdiaphana</i>	10	1
V98-37-6	V98-37	<i>Compsomyax subdiaphana</i>	7.6	1
V98-37-7	V98-37	<i>Compsomyax subdiaphana</i>	12.6	1
V98-37-8	V98-37	<i>Compsomyax subdiaphana</i>	5	~1
V98-37-9	V98-37	<i>Compsomyax subdiaphana</i>	5	1
V98-37-10	V98-37	<i>Compsomyax subdiaphana</i>	4.8	1
V98-37-11	V98-37	<i>Compsomyax subdiaphana</i>	11.1	1

V98-37-12	V98-37	<i>Compsomyax subdiaphana</i>	6.1	1
V98-37-13	V98-37	<i>Compsomyax subdiaphana</i>	8	1
V98-37-14	V98-37	<i>Compsomyax subdiaphana</i>	5.5	1
V98-37-15	V98-37	<i>Compsomyax subdiaphana</i>	18.2	1
V98-37-16	V98-37	<i>Compsomyax subdiaphana</i>	6.3	1
V98-37-17	V98-37	<i>Compsomyax subdiaphana</i>	4.1	1
V98-37-18	V98-37	<i>Compsomyax subdiaphana</i>	8.9	~1
V98-37-19	V98-37	<i>Compsomyax subdiaphana</i>	7.4	2 articulated
V98-37-20	V98-37	<i>Compsomyax subdiaphana</i>	1.7	1
V98-37-21	V98-37	<i>Compsomyax subdiaphana</i>	1.1	1
V98-37-22	V98-37	<i>Compsomyax subdiaphana</i>	1.2	1
V98-37-23	V98-37	<i>Compsomyax subdiaphana</i>	2.8	~1
V98-37-24	V98-37	<i>Compsomyax subdiaphana</i>	3.2	~1
V98-37-25	V98-37	<i>Compsomyax subdiaphana</i>	1	1
V98-37-26	V98-37	<i>Compsomyax subdiaphana</i>	2.1	~1
V98-37-27	V98-37	<i>Compsomyax subdiaphana</i>	1.5	1
V98-37-28	V98-37	<i>Compsomyax subdiaphana</i>	1.4	~1
V98-37-29	V98-37	<i>Compsomyax subdiaphana</i>	1.8	~1
V98-37-30	V98-37	<i>Compsomyax subdiaphana</i>	2.6	~1
V98-37-31	V98-37	<i>Compsomyax subdiaphana</i>	1.2	~1
V98-37-32	V98-37	<i>Compsomyax subdiaphana</i>	0.9	~1
V98-37-33	V98-37	<i>Compsomyax subdiaphana</i>	39.1	16 frag's
V98-37-34	V98-37	<i>Macoma lipara</i>	8.1	1
V98-37-35	V98-37	<i>Macoma lipara</i>	13	1
V98-37-36	V98-37	<i>Macoma lipara</i>	13	1
V98-37-37	V98-37	<i>Macoma lipara</i>	13.6	1
V98-37-38	V98-37	<i>Macoma lipara</i>	10.6	1
V98-37-39	V98-37	<i>Macoma lipara</i>	15.7	1
V98-37-40	V98-37	<i>Macoma lipara</i>	12.8	1
V98-37-41	V98-37	<i>Macoma lipara</i>	9.6	1
V98-37-42	V98-37	<i>Macoma lipara</i>	16.7	1
V98-37-43	V98-37	<i>Macoma lipara</i>	8.1	1
V98-37-44	V98-37	<i>Macoma lipara</i>	12.4	1
V98-37-45	V98-37	<i>Macoma lipara</i>	11.5	1
V98-37-46	V98-37	<i>Macoma lipara</i>	8.8	~1
V98-37-47	V98-37	<i>Macoma lipara</i>	7.9	1
V98-37-48	V98-37	<i>Macoma lipara</i>	6.4	1
V98-37-49	V98-37	<i>Macoma lipara</i>	6.6	1
V98-37-50	V98-37	<i>Macoma lipara</i>	6.5	1
V98-37-51	V98-37	<i>Macoma lipara</i>	12.6	1
V98-37-52	V98-37	<i>Macoma lipara</i>	7.1	1
V98-37-53	V98-37	<i>Macoma lipara</i>	7.3	1
V98-37-54	V98-37	<i>Macoma lipara</i>	6.8	1
V98-37-55	V98-37	<i>Macoma lipara</i>	4.5	1
V98-37-56	V98-37	<i>Macoma lipara</i>	5.3	1
V98-37-57	V98-37	<i>Macoma lipara</i>	3.5	1
V98-37-58	V98-37	<i>Macoma lipara</i>	3	~1
V98-37-59	V98-37	<i>Thracia trapezoides</i>	1.3	1
V98-37-60	V98-37	<i>Thracia trapezoides</i>	1	1
V98-37-61	V98-37	<i>Macoma sp.</i>	0.3	2 articulated
V98-37-62	V98-37	<i>Lucinoma annulatum</i>	3.9	1
V98-37-63	V98-37	<i>Lucinoma annulatum</i>	6.9	2 articulated
V98-37-64	V98-37	<i>Lucinoma annulatum</i>	7.8	2 articulated
V98-37-65	V98-37	<i>Lucinoma annulatum</i>	3.9	2 articulated
V98-37-66	V98-37	<i>Lucinoma annulatum</i>	2.5	2 articulated
V98-37-67	V98-37	<i>Lucinoma annulatum</i>	2	2 articulated
V98-37-68	V98-37	<i>Lucinoma annulatum</i>	2.4	~1
V98-37-69	V98-37	<i>Macoma incongrua</i>	1.5	1
V98-37-70	V98-37	<i>Macoma incongrua</i>	2.9	1
V98-37-71	V98-37	<i>Macoma incongrua</i>	2.8	1
V98-37-72	V98-37	<i>Macoma incongrua</i>	2.4	frag's of 1

V98-37-73	V98-37	<i>Chlamys rubida</i>	1.5	1
V98-37-74	V98-37	<i>Chlamys rubida</i>	1.4	1
V98-37-75	V98-37	<i>Chlamys rubida</i>	0.9	1
V98-37-76	V98-37	<i>Chlamys rubida</i>	0.5	~1
V98-37-77	V98-37	<i>Chlamys rubida</i>	2.8	1
V98-37-78	V98-37	<i>Chlamys rubida</i>	1.2	1
V98-37-79	V98-37	<i>Acila castrensis</i>	0.6	2 articulated
V98-37-80	V98-37	<i>Acila castrensis</i>	0.3	1
V98-37-81	V98-37	<i>Acila castrensis</i>	0.2	1
V98-37-82	V98-37	Unidentified gastropod frag's	2.5	~1
V98-37-83	V98-37	Unidentified clam shell frag's	8	21 frag's
V98-37-84	V98-37	<i>Sea urchin spine</i>	0.1	1
V98-37-85	V98-37	<i>Sea urchin spine</i>	0.1	1
Total weight (grams) V98-37			514.5	
V98-32-1	V98-32	<i>Macoma lipara</i>	20.6	2 articulated
V98-32-2	V98-32	<i>Humilaria kennerleyi</i>	12.3	~1
V98-32-3	V98-32	<i>Humilaria kennerleyi</i>	3.5	~1
V98-32-4	V98-32	<i>Macoma brota</i>	1.9	1
V98-32-5	V98-32	<i>Macoma brota</i>	2.1	1
V98-32-6	V98-32	<i>Macoma brota</i>	1.4	1
V98-32-7	V98-32	<i>Macoma brota</i>	2	1
V98-32-8	V98-32	<i>Mya truncata</i>	2.7	~1
V98-32-9	V98-32	<i>Mya truncata</i>	2	~1
V98-32-10	V98-32	<i>Mya truncata</i>	0.7	~1
V98-32-11	V98-32	<i>Mya truncata</i>	3.4	~1
V98-32-12	V98-32	<i>Mya truncata</i>	4.7	1
V98-32-13	V98-32	<i>Thracia trapezoides</i>	7.6	2 articulated
V98-32-14	V98-32	<i>Cyclocardia ventricosa</i>	0.2	1
V98-32-15	V98-32	<i>Pododesmus machrochisma</i>	1.6	1
V98-32-16	V98-32	<i>Chlamys rubida</i>	0.1	1
V98-32-17	V98-32	<i>Chlamys rubida</i>	0.2	1
V98-32-18	V98-32	<i>Chlamys rubida</i>	0.4	1
V98-32-19	V98-32	<i>Chlamys rubida</i>	0.1	~1
V98-32-20	V98-32	<i>Chlamys rubida</i>	0.6	2 articulated
V98-32-21	V98-32	<i>Astarte esquimalti</i>	0.4	2 articulated
V98-32-22	V98-32	<i>Modiolus modiolus</i>	0.6	~1
V98-32-23	V98-32	<i>Tectura persona ?</i>	0.2	1
V98-32-24	V98-32	<i>Nucella lamellosa</i>	1	~1
V98-32-25	V98-32	Unidentified clam shell frag's	1.1	8 frag's
Total weight (grams) V98-32			71.4	
V98-30-1	V98-30	Unidentified clam shell frag's	9.8	~1
V98-30-2	V98-30	Unidentified clam shell frag's	3	~1
V98-30-3	V98-30	Unidentified clam shell frag's	2.2	~1
V98-30-4	V98-30	<i>Compsomyx subdiaphana</i>	2.2	1
V98-30-5	V98-30	<i>Macoma brota</i>	2.2	1
V98-30-6	V98-30	<i>Macoma brota</i>	1.8	1
V98-30-7	V98-30	<i>Macoma brota</i>	1.2	2 articulated
V98-30-8	V98-30	<i>Mya truncata</i>	2.9	~1
V98-30-9	V98-30	<i>Mya truncata</i>	5.2	10 frag's of 1
V98-30-10	V98-30	<i>Chlamys rubida</i>	1.4	~1
V98-30-11	V98-30	<i>Chlamys rubida</i>	0.3	1
V98-30-12	V98-30	<i>Nemocardium centifilosum</i>	0.1	1
V98-30-13	V98-30	<i>Nemocardium centifilosum</i>	0.1	1
V98-30-14	V98-30	<i>Solamen columbianum</i>	0.2	2 articulated
V98-30-15	V98-30	<i>Acila castrensis</i>	0.3	1
V98-30-16	V98-30	<i>Cyclocardia ventricosa</i>	0.3	1
V98-30-17	V98-30	<i>Maccma</i> , or <i>Tellin</i> sp.	0.4	2 articulated
V98-30-18	V98-30	<i>Macoma</i> , or <i>Tellin</i> sp.	0.5	2 articulated
V98-30-19	V98-30	<i>Clinocardium</i> sp.	0.4	1

V98-30-20	V98-30	<i>Clinocardium</i> sp.	0.5	2 articulated
V98-30-21	V98-30	<i>Trichotropis cancellata</i>	0.4	1
V98-30-22	V98-30	<i>Nucella lamellosa</i>	4.8	~1
V98-30-23	V98-30	<i>Nucella lamellosa</i>	4.7	~1
V98-30-24	V98-30	Unidentified gastropod frag's	2.7	~1
V98-30-25	V98-30	<i>Balanus</i> spp.	1	many
Total weight (grams) V98-30			48.6	
V98-24-1	V98-24	<i>Astarte elliptica</i>	0.5	2 articulated
V98-24-2	V98-24	<i>Astarte esquimalti</i>	0.7	2 articulated
V98-24-3	V98-24	<i>Astarte esquimalti</i>	0.2	2 articulated
V98-24-4	V98-24	<i>Lucinoma annulatum</i>	0.5	2 articulated
V98-24-5	V98-24	<i>Chlamys rubida</i>	0.2	~1
V98-24-6	V98-24	<i>Cidarina cidaris</i>	0.5	1
V98-24-7	V98-24	<i>Amphissa columbiana</i>	0.1	1
V98-24-8	V98-24	waterlogged wood	7.3	1
Total weight (grams) V98-24			10	
V98-21-1	V98-21	<i>Protothaca tenerrima</i>	3	~1
V98-21-2	V98-21	<i>Protothaca tenerrima</i>	6.7	1
V98-21-3	V98-21	<i>Saxidomus giganteus</i>	13.9	1
V98-21-4	V98-21	<i>Saxidomus giganteus</i>	8.1	1
V98-21-5	V98-21	<i>Saxidomus giganteus</i>	10.4	2 frag's of 1
V98-21-6	V98-21	<i>Saxidomus giganteus</i>	6.1	~1
V98-21-7	V98-21	<i>Saxidomus giganteus</i>	6.2	~1
V98-21-8	V98-21	<i>Saxidomus giganteus</i>	6.6	~1
V98-21-9	V98-21	<i>Saxidomus giganteus</i>	2.9	~1
V98-21-10	V98-21	<i>Saxidomus giganteus</i>	30.9	2 articulated
V98-21-11	V98-21	<i>Saxidomus giganteus</i>	0.8	~1
V98-21-12	V98-21	<i>Saxidomus giganteus</i>	5.5	~1
V98-21-13	V98-21	<i>Saxidomus giganteus</i>	3.2	~1
V98-21-14	V98-21	<i>Saxidomus giganteus</i>	3	~1
V98-21-15	V98-21	<i>Saxidomus giganteus</i>	1.4	~1
V98-21-16	V98-21	<i>Saxidomus giganteus</i>	0.8	~1
V98-21-17	V98-21	<i>Saxidomus giganteus</i>	1.3	~1
V98-21-18	V98-21	<i>Saxidomus giganteus</i>	1.2	~1
V98-21-19	V98-21	<i>Saxidomus giganteus</i>	0.9	~1
V98-21-20	V98-21	<i>Saxidomus giganteus</i>	2.2	~1
V98-21-21	V98-21	<i>Saxidomus giganteus</i>	30.7	24 frag's
V98-21-22	V98-21	<i>Macoma secta</i>	3.2	1
V98-21-23	V98-21	<i>Macoma secta</i>	3.3	1
V98-21-24	V98-21	<i>Macoma secta</i>	2.3	1
V98-21-25	V98-21	<i>Macoma incongrua</i>	2.9	1
V98-21-26	V98-21	<i>Macoma incongrua</i>	1.3	1
V98-21-27	V98-21	<i>Macoma incongrua</i>	0.7	1
V98-21-28	V98-21	<i>Macoma incongrua</i>	0.5	1
V98-21-29	V98-21	<i>Cidarina cidaris</i>	1.4	1
V98-21-30	V98-21	<i>Lucinoma annulatum</i>	0.8	1
V98-21-31	V98-21	<i>Lucinoma annulatum</i>	0.7	1
V98-21-32	V98-21	<i>Lucinoma annulatum</i>	0.6	2 articulated
V98-21-33	V98-21	<i>Mya truncata</i>	3	~1
V98-21-34	V98-21	<i>Mya truncata</i>	5.7	~1
V98-21-35	V98-21	<i>Clinocardium</i> sp.	0.3	1
V98-21-36	V98-21	<i>Clinocardium</i> sp.	0.3	1
V98-21-37	V98-21	<i>Clinocardium</i> sp.	0.5	1
V98-21-38	V98-21	<i>Clinocardium</i> sp.	0.1	1
V98-21-39	V98-21	<i>Clinocardium</i> sp.	0.6	~1
V98-21-40	V98-21	<i>Euspira pallida</i>	0.6	1
V98-21-41	V98-21	<i>Chlamys rubida</i>	0.1	1
V98-21-42	V98-21	<i>Chlamys rubida</i>	1.3	2 frag's of 1
V98-21-43	V98-21	<i>Chlamys rubida</i>	1.2	2 frag's of 1

V98-21-44	V98-21	Unidentified clam shell frag's	75.5	137 frag's
V98-21-45	V98-21	<i>Solamen columbianum</i>	0.1	1
Total weight (grams) V98-21			252.8	
V98-29-1	V98-29	<i>Macoma lipara</i>	17.2	2 articulated
V98-29-2	V98-29	<i>Macoma lipara</i>	4.2	~1
V98-29-3	V98-29	<i>Macoma lipara</i>	7.8	~1
V98-29-4	V98-29	<i>Macoma lipara</i>	11.6	1
V98-29-5	V98-29	<i>Macoma lipara</i>	6.7	~1
V98-29-6	V98-29	<i>Macoma secta</i>	6.4	~1
V98-29-7	V98-29	<i>Compsomyax subdiaphana</i>	7.5	1
V98-29-8	V98-29	<i>Compsomyax subdiaphana</i>	14.4	2 articulated
V98-29-9	V98-29	<i>Compsomyax subdiaphana</i>	20.2	2 articulated
V98-29-10	V98-29	<i>Compsomyax subdiaphana</i>	8.9	2 articulated
V98-29-11	V98-29	<i>Compsomyax subdiaphana</i>	2	~1
V98-29-12	V98-29	<i>Compsomyax subdiaphana</i>	0.5	~1
V98-29-13	V98-29	<i>Compsomyax subdiaphana</i>	0.5	~1
V98-29-14	V98-29	<i>Compsomyax subdiaphana</i>	8.8	2 articulated
V98-29-15	V98-29	<i>Compsomyax subdiaphana</i>	9.3	2 articulated
V98-29-16	V98-29	<i>Compsomyax subdiaphana</i>	1.3	~1
V98-29-17	V98-29	<i>Compsomyax subdiaphana</i>	1.3	~1
V98-29-18	V98-29	<i>Mya truncata</i>	2.7	~1
V98-29-19	V98-29	<i>Mya truncata</i>	1.1	~1
V98-29-20	V98-29	<i>Lucinoma annulatum</i>	4.2	2 articulated
V98-29-21	V98-29	<i>Lucinoma annulatum</i>	1.6	2 articulated
V98-29-22	V98-29	<i>Lucinoma annulatum</i>	4.1	2 articulated
V98-29-23	V98-29	<i>Lucinoma annulatum</i>	6.7	2 articulated
V98-29-24	V98-29	<i>Lucinoma annulatum</i>	2.5	2 articulated
V98-29-25	V98-29	<i>Lucinoma annulatum</i>	2.9	2 articulated
V98-29-26	V98-29	<i>Lucinoma annulatum</i>	1.1	2 articulated
V98-29-27	V98-29	<i>Lucinoma annulatum</i>	3.5	2 articulated
V98-29-28	V98-29	<i>Lucinoma annulatum</i>	2.8	2 articulated
V98-29-29	V98-29	<i>Lucinoma annulatum</i>	2.5	2 articulated
V98-29-30	V98-29	<i>Lucinoma annulatum</i>	0.9	2 articulated
V98-29-31	V98-29	<i>Lucinoma annulatum</i>	1.3	2 articulated
V98-29-32	V98-29	<i>Lucinoma annulatum</i>	0.5	2 articulated
V98-29-33	V98-29	<i>Lucinoma annulatum</i>	0.8	2 articulated
V98-29-34	V98-29	<i>Lucinoma annulatum</i>	1	~1
V98-29-35	V98-29	<i>Lucinoma annulatum</i>	0.4	~1
V98-29-36	V98-29	<i>Lucinoma annulatum</i>	0.3	~1
V98-29-37	V98-29	<i>Lucinoma annulatum</i>	1.1	1
V98-29-38	V98-29	<i>Lucinoma annulatum</i>	0.3	3 frag's
V98-29-39	V98-29	<i>Lucinoma annulatum</i>	1.8	2 articulated
V98-29-40	V98-29	<i>Lucinoma annulatum</i>	2.2	2 articulated
V98-29-41	V98-29	<i>Lucinoma annulatum</i>	1	2 articulated
V98-29-42	V98-29	<i>Lucinoma annulatum</i>	1.2	2 articulated
V98-29-43	V98-29	<i>Lucinoma annulatum</i>	0.9	2 articulated
V98-29-44	V98-29	<i>Lucinoma annulatum</i>	0.6	2 articulated
V98-29-45	V98-29	<i>Astarte elliptica</i>	0.9	~1
V98-29-46	V98-29	<i>Yoldia seminuda</i>	0.3	2 articulated
V98-29-47	V98-29	Unidentified clam shell frag's	2.8	~1
V98-29-48	V98-29	Unidentified clam shell frag's	2.8	~1
V98-29-49	V98-29	Unidentified clam shell frag's	2.5	~1
V98-29-50	V98-29	Unidentified clam shell frag's	5.4	~1
V98-29-51	V98-29	Unidentified clam shell frag's	4.4	~1
V98-29-52	V98-29	Unidentified clam shell frag's	6.7	~12 frag's
V98-29-53	V98-29	<i>Euspira pallida</i>	0.4	1
V98-29-54	V98-29	<i>Cidarina cidaris</i>	1	1
V98-29-55	V98-29	<i>Nucella lamellosa</i>	6.8	~1
V98-29-56	V98-29	<i>Nucella lamellosa</i>	8.8	~1
V98-29-57	V98-29	Wood fragments	0.5	1

V98-29-58	V98-29	Wood fragments	0.5	1
V98-29-59	V98-29	Wood fragments	0.5	1
V98-29-60	V98-29	pine cone	1.8	1
V98-29-61	V98-29	basalt flake-detritus	1.2	1
Total weight (grams) V98-29			225.9	
V98-55-1	V98-55	<i>Protothaca tenerrima</i>	11.2	1
V98-55-2	V98-55	<i>Protothaca tenerrima</i>	2.4	~1
V98-55-3	V98-55	<i>Protothaca tenerrima</i>	2.6	2 frag's of 1
V98-55-4	V98-55	<i>Protothaca tenerrima</i>	2.6	~1
V98-55-5	V98-55	<i>Protothaca tenerrima</i>	1.9	~1
V98-55-6	V98-55	<i>Protothaca tenerrima</i>	0.8	~1
V98-55-7	V98-55	<i>Saxidomus giganteus</i>	3.9	~1
V98-55-8	V98-55	<i>Saxidomus giganteus</i>	2.7	~1
V98-55-9	V98-55	<i>Saxidomus giganteus</i>	3.1	~1
V98-55-10	V98-55	<i>Saxidomus giganteus</i>	1.9	2 frag's of 1
V98-55-11	V98-55	<i>Saxidomus giganteus</i>	2.6	~1
V98-55-12	V98-55	<i>Saxidomus giganteus</i>	0.9	~1
V98-55-13	V98-55	<i>Saxidomus giganteus</i>	1.4	~1
V98-55-14	V98-55	<i>Saxidomus giganteus</i>	0.8	~1
V98-55-15	V98-55	<i>Saxidomus giganteus</i>	1	~1
V98-55-16	V98-55	<i>Macoma lipara</i>	8.8	1
V98-55-17	V98-55	<i>Macoma inquinata-elongate</i>	1.7	1
V98-55-18	V98-55	<i>Lucinoma annulatum</i>	1.5	1
V98-55-19	V98-55	<i>Nemocardium centifilosum</i>	0.2	2 articulated
V98-55-20	V98-55	<i>Chlamys rubida</i>	0.3	1
V98-55-21	V98-55	<i>Chlamys rubida</i>	0.7	1
V98-55-22	V98-55	<i>Chlamys rubida</i>	0.2	1
V98-55-23	V98-55	<i>Chlamys rubida</i>	0.2	2 frag's of 1
V98-55-24	V98-55	<i>Polinices lewisii</i>	0.9	1
V98-55-25	V98-55	<i>Tegula pulligo</i>	2.6	1
V98-55-26	V98-55	<i>Cidarina cidaris</i>	0.4	~1
V98-55-27	V98-55	Unidentified clam shell frag's	1.2	~1
V98-55-28	V98-55	Unidentified clam shell frag's	1.6	~1
V98-55-29	V98-55	Unidentified clam shell frag's	1.1	~1
V98-55-30	V98-55	Unidentified clam shell frag's	1	~1
V98-55-31	V98-55	Unidentified clam shell frag's	0.6	~1
V98-55-32	V98-55	Unidentified clam shell frag's	0.6	~1
V98-55-33	V98-55	Unidentified clam shell frag's	0.6	~1
V98-55-34	V98-55	Unidentified clam shell frag's	3.2	9 frag's
V98-55-35	V98-55	Coniferous cone	3.3	1
Total weight (grams) V98-55			70.5	
V98-40-1	V98-40	Unidentified clam shell frag's	1.4	2 frag's of 1
V98-40-2	V98-40	Unidentified clam shell frag's	0.3	1 frag
V98-40-3	V98-40	Unidentified clam shell frag's	0.3	1 frag
V98-40-4	V98-40	Unidentified clam shell frag's	0.6	1 frag
V98-40-5	V98-40	Unidentified clam shell frag's	0.7	~1
V98-40-6	V98-40	<i>Macoma lipara</i>	15.1	2 artic'd
V98-40-7	V98-40	<i>Macoma brota</i>	7	2 artic'd
V98-40-8	V98-40	<i>Macoma brota</i>	5.4	2 artic'd
V98-40-9	V98-40	<i>Macoma elimata</i>	0.6	1
V98-40-10	V98-40	<i>Macoma elimata</i>	0.6	1
V98-40-11	V98-40	<i>Lucinoma annulatum</i>	3.6	2 artic'd
V98-40-12	V98-40	<i>Lucinoma annulatum</i>	1.2	~1
V98-40-13	V98-40	<i>Lucinoma annulatum</i>	12.4	~2 artic'd
V98-40-14	V98-40	<i>Saxidomus giganteus</i>	21.8	~1
V98-40-15	V98-40	<i>Saxidomus giganteus</i>	5.9	~1
V98-40-16	V98-40	<i>Saxidomus giganteus</i>	4.7	~1
V98-40-17	V98-40	<i>Saxidomus giganteus</i>	3.1	~1
V98-40-18	V98-40	<i>Saxidomus giganteus</i>	17.8	~1

V98-40-19	V98-40	<i>Saxidomus giganteus</i>	21.6	~1
V98-40-20	V98-40	<i>Compsomyax subdiaphana</i>	4.7	1
V98-40-21	V98-40	<i>Compsomyax subdiaphana</i>	5.3	1
V98-40-22	V98-40	<i>Compsomyax subdiaphana</i>	1.8	~1
V98-40-23	V98-40	<i>Compsomyax subdiaphana</i>	3.3	1
V98-40-24	V98-40	<i>Compsomyax subdiaphana</i>	1.1	~1
V98-40-25	V98-40	<i>Compsomyax subdiaphana</i>	1.1	~1
V98-40-26	V98-40	<i>Compsomyax subdiaphana</i>	0.6	~1
V98-40-27	V98-40	<i>Clinocardium sp.</i>	0.4	1
V98-40-28	V98-40	<i>Chlamys rubida</i>	0.1	1
V98-40-29	V98-40	<i>Polinices lewisii</i>	3.4	1
V98-40-30	V98-40	Unidentified clam shell frag's	22.8	~30 frag's
V98-40-31	V98-40	<i>Dentalia sp.</i>	0.1	1
V98-40-32	V98-40	Unidentified gastropod frag's	0.3	~1
Total weight (grams) V98-40			169.1	
V98-25-1	V98-25	<i>Cyclocardia ventricosa</i>	0.2	2 articulated
V98-25-2	V98-25	<i>Solamen columbianum</i>	0.4	1
V98-25-3	V98-25	<i>Solamen columbianum</i>	0.3	1
V98-25-4	V98-25	<i>Lucinoma annulatum</i>	0.9	2 articulated
V98-25-5	V98-25	<i>Lucinoma annulatum</i>	0.1	2 articulated
V98-25-6	V98-25	<i>Lucinoma annulatum</i>	0.1	1 frag
V98-25-7	V98-25	Unidentified gastropod frag's	0.8	1
V98-25-8	V98-25	tubeworm on a stone	7.7	
Total weight (grams) V98-25			10.5	
V98-46-1	V98-46	<i>Mya truncata</i>	3.1	1
V98-46-2	V98-46	<i>Mya truncata</i>	2.5	1
V98-46-3	V98-46	<i>Mya truncata</i>	5.4	1
V98-46-4	V98-46	<i>Mya truncata</i>	1.8	~1
V98-46-5	V98-46	<i>Mya truncata</i>	1.2	~1
V98-46-6	V98-46	<i>Mya truncata</i>	1.5	~1
V98-46-7	V98-46	<i>Mya truncata</i>	2.2	~1
V98-46-8	V98-46	<i>Mya truncata</i>	1.8	~1
V98-46-9	V98-46	<i>Mya truncata</i>	0.8	~1
V98-46-10	V98-46	<i>Mya truncata</i>	0.4	~1
V98-46-11	V98-46	<i>Mya truncata</i>	0.7	~1
V98-46-12	V98-46	<i>Mya truncata</i>	0.8	~1
V98-46-13	V98-46	<i>Mya truncata</i>	0.6	1 frag
V98-46-14	V98-46	<i>Mya truncata</i>	0.4	1 frag
V98-46-15	V98-46	<i>Mya truncata</i>	2	~1
V98-46-16	V98-46	<i>Mya truncata</i>	4.7	2 art'd frag's
V98-46-17	V98-46	<i>Mya truncata</i>	0.9	4 frag's of 1
V98-46-18	V98-46	<i>Lucinoma annulatum</i>	2.2	1
V98-46-19	V98-46	<i>Lucinoma annulatum</i>	1	1
V98-46-20	V98-46	<i>Lucinoma annulatum</i>	2.2	1
V98-46-21	V98-46	<i>Lucinoma annulatum</i>	3.3	2 artic'd
V98-46-22	V98-46	<i>Lucinoma annulatum</i>	0.5	1 frag
V98-46-23	V98-46	<i>Lucinoma annulatum</i>	0.1	2 artic'd
V98-46-24	V98-46	<i>Macoma brota</i>	2.9	1
V98-46-25	V98-46	<i>Macoma brota</i>	3.7	1
V98-46-26	V98-46	<i>Macoma brota</i>	1.2	1
V98-46-27	V98-46	<i>Macoma brota</i>	3	1
V98-46-28	V98-46	<i>Macoma brota</i>	1.1	1
V98-46-29	V98-46	<i>Macoma brota</i>	5.8	2 artic'd
V98-46-30	V98-46	<i>Macoma brota</i>	2.4	1
V98-46-31	V98-46	<i>Macoma brota</i>	2.4	1
V98-46-32	V98-46	<i>Macoma brota</i>	1.3	1
V98-46-33	V98-46	<i>Macoma brota</i>	2.5	1
V98-46-34	V98-46	<i>Macoma brota</i>	0.7	1
V98-46-35	V98-46	<i>Macoma brota</i>	2.9	1

V98-46-36	V98-46	<i>Macoma brota</i>	2	1
V98-46-37	V98-46	<i>Macoma brota</i>	1.3	1
V98-46-38	V98-46	<i>Macoma brota</i>	1.1	1
V98-46-393	V98-46	<i>Macoma brota</i>	0.8	1
V98-46-40	V98-46	<i>Macoma brota</i>	1.2	1
V98-46-41	V98-46	<i>Macoma lipara</i>	6.6	1
V98-46-42	V98-46	<i>Macoma lipara</i>	5.3	1
V98-46-43	V98-46	<i>Macoma lipara</i>	10.7	1
V98-46-44	V98-46	<i>Macoma lipara</i>	5	-1
V98-46-45	V98-46	<i>Clinocardium sp.</i>	1.1	1
V98-46-46	V98-46	<i>Clinocardium sp.</i>	0.2	1
V98-46-47	V98-46	<i>Clinocardium sp.</i>	0.3	1
V98-46-48	V98-46	<i>Chlamys rubida</i>	0.8	1
V98-46-49	V98-46	<i>Chlamys rubida</i>	2.7	1
V98-46-50	V98-46	<i>Cidarina cidaris</i>	1.6	1
V98-46-51	V98-46	<i>Nucella lamellosa</i>	2.9	-1
V98-46-52	V98-46	<i>Nucella lamellosa</i>	0.9	-1
V98-46-53	V98-46	<i>Nucella lamellosa</i>	1.1	-1
V98-46-54	V98-46	<i>Nucella lamellosa</i>	0.3	1
V98-46-55	V98-46	Unidentified gastropod frag's	1.2	-1
V98-46-56	V98-46	Unidentified gastropod frag's	0.8	-1
V98-46-57	V98-46	Unidentified gastropod frag's	1.7	-1
V98-46-58	V98-46	Unidentified gastropod frag's	1.1	-1
V98-46-59	V98-46	Unidentified gastropod frag's	0.8	-1
V98-46-60	V98-46	Unidentified clam shell frag's	1.2	-1
V98-46-61	V98-46	Unidentified clam shell frag's	0.7	-1
V98-46-62	V98-46	Unidentified clam shell frag's	3.1	-1
V98-46-63	V98-46	Unidentified clam shell frag's	1.9	-1
V98-46-64	V98-46	Unidentified clam shell frag's	0.9	-1
V98-46-65	V98-46	Unidentified clam shell frag's	2.2	3 frag's
V98-46-66	V98-46	Unidentified clam shell frag's	0.6	1 frag
V98-46-67	V98-46	Unidentified clam shell frag's	1	2 frag's
V98-46-68	V98-46	Unidentified clam shell frag's	1.6	8 frag's
Total weight (grams) V98-46			134.7	
V98-57-1	V98-57	<i>Mya truncata</i>	1.7	-1
V98-57-2	V98-57	<i>Mya truncata</i>	2.9	-1
V98-57-3	V98-57	<i>Mya truncata</i>	4.9	-1
V98-57-4	V98-57	<i>Mya truncata</i>	2.9	-1
V98-57-5	V98-57	<i>Mya truncata</i>	1	-1
V98-57-6	V98-57	<i>Mya truncata</i>	1.8	-1
V98-57-7	V98-57	<i>Mya truncata</i>	2.1	-1
V98-57-8	V98-57	<i>Mya truncata</i>	5.9	2 artic'd
V98-57-9	V98-57	<i>Mya truncata</i>	9.3	2 artic'd
V98-57-10	V98-57	<i>Lucinoma annulatum</i>	3.1	2 artic'd
V98-57-11	V98-57	<i>Lucinoma annulatum</i>	0.4	2 artic'd
V98-57-12	V98-57	<i>Lucinoma annulatum</i>	0.3	2 artic'd
V98-57-13	V98-57	<i>Macoma brota</i>	1.5	1
V98-57-14	V98-57	<i>Macoma brota</i>	2.2	1
V98-57-15	V98-57	<i>Macoma brota</i>	2.5	1
V98-57-16	V98-57	<i>Macoma brota</i>	1.2	1
V98-57-17	V98-57	<i>Macoma brota</i>	1.4	1
V98-57-18	V98-57	<i>Macoma brota</i>	1.6	1
V98-57-19	V98-57	<i>Macoma brota</i>	1.7	1
V98-57-20	V98-57	<i>Macoma brota</i>	1.2	1
V98-57-21	V98-57	<i>Macoma brota</i>	1.2	1
V98-57-22	V98-57	<i>Macoma brota</i>	3.6	2 artic'd
V98-57-23	V98-57	<i>Macoma brota</i>	2.8	1
V98-57-24	V98-57	<i>Macoma brota</i>	2	1
V98-57-25	V98-57	<i>Macoma brota</i>	1.5	1
V98-57-26	V98-57	<i>Macoma brota</i>	1.5	1

V98-57-27	V98-57	<i>Macoma brota</i>	2	1
V98-57-28	V98-57	<i>Macoma brota</i>	1.7	1
V98-57-29	V98-57	<i>Macoma brota</i>	1.3	1
V98-57-30	V98-57	<i>Macoma brota</i>	1.5	1
V98-57-31	V98-57	<i>Macoma brota</i>	1.7	1
V98-57-32	V98-57	<i>Macoma brota</i>	1.8	1
V98-57-33	V98-57	<i>Macoma brota</i>	0.9	1
V98-57-34	V98-57	<i>Macoma brota</i>	2	1
V98-57-35	V98-57	<i>Macoma brota</i>	1.1	~1
V98-57-36	V98-57	<i>Macoma brota</i>	1.8	1
V98-57-37	V98-57	<i>Macoma brota</i>	1.8	1
V98-57-38	V98-57	<i>Macoma brota</i>	1.5	1
V98-57-39	V98-57	<i>Macoma brota</i>	1.5	1
V98-57-40	V98-57	<i>Macoma brota</i>	1.4	1
V98-57-41	V98-57	<i>Macoma brota</i>	1.4	1
V98-57-42	V98-57	<i>Macoma brota</i>	2.5	1
V98-57-43	V98-57	<i>Macoma brota</i>	2.5	1
V98-57-44	V98-57	<i>Macoma brota</i>	1.8	1
V98-57-45	V98-57	<i>Macoma brota</i>	2.7	1
V98-57-46	V98-57	<i>Macoma brota</i>	1.5	1
V98-57-47	V98-57	<i>Macoma brota</i>	2.6	2 artic'd
V98-57-48	V98-57	<i>Macoma brota</i>	0.9	1
V98-57-49	V98-57	<i>Macoma brota</i>	0.8	1
V98-57-50	V98-57	<i>Macoma brota</i>	3.3	2 artic'd
V98-57-51	V98-57	<i>Macoma sp. ?</i>	0.6	1
V98-57-52	V98-57	<i>Macoma lipara</i>	11.6	1
V98-57-53	V98-57	<i>Chlamys rubida</i>	2.4	1
V98-57-54	V98-57	<i>Chlamys rubida</i>	1.4	1
V98-57-55	V98-57	<i>Chlamys rubida</i>	1.8	1
V98-57-56	V98-57	<i>Chlamys rubida</i>	1.2	1
V98-57-57	V98-57	<i>Chlamys rubida</i>	1.6	1
V98-57-58	V98-57	<i>Chlamys rubida</i>	1.6	1
V98-57-59	V98-57	<i>Chlamys rubida</i>	0.4	1
V98-57-60	V98-57	<i>Chlamys hastata</i>	1	~1
V98-57-61	V98-57	<i>Fusitriton oregonensis</i>	0.4	~1
V98-57-62	V98-57	<i>Nucella lamellosa</i>	0.7	1
V98-57-63	V98-57	<i>Balanus sp.</i>	1	1
V98-57-64	V98-57	Unidentified clam shell frag's	1.1	~1
V98-57-65	V98-57	Unidentified clam shell frag's	1.4	~1
V98-57-66	V98-57	Unidentified clam shell frag's	0.5	~1
V98-57-67	V98-57	Unidentified clam shell frag's	1.9	9 frag's
V98-57-68	V98-57	piece of clay	1.2	1
Total weight (grams) V98-57			136	
V98-59-1	V98-59	<i>Macoma brota</i>	0.8	1
V98-59-2	V98-59	<i>Macoma brota</i>	1.8	1
V98-59-3	V98-59	<i>Macoma brota</i>	2.8	1
V98-59-4	V98-59	<i>Macoma brota</i>	1.3	1
V98-59-5	V98-59	<i>Macoma brota</i>	1.1	1
V98-59-6	V98-59	<i>Macoma brota</i>	1.2	1
V98-59-7	V98-59	<i>Macoma brota</i>	4.5	1
V98-59-8	V98-59	<i>Macoma brota</i>	1.7	1
V98-59-9	V98-59	<i>Macoma brota</i>	0.9	1
V98-59-10	V98-59	<i>Macoma brota</i>	1.2	1
V98-59-11	V98-59	<i>Macoma brota</i>	1.8	1
V98-59-12	V98-59	<i>Macoma brota</i>	2.7	1
V98-59-13	V98-59	<i>Macoma brota</i>	2.2	1
V98-59-14	V98-59	<i>Macoma brota</i>	4.2	1
V98-59-15	V98-59	<i>Macoma brota</i>	4.8	1
V98-59-16	V98-59	<i>Macoma brota</i>	5	1
V98-59-17	V98-59	<i>Macoma brota</i>	4.6	2 artic'd

V98-59-18	V98-59	<i>Macoma brota</i>	6	2 artic'd
V98-59-19	V98-59	<i>Macoma brota</i>	2.7	2 artic'd
V98-59-20	V98-59	<i>Macoma brota</i>	1.3	1
V98-59-21	V98-59	<i>Macoma brota</i>	4.8	1
V98-59-22	V98-59	<i>Macoma brota</i>	2.7	1
V98-59-23	V98-59	<i>Macoma brota</i>	3.6	1
V98-59-24	V98-59	<i>Macoma brota</i>	1.5	1
V98-59-25	V98-59	<i>Macoma brota</i>	1.7	1
V98-59-26	V98-59	<i>Macoma brota</i>	1.3	1
V98-59-27	V98-59	<i>Macoma brota</i>	1	1
V98-59-28	V98-59	<i>Macoma brota</i>	1.9	1
V98-59-29	V98-59	<i>Macoma brota</i>	2.4	1
V98-59-30	V98-59	<i>Macoma brota</i>	4	1
V98-59-31	V98-59	<i>Macoma brota</i>	3.4	1
V98-59-32	V98-59	<i>Macoma brota</i>	4.1	1
V98-59-33	V98-59	<i>Macoma brota</i>	1.3	1
V98-59-34	V98-59	<i>Macoma brota</i>	5.8	2 artic'd
V98-59-35	V98-59	<i>Macoma brota</i>	2	~1
V98-59-36	V98-59	<i>Macoma lipara</i>	8	2 artic'd
V98-59-37	V98-59	<i>Macoma lipara</i>	10.5	1
V98-59-38	V98-59	<i>Macoma lipara</i>	8.6	1
V98-59-39	V98-59	<i>Macoma lipara</i>	2	1
V98-59-40	V98-59	<i>Macoma lipara</i>	5.1	1
V98-59-41	V98-59	<i>Macoma lipara</i>	0.7	1
V98-59-42	V98-59	<i>Mya truncata</i>	3.5	1
V98-59-43	V98-59	<i>Lucinoma annulatum</i>	1.8	1
V98-59-44	V98-59	<i>Lucinoma annulatum</i>	1.3	2 artic'd
V98-59-45	V98-59	<i>Protothaca tenerrima</i>	6	1
V98-59-46	V98-59	<i>Nucella lamellosa</i>	2.2	1
V98-59-47	V98-59	<i>Nucella lamellosa</i>	2.3	~1
V98-59-48	V98-59	<i>Nucella lamellosa</i>	2.5	~1
V98-59-49	V98-59	<i>Nucella lamellosa</i>	1.9	~1
V98-59-50	V98-59	<i>Nucella lamellosa</i>	0.6	~1
V98-59-51	V98-59	<i>Crepidula sp.</i>	0.1	1
V98-59-52	V98-59	<i>Cranopsis cucullata</i>	0.8	1
V98-59-53	V98-59	<i>Olivella baetica</i>	0.3	1
V98-59-54	V98-59	<i>Margarites pupilus</i>	0.1	1
V98-59-55	V98-59	<i>Hiatella arctica</i>	0.1	2 artic'd
V98-59-56	V98-59	<i>Hiatella arctica</i>	0.1	2 artic'd
V98-59-57	V98-59	<i>Balanus sp.</i>	0.6	1
V98-59-58	V98-59	Unidentified clam shell frag's	1.6	1
V98-59-59	V98-59	Unidentified clam shell frag's	2.1	~1
V98-59-60	V98-59	Unidentified clam shell frag's	0.8	~1
V98-59-61	V98-59	Unidentified clam shell frag's	2.2	~1
V98-59-62	V98-59	Unidentified clam shell frag's	1	~1
V98-59-63	V98-59	Unidentified clam shell frag's	0.9	~1
V98-59-64	V98-59	Unidentified clam shell frag's	0.5	~1
V98-59-65	V98-59	Unidentified clam shell frag's	0.5	3 frag's
V98-59-66	V98-59	Tubeworm	2.5	~1
V98-59-67	V98-59	Sea urchin spine	0.1	1
Total weight (grams) V98-59			165.4	
V98-45-1	V98-45	<i>Mya truncata</i>	2.7	1
V98-45-2	V98-45	<i>Mya truncata</i>	1.4	~1
V98-45-3	V98-45	<i>Mya truncata</i>	2.7	~1
V98-45-4	V98-45	<i>Mya truncata</i>	0.5	1 frag
V98-45-5	V98-45	<i>Mya truncata</i>	0.5	1 frag
V98-45-6	V98-45	<i>Macoma brota</i>	2.5	1
V98-45-7	V98-45	<i>Macoma brota</i>	1	1
V98-45-8	V98-45	<i>Macoma brota</i>	1.1	1
V98-45-9	V98-45	<i>Macoma brota</i>	2	1

V98-45-10	V98-45	<i>Macoma brota</i>	0.6	1
V98-45-11	V98-45	<i>Macoma brota</i>	1.4	1
V98-45-12	V98-45	<i>Macoma brota</i>	0.8	1
V98-45-13	V98-45	<i>Macoma brota</i>	1.1	1
V98-45-14	V98-45	<i>Macoma brota</i>	1.2	1
V98-45-15	V98-45	<i>Macoma brota</i>	0.7	1
V98-45-16	V98-45	<i>Macoma brota</i>	1	1
V98-45-17	V98-45	<i>Macoma brota</i>	1.5	1
V98-45-18	V98-45	<i>Macoma brota</i>	1.3	1
V98-45-19	V98-45	<i>Macoma brota</i>	1.3	1
V98-45-20	V98-45	<i>Macoma brota</i>	1.7	1
V98-45-21	V98-45	<i>Macoma brota</i>	1.1	1
V98-45-22	V98-45	<i>Macoma brota</i>	1.4	2 artic'd
V98-45-23	V98-45	<i>Macoma brota</i>	2	1
V98-45-24	V98-45	<i>Macoma brota</i>	0.8	~1
V98-45-25	V98-45	<i>Macoma brota</i>	1.4	1
V98-45-26	V98-45	<i>Macoma brota</i>	0.8	1
V98-45-27	V98-45	<i>Macoma brota</i>	1.6	1
V98-45-28	V98-45	<i>Macoma brota</i>	1	1
V98-45-29	V98-45	<i>Macoma brota</i>	1.2	1
V98-45-30	V98-45	<i>Macoma brota</i>	0.3	1
V98-45-31	V98-45	<i>Macoma brota</i>	0.7	1
V98-45-32	V98-45	<i>Macoma brota</i>	1.6	1
V98-45-33	V98-45	<i>Macoma brota</i>	2.7	1
V98-45-34	V98-45	<i>Macoma brota</i>	0.7	1
V98-45-35	V98-45	<i>Macoma brota</i>	1.4	1
V98-45-36	V98-45	<i>Macoma brota</i>	1	1
V98-45-37	V98-45	<i>Macoma brota</i>	1.2	1
V98-45-38	V98-45	<i>Macoma lipara</i>	6.5	1
V98-45-39	V98-45	<i>Macoma lipara</i>	3.4	~1
V98-45-40	V98-45	<i>Lucinoma annulatum</i>	0.6	1
V98-45-41	V98-45	<i>Lucinoma annulatum</i>	3.8	2 artic'd
V98-45-42	V98-45	<i>Lucinoma annulatum</i>	2.1	1
V98-45-43	V98-45	<i>Lucinoma annulatum</i>	5.5	2 artic'd
V98-45-44	V98-45	<i>Lucinoma annulatum</i>	2.1	1
V98-45-45	V98-45	<i>Lucinoma annulatum</i>	2	1
V98-45-46	V98-45	<i>Lucinoma annulatum</i>	2.1	1
V98-45-47	V98-45	<i>Lucinoma annulatum</i>	2.1	1
V98-45-48	V98-45	<i>Lucinoma annulatum</i>	0.2	1
V98-45-49	V98-45	<i>Cyclocardia ventricosa</i>	0.1	1
V98-45-50	V98-45	<i>Cyclocardia ventricosa</i>	0.1	2 artic'd
V98-45-51	V98-45	<i>Cyclocardia ventricosa</i>	0.1	1
V98-45-52	V98-45	<i>Chlamys rubida</i>	0.1	1
V98-45-53	V98-45	<i>Chlamys hastata</i>	0.1	1
V98-45-54	V98-45	<i>Amphissa columbiana</i>	0.2	1
V98-45-55	V98-45	<i>Amphissa columbiana</i>	0.3	1
V98-45-56	V98-45	<i>Nucella lamellosa</i>	4.1	1
V98-45-57	V98-45	<i>Nucella lamellosa</i>	1.8	1
V98-45-58	V98-45	<i>Nucella lamellosa</i>	0.6	1
V98-45-59	V98-45	<i>Cidarina cidaris</i>	0.4	~1
V98-45-60	V98-45	Unidentified gastropod frag's	0.9	~1
V98-45-61	V98-45	Unidentified gastropod frag's	2.4	~1
V98-45-62	V98-45	Unidentified gastropod frag's	0.7	~1
V98-45-63	V98-45	Unidentified gastropod frag's	2.3	~1
V98-45-64	V98-45	Unidentified gastropod frag's	0.7	~1
V98-45-65	V98-45	Unidentified gastropod frag's	0.4	~1
V98-45-66	V98-45	Unidentified gastropod frag's	0.5	~1
V98-45-67	V98-45	Unidentified gastropod frag's	0.2	~1
V98-45-68	V98-45	Unidentified gastropod frag's	0.5	1 frag
V98-45-69	V98-45	Unidentified gastropod frag's	0.7	~1
V98-45-70	V98-45	Unidentified clam shell frag's	1.2	~1

