INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

ProQuest Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

UMI®

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A

AN HISTORICAL ECOLOGY OF LABRADOR INUIT CULTURE CHANGE

by

JAMES M. WOOLLETT

Vol. 1

A dissertation submitted to the Graduate Faculty in Anthropology in partial fulfillment of the requirements of the degree of Doctor of Philosophy, The City University of New York

2003

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UMI Number: 3074693

Copyright 2003 by
Woollett, James Malcolm

All rights reserved.

UMI®

UMI Microform 3074693
Copyright 2003 by ProQuest Information and Learning Company.
All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

©2003

JAMES M. WOOLLETT

All Rights Reserved

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

This manuscript has been read and accepted for the Graduate Faculty in Anthropology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

1/27/03
Date

Thomas H. McGovern
Chair of Examining Committee

1/27/03
Date

Executive Officer

Warren DeBoer

William Parry

Sophia Perdikaris

Susan A. Kaplan

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Abstract

AN HISTORICAL ECOLOGY OF LABRADOR INUIT CULTURE CHANGE

by

James M. Woollett

Adviser: Professor Thomas H. McGovern

This dissertation reports the results of an historical ecology-oriented archaeological investigation of Labrador Inuit culture change during the contact period. The project involved four seasons of archaeological fieldwork and zooarchaeological laboratory analyses of faunal collections from Uivak Point 1 and several other sites in northern and central Labrador. The research provides the first detailed description of Labrador Inuit subsistence economies based on a detailed, regional-scale analysis of faunal remains. It also draws together archaeobotanical, palaeoentomological and palaeoenvironmental research and also ethnohistorical data, in order to define changes in the Inuit subsistence economy and their relationships to larger environmental and culture changes. This range of data sets and approaches are used to construct a landscape history for Labrador, linking complex climatic and ecological variables with historically situated agents and their economic activities.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In particular, the study examines the use of communal winter residences by the Labrador Inuit during the 18th century, a culture change that has been linked to environmental deterioration and economic stress during the Little Ice Age and, alternatively, to the social action of aggrandizers with circumstances of economic security and culture contact. These theories are tested with a variety of subsistence data that focus on the seasonality, diversity and productivity of Inuit hunting practices demonstrated in several well-dated faunal assemblages and on the roles of strategies of surplus production and stress management in economic decision-making. As well, a variety of high-resolution palaeoenvironmental records are used to determine the direction of environmental change and how it influenced economic opportunities.

The study suggests that the Labrador Inuit enjoyed a degree of economic security and success in the 18th century, aided in part by an interlude of moderated climatic and sea ice conditions. These conditions encouraged the use of cooperative sea mammal hunting methods, which were reinforced by the use of communal residences. This economy facilitated surplus-producing and risk-taking economic strategies and a more prominent social role for aggrandizers.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

PREFACE

The general purpose of this dissertation is to explore how the Labrador Inuit reacted and responded to their changing environmental and cultural circumstances, as seen in their subsistence economy. I have focused my attention on a period of multi-faceted culture changes for the Labrador Inuit, lasting from the late 17th to the early 19th century. Archaeologists and ethnohistorians have debated the causes and meanings of these culture changes for some time, without reaching any definitive conclusions. I have sought to contribute to this debate by undertaking extensive examinations of Labrador Inuit subsistence economies based on zooarchaeological analyses. In addition to the zooarchaeological analyses, I have synthesized existing palaeoenvironmental data, and related archaeological data to high-resolution palaeoenvironmental and ethnohistorical records. My work has been further informed by conducting interviews and traveling on hunting trips with Labrador residents.

The initial goal of this project was to conduct a general study of long-term change of subsistence economies of the Labrador Inuit. I saw that only a small number of zooarchaeological studies concerning Labrador had been published and vaguely envisioned undertaking a regional comparison of Neoeskimo subsistence patterns through faunal analyses. Several Labrador archaeological studies (notably those by Kaplan (1983), Spiess (1978) and Cox and Spiess (1980)), and similar studies concerning Greenland and the North Atlantic (Buckland et al. 1983, 1996; Grønnow, et al 1983; McGovern 1985, 1991; McGovern, et al. 1983) convinced me that subsistence economy studies could serve as methodological foundations for an anthropological study of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador's (pre)history. As well, they illustrated the potential of zooarchaeology as a research tool capable of elucidating detailed subsistence data. Much of the archaeology conducted in Labrador has been concerned with long term processes of adaptation measured, to a large degree, in terms of subsistence (see Fitzhugh 1972). Nevertheless, few of these studies have focused on zooarchaeological data. I thought it would be worthwhile to add a few more detailed zooarchaeological reconstructions of lifeways to the framework of Labrador's culture history and, in so doing, better distinguish the everyday lives of Thule and Inuit peoples in Labrador. Multidisciplinary studies with zooarchaeological, palaeoentomological, archaeobotanical, palaeoecological and dating components have been applied to notable effect elsewhere in the North American Arctic and in the North Atlantic (see, for example, Buckland, et al. 1983), and provided a methodological model for this project.

Early in the course of reading published work and learning the basic elements of Labrador's archaeology and ethnohistory, however, it became apparent that much of the scholarship pertinent to the Labrador Inuit was preoccupied with one particular issue, the so-called "Communal House Phase". During the late 17th century to the 19th century, the Inuit of Labrador (and Greenland) underwent a number of cultural and economic changes, some of which are distinctive within the terms of Labrador's culture history or in relation to that of Inuit peoples in general. Notable among these culture changes was the adoption of large, multifamily "communal" winter houses. Previously, Thule peoples in Labrador and Greenland used relatively small, single-family, semi-subterranean houses in winter, much as they did elsewhere in the Arctic. These settlements often comprised multiple contemporaneously occupied houses. In contrast, communal houses could

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

collapse the equivalent population of a Thule era winter settlement (or settlements) into a single household unit consisting of up to 35 people. The development of these complex households implies a reorganization of social relations, some degree of loss of autonomy for individual family units and a loss of private social space.

Various explanations have been advanced to explain this change in residence patterns and a suite of accompanying social changes. One of the most influential of these regards the communal house as a social adaptation to economic hardship related to climatic deterioration. An alternative explanation is that the restructured households and other culture changes are related to a renegotiation of traditional modes of leadership and of accruing prestige in the context of culture contact and expanding trade. This is an argument, in effect, that the communal house was part of the social strategy of entrepreneurial aggrandisers. A slow-running debate over the causal origin of the communal house has continued for many years and it has proved difficult to resolve the issue because of imprecise chronologies and a lack of data. Nevertheless, it was apparent that the major explanatory models implicated particular ecological and economic conditions and, because these conditions were largely mutually exclusive, the models might be evaluated with appropriate economic data.

I felt it was possible to make a contribution to the debate by using zooarchaeological subsistence data, bolstered by palaeoecological data, to determine the economic function of communal houses and to test the models concerning their origin. Accordingly, I set out to obtain large faunal collections from a number of communal house sites. First, I obtained a loan for a set of already-excavated collections from Hamilton Inlet. I then participated in an extensive program of fieldwork with Dr. Susan

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Kaplan, in which I was able to test or excavate four other sites in four summer field seasons between 1993 and 2000. These were the first new fieldwork projects conducted at communal house sites in northern Labrador since the 1970s and included the most extensive excavations of a communal house stratigraphically linked to a substantial midden deposit attempted at any site in northern Labrador. In the end, the project collected very large faunal collections from one house and four midden contexts from two sites, Uivak Point 1 and Oakes Bay 1; these faunal assemblages constitute the core data used in this dissertation. Coming from contexts with neutral soil pH, consistent soil humidity, and permafrost or at least ground frozen for most of the year, these faunal remains were, in general, very well preserved.

I began my faunal analyses at the Hunter College Bioarchaeology Laboratory (Department of Anthropology, Hunter College, New York) and completed them at the archaeology laboratory of the Peary MacMillan Arctic Museum and Arctic Studies Center, Bowdoin College. In addition to conventional zooarchaeological analyses, I analyzed large numbers of well-preserved seal teeth from these assemblages for seasonality information. I was able to obtain advice regarding the preparation of seal tooth thin sections and reading incremental growth structures from Dr. Michael Hammill and Mr. Jean-François Gosselin of the Institute Maurice-Lamontagne, Dept. of Fisheries and Oceans at Mont-Joli, Québec, and used comparative collections of the IML to aid my analysis. Also, I was able to use the microscopy and image analysis capabilities of the AMICA microscope facility at the Department of Anthropology, Hunter College, for much of this work.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In addition to zooarchaeology analyses, I made an initial study of artifact assemblages for dating purposes and participated in an NSF-funded archaeological tree-ring dating project directed by Drs. Susan Kaplan and Roseanne D'Arrigo. The initial results of this project, the first of its kind in Labrador, were incorporated into this dissertation. The use of these two dating methods was critical for obtaining fine dating controls for excavations at the Uivak Point site.