V98-45-71	V98-45	Unidentified clam shell frag's	0.3	~1
V98-45-72	V98-45	Unidentified clam shell frag's	0.1	~1
V98-45-73	V98-45	Unidentified clam shell frag's	4.5	20 frag's
V98-45-74	V98-45	<i>Balanus sp.</i>	0.1	~1
V98-45-75	V98-45	<i>Balanus sp.</i>	0.1	~1
Total weight (grams) V98-45			101.8	
V98-38-1	V98-38	<i>Compsomyax subdiaphana</i>	6.7	1
V98-38-2	V98-38	<i>Compsomyax subdiaphana</i>	4.4	1
V98-38-3	V98-38	<i>Compsomyax subdiaphana</i>	1.7	~1
V98-38-4	V98-38	<i>Compsomyax subdiaphana</i>	5.1	1
V98-38-5	V98-38	<i>Compsomyax subdiaphana</i>	2.2	~1
V98-38-6	V98-38	<i>Compsomyax subdiaphana</i>	7.6	1
V98-38-7	V98-38	<i>Compsomyax subdiaphana</i>	1.1	~1
V98-38-8	V98-38	<i>Macoma lipara</i>	6.6	1
V98-38-9	V98-38	<i>Macoma lipara</i>	9.2	1
V98-38-10	V98-38	<i>Macoma lipara</i>	6.6	1
V98-38-11	V98-38	<i>Macoma brota</i>	1.9	1
V98-38-12	V98-38	<i>Macoma brota</i>	1.4	1
V98-38-13	V98-38	<i>Lucinoma annulatum</i>	1.7	2 artic'd
V98-38-14	V98-38	<i>Lucinoma annulatum</i>	1.1	~1
V98-38-15	V98-38	<i>Lucinoma annulatum</i>	0.7	~1
V98-38-16	V98-38	<i>Lucinoma annulatum</i>	0.5	1+ artic'd
V98-38-17	V98-38	<i>Lucinoma annulatum</i>	1	2 artic'd
V98-38-18	V98-38	<i>Lucinoma annulatum</i>	5.8	2 artic'd
V98-38-19	V98-38	<i>Lucinoma annulatum</i>	0.3	1 frag
V98-38-20	V98-38	<i>Lucinoma annulatum</i>	0.4	2 artic'd
V98-38-21	V98-38	<i>Acila castrensis</i>	0.2	1
V98-38-22	V98-38	<i>Clinocardium sp.</i>	0.7	1
V98-38-23	V98-38	<i>Chlamys rubida</i>	2.4	1
V98-38-24	V98-38	<i>Chlamys rubida</i>	2.1	1
V98-38-25	V98-38	<i>Chlamys rubida</i>	2.8	1
V98-38-26	V98-38	<i>Chlamys rubida</i>	1.7	1
V98-38-27	V98-38	<i>Chlamys rubida</i>	1	1
V98-38-28	V98-38	<i>Chlamys rubida</i>	1.3	1
V98-38-29	V98-38	<i>Chlamys rubida</i>	0.9	1
V98-38-30	V98-38	<i>Chlamys rubida</i>	1.5	1
V98-38-31	V98-38	Unidentified clam shell frag's	4.3	~1
V98-38-32	V98-38	<i>Nucella lamellosa</i>	7.4	1
V98-38-33	V98-38	<i>Euspira pallida</i>	3.1	1
V98-38-34	V98-38	<i>Euspira pallida</i>	1.5	1
Total weight (grams) V98-38			96.9	
V98-50-1	V98-50	<i>Macoma brota</i>	1	1
V98-50-2	V98-50	<i>Macoma brota</i>	0.7	1
V98-50-3	V98-50	<i>Macoma brota</i>	1.4	1
V98-50-4	V98-50	<i>Macoma brota</i>	0.9	1
V98-50-5	V98-50	<i>Macoma brota</i>	1.3	1
V98-50-6	V98-50	<i>Macoma brota</i>	1.3	1
V98-50-7	V98-50	<i>Macoma brota</i>	0.8	1
V98-50-8	V98-50	<i>Macoma brota</i>	0.8	1
V98-50-9	V98-50	<i>Macoma brota</i>	0.5	~1
V98-50-10	V98-50	<i>Macoma brota</i>	0.3	1
V98-50-11	V98-50	<i>Macoma brota</i>	1.5	6 frag's
V98-50-12	V98-50	<i>Chlamys rubida</i>	2.9	1
V98-50-13	V98-50	<i>Chlamys rubida</i>	0.4	1
V98-50-14	V98-50	<i>Amphissa columbiana</i>	0.3	1
V98-50-15	V98-50	<i>Cidarina cidaris</i>	1.3	1 frag
V98-50-16	V98-50	Unidentified gastropod frag	0.3	~1
V98-50-17	V98-50	<i>Petalaeonchus compactus</i>	0.5	1
Total weight (grams) V98-50			16.2	

V98-27-1	V98-27	<i>Protothaca tenerrima</i>	2.2	1
V98-27-2	V98-27	<i>Protothaca tenerrima</i>	0.8	1
V98-27-3	V98-27	<i>Protothaca tenerrima</i>	0.9	1
V98-27-4	V98-27	<i>Protothaca tenerrima</i>	0.7	-1
V98-27-5	V98-27	<i>Protothaca tenerrima</i>	0.4	-1
V98-27-6	V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-7	V98-27	<i>Saxidomus giganteus</i>	0.9	-1
V98-27-8	V98-27	<i>Saxidomus giganteus</i>	1.3	-1
V98-27-9	V98-27	<i>Saxidomus giganteus</i>	0.4	-1
V98-27-10	V98-27	<i>Saxidomus giganteus</i>	0.3	-1
V98-27-11	V98-27	<i>Saxidomus giganteus</i>	0.1	-1
V98-27-12	V98-27	<i>Saxidomus giganteus</i>	0.4	-1
V98-27-13	V98-27	<i>Saxidomus giganteus</i>	0.7	-1
V98-27-14	V98-27	<i>Saxidomus giganteus</i>	0.1	-1
V98-27-15	V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-16	V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-17	V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-18	V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-19	V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-20	V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-21	V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-22	V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-23	V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-24	V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-25	V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-26	V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-27	V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-28	V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-29	V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-30	V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-31	V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-32	V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-33	V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-34	V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-35	V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-36	V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-37	V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-38	V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-39	V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-40	V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-41	V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-42	V98-27	<i>Astarte esquimalti</i>	0.5	2 artic'd
V98-27-43	V98-27	<i>Astarte esquimalti</i>	0.2	1
V98-27-44	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-45	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-46	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-47	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-48	V98-27	<i>Astarte esquimalti</i>	0.5	1
V98-27-49	V98-27	<i>Astarte esquimalti</i>	0.3	1
V98-27-50	V98-27	<i>Astarte esquimalti</i>	0.2	1
V98-27-51	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-52	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-53	V98-27	<i>Astarte esquimalti</i>	0.6	1
V98-27-54	V98-27	<i>Astarte esquimalti</i>	0.2	1
V98-27-55	V98-27	<i>Astarte esquimalti</i>	0.3	1
V98-27-56	V98-27	<i>Astarte esquimalti</i>	0.2	1
V98-27-57	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-58	V98-27	<i>Astarte esquimalti</i>	0.2	1
V98-27-59	V98-27	<i>Astarte esquimalti</i>	0.3	1
V98-27-60	V98-27	<i>Astarte esquimalti</i>	0.2	1

V98-27-61	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-62	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-63	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-64	V98-27	<i>Astarte esquimalti</i>	0.2	1
V98-27-65	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-66	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-67	V98-27	<i>Astarte esquimalti</i>	0.1	1
V98-27-68	V98-27	<i>Astarte esquimalti</i>	0.3	1
V98-27-69	V98-27	<i>Astarte esquimalti</i>	0.3	1
V98-27-70	V98-27	<i>Chlamys rubida</i>	1.9	1
V98-27-71	V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-72	V98-27	<i>Chlamys rubida</i>	0.7	~1
V98-27-73	V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-74	V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-75	V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-76	V98-27	<i>Chlamys rubida</i>	0.6	1
V98-27-77	V98-27	<i>Chlamys rubida</i>	0.4	1
V98-27-78	V98-27	<i>Chlamys rubida</i>	0.8	~1
V98-27-79	V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-80	V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-81	V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-82	V98-27	<i>Chlamys rubida</i>	0.3	~1
V98-27-83	V98-27	<i>Chlamys rubida</i>	0.3	~1
V98-27-84	V98-27	<i>Chlamys rubida</i>	0.3	~1
V98-27-85	V98-27	<i>Chlamys rubida</i>	0.2	~1
V98-27-86	V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-87	V98-27	<i>Chlamys rubida</i>	0.1	~1
V98-27-88	V98-27	<i>Chlamys rubida</i>	0.2	~1
V98-27-89	V98-27	<i>Chlamys rubida</i>	0.1	~1
V98-27-90	V98-27	<i>Parvamusium alaskensis</i>	0.2	1
V98-27-91	V98-27	<i>Parvamusium alaskensis</i>	0.2	1
V98-27-92	V98-27	<i>Parvamusium alaskensis</i>	0.3	1
V98-27-93	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-94	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-95	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-96	V98-27	<i>Parvamusium alaskensis</i>	0.2	1
V98-27-97	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-98	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-99	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-100	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-101	V98-27	<i>Parvamusium alaskensis</i>	0.1	~1
V98-27-102	V98-27	<i>Parvamusium alaskensis</i>	0.2	1
V98-27-103	V98-27	<i>Parvamusium alaskensis</i>	0.1	1
V98-27-104	V98-27	<i>Parvamusium alaskensis</i>	0.1	~1
V98-27-105	V98-27	<i>Modiolus modiolus</i>	22.6	110 frag's
V98-27-106	V98-27	<i>Modiolus modiolus</i>	54.6	301 frag's
V98-27-107	V98-27	<i>Modiolus modiolus</i>	57	233 frag's
V98-27-108	V98-27	<i>Modiolus modiolus</i>	80.7	416 frag's
V98-27-109	V98-27	<i>Modiolus modiolus</i>	62.9	300 frag's
V98-27-110	V98-27	<i>Modiolus modiolus</i>	59.5	307 frag's
V98-27-111	V98-27	<i>Modiolus modiolus</i>	71.4	309 frag's
V98-27-112	V98-27	<i>Modiolus modiolus</i>	1.5	1
V98-27-113	V98-27	<i>Modiolus modiolus</i>	1	1
V98-27-114	V98-27	<i>Modiolus modiolus</i>	0.4	~1
V98-27-115	V98-27	<i>Modiolus modiolus</i>	0.4	~1
V98-27-116	V98-27	<i>Modiolus modiolus</i>	58.3	391 frag's
V98-27-117	V98-27	<i>Pododesmus machrochisma</i>	1.4	~1
V98-27-118	V98-27	<i>Pododesmus machrochisma</i>	0.5	~1
V98-27-119	V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-120	V98-27	<i>Pododesmus machrochisma</i>	0.1	1
V98-27-121	V98-27	<i>Pododesmus machrochisma</i>	0.3	~1

V98-27-122 V98-27	<i>Pododesmus machrochisma</i>	0.1	~1
V98-27-123 V98-27	<i>Pododesmus machrochisma</i>	0.2	~1
V98-27-124 V98-27	<i>Pododesmus machrochisma</i>	2	~1
V98-27-125 V98-27	<i>Pododesmus machrochisma</i>	2.7	~1
V98-27-126 V98-27	<i>Pododesmus machrochisma</i>	0.8	~1
V98-27-127 V98-27	<i>Pododesmus machrochisma</i>	1.1	~1
V98-27-128 V98-27	<i>Pododesmus machrochisma</i>	0.3	1
V98-27-129 V98-27	<i>Pododesmus machrochisma</i>	0.4	~1
V98-27-130 V98-27	<i>Pododesmus machrochisma</i>	0.9	~1
V98-27-131 V98-27	<i>Pododesmus machrochisma</i>	0.1	1
V98-27-132 V98-27	<i>Pododesmus machrochisma</i>	7.3	29 frag's
V98-27-133 V98-27	<i>Pododesmus machrochisma</i>	1.7	1
V98-27-134 V98-27	<i>Pododesmus machrochisma</i>	5	1
V98-27-135 V98-27	<i>Pododesmus machrochisma</i>	0.6	~1
V98-27-136 V98-27	<i>Pododesmus machrochisma</i>	0.2	~1
V98-27-137 V98-27	<i>Pododesmus machrochisma</i>	0.5	1
V98-27-138 V98-27	<i>Pododesmus machrochisma</i>	0.6	1
V98-27-139 V98-27	<i>Pododesmus machrochisma</i>	1.3	~1
V98-27-140 V98-27	<i>Pododesmus machrochisma</i>	0.3	1
V98-27-141 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-142 V98-27	<i>Pododesmus machrochisma</i>	1.5	~1
V98-27-143 V98-27	<i>Pododesmus machrochisma</i>	2.2	1
V98-27-144 V98-27	<i>Pododesmus machrochisma</i>	0.4	~1
V98-27-145 V98-27	<i>Pododesmus machrochisma</i>	0.2	~1
V98-27-146 V98-27	<i>Pododesmus machrochisma</i>	0.2	~1
V98-27-147 V98-27	<i>Pododesmus machrochisma</i>	0.5	~1
V98-27-148 V98-27	<i>Pododesmus machrochisma</i>	0.1	1
V98-27-149 V98-27	<i>Pododesmus machrochisma</i>	0.3	1
V98-27-150 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-151 V98-27	<i>Pododesmus machrochisma</i>	0.7	1
V98-27-152 V98-27	<i>Pododesmus machrochisma</i>	0.9	~1
V98-27-153 V98-27	<i>Pododesmus machrochisma</i>	0.6	1
V98-27-154 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-155 V98-27	<i>Pododesmus machrochisma</i>	0.3	~1
V98-27-156 V98-27	<i>Pododesmus machrochisma</i>	0.4	~1
V98-27-157 V98-27	<i>Pododesmus machrochisma</i>	0.3	1
V98-27-158 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-159 V98-27	<i>Pododesmus machrochisma</i>	0.6	~1
V98-27-160 V98-27	<i>Pododesmus machrochisma</i>	22.3	73 frag's
V98-27-161 V98-27	<i>Pododesmus machrochisma</i>	0.2	~1
V98-27-162 V98-27	<i>Pododesmus machrochisma</i>	0.8	1
V98-27-163 V98-27	<i>Pododesmus machrochisma</i>	1.1	1
V98-27-164 V98-27	<i>Pododesmus machrochisma</i>	2.7	1
V98-27-165 V98-27	<i>Pododesmus machrochisma</i>	0.7	1
V98-27-166 V98-27	<i>Pododesmus machrochisma</i>	1.1	1
V98-27-167 V98-27	<i>Pododesmus machrochisma</i>	1.7	1
V98-27-168 V98-27	<i>Pododesmus machrochisma</i>	1.1	1
V98-27-169 V98-27	<i>Pododesmus machrochisma</i>	0.6	1
V98-27-170 V98-27	<i>Pododesmus machrochisma</i>	0.1	1
V98-27-171 V98-27	<i>Pododesmus machrochisma</i>	0.1	1
V98-27-172 V98-27	<i>Pododesmus machrochisma</i>	0.5	1
V98-27-173 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-174 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-175 V98-27	<i>Pododesmus machrochisma</i>	0.6	1
V98-27-176 V98-27	<i>Pododesmus machrochisma</i>	0.4	1
V98-27-177 V98-27	<i>Pododesmus machrochisma</i>	0.6	1
V98-27-178 V98-27	<i>Pododesmus machrochisma</i>	0.3	1
V98-27-179 V98-27	<i>Pododesmus machrochisma</i>	0.8	1
V98-27-180 V98-27	<i>Pododesmus machrochisma</i>	1.5	~1
V98-27-181 V98-27	<i>Pododesmus machrochisma</i>	1.1	~1
V98-27-182 V98-27	<i>Pododesmus machrochisma</i>	1	~1

V98-27-183 V98-27	<i>Pododesmus machrochisma</i>	0.8	1
V98-27-184 V98-27	<i>Pododesmus machrochisma</i>	0.6	~1
V98-27-185 V98-27	<i>Pododesmus machrochisma</i>	0.1	1
V98-27-186 V98-27	<i>Pododesmus machrochisma</i>	21.9	69 frag's
V98-27-187 V98-27	<i>Pododesmus machrochisma</i>	3.3	~1
V98-27-188 V98-27	<i>Pododesmus machrochisma</i>	1.3	1
V98-27-189 V98-27	<i>Pododesmus machrochisma</i>	1	~1
V98-27-190 V98-27	<i>Pododesmus machrochisma</i>	1.4	1
V98-27-191 V98-27	<i>Pododesmus machrochisma</i>	3.4	1
V98-27-192 V98-27	<i>Pododesmus machrochisma</i>	0.7	~1
V98-27-193 V98-27	<i>Pododesmus machrochisma</i>	0.5	1
V98-27-194 V98-27	<i>Pododesmus machrochisma</i>	0.5	~1
V98-27-195 V98-27	<i>Pododesmus machrochisma</i>	0.5	1
V98-27-196 V98-27	<i>Pododesmus machrochisma</i>	0.4	1
V98-27-197 V98-27	<i>Pododesmus machrochisma</i>	1	1
V98-27-198 V98-27	<i>Pododesmus machrochisma</i>	0.5	1
V98-27-199 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-200 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-201 V98-27	<i>Pododesmus machrochisma</i>	0.7	~1
V98-27-202 V98-27	<i>Pododesmus machrochisma</i>	1.5	~1
V98-27-203 V98-27	<i>Pododesmus machrochisma</i>	0.1	~1
V98-27-204 V98-27	<i>Pododesmus machrochisma</i>	0.8	~1
V98-27-205 V98-27	<i>Pododesmus machrochisma</i>	0.2	~1
V98-27-206 V98-27	<i>Pododesmus machrochisma</i>	0.6	~1
V98-27-207 V98-27	<i>Pododesmus machrochisma</i>	0.2	1
V98-27-208 V98-27	<i>Pododesmus machrochisma</i>	0.1	1
V98-27-209 V98-27	<i>Pododesmus machrochisma</i>	1.1	~1
V98-27-210 V98-27	<i>Pododesmus machrochisma</i>	0.3	1
V98-27-211 V98-27	<i>Pododesmus machrochisma</i>	19.6	49 frag's
V98-27-212 V98-27	<i>Pododesmus machrochisma</i>	0.1	~1
V98-27-213 V98-27	<i>Pododesmus machrochisma</i>	0.7	2 frag's
V98-27-214 V98-27	<i>Mya truncata</i>	1.1	~1
V98-27-215 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-216 V98-27	<i>Mya truncata</i>	1.1	~1
V98-27-217 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-218 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-219 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-220 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-221 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-222 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-223 V98-27	<i>Mya truncata</i>	2	1
V98-27-224 V98-27	<i>Mya truncata</i>	1.3	~1
V98-27-225 V98-27	<i>Mya truncata</i>	1.9	1
V98-27-226 V98-27	<i>Mya truncata</i>	1.2	~1
V98-27-227 V98-27	<i>Mya truncata</i>	2	1
V98-27-228 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-229 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-230 V98-27	<i>Mya truncata</i>	1.1	~1
V98-27-231 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-232 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-233 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-234 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-235 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-236 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-237 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-238 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-239 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-240 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-241 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-242 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-243 V98-27	<i>Mya truncata</i>	0.3	~1

V98-27-244 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-245 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-246 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-247 V98-27	<i>Mya truncata</i>	4.3	10 frag's
V98-27-248 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-249 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-250 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-251 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-252 V98-27	<i>Mya truncata</i>	2.9	1
V98-27-253 V98-27	<i>Mya truncata</i>	1.7	1
V98-27-254 V98-27	<i>Mya truncata</i>	0.7	1
V98-27-255 V98-27	<i>Mya truncata</i>	0.9	~1
V98-27-256 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-257 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-258 V98-27	<i>Mya truncata</i>	1	1
V98-27-259 V98-27	<i>Mya truncata</i>	3	1
V98-27-260 V98-27	<i>Mya truncata</i>	1.2	~1
V98-27-261 V98-27	<i>Mya truncata</i>	2.3	1
V98-27-262 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-263 V98-27	<i>Mya truncata</i>	1	1
V98-27-264 V98-27	<i>Mya truncata</i>	0.9	~1
V98-27-265 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-266 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-267 V98-27	<i>Mya truncata</i>	1.4	~1
V98-27-268 V98-27	<i>Mya truncata</i>	1	~1
V98-27-269 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-270 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-271 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-272 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-273 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-274 V98-27	<i>Mya truncata</i>	0.9	~1
V98-27-275 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-276 V98-27	<i>Mya truncata</i>	1.1	~1
V98-27-277 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-278 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-279 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-280 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-281 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-282 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-283 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-284 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-285 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-286 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-287 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-288 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-289 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-290 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-291 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-292 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-293 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-294 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-295 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-296 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-297 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-298 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-299 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-300 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-301 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-302 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-303 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-304 V98-27	<i>Mya truncata</i>	0.2	~1

V98-27-305 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-306 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-307 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-308 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-309 V98-27	<i>Mya truncata</i>	0.2	2 artic'd
V98-27-310 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-311 V98-27	<i>Mya truncata</i>	2	7 frag's
V98-27-312 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-311 V98-27	<i>Mya truncata</i>	1.6	1
V98-27-312 V98-27	<i>Mya truncata</i>	1.8	1
V98-27-313 V98-27	<i>Mya truncata</i>	3.7	1
V98-27-314 V98-27	<i>Mya truncata</i>	4	1
V98-27-315 V98-27	<i>Mya truncata</i>	1.6	1
V98-27-316 V98-27	<i>Mya truncata</i>	1	1
V98-27-317 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-318 V98-27	<i>Mya truncata</i>	1.1	1
V98-27-319 V98-27	<i>Mya truncata</i>	1	~1
V98-27-320 V98-27	<i>Mya truncata</i>	1.6	1
V98-27-321 V98-27	<i>Mya truncata</i>	0.7	1
V98-27-322 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-323 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-324 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-325 V98-27	<i>Mya truncata</i>	2.2	1
V98-27-326 V98-27	<i>Mya truncata</i>	0.8	1
V98-27-327 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-328 V98-27	<i>Mya truncata</i>	1.2	~1
V98-27-329 V98-27	<i>Mya truncata</i>	1.9	1
V98-27-330 V98-27	<i>Mya truncata</i>	1	1
V98-27-331 V98-27	<i>Mya truncata</i>	1	1
V98-27-332 V98-27	<i>Mya truncata</i>	0.9	1
V98-27-333 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-334 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-335 V98-27	<i>Mya truncata</i>	1.1	1
V98-27-336 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-337 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-338 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-339 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-340 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-341 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-342 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-343 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-344 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-345 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-346 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-347 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-348 V98-27	<i>Mya truncata</i>	1.7	~1
V98-27-349 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-350 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-351 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-352 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-353 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-354 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-355 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-356 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-357 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-358 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-359 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-360 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-361 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-362 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-363 V98-27	<i>Mya truncata</i>	1.4	1

V98-27-364 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-365 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-366 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-367 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-368 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-369 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-370 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-371 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-372 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-373 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-374 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-375 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-376 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-377 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-378 V98-27	<i>Mya truncata</i>	0.7	1
V98-27-379 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-380 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-381 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-382 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-383 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-384 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-385 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-386 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-387 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-388 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-389 V98-27	<i>Mya truncata</i>	2.3	6 frag's
V98-27-390 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-391 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-392 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-393 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-394 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-395 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-396 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-397 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-398 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-399 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-400 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-401 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-402 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-403 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-404 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-405 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-406 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-407 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-408 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-409 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-410 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-411 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-412 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-413 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-414 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-415 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-416 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-417 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-418 V98-27	<i>Mya truncata</i>	5	12 frag's
V98-27-419 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-420 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-421 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-422 V98-27	<i>Mya truncata</i>	1.2	~1
V98-27-423 V98-27	<i>Mya truncata</i>	1.5	1
V98-27-424 V98-27	<i>Mya truncata</i>	1.2	1

V98-27-425 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-426 V98-27	<i>Mya truncata</i>	2.4	1
V98-27-427 V98-27	<i>Mya truncata</i>	1.6	~1
V98-27-428 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-429 V98-27	<i>Mya truncata</i>	1.7	1
V98-27-430 V98-27	<i>Mya truncata</i>	0.9	1
V98-27-431 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-432 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-433 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-434 V98-27	<i>Mya truncata</i>	0.7	1
V98-27-435 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-436 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-437 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-438 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-439 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-440 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-441 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-442 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-443 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-444 V98-27	<i>Mya truncata</i>	1.7	1
V98-27-445 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-446 V98-27	<i>Mya truncata</i>	0.9	1
V98-27-447 V98-27	<i>Mya truncata</i>	1.6	1
V98-27-448 V98-27	<i>Mya truncata</i>	1.6	1
V98-27-449 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-450 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-451 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-452 V98-27	<i>Mya truncata</i>	0.8	~1
V98-27-453 V98-27	<i>Mya truncata</i>	1.9	~1
V98-27-454 V98-27	<i>Mya truncata</i>	0.5	1
V98-27-455 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-456 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-457 V98-27	<i>Mya truncata</i>	1.2	1
V98-27-458 V98-27	<i>Mya truncata</i>	0.8	1
V98-27-459 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-460 V98-27	<i>Mya truncata</i>	0.6	1
V98-27-461 V98-27	<i>Mya truncata</i>	0.7	1
V98-27-462 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-463 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-464 V98-27	<i>Mya truncata</i>	2.2	1
V98-27-465 V98-27	<i>Mya truncata</i>	0.2	1
V98-27-466 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-467 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-468 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-469 V98-27	<i>Mya truncata</i>	0.9	1
V98-27-470 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-471 V98-27	<i>Mya truncata</i>	0.7	~1
V98-27-472 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-473 V98-27	<i>Mya truncata</i>	0.3	1
V98-27-474 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-475 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-476 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-477 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-478 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-479 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-480 V98-27	<i>Mya truncata</i>	0.4	1
V98-27-481 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-482 V98-27	<i>Mya truncata</i>	0.2	~1
V98-27-483 V98-27	<i>Mya truncata</i>	0.5	~1
V98-27-484 V98-27	<i>Mya truncata</i>	0.1	1
V98-27-485 V98-27	<i>Mya truncata</i>	0.1	1

V98-27-486 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-487 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-488 V98-27	<i>Mya truncata</i>	0.4	~1
V98-27-489 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-490 V98-27	<i>Mya truncata</i>	0.6	7 frag's
V98-27-491 V98-27	<i>Mya truncata</i>	0.3	~1
V98-27-492 V98-27	<i>Mya truncata</i>	0.6	~1
V98-27-493 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-494 V98-27	<i>Mya truncata</i>	0.1	~1
V98-27-495 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-496 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-497 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-498 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-499 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-500 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-501 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-502 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-503 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-504 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-505 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-506 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-507 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-508 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-509 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-510 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-511 V98-27	<i>Limpet sp.</i>	0.1	~1
V98-27-512 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-513 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-514 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-515 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-516 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-517 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-518 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-519 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-520 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-521 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-522 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-523 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-524 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-525 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-526 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-527 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-528 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-529 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-530 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-531 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-532 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-533 V98-27	<i>Limpet sp.</i>	0.3	1
V98-27-534 V98-27	<i>Limpet sp.</i>	0.3	1
V98-27-535 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-536 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-537 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-538 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-539 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-540 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-541 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-542 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-543 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-544 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-545 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-546 V98-27	<i>Limpet sp.</i>	0.2	~1

V98-27-547 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-548 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-549 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-550 V98-27	<i>Limpet sp.</i>	0.1	1
V98-27-551 V98-27	Tubeworm	0.2	-1
V98-27-552 V98-27	Tubeworm	0.2	-1
V98-27-553 V98-27	Tubeworm	0.5	-1
V98-27-554 V98-27	Tubeworm	0.1	-1
V98-27-555 V98-27	Tubeworm	0.2	-1
V98-27-556 V98-27	Tubeworm	0.2	-1
V98-27-557 V98-27	Tubeworm	0.2	-1
V98-27-558 V98-27	Tubeworm	0.2	-1
V98-27-559 V98-27	Tubeworm	0.5	-1
V98-27-560 V98-27	Tubeworm	0.2	1
V98-27-561 V98-27	Tubeworm	0.1	1
V98-27-562 V98-27	Tubeworm	0.1	-1
V98-27-563 V98-27	Tubeworm	0.1	1
V98-27-564 V98-27	<i>Terebratalia transversa</i>	13.3	2 artic'd
V98-27-565 V98-27	<i>Hemithiris psittacea</i>	0.2	-1
V98-27-566 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-567 V98-27	<i>Hemithiris psittacea</i>	0.4	-1
V98-27-568 V98-27	<i>Hemithiris psittacea</i>	0.5	1
V98-27-569 V98-27	<i>Hemithiris psittacea</i>	1.8	1
V98-27-570 V98-27	<i>Hemithiris psittacea</i>	0.6	2 artic'd
V98-27-571 V98-27	<i>Hemithiris psittacea</i>	0.1	1
V98-27-572 V98-27	<i>Hemithiris psittacea</i>	0.4	1
V98-27-573 V98-27	<i>Hemithiris psittacea</i>	0.3	1
V98-27-574 V98-27	<i>Hemithiris psittacea</i>	0.1	1
V98-27-575 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-576 V98-27	<i>Hemithiris psittacea</i>	0.2	-1
V98-27-577 V98-27	<i>Hemithiris psittacea</i>	0.1	2 artic'd
V98-27-578 V98-27	<i>Hemithiris psittacea</i>	0.3	-1
V98-27-579 V98-27	<i>Hemithiris psittacea</i>	0.1	1
V98-27-580 V98-27	<i>Hemithiris psittacea</i>	0.1	1
V98-27-581 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-582 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-583 V98-27	<i>Hemithiris psittacea</i>	0.7	2 artic'd
V98-27-584 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-585 V98-27	<i>Hemithiris psittacea</i>	0.4	1
V98-27-586 V98-27	<i>Hemithiris psittacea</i>	0.6	1
V98-27-587 V98-27	<i>Hemithiris psittacea</i>	0.2	1
V98-27-588 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-589 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-590 V98-27	<i>Hemithiris psittacea</i>	1	2 artic'd
V98-27-591 V98-27	<i>Hemithiris psittacea</i>	0.1	1
V98-27-592 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-593 V98-27	<i>Hemithiris psittacea</i>	0.4	1
V98-27-594 V98-27	<i>Hemithiris psittacea</i>	0.2	-1
V98-27-595 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-596 V98-27	<i>Hemithiris psittacea</i>	0.1	1
V98-27-597 V98-27	<i>Hemithiris psittacea</i>	0.1	-1
V98-27-598 V98-27	<i>Clinocardium nuttallii</i>	2.1	3 frag's
V98-27-599 V98-27	<i>Clinocardium fucanum</i>	0.6	1
V98-27-600 V98-27	<i>Clinocardium fucanum</i>	0.3	-1
V98-27-601 V98-27	<i>Clinocardium fucanum</i>	0.1	1
V98-27-602 V98-27	<i>Clinocardium fucanum</i>	0.1	-1
V98-27-603 V98-27	<i>Clinocardium fucanum</i>	0.2	1
V98-27-604 V98-27	<i>Clinocardium fucanum</i>	0.1	1
V98-27-605 V98-27	<i>Clinocardium fucanum</i>	0.1	-1
V98-27-606 V98-27	<i>Clinocardium fucanum</i>	0.4	1
V98-27-607 V98-27	<i>Clinocardium fucanum</i>	0.2	-1

V98-27-608 V98-27	<i>Clinocardium fucanum</i>	0.4	1
V98-27-609 V98-27	<i>Clinocardium fucanum</i>	0.2	~1
V98-27-610 V98-27	<i>Clinocardium fucanum</i>	0.1	1
V98-27-611 V98-27	<i>Clinocardium fucanum</i>	0.2	~1
V98-27-612 V98-27	<i>Clinocardium fucanum</i>	0.3	1 frag
V98-27-613 V98-27	<i>Clinocardium fucanum</i>	0.3	1
V98-27-614 V98-27	<i>Clinocardium fucanum</i>	0.2	~1
V98-27-615 V98-27	<i>Clinocardium fucanum</i>	0.3	1
V98-27-616 V98-27	<i>Clinocardium fucanum</i>	0.3	1
V98-27-617 V98-27	<i>Clinocardium fucanum</i>	0.3	1
V98-27-618 V98-27	<i>Clinocardium fucanum</i>	0.2	~1
V98-27-619 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-620 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-621 V98-27	<i>Clinocardium fucanum</i>	0.2	1
V98-27-622 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-623 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-624 V98-27	<i>Clinocardium fucanum</i>	0.3	1 frag
V98-27-625 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-626 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-627 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-628 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-629 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-630 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-631 V98-27	<i>Clinocardium fucanum</i>	0.2	1
V98-27-632 V98-27	<i>Clinocardium fucanum</i>	0.5	1
V98-27-633 V98-27	<i>Clinocardium fucanum</i>	0.4	1
V98-27-634 V98-27	<i>Clinocardium fucanum</i>	0.3	1
V98-27-635 V98-27	<i>Clinocardium fucanum</i>	0.2	~1*
V98-27-636 V98-27	<i>Clinocardium fucanum</i>	0.5	2 artic'd
V98-27-637 V98-27	<i>Clinocardium fucanum</i>	0.2	1
V98-27-638 V98-27	<i>Clinocardium fucanum</i>	0.2	1
V98-27-639 V98-27	<i>Clinocardium fucanum</i>	0.1	1
V98-27-640 V98-27	<i>Clinocardium fucanum</i>	0.2	~1
V98-27-641 V98-27	<i>Clinocardium fucanum</i>	0.1	~1
V98-27-642 V98-27	<i>Cranopsis cucullata</i>	0.1	1
V98-27-643 V98-27	<i>Cranopsis cucullata</i>	0.2	1
V98-27-644 V98-27	<i>Cranopsis cucullata</i>	0.2	1
V98-27-645 V98-27	<i>Cranopsis cucullata</i>	0.2	1
V98-27-646 V98-27	<i>Cranopsis cucullata</i>	0.3	1
V98-27-647 V98-27	<i>Cranopsis cucullata</i>	0.1	1
V98-27-648 V98-27	<i>Cranopsis cucullata</i>	0.1	1
V98-27-649 V98-27	<i>Cranopsis cucullata</i>	0.1	1
V98-27-650 V98-27	<i>Euspira pallida</i>	0.9	1
V98-27-651 V98-27	<i>Euspira pallida</i>	0.1	1
V98-27-652 V98-27	<i>Euspira pallida</i>	0.1	1
V98-27-653 V98-27	<i>Euspira pallida</i>	0.7	1
V98-27-654 V98-27	<i>Euspira pallida</i>	0.5	1
V98-27-655 V98-27	<i>Balanus sp.</i>	0.3	~1
V98-27-656 V98-27	<i>Balanus sp.</i>	0.1	~1
V98-27-657 V98-27	<i>Balanus sp.</i>	0.1	~1
V98-27-658 V98-27	<i>Balanus sp.</i>	0.4	~1
V98-27-659 V98-27	<i>Balanus sp.</i>	0.1	~1
V98-27-660 V98-27	<i>Balanus sp.</i>	0.2	~1
V98-27-661 V98-27	<i>Balanus sp.</i>	0.1	~1
V98-27-662 V98-27	<i>Balanus sp.</i>	0.1	~1
V98-27-663 V98-27	<i>Balanus sp.</i>	0.3	~1
V98-27-664 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-665 V98-27	<i>Hiatella pholadis</i>	2	1
V98-27-666 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-667 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-668 V98-27	<i>Hiatella pholadis</i>	0.4	1

V98-27-669 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-670 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-671 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-672 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-673 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-674 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-675 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-676 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-677 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-678 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-679 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-680 V98-27	<i>Hiatella pholadis</i>	1.2	1
V98-27-681 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-682 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-683 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-684 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-685 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-686 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-687 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-688 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-689 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-690 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-691 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-692 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-693 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-694 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-695 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-696 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-697 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-698 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-699 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-700 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-701 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-702 V98-27	<i>Hiatella pholadis</i>	0.4	-1
V98-27-703 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-704 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-705 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-706 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-707 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-708 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-709 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-710 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-711 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-712 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-713 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-714 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-715 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-716 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-717 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-718 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-719 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-720 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-721 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-722 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-723 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-724 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-725 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-726 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-727 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-728 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-729 V98-27	<i>Hiatella pholadis</i>	0.5	1

V98-27-730 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-731 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-732 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-733 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-734 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-735 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-736 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-737 V98-27	<i>Hiatella pholadis</i>	0.6	~1
V98-27-738 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-739 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-740 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-741 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-742 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-743 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-744 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-745 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-746 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-747 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-748 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-749 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-750 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-751 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-752 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-753 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-754 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-755 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-756 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-757 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-758 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-759 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-760 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-761 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-762 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-763 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-764 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-765 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-766 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-767 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-768 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-769 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-770 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-771 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-772 V98-27	<i>Hiatella pholadis</i>	1.3	1
V98-27-773 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-774 V98-27	<i>Hiatella pholadis</i>	1.5	1
V98-27-775 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-776 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-777 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-778 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-779 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-780 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-781 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-782 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-783 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-784 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-785 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-786 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-787 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-788 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-789 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-790 V98-27	<i>Hiatella pholadis</i>	0.6	1

V98-27-791 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-792 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-793 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-794 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-795 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-796 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-797 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-798 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-799 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-800 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-801 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-802 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-803 V98-27	<i>Hiatella pholadis</i>	0.7	~1
V98-27-804 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-805 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-806 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-807 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-808 V98-27	<i>Hiatella pholadis</i>	1.4	1
V98-27-809 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-810 V98-27	<i>Hiatella pholadis</i>	1.4	1
V98-27-811 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-812 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-813 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-814 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-815 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-816 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-817 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-818 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-819 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-820 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-821 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-822 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-823 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-824 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-825 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-826 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-827 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-828 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-829 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-830 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-831 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-832 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-833 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-834 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-835 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-836 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-837 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-838 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-839 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-840 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-841 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-842 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-843 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-844 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-845 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-846 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-847 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-848 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-849 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-850 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-851 V98-27	<i>Hiatella pholadis</i>	0.5	1

V98-27-852 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-853 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-854 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-855 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-856 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-857 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-858 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-859 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-860 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-861 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-862 V98-27	<i>Hiatella pholadis</i>	0.6	~1
V98-27-863 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-864 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-865 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-866 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-867 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-868 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-869 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-870 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-871 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-872 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-873 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-874 V98-27	<i>Hiatella pholadis</i>	0.8	~1
V98-27-875 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-876 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-877 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-878 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-879 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-880 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-881 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-882 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-883 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-884 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-885 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-886 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-887 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-888 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-889 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-890 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-891 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-892 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-893 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-894 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-895 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-896 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-897 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-898 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-899 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-900 V98-27	<i>Hiatella pholadis</i>	0.8	~1
V98-27-901 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-902 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-903 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-904 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-905 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-906 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-907 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-908 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-909 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-910 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-911 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-912 V98-27	<i>Hiatella pholadis</i>	0.9	1

V98-27-913 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-914 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-915 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-916 V98-27	<i>Hiatella pholadis</i>	1.3	1
V98-27-917 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-918 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-919 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-920 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-921 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-922 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-923 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-924 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-925 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-926 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-927 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-928 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-929 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-930 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-931 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-932 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-933 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-934 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-935 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-936 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-937 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-938 V98-27	<i>Hiatella pholadis</i>	1.2	1
V98-27-939 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-940 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-941 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-942 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-943 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-944 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-945 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-946 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-947 V98-27	<i>Hiatella pholadis</i>	1.4	1
V98-27-948 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-949 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-950 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-951 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-952 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-953 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-954 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-955 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-956 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-957 V98-27	<i>Hiatella pholadis</i>	0.3	1 frag
V98-27-958 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-959 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-960 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-961 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-962 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-963 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-964 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-965 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-966 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-967 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-968 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-969 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-970 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-971 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-972 V98-27	<i>Hiatella pholadis</i>	1.2	1
V98-27-973 V98-27	<i>Hiatella pholadis</i>	0.4	1

V98-27-974 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-975 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-976 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-977 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-978 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-979 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-980 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-981 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-982 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-983 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-984 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-985 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-986 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-987 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-988 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-989 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-990 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-991 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-992 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-993 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-994 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-995 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-996 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-997 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-998 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-999 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-100 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.5	2 frag's
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-101 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-102 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.3	1

V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-103 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.4	-1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.6	-1
V98-27-104 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	1	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-105 V98-27	<i>Hiatella pholadis</i>	0.3	-1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-106 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.1	-1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-107 V98-27	<i>Hiatella pholadis</i>	1.2	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	1.5	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	0.2	-1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	1.2	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-108 V98-27	<i>Hiatella pholadis</i>	1.3	1
V98-27-109 V98-27	<i>Hiatella pholadis</i>	1.8	1
V98-27-109 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-109 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-109 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-109 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-109 V98-27	<i>Hiatella pholadis</i>	0.4	1

V98-27-115 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-115 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-115 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	1.5	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-116 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-117 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-118 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-119 V98-27	<i>Hiatella pholadis</i>	1.1	1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-120 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.4	~1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.1	~1

V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-121 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	1.3	5 frag's
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.9	1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-122 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-123 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-124 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.1	1
V98-27-125 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.3	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.1	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.5	~1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.8	1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-126 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.3	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.5	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.6	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.2	1
V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.2	~1

V98-27-127 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-128 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-128 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-128 V98-27	<i>Hiatella pholadis</i>	0.7	1
V98-27-128 V98-27	<i>Hiatella pholadis</i>	0.4	1
V98-27-128 V98-27	<i>Hiatella pholadis</i>	0.2	~1
V98-27-128 V98-27	<i>Saxidomus giganteus</i>	3.5	~1
V98-27-128 V98-27	<i>Saxidomus giganteus</i>	1.9	~1
V98-27-128 V98-27	<i>Saxidomus giganteus</i>	8.3	1
V98-27-128 V98-27	<i>Saxidomus giganteus</i>	0.3	~1
V98-27-128 V98-27	<i>Saxidomus giganteus</i>	0.3	~1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	0.1	~1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	1.2	1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	6.9	1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	3.9	1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	1.1	~1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	0.3	~1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-129 V98-27	<i>Saxidomus giganteus</i>	0.8	~1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	0.3	~1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	0.1	1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	3.2	3 frag's
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	5.5	~1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	3.6	1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	0.5	~1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	0.1	1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	0.1	1
V98-27-130 V98-27	<i>Saxidomus giganteus</i>	1.3	3 frag's
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.1	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.1	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.7	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.3	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-131 V98-27	<i>Saxidomus giganteus</i>	0.1	~1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	1	2 frag's
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	2.8	~1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	1.3	~1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	1	1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	1.4	1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	0.8	~1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	0.6	~1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	0.6	~1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	0.3	~1
V98-27-132 V98-27	<i>Saxidomus giganteus</i>	8.1	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	1.3	1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.5	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.1	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.3	1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.6	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.9	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.6	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.3	~1
V98-27-133 V98-27	<i>Saxidomus giganteus</i>	0.2	~1

V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.1	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.5	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.6	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.4	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-134 V98-27	<i>Saxidomus giganteus</i>	1.4	4 frag's
V98-27-135 V98-27	<i>Saxidomus giganteus</i>	0.6	~1
V98-27-135 V98-27	<i>Saxidomus giganteus</i>	0.1	~1
V98-27-135 V98-27	<i>Saxidomus giganteus</i>	0.2	~1
V98-27-135 V98-27	<i>Protothaca tenerrima</i>	3.4	1
V98-27-135 V98-27	<i>Protothaca tenerrima</i>	2.2	1
V98-27-135 V98-27	<i>Protothaca tenerrima</i>	2	1
V98-27-135 V98-27	<i>Protothaca tenerrima</i>	1.9	1
V98-27-135 V98-27	<i>Protothaca tenerrima</i>	1.2	1
V98-27-135 V98-27	<i>Protothaca tenerrima</i>	0.8	1
V98-27-135 V98-27	<i>Protothaca tenerrima</i>	1.9	~1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-136 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	0.1	~1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	5.7	18 frag's
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	1.9	1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	0.9	~1
V98-27-137 V98-27	<i>Protothaca tenerrima</i>	1.1	~1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	2	1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	0.7	1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	0.8	1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	1	~1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	1.5	~1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	0.9	~1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	0.4	1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	0.7	~1
V98-27-138 V98-27	<i>Protothaca tenerrima</i>	0.7	~1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	0.8	1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	1.1	1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	0.9	1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	2.1	1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	1	1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	0.6	~1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-139 V98-27	<i>Protothaca tenerrima</i>	0.4	1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.3	1

V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.8	~1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-140 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.7	~1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.7	1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.7	1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-141 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.1	~1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.1	~1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	12.4	36frag's
V98-27-142 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	1.6	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	3.3	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	2.3	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	3.2	~1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	1.6	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	1.5	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	1.7	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	1	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	1.7	1
V98-27-143 V98-27	<i>Protothaca tenerrima</i>	0.5	1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.6	1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.8	~1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	1.2	~1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.5	1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.7	1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.6	~1
V98-27-144 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	1	1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.9	~1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.9	1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.4	1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.8	~1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.8	1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.9	1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.6	~1
V98-27-145 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.2	1

V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.6	1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.6	~1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-146 V98-27	<i>Protothaca tenerrima</i>	0.1	~1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.7	~1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.1	~1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.1	~1
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	0.1	2 artic'd
V98-27-147 V98-27	<i>Protothaca tenerrima</i>	21.1	48 frag's
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	0.1	~1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	0.3	~1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	0.1	1 frag
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	2.4	1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	0.7	~1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	1.9	1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	1.5	1
V98-27-148 V98-27	<i>Protothaca tenerrima</i>	2.6	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	2.1	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	1.6	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	0.6	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	0.6	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	0.6	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	0.7	~1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	1.2	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	0.7	1
V98-27-149 V98-27	<i>Protothaca tenerrima</i>	1.1	~1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.2	1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.4	~1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.6	1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.5	~1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.3	1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.6	~1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	0.1	1
V98-27-150 V98-27	<i>Protothaca tenerrima</i>	8.8	21 frag's
V98-27-151 V98-27	<i>Protothaca tenerrima</i>	0.2	~1
V98-27-151 V98-27	<i>Protothaca staminea</i>	0.3	~1
V98-27-151 V98-27	<i>Protothaca staminea</i>	0.1	~1
V98-27-151 V98-27	<i>Protothaca staminea</i>	0.9	8 frag's
V98-27-151 V98-27	<i>Protothaca staminea</i>	2.3	1
V98-27-151 V98-27	<i>Protothaca staminea</i>	1	1
V98-27-151 V98-27	<i>Protothaca staminea</i>	1.8	1
V98-27-151 V98-27	<i>Protothaca staminea</i>	0.3	~1
V98-27-151 V98-27	<i>Protothaca staminea</i>	0.7	~1
V98-27-151 V98-27	<i>Protothaca staminea</i>	0.6	~1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.6	~1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.4	~1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.6	~1

V98-27-152 V98-27	<i>Protothaca staminea</i>	0.3	~1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.2	1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.2	~1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.2	~1
V98-27-152 V98-27	<i>Protothaca staminea</i>	0.1	~1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.3	~1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.5	~1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.4	~1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.3	~1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.2	~1
V98-27-153 V98-27	<i>Protothaca staminea</i>	9.5	19 frag's
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.9	~1
V98-27-153 V98-27	<i>Protothaca staminea</i>	0.3	~1
V98-27-154 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-154 V98-27	<i>Protothaca staminea</i>	0.1	~1
V98-27-154 V98-27	<i>Protothaca staminea</i>	0.1	2 artic'd
V98-27-154 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-154 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-154 V98-27	<i>Protothaca staminea</i>	0.1	1
V98-27-154 V98-27	<i>Protothaca staminea</i>	0.2	2 frag's
V98-27-154 V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-154 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-154 V98-27	<i>Chlamys rubida</i>	2.1	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	1.3	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.8	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.3	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.4	1 frag
V98-27-155 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-156 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-156 V98-27	<i>Chlamys rubida</i>	0.4	2 frag's
V98-27-156 V98-27	<i>Chlamys rubida</i>	1.3	1
V98-27-156 V98-27	<i>Chlamys rubida</i>	0.6	~1
V98-27-156 V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-156 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-156 V98-27	<i>Chlamys rubida</i>	0.4	1
V98-27-156 V98-27	<i>Chlamys rubida</i>	1.2	1
V98-27-156 V98-27	<i>Chlamys rubida</i>	0.7	~1
V98-27-156 V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-157 V98-27	<i>Chlamys rubida</i>	0.9	~1
V98-27-157 V98-27	<i>Chlamys rubida</i>	1.4	~1
V98-27-157 V98-27	<i>Chlamys rubida</i>	0.8	1
V98-27-157 V98-27	<i>Chlamys rubida</i>	1.7	1
V98-27-157 V98-27	<i>Chlamys rubida</i>	1.8	~1
V98-27-157 V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-157 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-157 V98-27	<i>Chlamys rubida</i>	1.3	1
V98-27-157 V98-27	<i>Chlamys rubida</i>	1.2	1
V98-27-157 V98-27	<i>Chlamys rubida</i>	0.8	1
V98-27-158 V98-27	<i>Chlamys rubida</i>	1.1	~1
V98-27-158 V98-27	<i>Chlamys rubida</i>	0.3	~1
V98-27-158 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-158 V98-27	<i>Chlamys rubida</i>	1.7	1

V98-27-158 V98-27	<i>Chlamys rubida</i>	1.9	1
V98-27-158 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-158 V98-27	<i>Chlamys rubida</i>	0.6	~1
V98-27-158 V98-27	<i>Chlamys rubida</i>	0.7	~1
V98-27-158 V98-27	<i>Chlamys rubida</i>	0.5	~1
V98-27-158 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	0.5	~1
V98-27-159 V98-27	<i>Chlamys rubida</i>	1.9	1
V98-27-159 V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-160 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-160 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-160 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-160 V98-27	<i>Chlamys rubida</i>	0.6	1
V98-27-160 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-160 V98-27	<i>Chlamys rubida</i>	0.5	~1
V98-27-160 V98-27	<i>Chlamys rubida</i>	1.4	~1
V98-27-160 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-160 V98-27	<i>Chlamys rubida</i>	0.8	~1
V98-27-160 V98-27	<i>Chlamys rubida</i>	0.2	~1
V98-27-161 V98-27	<i>Chlamys rubida</i>	4.3	13 frag's
V98-27-161 V98-27	<i>Chlamys rubida</i>	1.4	1
V98-27-161 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-161 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-161 V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-161 V98-27	<i>Chlamys rubida</i>	1.9	1
V98-27-161 V98-27	<i>Chlamys rubida</i>	1.7	1
V98-27-161 V98-27	<i>Chlamys rubida</i>	1.1	~1
V98-27-161 V98-27	<i>Chlamys rubida</i>	1.6	~1
V98-27-161 V98-27	<i>Chlamys rubida</i>	0.5	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	0.1	~1
V98-27-162 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	1.4	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	0.5	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	1.2	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	1.3	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-162 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	1.4	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	0.2	~1
V98-27-163 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	10.7	36 frag's
V98-27-163 V98-27	<i>Chlamys rubida</i>	2.5	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	2	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	4.7	1
V98-27-163 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	0.8	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	0.4	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	1.6	1

V98-27-164 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	0.5	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-164 V98-27	<i>Chlamys rubida</i>	1.9	1
V98-27-165 V98-27	<i>Chlamys rubida</i>	1.7	1
V98-27-165 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-165 V98-27	<i>Chlamys rubida</i>	0.7	~1
V98-27-165 V98-27	<i>Chlamys rubida</i>	1.4	~1
V98-27-165 V98-27	<i>Chlamys rubida</i>	0.8	~1
V98-27-165 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-165 V98-27	<i>Chlamys rubida</i>	0.5	1
V98-27-165 V98-27	<i>Chlamys rubida</i>	1.4	1
V98-27-165 V98-27	<i>Chlamys rubida</i>	1.2	1
V98-27-165 V98-27	<i>Chlamys rubida</i>	2.1	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	0.3	~1
V98-27-166 V98-27	<i>Chlamys rubida</i>	0.3	~1
V98-27-166 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	1.1	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	1.3	1
V98-27-166 V98-27	<i>Chlamys rubida</i>	1	1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.3	1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.4	1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.2	~1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.9	~1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.2	~1
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-167 V98-27	<i>Chlamys rubida</i>	9.1	24 frag's
V98-27-167 V98-27	<i>Chlamys rubida</i>	0.2	1 frag
V98-27-168 V98-27	<i>Chlamys rubida</i>	0.5	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	1.2	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	1.5	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	0.4	~1
V98-27-168 V98-27	<i>Chlamys rubida</i>	0.3	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	0.5	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	1.4	1
V98-27-168 V98-27	<i>Chlamys rubida</i>	0.5	~1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.9	1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.7	1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.8	~1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.4	1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.8	1
V98-27-169 V98-27	<i>Chlamys rubida</i>	1	~1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.5	~1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.2	1
V98-27-169 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-170 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-170 V98-27	<i>Chlamys rubida</i>	0.5	1
V98-27-170 V98-27	<i>Chlamys rubida</i>	0.1	1
V98-27-170 V98-27	<i>Chlamys rubida</i>	0.1	~1
V98-27-170 V98-27	<i>Chlamys rubida</i>	0.6	~1
V98-27-170 V98-27	<i>Chlamys rubida</i>	0.3	~1

V98-27-176	V98-27	<i>Macoma inquinata</i>	0.3	1
V98-27-176	V98-27	<i>Macoma inquinata</i>	0.2	1
V98-27-176	V98-27	<i>Macoma inquinata</i>	0.2	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.2	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	~1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.2	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	1
V98-27-177	V98-27	<i>Macoma inquinata</i>	0.1	1
V98-27-178	V98-27	<i>Olivella baetica cf.</i>	0.1	1
V98-27-178	V98-27	<i>Lyonsia sp.</i>	0.1	2 artic'd
V98-27-178	V98-27	<i>Lyonsia sp.</i>	0.1	2 artic'd
V98-27-178	V98-27	<i>Lyonsia sp.</i>	0.1	1
V98-27-178	V98-27	gastropod operculum?	0.1	~1
V98-27-178	V98-27	gastropod operculum?	1.1	1
V98-27-178	V98-27	Unidentified clam shell frag's	0.1	1
V98-27-178	V98-27	Unidentified clam shell frag's	0.1	1
V98-27-178	V98-27	Unidentified clam shell frag's	9.5	65 frag's
V98-27-178	V98-27	Unidentified clam shell frag's	14.1	55 frag's
V98-27-179	V98-27	Unidentified clam shell frag's	9.2	51 frag's
V98-27-179	V98-27	Unidentified clam shell frag's	6.9	32 frag's
V98-27-179	V98-27	Unidentified clam shell frag's	0.9	10 frag's
Total weight (grams) V98-27			1632.5	
V98-17-1	V98-17	<i>Macoma lipara</i>	12.9	1
V98-17-2	V98-17	<i>Macoma lipara</i>	6.8	1
V98-17-3	V98-17	<i>Macoma lipara</i>	4.6	1
V98-17-4	V98-17	<i>Macoma lipara</i>	9.6	1
V98-17-5	V98-17	<i>Macoma lipara</i>	9.3	1
V98-17-6	V98-17	<i>Macoma lipara</i>	13.4	1
V98-17-7	V98-17	<i>Macoma lipara</i>	7.6	1
V98-17-8	V98-17	<i>Macoma lipara</i>	8.5	1
V98-17-9	V98-17	<i>Macoma lipara</i>	6.4	~1
V98-17-10	V98-17	<i>Macoma lipara</i>	4.8	~1
V98-17-11	V98-17	<i>Macoma lipara</i>	8.3	1
V98-17-12	V98-17	<i>Macoma lipara</i>	7.5	1
V98-17-13	V98-17	<i>Macoma lipara</i>	6.9	1
V98-17-14	V98-17	<i>Macoma lipara</i>	4.1	1
V98-17-15	V98-17	<i>Macoma lipara</i>	8.6	1
V98-17-16	V98-17	<i>Macoma lipara</i>	4.2	1
V98-17-17	V98-17	<i>Macoma lipara</i>	8.7	1
V98-17-18	V98-17	<i>Macoma lipara</i>	5.8	1
V98-17-19	V98-17	<i>Macoma lipara</i>	3.8	~1
V98-17-20	V98-17	<i>Macoma lipara</i>	4.4	1
V98-17-21	V98-17	<i>Macoma lipara</i>	2.5	~1
V98-17-22	V98-17	<i>Macoma lipara</i>	3.3	~1
V98-17-23	V98-17	<i>Lucinoma annulatum</i>	8.6	2 artic'd
V98-17-24	V98-17	<i>Lucinoma annulatum</i>	8.7	2 artic'd
V98-17-25	V98-17	<i>Lucinoma annulatum</i>	4.1	2 artic'd
V98-17-26	V98-17	<i>Lucinoma annulatum</i>	1.6	2 artic'd
V98-17-27	V98-17	<i>Lucinoma annulatum</i>	1.5	2 artic'd
V98-17-28	V98-17	<i>Lucinoma annulatum</i>	0.4	2 artic'd
V98-17-29	V98-17	<i>Lucinoma annulatum</i>	0.6	~1
V98-17-30	V98-17	<i>Lucinoma annulatum</i>	0.3	~1
V98-17-31	V98-17	<i>Lucinoma annulatum</i>	0.9	4 frag's
V98-17-32	V98-17	<i>Compsomyx subdiaphana</i>	2.1	1
V98-17-33	V98-17	<i>Compsomyx subdiaphana</i>	2	1

V98-17-34	V98-17	<i>Compsomyax subdiaphana</i>	0.6	1
V98-17-35	V98-17	<i>Compsomyax subdiaphana</i>	0.3	~1
V98-17-36	V98-17	<i>Thracia trapezoides</i>	1.2	~1
V98-17-37	V98-17	<i>Thracia trapezoides</i>	1.4	~1
V98-17-38	V98-17	Unidentified clam shell frag's	0.7	~1
V98-17-39	V98-17	Unidentified clam shell frag's	1.1	~1
V98-17-40	V98-17	Unidentified clam shell frag's	0.3	~1
V98-17-41	V98-17	Unidentified clam shell frag's	4	8 frag's
V98-17-42	V98-17	Pine cones	1.3	1
V98-17-43	V98-17	Pine cones	1.3	1
Total weight (grams) V98-17			195	
V98-09-1	V98-09	<i>Pododesmus machrochisma</i>	28	1
V98-09-2	V98-09	<i>Pododesmus machrochisma</i>	18.5	1
V98-09-3	V98-09	<i>Pododesmus machrochisma</i>	13.7	1
V98-09-4	V98-09	<i>Pododesmus machrochisma</i>	11.5	1
V98-09-5	V98-09	<i>Pododesmus machrochisma</i>	1.7	1
V98-09-6	V98-09	<i>Pododesmus machrochisma</i>	6	1
V98-09-7	V98-09	<i>Compsomyax subdiaphana</i>	3.7	1
V98-09-8	V98-09	<i>Compsomyax subdiaphana</i>	3.6	1
V98-09-9	V98-09	<i>Saxidomus giganteus</i>	4.9	1
V98-09-10	V98-09	<i>Saxidomus giganteus</i>	5.4	~1
V98-09-11	V98-09	<i>Protothaca tenerrima</i>	2.2	~1
V98-09-12	V98-09	<i>Protothaca tenerrima</i>	1.4	1 frag
V98-09-13	V98-09	<i>Protothaca tenerrima</i>	1.7	1 frag
V98-09-14	V98-09	<i>Protothaca tenerrima</i>	0.4	1 frag
V98-09-15	V98-09	<i>Macoma sp.</i>	0.6	1
V98-09-16	V98-09	Unidentified clam shell frag's	1.2	3 frag's
Total weight (grams) V98-09			104.5	
V98-54-1	V98-54	<i>Saxidomus giganteus</i>	2.5	1
V98-54-2	V98-54	<i>Saxidomus giganteus</i>	2	1
V98-54-3	V98-54	<i>Saxidomus giganteus</i>	14.3	1
V98-54-4	V98-54	<i>Saxidomus giganteus</i>	1.8	~1
V98-54-5	V98-54	<i>Saxidomus giganteus</i>	2.4	1
V98-54-6	V98-54	<i>Saxidomus giganteus</i>	4.3	~1
V98-54-7	V98-54	<i>Saxidomus giganteus</i>	3.6	1
V98-54-8	V98-54	<i>Saxidomus giganteus</i>	3.4	1
V98-54-9	V98-54	<i>Saxidomus giganteus</i>	2.7	~1
V98-54-10	V98-54	<i>Saxidomus giganteus</i>	17.8	1
V98-54-11	V98-54	<i>Saxidomus giganteus</i>	1.6	~1
V98-54-12	V98-54	<i>Saxidomus giganteus</i>	0.9	~1
V98-54-13	V98-54	<i>Saxidomus giganteus</i>	2.1	~1
V98-54-14	V98-54	<i>Saxidomus giganteus</i>	1.2	~1
V98-54-15	V98-54	<i>Saxidomus giganteus</i>	2.9	~1
V98-54-16	V98-54	<i>Saxidomus giganteus</i>	0.5	~1
V98-54-17	V98-54	<i>Saxidomus giganteus</i>	1	~1
V98-54-18	V98-54	<i>Saxidomus giganteus</i>	1.1	~1
V98-54-19	V98-54	<i>Saxidomus giganteus</i>	1.3	~1
V98-54-20	V98-54	<i>Saxidomus giganteus</i>	0.5	~1
V98-54-21	V98-54	<i>Saxidomus giganteus</i>	2.3	~1
V98-54-22	V98-54	<i>Saxidomus giganteus</i>	4.6	~1
V98-54-23	V98-54	<i>Saxidomus giganteus</i>	0.7	~1
V98-54-24	V98-54	<i>Saxidomus giganteus</i>	1.1	~1
V98-54-25	V98-54	<i>Saxidomus giganteus</i>	0.9	~1
V98-54-26	V98-54	<i>Saxidomus giganteus</i>	2.5	~1
V98-54-27	V98-54	<i>Saxidomus giganteus</i>	3.9	1
V98-54-28	V98-54	<i>Saxidomus giganteus</i>	4.6	1
V98-54-29	V98-54	<i>Saxidomus giganteus</i>	0.9	~1
V98-54-30	V98-54	<i>Saxidomus giganteus</i>	3.2	~1
V98-54-31	V98-54	<i>Saxidomus giganteus</i>	1.5	~1

V98-54-32	V98-54	<i>Saxidomus giganteus</i>	0.9	~1
V98-54-33	V98-54	<i>Saxidomus giganteus</i>	2.3	~1
V98-54-34	V98-54	<i>Saxidomus giganteus</i>	1.1	~1
V98-54-35	V98-54	<i>Saxidomus giganteus</i>	0.9	~1
V98-54-36	V98-54	<i>Saxidomus giganteus</i>	0.7	~1
V98-54-37	V98-54	<i>Saxidomus giganteus</i>	77.6	49 frag's
V98-54-38	V98-54	<i>Saxidomus giganteus</i>	0.7	~1
V98-54-39	V98-54	<i>Lucinoma annulatum</i>	15.4	1
V98-54-40	V98-54	<i>Lucinoma annulatum</i>	10.3	1
V98-54-41	V98-54	<i>Lucinoma annulatum</i>	15	1
V98-54-42	V98-54	<i>Lucinoma annulatum</i>	12.9	1
V98-54-43	V98-54	<i>Lucinoma annulatum</i>	12.2	1
V98-54-44	V98-54	<i>Lucinoma annulatum</i>	0.8	2 artic'd
V98-54-45	V98-54	<i>Lucinoma annulatum</i>	9.8	2 frag's
V98-54-46	V98-54	<i>Lucinoma annulatum</i>	2.3	~1
V98-54-47	V98-54	<i>Lucinoma annulatum</i>	1.6	~1
V98-54-48	V98-54	<i>Chlamys rubida</i>	0.6	1
V98-54-49	V98-54	<i>Chlamys rubida</i>	1	~1
V98-54-50	V98-54	<i>Chlamys rubida</i>	0.4	1
V98-54-51	V98-54	<i>Chlamys rubida</i>	0.6	1
V98-54-52	V98-54	<i>Chlamys rubida</i>	0.6	1
V98-54-53	V98-54	<i>Chlamys rubida</i>	0.7	1
V98-54-54	V98-54	<i>Chlamys rubida</i>	2.2	1
V98-54-55	V98-54	<i>Chlamys rubida</i>	0.7	1
V98-54-56	V98-54	<i>Chlamys rubida</i>	0.3	1
V98-54-57	V98-54	<i>Chlamys rubida</i>	1.3	1
V98-54-58	V98-54	<i>Chlamys rubida</i>	1.9	1
V98-54-59	V98-54	<i>Chlamys rubida</i>	0.9	1
V98-54-60	V98-54	<i>Chlamys rubida</i>	1.2	1
V98-54-61	V98-54	<i>Chlamys rubida</i>	0.8	1
V98-54-62	V98-54	<i>Chlamys rubida</i>	1.4	1
V98-54-63	V98-54	<i>Chlamys rubida</i>	1	1
V98-54-64	V98-54	<i>Chlamys rubida</i>	1	1
V98-54-65	V98-54	<i>Chlamys rubida</i>	1.2	1
V98-54-66	V98-54	<i>Chlamys rubida</i>	0.4	1
V98-54-67	V98-54	<i>Chlamys rubida</i>	1.1	1
V98-54-68	V98-54	<i>Chlamys rubida</i>	0.5	~1
V98-54-69	V98-54	<i>Chlamys rubida</i>	1.3	1
V98-54-70	V98-54	<i>Chlamys rubida</i>	0.7	1
V98-54-71	V98-54	<i>Chlamys rubida</i>	0.6	~1
V98-54-72	V98-54	<i>Chlamys rubida</i>	3.4	8 frag's
Total weight (grams) V98-54			284.4	

Hetherington, R.

Appendix D: Submarine sediment core sample data

Sample #	Sample Group	Species name	Shell weight (grams)	Number of shells
E84B10-20-1	E84B10	<i>Yoldia</i> sp.	0.1	5 frag's
E84B10-20-2	E84B10	unidentified bivalve frag's	0.1	13 frag's
E84B10-20-3	E84B10	foraminifera	0.1	6
E84B10-50-1	E84B10	<i>Dentaliidae</i> sp. (cf)	0.1	21 frag's
E84B10-119-1	E84B10	<i>Rhabdus rectius</i>	0.1	~1
E84B10-119-2	E84B10	plant or wood	0.1	1 frag
E84B10-229-1	E84B10	foraminifera	0.1	64
E84B10-285-1	E84B10	<i>Yoldia</i> sp.	0.1	~1 in 2 frag's
E84B10-590-1	E84B10	<i>Yoldia</i> sp. (cf)	0.1	2 frag's
E84B10-753-1	E84B10	foraminifera	0.1	2
Total weight (grams) E84B10			1	
E84B11-338-1	E84B11	<i>Cyclocardia ventricosa</i>	0.1	1
E84B11-338-2	E84B11	<i>Nutricula lordi</i>	0.1	1
E84B11-338-3	E84B11	unidentified bivalve frag's	0.1	12 frag's
E84B11-338-4	E84B11	sea urchin spine	0.1	1 spine
Total weight (grams) E84B11			0.4	
E84B8-342-1	E84B8	<i>Yoldia</i> sp.	0.1	~1 in 2 frag's
E84B8-342-2	E84B8	<i>Dentaliidae</i> sp.	0.1	2 frag's
E84B8-342-3	E84B8	wood	0.1	1 frag
E84B8-509-1	E84B8	<i>Nuculana</i> sp.	0.1	1
E84B8-509-2	E84B8	<i>Yoldia</i> sp.	0.1	~1 in 13 frag's
Total weight (grams) E84B8			0.5	
E84B9-558-1	E84B9	unidentified bivalve frag's	0.1	10 frag's
E84B9-558-2	E84B9	foraminifera	0.1	2
E84B9-558-3	E84B9	wood	0.1	1 frag
E84B9-850-1	E84B9	<i>Yoldia</i> sp.	0.1	~1 in 2 frag's
E84B9-850-2	E84B9	<i>Yoldia</i> sp.	0.1	2 frag's
E84B9-850-3	E84B9	unidentified bivalve frag's	0.1	2
E84B9-850-4	E84B9	foraminifera	0.1	1
Total weight (grams) E84B9			0.7	
E87A13-26-1	E87A13	foraminifera	0.1	5
E87A13-26-2	E87A13	plant litter	0.1	2
E87A13-26-3	E87A13	wood	0.1	2 frag's
E87A13-35-1	E87A13	<i>Tellina</i> sp.	0.1	1 frag
E87A13-35-2	E87A13	unidentified bivalve frag's	0.1	16 frag's
E87A13-35-3	E87A13	unknown	0.1	1
E87A13-35-4	E87A13	wood	0.1	6 frag's
E87A13-55-1	E87A13	<i>Yoldia</i> sp.	0.1	2 frag's
E87A13-55-2	E87A13	unidentified bivalve frag's	0.1	12
E87A13-55-3	E87A13	sea urchin spine	0.1	1 frag
E87A13-55-4	E87A13	<i>Scorpaenidae</i> sp. not juvenile not full grown adult	0.1	1 scale
E87A13-55-5	E87A13	wood	0.1	6 frag's
E87A13-76-1	E87A13	<i>Macoma calcarea</i>	0.1	1
E87A13-76-2	E87A13	<i>Macoma calcarea</i>	0.1	1
E87A13-76-3	E87A13	<i>Macoma calcarea</i>	0.1	4 frag's
E87A13-76-4	E87A13	<i>Nutricula lordi</i>	0.1	1
E87A13-76-5	E87A13	<i>Yoldia</i> sp.	0.1	~1
E87A13-76-6	E87A13	<i>Yoldia</i> sp.	0.1	5 frag's
E87A13-76-7	E87A13	unidentified bivalve frag's	0.1	19 frag's
E87A13-76-8	E87A13	sea urchin spine	0.1	1
E87A13-76-9	E87A13	sea urchin spine	0.1	1
E87A13-76-10	E87A13	unknown	0.1	1
E87A13-76-11	E87A13	unknown	0.1	1
E87A13-76-12	E87A13	wood	0.1	5 frag's

E87A13-78-1	E87A13	<i>Merluccius productus</i> (cf.) - Pacific hake	0.1	2 frag's
E87A13-78-2	E87A13	sponge	0.1	1 frag
E87A13-95-1	E87A13	<i>Macoma</i> sp.	0.3	~1
E87A13-95-2	E87A13	<i>Macoma</i> sp.	0.2	~1
E87A13-95-3	E87A13	<i>Macoma</i> sp.	0.1	~1
E87A13-95-4	E87A13	<i>Macoma</i> sp.	0.5	12 frag's
E87A13-95-5	E87A13	<i>Tellina</i> sp.?	0.1	1
E87A13-95-6	E87A13	<i>Tellina</i> sp.?	0.1	1
E87A13-95-7	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-95-8	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-95-9	E87A13	<i>Astysis gausapata</i>	0.1	1
E87A13-95-10	E87A13	<i>Astysis gausapata</i>	0.1	1
E87A13-95-11	E87A13	<i>Margarites helicinus</i>	0.1	1
E87A13-95-12	E87A13	<i>Rhabdus rectius</i>	0.1	1 frag
E87A13-95-13	E87A13	<i>Rhabdus rectius</i>	0.1	1 frag
E87A13-95-14	E87A13	<i>Nitidiscala catalinensis</i>	0.1	1
E87A13-95-15	E87A13	<i>Embiotocidae</i> or <i>Scorpaenidae</i> sp. adult	0.1	1 scale
E87A13-86-1	E87A13	<i>Olivella</i> sp.	0.1	
E87A13-95-16	E87A13	plant & wood	0.1	12 frag's
E87A13-105-1	E87A13	<i>Macoma calcarea</i>	0.6	1
E87A13-105-2	E87A13	<i>Compsomyx subdiaphana</i>	2.1	~1, in 6 frag's
E87A13-105-3	E87A13	<i>Astysis gausapata</i>	0.2	1
E87A13-105-4	E87A13	<i>Epitoniidae</i> sp.	0.1	1 frag
E87A13-105-5	E87A13	plant & wood	0.1	6 frag's
E87A13-105-6	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-118-1	E87A13	<i>Macoma calcarea</i>	0.7	1
E87A13-118-2	E87A13	<i>Macoma calcarea</i>	0.1	~1
E87A13-118-3	E87A13	<i>Macoma calcarea</i>	0.3	1 frag
E87A13-118-4	E87A13	<i>Pandora</i> sp.	0.1	~1
E87A13-118-5	E87A13	<i>Pandora</i> sp.	0.1	4 frag's
E87A13-118-6	E87A13	<i>Chlamys rubida</i>	0.1	1 frag
E87A13-118-7	E87A13	<i>Yolida seminuda</i>	0.8	~1
E87A13-118-8	E87A13	<i>Yolida seminuda</i>	0.3	~1
E87A13-118-9	E87A13	<i>Yolida seminuda</i>	0.5	3 frag's
E87A13-118-10	E87A13	unidentified bivalve frag's	0.5	13 frag's
E87A13-118-11	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-118-12	E87A13	unknown	0.1	1
E87A13-118-13	E87A13	plant & wood	0.1	3 frag's
E87A13-134-1	E87A13	<i>Tellina</i> sp.?	0.1	1
E87A13-134-2	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-3	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-4	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-5	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-6	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-7	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-8	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-9	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-10	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-11	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-12	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-13	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-14	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-134-15	E87A13	unknown	0.1	18 frag's
E87A13-134-16	E87A13	unidentified bivalve frag's	0.1	4 frag's
E87A13-154-1	E87A13	<i>Diplodonta impolita</i>	0.1	2 artic'd
E87A13-154-2	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-154-3	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-154-4	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-154-5	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-154-6	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-154-7	E87A13	unknown	0.1	8 frag's
E87A13-154-8	E87A13	unknown	0.1	1 frag
E87A13-154-9	E87A13	plant & wood	0.1	frag's
E87A13-154-10	E87A13	<i>Clupea harengus</i> - Pacific herring	0.1	1 vertebrae

E87A13-171-1	E87A13	<i>Nucula tenuis</i>	0.1	1
E87A13-171-2	E87A13	<i>Nucula tenuis</i>	0.1	3 frag's
E87A13-171-3	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-171-4	E87A13	<i>Diplodonta impolita</i>	0.1	1
E87A13-171-5	E87A13	<i>Nuculana perula</i>	0.2	2 artic'd
E87A13-171-6	E87A13	unidentified bivalve frag's	0.4	15 frag's
E87A13-171-7	E87A13	plant & wood	0.1	8 frag's
E87A13-182-1	E87A13	unidentified bivalve frag's	0.2	15 frag's
E87A13-182-2	E87A13	unknown	0.1	5 frag's
E87A13-182-3	E87A13	unknown	0.1	1 frag
E87A13-182-4	E87A13	plant & wood	0.1	3 frag's
E87A13-204-1	E87A13	unidentified bivalve frag's	0.1	3 frag's
E87A13-204-2	E87A13	plant & wood	0.1	9 frag's
E87A13-204-3	E87A13	fish scale?	0.1	2
E87A13-205-1	E87A13	unidentified bivalve frag's	0.1	2 frag's
E87A13-205-2	E87A13	plant & wood	0.1	8 frag's
Total weight (grams) E87A13			16.7	
E87A22-51-1	E87A22	<i>Glans carpenteri</i>	0.1	~1
E87A22-51-2	E87A22	<i>Glans carpenteri</i>	0.1	1
E87A22-51-3	E87A22	<i>Glans carpenteri</i>	0.1	1
E87A22-51-4	E87A22	<i>Glans carpenteri</i>	0.1	4 frag's
E87A22-51-5	E87A22	<i>Chlamys</i> sp.	0.1	3 frag's
E87A22-51-6	E87A22	<i>Nuculana</i> sp.	0.1	~2 artic'd
E87A22-51-7	E87A22	<i>Nassarius mendicus</i>	0.1	1
E87A22-51-8	E87A22	<i>Amphissa columbiana</i>	0.1	1
E87A22-51-9	E87A22	<i>Amphissa columbiana</i>	0.1	1
E87A22-51-10	E87A22	<i>Amphissa columbiana</i>	0.1	1
E87A22-51-11	E87A22	<i>Amphissa columbiana</i>	0.1	1
E87A22-51-12	E87A22	<i>Amphissa columbiana</i>	0.1	~1
E87A22-51-13	E87A22	<i>Pododesmus machrochisma</i>	0.1	~1
E87A22-51-14	E87A22	<i>Pododesmus machrochisma</i>	0.1	~1
E87A22-51-15	E87A22	<i>Petalaconchus compactus</i>	0.8	1
E87A22-51-16	E87A22	<i>Petalaconchus compactus</i>	0.7	1
E87A22-51-17	E87A22	<i>Petalaconchus compactus</i>	0.3	1
E87A22-51-18	E87A22	<i>Petalaconchus compactus</i>	0.3	1
E87A22-51-19	E87A22	<i>Petalaconchus compactus</i>	0.1	4 frag's
E87A22-51-20	E87A22	<i>Cranopsis cucullata</i>	0.1	1
E87A22-51-21	E87A22	<i>Cranopsis cucullata</i>	0.1	1
E87A22-51-22	E87A22	<i>Acmaea mitra</i>	0.1	1
E87A22-51-23	E87A22	<i>Epitonium indianorum</i>	0.1	1 - 2 frag's
E87A22-51-24	E87A22	sea urchin spines	0.1	2
E87A22-51-25	E87A22	sponge	0.1	1 frag
E87A22-51-26	E87A22	coral	0.1	8 frag's
E87A22-51-27	E87A22	<i>Balanus</i> spp.	0.2	11 frag's
E87A22-51-28	E87A22	unidentified bivalve frag's	0.1	8 frag's
E87A22-51-29	E87A22	unidentified gastropod frag	0.1	1 frag
E87A22-84-1	E87A22	<i>Saxidomus giganteus</i>	1.2	~1
E87A22-84-2	E87A22	<i>Saxidomus giganteus</i>	0.1	1
E87A22-84-3	E87A22	<i>Saxidomus giganteus</i>	0.1	1
E87A22-84-4	E87A22	<i>Saxidomus giganteus</i>	3.1	6 frag's
E87A22-84-5	E87A22	<i>Amphissa columbiana</i>	0.1	1
E87A22-84-6	E87A22	<i>Nuculana minuta</i>	0.2	2 artic'd
E87A22-84-7	E87A22	<i>Euspira pallida</i>	0.1	~1
E87A22-84-8	E87A22	<i>Balanus</i> spp.	0.7	22 frag's
E87A22-84-9	E87A22	unidentified bivalve frag's	0.1	5 frag's
E87A22-84-10	E87A22	<i>Hiatella</i> sp.	0.1	~1
E87A22-84-11	E87A22	Plant & wood	0.1	13 frag's
E87A22-103-1	E87A22	<i>Nutricula lordi</i>	0.1	1
E87A22-103-2	E87A22	<i>Chlamys</i> sp.	0.1	1 frag
E87A22-103-3	E87A22	<i>Balanus</i> spp.	0.1	7 frag's
E87A22-103-4	E87A22	unidentified bivalve frag's	0.1	6 frag's
E87A22-103-5	E87A22	wood	0.1	22 frag's
E87A22-115-1	E87A22	<i>Balanus cariosus</i>	0.1	1 scutum

E87A22-115-2	E87A22	<i>Balanus cariosus</i>	0.1	1 scutum
E87A22-115-3	E87A22	<i>Balanus</i> spp.	0.1	6 frag's
E87A22-115-4	E87A22	unidentified bivalve frag's	0.1	5 frag's
E87A22-115-5	E87A22	<i>Nutricula lordi</i>	0.1	-1
E87A22-115-6	E87A22	wood	0.3	10 frag's
E87A22-121-1	E87A22	<i>Amphissa columbiana</i>	0.1	1
E87A22-121-2	E87A22	<i>Protothaca staminea</i>	0.1	1 frag
E87A22-121-3	E87A22	unidentified bivalve frag's	0.2	5 frag's
E87A22-121-4	E87A22	<i>Balanus glandulus</i>	0.1	1 tergum
E87A22-121-5	E87A22	unidentified bivalve frag's	0.3	17 frag's
E87A22-121-6	E87A22	<i>Neptunea lyrata</i>	0.1	1
E87A22-121-7	E87A22	charcoal	0.2	4 frag's
E87A22-121-8	E87A22	Plant & wood	0.1	5 frag's
Total weight (grams) E87A22			13.1	
E87A23-14-1	E87A23	<i>Pandora filosa</i>	0.1	-1
E87A23-14-2	E87A23	<i>Acila castrensis</i>	0.1	-1
E87A23-14-3	E87A23	<i>Acila castrensis</i>	0.1	-1 - 3 frag's
E87A23-14-4	E87A23	<i>Yoldia</i> sp.	0.1	-1
E87A23-14-5	E87A23	<i>Olivella biplicata</i>	0.1	1
E87A23-14-6	E87A23	<i>Balanus</i> sp.	0.1	-1
E87A23-14-7	E87A23	<i>Balanus</i> sp.	0.1	-1
E87A23-14-8	E87A23	unidentified bivalve frag's	0.1	2 + 2 frag's
E87A23-14-9	E87A23	wood	0.1	1
E87A23-23-1	E87A23	<i>Acila castrensis</i>	0.1	-1 - 2 frag's
E87A23-23-2	E87A23	<i>Lucinoma annulatum</i>	0.1	1 frag
E87A23-23-3	E87A23	<i>Lucinoma annulatum</i>	0.1	-1
E87A23-23-4	E87A23	<i>Mytilus</i> sp.	0.1	1 frag
E87A23-23-5	E87A23	unidentified bivalve frag's	0.1	1
E87A23-23-6	E87A23	unidentified bivalve frag's	0.1	1
E87A23-23-7	E87A23	unidentified bivalve frag's	0.1	1
E87A23-23-8	E87A23	unidentified bivalve frag's	0.1	1
E87A23-23-9	E87A23	unidentified bivalve frag's	0.1	1 frag
E87A23-23-10	E87A23	unidentified bivalve frag's	0.1	3 frag's
E87A23-23-11	E87A23	unidentified gastropod frag's	0.2	6 frag's
E87A23-23-12	E87A23	<i>Balanus</i> sp.	0.1	2 frag's
E87A23-23-13	E87A23	wood	0.1	1 frag
E87A23-51-1	E87A23	wood	0.1	4 frag's
E87A23-175-1	E87A23	lithic flakes (sharp edged, little travel)	0.1	2 flakes
Total weight (grams) E87A23			2.5	
E87A4-25-1	E87A4	<i>Rhabdus rectius</i>	0.1	1 frag
E87A4-25-2	E87A4	plant & wood	0.1	8 frag's
E87A4-65-1	E87A4	unidentified bivalve frag's	0.1	1 frag
E87A4-65-2	E87A4	plant & wood	0.1	2 frag's
E87A4-85-1	E87A4	plant & wood	0.1	6 frag's
E87A4-140-1	E87A4	unidentified bivalve frag's	0.1	4 frag's
E87A4-140-2	E87A4	plant & wood	0.1	9 frag's
E87A4-164-1	E87A4	<i>Tellina modesta</i>	0.1	-1
E87A4-164-2	E87A4	unidentified bivalve frag's	0.1	7 frag's
E87A4-164-3	E87A4	plant & wood	0.1	31 frag's
Total weight (grams) E87A4			1	
E88B24-26-1	E88B24	<i>Parvalucina tenuisculpta</i>	0.1	1
E88B24-26-2	E88B24	<i>Nuculana</i> sp.	0.1	-1
E88B24-26-3	E88B24	<i>Nuculana</i> sp.	0.1	3 frag's
E88B24-26-4	E88B24	unidentified bivalve frag's	3.2	59 frag's
E88B24-26-5	E88B24	<i>Mytilus</i> sp.	0.1	2 frag's
E88B24-26-6	E88B24	sea urchin	0.1	8 spines
E88B24-26-7	E88B24	<i>Balanus</i> spp.	0.2	8 frag's
E88B24-26-8	E88B24	foraminifera	0.1	1
E88B24-26-9	E88B24	foraminifera	0.1	1
E88B24-26-10	E88B24	wood	0.3	31 frag's
E88B24-26-11	E88B24	<i>Clupea harengus pallasii</i> scale	0.1	1

E88B24-26-12	E88B24	<i>cf. Theragra chalcogramma vetebrae</i>	0.1	1
E88B24-67-1	E88B24	<i>Macoma calcaria</i>	2.8	1
E88B24-67-2	E88B24	<i>Macoma calcaria</i>	2	-1
E88B24-67-3	E88B24	<i>Macoma sp.</i>	0.7	5 frag's
E88B24-67-4	E88B24	wood	0.1	2 frag's
E88B24-100-1	E88B24	unidentified bivalve frag's	1.3	18 frag's
E88B24-133-1	E88B24	<i>Macoma calcaria</i>	1.2	-1 in 3 frag's
E88B24-133-2	E88B24	unidentified bivalve frag's	2.1	18 frag's
E88B24-150-1	E88B24	unidentified bivalve frag's	0.2	5 frag's
E88B24-150-2	E88B24	unidentified gastropod frag's	0.1	-1
Total weight (grams) E88B24			15.1	
E88B29-24-1	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-2	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-3	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-4	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-5	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-6	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-7	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-8	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-9	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-24-10	E88B29	<i>Tellina nukuloides</i>	0.1	1 frag
E88B29-24-11	E88B29	<i>Chlamys sp.</i>	0.1	1 frag
E88B29-24-12	E88B29	<i>Balanus sp.</i>	0.1	5 frag's
E88B29-24-13	E88B29	unidentified bivalve frag's	0.1	2 frag's
E88B29-24-14	E88B29	sea urchin spine	0.1	1
E88B29-24-15	E88B29	fish scale	0.1	1
E88B29-24-16	E88B29	plant frag's	0.1	3 frag's
E88B29-51-1	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-51-2	E88B29	<i>Tellina nukuloides</i>	0.1	-1
E88B29-51-3	E88B29	unidentified bivalve frag's	0.1	3 frag's
E88B29-51-4	E88B29	<i>Balanus spp.</i>	0.1	6 frag's
E88B29-74-1	E88B29	<i>Saxidomus giganteus</i>	0.3	-1-2 frag's
E88B29-74-2	E88B29	<i>Saxidomus giganteus</i>	0.1	-1
E88B29-74-3	E88B29	<i>Saxidomus giganteus</i>	0.7	14 frag's
E88B29-74-4	E88B29	<i>Macoma sp.</i>	0.7	2 frag's
E88B29-74-5	E88B29	<i>Balanus spp.</i>	0.1	11 frag's
E88B29-74-6	E88B29	plant & wood	0.1	4 frag's
E88B29-86-1	E88B29	<i>Balanus sp.</i>	0.1	2 frag's
E88B29-89-1	E88B29	<i>Saxidomus giganteus</i>	0.1	-1
E88B29-89-2	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-89-3	E88B29	<i>Balanus spp.</i>	0.1	17 frag's
E88B29-89-4	E88B29	unidentified bivalve frag's	0.1	2 frag's
E88B29-89-5	E88B29	plant & wood	0.1	4 frag's
E88B29-96-1	E88B29	<i>Olivella baetica</i>	0.4	1
E88B29-113-1	E88B29	<i>Tellina nukuloides</i>	0.2	1
E88B29-113-2	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-113-3	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-113-4	E88B29	<i>Tellina nukuloides</i>	0.1	2 frag's
E88B29-113-5	E88B29	<i>Tellina nukuloides</i>	0.1	-1
E88B29-113-6	E88B29	<i>Balanus spp.</i>	0.1	12 frag's
E88B29-113-7	E88B29	<i>Polinices lewisii</i>	1.8	2 frag's
E88B29-113-8	E88B29	charcoal	0.2	2 frag's
E88B29-121-1	E88B29	<i>Olivella baetica</i>	0.3	1
E88B29-123-1	E88B29	<i>Tellina nukuloides</i>	0.2	1
E88B29-123-2	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-3	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-4	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-5	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-6	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-7	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-8	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-9	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-10	E88B29	<i>Tellina nukuloides</i>	0.1	1

E88B29-123-11	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-12	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-13	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-14	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-15	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-16	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-17	E88B29	<i>Tellina nukuloides</i>	0.1	1
E88B29-123-18	E88B29	<i>Tellina nukuloides</i>	0.1	~1
E88B29-123-19	E88B29	<i>Tellina nukuloides</i>	0.1	2 frag's
E88B29-123-20	E88B29	<i>Olivella baetica</i>	0.1	1
E88B29-123-21	E88B29	<i>Olivella baetica</i>	0.1	1
E88B29-123-22	E88B29	<i>Mytilus sp.</i>	0.1	~1-2 frag's
E88B29-123-23	E88B29	<i>Balanus pp.</i>	0.6	26 frag's
E88B29-123-24	E88B29	charcoal	0.1	1 frag
E88B29-123-25	E88B29	unknown	0.1	1
Total weight (garms) E88B29			11.1	
E88B30-43-1	E88B30	unidentified bivalve fragments	0.1	6 frag's
E88B30-43-2	E88B30	charcoal	0.1	20 frag's
E88B30-43-3	E88B30	wood	0.1	16 frag's
E88B30-60-1	E88B30	<i>Thracia trapezoides</i>	0.1	~1 in 5 frag's
E88B30-60-2	E88B30	<i>Mytilus sp.</i>	0.1	2 frag's
E88B30-60-3	E88B30	unidentified bivalve fragments	0.1	1 frag
E88B30-60-4	E88B30	charcoal	0.2	49 frag's
E88B30-60-5	E88B30	wood	0.4	26 frag's
E88B30-73-1	E88B30	<i>Saxidomus giganteus</i>	1.6	3 frag's
E88B30-73-2	E88B30	unidentified bivalve fragments	0.1	1 frag
E88B30-73-3	E88B30	charcoal	0.1	3 frag's
E88B30-73-4	E88B30	wood	0.1	2 frag's
E88B30-73-5	E88B30	sand globules	0.1	4
E88B30-82	E88B30	charcoal	0.1	5 frag's
E88B30-83	E88B30	wood & plant	0.1	9 frag's
E88B30-105-1	E88B30	unidentified bivalve fragments	0.1	2 frag's
E88B30-105-2	E88B30	charcoal	0.1	2 frag's
E88B30-105-3	E88B30	wood	0.1	1 frag
E88B30-122-1	E88B30	unidentified bivalve fragments	0.1	11 frag's
E88B30-122-2	E88B30	charcoal	0.1	9 frag's
E88B30-122-3	E88B30	wood & plant	0.1	52 frag's
E88B30-136-1	E88B30	charcoal	0.1	5 frag's
E88B30-136-2	E88B30	wood	0.1	11 frag's
Total weight (grams) E88B30			4.2	
E88B53-30-1	E88B53	<i>Balanus sp.</i>	0.1	1 frag
E88B53-30-2	E88B53	unidentified bivalve frag's	0.1	13 frag's
E88B53-30-3	E88B53	sea urchin spine	0.1	~3
E88B53-30-4	E88B53	unknown	0.1	2
E88B53-30-5	E88B53	wood	0.1	2 frag's
E88B53-32-1	E88B53	<i>Hiatella pholadis</i>	0.1	~1
E88B53-32-2	E88B53	<i>Hiatella pholadis</i>	0.1	~1
E88B53-32-3	E88B53	<i>Hiatella pholadis</i>	0.1	~1
E88B53-32-4	E88B53	<i>Hiatella pholadis</i>	0.1	~1
E88B53-32-5	E88B53	<i>Hiatella pholadis</i>	0.1	4 frag's
E88B53-32-6	E88B53	<i>Tellina nukuloides</i>	0.1	1
E88B53-32-7	E88B53	<i>Tellina nukuloides</i>	0.1	~1
E88B53-32-8	E88B53	<i>Tellina nukuloides</i>	0.1	~1
E88B53-32-9	E88B53	<i>Tellina nukuloides</i>	0.1	~1
E88B53-32-10	E88B53	<i>Tellina nukuloides</i>	0.1	1
E88B53-32-11	E88B53	<i>Tellina nukuloides</i>	0.1	1
E88B53-32-12	E88B53	<i>Tellina nukuloides</i>	0.1	1
E88B53-32-13	E88B53	<i>Tellina nukuloides</i>	0.1	~1
E88B53-32-14	E88B53	<i>Tellina nukuloides</i>	0.1	1
E88B53-32-15	E88B53	<i>Tellina nukuloides</i>	0.1	~1
E88B53-32-16	E88B53	<i>Tellina nukuloides</i>	0.4	12 frag's
E88B53-32-17	E88B53	<i>Mactromeris polynyma (cf.)</i>	0.1	~1