The work underlying this dissertation was aided by several additional collaborative relationships with other researchers. Collaborations with Dr. Cynthia Zutter (Grant McEwan Community College) and Dr. Allison Bain,(Université Laval), who conducted archaeobotanical and palaeoentomological analyses, were useful for broadening subsistence, site formation and palaeoecological studies for the Uivak Point site. I compiled a range of proxy and historical studies of past sea ice conditions and sources of interannual variability in sea ice climatology pertinent to the Labrador Sea in the past. In the course of doing so, I collaborated with Dr. Cameron Wake (University of New Hampshire) and Ms. Nancy Grumet, (who was then at UNH as well) in studies gauging the applicability of the Penny Ice Cap glaciochemical record as a proxy sea ice record for the Labrador Sea. Finally, I collaborated with the LINK: Small Scale Societies of the North Atlantic working group and working groups of the North Atlantic Biocultural Organization. These contacts aided the development of the multidisciplinary, environmental archaeology and subsistence economy methodological approach used in this project. Various of the working group workshops also aided in the development of theoretical perspectives on historical ecology and the anthropology of maritime-oriented small-scale societies of the North Atlantic used in this dissertation.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In order to bolster available environmental and subsistence data for northern Labrador, I made three early spring trips to Nain and Rigolet between 1996 and 1998. On these trips, I interviewed Inuit elders and active hunters to collect information regarding the environmental characteristics of, and contemporary and historical land use in, the Rigolet, Nain and Okak. These trips proved to be critical parts of my research program in different respects. Through them, I was able to compile a comparative collection of seal teeth of known date of death, representing all the major seal species in Labrador, from seals taken by local hunters. These samples were invaluable aids to my analysis of faunal remains. I also traveled with local people on snowmobile and boat trips, and was fortunate to visit several archaeological sites, including Uivak Point and Eskimo Island, during what would have been their season of occupation. Although all too brief, this dialogue with local people and the first hand experience of Labrador as an environment of snow and sea ice, into which they carefully guided me, were catalysts that rendered concepts of "landscape", "environment" and "living on the land" into concrete realities. The Labrador residents' enthusiasm for travelling in those places speaks volumes for their continued sense of place within the landscape in a general sense, and their self-identification with it.

As it turned out, my sample of archaeological sites was insufficient to meet all my original research goals. While the Eskimo Island 3 site in Hamilton Inlet includes several houses dated to the 17th century or earlier, all of these were the more traditional small houses; none were structures of the communal house type. The communal house and associated middens that I was able to investigate proved to date from between the mid-18th century to the very early 19th century. Two houses and a midden tested at Oakes Bay

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1 in 2000 also indicated mid to late 18th century occupations. Accordingly, I was unable to directly address my originally intended research question concerning the origins of the communal house form. Nevertheless, I was able to consider the nature of the subsistence economies that accompanied the continued use of communal houses through the 18th and into the 19th century. This is a worthy subject in its own right, this will be the first time researchers can discuss Labrador Inuit economy referencing zooarchaeological data rather than simply ethnohistorical information. In addition, it provides an opportunity to consider the causal factors identified in various theories of communal house origins against a well-documented context of accelerating culture contact, named historical actors and an overlapping history of environmental change.

In this dissertation, I review the environmental history and ecological structure of Labrador and the archaeology of several sites in Hamilton Inlet, and of the Oakes Bay 1 and Uivak Point 1, and present new zooarchaeological analyses of faunal assemblages from these sites. Finally, I address several questions about the subsistence economies of communal house sites, which are based on existing theories of the development of the communal house, using zooarchaeological and palaeoenvironmental data.

As a result of my research, I have reached several conclusions. Environmental change may be a significant factor in the development of communal houses and of the range of elaborated social activity associated with them. This association is one of possibilism, not determination. Most significantly, recent palaeoenvironmental reconstructions and archaeological dating in this study together associate communal houses of the late 18th century to early 19th century with a period of relative moderation of climate and sea ice conditions within the broadly defined Little Ice Age.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The subsistence economies associated with communal households are more varied than I expected and suggest that the communal house formation was sufficiently flexible in terms of social relations to allow effective employment of a full range of subsistence practices, as feasible - or as required - in different local environments. Nevertheless, a common characteristic identified in the investigation of these sites is a capacity of their residents to accumulate surpluses through exploitation of seasonally abundant migratory species or through high-risk activities, such as whale hunting, which yielded huge windfall rewards when successful. Whale hunting is demonstrated by archaeological and ethnohistorical data to have been a practical strategy for accumulating surpluses of trade goods, if not a dependable source of food every year.

Arguably, these subsistence economies also demonstrate a degree of productivity and security, and a relative absence of scarcity. Almost all of the useful prey species available to Inuit were represented in the faunal assemblages I examined, indicating that site occupants had a capacity to employ a generalized, flexible economy. At the same time, subsistence from fall to spring was focussed on a limited segment of the possible resources, the seals, which are probably the best of Labrador's prey species. All the most plentiful seal species were hunted extensively during their particular seasons of availability or abundance. Notably, there does not appear to have been significant breaks in the availability of seals. Alternative prey species that are likely to be available in the coastal region, such as caribou and fish, were represented in very small numbers, even when bone preservation conditions were optimal. Similarly, culling patterns of dogs maintained for traction demonstrate attritional mortality patterns indicative of normal dog

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

team management, not catastrophic culling of teams, including prime age adults, to cope with food crises.

In my opinion, the subsistence economy data and palaeoenvironmental data casts doubt upon the conception of communal houses and accompanying social changes as institutions that defray subsistence risk during times of hardship or during periods of increasingly unpredictable food resources. At least in later 18th century, there appear to have been opportunities for accumulation of surplus, and for would-be aggrandisers to accumulate resources, prestige, acumen and alliances to attain positions of social prominence and leadership. The factor limiting aggrandisers appears to have been the traditional Inuit leveling mechanisms, rather than lack of social or material capital.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

ACKNOWLEDGEMENTS

During the course of this project, I have been very fortunate, to have had the benefit of aid, advice, and encouragement from a great number of people. I owe thanks to too many people to realistically enumerate them all here and so may detail outline only the major contributors. I am happy to offer my thanks to all those people who have extended help to me and I hope that those who I do not mention will nevertheless accept my gratitude. Without their assistance, this would have been a very different dissertation and certainly a much poorer one.

Financial support for the work detailed in this dissertation and for my academic program came from grants and awards from several organizational sources. These included a Social Sciences and Humanities Research Council of Canada Doctoral Fellowship, a National Science Foundation (Office of Polar Programs) Dissertation Improvement Grant, a Canadian Circumpolar Institute/BAR Research Grant and two awards from the Arctic Institute of North America Student Grant-in-Aid Program. I owe thanks to Bob Buckley and the Hunter College Research Administration for their help administering grants. From the CUNY Graduate Center, I also received a Summer Travel Grant for Ph.D. Research and University Fellowships and Tuition Fellowships, and was offered a Robert E. Gilleece Fellowship as well. I also received financial support through National Science Foundation Grants held by Susan Kaplan and. Thomas McGovern.

I was able to conduct my archaeological fieldwork as part of several field projects organized by Susan Kaplan in 1993, 1994, 1996 and 2000, which were funded by the Kane Lodge Foundation, Inc. and the National Science Foundation. Permits for these

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

projects, held by Susan Kaplan, were issued by the Museum of Newfoundland and Delphina Mercer was of consistent and conspicuous help in expediting these permits. Permits were also reviewed by Gary Baikie, Director of the Torngasôk Cultural Center, Labrador Inuit Association. I am grateful to Gary for his help in seeing these projects put into action and for his hospitality in Nain.

The fieldwork projects were accomplished with the essential services of the MV *Cape Rouge*, and the help of its captain Henry Webb, and crew including Tom Barbour, Clemens Jararuse, Alan Murphy, Henry Voisey, and Joseph Webb. Thanks to their patience and hard work, our trips on the *Cape Rouge* were safe, comfortable and deliciously well-seasoned with char, caribou stew, and Labrador tales.