E88B53-32-18	E88B53	<i>Balanus</i> spp.	0.7	23 frag's
E88B53-32-19	E88B53	unidentified bivalve frag's	0.2	10 frag's
E88B53-56-1	E88B53	<i>Nuculana</i> sp.	0.1	~1
E88B53-56-2	E88B53	<i>Nuculana</i> sp.	0.1	1 in 2 frag's
E88B53-56-3	E88B53	<i>Nuculana</i> sp.	0.1	1 frag
E88B53-56-4	E88B53	<i>Pododesmus machrochisma</i>	0.1	1 frag
E88B53-56-5	E88B53	<i>Mytilus</i> sp.	0.1	1 frag
E88B53-56-6	E88B53	unidentified bivalve frag's	1.8	46 frag's
E88B53-56-7	E88B53	<i>Balanus</i> spp.	0.5	5 frag's
E88B53-56-8	E88B53	<i>Cidarina cidaris</i>	0.1	1 frag
E88B53-56-9	E88B53	sea urchin spine	0.1	10
E88B53-56-10	E88B53	coral	0.1	1 frag
E88B53-56-11	E88B53	coniferous needle	0.1	1
E88B53-56-12	E88B53	wood	0.1	6 frag's
E88B53-56-13	E88B53	calcified sand clump	2.2	2
E88B53-56-14	E88B53	<i>Clupea harengus pallasi</i>	0.1	1 scale
E88B53-69-1	E88B53	<i>Macoma moesta</i>	0.2	1+3 frag's artic'd
E88B53-69-2	E88B53	<i>Macoma</i> sp.	1.4	~2 artic'd in 10 frag's
E88B53-69-3	E88B53	<i>Cyclocardia ventricosa</i>	0.1	1 frag
E88B53-69-4	E88B53	<i>Balanus crenatus</i>	0.1	1 scutum
E88B53-69-5	E88B53	<i>Balanus crenatus</i>	0.1	1 scutum
E88B53-69-6	E88B53	<i>Balanus crenatus</i>	0.1	1 scutum
E88B53-69-7	E88B53	<i>Balanus</i> spp.	0.4	31 frag's
E88B53-69-8	E88B53	coral	0.1	1 frag
E88B53-69-9	E88B53	sea urchin spine	0.1	5
E88B53-69-10	E88B53	unidentified bivalve frag's	0.2	10 frag's
E88B53-85-1	E88B53	<i>Mya truncata</i>	8.5	~1 in 2 frag's
E88B53-85-2	E88B53	<i>Mya truncata</i>	1.6	~1 in 3 frag's
E88B53-85-3	E88B53	<i>Mya truncata</i>	1	4 frag's
E88B53-85-4	E88B53	<i>Macoma incongrua</i>	1.1	~1
E88B53-85-5	E88B53	<i>Macoma incongrua</i>	0.9	~1
E88B53-85-6	E88B53	<i>Macoma</i> sp.	0.7	4 frag's
E88B53-85-7	E88B53	<i>Modiolus</i> sp.	1.4	25 frag's
E88B53-85-8	E88B53	<i>Balanus glandulus</i>	0.1	1 scutum
E88B53-85-9	E88B53	<i>Balanus</i> spp.	2	24 frag's
E88B53-85-10	E88B53	coral	0.8	6 frag's
E88B53-85-11	E88B53	unidentified bivalve frag's	0.5	13 frag's
E88B53-85-12	E88B53	organic	0.8	6 frag's
E88B53-85-13	E88B53	wood	0.2	6 frag's
E88B53-85-14	E88B53	sea urchin spine	0.1	1
E88B53-85-15	E88B53	<i>Trichotropis cancellata</i>	0.1	1
E88B53-94-1	E88B53	<i>Macoma incongrua</i>	0.1	1
E88B53-94-2	E88B53	<i>Modiolus rectus</i>	3.6	20 frag's
E88B53-94-3	E88B53	<i>Balanus</i> spp.	0.2	3 frag's
E88B53-94-4	E88B53	sea urchin spine	0.1	5
E88B53-94-5	E88B53	sand dollar	0.1	1 frag
E88B53-94-6	E88B53	<i>Petalaconchus compactus</i>	0.1	2 frag's
E88B53-94-7	E88B53	unidentified bivalve frag's	0.5	10 frag's
E88B53-108-1	E88B53	<i>Petalaconchus compactus</i>	5.3	11 frag's
E88B53-108-2	E88B53	<i>Modiolus rectus</i>	1.1	3 frag's
E88B53-108-3	E88B53	coral	0.1	1 frag
E88B53-108-4	E88B53	unidentified bivalve frag's	0.1	2 frag's
E88B53-108-5	E88B53	<i>Trichotropis cancellata</i>	0.3	1
E88B53-136-1	E88B53	<i>Modiolus rectus</i>	8.3	25 frag's
E88B53-136-2	E88B53	<i>Petalaconchus compactus</i>	2	13 frag's
E88B53-136-3	E88B53	<i>Trichotropis cancellata</i>	0.1	1
E88B53-136-4	E88B53	sea urchin spine	0.1	2
E88B53-136-5	E88B53	<i>Balanus</i> sp.	0.1	2 frag's
E88B53-136-6	E88B53	coral	0.1	1 frag
E88B53-136-7	E88B53	unidentified bivalve frag's	0.1	5 frag's
E88B53-150-1	E88B53	<i>Modiolus rectus</i>	1.3	4 frag's
E88B53-150-2	E88B53	<i>Yoldia</i> sp.	0.2	~1
E88B53-150-3	E88B53	<i>Balanus glandulus</i>	0.5	11 scutum
E88B53-150-4	E88B53	<i>Balanus crenatus</i>	0.1	1 tergum

E88B53-150-5	E88B53	<i>Balanus</i> spp.	1.9	43 frag's
E88B53-150-6	E88B53	sea urchin spine	0.1	4
E88B53-150-7	E88B53	unidentified gastropod frag	0.1	1 frag
E88B53-150-8	E88B53	unidentified bivalve frag's	0.9	25 frag's
E88B53-169-1	E88B53	<i>Hiatella pholadis</i>	0.1	1
E88B53-169-2	E88B53	<i>Hiatella pholadis</i>	0.1	~1 in 2 frag's
E88B53-169-3	E88B53	<i>Hiatella pholadis</i>	0.1	1 frag
E88B53-169-4	E88B53	sea urchin spine	0.1	1
E88B53-169-5	E88B53	unidentified bivalve frag's	0.4	16 frag's
E88B53-192-1	E88B53	<i>Macoma calcarea</i>	6.2	2 artic'd
E88B53-192-2	E88B53	<i>Macoma calcarea</i>	0.9	~1
E88B53-192-3	E88B53	<i>Macoma calcarea</i>	0.5	4 frag's
E88B53-192-4	E88B53	<i>Balanus</i> spp.	0.1	5 frag's
E88B53-192-5	E88B53	unidentified bivalve frag's	0.3	11 frag's
Total weight (grams) E88B53			67.9	
E88B54-20-1	E88B54	bivalve siphon	29.4	1 siphon
E88B54-60-1	E88B54	<i>Simomactra falcata</i>	6.5	~1
E88B54-60-2	E88B54	<i>Simomactra falcata</i>	8.2	~1 in 3 frag's
E88B54-60-3	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-60-4	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-60-5	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-60-6	E88B54	<i>Pectinidae</i> sp.	0.1	~1
E88B54-60-7	E88B54	<i>Balanus</i> sp.	0.1	2 frag's
E88B54-60-8	E88B54	unidentified bivalve frag's	0.3	11 frag's
E88B54-60-9	E88B54	unknown	0.1	7
E88B54-60-10	E88B54	unknown	0.1	1
E88B54-80-1	E88B54	<i>Simomactra falcata</i>	0.1	~1
E88B54-80-2	E88B54	<i>Simomactra falcata</i>	0.1	~1
E88B54-80-3	E88B54	<i>Simomactra falcata</i>	0.1	~1
E88B54-80-4	E88B54	<i>Simomactra falcata</i>	0.1	~1
E88B54-80-5	E88B54	<i>Simomactra falcata</i>	5.1	6 frag's
E88B54-80-6	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-7	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-8	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-9	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-10	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-11	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-12	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-13	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-14	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-15	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-16	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-17	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-18	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-19	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-20	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-21	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-22	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-23	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-24	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-25	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-26	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-27	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-28	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-29	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-30	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-31	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-32	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-80-33	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-34	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-35	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-36	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-37	E88B54	<i>Tellina nukuloides</i>	0.1	~1

E88B54-80-38	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-39	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-40	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-41	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-80-42	E88B54	<i>Tellina nukuloides</i>	0.1	3 frag's
E88B54-80-43	E88B54	<i>Mytilus trossulus</i>	0.1	2 frag's
E88B54-80-44	E88B54	<i>Margarites helicinus</i>	0.1	1
E88B54-80-45	E88B54	<i>Balanus crenatus</i>	0.1	2 scutum
E88B54-80-46	E88B54	<i>Balanus glandulus</i>	0.1	2 scutum
E88B54-80-47	E88B54	<i>Balanus spp.</i>	0.6	17 frag's
E88B54-80-48	E88B54	unidentified bivalve frag's	0.1	11 frag's
E88B54-80-49	E88B54	unidentified gastropod frag's	0.1	1 frag
E88B54-96-1	E88B54	<i>Simomactra falcata</i>	1.9	~1
E88B54-96-2	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-96-3	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-96-4	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-96-5	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-96-6	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-96-7	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-96-8	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-96-9	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-96-10	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-96-11	E88B54	<i>Tellina nukuloides</i>	0.1	2 frag's
E88B54-96-12	E88B54	<i>Mytilus trossulus</i>	0.1	1 frag
E88B54-96-13	E88B54	<i>Balanus crenatus</i>	0.1	2 scutum
E88B54-96-14	E88B54	<i>Balanus spp.</i>	0.1	5 frag's
E88B54-96-15	E88B54	unidentified bivalve frag's	0.1	4 frag's
E88B54-96-16	E88B54	plant	0.1	1 frag
E88B54-102-1	E88B54	<i>Mytilimeria nuttalli</i>	0.1	1
E88B54-102-2	E88B54	<i>Mytilimeria nuttalli</i>	0.1	1
E88B54-102-3	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-102-4	E88B54	<i>Tellina nukuloides</i>	0.1	3 frag's
E88B54-102-5	E88B54	<i>Balanus spp.</i>	0.1	6 frag's
E88B54-102-6	E88B54	unidentified bivalve frag's	0.1	5 frag's
E88B54-128-1	E88B54	<i>Saxidomus giganteus</i>	18	~1
E88B54-128-2	E88B54	<i>Saxidomus giganteus</i>	2.5	2 frag's
E88B54-128-3	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-128-4	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-128-5	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-128-6	E88B54	<i>Tellina nukuloides</i>	0.1	1
E88B54-128-7	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-128-8	E88B54	<i>Tellina nukuloides</i>	0.1	~1
E88B54-128-9	E88B54	<i>Tellina nukuloides</i>	0.1	5 frag's
E88B54-128-10	E88B54	<i>Margarites helicinus</i>	0.1	~1
E88B54-128-11	E88B54	<i>Balanus spp.</i>	0.3	6 frag's
E88B54-128-12	E88B54	<i>Mytilimeria nuttalli</i>	0.1	1
E88B54-128-13	E88B54	unidentified bivalve frag's	1.5	15 frag's
E88B54-177-1	E88B54	<i>Saxidomus giganteus (cf)</i>	0.8	1 frag
E88B54-177-2	E88B54	<i>Clinocardium sp.</i>	0.4	1 frag
E88B54-177-3	E88B54	unidentified bivalve frag's	4.4	16 frag's
Total weight (grams) E88B54			88.3	
E88B55-49-1	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-49-2	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-49-3	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-49-4	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-49-5	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-49-6	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-49-7	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-49-8	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-49-9	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-49-10	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-49-11	E88B55	<i>Hiatella pholadis</i>	0.1	~1
E88B55-49-12	E88B55	<i>Hiatella pholadis</i>	0.1	1 frag

E88B55-49-13	E88B55	<i>Tellina bodegensis</i>	0.1	1
E88B55-49-14	E88B55	<i>Mytilus trossulus</i>	0.1	5 frag's
E88B55-49-15	E88B55	<i>Nucella lamellosa</i>	1.1	1 frag
E88B55-49-16	E88B55	<i>Balanus crenatus</i>	0.1	5 scutum
E88B55-49-17	E88B55	<i>Balanus spp.</i>	2	48 frag's
E88B55-49-18	E88B55	unidentified bivalve frag's	0.2	2 frag's
E88B55-49-19	E88B55	unidentified gastropod frag's	0.1	1 frag
E88B55-49-20	E88B55	unknown	0.1	3
E88B55-58-1	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-58-2	E88B55	<i>Tellina nukuloides</i>	0.1	1 frag
E88B55-58-3	E88B55	<i>Balanus crenatus</i>	0.1	2 scutum
E88B55-58-4	E88B55	<i>Balanus spp.</i>	0.1	5 frag's
E88B55-80-1	E88B55	<i>Mytilus trossulus</i>	0.1	~1
E88B55-80-2	E88B55	<i>Mytilus trossulus</i>	0.1	~1
E88B55-80-3	E88B55	<i>Mytilus trossulus</i>	0.1	14 frag's
E88B55-80-4	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-80-5	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-80-6	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-80-7	E88B55	<i>Tellina nukuloides</i>	0.1	1 frag
E88B55-80-8	E88B55	<i>Balanus crenatus</i>	0.1	9 scutum
E88B55-80-9	E88B55	<i>Balanus crenatus</i>	0.1	2 tergum
E88B55-80-10	E88B55	<i>Balanus spp.</i>	1.1	41 frag's
E88B55-80-11	E88B55	<i>Trichotropis cancellata</i>	0.1	1
E88B55-80-12	E88B55	unidentified bivalve frag's	0.1	2 frag's
E88B55-80-13	E88B55	unidentified gastropod frag's	0.1	1 frag
E88B55-95-1	E88B55	<i>Mytilus trossulus</i>	0.1	~1
E88B55-95-2	E88B55	<i>Mytilus trossulus</i>	0.1	9 frag's
E88B55-95-3	E88B55	<i>Balanus crenatus</i>	0.1	4 scutum
E88B55-95-4	E88B55	<i>Balanus crenatus</i>	0.1	1 tergum
E88B55-95-5	E88B55	<i>Mytilimeria nuttalli</i>	0.1	1
E88B55-95-6	E88B55	<i>Mytilimeria nuttalli</i>	0.1	1
E88B55-95-7	E88B55	<i>Balanus spp.</i>	0.6	37 frag's
E88B55-113-1	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-113-2	E88B55	<i>Tellina nukuloides</i>	0.1	1
E88B55-113-3	E88B55	<i>Tellina nukuloides</i>	0.1	~1
E88B55-113-4	E88B55	<i>Tellina nukuloides</i>	0.1	2 frag's
E88B55-113-5	E88B55	<i>Mytilus trossulus</i>	0.1	~1
E88B55-113-6	E88B55	<i>Mytilus trossulus</i>	0.1	~1
E88B55-113-7	E88B55	<i>Mytilus trossulus</i>	0.1	~1
E88B55-113-8	E88B55	<i>Mytilus trossulus</i>	0.1	~1
E88B55-113-9	E88B55	<i>Mytilus trossulus</i>	0.2	35 frag's
E88B55-113-10	E88B55	<i>Balanus crenatus</i>	0.3	20 scutum
E88B55-113-11	E88B55	<i>Balanus crenatus</i>	0.2	8 tergum
E88B55-113-12	E88B55	<i>Balanus spp.</i>	3.6	152 frag's
E88B55-113-13	E88B55	<i>Platyodon cancellatus (cf)</i>	0.1	1 frag
E88B55-113-14	E88B55	<i>Neptunea lyrata</i>	0.1	1
E88B55-113-15	E88B55	unidentified bivalve frag's	0.2	7 frag's
E88B55-113-16	E88B55	charcoal	0.1	2 frag's
E88B55-113-17	E88B55	wood	0.1	3 frag's
E88B55-135-1	E88B55	<i>Protothaca staminea</i>	0.1	~1
E88B55-135-2	E88B55	<i>Protothaca staminea</i>	0.1	4 frag's
E88B55-135-3	E88B55	<i>Platyodon cancellatus</i>	0.5	4 frag's
E88B55-135-4	E88B55	<i>Saxidomus giganteus</i>	0.3	1 frag
E88B55-135-5	E88B55	<i>Mytilus trossulus</i>	0.1	2 frag's
E88B55-135-6	E88B55	<i>sea urchin</i>	0.1	1 frag
E88B55-135-7	E88B55	<i>Acmaea mitra</i>	0.1	1
E88B55-135-8	E88B55	<i>Balanus spp.</i>	0.3	10 frag's
E88B55-135-9	E88B55	unidentified bivalve frag's	2.2	31 frag's
E88B55-135-10	E88B55	unidentified gastropod frag's	0.1	1 frag
E88B55-142-1	E88B55	<i>Platyodon cancellatus</i>	0.1	7 frag's
E88B55-142-2	E88B55	<i>Platyodon cancellatus</i>	0.1	~1
E88B55-142-3	E88B55	<i>Balanus sp.</i>	0.1	2 frag's
E88B55-142-4	E88B55	unidentified bivalve frag's	0.7	23 frag's
E88B55-142-5	E88B55	unidentified gastropod frag's	0.2	4 frag's

		Total weight (grams) E88B55	19.7	
E92A21-50-1	E92A21	<i>Lucinoma annulatum</i>	0.2	-1
E92A21-50-2	E92A21	<i>Lucinoma annulatum</i>	0.6	15 frag's
E92A21-50-3	E92A21	<i>Balanus spp.</i>	0.1	1 frag
E92A21-50-4	E92A21	unidentified bivalve frag's	0.1	9 frag's
E92A21-50-5	E92A21	wood	0.1	4 frag's
E92A21-50-6	E92A21	charcoal	0.1	1 frag
E92A21-89-1	E92A21	<i>Protothaca staminea</i>	0.1	1
E92A21-89-2	E92A21	<i>Saxidomus giganteus</i>	0.6	-2 artic'd
E92A21-89-3	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-89-4	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-89-5	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-89-6	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-89-7	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-89-8	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-89-9	E92A21	<i>Mytilus trossulus</i>	0.2	11 frag's
E92A21-89-10	E92A21	<i>Balanus spp.</i>	0.4	18 frag's
E92A21-89-11	E92A21	sea urchin	0.1	1 spine
E92A21-89-12	E92A21	unidentified gastropod	0.1	3 + 1 frag
E92A21-89-13	E92A21	unidentified bivalve frag's	0.1	1 + 3 frag's
E92A21-89-14	E92A21	wood	0.2	2 frag's
E92A21-117-1	E92A21	<i>Veneridae sp.</i>	0.1	-1
E92A21-117-2	E92A21	<i>Veneridae sp.</i>	0.1	-1
E92A21-117-3	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-4	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-5	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-6	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-7	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-8	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-9	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-10	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-11	E92A21	<i>Mytilus trossulus</i>	0.1	-1
E92A21-117-12	E92A21	<i>Mytilus trossulus</i>	0.1	23 frag's
E92A21-117-13	E92A21	<i>Hiatella pholadis</i>	0.1	1
E92A21-117-14	E92A21	<i>Hiatella pholadis</i>	0.1	-1
E92A21-117-15	E92A21	<i>Hiatella pholadis</i>	0.1	-1
E92A21-117-16	E92A21	<i>Hiatella pholadis</i>	0.1	1 frag
E92A21-117-17	E92A21	<i>Balanus spp.</i>	0.7	23 frag's
E92A21-117-18	E92A21	<i>Acmaea mitra</i>	0.1	1
E92A21-117-19	E92A21	<i>Epitonium sp.</i>	0.1	-1 in 2 frag's
E92A21-117-20	E92A21	<i>Neptunea lyrata</i>	0.1	1
E92A21-117-21	E92A21	<i>Petalaoconchus compactus</i>	0.1	1 frag
E92A21-117-22	E92A21	sea urchin	0.1	4 frag's
E92A21-117-23	E92A21	unidentified bivalve frag's	0.1	3 frag's
E92A21-117-24	E92A21	unidentified gastropod	0.1	2 frag's
E92A21-117-25	E92A21	wood	0.1	1
E92A21-131-1	E92A21	organic	0.1	1 frag
E92A21-131-2	E92A21	calcite (?) crystals	0.1	12
E92A21-142-1	E92A21	plant -seaweed?	0.1	3 frag's
E92A21-170-1	E92A21	wood	0.1	2 frag's
E92A21-230-1	E92A21	wood or plant	0.1	2 frag's
		Total weight (grams) E92A21	7.2	
H816-245-1	H816	<i>Yoldia sp.</i>	0.1	2 frag's
H816-245-2	H816	<i>Dentaliidae sp.</i>	0.1	1 frag
H816-245-3	H816	unidentified bivalve frag's	0.1	5 frag's
H816-245-4	H816	foraminifera	0.1	3 +14 frag's
H816-364.5-1	H816	foraminifera	0.1	1+17 frag's
		Total weight (grams) H816	0.5	
H818-246-1	H818	<i>Clupea harengus pallasii</i> caudal vertebrae	0.1	1
H818-246-2	H818	unidentified bivalve frag's	1	25
H818-246-3	H818	<i>Balanus glandulus</i>	0.1	1 tergum

H818-246-4	H818	wood & plant	0.1	6 frag's
H818-256-1	H818	<i>Nuculana</i> sp.	0.1	-1
H818-256-2	H818	<i>Nuculana</i> sp.	0.1	1 frag
H818-256-3	H818	sea urchin spine	0.1	1 frag
H818-256-4	H818	<i>Macoma</i> sp.	0.4	2 frag's
H818-256-5	H818	unidentified bivalve frag's	0.2	18 frag's
H818-256-6	H818	wood & plant	0.1	5 frag's
H818-256-7	H818	<i>Sebastes</i> sp.	0.1	1
H818-256-8	H818	<i>Clupea harengus pallasii</i>	0.1	1 caudal vertebrae
H818-256-9	H818	<i>Cottidae</i> , <i>Gymnocranthus</i> or <i>Leptocottus</i>	0.1	pre-operculum spine
H818-256-10	H818	unknown	0.1	1
H818-266-1	H818	<i>Nuculana</i> sp.	0.3	1
H818-266-2	H818	<i>Nuculana</i> sp.	0.3	1 in 2 frag's
H818-266-3	H818	<i>Nuculana</i> sp.	0.1	3 frag's
H818-266-4	H818	<i>Nuculana</i> sp.	0.1	-1
H818-266-5	H818	<i>Nuculana</i> sp.	0.1	-1
H818-266-6	H818	<i>Macoma elimata</i>	0.3	5 frag's
H818-266-7	H818	<i>Macoma</i> sp.	0.1	-1 in 3 frag's
H818-266-8	H818	unidentified bivalve frag's	0.2	16 frag's
H818-266-9	H818	foraminifera	0.1	1
H818-266-10	H818	wood	0.1	2 frag's
H818-266-11	H818	<i>Nutricola lordi</i>	0.1	1
H818-276-1	H818	<i>Macoma</i> sp.	0.3	-1 in 2 frag's
H818-276-2	H818	<i>Macoma</i> sp.	0.5	-1 in 4 frag's
H818-276-3	H818	<i>Macoma</i> sp.	0.2	-1
H818-276-4	H818	<i>Macoma</i> sp.	0.4	1 frag
H818-276-5	H818	unidentified bivalve frag's	0.1	11 frag's
H818-286-1	H818	<i>Yoldia</i> sp.	0.3	-1 in 2 frag's
H818-286-2	H818	unidentified bivalve frag's	0.9	17 frag's
H818-286-3	H818	plant	0.1	3 frag's
H818-286-4	H818	foraminifera	0.1	1
H818-296-1	H818	<i>Nutricola lordi</i>	0.4	78 some articulated
H818-296-2	H818	<i>Yoldia</i> sp.	0.1	2 frag's
H818-296-3	H818	<i>Yoldia</i> sp.	0.1	-1
H818-296-4	H818	<i>Margarites beringensis</i>	0.1	-1
H818-296-5	H818	unidentified bivalve frag's	0.4	25 frag's
H818-296-6	H818	<i>Balanus</i> sp.	0.1	1 frag
H818-296-7	H818	foraminifera	0.1	2
H818-296-8	H818	<i>Capelin Mallotus villosus</i>	0.1	1 dentary
H818-306-1	H818	<i>Nutricola lordi</i>	0.1	43 some articulated
H818-306-2	H818	<i>Cottidae</i> sp. (cf.)	0.1	1 right quadrate
H818-306-3	H818	unidentified bivalve frag's	0.1	6 frag's
Total weight (grams) H818			9.1	
M934-58-1	M934	<i>Parvalucina tenuisculpta</i>	0.1	-1
M934-58-2	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-58-3	M934	<i>Parvalucina tenuisculpta</i>	0.1	-1
M934-58-4	M934	<i>Pododesmus machrochisma</i>	0.5	2 frag's
M934-58-5	M934	<i>Lucinoma annulatum</i>	0.1	2 frag's
M934-58-6	M934	<i>Mytilus</i> sp.	0.1	1 frag
M934-58-7	M934	unidentified bivalve frag's	0.1	6 frag's
M934-58-8	M934	unidentified gastropod frag's	0.1	1 frag
M934-58-9	M934	wood	0.4	8 frag's
M934-117-1	M934	<i>Mya</i> sp.	7.9	31 frag's; MNI 3
M934-117-2	M934	<i>Parvalucina tenuisculpta</i>	0.1	5
M934-117-3	M934	<i>Mytilus</i> sp.	0.1	3 frag's
M934-117-4	M934	<i>Chlamys rubida</i>	0.3	1 frag
M934-117-5	M934	unidentified bivalve frag's	0.1	8 frag's
M934-117-6	M934	<i>Balanus</i> sp.	0.1	1 frag
M934-117-7	M934	wood	0.1	3 frag's
M934-146-1	M934	<i>Chlamys rubida</i>	1.3	1
M934-146-2	M934	<i>Chlamys rubida</i>	0.2	-1
M934-146-3	M934	<i>Chlamys rubida</i>	0.1	8 frag's
M934-146-4	M934	<i>Lucinoma annulatum</i>	0.6	1

M934-146-5	M934	<i>Lucinoma annulatum</i>	0.1	~1
M934-146-6	M934	<i>Lucinoma annulatum</i>	0.2	7 frag's
M934-146-7	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-8	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-9	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-10	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-11	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-12	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-13	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-14	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-15	M934	<i>Parvalucina tenuisculpta</i>	0.1	1
M934-146-16	M934	<i>Parvalucina tenuisculpta</i>	0.1	~1
M934-146-17	M934	<i>Parvalucina tenuisculpta</i>	0.1	~1
M934-146-18	M934	<i>Parvalucina tenuisculpta</i>	0.1	3 frag's
M934-146-19	M934	<i>Pododesmus machrochisma</i>	0.1	1
M934-146-20	M934	<i>Pododesmus machrochisma</i>	0.1	1 frag
M934-146-21	M934	<i>Mya truncata</i>	0.4	~1
M934-146-22	M934	<i>Mya sp.</i>	2.2	12 frag's
M934-146-23	M934	<i>Thyasira flexuosa</i>	0.4	3 frag's
M934-146-24	M934	<i>Mytilus sp.</i>	0.1	3 frag's
M934-146-25	M934	<i>Littorina sitkana</i>	0.1	1
M934-146-26	M934	<i>Littorina sitkana</i>	0.1	5 frag's
M934-146-27	M934	purple sea urchin	0.1	1 spine
M934-146-28	M934	unidentified bivalve frag's	0.8	20 frag's
M934-146-29	M934	wood - cone	0.4	1
M934-146-30	M934	wood twig	0.1	2 frag's
M934-205-1	M934	<i>Saxidomus giganteus</i>	15.4	~1 - 5 frag's
M934-205-2	M934	<i>Saxidomus giganteus</i>	12.9	~1 - 7 frag's
M934-205-3	M934	<i>Chlamys rubida</i>	0.2	6 frag's
M934-205-4	M934	<i>Pododesmus machrochisma</i>	0.1	1 frag
M934-205-5	M934	<i>Crepidula adunca</i>	0.1	1
M934-205-6	M934	unidentified bivalve frag's	1.1	14 frag's
M934-205-7	M934	unidentified gastropod frag's	0.1	~1
M934-205-8	M934	<i>Balanus sp.</i>	0.1	2 frag's
M934-205-9	M934	wood - cone	0.4	1
M934-205-10	M934	wood - cone	0.4	1
M934-205-11	M934	wood - bark	0.1	1 frag
M934-205-12	M934	wood	0.1	1 frag
M934-218-1	M934	<i>Mytilus trossulus</i> ?	0.4	19 frag's
M934-218-2	M934	wood	1.1	8 frag's
M934-219-1	M934	<i>Saxidomus giganteus</i>	0.1	1
M934-219-2	M934	<i>Saxidomus giganteus</i>	0.1	1 frag
M934-219-3	M934	<i>Protothaca staminea</i>	0.1	1
M934-219-4	M934	<i>Protothaca staminea</i>	0.1	2 frag's
M934-219-5	M934	<i>Clinocardium sp.</i>	0.2	2 frag's
M934-219-6	M934	<i>Chlamys rubida</i>	0.1	2 frag's
M934-219-7	M934	<i>Nassarius mendicus</i>	0.1	1
M934-219-8	M934	<i>Nassarius mendicus</i>	0.1	1
M934-219-9	M934	<i>Thyasira flexuosa</i>	0.1	1
M934-219-10	M934	unidentified bivalve frag's	0.5	15 frag's
M934-219-11	M934	wood	0.1	3 frag's
M934-56-1	M934	<i>Lucinoma annulatum</i>	0.1	1
M934-194-1	M934	<i>Saxidomus giganteus</i>	0.1	1
Total weight (grams) M934			53.2	
T91C20-115-1	T91C20	<i>Patinopecten caurinus</i>	19.3	10 frag's
T91C20-217	T91C20	<i>Clinocardium sp.</i>	0.1	11 frag's
T91C20-218-1	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-218-2	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-218-3	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-218-4	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-218-5	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-218-6	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-218-7	T91C20	<i>Nutricula lordi</i>	0.1	1

T91C20-218-72	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-218-73	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-218-74	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-218-75	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-218-76	T91C20	<i>Yoldia</i> sp.	0.1	1 frag
T91C20-218-77	T91C20	<i>Cylichna alba</i>	0.1	1
T91C20-218-78	T91C20	<i>Cylichna alba</i>	0.1	1
T91C20-218-79	T91C20	<i>Cylichna alba</i>	0.1	1
T91C20-218-80	T91C20	<i>Olivella baetica</i>	0.1	1
T91C20-218-81	T91C20	<i>Olivella</i> sp.	0.1	1 frag
T91C20-218-82	T91C20	<i>Mactridae</i> sp.	0.1	1 frag
T91C20-218-83	T91C20	sea urchin spines	0.1	1
T91C20-218-84	T91C20	sea urchin spines	0.1	1
T91C20-218-85	T91C20	sea urchin spines	0.1	1
T91C20-218-86	T91C20	<i>Macoma moesta</i>	0.1	1
T91C20-218-87	T91C20	<i>Margarites</i> sp.	0.1	1
T91C20-218-88	T91C20	wood and plant	0.1	many frag's
T91C20-218-89	T91C20	unidentified bivalve frag's	0.5	29 frag's
T91C20-150-1	T91C20	<i>Yoldia</i> sp.	0.1	1
T91C20-150-2	T91C20	unidentified bivalve frag's	0.1	3 frag's
T91C20-150-3	T91C20	wood	0.5	8 frag's
T91C20-171-1	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-2	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-3	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-4	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-5	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-6	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-7	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-8	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-9	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-10	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-11	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-12	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-13	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-14	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-15	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-16	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-17	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-18	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-19	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-20	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-21	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-22	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-23	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-24	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-25	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-171-26	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-27	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-28	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-29	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-30	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-31	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-32	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-33	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-34	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-35	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-36	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-37	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-38	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-39	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-40	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-171-41	T91C20	<i>Simomactra falcata</i>	0.1	1
T91C20-171-42	T91C20	<i>Simomactra falcata</i>	0.1	1
T91C20-171-43	T91C20	<i>Simomactra falcata</i>	0.1	~1

T91C20-171-44	T91C20	<i>Simomactra falcata</i>	0.1	~1
T91C20-171-45	T91C20	<i>Simomactra falcata</i>	0.1	3 frag's
T91C20-171-46	T91C20	<i>Yoldia</i> sp.	0.1	1 frag
T91C20-171-47	T91C20	<i>Yoldia</i> sp.	0.1	1 frag
T91C20-171-48	T91C20	<i>Cylichna attonsa</i>	0.1	1
T91C20-171-49	T91C20	<i>Cylichna alba</i>	0.1	1
T91C20-171-50	T91C20	<i>Clinocardium</i> sp.	0.1	1
T91C20-171-51	T91C20	unidentified bivalve frag's	0.9	9 frag's
T91C20-171-52	T91C20	unidentified gastropod frag's	0.1	2 frag's
T91C20-171-53	T91C20	wood	0.3	43 frag's
T91C20-171-54	T91C20	charcoal	0.1	1 frag
T91C20-9-1	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-9-2	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-9-3	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-9-4	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-9-5	T91C20	<i>Tellina nukuloides</i>	0.1	5 frag's
T91C20-9-6	T91C20	<i>Mya</i> sp.	1.1	4 frag's
T91C20-9-7	T91C20	<i>Glycymeris septentrionalis</i>	0.1	1
T91C20-9-8	T91C20	<i>Simomactra falcata</i>	0.1	1
T91C20-9-9	T91C20	unidentified bivalve frag's	0.2	8 frag's
T91C20-9-10	T91C20	<i>Balanus</i> sp.	0.1	1 frag
T91C20-9-11	T91C20	unidentified shell?	0.1	1 frag
T91C20-24-1	T91C20	<i>Mya truncata</i>	1	1 frag
T91C20-24-2	T91C20	<i>Mya</i> sp.	1	6 frag's
T91C20-24-3	T91C20	<i>Chlamys</i> sp.	0.1	3 frag's
T91C20-24-4	T91C20	<i>Glycymeris septentrionalis</i>	0.2	1
T91C20-24-5	T91C20	<i>Glycymeris septentrionalis</i>	0.2	1
T91C20-24-6	T91C20	<i>Glycymeris septentrionalis</i>	0.1	1
T91C20-24-7	T91C20	<i>Glycymeris septentrionalis</i>	0.2	~1
T91C20-24-8	T91C20	<i>Yoldia</i> sp.	0.1	~1
T91C20-24-9	T91C20	<i>Yoldia</i> sp.	0.1	~1
T91C20-24-10	T91C20	<i>Tellina nukuloides</i>	0.1	~1
T91C20-24-11	T91C20	<i>Tellina nukuloides</i>	0.1	~1
T91C20-24-12	T91C20	<i>Olivella biplicata</i>	0.1	~1
T91C20-24-13	T91C20	<i>Olivella biplicata</i>	0.1	~1
T91C20-24-14	T91C20	<i>Olivella biplicata</i>	0.2	1 - 2 frag's
T91C20-24-15	T91C20	<i>Amphissa columbiana</i>	0.1	1
T91C20-24-16	T91C20	<i>Antalis pertiosum</i>	0.2	6 frag's
T91C20-24-17	T91C20	unidentified bivalve frag's	0.1	1
T91C20-24-18	T91C20	unidentified bivalve frag's	0.1	1
T91C20-24-19	T91C20	unidentified bivalve frag's	0.1	1
T91C20-24-20	T91C20	unidentified bivalve frag's	0.3	16 frag's
T91C20-24-21	T91C20	<i>Balanus</i> sp.	0.1	2 frag's
T91C20-24-22	T91C20	wood	0.1	2 frag's
T91C20-24-23	T91C20	sea urchin spines	0.1	4
T91C20-65-1	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-65-2	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-65-3	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-65-4	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-65-5	T91C20	<i>Tellina nukuloides</i>	0.1	~1
T91C20-65-6	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-65-7	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-65-8	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-65-9	T91C20	unidentified bivalve frag's	0.1	6 frag's
T91C20-65-10	T91C20	<i>Balanus</i> sp.	0.1	1
T91C20-82-1	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-2	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-3	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-4	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-5	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-6	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-7	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-8	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-9	T91C20	<i>Nutricula lordi</i>	0.1	1

T91C20-82-10	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-11	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-12	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-13	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-14	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-82-15	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-82-16	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-82-17	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-82-18	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-82-19	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-82-20	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-82-21	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-82-22	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-82-23	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-82-24	T91C20	<i>Yoldia sp.</i>	0.1	~1
T91C20-82-25	T91C20	<i>Yoldia sp.</i>	0.1	1
T91C20-82-26	T91C20	<i>Protothaca staminea</i>	0.1	~1
T91C20-82-27	T91C20	<i>Mactromeris sp.</i>	0.1	~1
T91C20-82-28	T91C20	<i>Mactromeris sp.</i>	0.1	~1
T91C20-82-29	T91C20	<i>Mactromeris sp.</i>	0.1	~1
T91C20-82-30	T91C20	<i>Acila castrensis</i>	0.1	1
T91C20-82-31	T91C20	<i>Acila castrensis</i>	0.1	1
T91C20-82-32	T91C20	<i>Solaria peramabilis</i>	0.1	1
T91C20-82-33	T91C20	unidentified bivalve frag's	0.3	19 frag's
T91C20-82-34	T91C20	unidentified gastropod frag's	0.1	1
T91C20-82-35	T91C20	unidentified gastropod frag's	0.1	~1
T91C20-82-36	T91C20	unidentified gastropod frag's	0.1	3 frag's
T91C20-82-37	T91C20	<i>Antalis pertiosum</i>	0.1	~1
T91C20-82-38	T91C20	<i>Antalis pertiosum</i>	0.1	~1
T91C20-82-39	T91C20	<i>Antalis pertiosum</i>	0.1	~1
T91C20-82-40	T91C20	<i>Antalis pertiosum</i>	0.1	1 frag
T91C20-108-1	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-108-2	T91C20	<i>Tellina nukuloides</i>	0.1	1
T91C20-108-3	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-108-4	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-108-5	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-108-6	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-108-7	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-108-8	T91C20	<i>Diplodonta impolita</i>	0.1	1
T91C20-108-9	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-10	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-11	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-12	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-13	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-14	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-15	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-16	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-17	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-18	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-19	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-20	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-21	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-22	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-23	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-24	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-25	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-26	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-27	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-28	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-29	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-30	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-31	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-32	T91C20	<i>Nutricula lordi</i>	0.1	1
T91C20-108-33	T91C20	<i>Nutricula lordi</i>	0.1	1

T91C20-108-34	T91C20	<i>Clinocardium sp.?</i>	0.1	1
T91C20-108-35	T91C20	<i>Olivella sp.</i>	0.1	2 frag's
T91C20-108-36	T91C20	<i>Mytilus sp.</i>	0.1	1 frag
T91C20-108-37	T91C20	unidentified bivalve frag's	0.1	3 frag's
T91C20-108-38	T91C20	unidentified gastropod frag's	0.1	-1
T91C20-108-39	T91C20	<i>Antalis pertiosum</i>	0.1	1 frag
T91C20-108-40	T91C20	<i>Balanus sp.</i>	0.1	1 frag
Total weight (grams) T91C20			52.2	
T91C34-22-1	T91C34	<i>Mya sp.</i>	0.5	-1
T91C34-22-2	T91C34	<i>Mya sp.</i>	0.3	-1
T91C34-22-3	T91C34	<i>Mya sp.</i>	1.6	17 frag's
T91C34-22-4	T91C34	<i>Pododesmus machrochisma</i>	0.1	-1
T91C34-22-5	T91C34	<i>Pododesmus machrochisma</i>	0.1	-1
T91C34-22-6	T91C34	<i>Pododesmus machrochisma</i>	0.1	4 frag's
T91C34-22-7	T91C34	<i>Chlamys sp.</i>	0.1	5 frag's
T91C34-22-8	T91C34	<i>Balanus sp.</i>	2.7	72 frag's
T91C34-22-9	T91C34	<i>Balanus glandulus</i>	0.1	1 scutum
T91C34-22-10	T91C34	<i>Balanus glandulus</i>	0.1	1 scutum
T91C34-22-11	T91C34	<i>Protothaca sp. (cf)</i>	0.1	1 frag
T91C34-22-12	T91C34	<i>Mytilus sp.</i>	0.1	1 frag
T91C34-22-13	T91C34	unidentified bivalve frag's	0.9	21 frag's
T91C34-22-14	T91C34	unidentified gastropod frag's	0.3	2 frag's
T91C34-42-1	T91C34	<i>Lirularia lirulata (cf)</i>	0.1	-1 in 5 frag's
T91C34-42-2	T91C34	<i>Balanus glandulus</i>	0.1	1 scutum
T91C34-42-3	T91C34	<i>Balanus glandulus</i>	0.1	1 scutum
T91C34-42-4	T91C34	<i>Balanus glandulus</i>	0.1	1 scutum
T91C34-42-5	T91C34	<i>Balanus sp.</i>	0.1	1 tergum
T91C34-42-6	T91C34	<i>Balanus sp.</i>	0.1	1 tergum
T91C34-42-7	T91C34	<i>Balanus sp.</i>	0.2	21 frag's
T91C34-42-8	T91C34	unidentified gastropod frag's	0.1	1 frag
T91C34-94-1	T91C34	organic - seaweed?	0.1	2 frag's
T91C34-102-1	T91C34	wood	0.4	40+ frag's
T91C34-114-1	T91C34	wood & plant	0.5	50+ frag's
T91C34-124-1	T91C34	wood & plant	0.1	30+ frag's
Total weight (grams) T91C34			9.1	
T95B12-46-1	T95B12	<i>Parvalucina tenuisculpta</i>	0.1	-1
T95B12-46-2	T95B12	<i>Chlamys sp.</i>	0.1	7 frag's
T95B12-46-3	T95B12	sea urchin	0.1	3 spines
T95B12-46-4	T95B12	sponge	0.1	5 frag's
T95B12-46-5	T95B12	unidentified bivalve frag's	0.1	7 frag's
T95B12-46-6	T95B12	<i>Balanus sp.</i>	0.1	8 frag's
T95B12-46-7	T95B12	wood	0.1	3 frag's
T95B12-87-1	T95B12	<i>Mytilus sp.</i>	0.1	3 frag's
T95B12-87-2	T95B12	unidentified bivalve frag's	0.8	9 frag's
T95B12-100-1	T95B12	<i>Macoma calcareea</i>	2.1	-1
T95B12-100-2	T95B12	<i>Macoma sp.</i>	0.3	-1
T95B12-100-3	T95B12	<i>Macoma sp.</i>	0.3	-1
T95B12-100-4	T95B12	<i>Macoma sp.</i>	0.1	-1
T95B12-100-5	T95B12	<i>Macoma sp.</i>	0.9	2 frag's
T95B12-100-6	T95B12	<i>Mytilus sp.</i>	0.1	1 frag
T95B12-100-7	T95B12	unidentified bivalve frag's	0.5	11 frag's
T95B12-100-8	T95B12	<i>Balanus sp.</i>	0.1	1 frag
T95B12-100-9	T95B12	seaweed	0.1	2 frag's
T95B12-133-1	T95B12	<i>Macoma calcareea</i>	1.2	1
T95B12-133-2	T95B12	<i>Macoma sp.</i>	0.3	3 frag's
T95B12-133-3	T95B12	<i>Mytilus sp.</i>	0.1	3 frag's
T95B12-133-4	T95B12	sea urchin	0.1	2 spine
T95B12-133-5	T95B12	unidentified bivalve frag's	0.4	22 frag's
T95B12-133-6	T95B12	wood	0.1	8 frag's
T95B12-182-1	T95B12	<i>Mytilus trossulus</i>	1.8	15 frag's
T95B12-182-2	T95B12	sea urchin	0.1	2 spines
T95B12-182-3	T95B12	sea urchin	0.1	1 frag

T95B12-182-4	T95B12	unidentified bivalve frag's	1	5 frag's
T95B12-182-5	T95B12	<i>Balanus</i> sp.	0.1	1 frag
T95B12-198-1	T95B12	<i>Macoma inquinata</i> (cf)	1.2	-1 in 2 frag's
T95B12-198-2	T95B12	<i>Mytilus</i> sp.	0.1	4 frag's
T95B12-198-3	T95B12	sea urchin	0.1	1 spine
T95B12-198-4	T95B12	<i>Balanus</i> sp.	0.1	1 frag
T95B12-198-5	T95B12	unidentified bivalve frag's	0.3	13 frag's
T95B12-211-1	T95B12	<i>Musculus taylori</i> (cf)	0.1	1
T95B12-211-2	T95B12	<i>Musculus taylori</i> (cf)	0.1	6 frag's
T95B12-211-3	T95B12	<i>Hiatella pholadis</i>	0.1	1
T95B12-211-4	T95B12	<i>Hiatella pholadis</i>	0.1	1
T95B12-211-5	T95B12	<i>Hiatella pholadis</i>	0.1	1
T95B12-211-6	T95B12	<i>Hiatella pholadis</i>	0.1	1
T95B12-211-7	T95B12	<i>Hiatella pholadis</i>	0.1	1
T95B12-211-8	T95B12	<i>Hiatella pholadis</i>	0.1	-1
T95B12-211-9	T95B12	<i>Hiatella pholadis</i>	0.1	-1
T95B12-211-10	T95B12	unidentified bivalve frag's	0.1	9 frag's
T95B12-235-1	T95B12	<i>Macoma incongrua</i> (cf)	0.6	-1 in 5 frag's
T95B12-235-2	T95B12	<i>Modiolus</i> sp.	0.1	-1
T95B12-235-3	T95B12	<i>Modiolus</i> sp.	0.1	-1
T95B12-235-4	T95B12	<i>Modiolus</i> sp.	0.2	10 frag's
T95B12-235-5	T95B12	<i>Macoma</i> sp.	0.2	-1 in 2 frag's
T95B12-235-6	T95B12	unidentified bivalve frag's	0.4	20 frag's
T95B12-235-7	T95B12	sea urchin	0.1	2 spines
T95B12-235-8	T95B12	<i>Balanus</i> sp.	0.2	2 frag's
T95B12-235-9	T95B12	plant	0.1	2 frag's
T95B12-235-10	T95B12	lithic	2.3	1 flake
T95B12-246-1	T95B12	<i>Mytilus</i> sp.	0.1	-1
T95B12-246-2	T95B12	<i>Mytilus</i> sp.	0.1	3 frag's
T95B12-246-3	T95B12	<i>Musculus taylori</i> (cf)	0.1	-1
T95B12-246-4	T95B12	sea urchin	0.1	3 spines
T95B12-246-5	T95B12	<i>Balanus</i> sp.	0.1	5 frag's
T95B12-246-6	T95B12	unidentified bivalve frag's	0.1	5 frag's
Total weight (grams) T95B12			19.1	
V94A11-19-1	V94A11	wood	0.1	5 frag's
V94A11-19-2	V94A11	plant	0.1	1 frag
V94A11-41-1	V94A11	plant & wood	0.1	40+ frag's
V94A11-70-1	V94A11	wood and plant	0.2	many
V94A11-83-1	V94A11	wood	0.1	24 frag's
Total weight (grams) V94A11			0.6	
V94A12-3-1	V94A12	wood & plant	0.1	11 frag's
V94A12-8-1	V94A12	wood & plant	0.1	12 frag's
V94A12-8-2	V94A12	fish scale	0.1	1?
V94A12-52-1	V94A12	plant & wood	0.1	8 frag's
V94A12-52-2	V94A12	fish scale	0.1	1?
V94A12-79-1	V94A12	plant & wood	0.1	15 frag's
V94A12-79-2	V94A12	fish scale	0.1	2?
V94A12-204-1	V94A12	plant	0.1	1 frag
Total weight (grams) V94A12			0.8	
V94A15-69-1	V94A15-69	<i>Nassarius mendicus</i>	0.1	-1
V94A15-69-2	V94A15-69	<i>Mytilus trossulus</i> (cf)	0.1	1 frag
V94A15-69-3	V94A15-69	unidentified bivalve frag's	0.1	34 frag's
V94A15-69-4	V94A15-69	plant & wood	0.1	1 frag's
V94A15-98-1	V94A15-69	<i>Macoma nasuta</i>	7.5	-1 in 2 frag's
V94A15-98-2	V94A15-69	<i>Macoma nasuta</i>	7.4	-1 in 5 frag's
V94A15-98-3	V94A15-69	<i>Protothaca tenerrima</i>	0.1	1 frag
V94A15-98-4	V94A15-69	<i>Nassarius mendicus</i>	0.1	1
V94A15-98-5	V94A15-69	<i>Axinopsida serricata</i>	0.1	13
V94A15-98-6	V94A15-69	<i>Mytilus</i> sp.	0.1	2 frag's
V94A15-98-7	V94A15-69	<i>Yoldia</i> sp.	0.1	3 frag's
V94A15-98-8	V94A15-69	<i>Dentaliidae</i> sp.	0.1	7 frag's

V94A15-98-9	V94A15-69	unidentified bivalve frag's	0.9	20 frag's
V94A15-98-10	V94A15-69	wood	9	significant
V94A15-120-1	V94A15-69	<i>Mytilus sp.</i>	0.1	7 frag's
V94A15-120-2	V94A15-69	<i>Protothaca sp.(cf)</i>	0.1	1 frag
V94A15-120-3	V94A15-69	<i>Clinocardium sp. (cf)</i>	0.1	1 frag
V94A15-120-4	V94A15-69	wood & plant	0.1	16 frag's
V94A15-129-1	V94A15-69	wood & plant	0.1	12 frag's
V94A15-129-2	V94A15-69	quartz crystals	0.1	11
V94A15-142-1	V94A15-69	wood & plant	0.1	11 frag's
V94A15-142-2	V94A15-69	quartz crystals	0.1	4
V94A15-163-1	V94A15-69	plant & wood	0.1	7 frag's
V94A15-163-2	V94A15-69	quartz crystals	0.1	11
V94A15-180-1	V94A15-69	plant & wood	0.1	12 frag's
V94A15-209-1	V94A15-69	plant	0.1	1 frag
V94A15-250-1	V94A15-69	plant & wood	0.1	17 frag's
Total weight (grams) V94A15			27.1	

APPENDIX E:
Queen Charlotte Islands/Hecate Strait region
Submarine sediment core analyses

KC - Kim Conway
 RH - Renée Hetherington
 OL - Olav Lian

93M4

Depth interval: 0-245 cm

Scientist: HJ

Described by: KC

Type of Core:

Section: 1

Latitude:

Longitude:

Depth: 27 m

Lithological Description:

Depth in core: Lithological description

Section 1:

0-68 cm	KC: dark olive grey massive bioturbated sandy mud with some shell debris; some wood to 3 cm; minor gravel to 2.5 cm, 2 mm diam worm, 10 cm long @ 25 cm depth
0-60 cm	RH: grey mud/fine sand with large shells and wood chunks, complete lack of stratigraphy
	*56 cm shell sample: <i>Lucinoma annulatum</i>
	*58-60 cm shell sample 4 cm ³ - <i>Parvalucina tenuisculpta</i> , <i>Pododesmus machrochisma</i> , <i>Lucinoma annulatum</i> , <i>Mytilus sp.</i> , wood; significant amount of small wood frag's twigs, grass?; angular pebbles to 1.25 cm
68-118 cm	KC: dark olive grey massive muddy sand; shells and shell debris becoming abundant at base, wood 5x2 cm
60-110 cm	RH: black chert or fine grained angular pebbles, high wood content
70-77 cm	large wood chunk
	*117-119 cm shell sample 4 cm ³ - <i>Parvalucina tenuisculpta</i> , <i>Mya sp.</i> , <i>Serripes groenlandicus?</i> , <i>Balanus sp.</i> , wood;
Section 2:	
0-48 cm(118-166)	KC: v. dk. Olive grey muddy fine sand with shells and shell debris; minor gravel to 3 cm diam; minor wood fragments to 1 cm; Unit 4b; gradational/arbitrary contact with unit 4a
110-203 cm	RH: muddy sand with angular pebbles up to 5 cm, some large

pebbles to 5 cm, wood throughout

*146-148 cm shell sample - *Chlamys rubida*, *Lucinoma annulatum*, *Parvalucina tenuisculpta*, *Pododesmus machrochisma*, *Mya truncata*, *Mya sp.*, *Thyasira flexuosa*, *Mytilus sp.*, *Littorina sitkana*, purple sea urchin, wood - cone, twig; angular gravel, wood frag's

48-71 cm(166-189) KC: very dark olive grey sl, muddy fine sand with minor fine shells and shell debris; minor gravel; unit 4a; sharp contact with unit 3c

71-83 cm(189-201) KC: shelly gravelly muddy coarse sand, shells ~ 20-30%; unit 3c; gradational/arbitrary contact with 3b

*194 cm - *Saxidomus giganteus*

83-95 cm(201-213) KC: muddy shelly sandy gravel; fine to coarse gravel; shell 5 cm diameter; gravel to 2 cm; mean ~5 mm; unit 3b
RH: gravel, mud, sand; potential increase in gravel content, but not significant, hi gravel content above 203 cm and below 225 cm; high shell content, no obvious stratigraphy

*205-207c m shell sample - *Saxidomus giganteus*, *Chlamys rubida*, *Pododesmus machrochisma*, *Crepidula adunca*, *Balanus sp.*, wood - cone, bark; greenish angular gravel to 2.5 cm, more gravel than in 146-148 cm

95-105 cm (213-223) KC: muddy sandy gravel, fine to coarse gravel; minor fine shell debris; unit 3a; gradational contact with unit 2

*219-221cm shell sample - *Saxidomus giganteus*, *Protothaca staminea*, *Clinocardium sp.*, *Chlamys rubida*, *Nassarius mendicus*, *Thyasira flexuosa*, wood; woody, gravel angular to 2.5 cm

*218-220 cm shell sample - *Mytilus sp.* (Probably *M. trossulus*), wood; woody chunks, gravel sand, gravel angular to 2cm

105-122 cm(223-240) KC: dark grey muddy gravelly sand; abundant wood debris to 1 cm; unit 2; sharp contact with unit 1

122-127 cm KC: gravelly sandy mud

Malacological description:

93M4-25.56 shell sample:

Lucinoma annulatum (Reeve, 1850)

- Alaska to southern California, fairly commonly dredged from 8-75 fathoms (Abbott1974:461)

- 60°N-28°N; Prince William Sound and northern Alaskan islands south to the Gulf of California; intertidal sand-mud to 750 m (Harbo 1997:145)
- 33°N-60°N; median latitude 47N; habitat:25-750 m; temp:+1° to +12°C; geologic range: Miocene (Bernard 1983:29)
- anoxic, high sulphur environment

93M4-25.58-60 shell sample:

Parvalucina tenuisculpta (Carpenter, 1864)

- 0.1g, 1; 0.1g, ~1; 0.1g, ~1
- Bering Sea to Baja California; common just offshore (Abbott 1974:459)
- 60°N-28°N; Kodiak Island, Alaska south to Isla Cedros, Baja California Norte; intertidal in sand-mud, to depths of 275 m and more, sometimes in dense numbers (Habo 1997:145)
- 33°N-60°N; median latitude 47N; habitat: 5-275 m; temp: +1 to +22°C; geologic range: Pliocene (Bernard 1983:29)

Pododesmus machrochisma (Deshayes, 1839)

- 0.5g, frag's
- Adak Island, Alaska to Baja California. Japan. Very common species attached to stones and wharf pilings from low tide mark to about 35 fathoms. Often found on *Haliotis* (Abbott 1974:452)
- 58°N-28°N; Bering Sea to Alaska and south to Baja California Sur, and the Gulf of California; rocks and other solid objects, intertidal to 90 m (Harbo 1997:141)
- 57°N-70°N; median latitude 64N; habitat: intertidal to 40 m; temp: -2° to 14°C; geologic range: Miocene; northwest Pacific (Bernard 1983:28)
- occasionally found on protected outer coast, but more common on rocks in quiet bays or on wharf pilings, fastened to reefs, bays and estuaries on rocky shores at low intertidal, (Ricketts et al., 1985: 160, 290)

Lucinoma annulatum (Reeve, 1850)

- 0.1g, 2 frag's
- Alaska to southern California, fairly commonly dredged from 8-75 fathoms (Abbott 1974:461)
- 60°N-28°N; Prince William Sound and northern Alaskan islands south to the Gulf of California; intertidal sand-mud to 750 m (Harbo 1997:145)
- 33°N-60°N; median latitude 47N; habitat:25-750 m; temp:+1° to +12°C; geologic range: Miocene (Bernard 1983:29)
- anoxic, high sulphur environment

Mytilus sp.

- 0.1g, 1 frag
- probably intertidal

Appendix E

93M4-26.17-26.19 shell sample*Parvalucina tenuisculpta* (Carpenter, 1864)

- 0.1g, 5
- Bering Sea to Baja California; common just offshore (Abbott 1974:459)
- 60°N-28°N; Kodiak Island, Alaska south to Isla Cedros, Baja California Norte; intertidal in sand-mud, to depths of 275m and more, sometimes in dense numbers (Harbo 1997:145)
- 33°N-60°N; median latitude 47°N; habitat: 5-275 m; temp: +1 to +22°C; geologic range: Pliocene (Bernard 1983:29)

Mya sp. Probably *Mya truncata* (*Mya arenaria* introduced to NW coast - Abbott 1974:536; Harbo 1997:169)

Mya truncata (Linne, 1758)

- 7.9g, 31 frag's, MNI=3
- Arctic Seas to Nahant, Massachusetts. Europe. Arctic Seas to Washington. Japan. In Greenland and Iceland this species is fairly common and considered a delicacy (Abbott 1974:537)
- 71°N-47°N; Circumboreal; Panarctic; Beaufort Sea, Bering Sea and south to Neah Bay, Washington; intertidal to 100 m, in mud and sand of protected bays (Harbo 1997:170)
- 48°N-71°N; median latitude: 59°N; Habitat: intertidal to -100 m; temp: -2°C to +16°C; geologic range: Miocene; Panarctic, circumboreal (Bernard 1983:57)

Serripes groenlandicus? (Bruguiere, 1789)

- 0.3g, 1 frag
- Arctic Seas to Cape Cod, Massachusetts. Alaska to Puget Sound, Washington. Very commonly dredged in cold, northern waters, from 2 to 60 fathoms. (Abbott 1974:487)
- 71°N-48°N; Circumboreal, Panarctic; Point Barrow Alaska south to Puget Sound, Washington; intertidal to depths of 80 m (Harbo 1997:152)
- 47°N-71°N; median latitude: 59°N; habitat: intertidal to -80 m; temp: -2°C to +10°C; Pliocene; Panarctic, Circumboreal (Bernard 1983: 39)

Balanus sp.

- 0.1g, 1 frag

93M4-26.46-26.48 shell sample*Chlamys rubida* (Hinds, 1845)

- 1.3g, 1; 0.2g, ~1; 0.1g, 8 frag's
- Alaska to off San Diego California; common species dredged in shallow water down to 822 fathoms. (Abbott 1974:444)

- 57°N-33°N; on gravel-mud bottoms, at depths of 3-66' (1-200 m) (Harbo 1997:142)
- 33°N-58°N; median latitude: 46°N; habitat: 1-200 m; temp range: +1 to +17°C; geologic range: Miocene (Bernard 1983: 25)

Lucinoma annulatum (Reeve, 1850)

- 0.6g, 1; 0.1g, ~1; 0.2g, 7 frag's
- Alaska to southern California, fairly commonly dredged from 8-75 fathoms (Abbott 1974:461)
- 60°N-28°N; Prince William Sound and northern Alaskan islands south to the Gulf of California; intertidal sand-mud to 750m (Harbo 1997:145)
- 33°N-60°N; median latitude 47°N; habitat: 25-750 m; temp: +1° to +12°C; geologic range: Miocene (Bernard 1983:29)
- anoxic, high sulphur environment

Parvalucina tenuisculpta (Carpenter, 1864)

- 0.1g x 9; 0.1g x 2@~1; 0.1g, 3 frag's
- Bering Sea to Baja California; common just offshore (Abbott 1974:459)
- 60°N-28°N; Kodiak Island, Alaska south to Isla Cedros, Baja California Norte; intertidal in sand-mud, to depths of 275 m and more, sometimes in dense numbers (Habo 1997:145)
- 33°N-60°N; median latitude 47°N; habitat: 5-275 m; temp: +1 to +22°C; geologic range: Pliocene (Bernard 1983:29)

Pododesmus machrochisma (Deshayes, 1839)

- 0.1g, 1; 0.1g, 1 frag
- Adak Island, Alaska to Baja California. Japan. Very common species attached to stones and sharp pilings from low tide mark to about 35 fathoms. Often found on *Haliotis* (Abbott 1974:452)
- 58°N-28°N; Bering Sea to Alaska and south to Baja California Sur, and the Gulf of California; rocks and other solid objects, intertidal to 90 m (Harbo 1997:141)
- 57°N-70°N; median latitude 64°N; habitat: intertidal to 40 m; temp: -2° to 14°C; geologic range: Miocene; northwest Pacific (Bernard 1983:28)
- occasionally found on protected outer coast, but more common on rocks in quiet bays or on wharf pilings, fastened to reefs, bays and estuaries on rocky shores at low intertidal, (Ricketts et al., 1985: 160, 290)

Mya truncata (Linne, 1758)

- 0.4g, ~1
- Arctic Seas to Nahant, Massachusetts. Europe. Arctic Seas to Washington. Japan. In Greenland and Iceland this species is fairly common and considered a delicacy (Abbott 1974:537)

Appendix E

- 71°N-47°N; Circumboreal; Panarctic; Beaufort Sea, Bering Sea and south to Neah Bay, Washington; intertidal to 100 m, in mud and sand of protected bays (Harbo 1997:170)
- 48°N-71°N; median latitude: 59°N; Habitat: intertidal to -100 m; temp: -2°C to +16°C; geologic range: Miocene; Panarctic, circumboreal (Bernard 1983:57)

Mya sp. (Probably *Mya truncata* as above)

- 2.2g, 12 frag's

Thyasira flexuosa (Montagu, 1803)

- 0.4g, 3 frag's
- Greenland to off North Carolina, Bering Sea to off San Diego, California. Common offshore to 60 fathoms (Abbott 1974: 463)
- 71°N-34°N; Circumboreal; Panarctic; Beaufort Sea south to San Pedro California; in sand-mud, 12-250 m (Harbo 1997:146)
- 33°N-71°N; median latitude: 52°N; habitat: 20-250 m; temp: -2°C to +13°C; Pliocene; Panarctic, North Pacific (Bernard 1983:29)

Mytilus sp.

- 0.1g, 3 frag's

Littorina sitkana (Philippi, 1846)

- 0.1g, 1; 0.1 5 frag's
- Bering Sea to Puget Sound, Washington. A common littoral species of the north (Abbott 1974:67)
- Alaska south to Puget Sound; in sheltered waters on rocks among rockweed and other algae; in eelgrass from high to low intertidal Harbo 1997:199-200)
- extreme high water form - high intertidal, prefers somewhat more protected ocean shores in Oregon, prefers damp, sheltered crevices, eggs laid in gelatinous masses susceptible to drying, no planktonic dispersal stage which may contribute to snail's failure to extend its range south, never migrate from the immediate neighbourhood of the pool in which they were born; found in upper splash zone - +11' above tidal datum (Ricketts et al., 1985: 20-21; 272-273; 433)

purple sea urchin,

- 0.1g, 1 spine

93M4-26.94 shell sample

Saxidomus giganteus (Deshayes, 1839)

- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to

southern California; buried to 30cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)

- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

93M4-27.05-27.07 shell sample

Saxidomus giganteus (Deshayes, 1839)

- 0.1~1; 15.4g, 5 frag's of 1; 12.9g, 7 frag's of 1 - articulated
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Chlamys rubida (Hinds, 1845)

- 0.2g, 6 frag's
- Alaska to off San Diego California; common species dredged in shallow water down to 822 fathoms. (Abbott 1974:444)
- 57°N-33°N; on gravel-mud bottoms, at depths of 3-66' (1-200 m) (Harbo 1997:142)
- 33°N-58°N; median latitude: 46N; habitat: 1-200 m; temp range: +1 to +17°C; geologic range: Miocene (Bernard 1983: 25)

Pododesmus machrochisma (Deshayes, 1839)

- 0.1, 1 frag
- Adak Island, Alaska to Baja California. Japan. Very common species attached to stones and sharp pilings from low tide mark to about 35 fathoms. Often found on *Haliotis* (Abbott 1974:452)
- 58°N-28°N; Bering Sea to Alaska and south to Baja California Sur, and the Gulf of California; rocks and other solid objects, intertidal to 90 m (Harbo 1997:141)

- 57°N-70°N; median latitude 64N; habitat: intertidal to 40 m; temp: -2° to 14°C; geologic range: Miocene; northwest Pacific (Bernard 1983:28)
- occasionally found on protected outer coast, but more common on rocks in quiet bays or on wharf pilings, fastened to reefs, bays and estuaries on rocky shores at low intertidal, (Ricketts et al., 1985: 160, 290)

Crepidula adunca (Sowerby, 1825)

- 0.1g, 1
- Graham Island, B.C. to southern California. Dredged from 20 fathoms (Abbott 1974: 142)
- Queen Charlotte Islands to Baja California; Intertidal and deeper, stacked on snail shells esp. black turban (Harbo 1997:203)
- often found on *Tegula brunnea* and *Tegula funebris*, protandric hermaphrodites, breeding female carries eggs in shell cavity, strain food over gill; protected outer coast, rocky shores: middle intertidal

Balanus sp.

- 0.1g, 2 frag's

93M4-27.19-27.21 shell sample

Saxidomus giganteus (Deshayes, 1839)

- 0.1g, 1; 0.1g, 1 frag
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Protothaca staminea (Conrad, 1837)

- 0.1g, 1; 0.1g, 1 frag
- Aleutian Islands to Baja California. (Abbott 1974: 526)
- 54°N-23°N; Aleutian Islands, Alaska south to Baja California Sur; buried to 10cm or more in gravel, and in sand-mud bottoms in the mid-intertidal zone to 10m, can live 14 years, edible (Harbo 1997:166)

- 23°N-60°N; median latitude: 42N; habitat: intertidal to -10 m; temp: +2°C to +27°C; Miocene (Bernard 1983: 52)
- widely used for food, may occur in such superabundance that two or three shovelfuls of substratum would contain enough clams to provide meal for several people; a poor diggers thus never lives in shifting sand where rapid digging is essential, may be found in packed mud or in gravel mixed with sand but prefers clayey gravel where lives at depths of 8cm below surface; bays and estuaries, rocky shores: middle intertidal, but can occur in preferred clayey gravel in isolated bits of protected outer coast, spawning occurs in summer in BC and Alaska, slow growth especially in south-central Alaska where requires 8 years to reach 30 mm; growth rate determined primarily by extent and constancy of food supply which depends on the animal's position in relation to the tidal current and its degree of protection from storms, as well as water temp.; often drilled by *Polinices* sp. (Ricketts 1985: 149, 220, 281-282, 326)

Clinocardium sp.

- 0.2g, 2 frag's

Chlamys rubida (Hinds, 1845)

- 0.1g, 2 frag's
- Alaska to off San Diego California; common species dredged in shallow water down to 822 fathoms. (Abbott 1974:444)
- 57°N-33°N; on gravel-mud bottoms, at depths of 3-66' (1-200 m) (Harbo 1997:142)
- 33°N-58°N; median latitude: 46N; habitat: 1-200 m; temp range: +1 to +17°C; geologic range: Miocene (Bernard 1983: 25)

Nassarius mendicus (Gould, 1849)

- 0.1g, 1; 0.1g, 1
- Alaska to Baja California; common in shallower water in the north; shore to 25 fathoms (Abbott 1974: 225)
- Alaska south to central Baja California; on sand, mud and rocks, intertidal to 18 m (Harbo 1997: 216)

Thyasira flexuosa (Montagu, 1803)

- 0.1g, 1
- Greenland to off North Carolina, Bering Sea to off San Diego, California. Common offshore to 60 fathoms (Abbott 1974: 463)
- 71°N-34°N; Circumboreal; Panarctic; Beaufort Sea south to San Pedro California; in sand-mud, 12-250 m (Harbo 1997:146)
- 33°N-71°N; median latitude: 52N; habitat: 20-250 m; temp: -2°C to +13°C; Pliocene; Panarctic, North Pacific (Bernard 1983:29)

Appendix E

93M4-27.18-27.20 shell sample***Mytilus* sp. (Probably *M. trossulus*) (Linnaeus, 1758)**

- 0.4g, 19 frag's
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974, 428-429)
- 71°N-19°N; Arctic to Alaska and south to Mexico, considered introduced into BC; quiet, sheltered locations in the intertidal zone to 5 m depths, form dense masses on hard surfaces (Harbo 1997: 135)
- 23°N-71°N; median latitude 47°N; habitat: intertidal to -5 m; temp: -4°C to +30°C; Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983: 18)
- predominately quiet water animal, wide distribution, grows larger when farmed as not overcrowded, can form beds along gravel beaches in blanketlike mass; bays and estuaries, rocky shores: uppermost horizon and high intertidal, can occur on open coast but prefers quiet water, more mobile than *M. californianus* can move rapidly to avoid being buried by sediment deposition, spawning occurs in late fall or winter, growth rate depends on the amount of time submerged, thus feeding which varies depending on position on shore, those exposed to greater wave action grow more slowly and have thicker shells. (Ricketts 1985: 273-274)

E87A-13

Depth interval: 223 cm

Scientist: LZ

Described by: SMS/KC

Type of Core: vibracore

Section: 1 & 2

Latitude: 51.1717 N

Longitude: 128.6012W

Depth: 140 m

Lithological Description:

Depth in core:	Lithological description
0-67 cm	KC: fine to very fine well sorted slightly silty sand with disseminated shell fragments, slight tendency to fine downsection. Shell frags are rare in the upper 30 cm, 1-3 cm shell frags. Occasional silty blebs.
40 cm	KC: dark, heavy mineral rich patch
0-77 cm	RH: fine silty grey/brown sand with shell frag's
	*26-29 cm shell sample: fine silty sand; minor very small shell frag's; unknown, plant litter, wood frag's
	*35-38 cm shell sample: fine silty sand; minor shell frag's, wood frag's; <i>Tellina</i> sp., unidentified bivalve frag's, unknown, wood
	*55-58 cm shell sample: fine silty sand; minor shell frag's; <i>Yoldia</i> sp. sea urchin spine, <i>Scorpaenidae</i> sp. scale - not juvenile, not adult, young adult, wood fragments
	*76-79 cm shell sample: silty sand, increasing silt content, fish vertebrate? <i>Tellina</i> sp.?, <i>Nutricula lordi</i> , <i>Yoldia</i> sp., unidentified bivalve frag's, sea urchin spine, unknown, wood
67-72 cm	KC: silty laminae
79 cm	KC: fish vertebrae
	RH: fish vertebrae, <i>Merluccius productus</i> (cf.) - Pacific hake,
sponge	
80-90 cm	KC: silty laminations <1 cm thick
96 cm	KC: 1cm <i>Olivella</i> sp., faint heavy mineral rich laminations (0.5-1.0 cm)
96-112 cm	KC: silty sand with faint heavy mineral; intact bivalve (<i>Macoma</i> sp.); rich laminations, bivalve frag, 1 cm <i>Olivella</i> sp.
77-112 cm	RH: increasing silt content; grey silty sand, high shell content, whole and fragmented shells, increasing wood and shell content at 86 cm
	*95-98 cm shell sample: whole and fragmented shell increasing amount,

Appendix E

wood and plant frag's, 1 fish scale; *Macoma* sp., *Tellina* sp.?, *Diplodonta impolita*, *Astysis gausapata*, *Margarites helcinus*, *Rhabdus rectius*, *Nitidiscala catalinensis*, adult *Embiotocidae* family (surf perch), *Scorpaenidae* family (rockfish) fish scale, plant & wood

*105-108 cm shell sample: whole shell in fine silty sand; *Macoma calcaria*, *Compsomyx subdiaphana*, *Astysis gausapata*, *Epitoniidae* sp., plant & wood, *Diplodonta impolita*

- 112-180 cm KC: very fine to silty sand, heavy mineral rich disseminated shell fragments, massive to faintly laminated, well-sorted; occasional blebs of dark heavy mineral rich material © 3 cm long x 1 cm thick; 122 cm, 136 cm)
- 172 cm KC: intact bivalve, dated to 10,360 C¹⁴ marine reservoir corrected BP
- 112-140 cm RH: fine silty grey sand; shell frag's throughout
 *118-121 cm shell sample: shells articulated, fine silty sand; *Macoma calcaria*, *Pandora* sp., *Chlamys rubida*, *Yolida seminuda*, unidentified bivalve frag's, *Diplodonta impolita*, unknown, plant & wood
 *134-137 cm shell sample: fine silty sand, fine shell & fish vertebrae
- 140-160 cm RH: fine laminations - truncated @ 145-148 cm, possibly a fault; laminations folded and disrupted; *Tellina* sp.?, *Diplodonta impolita*, unknown, unidentified bivalve frag's
 *154-157 cm shell sample: fine silty sand, laminated; small shell frag's fish vertebrae, plant & wood frag's; *Diplodonta impolita*, unknown, plant & wood, *Clupea harengus* - Pacific herring
- 180-233 cm KC: as above, with very little shell debris
- 160-233 cm RH: ver fine silty grey sand, fewer shell frag's as move down core
 *171-174 cm shell sample: fine silty grey sand, articulated bivalves, fish bone?, wood/plant frag's; *Nucula tenuis*, *Diplodonta impolita*, *Nuculana pernula*, unidentified bivalve frag's, plant & wood
 *182-185 cm shell sample: fine silty grey sand, fine shell frag's, fish vertebrae, fewer wood and plant frag's; unidentified bivalve frag's, unknown, plant & wood
 *204-207 cm shell sample: very fine silty grey sand; minor fine shell frag's, fish scale?, bone?, plant & wood frag's; unidentified bivalve frag's, plant & wood, fish scale?
 *205-208 cm shell sample: very little shell, fine plant & wood frag's; unidentified bivalve frag's, plant & wood

Malacological description:

E87A-13 - 140.26-29 shell sample

unknown

- 0.1g, 5

plant litter

- 0.1g, 2

wood fragments

- 0.1g, 2 fragments

E87A-13 - 140.35-38 shell sample

Tellina sp.,

- 0.1g, 1

Family *Tellinidae*; local species range from intertidal to -440 m

unidentified bivalve frag's

- 0.1g, 16 fragments

unknown

- 0.1g, 1

wood fragments

- 0.1g, 6 fragments

E87A-13 - 140.55-58 shell sample

Yoldia sp.

- 0.1g, 2 fragments

Family *Sareptidae* (*Yoldiidae*); local species range from 15-600 m on mud sand bottoms

minor shell fragments, unidentifiable

- 0.1g, 12

sea urchin spine

- 0.1g, 1 frag

wood fragments

- 0.1g, 6 frag's

Scorpaenidae family scale - not juvenile, not adult, young adult scale

- 0.1g, 1

E87A-13 - 140.76-79 shell sample

Tellina sp.?

- 0.1g, 1; 0.1g, 1; 0.1g, 4 fragments

Family *Tellinidae*; local species range from intertidal to -440 m

unidentified bivalve frag's

Nutricula lordi (*Psephidia lordi*) (Baird, 1863)

- 0.1g, 1

- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47°N; intertidal to -70 m; temp: 0 to +16°C; Pliocene (Bernard 1983: 56)

Yoldia sp.

- 0.1g, ~1; 0.1g, 5 fragments
- Family *Sareptidae* (*Yoldiidae*); local species range from 15-600 m on mud sand bottoms

unidentified bivalve frag's

- 0.1g, 19 fragments

sea urchin spine

- 0.1g, 1; 0.1g, 1

unknown

- 0.1g, 1; 0.1 g, 1

wood

- 0.1g, 5 fragments

E87A-13 - 140.79 shell sample

Merluccius productus (cf.) - Pacific Hake

- 0.1g, 2 fragments
- hake eggs are pelagic
- young larvae eat copepods & their eggs in spring and early summer
- adult hake eat euphausiids and sand lance, to a lesser extent herring, smelt, anchovy, and shrimp (Hart 1973: p. 225-226)
- distribution: Gulf of California to Gulf of Alaska; surface to 900 m; common along BC coast (Hart 1973: p. 225-226)

sponge

- 0.1g, 1 fragment

E87A-13 - 140.95-98 shell sample

Macoma sp.

- 0.3g, ~1; 0.2g, ~1; 0.1g, ~1; 0.5g, 12 fragments
- Family *Tellinidae*; local species range from intertidal to -1,547 m

Tellina sp.?

- 0.1g, 1; 0.1g, 1
 - Family *Tellinidae*; local species range from intertidal to -440 m
- unidentified bivalve frag's

Diplodonta impolita (Berry, 1953)

- 0.1g, 1; 0.1g, 1
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Astysis gausapata (Gould, 1850)

- 0.1g, 1; 0.1g, 1
- California to Alaska (Abbott 1974: 199)
- 55°N-33°N; Alaska south to San Diego, California; on rocks, subtidal to 200 m (Harbo 1997:216)

Margarites helycinus (Phipps, 1874)

- 0.1g, 1
- Arctic Seas to Alaska and to Massachusetts; common from 1 to 75 fathoms (Abbott 1974: 35)
- Aleutian Islands, Alaska south to Washington; on kelp or under rocks, shallow water to -30 m (Harbo 1997:192)

Rhabdus rectius (Carpenter, 1865)

- 0.1g, 1 fragment; 0.1g, 1 fragment
- Alaska south to Panama; offshore in mud and silt (Harbo 1997:224)

Nitidiscala catalinensis (Dall, 1917)

- 1g, 1
- synonym *Epitonium sawinae* (Dall, 1903); British Columbia to Catalina Island, California; common on gravel, shale or mud from 10 to 50 fathoms (Abbott 1974: 119)
- subtidal (Kozloff 1996: 218)

fish scale surperch (cf) - Family *Embiotocidae*

- 0.1g, 1
- live in bays and "surfy" habitat in shallow waters of the north Pacific

plant & wood

- 0.1g, 12 fragments

E87A-13 - 141.05-.08 shell sample

Macoma calcaria (Gmelin, 1791)

- 0.6g, 1
- Bering Sea to Washington, a common cold-water species (Abbott 1974: 505-506)
- 71°N-47°N; Circumboreal; Arctic to Bering Sea and south to Newport Oregon; in sand, silt, and gravel, intertidal to 320 m (Harbo 1997: 159)
- Panarctic, circumboreal; 47N-71N: median latitude 59N; Intertidal-320 m; temp: -2°C to +15°C; ?Oligocene (Bernard 1983: 44)

Compsomyx subdiaphana (Carpenter, 1864)

- 2.1g, ~1 in 6 fragments
- Alaska to the Gulf of California; dredged in soft mud from 5 to 25 fathoms (Abbott 1974: 534)
- 59°N-30°N; Cook Inlet and northern Gulf of Alaska, south to Baja California Norte, and in the Gulf of California; 2-550 m, often in soft mud, edible (Harbo 1997: 166)
- 28N-61N: median latitude 45N; 2-550 m; 0 to +16°C; Miocene (Bernard 1983: 56)

Astysis gausapata (Gould, 1850)

- 0.2g, 1
- California to Alaska (Abbott 1974: 199)
- 55°N-33°N; Alaska south to San Diego, California; on rocks, subtidal to 200 m (Harbo 1997: 216)

Epitoniidae sp.

- 0.1g, 1 fragment

Diplodonta impolita (Berry, 1953)

- 0.1g, 1
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997: 146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

plant & wood,

- 0.1g, 6 fragments

adult *Embiotocidae* family (surf perch), *Scorpaenidae* family (rockfish) fish scale

•

E87A-13 - 141.18-.21 shell sample

Macoma calcaria (Gmelin, 1791)

- 0.7g, 1; 0.1 g, ~1; 0.3g, 1 fragment
- Bering Sea to Washington, a common cold-water species (Abbott 1974: 505-506)
- 71°N-47°N; Circumboreal; Arctic to Bering Sea and south to Newport Oregon; in sand, silt, and gravel, intertidal to 320 m (Harbo 1997: 159)
- Panarctic, circumboreal; 47N-71N: median latitude 59N; Intertidal-320 m; temp: -2°C to +15°C; ?Oligocene (Bernard 1983: 44)

Pandora sp.

- 0.1g, ~1; 0.1g, 4 fragments
- family *Pandoridae*

Chlamys rubida (Hinds, 1845)

- 0.1g, 1 fragment
- Alaska to off San Diego California; common species dredged in shallow water down to 822 fathoms. (Abbott 1974:444)
- 57°N-33°N; on gravel-mud bottoms, at depths of 3-66'(1-200m) (Harbo 1997:142)
- 33°N-58°N; median latitude: 46N; habitat: 1-200 m; temp range: +1 to +17°C; geologic range: Miocene (Bernard 1983: 25)

Yoldia seminuda (Dall, 1871)

- 0.8g, ~1; 0.3, ~1; 0.5g, 3 fragments
- Arctic Ocean to off San Diego, California, 8 to 75 fathoms. Common (Abbott 1974:418)
- synonym *Yoldia scissurata* (Dall, 1897); 71°N-34°N; Arctic, Beaufort Sea, Bering Sea south to San Diego, California; mud-sand bottoms, 15-150 m (Harbo 1997: 133)
- 58N-60N: median latitude 59N; 25-40 m; -1 to +10°C; Pliocene (Bernard 1983:13)

Diplodonta impolita (Berry, 1953)

- 0.1g, 1
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Appendix E

unidentified bivalve frag's

- 0.5 g, 13 fragments

unknown

- 0.1g, 1

plant & wood

- 0.1g, 3 fragments

E87A-13 - 141.34-.37 shell sample

Tellina sp.

- 0.1g, 1
 - Family *Tellinidae*; local species range from intertidal to -440 m
- unidentified bivalve frag's

Diplodonta impolita (Berry, 1953)

- 0.1g (x13); 1 (x13)
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to+19°C; Recent (Bernard 1983: 30)

unknown

- 0.1g, 18 fragments

unidentified bivalve frag's

- 0.1g, 4 fragments

E87A-13 - 141.54-.57 shell sample

Diplodonta impolita (Berry, 1953)

- 0.1g, 2 articulated; 0.1g (x5), 1 (x5)
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to+19°C; Recent (Bernard 1983: 30)

unknown

- 0.1, 8 fragments; 0.1, 1 fragment

plant & wood

- 0.1g, ? fragments

Clupea harengus - Pacific herring

- 0.1g, 1 vertebrae
- spawning **temperature** is 4.4 to 10.7 °C in BC and 3.0 to 12.3 °C on a coastwise basis; spawn on shoreline at depths between high tide and 11 m; eggs adhere to eelgrass, kelp, rockweed and other seaweed, sometimes on rocks. **Diet:** first food in copepods and diatoms; at 2 months diet includes barnacle larvae, mollusc larvae, bryozoans, rotifers, and young fish but copepods still most important. **Salinity:** salinity effects on egg development seem relatively unimportant and tolerance is wide at all stages. **Preyed upon** by chinook and coho salmon, waterfowl, dogfish, other sharks and lingcods, sea lions and whales. **Distribution:** from northern Baja California (~37.40N) to St. Michael Island and Cape Bathurst in the Beaufort Sea. **Uses:** bait, dry-salting, raw fish used for oil and meal; canned (Hart 1973:96-100).

E87A-13 - 141.71-.74 shell sample

Nucula tenuis (Montague, 1808)

- 0.1g, 1; 0.1g, 3 fragments
- Alaska to Baja California; moderately common; offshore (Abbott 1974: 411)
- Circumboreal, 28°N-62°N; median latitude: 45N; 5-300 m; +1°C; to +16°C; Pleistocene

Diplodonta impolita (Berry, 1953)

- 0.1g, 1; 0.1g, 1
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Nuculana pernula (Müller, 1771)

- 0.2g, 2 articulated
- Northern Alaska to Chatham Sound, British Columbia; commonly dredged offshore in cold water (Abbott 1974: 413-414)
- Panarctic and circumboreal; 52N-71N: median latitude 62N; 20-1400 m; -1°C; to +7°C; Pliocene (Bernard 1983: 12)

unidentified bivalve frag's

- 0.4g, 15 fragments

plant & wood

- 0.1g, 8 fragments

E87A-13 - 141.82-.85 shell sample

unidentified bivalve frag's

- 0.2g, 15 fragments

unknown

- 0.1g, 5 fragments; 0.1g, 1 fragment

plant & wood

- 0.1g, 3 fragments

E87A-13 - 142.04-.07 shell sample

unidentified bivalve frag's

- 0.1g, 3 fragments

plant & wood

- 0.1g, 9 fragments

fish scale?

- 0.1g, 2

E87A-13 - 142.05-.08 shell sample

unidentified bivalve frag's

- 0.1g, 2 fragments

plant & wood

- 0.1g, 8 fragments

E87A-22

Depth interval: 201 cm

Scientist: J.L. Luternauer

Described by: KC/VB

Type of Core: vibrocore

Section: 1&2

Latitude: 50 57.05

Longitude: -128 31.01

Depth: 104 m

Lithological Description:

Depth in core: Lithological description

0-6 cm	KC: dark grey, sl. Silty, fine-med well-sorted sand RH: dark grey sand
6-17 cm	KC: light olive brown, med-coarse shelly sand with some granules; massive RH: light olive shelly sand, many shell fragments
17-99 cm	KC: grayish brown, gravelly, shelly, muddy sand; gravel to 6 cm diam; shells incl. Gastropods, serpulid worm tubes, pelecycods; pelecypod frag's to 5 cm diam; gravel is well-rounded; unit is irregular bedded to massive; larger shell frag's near base of unit. RH: silty sand with gravel to 6 cm diameter, many shell fragments *51-54 cm shell sample: silty sandy gravel, rounded pebbles to 4 cm, significant small shell fragments: <i>Glans carpenteri</i> , <i>Chlamys sp.</i> , <i>Nuculana sp.</i> , <i>Nassarius mendicus</i> , <i>Amphissa columbiana</i> , <i>Pododesmus</i> <i>machrochisma</i> , <i>Petalaconchus compactus</i> , <i>Cranopsis cucullata</i> , <i>Acmaea</i> <i>mitra</i> , <i>Epitonium indianorum</i> , sea urchin spines, sponge, coral, <i>Balanus</i> <i>spp.</i> , unidentified bivalve frag's, unidentified gastropod frag *84-88 cm shell sample: silty sandy gravel, many shell fragments; <i>Balanus</i> <i>spp.</i> , <i>Saxidomus giganteus</i> , fine wood fragments throughout, mud and gravel, rounded pebbles to 2 cm; <i>Saxidomus giganteus</i> , <i>Amphissa</i> <i>columbiana</i> , <i>Nuculana minuta</i> , <i>Euspira pallida</i> , <i>Hiatella sp.</i> , <i>Balanus spp.</i> , unidentified bivalve frag's, Plant & wood
93-95 cm	KC: wood fragment; 2 cm diam.
99-100 cm	KC: very dark grey sl. Muddy gravelly sand; gravel less rounded than overlying unit
100-111 cm	KC: very dark grey sl. Muddy gravelly sand
99-111 cm	RH: gravelly sand *103-107 cm shell sample: gravelly sand, subangular gravel, pebbles to

1.5 cm, significantly less shell, more wood fragments; *Nutricula lordi*, *Chlamys* sp., *Balanus* spp., unidentified bivalve frag's, wood

111-114 cm KC: very dark grey gravelly muddy sand; gravel to 2 cm
RH: dark grey gravelly coarse sand, subangular

114-123 cm KC: reddish brown stained gravelly sand; gravel to 2 cm; at 120 cm changes to very dark grey
RH: dark grey gravelly coarse sand stained with rust colour
*115-118 cm shell sample: subangular gravel to 2.5 cm, some shell fragments, wood chunks/fragments; *Balanus cariosus*, *Balanus* spp., *Nutricula lordi*, unidentified bivalve frag's, wood
*121-124 cm shell sample: subangular gravel to 2.5 cm, shell fragments and small shell, wood fragments; *Amphissa columbiana*, *Protothaca staminea*, unidentified bivalve frag's, *Balanus glandulus*, unidentified bivalve frag's, *Neptunea lyrata*, charcoal, Plant & wood

122-150 cm olive grey gravelly sand; minor shell debris; layered- alternating between gravelly coarse sand and silty fine sand; gravel to 3 cm diam; layers 2-5 cm wide. 150 cm is the lower limit of shell debris and the upper limit of till clasts
RH: grey gravel sand, subangular with large pebbles to 6 cm, lenses of dark grey silty sand - 4 cm thick
*141-144cm shell sample: angular/subangular gravel, pebbles to 2.5 cm, no shell, no wood

150-175 cm KC: dark grey stratified fine sand and gravelly sand; layers are 3.7 cm thick;
156 cm: oxidized clast or zone
160-162 cm: till clast 2 cm diam - rounded
167 cm: oxidized (?) Clast or zone
168-171 cm: 4-5 2mm thick peaty laminae
RH: olive grey sand with subangular gravel layers ~3 cm thick.
*166-169 cm shell sample: olive grey sand with subangular gravel, pebbles to 2 cm, no shell, no wood

175-187 cm KC: dark grey, massive, med sand

187-201 cm KC: dark grey, stiff, plastic mud with minor gravel; with some sand beds to 1 cm thick;
196 cm: very angular 1 cm gravel

Malacological description:

E87A-22 - 104.51-54 shell sample

Appendix E

Glans carpenteri (Lamy, 1922) syn. *Glans subquadrata* (Carpenter, 1864)

- 0.1g, ~1; 0.1g, 1; 0.1g, 1; 0.1g, 4 fragments
- Common; under stones from low tide to 50 fathoms (Abbott 1974: 477)
- 54°N-28°N; Frederick Island, BC south to Punta Rompiente, Baja California; nestling or attached to the underside of rocks, intertidal to 100 m (Harbo 1997: 148)
- 28N-58N: median latitude 43N; intertidal to -100 m; +5°C to +28°C; recent

Chlamys sp.

- 0.1g, 3 fragments

Nuculana sp.

- 0.1g, ~2 articulated

Nassarius mendicus (Gould, 1849)

- 0.1g, 1
- Alaska to Baja California; common in shallower water in the north; shore to 25 fathoms (Abbott 1974: 225)
- Alaska south to central Baja California; on sand, mud and rocks, intertidal to 18 m (Harbo 1997: 216)

Amphissa columbiana (Dall, 1916)

- 0.1g, 1; 0.1g, 1; 0.1g, 1; 0.1g, 1; 0.1g, ~1
- Alaska to San Pedro, California; moderately common in shallow water from Oregon to Alaska (Abbott 1974: 203)
- Alaska south to Oregon; not common in California; on rocky beaches and mud, in shallows (Harbo 1997: 215)

Pododesmus machrochisma (Deshayes, 1839)

- 0.1g, ~1; 0.1g, ~1
- Adak Island, Alaska to Baja California. Japan. Very common species attached to stones and sharp pilings from low tide mark to about 35 fathoms. Often found on *Haliotis* (Abbott 1974:452)
- 58°N-28°N; Bering Sea to Alaska and south to Baja California Sur, and the Gulf of California; rocks and other solid objects, intertidal to 90 m (Harbo 1997:141)
- 57°N-70°N; median latitude 64N; habitat: intertidal to 40 m; temp: -2° to 14°C; geologic range: Miocene; northwest Pacific (Bernard 1983:28)
- occasionally found on protected outer coast, but more common on rocks in quiet bays or on wharf pilings, fastened to reefs, bays and estuaries on rocky shores at low intertidal, (Ricketts et al., 1985: 160, 290)

Petalaconchus compactus, (Carpenter, 1864)

- 0.8g, 1; 0.7g, 1; 0.3g, 1; 0.3g, 1; 0.1g, 4 fragments
- Washington to California; moderately common from low-tide mark to 50 fathoms (Abbott 1974:100)
- Vancouver Island south to California; on or under rocks, shallow subtidal to 50 m (Harbo 1997:201)

Cranopsis cucullata (Gould, 1846) syn. *Puncturella cucullata* (Gould, 1846)

- 0.1g, 1; 0.1g, 1
- Alaska to La Paz, Mexico; Found at low tide in Alaska and dredged from 20-75 fathoms off southern California, common (Abbott, 1974: 22)
- 57°N-30°N; Alaska to Cabo San Quintin, Baja California; on and under rocks from the low tide to 200 m (Harbo 1997: 185)

Acmaea mitra (Rathke, in Eschscholtz, 1833)

- 0.1g, 1
- Alaska to Baja California in cold water; commonly washed ashore; lives in cold water below the low-tide level (Abbott 1974: 30)
- Aleutian Islands, Alaska south to Baja California; intertidal and in shallow subtidal area, on rocks with encrusting coralline algae; shells often wash up on surf beaches (Harbo 1997: 196)
- frequents to lowest intertidal; occasionally shows up in rocky shores: lowest zone of middle intertidal; range from the Aleutian Islands to Isla San Martín, northern Baja California, ordinarily solitary and fairly uncommon, in California, this species spawns in the winter (Ricketts, Calvin and Hedgpeth 1985: 27, 56, 150-151)

Epitonium indianorum (Carpenter, 1865)

- 0.1g, 1 in 2 fragments
- Forrester Island, Alaska to Baja California; fairly common offshore on gravel bottom in association with sea anemones; from Monterey south this species is found from 25 to 71 fathoms, just below low-tide mark from British Columbia north to Alaska. (Abbott 1974: 119)
- 55°N-25°N; Alaska south to Baja California; often found associated with and feeding on tealia anemones; intertidal and subtidal to 120 m (Harbo 1997: 208)

sea urchin spines

- 0.1g, 2

sponge

- 0.1g, 1 fragment

coral

- 0.1g, 8 fragments

Appendix E

Balanus spp.

- 0.2g, 11 fragments

unidentified bivalve frag's

- 0.1g, 8 fragments

unidentified gastropod frag

- 0.1g, 1 fragment

E87A-22 - 104.84-88 shell sample***Saxidomus giganteus* (Deshayes, 1839)**

- 1.2g, ~1; 0.1g, 1; 0.1g, 1; 30.1g, 6 fragments
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30cm in the mid- to lower intertidal zone, to depths of 40m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

***Amphissa columbiana* (Dall, 1916)**

- 0.1g, 1
- Alaska to San Pedro, California; moderately common in shallow water from Oregon to Alaska (Abbott 1974: 203)
- Alaska south to Oregon; not common in California; on rocky beaches and mud, in shallows (Harbo 1997: 215)

***Nuculana minuta* (Fabricius, 1776)**

- 0.2g, 2 articulated
- Arctic to off San Diego; and to Maine; Uncommon offshore (Abbott 1974:414)
- 53N-71N: median latitude 62N; 20-250m; -1°C to +6°C; Pleistocene (Bernard 1983:12)

Euspira pallida* (Broderip & Sowerby, 1829) syn. *Natica clausa

- 0.1g, ~1

Appendix E

- Arctic Ocean to off California; commonly dredged in moderately deepwater, and occasionally found intertidal north of Massachusetts. Deepest record is 1,240 fathoms (Abbott 1974: 159)
- Circumpolar; Arctic south to northern California; in or on the sand; shallow subtidal to 500m (Harbo 1997: 206-207)

Hiatella sp.

- 0.1g, ~1

Balanus spp.

- 0.7g, 22 fragments

unidentified bivalve frag's

- 0.1g, 5 fragments

Plant & wood

- 0.1g, 13 fragments

E87A-22 - 105.03 - 105.07 shell sample

Nutricula lordi (*Psephidia lordi*) (Baird, 1863)

- 0.1g, 1
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47°N; intertidal to -70 m; temp: 0 to +16°C; Pliocene (Bernard 1983: 56)

Chlamys sp.

- 0.1g, 1 fragment

Balanus spp.

- 0.1g, 7 fragments

unidentified bivalve frag's

- 0.1g, 6 fragments

wood

- 0.1g, 22 fragments

E87A-22 - 105.15 - 105.18 shell sample

Balanus cariosus syn. *Semibalanus cariosus*

- 0.1g, 1 scutum; 0.1g, 1 scutum
- middle intertidal in Puget Sound; a high intertidal assembly: *Mytilus californianus*, *Collisella digitalis* (limpet), *Littorina* sp., *Nucella* sp., and *Nuttallina* (chitons); In the high intertidal zone in bays and estuaries, it prefers steep shores with strong currents and considerable wave action; in protected outer coast, it avoids oceanic conditions, preferring maximum protection in overhangs and deep crevices in the low zone; association with *Mytilus californianus* (Ricketts et al., 1985: 8, 33, 270-272)

Balanus spp.