The archaeological field team members included Derek Alderman ('94), Colin Amundsen ('00), Blaine Anderson ('93, '94), Daryll Bereziuk ('96), Katharine Cheney ('94), Clemence Corriveau ('00), Brian Dunphy ('93), Caitlin Evans ('94), Matt Gallon ('00), Joshua Koyak, ('94), Sylvie LeBlanc ('94), Adam Moroze ('94), Chris Penney ('96), Valeri Pilgrim ('93), and Jason Rand ('93). In 2000, the tree ring researchers Brendan Buckley and Chris Buckley also aided us. All these people endured much miserable weather, toil and maddening swarms of bugs with remarkable good grace and dedication. It was a great pleasure to have such companions in the field and I would have very little indeed to say here but for their work. I also want to thank my Labrador field crew of 2002 including Carleen Knight, Marty Meier, Mary Melnik, Yvonne Nochasak and Julia Thompson, whose great humour and enthusiasm buoyed my desperate attempts at dissertation writing in the field.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Gary Baikie and Rita Anderson were of great help in setting up interviews with Inuit and Settler residents of Nain, Hopedale and Rigolet in 1997 and 1998. I was also fortunate to accompany Nain residents on snowmobile hunting trips in the Nain and Okak Bay regions. For me, these interactions with the current residents of Labrador were, personally and intellectually, the most rewarding elements of my project. Nevertheless, this dialogue was accomplished only through the goodwill and generosity of people who willingly shared their time, expertise and memories with me. I am grateful for the wisdom of these people who, so often, sifted through my clumsy questions and found a way to tell me something that I really needed to know. Furthermore, I wish to thank the residents of Nain and Rigolet in general for their hospitality during my visits and interest in my project. Among them, George Adams, August Anderson, Gustav Boase, Tom and Silpa Barbour, Edward Flowers, Gus Flowers, Conrad Kautjasiak, Abraham Koyak, Abel Leo, George Riche, Margaret Saksagiak, John Terriak, Henry Voisey, William and Katie Winters, Herman Webb, Joseph Webb and Ronald Webb were particularly kind and helpful to me. It is my hope that this work is the beginning of a long-lasting exchange with them. To all of these people, *Nakomêk.*

Loans of research materials were obtained from the Department of Historic Resources of Newfoundland and Labrador. I am very grateful for the consideration and help of that department, and of Elaine Anton in particular, in securing access to these collections. I depended heavily upon the laboratory resources of the Peary-MacMillan Arctic Museum and Arctic Studies Center, the departments of Geology and Chemistry of Bowdoin College and the Bioarchaeology Laboratory and the AMICA microscope facility of the Department of Anthropology, Hunter College, to complete my analyses.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Furthermore, a number of Bowdoin College students laboured over the cleaning, labeling and cataloguing of artifacts described in this study. Charlotte Parry and Ana Conboy undertook informative chemical analyses of organic remains.

At various stages of my research, I was also given access to laboratory facilities of Dr. Benjamin Walcott of the Department of Neurobiology and Behaviour of the University of Stony Brook, the Department of Anthropology of the University of Alberta, and the Institute Maurice-Lamontagne of the Department of Fisheries and Oceans, Environment Canada. Joseph Webb and Ronald Webb provided contemporary seal tooth samples that were vital to my analysis. Dennis Carmel kindly prepared seal tooth sections. Yin-Man Lam also helped me prepare thin sections of dog teeth and was always ready to engage in informative zooarchaeology discussions with me.

My understanding of the local ecology, site formation processes and patterns of Inuit land at the Uivak Point 1 and Oakes Bay 1 sites benefited immeasurably from several interdisciplinary collaborations. Cynthia Zutter convinced me of the value of an archaeobotanical study and gamely took on the analysis, aided by Lisa Mutch. Allison Bain also agreed to conduct palaeoentomological analyses. I am very thankful for their considerable efforts sifting through a monumental pile of sediment and am fortunate to have such friends as colleagues.

Similarly, I learned a great deal about dendroclimatological palaeoenvironment records and gained vital dating information though involvement in a collaborative project with Roseanne D'Arrigo and Brendan Buckley. I gained a better understanding of the various proxy palaeoenvironmental records of the Penny Ice Cap ice core through collaborations with Cameron Wake and Nancy Grumet. My research design and thinking

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

owe much to participation in working groups of the North Atlantic Biocultural Organization (NABO) and the LINK Small Scale Societies of the North Atlantic working group. Michael Hammill and Jean-François Gosselin also gave much advice regarding preparation and interpretation of incremental structures. Furthermore, I gained much from the comments and advice of Paul Mayewski, Greg Zieilinski and Gary Clow concerning other palaeoenvironmental records.

I wish to offer my sincere thanks to the members of my dissertation committee, Warren DeBoer, Susan Kaplan, Thomas McGovern, William Parry and Sophia Perdikaris, for their advice, comments, editing help and exemplary patience seeing me to the completion of this dissertation. Tom lured me to the North Atlantic and to New York, and gave me much support and guidance throughout my doctoral program. My interest in multidisciplinary research was learned in large part from working with him and through contacts with other researchers he initiated. Susan introduced me to the archaeology of Labrador and to the particular charms of fieldwork there. I benefited immeasurably for having been involved in Susan's ongoing fieldwork program and from the substantial intellectual and material support she has given to my dissertation project. Susan gently and consistently pushed me to clarify my thinking while critiquing earlier drafts of this dissertation and in many conversations about Labrador archaeology. Throughout this project, she encouraged me with her infamous sense of humour and provided an example of professionalism that I hope to emulate.

I also wish to extend my thanks to several researchers who were not part of my committee, but who all had important influences upon this work. My dissertation draws directly upon the fieldwork and writings of the late Richard Jordan and it is to my regret

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

that I did not have the opportunity to hear his comments on this work. Similarly, the works of Peter Schledermann and J. Garth Taylor, William Fitzhugh's environmental archaeology research and land use studies by Carol Brice-Bennett, Tony Williamson and Randy Ames were all of vital importance to this study.

I owe many thanks to Ellen DeRiso of the GSUC Dept. of Anthropology for providing much material help during my degree program and to Louise Lennihan for motivation. Douglas Ewing of the Office of International Students also provided much needed help with visas and permits. Similarly, I also wish to thank my colleagues at Bowdoin College and the Peary-MacMillan Arctic Museum and Arctic Studies Center, including Kristi Clifford, John Cross, Anne Henshaw, Molly Laird, Dave Maschino, Scott MacEachern, Leslie Shaw, Nancy Wagner, Susan Kaplan and Peter Trumper, whose friendship, hospitality and shared interests provided me with a happy and collegial place in which to work. In addition, Genny Lemoine was of tremendous help to me while printing this dissertation and Joe Calvo of the Bowdoin College Copy Center kindly took care of photocopying my dissertation drafts. I am very grateful to Claire Allum for her patience, love and companionship, and for keeping my head on straight while finishing this work. Finally, I owe the greatest debt of gratitude to my parents, Ginny and George Woollett, and the rest of my family for their unstinting help and for all the love and faith they have placed in me.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

TABLE OF CONTENTS

PREFACE vi

ACKNOWLEDGEMENTS xv

LIST OF TABLES. xxx

LIST OF FIGURES. xxxiii

VOLUME 1

CHAPTER 1: INTRODUCTION. 1

Project Objectives. 4
Research Questions. 9
Anthropological and Archaeological Issues. 10
Zooarchaeology 11
Arctic Anthropology and Archaeology 12
Generalized and Complex Hunter-Gatherers 18
Foragers and Collectors 19
Immediate Return Systems 21
Delayed Return Systems 23
Competition and Inequality in Delayed Return Societies . . 24
Summary Statement 27
Applying Historical Ecology as a Research Framework 28
Culture Ecology Research in Labrador Archaeology . . . 29
Historical Ecology as a Balanced System-Centered and Subject-Centered Approach 34
The Problem of Scale 34
Summary Statement 37
Thesis Plan 38

CHAPTER 2: NEOESKIMO CULTURE HISTORY IN LABRADOR AND THEORIES OF THE DEVELOPMENT AND FUNCTION OF COMMUNAL HOUSES 42

A Brief Review of the Thule Culture in Labrador 42
Description of Thule Culture 43
Thule Settlement Patterns and Subsistence in Labrador . . . 46
Thule House Forms 49
Labrador Inuit during the Historic Period 50
Settlement Expansion 51
18th Century Inuit Settlement Patterns and Subsistence . . . 52
19th Century Inuit Subsistence and Settlement Patterns . . . 56
House Architecture of the Historic Inuit Era 57

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Inuit Communal Houses in Greenland 59
Labrador Inuit Houses of the 19th century 62
Considering the Development of the Communal House 63
The Environmental Theories for the Development of the Communal House 64
Social Theories for the Development of the Communal House . 68
Diffusionary European Influence 68
Key Questions for Evaluating the Communal House Theories. . . . 75

CHAPTER 3: LABRADOR IN THE NORTH ATLANTIC CLIMATE SYSTEM: OUTLINE OF PHYSICAL ENVIRONMENT 81
Introduction 81
Overview of the Geography of Labrador 85
Topography of the Labrador Coast 85
Marine Hydrology of the Labrador Region 92
Marine Circulation in the Northwest North Atlantic 92
The Labrador Current 94
Climate and Atmospheric Circulation Patterns of Labrador 96
The Climate of Labrador 101
Regional Climate Zones of Labrador 105
Variability in Climate Zones 108
The Sea Ice Environment of Labrador 109
Properties of Types of Sea Ice 110
Pack Ice 111
Pack Ice as an Ecosystem 118
Landfast Ice 118
Fast Ice as an Ecosystem 122
Ice-Free Areas: Polynyas and Leads 124
Polynyas 127
Polynyas as Ecosystems 128
Leads 129
Flaw Leads as Ecosystems 130
Interannual Variability in Sea Ice 130
Variability in Fall and Winter Ice Formation Dates . . 130
Variability in Spring and Summer Ice Clearance Dates . 132
Influences of Hemispherical and Global-Scale Circulation . . 136
Patterns and Climate Systems on Sea Ice 136
The North Atlantic Oscillation and Sea Ice Variability 136
The El Niño/Southern Oscillation and Sea Ice Variability 142
Summary 144