- 0.1g, 6 fragments

Nutricola lordi (Ricketts et al., 1985: 378-379)

- 0.1g, ~1
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47°N; intertidal to -70 m; temp: 0 to +16°C; Pliocene (Bernard 1983: 56)

unidentified bivalve frag's

- 0.1g, 5 fragments

wood

- 0.3g, 10 fragments

E87A-22 - 105.21 - 105.24 shell sample

Amphissa columbiana (Dall, 1916)

- 0.1g, 1
- Alaska to San Pedro, California; moderately common in shallow water from Oregon to Alaska (Abbott 1974: 203)
- Alaska south to Oregon; not common in California; on rocky beaches and mud, in shallows (Harbo 1997: 215)

Protothaca staminea (Conrad, 1837)

- 0.1g, 1 fragment
- Aleutian Islands to Baja California. (Abbott 1974: 526)
- 54°N-23°N; Aleutian Islands, Alaska south to Baja California Sur; buried to 10 cm or more in gravel, and in sand-mud bottoms in the mid-intertidal zone to 10 m, can live 14 years, edible (Harbo 1997:166)
- 23°N-60°N; median latitude: 42°N; habitat: intertidal to -10 m; temp: +2°C to

+27°C; Miocene (Bernard 1983: 52)

- widely used for food, may occur in such superabundance that two or three shovelfuls of substratum would contain enough clams to provide meal for several people; a poor diggers thus never lives in shifting sand where rapid digging is essential, may be found in packed mud or in gravel mixed with sand but prefers clayey gravel where lives at depths of 8 cm below surface; bays and estuaries, rocky shores: middle intertidal, but can occur in preferred clayey gravel in isolated bits of protected outer coast, spawning occurs in summer in BC and Alaska, slow growth especially in south-central Alaska where requires 8 years to reach 30 mm; growth rate determined primarily by extent and constancy of food supply which depends on the animal's position in relation to the tidal current and its degree of protection from storms, as well as water temp.; often drilled by *Polinices* sp. (Ricketts 1985: 149, 220, 281-282, 326)

unidentified bivalve frag's

- 0.2g, 5 fragments

Balanus glandulus

- 0.1g, 1 tergum
- Uppermost horizon, bare rocks abundant on the protected coast, also thrives in quiet waters and along the surf-swept outer coast; high intertidal, unspecialized habitat requirements, range from Aleutian Islands to Bahía de San Quitin, Baha California, thrives in constantly aerated ocean waters along the protected outer coast, even in violently surf-swept points, but also in quiet waters of Puget Sound; common in bays and estuaries, great variability of habitat due to high tolerance and generalization, unusual for marine invertebrates (eg. Outer coast is wave shock, low temperature, high salinity, and high Oxygen, whereas in bays and estuaries is high temperatures, variable and often low salinities, and relatively low oxygen content; upper intertidal in Washington region (middle intertidal in California) (Ricketts 1985: 8, 24, 25, 270, 433)

unidentified bivalve frag's

- 0.3g, 17 fragments

Neptunea lyrata (Gmelin, 1791)

- 0.1g, 1
- Arctic Ocean to off California, fairly common in Alaska from shore to 50 fathoms (Abbott 1974: 212-213)
- Alaska south to northern California; on sand and mud, from shallow shores, occasionally intertidal to 100 m (Harbo 1997: 214)

charcoal

- 0.2g, 4 fragments

Plant & wood

- 0.1g, 5 fragments

E87A23

Depth interval: 0-184 cm

Scientist: LZ

Described by: SMS/KC

Type of Core: vibracore

Section: 2 sections

Latitude: 50 59'94"

Longitude: 128 26'55"

Depth: 94 m

Lithological Description:

Depth in core:	Lithological description
0-39 cm	KC: well sorted fine sand, heavy mineral rich (5-10%) massive, compact minor shell fragments throughout, shell frag at 13 cm (<i>Macoma expansa</i>); silty beds at 19-22 cm; intact bivalve from 25-31 cm (<i>Saxidomus giganteus</i>)
0-40 cm	RH: fine grey/olive sand with shell fragments to ~35 cm *14-17 cm shell sample: very fine sand, coniferous needle, little shell; <i>Pandora filosa</i> , <i>Acila castrensis</i> ; <i>Yoldia</i> sp., <i>Olivella biplicata</i> , <i>Balanus</i> sp., unidentified bivalve, wood. *23-26 cm shell sample: fine sand, some gravel, wood, <i>Balanus</i> spp., intact bivalve 25-31 cm, <i>Saxidomus giganteus</i> previously removed, 13 cm <i>Macoma expansa</i> previously removed; <i>Acila castrensis</i> , <i>Lucinoma annulatum</i> , <i>Mytilus</i> sp., unidentified bivalve, unidentified gastropod, <i>Balanus</i> sp., wood
39-54 cm	KC: coarse sand, massive well sorted, c0.5% heavy mineral, charcoal fragment @ 42 cm; woody debris @ 44-45 cm; shell hash @ 51-52 cm (<i>T. Nucella emarginata</i>); wood fragment and <i>Clinocardium californiense</i> @ 53 cm
40-54 cm	RH: coarse sand *51-54 cm shell sample: no shell, some wood; 51-52 cm <i>Nucella emarginata</i> previously removed, 54 cm <i>Clinocardium californiense</i> previously removed; wood
54-55 cm	KC: peat
55-56 cm	KC: silt
56-70 cm	KC: sand bleb?, medium grained with granules, peat with some silt
54-106 cm	RH: terrestrial and organic sandy soil, rootlet 90-100 cm
70 cm	KC: very fine silty organic sand
70-107 cm	KC: coarse organic, 80-88 cm (irregular shape) becomes slightly

more oxidized at the base

NOTE: during subsampling a 3 mm x 2 cm log twig or root was exposed from 29-91 cm, for R. Mathewes

KC: beginning of section 2, very fine silty muddy sand with very dark greyish brown vertically oriented rootlets possible "B" soil horizon

NOTE: small (3 mm) pc. Of root from archive ½ sent to E. Nelson for C13 calc. May'88

107-135 cm KC: moderately sorted gravelly sand with minor oxidized mud clasts (weathered?) The lower part of the section contains fewer pebbles and granules max gravel size (1 cm); coarsening upward, medium to coarse moderately sorted sand with granules

106-135 cm RH: coarse organic layers, rounded pebbles to 1 cm

135-136 cm KC: fine sandy mud

RH: layer of fine grey brown sand/silt

*135-138 cm shell sample: no shell, no wood, subangular/rounded gravel to 1.5 cm

136-170 cm KC: gravelly medium to coarse sand to sandy gravel moderately sorted max gravel size 1cm; becomes more oxidized from 160 upsection and coarsens upwards; below 160 cm coarse sand moderately sorted with granules

RH: gravelly sand, increasing oxidation upwards in core

*164-167 cm shell sample: gravel, no shell, no wood, subangular pebbles to 1 cm

170-184 cm KC: gravelly sand, moderately sorted to well-sorted max gravel size - 1 cm sand is coarse, the pebbles are more polished in this zone than above.

RH: coarse sand, gravel to 2.5 cm, fining upwards

*175-178 cm shell sample, no shell, no wood, rounded and subangular gravel, fine basalt flakes; lithic flakes - 0.1g, 2 flakes, sharp edged, evidence of little travelling

NOTE: twig and 2 sand subsamples sent to R. Mathewes (6-8 cm, 45-48 cm, 88-90 cm) May/88

Malacological description:

E87A23-94.14-94.17

Pandora filosa (Carpenter 1864)

- 0.1g, ~1
- Alaska to Ensenada, Baja California, 10 to 75 fathoms (Abbott 1974; 558)
- 61°N to 32°N; Northern Gulf of Alaska south to Ensenada, Baja California Sur;

- gravel bottoms 20-300 m
- 32°N to 60°N; median lat: 46N; 20-300 m; +1°C to +18°C; Pliocene

Acila castrensis (Hinds 1843)

- 0.1g x2, 1 x2
- Bering Sea to Baja California; commonly dredged from 4 to 100 fathoms in sandy mud (Abbott 1974: 411)
- 57°N-24°N; NE Bering Sea, Alaska south to Punta San Pablo, Baja California, and in the Gulf of California; mud-sand bottoms 5-220 m (Harbo 1997: 132)
- 28°N-57°N; median: 42N; 5-200 m; +3 to +26°C; Miocene

Yoldia sp.,

- 0.1g, ~1

Olivella biplicata (Sowerby, 1825)

- 0.1g, ~1; 0.1g, ~1; 0.2g, 1 (2 frag's)
- Vancouver Island, British Columbia, to Baja California; abundant in summer months in sandy bays and beaches, sometimes dredged down to 25 fathoms on gravel bottoms (Abbott 1974: 235)
- Vancouver Island, BC south to Baja California; in sand, on open coast, burrow in sand quickly when tide goes out; used by Native peoples for jewellery and ornaments (Harbo 1997:217)
- NOTE: range is exclusive of QCI today; ie: warmer

Balanus sp.

- 0.1g, ~1, 0.1g, ~1

unidentified bivalve

- 0.1g, 2 + 2 frag's

wood

- 0.1g, 1 frag

E87A23-94.23-94.26

Saxidomus giganteus (Deshayes, 1839)

- previously removed @ 13 cm
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible

(Harbo 1997:164)

- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Macoma expansa (Carpenter 1864)

- previously removed
- Puget Sound to La Jolla California (Abbott 1974: 508)
- 71°N to 53°N; Arctic, Bering Sea south to Queen Charlotte Islands, BC possibly farther south; clean sand along exposed coasts, intertidal to 183 m (Harbo 1997: 160)
- 35°N to 60°N; median lat 48N; intertidal to -30 m; -2°C to +25°C; Pleistocene (Bernard 1983: 45)

NOTE: a lot of uncertainty as to the geographical distribution of this species

Acila castrensis (Hinds 1843)

- 0.1g, ~1 (2frag's)
- Bering Sea to Baja California; commonly dredged from 4 to 100 fathoms in sandy mud (Abbott 1974: 411)
- 57°N-24°N; NE Bering Sea, Alaska south to Punta San Pablo, Baja California, and in the Gulf of California; mud-sand bottoms 5-220 m (Harbo 1997: 132)
- 28°N-57°N; median: 42N; 5-200 m; +3 to +26°C; Miocene (Bernard 1983: 9)

Lucinoma annulatum (Reeve, 1850)

- 0.1g, ~1, 0.1g, 1 frag
- Alaska to southern California, fairly commonly dredged from 8-75 fathoms (Abbott 1974:461)
- 60°N-28°N; Prince William Sound and northern Alaskan islands south to the Gulf of California; intertidal sand-mud to 750 m (Harbo 1997:145)
- 33°N-60°N; median latitude 47N; habitat:25-750m; temp:+1° to +12°C; geologic range: Miocene (Bernard 1983:29)
- anoxic, high sulphur environment

Mytilus sp.,

- 0.1g, 1 frag

unidentified bivalve

- 0.1g x4, 1 x4; 0.2g, 4 frag's

unidentified gastropod

- 0.2g, 6 frag's

Balanus sp.

- 0.1g, 2 frag's

wood

- 0.1g, 1 frag

E87A23-94.51-94.54

Nucella emarginata (Deshayes 1839)

- previously removed
- Bering Sea to Mexico, common along coastal rocky shorelines (Abbott 1974: 182)
- Bering Sea, Alaska south to northern Baja California; feeds on mussels, semi-protected and exposed rocky beaches (Harbo 1997: 212)
- middle intertidal, -0.1m to +2.5 m abundant on rocky shores where surf is fairly heavy - almost entirely restricted to these regions; spawning is not seasonal; carnivorous (Ricketts et al. 1985: 8,230-232,271,434,463)

Clinocardium californiense (Deshayes, 1839)

- previously removed @ 54 cm
- 60°N to 58°N; Bering Sea and southeast into the Gulf of Alaska; not found in California; subtidal 10 to 100 m (Harbo 1997: 151)
- 58°N to 60°N; median Lat 59N; 10-100 m; +1°C to +9°C; Pleistocene (Bernard 1983; 39)

wood

- 0.1g, 4 frag's

E87A4

Depth interval: 171 cm

Scientist: JVB

Described by: KC

Type of Core: vibrocore

Section: 1 & 2

Latitude: 51° 8.51 N

Longitude: 128° 40.1 W

Depth: 122 m

Lithological Description:

Depth in core: Lithological description

0-36cm KC: pale yellow (5y 6/3) clean, well sorted, fine sand; >10% heavy minerals; silt beds at 11 cm - 2 to 3 cm width, 20 cm - silty pockets more tan beds, 30 cm; yellowish colouration of quartz grains may be Fe stain.

RH: yellow grey fine sand

*25-28 cm shell sample: very little shell, tiny shell fragments & wood fragments; *Rhabdus rectius*, plant & wood

36-61cm RH: grey fine sand

36-91cm KC: sharp colour change to grey; grey (2.5y 5/0) fine well-sorted sand with >15% heavy minerals; silty sand beds at 37 cm & 48 cm;
76 cm wood fragment

61-91cm RH: light grey fine sand

*65-68 cm shell sample: fine sand, 1 shell fragment, plant fragments; unidentified bivalve frag's, plant & wood

*85-88 cm shell sample: fine sand, no shell, small plant fragments; plant & wood

91-171cm KC: grey (2.5y 5/0) fine well-sorted sand with >20% heavy minerals <1%CaCO₃

108-162 KC: heavy mineral beds every cm

139cm KC: wood fragment ~5 mm

162cm KC: dark grey (2.5y 4/0) gradational contact

168cm KC: lens of silt

RH: dark grey fine to very fine sand with darker grey layers/wisps

*103-107 cm shell sample: fine/very fine sand, no shell, tiny wood/plant fragments - none collected

*140-143 cm shell sample: fine/very fine sand, very few tiny shell fragments, tiny wood/plant fragments; unidentified bivalve frag's, plant & wood

*164-167 cm shell sample: fine/very fine sand, shell fragments > than overlying layers, also >plant and wood fragments; *Tellina modesta*, unidentified bivalve

frag's, plant & wood

Malacological description:

E87A4-122.25 to .28 shell sample

Rhabdus rectius (Carpenter, 1865)

- 0.1g, 1 fragment
- Alaska south to Panama; offshore in mud and silt (Harbo 1997:224)

plant & wood

- 0.1g, 8 fragments

E87A4-122.65-.68 shell sample

unidentified bivalve frag's

- 0.1 g, 1 frag

plant & wood

- 0.1g, 2 fragments

E87A4-122.85-.88 shell sample

plant & wood

- 0.1g, 6 frag's

E87A4-123.03-.07 shell sample

nothing

E87A4-123.40-.43 shell sample

unidentified bivalve frag's

- 0.1g, 4 fragments

Plant & wood

- 0.1g, 9 fragments

E87A4-123.64-.67 shell sample

Tellina modesta (Carpenter, 1864)

- 0.1g, ~1
- Alaska to the Gulf of California; common in certain sandy localities from shore to 25 fathoms (Abbott 1974: 502)
- 59°N - 28°N, Cook Inlet, Alaska south to Baja California Sur; in sand, intertidal to -50 m (Harbo 1997:156)
- 28N-60N; median latitude 44N; intertidal to -50 m; +4° to +24°C; Pleistocene

unidentified bivalve fragments

- 0.1g, 7 fragments

Plant & wood

- 0.1g, 7 fragments

E88B24

Depth interval: 152 cm

Scientist: VB

Described by: KC

Type of Core: vibrocore

Section: 1

Latitude: 53 15.59 N

Longitude: 130 51.30W

Depth: 144 m

Lithological Description:

Depth in core:	Lithological description
0-25cm	KC: greener than olive, massive muddy very fine sand; minor shell debris; minor forams; mud ~2%; well sorted - unit 3, sharp contact with underlying layer RH: olive grey fine sand, erosional contact @ base with shell layer underlying unit
25-29cm	KC: olive shell fine sand, sharp contact with underlying unit - unit 2 RH: olive grey sand & shell, erosional contact with underlying unit
26-28 cm	shell sample: rounded pebble 5 cm diameter, fine olive grey sand, abundant shell & wood, sea urchin, <i>Clupea harengus pallasii</i> fish scale, fish vertebrae, foram - intertidal; shell: <i>Parvalucina tenuisculpta</i> , <i>Nuculana</i> sp., unidentified bivalve frag's, <i>Mytilus</i> sp., sea urchin, <i>Balanus spp.</i> , foram, wood, <i>Clupea harengus pallasii</i> scale, cf. <i>Theragra chalcogramma</i> vertebrae
29-64cm	KC: dark grey mud with fine sand lenses (= infilled burrows) and olive grey mud lenses associated with burrows; laminated to massive (due to bioturbation), gradational contact with underlying unit, Unit 1B
64-152cm	KC: dark grey muddy very fine sand; (30% mud), massive to finely laminated; bioturbated some shells and shell debris concentrated in ~10cm thick zones; some mud lenses (assoc. With burrows?); some minor shell lenses and pockets and minor gravel to 2 cm diameter; becomes muddier near top of unit (50% mud); unit 1A C14 13,610 +/- 80n @ 149-150 cm RH: med grey muddy sand with shells, valves and large fragments

Appendix E

throughout.

67-70 cm shell sample: fine med grey muddy very fine sand, *Macoma sp.*, virtually no wood, shell: *Macoma calcarea*, *Macoma sp.*, wood
 100-103 cm shell sample: very fine med grey muddy sand, well compacted, *Macoma sp.*, no wood, shell: unidentified bivalve frag's- worn
 130-133 cm shell sample: very fine med grey muddy sand, well compacted, *Macoma sp.*, *Mya sp.*?, shell: *Macoma calcarea*, unidentified bivalve frag's
 150-152 cm shell sample: very fine med grey muddy sand, well compacted, small gastropod, shell frag's & plant frag's, shell: unidentified bivalve frag's, unidentified gastropod frag's

Malacological description:

E88B24-144.26-.28

Parvalucina tenuisculpta (Carpenter, 1864)

- 0.1g, 1
- Bering Sea to Baja California; common just offshore (Abbott 1974:459)
- 60°N-28°N; Kodiak Island, Alaska south to Isla Cedros, Baja California Norte; intertidal in sand-mud, to depths of 275 m and more, sometimes in dense numbers (Habo 1997:145)
- 33°N-60°N; median latitude 47°N; habitat: 5-275 m; temp: +1 to +22 °C; geologic range: Pliocene (Bernard 1983:29)

Nuculana sp.

- 0.1g, ~1; 0.1g, 3 frag's

unidentified bivalve frag's

- 3.2g, 59 frag's

Mytilus sp.

- 0.1g, 2 frag's

sea urchin

- 0.1g, 8 spines

Balanus spp.

- 0.2g, 8 frag's

foram

- 0.1g, 1; 0.1g, 1

wood

- 0.3g, 31 frag's

Clupea harengus pallasii fish scale (Valenciennes, 1847) (Pacific herring)

- <0.1g, 1
- in eastern Pacific from Baja California 37.4N to Beaufort Sea
- spawning temperatures in BC 4.4 to 10.7 °C and 3.0 to 12.3 °C on a coastwise basis
- first food is invertebrate eggs, copepods, and diatoms followed by barnacle and mollusc larvae, bryozoans, rotifers, young fish and copepods
- salinity tolerance for egg development and when mature is high
- food for chinook and coho salmon, sharks, lingcods, sea lions, whales
- annual inshore movement for spawning in the fall

cf. *Theragra chalcogramma* vertebrae

- 0.1g, 1
- range from Carmel, central California through Bering Sea to St. Lawrence Island and on the Asian coast to Kamchatka, Okhotsk Sea, and southern Sea of Japan. From 0 to -366 m; food is shrimps, sand lance, and herring; in Alaska as young pink, chum and coho salmon, in Asian waters mysids, euphausiids, silver smelt, and capelin. Eat by fur seals.

E88B24-144.67-.70*Macoma calcarea* (Gmelin, 1791)

- 2.8g, 1, 1; 2, ~1
- Greenland to Long Island, New York; Bering Sea to Washington; common cold-water species (Abbott 1974: 505)
- 71°N-47°N, circumboreal, Arctic to Bering Sea and south to Newport Oregon; in sand, silt, and gravel; intertidal to -320 m (Harbo 1997:159)
- 47°N-71°N, median 59N; intertidal to -320 m, -2°C to +15°C; ?Oligocene; Panarctic, circumboreal (Bernard 1983: 44)

Macoma sp.

- 0.7g, 5 frag's

wood

- 0.1g, 2 frag's

E88B24-145.00-.03

Unidentified bivalve frag's

- 1.3g, 18 frag's - worn

E88B24-145.30-.33*Macoma calcarea* (Gmelin, 1791)

- 1.2g, ~1 in 3 frag's
- Greenland to Long Island, New York; Bering Sea to Washington; common cold-water species (Abbott 1974: 505)
- 71°N-47°N, circumboreal, Arctic to Bering Sea and south to Newport Oregon; in sand, silt, and gravel; intertidal to -320 m (Harbo 1997:159)
- 47°N-71°N, median 59N; intertidal to -320 m, -2°C to +15°C; ?Oligocene; Panarctic, circumboreal (Bernard 1983: 44)

unidentified bivalve frag's

- 2.1g, 18 frag's

E88B24-145.42

Macoma nasuta (Conrad, 11837) dated to 13,610 +/- 80 MRC to 13,210 YBP

- 60°N - 22°N, Cook Inlet, Alaska south to southern Baja California Sur; 10-15 cm buried, common in intertidal sand to -50 m (Harbo 1998:158)
- 27°N - 60°N, intertidal to -50 m, +1°C to +22°C, Miocene
- mudflats, live in softer mud than any other species, high tolerance to stale, highly sedimented, irregularly flushed lagoonal water, frequently used as food by aborigines (Ricketts et al., 1985: 379-380)

E88B24-145.50-.52

Unidentified bivalve frag's

- 0.2g, 5 frag's

unidentified gastropod frag's

- 0.1g, ~1

E88B-29

Depth interval: 134 cm

Scientist: VB

Described by: KC

Type of Core: vibrocore

Section: 1

Latitude: 51.9705 N

Longitude: 128.5942W

Depth: 118 m

Lithological Description:

Depth in core:	Lithological description
0-2 cm	KC: sandy mud; unit 4B; sharp contact with unit 4A RH: grey sand & subangular gravel to 2c m
2-5 cm	KC: grey mud/sand; unit 4A; sharp contact with unit 3C
5-8 cm	KC: muddy sandy gravel to 5 cm diameter; unit 3C; gradational contact with unit 3B
8-18cm	KC: olive gravelly muddy sand, poorly bedded, unit 3B, gradational contact with unit 3A
18-32 cm	KC: olive gravelly sandy mud, some sand lenses and bedding; unit 3A, sharp contact with unit 2B, possibly erosional
2-32 cm	RH: olive silty sand with small pebbles to 1 cm, shell fragments *24-27 cm shell sample: medium sand, pebbles to 1 cm, whole shell and fragments, fish scales; <i>Tellina nukuloides</i> , <i>Chlamys</i> sp., <i>Balanus</i> spp., unidentified bivalve fragments, sea urchin spine, fish scale, plant fragments
32-35 cm	KC: light olive brown medium well sorted sand, unit 2B; sharp contact with unit 1E, possibly erosional RH: olive grey medium sand with wood
35-37 cm	KC: silt bed; unit 2A; sharp erosional? contact with unit 1E
37-67 cm	KC: grey massive medium sand with minor shell debris; unit 1E; sharp contact with unit 1D, interbedded
33-68 cm	RH: grey medium sand with shell *51-54 cm shell sample: medium grey sand with minor shell; <i>Tellina</i> <i>nukuloides</i> , unidentified bivalve fragments, <i>Balanus</i> spp.
67-88 cm	KC: grey to dark grey medium sand with some fine sand beds which are heavy mineral enriched; unit 1D, sharp interbedded contact with unit 1C
68-89 cm	RH: medium grey/dark grey laminated sand with minor shell fragments 74-74 cm RH: shell layer *74-77 cm shell sample: medium dark grey sand with shell, minor wood

Appendix E

fragments; *Saxidomus giganteus*, *Macoma* sp., *Balanus* spp., plant & wood

*86 cm fish bone sample, is *Balanus* sp.

- 88-123 cm KC: dark grey, laminated fine sand with some shells and shell debris; some medium sand interbeds; unit 1C; sharp interbedded contact with unit 1B
- 89-122 cm RH: medium grey sand with dark grey silt lamination, whole shell, increasing shell to base of core
- *89-92 cm shell sample: medium dark grey sand, shell fragments
- *96 cm shell sample: took 1 shell only - *Olivella baetica*.
- *113-116 cm shell sample: medium grey sand with some large shell fragments, wood fragments; *Tellina nukuloides*, *Polinices lewisii*, *Balanus* spp., charcoal
- *121 cm shell sample: one shell only, *Olivella baetica*.
- *123-127 cm shell sample: medium grey sand, shell in crushed *Balanus* spp. shell matrix, some wood fragments; *Tellina nukuloides*, *Olivella baetica*, *Mytilus* sp., *Balanus* spp., charcoal, unknown
- 123-128 cm KC: dark grey moderately sorted shell medium sand; sharp interbedded contact with unit 1A
- 128-135 cm KC: dark grey moderately sorted medium sand with abundant shell debris

Malacological description:

E88B29-118.24-.27 shell sample

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1; 0.1g, 1; 0.1g, 1; 0.1g, 1; 1g, 1; 0.1g, 1; 0.1g, 1; 0.1g, 1; 0.1g, 1; 0.1g, 1
- frag
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Chlamys sp.

- 0.1g, 1 frag

Balanus spp.

- 0.1g, 5 fragments

Unidentified bivalve fragments

- 0.1g, 2 fragments

sea urchin spine

- 0.1g, 1

fish scale

- 0.1g, 1

Plant fragments

0.1g, 3 fragments

E88B29-118.51-.54 shell sample

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1; 0.1g, ~1
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Unidentified bivalve fragments

- 0.1g, 3 fragments

Balanus spp.

- 0.1g, 6 fragments

E88B29-118.74-.77 shell sample

Saxidomus giganteus (Deshayes, 1839)

- 0.3g, ~1 in 2 fragments; 0.1g, ~1; 0.7g, 14 fragments
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Macoma sp.

- 0.7g, 2 fragments

Balanus sp.

- 0.1g, 1 fragments

Plant & wood

- 0.1g, 4 fragments

E88B29-118.86 shell sample

Balanus sp.

- 0.1g, 2 fragments

E88B29-118.89-.92 shell sample

Saxidomus giganteus (Deshayes, 1839)

- 0.1g, ~1
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Balanus spp.

- 0.1g, 17 fragments

Unidentified bivalve fragments

Appendix E

- 0.1g, 2 fragments

Plant & wood

- 0.1g, 4 fragments

Note: *Olivella sp.* dated at 91 cm.

E88B29-118.96 shell sample

Olivella baetica (Carpenter, 1864)

- 0.4g, 1
- Kodiak Island, Alaska to Baja California (Abbott 1974: 235)
- Alaska south to Baja California, in sandy bays and beaches, often in same areas as purple olive. Also found in more protected waters (Harbo1997:217)
- most commonly found south of Point Conception, although total range is about the same as *O. biplicata* – Vancouver to Baja California, bays & estuaries (Ricketts et al. 1985: 328)

E88B29-119.13-.16 shell sample

Tellina nukuloides (Reeve, 1854)

- 0.2g, 1; 0.1g, 1; 0.1g, 1; 0.1g, 2 fragments, 0.1g, ~1
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Polinices lewisii (Gould, 1847) *Lunatia lewisii*

- 1.8g, 2 fragments
- British Columbia to Baja California, very common species found in shallow water to 25 fathoms (Abbott 1974:156)
- Southeastern Alaska to southern California; on sand, intertidal to 50 m (Harbo 1997:207)
- bays and estuaries, may occur in muddy sand, B.C. to Baja California

E88B29-119.21 shell sample

Olivella baetica (Carpenter, 1864)

- 0.3g, 1
- Kodiak Island, Alaska to Baja California (Abbott 1974: 235)
- Alaska south to Baja California, in sandy bays and beaches, often in same areas as purple olive. Also found in more protected waters (Harbo1997:217)
- most commonly found south of Point Conception, although total range is about the same as *O. biplicata* – Vancouver to Baja California, bays & estuaries

Appendix E

(Ricketts et al. 1985: 328)

E88B29-119.23-.27 shell sample

Tellina nukuloides (Reeve, 1854)

- 0.2g, 1; 0.1g, 1g, 1 (x16); 0.1g, ~1; 0.1g, 2 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Olivella baetica (Carpenter, 1864)

- 0.1g, 1; 0.1g, 1
- Kodiak Island, Alaska to Baja California (Abbott 1974: 235)
- Alaska south to Baja California, in sandy bays and beaches, often in same areas as purple olive. Also found in more protected waters (Harbo 1997: 217)
- most commonly found south of Point Conception, although total range is about the same as *O. biplicata* – Vancouver to Baja California, bays & estuaries (Ricketts et al. 1985: 328)

Mytilus sp.

- 0.1g, ~1 in 2 fragments

Balanus spp.

- 0.6g, 26 fragments

Charcoal

- 0.1g, 1 fragment

Unknown

- 0.1g, 1

E88B-30

Depth interval: 144 cm

Scientist: VB

Described by: ?

Type of Core: vibrocore

Section: 1

Latitude: 53 01.47 N

Longitude: 130 32.20W

Depth: 111 m

Lithological Description:

Depth in core:	Lithological description
0~25 cm	?: burrowed sand facies, thalassanoides; wood, shell and pebble clasts; ploycheate worm tubes
1-26 cm	RH: olive green medium sand with shell and wood
25-82 cm	?: laminated sand facies; thalassanoides, well sorted sand 250 microns, resedimented plant material
26-60 cm	RH: medium grey fine sand, laminated inconsistently; evidence of burrowing
	*43-46 cm shell sample: med grey fine sand, lots of wood frag's, some shell frag's: unidentified bivalve fragments, charcoal, and wood
60-63 cm	RH: med grey muddy sand with abundant wood/charcoal & shell
	*60-63 cm shell sample: fine muddy sand; significant wood/charcoal fragments, minor shell frag's: <i>Thracia trapezoides</i> , <i>Mytilus sp.</i> , unidentified bivalve fragments, charcoal, wood
63-82 cm	RH: med grey fine sand, large shell fragments
	*73-76 cm shell sample: med grey fine sand, large shell fragments: <i>Saxidomus giganteus</i> , unidentified bivalve fragments, charcoal, wood, sand globules
82-144 cm	?: laminated sand facies, 150-250 micron mean; wood fragments and lithoclasts (4 mm diam.)
82-84 cm	RH: med grey muddy sand with abundant wood, truncated
	*82-84 cm shell sample: med grey muddy sand with clay globules, woody: charcoal, wood, and plant
84-122 cm	RH: fine grey sand, laminated, fine shell
	*105-108 cm shell sample: virtually no shell, a little wood: unidentified bivalve fragments, charcoal, wood
122-126 cm	RH: fine grey sand with abundant shell, large mussel
	*122-125 cm shell sample: periostracum of large mussel shell fossilized in sand, balance of large mussel shell in archived core; significant wood, shell has not traveled far: mussel - <i>Mytilus sp.</i> ?, unidentified bivalve fragments, charcoal, wood & plant
126-145 cm	RH: fine grey laminated sand, fine shell

*136-139 cm shell sample: fine grey sand, virtually no shell, some wood:
charcoal, wood

Malacological description:

E88B30 - 111.43-.46 shell sample

unidentified bivalve fragments

- 0.1g, 6 frag's

charcoal

- 0.1g, 20 frag's

wood

- 0.1g, 16 frag's

E88B30 - 111.60-.63 shell sample

Thracia trapezoides (Conrad, 1849)

- 0.1g, ~1 in 5 frag's
- commonly dredged off the west coast (Abbott 1974: 558)
- 57°N-28°N; Wide Bay, Alaska south to Isla Cedros, Baja California, in sand-mud, at 11-200 m, (Harbo 1997: 179)
- 34°N-61°N, median latitude 48N; depth 20-200 m; +2° to +20°C, Miocene (Bernard 1983: 64)

Mytilus sp.

- 0.1g, 2 frag's

unidentified bivalve fragments

- 0.1g, 1 frag's

charcoal

- 0.2g, 49 frag's

wood

- 0.4g, 26 frag's

E88B30 - 111.73-.76 shell sample

Saxidomus giganteus (Deshayes, 1839)

- 1.6g, 3 frag's
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths

of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)

- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

unidentified bivalve fragments

- 0.1g, 1 frag

charcoal

- 0.1g, 3 frag's

wood

- 0.1g, 2 frag's

sand globules

- 0.1g, 4

E88B30 - 111.82-.84 shell sample

charcoal

- 0.1g, 5 frag's

wood and plant

- 0.1g, 9 frag's

E88B30 - 112.05-.08 shell sample

unidentified bivalve fragments

- 0.1g, 2 frag's

charcoal

- 0.1g, 2 frag's

wood

- 0.1g, 1 frag

E88B30 - 112.22-.25 shell sample

Mussel, *Mytilus sp.*? In archive half of core

unidentified bivalve fragments

- 0.1g, 11 frag's

charcoal

- 0.1g, 9 frag's

wood & plant

- 0.1g, 52 frag's

Note: *Modiolus rectus* dated

E88B30 - 112.36-.39 shell sample

charcoal

- 0.1g, 5 frag's

wood

- 0.1g, 11 frag's

E88B-53

Depth interval: 200 cm

Scientist: LZ

Described by: KC

Type of Core: vibrocore

Section: 1&2

Latitude: 51 56.53 N

Longitude: 129 04.93W

Depth: 133 m

Lithological Description:

Depth in core:	Lithological description
0-72 cm	KC: olive massive silty sand with abundant fine shell debris
0-69 cm	RH: olive grey fine sand with shell fragments throughout, interspersed with muddy lenses
	*30-33 cm shell sample: fine sand, shelly matrix, barnacle: <i>Balanus spp.</i> , unidentified bivalve fragments, sea urchin spin, unknown, wood, <i>Hiatella pholadis</i> , <i>Tellina nukuloides</i> , <i>Mactromeris polynyma</i>
	*56-59 cm shell sample: fine sand, shell matrix, significant shell fragments, fish scale, calcified sand clumps: <i>Nuculana sp.</i> , <i>Pododesmus machrochisma</i> , <i>Mytilus sp.</i> , <i>Cidarina cidaris</i> , <i>Clupea harengus pallasi</i> scale, unidentified bivalve frag's, <i>Balanus spp.</i> , sea urchin spine, coral, coniferous needle, wood, calcified sand clump
69-71 cm	RH: grey shelly mud sand lens
	*69-71 cm shell sample: clayey sand, lots of shell, articulated <i>Macoma sp.</i> , fish scale, obsidian, wood: <i>Macoma moesta</i> , <i>Macoma sp.</i> , <i>Cyclocardia ventricosa</i> , <i>Balanus crenatus</i> , <i>Balanus spp.</i> , coral, sea urchin spine, unidentified bivalve frag's
71-72 cm	RH: olive grey fine sand with shell fragments
72-75 cm	KC: dark grey soft mud
75-84 cm	KC: dark grey sandy mud
72-84 cm	RH: massive med grey muddy sand with large " <i>Macoma sp.?</i> " shells articulated
84-89 cm	KC: Almost solid shells and shell debris with base of coarse sand and fine gravel
	RH: shelly layer in mud and increasingly sand matrix, articulated massive shell
	*85-88 cm shell sample: abundant large shell, articulated macoma sp. periostracum & siphon preserved from <i>Mya sp.</i> : <i>Mya truncata</i> , <i>Macoma incongrua</i> , <i>Macoma sp.</i> , <i>Modiolus</i> , <i>Balanus glandulus</i> , <i>Trichotropis cancellata</i> , <i>Balanus spp.</i> , coral, unidentified bivalve frag's, organics, wood, sea urchin spine

- 89-102 cm KC: very dark grey massive sandy mud with shells and shell debris; some zones of abundant tube worms (possibly *Serulid vermiculonis*?); very stiff
 RH: med grey muddy sand with abundant shell
 *94-97 cm shell sample: muddy sand with large fragments of *Modiolus modiolus*?; *Macoma incongrua*, *Modiolus rectus*, *Petalaconchus compactus*, *Balanus spp.*, sea urchin spine, sand dollar, unidentified bivalve frag's
- 102-200 cm KC: very dark grey laminated to massive muddy sand with some shell debris and zones of abundant colonies of worm tubes
- 102-145 cm RH: massive med grey muddy sand with shell, tubeworms, *Modiolus sp.*
 *108-111 cm shell sample: fine muddy sand, *Modiolus sp.*, tubeworms, gastropod & fine wood fragments: *Petalaconchus compactus*, *Modiolus rectus*, *Trichotropis cancellata*, coral, unidentified bivalve frag's
 *136-139 cm shell sample: significant shell fragments, fine wood fragments, tubeworms & *Modiolus sp.*: *Modiolus rectus*, *Petalaconchus compactus*, *Trichotropis cancellata*, sea urchin spine, *Balanus spp.*, coral, unidentified bivalve frag's
- 145-155 cm RH: massive shelly deposit, med grey sand, large tubeworm colonies
 *150-153 cm shell sample: med grey fine sand/barnacle matrix, angular granite pebbles to 5.5 cm, predominantly *Balanus spp.* shell material, significant # of shell frag's, no wood frag's, angular pebbles throughout: *Modiolus rectus*, *Yoldia sp.*, *Balanus glandulus*, *Balanus crenatus*, *Balanus spp.*, sea urchin spine, unidentified gastropod frag's, unidentified bivalve frag's
- 155-200 cm RH: med grey massive muddy sand with shell fragments
 *169-172 cm shell sample: well packed, muddy fine sand, pebbles to 0.5 cm; *Hiatella sp.*, minor small wood fragments: *Hiatella pholadis*, sea urchin spine, unidentified bivalve frag's
 *192-195 cm shell sample: muddy fine sand with pebbles to 0.25 cm, articulated *Macoma sp.*, *Balanus spp.*, some fine wood fragments

Malacological description:

E88B53-130.30-.33

Hiatella pholadis (Linné, 1771)

- 0.1g (x5), ~1 (x4) + 4 frag's
- *Hiatella arctica* (Linné, 1767), common in cold water. Common in California; nest in kelp holdfasts and rock crevices, from low tide to deep water, This is *pholadis* (Linné, 1767), (Abbott 1974: 541).
- 68°N-48°N; Bering Sea and south to Puget Sound, Washington; in burrows of

pholads (piddocks), mussel beds and kelp holdfasts; intertidal to 10 m (Harbo 1997:174)

- 48°N-68°N, median latitude 58°N; intertidal to -10; -3°C to +15°C; Pliocene; circumboreal. (Bernard 1983: 59)

Tellina nukuloides (Reeve, 1854)

- 0.1g (x10), ~1 (x5) + 1 (x5); 0.4g, 12 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: Recent (Bernard 1983: 42)

Mactromeris polynyma (cf.) (*Spisula polynyma*) (Stimpson, 1860)

- 0.1g, ~1
- moderately common from low-tide line to 60 fathoms (Abbott 1974:490)
- 65°N-46°N; Bering Sea, Alaska south to Neah Bay, Washington; in sand, mud or gravel, intertidal to 365' (110 m); this clam is longlived (25 years +), it has been harvested commercially by dragging in Alaska (Harbo 1997: 154)
- 57°N-60°N, median 58°N; intertidal to -110 m; -1°C to +10°C; Northwest Atlantic, North Pacific, Pliocene (Bernard 1983: 40)

Balanus spp.

- 0.1g, 1 frag; 0.7 g, 23 frag's

unidentified bivalve frag's

- 0.1g, 13 frag's; 0.2g, 10 frag's

sea urchin spine

- 0.1g, ~3

unknown

- 0.1g, 2

wood

- 0.1g, 2 frag's

E88B53-130.56-.59

Nuculana sp.

- 0.1g, ~1; 0.1g, 1 (in 2 frag's); 0.1g, 1 frag

Pododesmus machrochisma (Deshayes, 1839)

- 0.1g, 1 frag
- Adak Island, Alaska to Baja California. Japan. Very common species attached to stones and sharp pilings from low tide mark to about 35 fathoms. Often found on *Haliotis* (Abbott 1974:452)
- 58°N-28°N; Bering Sea to Alaska and south to Baja California Sur, and the Gulf of California; rocks and other solid objects, intertidal to 90 m (Harbo 1997:141)
- 57°N-70°N; median latitude 64°N; habitat: intertidal to 40 m; temp: -2° to 14°C; geologic range: Miocene; northwest Pacific (Bernard 1983:28)
- occasionally found on protected outer coast, but more common on rocks in quiet bays or on wharf pilings, fastened to reefs, bays and estuaries on rocky shores at low intertidal, (Ricketts et al., 1985: 160, 290)

Mytilus sp.

- 0.1g, 1 frag

Cidarina cidaris (Carpenter, 1864) (*Lischkeia cidaris*) (Fischer 1879)

- 0.1g, 1 frag
- Alaska to Baja California; moderately common from 20-350 fathoms (Abbott 1974:39)
- 60°N-28°N; Prince Williams Sound, Alaska south to Isla Cedros, Baja California; on offshore rocky-rubble bottoms; moderately deep (Harbo 1997:195)

Clupea harengus pallasii

- 0.1g, 1 scale

unidentified bivalve frag's

- 1.8g, 46 frag's

Balanus spp.

- 0.5g, 5 frag's

sea urchin spine

- 0.1g, 10

coral

- 0.1g, 1 frag

coniferous needle

- 0.1g, 1

wood

- 0.1g, 6 frag's

Appendix E

calcified sand clump

- 2.2g, 2

E88B53-130.69-.71

Macoma moesta (Deshayes, 1855)

- 0.2g, 1 + 3 frag's - articulated
- Circumpolar Arctic sea, Greenland, Alaska; common offshore (Abbott 1974: 506)
- 71°N-43°N; Arctic to Bering Sea and south to of Coos Bay, Oregon; in silt and a variety of bottom types; intertidal to 300 m (Harbo 1997: 160)
- 45°N-71°N, median lat 58N; 1-300 m; -2°C to +16°C; Pleistocene; Panarctic, Northwest Pacific (Bernard 1983: 45)

Macoma sp.

- 1.4g, ~2 articulated in 10 frag's

Cyclocardia ventricosa (Gould, 1850)

- 0.1g, 1 frag
- Alaska to Santa Barbara Islands; common offshore (Abbott 1974: 478)
- 28°N-60°N; med latitude 44°N; habitat: 20-620 m; temp range: +1°C to +17°; geologic range: Pleistocene (Bernard 1983: 34)

Balanus crenatus

- 0.1g, 1 scutum; 0.1g, 1 scutum; 0.1g, 1 scutum

Balanus spp.

- 0.4g, 31 frag's

coral

- 0.1g, 1 frag

sea urchin spine

- 0.1g, 5 spines

unidentified bivalve frag's

- 0.2g, 10 frag's

E88B53-130.85-.88

Mya truncata (Linne, 1758)

- 8.5g, ~1 in 2 frag's; 1.6g, ~1 in 3 frag's; 1g, 4 frag's
- Arctic Seas to Nahant, Massachusetts. Europe. Arctic Seas to Washington. Japan. In Greenland and Iceland this species is fairly common and considered a delicacy (Abbott 1974:537)

- 71°N-47°N; Circumboreal; Panarctic; Beaufort Sea, Bering Sea and south to Neah Bay, Washington; intertidal to 100 m, in mud and sand of protected bays (Harbo 1997:170)
- 48°N-71°N; median latitude: 59N; Habitat: intertidal to -100 m; temp: -2°C to +16°C; geologic range: Miocene; Panarctic, circumboreal (Bernard 1983:57)

Macoma incongrua *Macoma obliqua* (Sowerby, 1817)

- 10.1g, ~1; 0.9g, ~1
- Point Barrow, Alaska to Washington, common in Alaska (Abbott 1974: 507)
- 71°N-47°N; Point Barrow, Alaska south to Puget Sound, Washington; in gravel or sand, intertidal to 200 m (Harbo 1997:161)
- 46°N-71°N, median 59N; intertidal to -200 m; -3°C to +16°C; Recent; Arctic Ocean (Bernard 1983:45)

Macoma sp.

- 0.7g, 4 frag's

Modiolus sp.

- 1.4g, 25 frag's

Balanus glandulus

- 0.1g, 1 scutum
-

Trichotropis cancellata (Hinds, 1843)

- 0.1g, 1
- Bering sea to Oregon; commonly dredged in cold, shallow water (Abbott 1974:138)
- subtidal in rocky areas, often among sea squirts and tube worms, and overgrown with other organisms. Found on tube worms up off the bottom, where currents are stronger and more food is carried by (Harbo 1997:205)
- bays and estuaries, rocky shores: low intertidal (Ricketts et al., 1985: 289)

Balanus spp.

- 2g, 24 frag's

coral

- 0.8g, 6 frag's

unidentified bivalve frag's

- 0.5g, 13 frag's

Appendix E

organic

- 0.8g, 6 frag's

wood

- 0.2g, 6 frag's

sea urchin spine

- 0.1g, 1

E88B53-130.94-.97*Macoma incongrua* *Macoma obliqua* (Sowerby, 1817)

- 0.1g, 1
- Point Barrow, Alaska to Washington, common in Alaska (Abbott 1974: 507)
- 71°N-47°N; Point Barrow, Alaska south to Puget Sound, Washington; in gravel or sand, intertidal to 200 m (Harbo 1997:161)
- 46°N-71°N, median 59°N; intertidal to -200 m; -3°C to +16°C; Recent; Arctic Ocean (Bernard 1983:45)

Modiolus rectus (Conrad, 1837)

- 3.6g, 20 frag's
- Vancouver, British Columbia to the Gulf of California; lives burrowed in mud; intertidal to 45 m (Abbott 1974: 435)
- 54°N-5.1°S; Tow Hill, QCI, BC south to Baja and Gulf of California, and as far south as Païta, Peru; solitary, buried in sand, anchored by byssal threads and sand or mud; intertidal zone to depths of 15 m (Harbo 1997:136)
- 5S-35N: 15N; intertidal to -15 m; +19°C to +34°C; Miocene; Galapagos Islands (Bernard 1983:20)

Petalaconchus compactus (Carpenter, 1864)

- 0.1g, 2 frag's
- Washington to California; moderately common from just below low-tide mark to 50 fathoms (Abbott 1974:100)
- Vancouver Island south to California; on or under rocks, shallow subtidal to 50 m; (Harbo 1997: 201)

Balanus spp.

- 0.2g, 3 frag's

sea urchin spine

- 0.1g, 5

sand dollar

- 0.1g, 1 frag

unidentified bivalve frag's

- 0.5g, 10 frag's

E88B53-131.08-11

Petalaconchus compactus (Carpenter, 1864)

- 5.3g, 11 frag's
- Washington to California; moderately common from just below low-tide mark to 50 fathoms (Abbott 1974:100)
- Vancouver Island south to California; on or under rocks, shallow subtidal to 50 m; (Harbo 1997: 201)

Modiolus rectus (Conrad, 1837)

- 1.1g, 3 frag's
- Vancouver, British Columbia to the Gulf of California; lives burrowed in mud; intertidal to 45 m (Abbott 1974: 435)
- 54°N-5.1°S; Tow Hill, QCI, BC south to Baja and Gulf of California, and as far south as Paita, Peru; solitary, buried in sand, anchored by byssal threads and sand or mud; intertidal zone to depths of 15 m (Harbo 1997:136)
- 5S-35N: 15N; intertidal to -15 m; +19°C to +34°C; Miocene; Galapagos Islands (Bernard 1983:20)

Trichotropis cancellata (Hinds, 1843)

- 0.3g, 1; 0.1g, 1 frag
- Bering sea to Oregon; commonly dredged in cold, shallow water (Abbott 1974:138)
- subtidal in rocky areas, often among sea squirts and tube worms, and overgrown with other organisms. Found on tube worms up off the bottom, where currents are stronger and more food is carried by (Harbo 1997:205)
- bays and estuaries, rocky shores: low intertidal (Ricketts et al., 1985: 289)

coral

unidentified bivalve frag's

- 0.1g, 2 frag's

E88B53-131.36-39

Modiolus rectus (Conrad, 1837)

- 8.3g, 25 frag's
- Vancouver, British Columbia to the Gulf of California; lives burrowed in mud;

- intertidal to 45 m (Abbott 1974: 435)
- 54°N-5.1°S; Tow Hill, QCI, BC south to Baja and Gulf of California, and as far south as Paita, Peru; solitary, buried in sand, anchored by byssal threads and sand or mud; intertidal zone to depths of 15 m (Harbo 1997:136)
- 5S-35N: 15N; intertidal to -15 m; +19°C to +34°C; Miocene; Galapagos Islands (Bernard 1983:20)

Petalaconchus compactus (Carpenter, 1864)

- 2g, 13 frag's
- Washington to California; moderately common from just below low-tide mark to 50 fathoms (Abbott 1974:100)
- Vancouver Island south to California; on or under rocks, shallow subtidal to 50 m; (Harbo 1997: 201)

Trichotropis cancellata (Hinds, 1843)

- 0.1g, 1
- Bering sea to Oregon; commonly dredged in cold, shallow water (Abbott 1974:138)
- subtidal in rocky areas, often among sea squirts and tube worms, and overgrown with other organisms. Found on tube worms up off the bottom, where currents are stronger and more food is carried by (Harbo 1997:205)
- bays and estuaries, rocky shores: low intertidal (Ricketts et al., 1985: 289)

sea urchin spine

- 0.1g, 2

Balanus sp.

- 0.1g, 2 frag's

coral

- 0.1g, 1 frag

unidentified bivalve frag's

- 0.1g, 5 frag's

E88B53-131.50-.53

Modiolus rectus (Conrad, 1837)

- 1.3g, 4 frag's
- Vancouver, British Columbia to the Gulf of California; lives burrowed in mud; intertidal to 45 m (Abbott 1974: 435)
- 54°N-5.1°S; Tow Hill, QCI, BC south to Baja and Gulf of California, and as far south as Paita, Peru; solitary, buried in sand, anchored by byssal threads and sand

- or mud; intertidal zone to depths of 15 m (Harbo 1997:136)
5S-35N: 15N; intertidal to -15 m; +19°C to +34°C; Miocene; Galapagos Islands (Bernard 1983:20)

Yoldia sp.

- 0.2g, ~1

Balanus glandulus

- 0.5g, 11 scutum

Balanus crenatus

- 0.1g, 1 tergum

Balanus spp.

- 1.9g, 43 frag's

sea urchin spine

- 0.1g, 4

unidentified gastropod frag

- 0.1g, 1 frag

unidentified bivalve frag's

- 0.9g, 25 frag's

E88B53-131.69-.72

Hiatella pholadis (Linné, 1771)

- 0.1g, 1; 0.1g, ~1 in 2 frag's; 0.1g, 1 frag
- *Hiatella arctica* (Linné, 1767), common in cold water. Common in California; nest in kelp holdfasts and rock crevices, from low tide to deep water, This is *pholadis* (Linné, 1767), (Abbott 1974: 541).
- 68°N-48°N; Bering Sea and south to Puget Sound, Washington; in burrows of pholads (piddocks), mussel beds and kelp holdfasts; intertidal to 10 m (Harbo 1997:174)
- 48°N-68°N, median latitude 58°N; intertidal to -10 m; -3°C to +15°C; Pliocene; circumboreal. (Bernard 1983: 59)

sea urchin spine

- 0.1g, 1

unidentified bivalve frag's

- 0.4g, 16 frag's

E88B53-131.92-.95

Macoma calcarea (Gmelin, 1791)

- 6.2g, 2 artic'd; 0.9g, ~1; 0.5g, 4 frag's
- Bering Sea to Washington, a common cold-water species (Abbott 1974: 505-506)
- 71°N-47°N; Circumboreal; Arctic to Bering Sea and south to Newport Oregon; in sand, silt, and gravel, intertidal to 320 m (Harbo 1997: 159)
- Panarctic, circumboreal; 47N-71N: median latitude 59N; Intertidal-320 m; temp: -2°C to +15°C; ?Oligocene (Bernard 1983: 44)

Balanus spp.

- 0.1g, 5 frag's

unidentified bivalve frag's

- 0.3g, 11 frag's

E88B-54

Depth interval: 183 cm

Scientist: LZ

Described by: KC

Type of Core: vibrocore

Section: 1 & 2

Latitude: 51 52.04 N

Longitude: 129 11.22W

Depth: 121 m

Lithological Description:

Depth in core:	Lithological description
0-5 m	KC: fine, fining increasing to very fine sand, Unit 3B RH: med grey very fine sand, bioturbated into underlying layers
5-33 cm	KC: olive yellow to very dark greyish brown well sorted fine sand with some convolute dark grey beds or bed; burrows - 1 contains organism; Unit 3a RH: olive green fine sand, laminated & bioturbated, some shell fragments
33-107 cm	*20-23 cm shell sample: geoduck siphon - modern KC: dark grey fine well sorted sand with some shells and shell debris; massive appearing; minor gravel; shell to 5 cm; Unit 2B
33-84 cm	RH: massive med grey fine/med sand with large shell valves - 54 to 64 cm - <i>Macoma secta</i> ? *60-63 cm shell sample: fine sand, large articulated <i>Macoma</i> sp.: <i>Simomactra falcata</i> , <i>Tellina nukuloides</i> , <i>Pectinidae</i> sp., <i>Balanus</i> spp., unidentified bivalve frag's, unknown (forams?) *80-83cm shell sample: abundant shell fragments, appears intertidal, 2mm. granules with fine sand: <i>Simomactra falcata</i> , <i>Tellina nukuloides</i> , <i>Mytilus trossulus</i> , <i>Margarites helycinus</i> , <i>Balanus crenatus</i> , <i>Balanus glandulus</i> , <i>Balanus</i> spp., unidentified bivalve fragments, unidentified gastropod fragments
84-105 cm	RH: light grey med. Sand with shell fragments *96-99 cm shell sample: med sand with subangular pebbles to 0.5cm, shell fragments to 4 cm: <i>Simomactra falcata</i> , <i>Tellina nukuloides</i> , <i>Mytilus trossulus</i> , <i>Balanus crenatus</i> , <i>Balanus</i> spp., unidentified bivalve frag's, plant *102-105cm shell sample: med sand with shell fragments: <i>Mytilmeria nuttalli</i> , <i>Tellina nukuloides</i> , <i>Balanus</i> spp., unidentified bivalve frag's
107-166 cm	KC: dark grey fine-med moderately well-sorted gravelly, shelly sand; gravel to 1cm, shells to 3 cm.; unit 2A
105-166 cm	RH: med. Grey med. Sand with pebbles to 1.5 cm and large shell

fragments to 7 cm

*128-131 cm shell sample: med sand with pebbles to 0.5 cm, *Saxidomus giganteus*: *Saxidomus giganteus*, *Tellina nukuloides*, *Margarites helacinus*, *Mytilimeria nuttalli*, *Balanus spp.*, unidentified bivalve frag's

166-183 cm KC: pea gravel, cleaner and increasing coarse down unit; gravel to 1 cm; shell fragments (rounded) to 2 cm; various lithologies; Unit 1
RH: gravel/sand, increasing coarseness downcore, shell fragments throughout, rounded pebbles to 2 cm

*177-180 cm shell sample: rounded pebbles to 3 cm, rounded shell fragments: *Saxidomus giganteus* (cf), *Clinocardium sp.*, unidentified bivalve frag's

Malacological description:

E88B54121.20-.23

Geoduck siphon (modern)

- 29.4g, 1 siphon

E88B54121.60-.63

Simomactra falcata (A.A. Gould, 1850)

- 6.5g, ~1; 8.2g, ~1 in 3 frag's
- *Spisula falcata* (Gould, 1850) "moderately common in sand below low-water line" (Abbott 1974: 490)
- "Range: 54°N-31°N; Rose Spit, Queen Charlotte Islands, BC south to Isle San Martin, Baja California Norte. Habitat: Buried shallow in sand from intertidal to 165' (50 m) depths; often in protected waters." (Harbo 1997:154)
- Geographic range: 32N-57N; median latitude: 43N; habitat: intertidal - 50 m; temp range: +4° to +24°C; Geologic range: Pliocene (Bernard 1983: 40)

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1; 0.1g, 1; 0.1g, 1
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Pectinidae sp.

- 0.1g, ~1

Balanus sp.

- 0.1g, 2 frag's

unidentified bivalve frag's

- 0.3g, 11 frag's

unknown (forams?)

- 0.1g, 7; 0.1g, 1

E88B54121.80-.83*Simomactra falcata* (A.A. Gould, 1850)

- 0.1g (x4); ~1 (x4); 5.1g, 6 frag's
- *Spisula falcata* (Gould, 1850) "moderately common in sand below low-water line" (Abbott 1974: 490)
- "Range: 54°N-31°N; Rose Spit, Queen Charlotte Islands, BC south to Isle San Martin, Baja California Norte. Habitat: Buried shallow in sand from intertidal to 165' (50 m) depths; often in protected waters." (Harbo 1997:154)
- Geographic range: 32N-57N; median latitude: 43N; habitat: intertidal - 50 m; temp range: +4° to +24°C; Geologic range: Pliocene (Bernard 1983: 40)

Tellina nukuloides (Reeve, 1854)

- 0.1 (x14); 1 (x14); 0.1g (x9), ~1 (x9); 0.1g, 3 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Mytilus trossulus (Linnaeus, 1758)

- 0.1g, 2 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23N-71N, median 47N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Appendix E

Margarites helycinus (Phipps, 1874)

- 0.1g, 1
- Arctic seas to Alaska and to Massachusetts; common from 1 to 75 fathoms (Abbott 1974:35)
- Aleutian Islands, Alaska south to Washington; on kelp or under rocks; shallow water to 30 m (Harbo 1997:192)

Balanus crenatus

- 0.1g, 2 scutum

Balanus glandulus

- 0.1g, 2 scutum
- uppermost horizon, high water range, mainly on bare rocks, abundant on protected outer coast, also in quiet waters and along surf-swept open coast (Ricketts, Calvin and Hedgpeth 1985:8, 24ff)

Balanus spp.

- .6g, 17 frag's

unidentified bivalve frag's

- 0.1g, 11 frag's

unidentified gastropod frag's

- 0.1g, 1 frag

E88B54121.96-.99*Simomactra falcata* (A.A. Gould, 1850)

- 1.9g, ~1
- *Spisula falcata* (Gould, 1850) "moderately common in sand below low-water line" (Abbott 1974: 490)
- "Range: 54°N-31°N; Rose Spit, Queen Charlotte Islands, BC south to Isle San Martin, Baja California Norte. Habitat: Buried shallow in sand from intertidal to 165' (50 m) depths; often in protected waters." (Harbo 1997:154)
- Geographic range: 32N-57N; median latitude: 43N; habitat: intertidal - 50 m; temp range: +4° to +24°C; Geologic range: Pliocene (Bernard 1983: 40)

Tellina nukuloides (Reeve, 1854)

- 0.1g (x5); 1 (x5); 0.1g (x4), ~1 (x4), 0.1g, 2 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal

to 100 m (Harbo 1997: 157)

- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Mytilus trossulus (A.A. Gould, 1850)

- 0.1g, 1 frag
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23°N-71°N, median 47°N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Balanus crenatus

- 0.1g, 2 scutum

Balanus spp.

- 0.1g, 5 frag's

unidentified bivalve frag's

- 0.1g, 4 frag's

plant

- 0.1g, 1 frag

E88B54122.02-.05

Mytilmeria nuttalli (Conrad, 1837)

- 0.1g, 1; 0.1g, 1
- Alaska to Baja California, common under rocks at low to to 10 fathoms, always embedded in compound ascidians or sea squirts (Abbott 1974:556)
- 57°N-30°N; Sitka, Alaska to Baja California Norte; intertidal to -40 m, protected in or under the thin mat of a compound ascidian such as *Aplidium* species or *Cystodes lobatus* (Harbo 1997:178)
- 30°N-57°N, median 44°N; intertidal to -45 m, +4°C to +17°C, recent (Bernard 1983: 64)

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1; 0.1g, 3 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974: 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Balanus spp.

- 0.1g, 6 frag's

unidentified bivalve frag's

- 0.1g, 5 frag's

Note: *Spisula falcata* dated

E88B54122.28-31

Saxidomus giganteus (Deshayes, 1839)

- 18g, ~1; 2.5g, 2 frag's
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths of 40m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Tellina nukuloides (Reeve, 1854)

- 0.1g (x3), 1(x3); 0.1g(x3), ~1 (x3); 0.1g, 5 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974: 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Margarites helycinus (Phipps, 1874)

- 0.1g, ~1
- Arctic seas to Alaska and to Massachusetts; common from 1 to 75 fathoms (Abbott 1974:35)
- Aleutian Islands, Alaska south to Washington; on kelp or under rocks; shallow water to 30 m (Harbo 1997:192)

Mytilmeria nuttalli (Conrad, 1837)

- 0.1g, 1
- Alaska to Baja California, common under rocks at low to to 10 fathoms, always embedded in compound ascidians or sea squirts (Abbott 1974:556)
- 57°N-30°N; Sitka, Alaska to Baja California Norte; intertidal to -40 m, protected in or under the thin mat of a compound ascidian such as *Aplidium* species or *Cystodes lobatus* (Harbo 1997:178)
- 30°N-57°N, median 44N; intertidal to -45 m, +4°C to +17°C, recent (Bernard 1983: 64)

Balanus spp.

- 0.3g, 6 frag's

unidentified bivalve frag's

- 1.5g, 15 frag's

E88B54122.77-.80*Saxidomus giganteus* (cf) (Deshayes, 1839)

- 0.8g, 1 frag
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Clinocardium sp.

- 0.4g, 1 frag

unidentified bivalve frag's

- 0.4g, 16 frag's, rounded

E88B-55

Depth interval: 146 cm

Scientist: VB

Described by: KC

Type of Core: vibrocore

Section: 1 & 2

Latitude: 51 51.86 N

Longitude: 129 14.71W

Depth: 124 m

Lithological Description:

Depth in core:	Lithological description
0-14 cm	KC: olive massive medium sand with some shell debris; unit 4 - probably Holocene RH: olive green medium sand with shell fragments
14-112 cm	KC: dark grey laminated medium sand with some shelly zones and laminae; some heavy mineral rich laminae; shelly gravelly sand layer @83-87 cm; heavy mineral rich zone @90-102 cm; unit 3B - transgressive or regressive sand (H min rich)
14-55 cm	RH: massive medium grey shelly sand with rounded gravel to 0.5 cm, increasing gravel to base of unit. *32-35 cm shell sample: grey medium sand, numerous shell fragments *49-52 cm shell sample: grey medium sand, significant small shell valves and fragments, subangular pebbles to 0.5 cm: <i>Tellina nukuloides</i> , <i>Hiatella pholadis</i> , <i>Tellina bodegensis</i> , <i>Mytilus trossulus</i> (cf), <i>Nucella lamellosa</i> , <i>Balanus crenatus</i> , <i>Balanus spp.</i> , unidentified bivalve frag's, unidentified gastropod frag's, unknown (forams)
55-70 cm	RH: medium grey laminated fine sand with shell fragments *58-61 cm shell sample: grey fine sand with significantly less shell than samples above: <i>Tellina nukuloides</i> , <i>Balanus crenatus</i> , <i>Balanus spp.</i>
70-85 cm	RH: medium grey fine sand coarsening to 85 cm mark, with significant shell fragments throughout. *80-83 cm shell sample: medium sand, lots of <i>Balanus spp.</i> , <i>Mytilus trossulus</i> , rounded pebbles to 1cm: <i>Mytilus trossulus</i> , <i>Tellina nukuloides</i> , <i>Balanus crenatus</i> , <i>Trichotropis cancellata</i> , unidentified bivalve frag's, unidentified gastropod frag's
85-110 cm	RH: strongly laminated dark grey/grey sand with lighter grey layers containing abundant shell fragments *95-98 cm shell sample: medium sand, abundant <i>Balanus spp.</i> , some <i>Mytilus sp.</i> : <i>Mytilus trossulus</i> , <i>Balanus crenatus</i> , <i>Mytilimeria nuttalli</i> , <i>Balanus spp.</i>
112-117 cm	KC: fine shell debris and medium sand, unit 3A - transgressive or

- regressive sand (H min rich)
- 110-117 cm RH: medium grey medium sand with abundant shell material
 *113-116 cm shell sample: medium sand with very abundant *Balanus spp.* matrix, *Mytilus trossulus* valves in core but disintegrate on removal, lying in inconsistent directions, not all *Balanus spp.* kept.: *Tellina nukuloides*, *Mytilus trossulus*, *Balanus crenatus*, *Neptunea lyrata*, *Platyodon cancellatus* (cf), *Balanus spp.*, unidentified bivalve frag's, charcoal, wood
- 117-139 cm KC: sandy gravel; gravel is well rounded & polished; max diameter = 6cm; unit 2 - paleobeach
 RH: dark grey medium sand with large rounded pebbles and cobbles to 8 cm, shell fragments throughout
 *135-138 cm shell sample: medium dark grey sand with pebbles to 5 cm; mix of shell, much fewer barnacle, looks intertidal: *Protothaca staminea*, *Platyodon cancellatus*, *Saxidomus giganteus*, *Mytilus trossulus*, *Acmaea mitra*, sea urchin, *Balanus spp.*, unidentified bivalve frag's, unidentified gastropod frag's
- 139-146 cm KC: indurated fissile, dark grey mudstone?; unit 1 - possibly tertiary
 RH: dark grey mud, subangular pebbles, some shell fragments
 *142-145 cm shell sample: mud, like clay, difficult to break up, small fragments of shells within clay, looks basal to beach, pebbles to 1 cm: *Platyodon cancellatus*, *Balanus spp.*, unidentified bivalve frag's, unidentified gastropod frag's.

Malacological description:

E88B55-124.32-.35

- no species identified

E88B55-124.49-.52

Tellina nukuloides (Reeve, 1854)

- 0.1g (x6), 1 (x6); 0.1g (x4), ~1 (x4)
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Hiatella pholadis (Linné, 1771)

- 0.1g, ~1; 0.1g, 1 frag
- *Hiatella arctica* (Linné, 1767), common in cold water. Common in California; nest in kelp holdfasts and rock crevices, from low tide to deep water, This is

pholadis (Linné, 1767), (Abbott 1974: 541).

- 68°N-48°N; Bering Sea and south to Puget Sound, Washington; in burrows of pholads (piddocks), mussel beds and kelp holdfasts; intertidal to 10 m (Harbo 1997:174)
- 48°N-68°N, median latitude 58°N; intertidal to -10 m; -3°C to +15°C; Pliocene; circumboreal. (Bernard 1983: 59)

Tellina bodegensis (Hinds, 1845)

- 0.1g, 1
- Graham Island, BC to Gulf of California; moderately common from shore to 15 fathoms (Abbott 1974: 503)
- 57°N-25°N, Sitka, Alaska south to Bahia Magdalena, Baja California Sur; on beaches exposed or partially exposed to open ocean; intertidal to 100 m (Harbo 1997: 156)
- 25°N-57°N, median 41°N; intertidal to -100 m, +4°C to +28°C; Miocene (Bernard 1983: 43)

Mytilus trossulus (cf) (A.A. Gould, 1850)

- 0.1g, 5 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23°N-71°N, median 47°N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Nucella lamellosa (Gmelin, 1791)

- 10.1g, 1 frag
- Bering Straits to Santa Cruz, California; a very common rock-loving species (Abbott 1974: 182)
- Aleutian Islands, Alaska south to central California; on rocks and in crevices, intertidal to shallow subtidal (Harbo 1997:211)
- common quiet water snails, found below mussels in the middle intertidal of rocky shores in bays and estuaries; range from at least Alaska to Monterey Bay, also occur on sheltered outer-coast rocky shores; predators of mussels and *Balanus* spp. (Ricketts, Calvin and Hedgpeth 1985: 276)

Balanus crenatus

- 0.1g, 5 scutum

Balanus spp.

- 2, 48 frag's

unidentified bivalve frag's

- 0.2g, 2 frag's

unidentified gastropod frag's

- 0.1g, 1 frag

unknown (forams)

- 0.1g, 3

E88B55-124.58-.61*Tellina nukuloides* (Reeve, 1854)

- 0.1g, ~1; 0.1g, 1 frag
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974: 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: Recent (Bernard 1983: 42)

Balanus crenatus

- 0.1g, 2 scutum

Balanus spp.

- 0.1g, 5 frag's

E88B55-124.80-.83*Mytilus trossulus* (A.A. Gould, 1850)

- 0.1g, ~1; 0.1g, ~1; 0.1g, 14 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23°N-71°N, median 47°N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. californianus*, spawning n

the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1; 0.1g, ~1; 0.1g, ~1; 0.1g, 1 frag
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974: 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Balanus crenatus

- 0.1g, 9 scutum; 0.1g, 2 tergum

Trichotropis cancellata (Hinds, 1843)

- 0.1g, 1
- Bering sea to Oregon; commonly dredged in cold, shallow water (Abbott 1974:138)
- subtidal in rocky areas, often among sea squirts and tube worms, and overgrown with other organisms. Found on tube worms up off the bottom, where currents are stronger and more food is carried by (Harbo 1997:205)
- bays and estuaries, rocky shores: low intertidal (Ricketts et al., 1985: 289)

Balanus spp.

- 10.1g, 41 frag's

unidentified bivalve frag's

- 0.1g, 2 frag's

unidentified gastropod frag's

- 0.1g, 1 frag

E88B55-124.95-.98

Mytilus trossulus (A.A. Gould, 1758)

- 0.1g, ~1; 0.1g, 9 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23°N-71°N, median 47°N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced

cosmopolitan in temperate and cold seas (Bernard 1983:18).

- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Balanus crenatus

- 0.1g, 4 scutum; 0.1g, 1 tergum

Mytilimeria nuttalli (Conrad, 1837)

- 0.1g, 1; 0.1g, 1
- Alaska to Baja California, common under rocks at low to to 10 fathoms, always embedded in compound ascidians or sea squirts (Abbott 1974:556)
- 57°N-30°N; Sitka, Alaska to Baja California Norte; intertidal to -40 m, protected in or under the thin mat of a compound ascidian such as *Aplidium* species or *Cystodes lobatus* (Harbo 1997:178)
- 30°N-57°N, median 44N; intertidal to -45 m, +4°C to +17°C, recent (Bernard 1983: 64)

Balanus spp.

- 0.6g, 37 frag's

E88B55-125.13-.16

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1; 0.1g, 1; 0.1g, ~1; 0.1g, 2 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Mytilus trossulus (A.A. Gould, 1850)

- 1g, (x4); ~1 (x4); 0.2g, 35 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23°N-71°N, median 47N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*,

best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Balanus crenatus

- 0.3g, 20 scutum; 0.2g, 8 tergum

Neptunea lyrata (Gmelin, 1791)

- 0.1g, 1
- Arctic Ocean to off California, fairly common in Alaska from shore to 50 fathoms (Abbott 1974: 212-213)
- Alaska south to northern California; on sand and mud, from shallow shores, occasionally intertidal to 100 m (Harbo 1997: 214)

Platyodon cancellatus (cf) (Conrad, 1837)

- 0.1g, 1 frag
- QCI to San Diego, California; moderately common near beds of pholads, lives in hard-packed clay or soft sandstone (Abbott 1974: 538)
- 54°N-28°N, Tlell, QCI and south to Isla Cedros, Baja California Sur; burrowing in soft clay or rock, intertidal to -20 m, harvested occasionally for food by Haida (Harbo 1997:170)
- 33°N-55°N, median 44°N; intertidal to -20 m, -1°C to +17°C, Pliocene (Bernard 1983: 58)

Balanus spp.

- 3.6g, 152 frag's

unidentified bivalve frag's

- 0.2g, 7 frag's

charcoal

- 0.1g, 2 frag's

wood

- 0.1g, 3 frag's

E88B55-125.35-.38

Protothaca staminea (Conrad, 1837)

- 0.1g, ~1; 0.1g, 4 frag's
- Aleutian Islands to Baja California. (Abbott 1974: 526)

- 54°N-23°N; Aleutian Islands, Alaska south to Baja California Sur; buried to 10 cm or more in gravel, and in sand-mud bottoms in the mid-intertidal zone to 10 m, can live 14 years, edible (Harbo 1997:166)
- 23°N-60°N; median latitude: 42N; habitat: intertidal to -10 m; temp: +2°C to +27°C; Miocene (Bernard 1983: 52)
- widely used for food, may occur in such superabundance that two or three shovelfuls of substratum would contain enough clams to provide meal for several people; a poor diggers thus never lives in shifting sand where rapid digging is essential, may be found in packed mud or in gravel mixed with sand but prefers clayey gravel where lives at depths of 8cm below surface; bays and estuaries, rocky shores: middle intertidal, but can occur in preferred clayey gravel in isolated bits of protected outer coast, spawning occurs in summer in BC and Alaska, slow growth especially in south-central Alaska where requires 8 years to reach 30mm; growth rate determined primarily by extent and constancy of food supply which depends on the animal's position in relation to the tidal current and its degree of protection from storms, as well as water temp.; often drilled by *Polinices sp.* (Ricketts 1985: 149, 220, 281-282, 326)

Platyodon cancellatus (Conrad, 1837)

- 0.5g, 4 frag's
- QCI to San Diego, California; moderately common near beds of pholads, lives in hard-packed clay or soft sandstone (Abbott 1974: 538)
- 54°N-28°N, Tlell, QCI and south to Isla Cedros, Baja California Sur; burrowing in soft clay or rock, intertidal to -20 m, harvested occasionally for food by Haida (Harbo 1997:170)
- 33°N-55°N, median 44N; intertidal to -20 m, -1°C to +17°C, Pliocene (Bernard 1983: 58)

Saxidomus giganteus (Deshayes, 1839)

- 0.3g, 1 frag
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30 cm in the mid- to lower intertidal zone, to depths of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)
- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Mytilus trossulus (A.A. Gould, 1850)

- 0.1g, 2 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23N-71N, median 47N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Acmaea mitra (Rathke, in Eschscholtz, 1833)

- 0.1g, 1
- Alaska to Baja California in cold water; commonly washed ashore; lives in cold water below the low-tide level (Abbott 1974: 30)
- Aleutian Islands, Alaska south to Baja California; intertidal and in shallow subtidal area, on rocks with encrusting coralline algae; shells often wash up on surf beaches (Harbo 1997: 196)
- frequents to lowest intertidal; occasionally shows up in rocky shores: lowest zone of middle intertidal; range from the Aleutian Islands to Isla San Martín, northern Baja California, ordinarily solitary and fairly uncommon, in California, this species spawns in the winter (Ricketts, Calvin and Hedgpeth 1985: 27, 56, 150-151)

sea urchin

- 0.1g, 1 frag

Balanus spp.

- 0.3g, 10 frag's

unidentified bivalve frag's

- 2.2g, 31 frag's

unidentified gastropod frag's

- 0.1g, 1 frag

E88B55-125.42-.45*Platyodon cancellatus*

(Conrad, 1837)

Appendix E

- 0.1g, 7 frag's; 0.1g, ~1
- QCI to San Diego, California; moderately common near beds of pholads, lives in hard-packed clay or soft sandstone (Abbott 1974: 538)
- 54°N-28°N, Tlell, QCI and south to Isla Cedros, Baja California Sur; burrowing in soft clay or rock, intertidal to -20 m, harvested occasionally for food by Haida (Harbo 1997:170)
- 33°N-55°N, median 44N; intertidal to -20 m, -1°C to +17°C, Pliocene (Bernard 1983: 58)

Balanus sp.

- 0.1g, 2 frag's

unidentified bivalve frag's

- 0.7g, 23 frag's

unidentified gastropod frag's

- 0.2g, 4 frag's

AMC C14 dated:

Zirfaea pilsbryi (Lowe, 1931)

- 24N-70N, median 47N; intertidal to -125, -1°C to +25°, Pliocene (Bernard 1983:60)
- 70N-25N, Arctic coast of Alaska to Baja California, buried 50 cm, intertidal in limestone, shale or hard clay; sand, mud to -125 m (Harbo 1997:174)

E92A-21

Depth interval:
 Scientist: H. Josenhans
 Described by: OL
 Type of Core: vibracore
 Section: 1&2
 Latitude: 52 53.14
 Longitude: -131 19.28
 Depth: 116 m

Lithological Description:

Depth in core:	Lithological description
0-61 cm	OL: dark olive grey, fine to medium sand (~50/50) with some faint banding; generally massive; scattered shell fragments; small wood fragments at 50 cm; sharp contact with underlying unit RH: massive dark grey medium sand with shell fragments throughout * 50-53 cm shell sample: dark grey medium sand, subangular pebbles to 1.5cm, <i>Lucinoma annulatum</i> valve disintegrated on removal, small work fragments: <i>Lucinoma annulatum</i>, <i>Balanus spp.</i>, unidentified bivalve frag's, wood, charcoal
61-121 cm	OL: silt - medium sand matrix with scattered pebbles (mm's); high concentration of shell fragments becoming more concentrated (shells) between 115-120 cm; high(er) concentration of pebbles at 100 cm; wood fragments at 100 cm; hint of bedding at base of this unit, otherwise massive; sharp contact with underlying unit. RH: massive dark grey medium sand with abundant shelly material throughout, tubeworm colony at 75-79 cm; very firmly packed; <i>Mytilus trossulus</i> colony at 99-104 cm - wood fragments, increasing concentration of shell to base where is ~75% shell and wood chunks as well. * 89-92 cm shell sample: dark grey medium sand with subangular gravel to 1.5 cm; abundant shell, <i>Balanus spp.</i> appears oxidized whereas other shells do not, <i>Saxidomus giganteus</i> articulated, <i>Mytilus trossulus</i>, wood fragments; Intertidal: <i>Protothaca staminea</i>, <i>Saxidomus giganteus</i>, <i>Mytilus trossulus</i>, <i>Hiatella pholadis</i>, <i>Acmaea mitra</i>, <i>Neptunea lyrata</i>, <i>Petalconchus compactus</i>, <i>Veneridae sp.</i>, <i>Epitonium sp.</i>, <i>Balanus spp.</i>, sea urchin, unidentified gastropod, unidentified bivalve frag's, wood. * 117-120 cm shell sample: dark grey medium sand with subangular pebbles to 1.5 cm; lots of <i>Balanus spp.</i>, <i>Mytilus sp.</i>, limpet - looks intertidal: <i>Veneridae sp.</i>, <i>Mytilus trossulus</i>, <i>Hiatella pholadis</i>, <i>Neptunea lyrata</i>, <i>Petalconchus compactus</i>, <i>Acmaea mitra</i>, <i>Epitonium sp.</i>, <i>Balanus</i>

- spp.*, sea urchin, unidentified bivalve frag's, unidentified gastropod, wood.
- 121-140 cm OL: clayey silt; massive, lens of material similar to overlying unit
RH: massive dark grey clayey silt, lens of overlying sediment within unit.
- *131-134 cm shell sample: dark grey clayey silt, no shell, some small wood/plant fragments, forams?: organic, calcite crystals
- 120-292 cm OL: very dark grey changing to dark reddish brown at ~148 cm, 2 sticks at 145 cm; dark reddish brown with black streaks coming in at 160 cm, grading to grey with black streaks by 210 cm, rounded pebble (~1 cm) at 170 cm; grey speckles appear at 210 cm and continue to 270 cm; becomes laminated by 270 cm, laminations become increasingly well defined with depth, 5 dark bands of very fine sand at 272, 275, 279, 282, and 288 cm.
- 140-145 cm RH: olive grey silty clayey mud.
142-145 cm shell sample: dark grey silty clay with small plant & wood fragments, no shell, looks terrestrial
- 145-174 cm RH: dark brown silty clay, coarser with pebbles @170 cm.
170-173 cm shell sample: no shell, dark brown silty clay with fine orange granules, a few conifer needles, plant and wood fragments; gradational to underlying sediments
- 174-255 cm RH: dark brown silty clay grading into light brown silty clay with orange flecks throughout. @~235 cm becomes grey clay.
230-233 cm shell sample: olive grey clay with dark blue/black chunk in it, smells sulphuric, tiny plant fragments, no shell, definitely more silt than overlying unit.
250-253 cm shell sample: olive grey clay with a little silt, no shell, wood or plant.
- 255-292 cm RH: dark grey/light grey laminated clay with increasing thickness of dark grey laminations to base.
287-290 cm shell sample: med grey clay. Tiny plant fragments?

Malacological description:

E92A21-116.50-.53

Lucinoma annulatum (Reeve, 1850)

- 0.2g, ~1; 0.6g, 15 frag's
- Alaska to southern California, fairly commonly dredged from 8-75 fathoms (Abbott 1974:461)
- 60°N-28°N; Prince William Sound and northern Alaskan islands south to the Gulf of California; intertidal sand-mud to 750 m (Harbo 1997:145)
- 33°N-60°N; median latitude 47°N; habitat: 25-750 m; temp: +1° to +12°C; geologic range: Miocene (Bernard 1983:29)

Appendix E

- anoxic, high sulphur environment

Balanus sp.

- 0.1g, 1 frag

unidentified bivalve frag's

- 0.1g, 9 frag's

wood

- 0.1g, 4 frag's

charcoal

- 0.1g, 1 frag

E92A21-116.89-92

Protothaca staminea (Conrad, 1837)

- 0.1g, 1
- Aleutian Islands to Baja California. (Abbott 1974: 526)
- 54°N-23°N; Aleutian Islands, Alaska south to Baja California Sur; buried to 10 cm or more in gravel, and in sand-mud bottoms in the mid-intertidal zone to 10 m, can live 14 years, edible (Harbo 1997:166)
- 23°N-60°N; median latitude: 42°N; habitat: intertidal to -10 m; temp: +2°C to +27°C; Miocene (Bernard 1983: 52)
- widely used for food, may occur in such superabundance that two or three shovelfuls of substratum would contain enough clams to provide meal for several people; a poor diggers thus never lives in shifting sand where rapid digging is essential, may be found in packed mud or in gravel mixed with sand but prefers clayey gravel where lives at depths of 8 cm below surface; bays and estuaries, rocky shores: middle intertidal, but can occur in preferred clayey gravel in isolated bits of protected outer coast, spawning occurs in summer in BC and Alaska, slow growth especially in south-central Alaska where requires 8 years to reach 30 mm; growth rate determined primarily by extent and constancy of food supply which depends on the animal's position in relation to the tidal current and its degree of protection from storms, as well as water temp.; often drilled by *Polinices sp.* (Ricketts 1985: 149, 220, 281-282, 326)

Saxidomus giganteus (Deshayes, 1839)

- 0.6g, ~2 articulated
- Aleutian Islands to Monterey California. Commonest and best food clam in Alaska (Abbott 1974:533)
- 60°N-37°N; Southeast Bering Sea, Alaska south to central California; rarely to southern California; buried to 30cm in the mid- to lower intertidal zone, to depths

Appendix E

of 40 m; forms abundant populations at the lower region of intertidal zones, can live 20 years or longer, shells used by aboriginals in salmon traps and edible (Harbo 1997:164)

- 37°N-60°N; median latitude: 48N; habitat: intertidal to -40 m; temp: -1°C to +26°C; Miocene; Northwest Pacific (Bernard 1983:55)
- tidal currents important factor in distribution because of pelagic larvae, at 4 weeks bivalve veliger larvae settle down on the gravel, live for +20 years; mudflats, low intertidal, burrowing (Ricketts et al., 1985: 378-379)

Mytilus trossulus (A.A. Gould, 1850)

- 0.1g (x6), ~1 (x6); 0.2g, 11 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23N-71N, median 47N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Balanus spp.

- 0.4g, 18 frag's

sea urchin

- 0.1g, 1 spine;

unidentified gastropod

- 0.1g, 3 + 1 frag

unidentified bivalve frag's

- 0.1g, 1 + 3 frag's

wood

- 0.2g, 2 frag's

E92A21-117.17-.20

Mytilus trossulus (A.A. Gould, 1850)

- 0.1g (x9), ~1 (x9); 0.1g, 23 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC,

quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)

- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23N-71N, median 47N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. Californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

Hiatella pholadis (Linné, 1771)

- 0.1g, 1; 0.1g (x2). ~1 (x2); 0.1g, 1 frag
- *Hiatella arctica* (Linné, 1767), common in cold water. Common in California; nest in kelp holdfasts and rock crevices, from low tide to deep water, This is *pholadis* (Linné, 1767), (Abbott 1974: 541).
- 68°N-48°N; Bering Sea and south to Puget Sound, Washington; in burrows of pholads (piddocks), mussel beds and kelp holdfasts; intertidal to 10 m (Harbo 1997:174)
- 48°N-68°N, median latitude 58°N; intertidal to -10 m; -3°C to +15°C; Pliocene; circumboreal. (Bernard 1983: 59)

Acmaea mitra (Rathke, in Eschscholtz, 1833)

- 0.1g, 1
- Alaska to Baja California in cold water; commonly washed ashore; lives in cold water below the low-tide level (Abbott 1974: 30)
- Aleutian Islands, Alaska south to Baja California; intertidal and in shallow subtidal area, on rocks with encrusting coralline algae; shells often wash up on surf beaches (Harbo 1997: 196)
- frequents to lowest intertidal; occasionally shows up in rocky shores: lowest zone of middle intertidal; range from the Aleutian Islands to Isla San Martín, northern Baja California, ordinarily solitary and fairly uncommon, in California, this species spawns in the winter (Ricketts, Calvin and Hedgpeth 1985: 27, 56, 150-151)

Petalaconchus compactus (Carpenter, 1864)

- 0.1g, 1 frag
- Washington to California; moderately common from low-tide mark to 50 fathoms (Abbott 1974:100)
- Vancouver Island south to California; on or under rocks, shallow subtidal to 50 m (Harbo 1997:201)

Appendix E

***Neptunea lyrata* (Gmelin, 1791)**

- 0.1g, 1
- Arctic Ocean to off California, fairly common in Alaska from shore to 50 fathoms (Abbott 1974: 212-213)
- Alaska south to northern California; on sand and mud, from shallow shores, occasionally intertidal to 100 m (Harbo 1997: 214)

Veneridae sp.

- 0.1g, ~1; 0.1g, ~1
- all occur intertidally in BC, some subtidal in Washington (Harbo 1997:162)

Epitonium sp.

- 0.1g, ~1 in 2 frag's
- carnivorous, feed on sea anenomes, corals (Harbo 1997: 208)

Balanus spp.

- 0.7g, 23 frag's

sea urchin

- 0.1g, 4 frag's

unidentified bivalve frag's

- 0.1g, 3 frag's

unidentified gastropod

- 0.1g, 2 frag's

wood

- 0.1g, 1

E92A21-117.31-.34**organic**

- 0.1g, 1 frag

calcite (?) crystals

- 0.1g, 12 crystals

H816

Depth interval: 377.5 cm

Scientist: Luternauer

Described by:

Type of Core: piston

Section: 1,2 &3

Latitude: 51 14.1' N

Longitude: 129 30.8'W

Depth: 284m

Lithological Description:

Depth in core:	Lithological description
0-65.5 cm	?: 4/I silty mud with some fine sand, longitudinal mottline or banding disturbed
65.5-72 cm	?: 4/I silty mud with some fine sand, highly disturbed, very soupy
72-104.5 cm	?: 5/Y-4/I silty mud, with sand laminae bedding 3-5 mm, stiff
104.5-161.5 cm	?: fine, sandy stiff mud, shell debris frag's to 7 mm, sharp base
161.5-195.5 cm	?: 5/Y -3/I minor sandy mud bedding, indistinct gradational base
195.5-224.5 cm	?: 5Y/4/I fine sandy mud, stiff
224.5-308 cm	?: 5Y silty mud, minor sand with shell fragments at 245 cm and shell pocket at 260.5 cm, indistinct gradational base
Date: 245 cm 10,930 +/-160 (marine bivalve) MRC to 10,530 BP and 10,230 +/-120 (<i>Balanus glandulus</i>) MRC to 9,830 BP	
245 cm shell sample: <i>Yoldia</i> sp., <i>Dentaliidae</i> sp., unidentified bivalve fragments, forams x2 types	
308 - 337 cm	?: muddy sand, some fine sand lenses, shell debris pocket, indistinct gradational base at 337 cm
337 - 377.5 cm	?: silty mud bedded, with fine sand, shell valve at 359 cm dated 359 cm shell sample for dating: <i>Nuculana cellulita</i> dated to 10,400 +/-80 ¹⁴ C YBP and MRC to 10,000 ¹⁴ C YBP

Malacological analysis

245 cm the only sample available:

Yoldia sp.

- 0.1g, 2 frag's

Dentaliidae sp.

- 0.1g, 1 frag
- unidentified bivalve frag's
- 0.1g, 5 frag's
- forams

- 0.1g, 3 +14 frag's; 0.1g, 1 +17 frag's

H818

Depth interval: 408 cm

Scientist: Luternauer

Described by:

Type of Core: piston

Section: 1,2 &3

Latitude: 51 29.24 N

Longitude: 128 29.4W

Depth: 192 m

Lithological Description:

Depth in core:	Lithological description
0-52.0 cm	?: 5Y 4/3 mud, primarily clay with shell debris
	38.5 cm: C14 date
52-143.0 cm	?: 5Y 4/3 as above with grey to black mottling, muddy shelly bioturbated
143-239 cm	?: 5Y 4/3 mud with black/grey mottling, primarily clay with bioturbation and irregular gradational base
	238 cm <i>Macoma nasuta</i> dated
239-244 cm	?: 5Y 4/2 fine to medium sandy mud, bedding in mud, primarily clay
	246 cm shell sample from archive sediments: <i>Clupea harengus pallasii</i> caudal vertebrae, unidentified bivalve fragments, <i>Balanus glandulus</i> tergum, wood and plant
244-248.5 cm	?: 5Y 4/1 fine to medium sandy mud with subrounded gravel to 1 cm
248.5-249.5 cm	?: shell debris in sandy mud
249.5-253.5 cm	?: 5Y 4/1 fine to medium sandy mud
253.5-256 cm	?: fine to coarse sandy mud
	254.0 cm: C14 date snail shell
256-268 cm	?: 5Y 4/1 gravelly, muddy fine to coarse sand, gravel to 4 mm, shell debris throughout, irregular gradational base
	256 cm shell sample: <i>Nuculana sp.</i> , sea urchin, <i>Macoma sp.</i> , unidentified bivalve fragments, wood and plant, <i>Sebastes sp.</i> , <i>Clupea harengus pallasii</i> caudal vertebrae, <i>Cottidae</i> , <i>Gymnocanthus</i> or <i>leptocottus</i> pre-operculum spine
	266 cm shell sample: <i>Nuculana sp.</i> , <i>Macoma elimata</i> , <i>Macoma sp.</i> , unidentified bivalve frag's, foram, wood, <i>Nutricula lordi</i>
268-283 cm	?: gravelly, sandy mud, sand fine to coarse, gravel to 6mm, shell debris throughout, articulated bivalve, regular gradational base
	273.5 cm: bivalve C14 @ 15,200 +/-490 (GSC 3746)
	276 cm shell sample: <i>Macoma sp.</i> , unidentified bivalve fragments

- Uppermost horizon, bare rocks abundant on the protected coast, also thrives in quiet waters and along the surf-swept outer coast; high intertidal, unspecialized habitat requirements, range from Aleutian Islands to Bahia de San Quitin, Baha California, thrives in constantly aerated ocean waters along the protected outer coast, even in violently surf-swept points, but also in quiet waters of Puget Sound; common in bays and estuaries, great variability of habitat due to high tolerance and generalization, unusual for marine invertebrates (eg. Outer coast is wave shock, low temperature, high salinity, and high Oxygen, whereas in bays and estuaries is high temperatures, variable and often low salinities, and relatively low oxygen content; upper intertidal in Washington region (middle intertidal in California) (Ricketts 1985: 8, 24, 25, 270, 433)

wood and plant

- 0.1g, 6 frag's

H818-194.56-194.66

Nuculana sp.

- 0.1g, ~1, 0.1g, 1 frag

sea urchin

- 0.1g, 1 frag

Macoma sp.

- 0.4g, 2 frag's

unidentified bivalve fragments

- 0.2g, 18 frag's

wood and plant

- 0.1g, 5 frag's

Sebastes sp. (Rockfish)

- 0.1g, 1 scale

Clupea harengus pallasii caudal vertebrae (Valenciennes, 1847) (Pacific herring)

- 0.1g, 1
- in eastern Pacific from Baja California 37.4N to Beaufort Sea
- spawning temperatures in BC 4.4 to 10.7 °C and 3.0 to 12.3 °C on a coastwise basis
- first food is invertebrate eggs, copepods, and diatoms followed by *Balanus spp.* and mollusc larvae, bryozoans, rotifers, young fish and copepods
- salinity tolerance for egg development and when mature is high

Appendix E

- food for chinook and coho salmon, sharks, lingcods, sea lions, whales
- annual inshore movement for spawning in the fall

Cottidae, (sculpins) *Gymnocanthus* or

- north and south of Alaska Peninsula (Coad, 1995: 70-72)

leptocottus (Girard, 1854) pre-operculum spine

- 0.1g, 1 pre-operculum spine
- diet mainly invertebrates - molluscs, crustaceans, worms, insects and small fishes, eaten by waterfowl; buries itself in the sand; northern Baja California to Gulf of Alaska, in tide pools and at moderate depths, penetrates lower portions of coastal streams (Hart 1973: 518-519)
- abundant north and south of the Alaska Peninsula, a shallow-water species, found in brackish water new freshwater streams or rivers (Coad, 1995: 73).

H818-194.66-194.76

Nuculana sp.

- 0.3g, 1; 0.3g, 1 in 2 frag's; 0.1g, 3 frag's; 0.1, ~1; 0.1g, ~1

Macoma elimata (Dunhill & Coan, 1968)

- 0.3g, 5 frag's
- 55N to 34N, Aleutian Islands, Alaska to Redondo Beach, California; in sand and silt, 9-435 m (Harbo 1997: 159)
- 34-60N, median 46N, 5-435 m, +1 °C to +26 °C, Recent (Bernard 1983: 44)

Macoma sp.

- 0.1g, ~1 in 3 frag's

unidentified bivalve frag's

- 0.2g, 16 frag's

foram

- 0.1g, 1

wood

- 0.1g, 2 frag's

Nutricula lordi (*Psephidia lordi*) (Baird, 1863)

- 0.1g, 1
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand

- and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
33°N-61°N; median: 47N; intertidal to -70 m; temp: 0 to +16°C; Pliocene
(Bernard 1983: 56)

H818-194.76-194.86*Macoma sp.*

- 0.3g, ~1 in 2 frag's; 0.5g, ~1 in 4 frag's; 0.2g, ~1; 0.4g, 1 frag

unidentified bivalve fragments

- 0.1g, 11 frag's

H818-194.86-194.96*Yoldia sp.*

- 0.3g, ~1 in 2 frag's

unidentified bivalve frag's

- 0.9g, 17 frag's

plant

- 0.1g, 3 frag's

foram

- 0.1g, 1

H818-194.96-195.06*Nutricula lordi (Psephidia lordi)* (Baird, 1863)

- 0.4g, 78 some articulated
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47N; intertidal to -70 m; temp: 0 to +16 °C; Pliocene
(Bernard 1983: 56)

Yoldia sp.

- 0.1g, 2 frag's; 0.1g, ~1

Margarites beringensis (E.A.Smith, 1899)

- 0.1g, ~1
- Arctic to Alaska south to Hope Island, BC; on sand and mud (Harbo 1997:192)

unidentified bivalve frag's

- 0.4g, 25 frag's

Balanus sp.