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Analyses of Faunal Collections from Uivak Point 1 540
Test Pits 9, 10 and 11 540
House 6 Midden 541
House 7 541
House 7 Midden 542
Test Pits 9, 10 and 11 543
Total Number of Fragments 543
Numbers of Identified Specimens Counts . . . 545
Relative Frequency Counts 547
Density of Deposition Counts 549
House 6 Midden Analysis 550
Total Numbers of Fragments 550
Numbers of Identified Specimens Counts . . . 553
Faunal Analysis of the House 7 Assemblage 559
Faunal Analyses of the House 7 Midden 564
Relative Frequency Counts 574
Density of Deposition Counts 574
Estimations of Age and Season of Death of Seals Based on Incremental Structures 578
House 6 Midden 578
House 7 Floor 579
House 7 Midden 580
Studies of Dog Mortality 581
Summary of Uivak Point 1 Faunal Analyses 598
Summary of Archaeobotanical Analyses 608
Summary of Palaeoentomological Analyses 611
Chapter Summary 613

CHAPTER 10: CONCLUSIONS 615

Summary of Results 621
Field work 621
Review of Palaeoenvironmental Studies 622
Faunal Analyses 622
Hamilton Inlet 624
Oakes Bay 1 625
Uivak Point 1 625
Major Research Questions Concerning the Function of the Communal House 628
Implications of the Study 638
Arctic Anthropology 638
Labrador Inuit as Complex Hunter-Gatherers 641
Zooarchaeology as Part of Integrated Historical Ecology Approach 642
Future Research 644

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Ecological Description and Land Use in the Hamilton Inlet Region and The Narrows 210
Sea Ice 211
Biological Communities of Hamilton Inlet 215
A Brief Survey of the Animals of Hamilton Inlet 216
Terrestrial Animals 216
Carnivores 217
Birds 218
Fish 218
Sea Mammals 220
Ecological Description and Land Use in the Nain Bay-Dog Island Region 227
Ecological Description and Land Use in the Okak Bay Region . . . 229
Resources of the Terrestrial Environment 229
Resources of Freshwater and Marine Environments . . . 230
Sea Ice in the Okak Bay Region 233
Chapter Summary 235

CHAPTER 5: FIELDWORK METHODS AND THE ARCHAEOLOGY OF THE NARROWS REGION OF HAMILTON INLET 237

Introduction 237
Rationale and Methods of Fieldwork 239
Site Selection 239
Crew, Logistics and Permits 242
Site Sampling and Excavation Procedures 234
Visual Survey 243
Sub-surface Sampling: Prospecting for Middens 243
Test Pitting and Excavation 244
Excavation Methods 246
Summary of Fieldwork Methods 248
Archaeology of the Hamilton Inlet Region and The Narrows . . . 251

Overview of Previous Research in Hamilton Inlet 251
William Fitzhugh's Hamilton Inlet Project, 1968-1969 251
Richard Jordan's Project In The Narrows, 1973-1975 254
Eskimo Island 1, 2, 3 (GaBp-1, 2, 3) 256
Overview of Eskimo Island 256
Eskimo Island 1 (GaBp-1) 258
Eskimo Island 2 (GaBp-2) 262
Eskimo Island 3 (GaBp-3) 267
Double Mer Point (GhBo-2) 272
Snooks Cove (GaBp-7) 275
Summary of Jordan's Archaeological Project in The Narrows . . . 277

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 6: ARCHAEOLOGY OF OAKES BAY 1 (HeCg-8) 281

Description and Setting of Oakes Bay 1 281
Archaeological Research at Oakes Bay 1 282
House 1 284
House 2 285
House 3 285
H3 Midden 287
House 3 Midden Artifact Assemblage . . . 289
Dating of House 3 290
House 4 290
House 5 291
House 6 292
House 7 292
Summary of Archaeology at Oakes Bay 1 293

VOLUME 2

CHAPTER 7: ARCHAEOLOGY OF UIVAK POINT (HjCl-9) 294

Description and Setting 294
A Summary of Fieldwork at Uivak Point 296
Recent Fieldwork at Uivak Point 298
Descriptions of Houses at Uivak Point 302
House 1 302
Houses 2 and 4 303
House 3 305
Houses 5 and 8 306
Test Pits 9, 10 and 11 308
Stratigraphic Interpretation of Test Pits 9, 10 and 11 . 310
House 6 312
House 6 Midden 314
Stratigraphic Interpretation of House 6 Midden . . . 316
Artifacts Recovered from the House 6 Midden . . . 317
House 6 Midden Chronology 319
House 7 320
Excavations within House 7 321
Description of the House 7 Artifact Assemblage . . . 335
Ceramics 341
Glass and Brick 344
Buttons 344
Lead Drops and Beads 348
Combs 357
Kaolin Pipes 357
Musical Instruments 358

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 7 Midden 358
House 7 Midden Stratigraphy 360
House 7 Midden Artifact Assemblage 376
Ceramics and Glass 381
Clothing and Adornments 382
Beads 382
Kaolin Pipes 385
House 9 386
Dating Uivak Point 1 and Excavated Archaeological Contexts . 386
Historical Documentation 387
Dates from Artifact Assemblages 390
Radiocarbon Dates for House 7 and House 7 Midden . . 402
Radiocarbon Dates for House 7 402
Radiocarbon dates for House 7 Midden 403
Interpretation of Radiocarbon Dates 405
Dendrochronological Dating 406
Summary of Uivak Point 1 Chronologies 410
Uivak Point 2 414
Uivak Point 3 414
Uivak Point Site Summary 416
Summary of Fieldwork 417

CHAPTER 8: METHODOLOGY OF LABORATORY ANALYSES . . . 419

Introduction 419
Methodology of Artifact Analysis 420
Methodology of Stratigraphic and Geoarchaeological Analyses . . . 421
Methodology of Palaeoentomological Analyses 422
Methodology of Archaeobotanical Analyses 422
Methodology of Zooarcheological Analyses 423
Rationale of Sub-sampling Faunal Assemblages 424
Methods of Identifying Faunal Remains 425
On the Art of Identifying Seal Bones 426
Recording and Quantifying Zooarchaeological Data 429
Quantitative and Qualitative Approaches to Zooarchaeological Analyses 430
Numbers of Identified Specimens (NISP) 434
Percent Relative Frequency 438
Density of Deposition Counts 439
Minimum Number of Elements 441
Minimum Animal Units (MAU) 442
Qualitative Zooarchaeological Approaches: Seasonality and Life History Information in Zooarchaeological Data. . . 443
Estimations of Age and Season of Death 445

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Protocols for Aging by Dental Eruption and Epiphyseal Fusion 448
Methods of Preparation of Tooth Thin Sections . . . 451
Use of Dentine as a Recording Structure 453
Tooth Cementum as a Recording Structure 455
Estimating Ages and Season of Death for Harp Seals. . 456
Estimating Age and Season of Death of Ringed Seals. . 461
Estimating Age and Seasonality of Harbour Seals. . . 464
Estimating the Age of Dogs 466
Summary 471

CHAPTER 9: PALAEOEVIRONMENTAL DISCUSSION AND ZOOARCHAEOLOGICAL ANALYSIS 473

Introduction 473
Environmental Change in Labrador during the Little Ice Age . 474
Ice Core Stable Oxygen Isotopes 475
Borehole Temperatures 478
Dendroclimatological Temperature Reconstructions . . 479
Glaciochemical Sea Ice Proxies 485
Archival Sea Ice Records 488
Summary of Palaeoenvironmental Data 490

Analyses of Faunal Collections from Hamilton Inlet. . . . 493
Characteristics of the Hamilton Inlet Faunal Assemblages 493
Description of Faunal Assemblages 495
Total Numbers of Fragments Counts (TNF) . . . 495
Numbers of Identified Specimens Counts (NISP) . 498
Eskimo Island 3 NISP Counts 498
Eskimo Island 1/Double Mer Point NISP Counts. . 504
Eskimo Island 2 NISP Counts 506
Snook's Cove NISP Counts 508
Relative Frequency Counts (RF) 510
NISP Counts of Seals Identified to Species . . . 513
Estimating Seal Season and Age of Death from Incremental Structures 516
Summary 525

Analyses of Faunal Collections from Oakes Bay 1 525
Total Numbers of Fragments 527
Numbers of Identified Specimens Counts . . . 531
Relative Frequency Counts 533
Density of Deposition Counts 534
Analyses of Age and Season of Death of Seals based on Incremental Structures 537

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Analyses of Faunal Collections from Uivak Point 1 540
Test Pits 9, 10 and 11 540
House 6 Midden 541
House 7 541
House 7 Midden 542
Test Pits 9, 10 and 11 543
Total Number of Fragments 543
Numbers of Identified Specimens Counts . . . 545
Relative Frequency Counts 547
Density of Deposition Counts 549
House 6 Midden Analysis 550
Total Numbers of Fragments 550
Numbers of Identified Specimens Counts . . . 553
Faunal Analysis of the House 7 Assemblage 559
Faunal Analyses of the House 7 Midden 564
Relative Frequency Counts 574
Density of Deposition Counts 574
Estimations of Age and Season of Death of Seals Based on Incremental Structures 578
House 6 Midden 578
House 7 Floor 579
House 7 Midden 580
Studies of Dog Mortality 581
Summary of Uivak Point 1 Faunal Analyses 598
Summary of Archaeobotanical Analyses 608
Summary of Palaeoentomological Analyses 611
Chapter Summary 613

CHAPTER 10: CONCLUSIONS 615

Summary of Results 621
Field work 621
Review of Palaeoenvironmental Studies 622
Faunal Analyses 622
Hamilton Inlet 624
Oakes Bay 1 625
Uivak Point 1 625
Major Research Questions Concerning the Function of the Communal House 628
Implications of the Study 638
Arctic Anthropology 638
Labrador Inuit as Complex Hunter-Gatherers 641
Zooarchaeology as Part of Integrated Historical Ecology Approach 642
Future Research 644

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

APPENDIX 1 646

APPENDIX 2 653

BIBLIOGRAPHY 659

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 1

INTRODUCTION

This thesis is an examination of the role of subsistence economy within larger changes in the culture of the Inuit of Labrador. The present-day Labrador Inuit are descendants of Thule culture migrants who reached Labrador, located along the northeastern-most coastline of Arctic North America, in the late 13th century (Fitzhugh 1994). The Thule are widely considered to have been extraordinarily well adapted to life in the Arctic. Their inventive and effective technologies, flexible social organization and detailed ecological knowledge afforded the Thule and their Inuit descendants a unique capacity to maintain successful, long term occupations of most of the North American Arctic. Upon reaching Labrador, Thule people settled in, and adapted to, one of the richest and most diverse ecological regions of the eastern Arctic.

A number of archaeologists and anthropologists have sought to describe the nature and scale of cultural changes experienced by the Thule and Inuit people in Labrador. Changes of the later 19th and 20th centuries were certainly profound and involved, among other things, the adoption and collapse of commercial trapping and fishing economies, the advent of schools, technological developments, and also epidemic disease, settlement relocation and, most recently, industrial development and land claims negotiations (Brice-Bennett 1977; Kleivan 1966; Maggo 1999; Richling 1978; Williamson 1997). In spite of these often disruptive changes, Labrador Inuit have had a remarkable history of resilience and success manifest in a more diverse settlement pattern, use of resources, and scale of occupation than any other ethnic group that has

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

occupied Labrador (Fitzhugh 1977). Their sustained sense of community, self-identification, and place in the landscape is, in large part, due to the ongoing reproduction of ecological knowledge and social relations and their reapplication to current needs.

Judged from the perspective of this recent history, Inuit cultural changes of the early contact period seem somewhat subtler, but are also of interest. In particular, a number of social and economic changes of the late 17th to early 19th centuries have elicited ongoing examination from anthropologists. During this period, the Inuit abandoned small Thule winter settlements with small houses located on outer islands, in favour of larger settlements in the inner coastal region. Winter communities also took on new modes of organization as the Labrador Inuit adopted a pattern of commensal, multifamily residence in conspicuously large houses (termed communal houses) at these new settlements. As well, polygyny was practiced on a much more common basis and leadership roles were extended. At the same time, the Inuit both exploited and resisted the growing European colonial presence in Labrador. The Inuit maintained extensive regional exchange networks that involved whale hunting as well as expeditions to trade with, and raid European establishments. They also kept uneasy relations with missionaries into the 19th century, including overt resistance from shamans, avoidance and accommodation.

It is the apparent distinctiveness of these cultural changes, in relation to the social organization and residence patterns documented for the 19th and 20th century Inuit in Labrador and elsewhere, as well as those inferred for the Thule people in Labrador, that has earned Labrador's contact period a degree of ongoing attention from archaeologists and ethnohistorians. Much archaeological work has determined that the progression from

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the relatively cohesive Thule phase to the Inuit phase was, throughout the Arctic, one of regional diversification and specialization. Nevertheless, the early contact period Labrador Inuit retains the sense of an atypical case, particularly in terms of the size of households and the frequency of polygyny.

Researchers have advanced a variety of accounts of the early contact period in order to explain the unusual aspects of Labrador culture, especially the communal house itself. In these different explanations, the social and economic circumstances of the period are portrayed in remarkably different terms. One major model focuses on the communal houses and suggests that communalism was an adaptive, reciprocity-enforcing, response to economic shortfalls and environmental severity. Alternative explanations see evidence of economic surplus production, if not wealth, and development of limited scales of hierarchy, in economic activities such as whale hunting and trade, and in the activities of entrepreneurial aggrandisers. In this dissertation, I revisit these explanatory models and apply subsistence data and palaeoenvironmental data to evaluate them.

This dissertation is intended as a multidisciplinary examination of social and economic change among the Labrador Inuit during the contact period, from the 17th to the 19th century. It reports on archaeological fieldwork that was conducted at the sites of Uivak Point 1 and Oakes Bay 1 between 1993 and 2000, and presents analyses of faunal remains from these sites and several other sites excavated previously in the Eskimo Island locality. Supplementary analyses of artifacts, plant macrofossils and insect remains are also reviewed, along with a synthesis of palaeoenvironmental data pertinent to 17th to 19th century Labrador.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Project Objectives

The dissertation project was undertaken with multiple interrelated goals in mind. These goals are summarized as follows:

- *To improve the documentation of the zooarchaeological record of Labrador in terms of the number of sites analyzed, their regional coverage, and the consistency of analytical methods and standards employed.*
- *To conduct a comparative analysis of Labrador Inuit subsistence economies of the early contact period, based on detailed analyses of archaeological animal remains from several archaeological sites.*
- *To determine the relationships of trends in subsistence economy to environmental and social changes as defined in high-resolution palaeoenvironmental data and ethnohistorical records, and to possible conditions of economic scarcity or prosperity.*
- *To evaluate existing models of culture change related to the adoption of communal houses and other related phenomena, using subsistence data.*
- *To refine methods by which high resolution palaeoenvironmental data may be incorporated within archaeological and anthropological investigations.*

Contact period Inuit subsistence economies of Labrador have been understood primarily through seasonal rounds reconstructed from ethnohistorical data and through archaeological locational analyses of settlement patterns. These methods have been

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

productively applied to Hamilton Inlet by William Fitzhugh (1972) and to northern and central Labrador by Susan Kaplan (1983), and are entirely suitable for generalized economic analyses or hypothesis-building approaches. Such methods are, however, necessarily more limited than zooarchaeology as a means of examining subsistence economies practiced at particular sites or for identifying spatial or temporal variability in subsistence economies. Nevertheless, only a handful of previous archaeological projects regarding the Labrador Inuit have incorporated zooarchaeological analyses of any scale as a standard methodological component, nor did many projects make a priority of recovering substantial faunal collections in a systematic manner.

The bulk of previous archaeological research was accomplished through survey projects conducted over large regional scales, such as the Hamilton Inlet Project and the Torngat Archaeology Project (Fitzhugh 1972, 1980). These enterprises located sites and documented culture-history and adaptation in huge areas that had not received significant previous archaeological investigation or, in many cases, any archaeological attention at all. Because of the requisite emphasis of areal coverage in this research, few Neoeskimo sites were examined in an intensive fashion, with comprehensive excavations of houses and middens, and systematic recovery of faunal remains.

A series of economic analyses by Fitzhugh (1972), Cox (1977) and Kaplan (1983), stem from these survey projects. These researchers concentrated on reconstructing subsistence economies by applying ethnohistorical and modern ecological data, through the geographic perspective of locational analysis, to the regional settlement patterns documented by surveys. Their works represent effectual first steps in the reconstruction of Neoeskimo subsistence economies in Labrador. Now that several major

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Neoeskimo sites have been identified and overall subsistence and settlement patterns have been hypothesized, it seems appropriate to test some of their conclusions. Zooarchaeology provides suitable proxy subsistence data with which to examine subsistence economies and zooarchaeology has previously been applied to site-oriented economic analyses of Dorset settlements in Labrador (Spiess 1978; Cox and Spiess 1980). This study, then, is the first attempt to examine Neoeskimo subsistence in a multi-site zooarchaeological study. It represents a logical second step in Neoeskimo economic analyses, that of testing earlier economic hypotheses with zooarchaeological economic data and so makes an original contribution to Labrador archaeology.

In particular, faunal analyses contribute proxy data about the kinds of animal resources used, the seasonality of hunting, about the life history of prey species and about the means in which animal resources were procured and used at different sites or in particular site contexts. These data cannot be obtained consistently, directly or with comparable detail through locational analyses or from ethnohistorical sources. Such data are essential elements of detailed subsistence analyses and are required to link changing subsistence practices to high-resolution palaeoenvironmental, palaeoecological or ethnohistorical records, in empirical terms. The convergence of dense subsistence data with detailed information regarding the social, environmental and ecosystem contexts of subsistence allows for a more informative explanation of the nature and motivation of economic decision-making of the Labrador Inuit.