- 0.1g, 1 frag

foram

- 0.1g, 2

Capelin Mallotus villosus - 1 dentary (Müller, 1777) (smelt)

- 0.1g, 1 dentary
- spawn on beaches with fine gravel at high tide in late September to October in water temperatures of 10 to 12.5 °C (though in Grand Banks spawn at much lower temperatures (2.8 °C); eggs stick to gravel, smelt eaten by spring and coho salmon, as well as cod, seals, and birds, distribution from Juan de Fuca to Alaska and Sea of Okhotsk

H818-196.06-195.16

Nutricula lordi (Psephidia lordi) (Baird, 1863)

- 0.1g, 43, some articulated
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47°N; intertidal to -70 m; temp: 0 to +16 °C; Pliocene (Bernard 1983: 56)

Cottidae sp. (cf.) (sculpin) - right quadrate

- 0.1g, 1 right quadrate
- most species shallow water and cottids may be abundant in the intertidal zone, some occur in moderately deep water, and several are well established in fresh water far from the sea (Hart 1973:472)

unidentified bivalve fragments

- 0.1g, 6 frag's

TUL91C15

Depth interval: 0-132 cm

Scientist: VB

Described by: KC

Type of Core: vibracore

Section: 1 sections

Latitude: 54 12.45'

Longitude: 132 00.82'

Depth: 96 m

Lithological Description:

Depth in core:	Lithological description
0-25 cm	KC: dark olive grey muddy fine sand; minor shell frag's, gravel to 2.5cm diam, in beds, poorly sorted; unit 2 - Holocene
25-31 cm	KC: light olive grey poorly sorted med sand massive; unit 1f - overall fining upwards
31-38 cm	KC: subrounded clast supported gravel to 3 cm diam; unit 1e - fining upwards
38-82 cm	KC: light olive grey poorly sorted med.sand; massive with minor shell debris and gravel; 1d - fining upwards
82-103 cm	KC: dark olive grey poorly sorted coarse sand with minor gravel (pea); minor shells; unit 1c
	Date: 10,570 +/- 90, MRC to 9,770 BP on Arthropoda cirrepedia
103-126 cm	KC: dark olive grey coarse to v. coarse sand with minor gravel to 1cm diam; massive; 1b
126-132 cm	KC: clast supported gravel to 2.5 cm diam; unit 1a

TUL91C20

Depth interval: 0-238 cm

Scientist: VB

Described by: KC

Type of Core: vibracore

Section: 2 sections

Latitude: 54 07.45'

Longitude: 132 07.56'

Depth: 33 m

Lithological Description:

Depth in core:	Lithological description
0-19 cm	KC: pale olive well sorted medium sand; some bedding; horizontal lamination; unit 4 RH: fine olive/brown sand with shell fragments throughout *9-12 cm shell sample: <i>Tellina nuculoides</i> , <i>Mya sp.</i> , <i>Glycymeris septentrionalis</i> , <i>Simomactra falcata</i> , <i>Balanus sp.</i> , bone?
19-67 cm	KC: grey moderately sorted medium sand; some shelly beds, beds 5-10 cm thick; 39-56 bioturbated structures; burrows, horizontal laminations; unit 3 RH: significant change in sand colour @20cm to grey with similar amount of shell content; layering in shelly material @24-29 cm and again @36cm & 57 cm *24-27 cm shell sample: <i>Mya truncata</i> , <i>Mya sp.</i> , <i>Chlamys sp.</i> , <i>Glycymeris septentrionalis</i> , <i>Yoldia sp.</i> , <i>Tellina nuculoides</i> , <i>Olivella biplicata</i> , <i>Amphissa columbiana</i> , <i>Antalis pertiosum</i> , <i>Balanus sp.</i> , sea urchin; fine sand, many shell frag's & whole small shells *65-68 cm shell sample: <i>Tellina nuculoides</i> , <i>Diplodonta impolita</i> , <i>Balanus sp.</i> ; fine sand, significantly fewer shell fragments & whole small shells
67-200 cm	KC: very dark grey fine sand; moderately to poorly (sorted?); becomes silty; laminated; lamina are contorted; ripple laminations; unit 2
118-120 cm	KC: large scallop shell on bedding plane
160 cm	KC: wood fragments to 3x1cm; burrows
180 cm	KC: shelly zone, shells are very leached
67-115 cm	RH: colour change to dark grey at 67 cm, silt laminations, one very clear at 104 cm *82-85 cm shell sample: <i>Nutricula lordi</i> , <i>Diplodonta impolita</i> , <i>Tellina</i>

nuculoides, *Yoldia* sp., *Protothaca* sp. or *Serripes groenlandicus* ?
Mactromeris sp.?, *Acila castrensis*, *Solariella peramabilis*, *Antalis*
pertiosum; fine sand, shell fragments and whole small shells, a few
 wood fragments, one 1 cm rounded pebble

- *108-111 cm shell sample: *Tellina nuculoides*, *Diplodonta impolita*,
Nutricula lordi, *Clinocardium* sp.?, *Olivella* sp., *Mytilus* sp.,
Antalis pertiosum, *Balanus* sp.; fine sand, shell fragments, whole
 small shells, a few wood fragments.
- 115-127 cm RH: grey sand with a number of shells, one large scallop
- *115-120 cm shell sample: *Patinopecten caurinus*
- *118-121 cm shell sample: lots of wood fragments, sand and some
 mud/silt, shell fragments and whole small shells.
- 127-152 cm RH: grey fine sand with shell and wood
- 152-170 cm RH: clearly defined laminations
- *150-153 cm shell sample: very fine sand, wood chunks, very little shell -
 some small fragments: *Yoldia* species, unidentified bivalve
 fragments, wood
- 170-203 cm RH: change to lighter colour sand, light grey, increase in wood and
 shell
- *171-174 cm shell sample: *Nutricula lordi*, *Diplodonta impolita*,
Simomactra falcata, *Yoldia* sp., *Cylichna attonsa*, *Cylichna alba*,
Clinocardium sp., unidentified bivalve frag's, unidentified gastropod
 frag's, wood, charcoal
- 203-205 cm KC: coarse sand; inter(tidal?); unit 1c
- 205-207 cm KC: very dark grey silty sand: unit 1b
- 207-238 cm KC: olive grey sandy clast supported gravel; gravel to 6vm; various
 shapes blades, rollers; ? - suborg. ?; unit 1a
- 203-237 cm RH: gravel, fine gravel to 216, increasingly coarse to base, base
 coarse gravel, rounded pebbles to 6 cm
- *217-220 cm shell sample: large rounded gravel to 6 cm, broken shell:
Clinocardium sp., *Nutricula lordi*, *Diplodonta impolita*, *Yoldia* species,
Cylichna alba, *Olivella baetica*, *Olivella* sp., *Mactridae* sp., sea urchin
 spines, *Macoma moesta*, *Margarites* sp., wood and plant, unidentified
 bivalve frag's
- *232-235 cm shell sample: no shell material, rounded gravel to 5cm

NOTES: KC -

Unit 2 very similar to Cook Bank subtidal sand, silt content, organic and wood content,

Appendix E

laminations, colour

Unit 4 mobile bed?

Unit 1 paleobeach, frosted rounded clasts

Malacological description:

TUL91C20-33.09-33.12 shell sample

Tellina nucloides (Reeve, 1854)

- 0.1g x4, 1x4, 0.1 5 frag's
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Mya sp.

- 10.1g, 4 frag's

Glycymeris septentrionalis (Middendorff, 1849)

- 0.1g, 1
- Aleutians to Forrester Island, Alaska (Abbott 1974; 427)
- 59°N-25°N; Cook Inlet, Alaska south to Baja California Sur and the Gulf of California; in sand or gravel, intertidal to 55 m (Harbo 1997: 134)
- 60°N-37°N; median latitude 48N; intertidal to -55 m; temp: +4 to +16°C; Pliocene (Bernard 1983: 17)

Simomactra falcata (A.A. Gould, 1850)

- 0.1g 1
- *Spisula falcata* (Gould, 1850) "moderately common in sand below low-water line" (Abbott 1974: 490)
- "Range: 54°N-31°N; Rose Spit, Queen Charlotte Islands, BC south to Isle San Martin, Baja California Norte. Habitat: Buried shallow in sand from intertidal to 165' (50 m) depths; often in protected waters." (Harbo 1997:154)
- Geographic range: 32N-57N; median latitude: 43N; habitat: intertidal - 50 m; temp range: +4° to +24°C; Geologic range: Pliocene (Bernard 1983: 40)

Balanus sp.

- 0.1g, 1

bone?

- 0.1g, 1

TUL91C20-33.24-33.27 shell sample

Appendix E

Mya truncata (Linne, 1758)

- 1.0g, 1 frag
- Arctic Seas to Nahant, Massachusetts. Europe. Arctic Seas to Washington. Japan. In Greenland and Iceland this species is fairly common and considered a delicacy (Abbott 1974:537)
- 71°N-47°N; Circumboreal; Panarctic; Beaufort Sea, Bering Sea and south to Neah Bay, Washington; intertidal to 100 m, in mud and sand of protected bays (Harbo 1997:170)
- 48°N-71°N; median latitude: 59°N; Habitat: intertidal to -100 m; temp: -2°C to +16°C; geologic range: Miocene; Panarctic, circumboreal (Bernard 1983:57)

Mya sp.

- 1.0g, 6 frag's

Chlamys sp.

- 0.1 g, 3 frag's

Glycymeris septentrionalis (Middendorff, 1849)

- 0.2g, 1; 0.2g, 1; 0.1g, 1; 0.2 g, ~1
- Aleutians to Forrester Island, Alaska (Abbott 1974; 427)
- 59°N-25°N; Cook Inlet, Alaska south to Baja California Sur and the Gulf of California; in sand or gravel, intertidal to 55 m (Harbo 1997: 134)
- 60°N-37°N; median latitude 48°N; intertidal to -55 m; temp: +4 to +16°C; Pliocene (Bernard 1983: 17)

Yoldia sp.

- 0.1g, ~1; 0.1g, ~1

Tellina nukuloides (Reeve, 1854)

- 0.1g, ~1; 0.1g, ~1
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

*****Olivella biplicata* (Sowerby, 1825) Double check this ID**

- 0.1g, ~1; 0.1g, ~1; 0.2g, 1 (2 frag's)
- Vancouver Island, British Columbia, to Baja California; abundant in summer months in sandy bays and beaches, sometimes dredged down to 25 fathoms on

gravel bottoms (Abbott 1974: 235)

- Vancouver Island, BC south to Baja California; in sand, on open coast, burrow in sand quickly when tide goes out; used by Native peoples for jewellery and ornaments (Harbo 1997:217)

Amphissa columbiana (Dall, 1916)

- 0.1g, 1
- Alaska to San Pedro, California; moderately common in shallow water from Oregon to Alaska (Abbott 1974: 203)
- Alaska south to Oregon; not common in California; on rocky beaches and mud, in shallows (Harbo 1997: 215)

Antalis pertiosum (*Dentalium pretiosum*) (Sowerby, 1860)

- 0.2g, 6 frag's
- Alaska to Baja California, common offshore species, used extensively by the northwest Indians for money, depth 1 to 80 fathoms (Abbott 1974: 385)
- Alaska south to Baja California; common offshore in coarse shell-gravel; common name - Indian money tusk - comes from the tradition of the Nucc-chah-nulth Indians of Vancouver Island who harvested the tusks with pronged spears or a dredge-like apparatus (Harbo 1997:224)

Balanus sp.

- 0.1g, 2 frag's

sea urchin

- 0.1g, 4 spines

TUL91C20-33.65-33.68 shell sample

Tellina nukuloides (Reeve, 1854)

- 0.1gx4, 1x4; 0.1g, ~1
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46°N; intertidal to -100 m; temp: +1 to +24°C; geologic range: Recent (Bernard 1983: 42)

Diplodonta impolita (Berry, 1953)

- 0.1g x3, 1x3;
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo

- 1997:146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Balanus sp.

- 0.1g, 2 frag's

TUL91C20-33.82-33.85 shell sample

Nutricula lordi (Psephidia lordi) (Baird, 1863)

- 0.1g x14; 1 x14
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47N; intertidal to -70 m; temp: 0 to +16°C; Pliocene (Bernard 1983: 56)

Diplodonta impolita (Berry, 1953)

- 0.1g x6, 1 x6
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)
- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Tellina nukuloides (Reeve, 1854)

- 0.1g x3, 1 x3
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: recent (Bernard 1983: 42)

Yoldia sp.

- 0.1, ~1; 0.1g, 1

Protothaca sp. or Serripes groenlandicus ?

- 0.1g, ~1

Mactromeris sp.?

Appendix E

- 0.1g x3; ~1 x3

Acila castrensis (Hinds 1843)

- 0.1g x2, 1 x2
- Bering Sea to Baja California; commonly dredged from 4 to 100 fathoms in sandy mud (Abbott 1974: 411)
- 57°N-24°N; NE Bering Sea, Alaska south to Punta San Pablo, Baja California, and in the Gulf of California; mud-sand bottoms 5-220 m (Harbo 1997: 132)
- 28°N-57°N; median: 42N; 5-200 m; +3 to +26°C; Miocene

Solariella peramabilis (Carpenter, 1864)

- 0.1g, 1
- Alaska to the Gulf of California, Japan; moderately common from 20 to 339 fathoms (Abbott, 1974: 41-42)
- 58°N-18°N; Japan, and Forrester Island, Alaska south to Mexico; on offshore rocky and soft bottoms; 100-600 m (Harbo 1997: 193)

Antalis pertiosum (*Dentalium pretiosum*) (Sowerby, 1860)

- 0.1g x3, ~1 x3; 1.g, 1 frag
- Alaska to Baja California, common offshore species, used extensively by the northwest Indians for money, depth 1 to 80 fathoms (Abbott 1974: 385)
- Alaska south to Baja California; common offshore in coarse shell-gravel; common name - Indian money tusk - comes from the tradition of the Nucc-chah-nulth Indians of Vancouver Island who harvested the tusks with pronged spears or a dredge-like apparatus (Harbo 1997:224)

TUL91C20-34.08-34.11 shell sample

Tellina nukuloides (Reeve, 1854)

- 0.1g, 1
- Aleutian Islands to San Pedro, California; low tide to 34 fathoms in sand (Abbott 1974; 502)
- 60°N-32°N; Bering Sea, Cook Inlet south to Baja California Sur; in sand, intertidal to 100 m (Harbo 1997: 157)
- 32°N-60°N; median latitude 46N; intertidal to -100 m; temp: +1 to +24°C; geologic range: Recent (Bernard 1983: 42)

Diplodonta impolita (Berry, 1953)

- 0.1g x6, 1 x6
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)

- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Nutricula lordi (Psephidia lordi) (Baird, 1863)

- 0.1g x25, 1x25
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47N; intertidal to -70 m; temp: 0 to +16 °C; Pliocene (Bernard 1983: 56)

Clinocardium sp.?

- 0.1g, 1

Olivella sp.

- 0.1g, 2 frag's
- intertidal, sand (Harbo 1997)

Mytilus sp.

- 0.1g, 1 frag

Antalis pretiosum (Dentalium pretiosum) (Sowerby, 1860)

- 0.1g, 1 frag
- Alaska to Baja California, common offshore species, used extensively by the northwest Indians for money, depth 1 to 80 fathoms (Abbott 1974: 385)
- Alaska south to Baja California; common offshore in coarse shell-gravel; common name - Indian money tusk - comes from the tradition of the Nucc-chah-nulth Indians of Vancouver Island who harvested the tusks with pronged spears or a dredge-like apparatus (Harbo 1997:224)

Balanus sp.

- 0.1g, 1 frag

TUL91C20-34.15-34.20 shell sample

Patinopecten caurinus

- 19.3g, 10 frag's
- 59-36N, Northern Alaskan Islands to Point Sur, California; in small depressions on sand or gravel -10 to -200 m; edible, also used by aboriginals for rattles and noisemakers (Harbo 1997:144)
- 36-59N; median 47N; 10-200 m; +1 to +11 °C; Pliocene (Bernard 1983:27)

118-121cm;

TUL91C20-34.50-34.53 shell sample

Yoldia sp.

- 0.1g, 1

unidentified bivalve fragments

- 0.1g, 3 frag's

wood

- 0.5g, 8 frag's

TUL91C20-34.71-34.74 shell sample

Nutricula lordi (Psephidia lordi) (Baird, 1863)

- 0.1gx25, 1x25
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47°N; intertidal to -70 m; temp: 0 to +16°C; Pliocene (Bernard 1983: 56)

Diplodonta impolita (Berry, 1953)

- 0.1g x15, 1 x15
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)
- 33°N-55°N; median latitude 18°N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Simomactra falcata (A.A. Gould, 1850)

- 0.1g x2, 1 x2; 0.1g x2, ~1x2; 0.1g, 3 frag's
- *Spisula falcata* (Gould, 1850) "moderately common in sand below low-water line" (Abbott 1974: 490)
- "Range: 54°N-31°N; Rose Spit, Queen Charlotte Islands, BC south to Isle San Martin, Baja California Norte. Habitat: Buried shallow in sand from intertidal to 165' (50 m) depths; often in protected waters." (Harbo 1997:154)
- Geographic range: 32°N-57°N; median latitude: 43°N; habitat: intertidal - 50 m; temp range: +4° to +24°C; Geologic range: Pliocene (Bernard 1983: 40)

Yoldia sp.

- 0.1g, 1 frag; 0.1g, 1 frag

Cylichna attonsa

- 0.1g, 1

Cylichna alba

- 0.1g, 1

Clinocardium sp.

- 0.1g, 1

unidentified bivalve fragments

- 0.9g, 9 fragments

unidentified gastropod fragments

- 0.1g, 2 frag's

wood

- 0.3g, 43 frag's

charcoal

- 0.1g, 1 frag

TUL91C20-35.17-35.20 shell sample; *217-220 cm

Clinocardium sp.

- 11 frag's

Nutricula lordi Psephidia lordi (Baird, 1863)

- 0.1g x59, 1 x59; 0.3g, 1
- Alaska to San Diego, California; tiny young shells may be found inside the adult clams in the summer and spring months, common (Abbott 1974: 527)
- 59°N-26°N; Bering Sea, Gulf of Alaska and south to Baja California Sur; in sand and mud, often in the roots of eelgrass, intertidal to 70 m (Harbo 1997: 167)
- 33°N-61°N; median: 47°N; intertidal to -70 m; temp: 0 to +16°C; Pliocene (Bernard 1983: 56)

Diplodonta impolita (Berry, 1953)

- 0.1g, x15; 1 x15
- Alaskan subspecies of *Diplodonta orbellus* (Gould, 1852); dredged in 15 fathoms at Forrester Island (Abbott 1974: 465)
- 57°N-44°N; Kodiak Island, Alaska south to Oregon; intertidal to 100 m (Harbo 1997:146)

- 33°N-55°N; median latitude 18N; 2-100 m; temp: 0 to +19°C; Recent (Bernard 1983: 30)

Yoldia sp.

- 0.1g, 1 frag

Cylichna alba

- 0.1g x3, 1 x3

Olivella baetica (Carpenter, 1864)

- 0.1g, 1
- Kodiak Island, Alaska to Baja California (Abbott 1974: 235)
- Alaska south to Baja California, in sandy bays and beaches, often in same areas as purple olive. Also found in more protected waters (Harbo 1997:217)
- most commonly found south of Point Conception, although total range is about the same as *O. biplicata* – Vancouver to Baja California, bays & estuaries (Ricketts et al. 1985: 328)

Olivella sp.

- 0.1g, 1 frag

Mactridae sp.

- 0.1g, 1 frag
- probably intertidal to -50 m, edible

sea urchin spines

- 0.1gx3; 1x3

Macoma moesta (Deshayes, 1855)

- 0.1g, 1
- Circumpolar Arctic sea, Greenland, Alaska; common offshore (Abbott 1974: 506)
- 71°N-43°N; Arctic to Bering Sea and south to of Coos Bay, Oregon; in silt and a variety of bottom types; intertidal to 300 m (Harbo 1997: 160)
- 45°N-71°N, median lat 58N; 1-300 m; -2°C to +16°C; Pleistocene; Panarctic, Northwest Pacific (Bernard 1983: 45)

Margarites sp.

- 0.1g, 1

wood and plant

- 0.1g, many fragments

Appendix E

unidentified bivalve frag's

- 0.5g, 29 fragments

TUL91C20-35.32-35.35 shell sample; *232-235 cm shell

Seismic description: shallow basin, thin layer of Holocene sediments overlying what appear to be Pleistocene terrestrial sediments with channel deposits.

T91C34

Depth interval: 128 cm

Scientist: VB

Described by: KC

Type of Core: vibrocore

Section: 1

Latitude: 53 52.00 N

Longitude: 131 17.93W

Depth: 31 m

Lithological Description:

Depth in core:	Lithological description
0-27 cm	KC: pale olive poorly sorted shelly gravelly coarse sand; gravel to 7cm, fine shell debris ~25%; massive appearing - unit 4 RH: olive gravel in sand/shell matrix, rounded cobbles to 12 cm 22-26 cm shell sample: coarse sand with rounded pebbles to 4cm, shell matrix with high concentration of <i>Balanus spp.</i>, lots of shell frag's, no complete valves - shell: <i>Mya sp.</i>, <i>Pododesmus machrochisma</i>, <i>Chlamys sp.</i>, <i>Balanus glandulus</i>, <i>Balanus spp.</i>, <i>Protothaca sp.</i>, <i>Mytilus sp.</i>, unidentified bivalve frag's, unidentified gastropod frag's
27-58 cm	KC: olive grey well-moderately well sorted, fine-med sand, massive with a few beds and minor burrows, shelly where bioturbated - unit 3 RH: olive grey med-fine sand with shell fragments throughout. 42-45 cm shell sample: olive grey med/fine sand, much less shell, <i>Balanus spp.</i> & gastropod - littorina. Shell: <i>Balanus glandulus</i>, <i>Balanus ?</i>, <i>Balanus spp.</i>, unidentified gastropod frag's
58-98 cm	KC: pale olive to very dark grey laminated fine-very fine sand; some silty beds, organic matter and roots at base of unit, bedding is 2-10 mm thick - Unit 2 - beach? RH: laminated olive grey sand with fine dark grey sand, laminations < 1 cm thickness for grey fine sand, <2 cm for olive grey sand and throughout length of unit. 74-77 cm shell sample: fine grey sand, no shell, no organic 94-97 cm shell sample: fine grey sand, no shell, tiny, tiny organic
98-128 cm	KC: very dark grey to dark olive grey organic rich sand silt; some sand (med) interbeds; laminated; beds are 1-10 mm thick; sectioned root - unit 1 - lagoonal or terrestrial 104-114 cm Rolf Mathewes: 3 species of moss (leaves), dwarf willow seed, other material of a terrestrial organic nature, small berry plant bud scale, Rolf suggest this assemblage represents a terrestrial environment from about 12,000 - 12,500 YBP of dwarf willow everywhere at this time.

RH: dark grey organic rich silt with orange blotching
 102-105 cm shell sample: fine dark grey sand with abundant wood & plant fragments
 114-117 cm shell sample: fine dark grey sand with abundant wood & plant fragments, numerous seed pods.
 124-127 cm shell sample: fine dark grey sand with wood & plant frag's

Malacological description:

T91C34-31.22-.26

Mya sp.

- 0.5g, ~1; 0.3g, ~1; 1.6g, 17 frag's

Pododesmus machrochisma (Deshayes, 1839)

- 0.1g, ~1; 0.1g, ~1; 0.1g, 4 frag's
- Adak Island, Alaska to Baja California. Japan. Very common species attached to stones and sharp pilings from low tide mark to about 35 fathoms. Often found on *Haliotis* (Abbott 1974:452)
- 58°N-28°N; Bering Sea to Alaska and south to Baja California Sur, and the Gulf of California; rocks and other solid objects, intertidal to 90 m (Harbo 1997:141)
- 57°N-70°N; median latitude 64°N; habitat: intertidal to 40 m; temp: -2° to 14°C; geologic range: Miocene; northwest Pacific (Bernard 1983:28)
- occasionally found on protected outer coast, but more common on rocks in quiet bays or on wharf pilings, fastened to reefs, bays and estuaries on rocky shores at low intertidal, (Ricketts et al., 1985: 160, 290)

Chlamys sp.

- 0.1g, 5 frag's

Balanus spp.

- 2.7g, 72 frag's

Balanus glandulus

- 0.1g, 1 scutum; 0.1g, 1 scutum
- Uppermost horizon, bare rocks abundant on the protected coast, also thrives in quiet waters and along the surf-swept outer coast; high intertidal, unspecialized habitat requirements, range from Aleutian Islands to Bahía de San Quitin, Baja California, thrives in constantly aerated ocean waters along the protected outer coast, even in violently surf-swept points, but also in quiet waters of Puget Sound; common in bays and estuaries, great variability of habitat due to high tolerance and generalization, unusual for marine invertebrates (eg. Outer coast is wave shock, low temperature, high salinity, and high Oxygen, whereas in bays and estuaries is high temperatures, variable and often low salinities, and relatively low

oxygen content; upper intertidal in Washington region (middle intertidal in California) (Ricketts 1985: 8,24,25, 270, 433)

Protothaca sp. (cf)

- 0.1g, 1 frag
- 54N-23N; Alaska to Baja California (max range is *P. staminea*), intertidal to -10 m (Harbo 1997:166-67)

Mytilus sp.

- 0.1g, 1 frag

unidentified bivalve frag's

- 0.9g, 21 frag's

unidentified gastropod frag's

- 0.3g, 2 frag's

T95B05

Depth interval: 481 cm

Scientist: VB

Described by: KC

Type of Core: piston

Section: 1 & 2&3

Latitude: 52 24.24N

Longitude: 132 35.76W

Depth: 152 m

Lithological Description:

Depth in core:	Lithological description
0-2 cm:	KC: grey sandy silt with shells
2-244 cm	KC: dark grey sandy mud and muddy sand, bioturbated; some sand laminations with turbidite features - graded and sharp base, laminae are 3 mm to 1 cm thick; ~118 cm: C14 date 11820 +/-80 at 132 cm turns dark grey ~225 cm: C14 date 12,380 +/-60 221 cm very dark grey bioturbated sandy mud with minor wood to 1 cm
244-407 cm	KC: very dark grey well sorted fine sand, silt laminations, bioturbated, massive watery sand ~244 cm: C14 date 12,760 +/-60
407-456 cm	KC: very dark grey interbedded bioturbated fine sand and silt; minor gravel to 0.5 cm; wood concentrated on silt beds, concretion at 450 cm - 3 cm ~440 cm: C14 date 12,340 +/-60
456-481 cm	KC: black massive sand grading from medium sand to fine gravel; slightly silty

T95B12

Depth interval: 250 cm

Scientist: VB

Described by: KC

Type of Core: vibrocore

Section: 1 & 2

Latitude: 53 57.62N

Longitude: 130 52.94W

Depth: 77 m

Lithological Description:

Depth in core: Lithological description

0-66 cm

KC: olive poorly sorted shelly gravelly med sand; poorly developed bedding, shell and gravel concentrated in beds; mixing of some silt/clay into unit (by bioturbation); sharp erosional contact with underlying unit; unit 2 - Holocene
 RH: olive med sand with pebbles to 2 cm, shell fragments throughout, interfingering with clay at base from 50 to 65 cm with clay fingers ~5 cm thick.

46-49 cm shell sample: olive med sand, subangular pebbles to 2 cm, shell fragments, wood: *Parvalucina tenuisculpta*, *Chlamys sp.*, sea urchin, sponge, unidentified bivalve frag's, *Balanus spp.*, wood

66-250 cm

KC: dark grey interbedded clay and fine sand with minor shells and gravel; clay units often intermixed at contacts with sand; (due to bioturbation); bioturbated contact blebs of clay in sand ~150 cm; 1 g shell fragments including well preserved mussel fragments to 2x3 cm @ 180 cm; 13,290 +/- 60 BP @ 185 cm; @ ~201 cm: dark grey sand and silt, contacts are chaotic with blobs of sand in the silt and silt in the sand (due to bioturbation); unit 2 - good unit to look at for macrofauna/depth changes (eg) brackish indicators? (mussel shells)

65-81 cm

RH: grey clay, bioturbated at base

81-202 cm

RH: grey med to fine sand with large intact articulated bivalves

87-90 cm shell sample: med to fine sand with subangular pebbles to 2 cm, shell: *Mytilus sp.*, unidentified bivalve fragments

100-103 cm shell sample: fine sand, subangular pebbles to 2 cm, *Mytilus sp.*, *Macoma sp.*: *Macoma calcarea*, *Macoma sp.*, *Mytilus sp.*, unidentified bivalve frag's, *Balanus spp.*, seaweed

133-136 cm shell sample: fine sand, *Macoma sp.*, *Mytilus sp.*, *Balanus spp.*, sea urchin, wood & charcoal: *Macoma calcarea*, *Macoma sp.*,

Mytilus sp., sea urchin, unidentified bivalve fragments, wood

182-185 cm shell sample: fine sand with subangular pebbles to 1 cm, no

wood, *Mytilus sp.*, sea urchin, *Macoma sp.* - shell: *Mytilus trossulus*, sea urchin, unidentified bivalve frag's, *Balanus spp.*

198-201 cm shell sample: fine sand with subangular pebbles to 1 cm, no wood, *Mytilus sp.*, *Macoma sp.* - shell: *Macoma inquinata* (cf), *Mytilus sp.*, sea urchin, *Balanus spp.*, unidentified bivalve frag's

202-225 cm RH: grey clay, bioturbated base

211-214 cm shell sample: clay with some fine sand, a few subangular pebbles to ½ cm, *Hiatella sp.*, shell casings?- shell: *Musculus taylori* (cf), *Hiatella pholadis*, unidentified bivalve frag's

225-250 cm RH: fine grey sand with shell, bioturbated at top

235-238 cm shell sample: fine sand with 1/4 cm pebbles, 1 large flake - basalt?, *Macoma sp.*, sea urchin, *Mytilus sp.*, plant or wood, fish scale?- shell: *Macoma incongrua* (cf), *Modiolus sp.*, *Macoma sp.*, unidentified bivalve frag's, sea urchin, *Balanus spp.*, plant, lithic

246-249 cm shell sample: fine sand with subangular pebbles to ½ cm, *Mytilus sp.*?, sea urchin *Balanus spp.* - shell: *Mytilus sp.*, *Musculus taylori* (cf), sea urchin, *Balanus spp.*, unidentified bivalve frag's

Malacological description:

T95B12-77.46-.49

Parvalucina tenuisculpta (Carpenter, 1864)

- 0.1g, ~1
- Bering Sea to Baja California; common just offshore (Abbott 1974:459)
- 60°N-28°N; Kodiak Island, Alaska south to Isla Cedros, Baja California Norte; intertidal in sand-mud, to depths of 275 m and more, sometimes in dense numbers (Habo 1997:145)
- 33°N-60°N; median latitude 47°N; habitat: 5-275 m; temp: +1 to +22°C; geologic range: Pliocene (Bernard 1983:29)

Chlamys sp.

- 0.1g, 7 fragments

sea urchin

- 0.1g, 3 spines

sponge

- 0.1g, 5 fragments

unidentified bivalve fragments

- 0.1g, 7 fragments

Balanus spp.

- 0.1g, 8 fragments

wood

- 0.1g, 3 fragments

T95B12-77.87-.90

Mytilus sp.

- 0.1g, 3 fragments

unidentified bivalve fragments

- 0.8g, 9 fragments

T95B12-78.0-.03

Macoma calcaria (Gmelin, 1791)

- 2.1g, ~1
- Greenland to Long Island, New York; Bering Sea to Washington; common cold-water species (Abbott 1974: 505)
- 71°N-47°N, circumboreal, Arctic to Bering Sea and south to Newport Oregon; in sand, silt, and gravel; intertidal to -320 m (Harbo 1997:159)
- 47°N-71°N, median 59N; intertidal to -320 m, -2°C to +15°C; ?Oligocene; Panarctic, circumboreal (Bernard 1983: 44)

Macoma sp.

- 0.3g, ~1; 0.3g, ~1; 0.1g, ~1; 0.9g, 2 frag's

Mytilus sp.

- 0.1g, 1 frag

unidentified bivalve frag's

- 0.5g, 11 frag's

Balanus sp.

- 0.1g, 1 frag

seaweed

- 0.1g, 2 frag's

T95B12-78.33-.36

Macoma calcaria (Gmelin, 1791)

- 1.2g, 1
- Greenland to Long Island, New York; Bering Sea to Washington; common cold-water species (Abbott 1974: 505)

- 71°N-47°N, circumboreal, Arctic to Bering Sea and south to Newport Oregon; in sand, silt, and gravel; intertidal to -320 m (Harbo 1997:159)
- 47°N-71°N, median 59N; intertidal to -320 m, -2°C to +15°C; ?Oligocene; Panarctic, circumboreal (Bernard 1983: 44)

Macoma sp.

- 0.3g, 3 frag's

Mytilus sp.

- 0.1g, 3 frag's

sea urchin

- 0.1g, 2 spines

unidentified bivalve frag's

- 0.4g, 22 frag's

wood

- 0.1g, 8 frag's

T95B12-78.82-.85

Mytilus trossulus (A.A. Gould, 1850)

- 1.8g, 15 frag's
- 71°N-19°N; Arctic to Alaska and south to Mexico; considered introduced to BC, quiet, sheltered locations, in the intertidal zone to 5 m; form dense masses on hard surfaces and attached by strong byssal threads (Harbo 1997:135)
- Arctic Ocean to South Carolina, Alaska to California (Abbott 1974:428-9)
- 23°N-71°N, median 47°N; intertidal to -5 m; -4°C to +30°C, Miocene; introduced cosmopolitan in temperate and cold seas (Bernard 1983:18).
- quiet water bays, wharf pilings, in open coast occurs above *Mytilus californianus*, best suited for life in quiet water, more mobile than *M. californianus*, spawning in the late fall or winter, those exposed to greater wave action grow more slowly and have thicker shells than quiet water counterparts (Ricketts, Calvin and Hedgpeth 1985:273-274)

sea urchin

- 0.1g, 2 spines; 0.1g, 1 frag

unidentified bivalve fragments

- 1, 5 frag's

Balanus sp.

- 0.1g, 1 frag

T95B12-78.98-79.01

Macoma inquinata (cf) (Deshayes, 1855)

- 1.2g, ~1 in 2 frag's
- Bering Strait to Los Angeles, California (Abbot, 1974)
- 57°N-34°N, Pribilof Islands, Bering Sea south to Santa Barbara, California; in sand-mud, intertidal to 50 m depths in bays and offshore (Harbo 1997:158)
- 34°N-57°N, median 46N; intertidal to -50 m, +1°C to +20°C, Pleistocene, Northwest Pacific (Bernard 1983: 45)

Mytilus sp.

- 0.1g, 4 frag's

sea urchin

- 0.1g, 1 spine

Balanus sp.

- 0.1g, 1 frag

unidentified bivalve frag's

- 0.3g, 13 frag's

T95B12-79.11-.14

Musculus taylori (cf) (Dall, 1897)

- 0.1g, 1; 0.1g, 6 frag's
- 53°N-48°N, Hotspring Island, QCI south to Victoria BC; intertidal, distribution reported to be limited to BC (Harbo 1997:138)
- 48°N-57°N, median 53N; intertidal, Recent

Hiatella pholadis (Linné, 1771)

- 0.1g, (x5), 1(x1); 0.1g, (x2), ~1 (x2)
- *Hiatella arctica* (Linné, 1767), common in cold water. Common in California; nest in kelp holdfasts and rock crevices, from low tide to deep water, This is *pholadis* (Linné, 1767), (Abbott 1974: 541).
- 68°N-48°N; Bering Sea and south to Puget Sound, Washington; in burrows of pholads (piddocks), mussel beds and kelp holdfasts; intertidal to 10 m (Harbo 1997:174)
- 48°N-68°N, median latitude 58°N; intertidal to -10 m; -3°C to +15°C; Pliocene; circumboreal. (Bernard 1983: 59)

unidentified bivalve fragments

- 0.1g, 9 frag's

T95B12-79.35-38

Macoma incongrua *Macoma obliqua* (Sowerby, 1817)

- 0.6g, ~1 in 5 frag's
- Point Barrow, Alaska to Washington, common in Alaska (Abbott 1974: 507)
- 71°N-47°N; Point Barrow, Alaska south to Puget Sound, Washington; in gravel or sand, intertidal to 200 m (Harbo 1997:161)
- 46°N-71°N, median 59N; intertidal to -200 m; -3°C to +16°C; Recent; Arctic Ocean (Bernard 1983:45)

Modiolus sp.

- 0.1g, ~1; 0.1g, ~1; 0.2g, 10 frag's

Macoma sp.

- 0.2g, ~1 in 2 frag's

unidentified bivalve fragments

- 0.4g, 20 fragments

sea urchin

- 0.1g, 2 spines

Balanus sp.

- 0.2g, 2 frag's

plant

- 0.1g, 2 frag's

lithic

- 2.3g, 1 flake

T95B12-79.46-49

Mytilus sp.

- 0.1g, ~1; 0.1g, 3 frag's

Musculus taylori (cf) (Dall, 1897)

- 0.1g, ~1
- 53°N-48°N, Hotspring Island, QCI south to Victoria BC; intertidal, distribution reported to be limited to BC (Harbo 1997:138)
- 48°N-57°N, median 53N; intertidal, recent

sea urchin

- 0.1g, 3 spines

Balanus spp.

- 0.1g, 5 frag's

unidentified bivalve frag's

- 0.1g, 5 frag's

V94A11

Depth interval: 92 cm

Scientist: H. Josenhans

Described by: KC

Type of Core: gravity

Section: 1

Latitude: 52 26.19

Longitude: -131 23.72

Depth: 109 m

Lithological Description:

Depth in core: Lithological description

0-39 cm KC: olive muddy massive sand, some bivalves in life position, bioturbated, minor gravel, angular 1cm, shell debris; sharp erosional contact with underlying unit; unit 3

RH: olive massive very fine sand, shell fragments & minor gravel throughout, *Lucinoma annulatum* in growth position @ 8 cm.

*19-22 cm shell sample: silty sand with fine gravel, wood & plant, no

shell.

39-82 cm

KC: dark olive grey mud interbedded with very dark grey sand; slightly bioturbated, 2 cm diameter wood fragments @ base of unit; sharp contact with underlying unit; unit 2

RH: olive brown mud interbedded with dark grey sand, large wood chunks @75-79 cm.

*41-43 cm shell sample: significantly more wood and plant fragments than 19-22 cm sample; wood, plant, fishscales-2, no shell, very fine mud/silt with minor angular gravel.

*70-73 cm shell sample: very fine mud/silt, no shell, abundant wood and

plant

82-92 cm

KC: very dark grey - black muddy sandy gravel to 3 cm, shell debris ?; unit 1

RH: dark grey muddy sandy gravel, gravel to 3 cm

*83-86 cm shell sample: no shell, some wood/plant, subangular gravel to 3 cm

V94A12

Depth interval: 335 cm

Scientist: H. Josenhans

Described by: KC

Type of Core: percussion

Section: 1&2

Latitude: 52 27.45 N

Longitude: -131 27.0 W

Depth: +15 m

Lithological Description:

Depth in core:	Lithological description
0-60 cm	KC: Dark reddish brown gyttja; very finely divided organic matter; high water content; ~0% mineral content; soft; colour change to various brown/red hues down section; unit 3 RH: Medium brown organic layer becoming dark brown at base; dated samples at 1 cm and 2 cm, come from same sample in core, core heavily sampled right down to 92 cm *3-5 cm shell sample: solely organic, some wood and plant fragments, coprolites, 710 micrometre mesh screen, no sand. *8-10 cm shell sample: no shell, wood, plant & fish scales; Sediment sample: dark reddish brown organic, much fewer coprolites than lower levels. *52-54 cm shell sample: dark brown organic wood, plant, fish scales(?), forams (?) Sediment sample: heavy in coprolites
60-94 cm	KC: dark brown gyttja; soft; high water content; changing to very dark brown at ~82 cm; sharp contact with underlying unit; unit 3 RH: medium brown to dark brown muddy silt with organics, heavy in coprolites *79-81 cm shell sample: tiny shells, fish scales, lots of wood & plant Sediment sample: dark brown muddy silt, screened over 63 micrometre screen, sediment sample taken, heavy with coprolites, no sand, high organic content
94-168 cm	KC: grey laminated clay; silt to fine sand increasing to 1 cm thick, most bedding at 1-2 mm thick; gravelly towards base; gravel to 5 cm diameter; sharp contact with underlying unit; unit 2 RH: grey laminated silt with dropstone @ 155 cm *102-105 cm shell sample: little organic, grey silt, some plant Sediment sample: *143-146 cm shell sample: forams? Grey silt, dropstone in sample, angular gravel to 2 cm, dropstone (4cm diam) - striated.

Appendix E

- 168 - 335 cm KC: olive grey massive to poorly bedded sandy gravelly silty clay; sandy gravelly zones or beds to 7 cm thick; gravel to 2.5 cm diam.; unit 1
RH: massive olive grey clay, one stone @ 305 cm, increasing pebbles at 310 cm
*204-207 cm shell sample: glacial, 4 cm stone is striated, 1 wood/plant fragment, clay fine angular gravel to 1.5 cm
*259-262 cm shell sample: clay with fine angular gravel to 1 cm, no organic
*302-305 cm shell sample: clay with fine angular & subangular gravel to 1.5 cm, no organic

V94A15

Depth interval: 296 cm

Scientist: H. Josenhans

Described by: KC

Type of Core: piston

Section: 1 & 2

Latitude: 52 17.55 N

Longitude: -131 16.76 W

Depth: 81 m

Lithological Description:

Depth in core:	Lithological description
0-95 cm	KC: massive, olive, mud with shells and shell debris; minor wood debris (fine), more common towards base of unit; pelecypod shell fragments to 1 cm diameter; soft to firm; unit 6; sharp contact with underlying unit
0-93 cm	RH: massive olive silty mud with shell fragments
	*69-72 cm shell sample: mud with fine shell fragments & wood, no gravel
93-104 cm	RH: muddy shelly layer with bivalves intact
	*98-102 cm shell sample: mud with very abundant wood, needle and seed fragments, <i>Macoma sp.</i> , <i>Dentalium sp.</i> , <i>Mytilus sp.</i>
	Wood sample: taken
95-107 cm	KC: olive grey shelly muddy sand/sandy mud; abundant wood; unit 5
107-134 cm	KC: very dark grey sandy mud with minor shells and shell debris; minor wood fragments; massive; unit 4; sharp contact with underlying unit
104-133 cm	RH: dark grey brown mud with shell fragments
	*120-123 cm shell sample: mud with calcified crystals, significantly different composition than overlying layer, very little shell and wood
	*129-131 cm shell sample: tiny shell fragments (2 - <i>Mytilus sp.</i> ?), coniferous needles, very little shell & minor wood, crystals throughout
134-187 cm	KC: dark reddish brown silt; bedded on a 10 cm scale; abundant organic flecks and laminae; woody flecks are black; soft to firm; unit 3 gradational contact with underlying unit
	RH: dark reddish brown silt, laminated, grading into much lighter brown @ 160 to 167 cm then dark again
	*142-144 cm shell sample: silt, a few crystals, no shell, coniferous needles and seeds, other plant/wood
	*163-166 cm shell sample: brown silt, no shell, coniferous needles and seed, clear crystals
	*180-183 cm shell sample: dark brown silt, no shell, minor coniferous

Appendix E

- seeds, plant and wood
- 187-249 cm KC: grey laminated clay; bedding are 1-2 mm thick; soft to firm; some evidence of deformation (coring?) In distorted bedding and silt clast; flecks of woody organic matter; sharp contact with underlying unit
 RH: grey laminated clay
 *202-205 cm shell sample: grey clay, no wood, no shell, gravel flecks to 0.2 cm
 *209-212 cm shell sample: sand bleb in clay, angular gravel to 0.5 cm, 1 plant fragment
 *242-245 cm shell sample: grey clay, no wood, no shell
- 249-296 cm KC: grey laminated clay and silt; base of unit is broken up with 1-3 mm cracking? on bedding planes (coring deformation?), minor gravel to 1cm diameter; unit 1
 RH: grey laminated clay
 *250-253 cm shell sample: grey clay, some wood, subrounded gravel to 0.6 cm
 *287-290 cm shell sample: grey clay, no wood, no shell, no gravel

VEC94A027

Depth interval: 183 cm

Scientist: JVB

Described by: KC

Type of Core: Piston

Section: 1 & 2

Latitude: 53°36.21 N

Longitude: 131°07.151W

Depth: 68 m

Lithological Description:

Depth in core: Lithological description

0-3 cm KC: medium sand, olive

3-23 cm KC: dk grey coarse sand/shell hash, becomes muddy at 10 cm, minor gravel to 1.5 cm diam.

RH: highly fractured shell hash containing *Balanus spp.*, sea urchin spines, Clinocardium species - intertidal; required strong wave/current action to create hash and move to -68 m depth.

23-39 cm RH: shell hash interspersed with silt sand and mud; possible interbedding, bioturbation or storm events separated by silt/sand deposition.

39-47 cm RH: mud sand silt

47-56 cm RH: some gravel, coarser shell hash

* shell sample @ 54cm from shell hash, 4cm³ sample size

56-88cm RH: fine sand interspersed with shell hash, some wood & gravel

* RH: 85-89 cm shell hash sampled, 4 cm³ sample size screened through 355 µm screen* KC: 87 cm wood dated to 9,480 C¹⁴ ypb ± 70

90-120cm RH: fine sand with some shell & wood

* 104-107 cm shell sample - *Simomactra falcata*

* 113-116 cm shell sample of hash

120-183 cm RH: laminated sand/silt with wood fragments, probably ice/land proximal, rapid deposition to 87 cm, i.e., 55 cm in 180 years.

* 183 cm wood sampled

KC: * 142 cm - wood dated to 9,660 C¹⁴ ypb ± 70

23-183 cm KC: dark grey interbedded and interlaminated mud and fine sand; sands are moderate to well sorted; some shell rich zones; bioturbated and burrowed variably; some coring deformation from 118 - 132 cm; some wood debris and fragments

Malacological description:

V94A27-68.54 shell sample, *Nucula* sp.

- 0.2g, ~1

V94A27-68.85-.89 shell hash sample*Chlamys rubida* (Hinds, 1845)

- 0.1g, 1; 0.1g, 1 frag
- Alaska to off San Diego California; common species dredged in shallow water down to 822 fathoms. (Abbott 1974:444)
- 57°N-33°N; on gravel-mud bottoms, at depths of 3-66'(1-200 m) (Harbo 1997:142)
- 33°N-58°N; median latitude: 46°N; habitat: 1-200 m; temp range: +1 to +17°C; geologic range: Miocene (Bernard 1983: 25)

Cyclocardia ventricosa (Gould, 1850)

- 0.1g, ~1; 0.1g, 1; 0.1g, ~1; 0.2g, ~1
- Alaska to Santa Barbara Islands; common offshore (Abbott 1974: 478)
- 28°N-60°N; med latitude 44°N; habitat: 20-620 m; temp range: +1°C to +17°C; geologic range: Pleistocene (Bernard 1983: 34)

Trichotropis cancellata (Hinds, 1843)

- 0.1g, ~1
- Bering sea to Oregon; commonly dredged in cold, shallow water (Abbott 1974:138)
- subtidal in rocky areas, often among sea squirts and tube worms, and overgrown with other organisms. Found on tube worms up off the bottom, where currents are stronger and more food is carried by (Harbo 1997:205)
- bays and estuaries, rocky shores: low intertidal (Ricketts et al., 1985: 289)

Balanus spp.

- 1.0g, 33 frag's

Unidentified gastropod

- 0.1g, 1 frag

Unidentified bivalve frag

- 0.2g, 1 frag

Sediment matrix

- 6.2g

V94A27-69.04 - .07 shell sample*Simomactra falcata* (A.A. Gould, 1850)

- 1.5g, ~1 in 10 frag's (broken by core cutter)
- *Spisula falcata* (Gould, 1850) "moderately common in sand below low-water line" (Abbott 1974: 490)
- "Range: 54°N-31°N; Rose Spit, Queen Charlotte Islands, BC south to Isle San Martin, Baja California Norte. Habitat: Buried shallow in sand from intertidal to 165' (50 m) depths; often in protected waters." (Harbo 1997:154)

- Geographic range: 32N-57N; median latitude: 43N; habitat: intertidal - 50 m; temp range: +4° to +24°C; Geologic range: Pliocene (Bernard 1983: 40)

V94A27-69.13 -.16

Frag'd shell sample, probably *Simomactra falcata* (A.A. Gould, 1850) - same data as above

- 0.6g, 12 frag's

V94A27-69.80-.83

Wood sample

- 0.2g, 10 frag's

Seismic description: shallow basin, thin layer of Holocene sediments overlying what appear to be Pleistocene terrestrial sediments with channel deposits.