The larger goals of this project regard the definition of relationships between culture changes of the early contact period and patterns of subsistence. In particular, this project is intended to evaluate existing theories that explain these culture changes in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

terms of ecological adaptation or development of more elaborate and hierarchical social formations. Archaeologists and ethnohistorians have demonstrated that the Labrador Inuit experienced several significant changes during the early contact period. The most conspicuous culture change of the period, at least in terms of its prominence in the anthropological literature, was the adoption of large, multi-family winter houses, termed communal households. Houses of this type are much different from those of the preceding Thule era, and are typologically distinctive of the contact period Inuit peoples of Labrador and Greenland.

Several other changes in social practices accompanied the shift to communal houses. Winter settlement patterns shifted from the islands of the outer coast to sheltered bays and inner coastal areas, and winter settlements appear to have grown in population (Kaplan 1983). Regional exchange networks of the period appear to have been more conspicuously well-developed, and involved the development of more intensive trading and raiding interactions with Europeans (Hiller 1968; Kaplan 1985; Taylor 1974). Polygyny was, by the standards of Inuit peoples in general, a remarkably common practice in Labrador during this time, and ethnohistorical sources point to the development of a demographic imbalance through differential mortality.

Researchers have, over the years, proposed a wide variety of hypotheses explaining the origin and function of communal houses, the most compelling of which consider this change in residence pattern as part of wider social and economic changes. In a widely-cited explanation, Peter Schledermann (1976a, 1976b) proposed that the adoption of the communal house was a social adjustment to environmental deterioration which forced a re-focusing of the subsistence economy upon seal hunting and a

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

reformulation of food sharing networks and practices (Schledermann 1976a, 1976b). Alternatively, several researchers (notably Jordan 1974, 1977, 1978; Kaplan 1983, 1985a; Taylor 1974; 1986) have proposed that the use of communal houses was related primarily to social and economic processes. Certain social institutions and activities, such as polygyny, whale hunting and contact-related trade and conflict, promoted the efforts of male kindred heads to coordinate labour and build alliances. This tightened community organization encouraged the establishment of large, co-resident households centered on productive and prosperous individuals.

Because the explanations of the origins of the communal house focus on ongoing processes (ecological adaptation, the negotiation of hierarchical social relations and surplus production), they are also relevant to the function of this house form during its continued use lasting into the early 19th century. Since the archaeological materials available to this study date to the 18th and early 19th century, the issue of the function of the communal house, rather than its origin, is the subject of this dissertation.

Both of these hypotheses have strengths but neither has been definitively evaluated with archaeological data. Because the two arguments have inherent economic and environmental implications, analyses of subsistence economies that are based on zooarchaeology and linked with palaeoenvironmental studies have great potential to resolve elements of the communal house debate. In particular, subsistence studies can be used to examine the various associations of communal houses with selective hunting practices, economic productivity, and ecological change that have been advanced. An important goal of this dissertation is to apply new subsistence and palaeoenvironmental data that are capable of clarifying the communal house debate by determining the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

function of this house form as it was used throughout the 18th century. The archaeological research plan employed in this dissertation was structured specifically to generate these subsistence and palaeoenvironmental data.

Several large faunal collections used in this study were obtained through loans of already-excavated materials and from new archaeological excavations of communal house sites that were identified in historical records of the 18th century. These excavations were conducted in both houses and stratified middens having well-preserved organic remains, with the systematic collection of faunal remains through standardized sieving procedures, along with other ecofacts and artifacts. The faunal assemblages were then analysed following conventions established by similar studies elsewhere in the Eastern Arctic and North Atlantic, providing species abundance, element frequency, seasonality and life history data based on the largest combined sample of faunal remains from Neoeskimo sites yet reported for Labrador. As well, ethnohistorical and recent palaeoenvironmental data concerning aspects of the climate system that have direct impacts on subsistence were reviewed to draw a comprehensive picture of factors mitigating economic decision-making.

Research Questions

The economic and palaeoenvironmental data generated in this study were applied to questions concerning Neoeskimo subsistence economy in Labrador in a general sense and, more specifically, to the conditions associated with, and the function of, communal houses in Labrador in the 18th century. These questions were derived from explicit and implicit assumptions inherent in the major arguments for the development of communal

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

houses and are intended to provide a framework for accepting or rejecting any or all of the communal house models on the basis of new zooarchaeological and palaeoenvironmental data. The questions are presented below, and are discussed in more detail in Chapter 2.

- Question 1: *Is the time period associated with the communal house (the late 17th to early 19th century) a period of environmental degradation, unpredictability or stability?*

- Question 2: *Do the subsistence economies associated with communal houses reflect specialized hunting of ice-adapted sea mammal species or other species associated with cold conditions?*

- Question 3: *Is there evidence for a maintained or increased role of whale hunting at communal house sites?*

- Question 4: *Is there evidence for food shortages or economic hardship in the archeological record?*

Anthropological and Archaeological Issues that Inform and are Informed by this Study

This dissertation takes a regional approach to the study of Inuit culture and economy in Labrador. As a result, it builds directly upon the existing corpus of archaeological and ethnohistorical research concerning Labrador and the Eastern Arctic. The goals, methods and conclusions of this research are relevant to several theoretical and methodological issues of more general interest to the disciplines of archaeology and anthropology. These subjects include methodologies of zooarchaeology, issues of complexity in hunter-

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

gatherer societies and the application of complex archaeological and palaeoenvironmental data to historical ecology research.

Zooarchaeology

This dissertation has methodological relevance to zooarchaeology in the Eastern Arctic and North Atlantic regions as it explores the analytical possibilities offered by the use of multiple, large, well-dated and well-preserved faunal assemblages. The reconstruction of subsistence economies in this project requires the use of a regional perspective, and therefore involves temporal and spatial comparisons of faunal assemblages from multiple sites. The depth of economic reconstructions and reliability of regional comparisons in this study are improved by the use of large faunal assemblages. Large sample sizes allow subdivision of time-averaged assemblages into finer temporal units and support valid examinations of secondary taxa, more reliable quantification of palaeoenvironmental indicator species, and more effective use of selected skeletal elements for seasonality and life history studies.

Analyses of incremental growth structures in teeth play a particularly important role in this research project. Incremental structures in both tooth cementum and dentine are both examined in a wide range of seal species using multiple blind trials and modern control samples. As well, an experimental analysis of cemental annulations in the teeth of dogs is presented, demonstrating initial success as a means of assessing culling patterns. Studies of life history and seasonality of prey populations open frontiers for zooarchaeology as qualitative approaches to palaeoeconomy and palaeoecology that are relatively free of the ambiguities of quantifying zooarchaeological taxonomic abundance.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

They also provide means by which to examine interactions of environment and culture, as evidence for the health of communities and as a way to investigate management of animal populations by hunter-gatherers.

Arctic Anthropology and Archaeology

This dissertation makes several contributions to the archaeology of Labrador and the Eastern Arctic, through the use of multiple dating methods, by expanding the number of excavated sod house sites in Labrador, by undertaking a detailed study of subsistence economies based on analyses of faunal remains from multiple sites, and by providing a means of evaluating major theories addressing the course of culture change during the contact period.

One specific methodological contribution to the archaeology of Labrador made by this project lies in the application of dendrochronological dating methods. Very precise dates for archaeological contexts at the Uivak Point site were available as initial results of an ongoing, collaborative dating project involving the Peary-MacMillan Arctic Museum and Arctic Studies Center of Bowdoin College, and the Tree Ring Research Laboratory of the Lamont-Doherty Earth Observatory. This is the first application of dendrochronological dating techniques to archaeological materials in Labrador. These dates were of central importance to this project for dating archaeological deposits at Uivak Point to within decadal scales, and thereby allowing effective application of high-resolution ethnohistorical and palaeoenvironmental data to subsistence economy data. On the basis of this initial application, dendrochronological dating methods appear to be

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

applicable on a widespread basis in Labrador, where conditions for organic preservation allow.

Only a handful of communal house sites have previously been excavated in Labrador, and fewer yet have been investigated with substantial excavations. As part of this project, Uivak Point 1 and Oakes Bay 1, two communal house sites that had previously received only initial simple testing during brief survey visits, were excavated. These were the first communal house sites excavated in or north of Hamilton Inlet since the work of Peter Schledermann (1971) and Richard Jordan (1977) in the 1970s (noting, as well, Reginald Auger's excavation of a communal house at Seal Islands (Auger 1991) in southernmost Labrador in the 1980s). The excavation of Uivak Point 1's House 7 and its midden is the largest excavation of a Neoeskimo sod house and midden in Labrador.

Similarly, this project was one of the first in Labrador to make a priority of excavating stratified midden deposits associated with sod houses in a systematic fashion, and of systematic recovery of very large faunal assemblages for the purpose of supporting subsistence analyses based on primary, zooarchaeological data. Junius Bird (1945) excavated middens and noted the presence of animal bones in his pioneering investigation of the Avertok site at Hopedale, but did not describe these middens in detail and apparently did not recover samples of animal bones. Schledermann recovered samples of faunal remains from sites he excavated in Saglek Bay, but these were not studied because of curation problems (P. Schledermann 2001: personal communication). Jordan (1974, 1977) made a priority of recovering faunal remains from houses excavated during his project in Hamilton Inlet but did not sample middens extensively. A large sample of these collections was analysed to the level of species identification (McGovern

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1979), but results of this study have been only published in summary and excerpted form (Kaplan 1983).

Some other faunal assemblages, of varying scales, from Labrador Neoeskimo sites have been analysed more recently. Cathy Yasui examined faunal assemblages from an 18th century sod house excavated at the Seal Islands site in southernmost Labrador (Yasui 1987; see also Auger 1991). However, the geographical context of this site and acknowledged questions about the complex ethnic identity of site inhabitants limits the application of these subsistence data to northern Labrador. Several other faunal collections from Neoeskimo sites in Labrador have also been analysed to date including, for example, the sites of South Aulatsivik Island 6 (Spiess n.d., cited in Kaplan 1983: 496), Eskimo Hutte (Loring, et al. 1998), Nunaingok (Julien 1979; Woollett n.d) and Skull Island (Kupferschmidt n.d.). These sites, too, are of limited use in this study. Some were imprecisely dated or, if well-dated, predate or post-date the 18th century. Others were derived from very narrow site sampling methods, or comprise small sample sizes. As well, Spiess (cited in Cox 1977) analysed a number of faunal collections from Neoeskimo sites in Okak Bay. These collections, however, were all very broadly dated (no distinctions between the Thule and various Inuit periods were made), and were all very small collections comprising approximately 300 specimens or less, excavated from test pits. Accordingly, these analyses were also excluded from this study. Finally, on-going analyses of faunal assemblages from 18th and 19th century contexts from the Nain Mission site (noted in Cabak 1991) and the Adlavik site in the Makkovik region (S. Loring 2002: personal communication) are of considerable relevance to this study, but are in progress at the time of writing.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

On the basis of this brief review, it is apparent that previous research has not furnished a sufficient body of zooarchaeological data from suitably dated communal house sites in northern Labrador, or sufficiently detailed studies of subsistence economy, to address the objectives of this study. In the absence of such data, the methods of economic analysis remaining to Labrador archaeologists are the use of ethnohistorical and oral history sources and locational analyses, as applied by Fitzhugh (1972) and Kaplan (1983). This project makes a straightforward contribution to the archaeology of Labrador through the analysis of large faunal collections from multiple, well-dated communal house sites and by linking ethnohistorical knowledge with zooarchaeology. In addition, this study contributes to broader Inuit subsistence studies by examining economic behaviour in the relatively productive and ecologically diverse Labrador region. This work will provide interesting comparative data to examine and compare adaptive responses in Labrador and in the more environmentally constrained Central Arctic.

This dissertation makes a third contribution to the archaeology and anthropology of Labrador by addressing the functions of the communal house in Labrador, and examining the social and historical phenomena surrounding the use of this type of structure. The communal winter house form used by the Labrador Inuit from the late 17th to early 19th century represents a substantial change in the plan of winter houses with obvious implications for the organization of households and conduct of daily life. Concurrent with this change in residential patterns were a number of other cultural changes and historical developments including a settlement pattern change shift,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

increased incidence of polygyny, demographic change, apparent enhancement of leadership roles, and increased interactions with Europeans.

As discussed above, several different causal arguments have been advanced for these cultural and historical developments. They are linked, on one hand, with efforts to minimize subsistence risk and, on the other, to a synergy of indigenous social and economic institutions with processes of brokerage encouraged increasingly profound external contact relations. The communal house has remained an elusive phenomenon for some years, in part because of a lack of sufficient new data capable of addressing key elements of the question. An injection of new information, be it related to chronologies, architectural, artifactual, palaeoecological, or zooarchaeological data (and preferably all of these) is needed to review the old models and to propel the investigation to a resolution, or to consider new hypotheses. Similarly, new subsistence data are needed to explain the function of the communal house.

The dominant existing communal house models variously posit the existence of particular environmental and economic conditions and the practice of particular economic activities. It seems likely, therefore, that the application of these models to communal house function can be evaluated with suitable economic and palaeoenvironmental data. I seek to make a contribution to Arctic archaeology by obtaining and presenting these data through a regional comparison of large faunal collections from multiple, well-dated houses and middens, together with consideration of diverse ecofact studies, overlapping high resolution proxy records for critical environmental variables (including climate and sea ice), and ethnohistorical data. While Labrador archaeology has long benefited from perspectives afforded by palaeoenvironmental analyses and detailed ethnohistorical

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

records, the use of zooarchaeological and palaeoenvironmental data in this study provide the means to address issues that could not be approached previously.

While the communal house and the other culture changes and historical developments are not unique to the Labrador Inuit, they are sufficiently distinctive, in relation to other Inuit groups and to circumpolar hunter-gatherers in general, to attract a degree of ongoing, wider attention from archaeologists and anthropologists. This interest is of long standing, dating back to the pioneering archaeological work of Junius Bird in the 1920's (Bird 1945), to ethnohistorical research of the 1960's (Hiller 1968; Kleivan 1966; Taylor 1968) and to early research concerning the relationships between Greenlandic communal houses and the Thule 'whalebone' house type (Mathiassen 1927; Thalbitzer 1914). Researchers working on the archaeology of Greenlandic and Baffin Island Inuit households and even farther afield continue to look to Labrador for comparisons (see Gullason 1999; Gulløv 1998; Henshaw 1995; McGhee 1984; Stevenson 1997 among others).

Similarly, examples drawn from ethnohistorical and archaeological accounts of the contact period Labrador Inuit continue to figure in surveys of hunter-gatherers, often in regard to residential group size (see for example, Riches 1982). Most recently, the Labrador Inuit appear as conspicuous outliers in terms of the frequency of polygyny and in household size, in a study of the evolution and ecology of foraging cultures (Binford 2001: 301, 340-341). The works of Schledermann (1976a, 1976b), Kaplan (1983, 1985) and Taylor (1974) are cited with particular frequency in these references to Labrador's communal house phase. Given this general interest in the communal house, and the very different social, economic and ecological situations envisioned in the explanations

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

proposed by these writers, it would be helpful to have a means of determining if any of these hypotheses is correct. With such an evaluation, a clearer picture of the economic function of the communal house, and of the nature of Labrador Inuit culture change during the early contact period, might result.

Relevance to Hunter-Gatherer Research: Generalized and Complex Hunter-Gatherers

Current issues in the anthropology of hunter-gatherers open useful avenues for examining Labrador Inuit culture change. The definition of "complex" hunter-gatherer societies has provided a means of addressing, as variables, the degrees of complexity (both in the sense of hierarchy and heterarchy) in social and economic organization of hunter-gatherer societies. Whitridge (1999) presented a rather complete review of the complex hunter-gatherer concept and its application to Thule prehistory. Following this work, it is apparent that Labrador Inuit culture changes, such as the communal house, can be examined productively within the framework of complexity.

Until fairly recently, and in general terms, Inuit peoples have been presented as quintessential examples of hunter-gatherers in introductory anthropological texts. Such works as Elman Service's book *The Hunters* (Service 1978: 77-79) emphasized particular characteristics that are exhibited to varying degrees by different Inuit groups. These characteristics have come to be considered hallmark characteristics of hunter-gatherers. They include high degrees of mobility on at least a seasonal basis, ingenious but readily replicated and portable technologies, typically small communities, circumscribed leadership, and especially social interactions governed by egalitarianism and reciprocity. Through these normative attributes, parallels were drawn between the Inuit and other

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

hunter-gatherers, while the capacity of culture to furnish a non-biological means for humans to adapt to even the harshest of environments was positively demonstrated (Weyer 1969). In their basic social and political organization, Inuit also joined most other hunter-gathering societies and some sedentary horticultural societies as examples of band societies, considered the most simple and original stage of cultural evolution.

The straightforward association of the Inuit with other "simple" hunter–gatherers has, however, proved problematical from the start. As Damas (1968) observed, Inuit groups display considerable variability in features of their economic and social organization, for example, in the size of villages and degree of sedentism, the structure of households, kinship patterns, sharing practices and modes of leadership. The extent of this variability tends to limit the consistent or meaningful application of the "band society" appellation, even though all are fundamentally hunting-oriented societies (Damas 1968: 116-177).

Foragers and Collectors: Residential and Logistical Mobility as Key Elements of Hunter-Gatherer Variability

Further indications of the variable and complex nature of the hunter-gatherer category came from studies of settlement and food storage systems and modes of resource production and distribution. Lewis Binford (1980) categorized hunter-gatherers into two major groups, foragers and collectors, on the basis of their mode of economic organization. Foragers employ strategies of residential mobility, moving base camps frequently through environments with relatively uniformly distributed resources, foraging

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in proximity to base camps until a point of diminishing returns is met, and then moving on.

Collectors are characterized by a strategy of logistical mobility; they tend to move less often and cope with spatially or temporally clustered resources through the use of food storage, and the use of far-faring task groups that procure resources when and where they are and return them to residence sites. Logistical strategies require extensive knowledge of the environment, reasonably predictable occurrences of resources, even if separated in time and space, capacity to store foods and to transport bulk resources. The categories of forager and collector are most usefully considered as extremes of a continuum of variation rather than absolute categories, but each may be associated with particular sets of social relations, technologies, and kinds of archaeological sites. Binford (1980) considered that most, though not all, Arctic hunting and gathering cultures might be classed as collectors, due to the tendency of most Arctic environments to have very clustered resources, especially in terms of seasonality.

More recently, Binford (1991) expanded his discussion of logistically organized hunter-gatherers to emphasize the critical importance of ecological information to the successful operation of a strategy of logistical mobility. This information enables the effective planning of the travel of residence or task groups to intercept resource pulses. In situations of resource shortfall or unpredictability, Binford (1991: 129) notes that wide experiential knowledge is of even greater importance. In such a situation, only comprehensive information will allow task groups wisely decide to move camp, to intercept primary prey resources in areas outside their accustomed range, or to guide the effective exploitation of secondary resources. This sort of knowledge, as demonstrated in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

long term hunting success, is one of the essential attributes of situational leadership of hunting task groups. In times of unpredictable resource availability then, the importance of leadership is reinforced, not through prestige seeking, but through the need to disseminate experiential ecological knowledge effectively.

Delayed-Return and Immediate-Return Societies

James Woodburn (1980, 1982) also distinguished two major categories of hunter-gatherer societies according to modes of production and distribution of resources; there are immediate-return and delayed-return foragers. Foragers who use an immediate-return system consume food resources shortly after they are procured, without extensive processing or storage, or use of elaborate tools (Woodburn 1982: 432). In contrast, those employing a delayed return system invest labour before a yield of resources is consumed, and also store and process foods and hold some kind of rights over assets. These assets include the yields of harvested, processed or stored foods, and facilities in which labour and resources are invested, used to produce or process food and for transportation (Woodburn 1982: 433).

Immediate Return Systems

Woodburn (1982: 434) related immediate-return economies to societies practicing a high degree of residential mobility, flexibility in membership of social groupings and economic task groups, equivalent access to the means of production, and the frequently militant emphasis on sharing, reciprocity and individual autonomy in social relations. Significantly, societies with immediate-return economies also lacked social relationships of long-term dependency, engendered through kinship or other means, and employment

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of strong leveling mechanisms that constrain the accumulation of property and the exercising of authority (Woodburn 1982: 444-445). Societies with immediate-return systems included some of the archetypical "simple" hunter-gatherers such as the !Kung and Hadza, who would be classed as "foragers" in Binford's terminology.

Richard Lee and Eleanor Leacock (Leacock and Lee 1982; Lee 1988) have placed the kinds of egalitarian social relations described in Woodburn's immediate-return system within a precapitalist, classless type of society having communal relations of production, termed by Lee as the "foraging mode of production" and also "primitive communism". The foraging mode of production is marked by collective ownership to means of production, reciprocal access to resources held by others through various social alliances, avoidance of accumulation and rejection of hoarding, camp-wide sharing, equal access to implements used to acquire or process food, and individual ownership of these implements (Leacock and Lee 1982).

Because of the stress he placed on reciprocal sharing as the central social arrangements underlying the use of communal houses, and on the collectivization of group interests and subsistence risk, Schledermann's environmental theory is reminiscent of primitive communism as phrased by Leacock and Lee, and by earlier writers (Schledermann 1971: 111-112; Weyer 1962). A core element of Schledermann's argument is, in effect, that Labrador Inuit culture was structured as that of simple foragers, and employed reciprocal food sharing relations in an immediate return economy.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Delayed Return Systems

In contrast to immediate return systems, delayed-return systems do generate property through energy invested in resource patches, in facilities and tools used to procure and process resources, and through socially sanctioned rights of access to these assets and to stored food (Woodburn 1982: 432-433). The labour of many people is often pooled in these assets and their interests guaranteed as shares. Long-term relationships of dependency and commitment are developed through these commingled interests, as well as through more strict and permanent definitions of group membership. Leadership roles are more important as they are needed to organize labour and the distribution of goods, and to adjudicate rights and membership. Property too may be accumulated in delayed-return economies, especially through unequal access to the means of production achieved through degrees of control exercised over corporately held resources, over expensive processing facilities or transportation technology.

Through inequities of authority and wealth, social inequalities are likely to be manifest in societies with delayed-return systems. This is not to say that equality and reciprocity are not considered virtues or social ideals in such societies, but rather that claims to equality require support in behaviour and production, rather than as a matter of inherent entitlement (Woodburn 1982: 446). Because of its tendencies to circumscribe sharing and prestige and permitting of accumulation of wealth and authority, the delayed-return system cannot be equated with the strictly defined foraging mode of production (Kelly 1995: 32). Evolutionary anthropologists are very much concerned with the reasons for the accumulation of surpluses, property and power exhibited in delayed return systems. Hunter-gatherers using delayed return systems, with their more elaborated (and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

unequal) leadership structures, property and exchange arrangements, and other attendant practices, have been labeled "complex" hunter-gatherers (Kelly 1985; Price and Brown 1985).

Competition and Inequality in Delayed Return Societies

Woodburn (1982: 446) noted that an important element of social inequity in societies having delayed return systems revolves around the structure of households and the relationships between them. Obligations of obedience or at least deference defined by age and sex, achieved status and inheritance rules encourage the concentration of both property and authority in the hands of household heads and intergenerational elders, leading to disproportionate access to, or control over, household assets and labour. In many societies, the economic equality and perhaps independence of households is demonstrated and negotiated though competitive production and demonstrations, and through reciprocity carefully managed to avoid indebtedness (Woodburn 1982: 446). While a household, (given a degree of voluntary membership in households and other economic alliances) might maintain its social prestige and moral and economic independence through such competition, it necessarily results in increased demands on surplus labour and decreased equality within the household.

Since the publication of Binford's and Woodburn's studies, a major goal of archaeology has been to reassess analyses examinations of hunter-gatherers in order to consider the organization of economic and settlement systems, and the roles of inequality, competition and politics in hunter-gatherer cultures of the past (Price and Brown 1985). Brian Hayden's work has been some of the most widely cited in this latter respect.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hayden (1990, 1995) regarded social competition as a prime motivation propelling inequality in transegalitarian societies, those that are neither strictly egalitarian nor politically stratified (Clark and Blake 1994, cited in Hayden 1995: 18). Economic competition and feasting are Hayden's core subjects, though this competition may permeate any dimension of social life. Hayden (1990, 1995: 24) proposed that debt was an important strategic tool for aggrandisers, also termed accumulators, defined as any "ambitious, enterprising, aggressive, accumulative individual...who strives to become dominant in a community, especially by economic means" (Hayden 1995: 18). Debt may be strategically applied and manipulated through feasts, with the ultimate result of placing more control over labour and surplus in the hands of the aggrandiser (Hayden 1990: 36-37; 1995: 24). A preexisting state of economic prosperity is required for the initiation of political action by Hayden's model; these surpluses are used to fund feasts that create the social situations and relationships that extend the aggrandiser's control over labour, future production and resource payments.

Hayden (1995) described three basic types of transegalitarian societies, each with distinctive paths to economic and status differentiation. Though it is beyond the scope of this dissertation to review each in detail, a very brief overview is helpful. In all these cases, initial surpluses of some scale are used in feasts held by aggrandisers for competitive and strategic reasons, with the object of creating debt, and gaining control over surpluses and labour. Feasts promote social cohesion within communities and secure alliances in situations where conflict with neighouring groups is being resisted or initiated. The conflict itself provides "Despots" with a chance to co-opt resources that are, in effect, extorted from ordinary folk for protection or to make peace with enemies,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

without the public appearance of self-interested action on the part of the aggrandiser. Feasts and bridewealth may be used by "Reciprocator" lineage and community leaders to create debts while providing patron-like gifts to recipients. In turn, acquired women and indebted gift recipients contribute surplus labour to the corporate kin group of the accumulator. Finally, very elaborate competitive feasts with lavish gift giving and ritual performance are used by "Entrepreneurs", as a means of contracting conspicuous debts backed by stern social sanctions. Such feasts are a kind of economic investment, therefore, as these debts come to be repaid with a net gain. They also serve to reinforce ritual offices that entitle the accumulator to extract payments of labour or resources at various other ritual occasions.

Hayden's model of development of wealth and power asymmetries concentrates on strategies of debt creation, institutionalized payments, inheritable property and ritual offices that seem indicative of decidedly complex transegalitarian societies. Accordingly, his scheme is difficult to apply to societies practicing delayed return economies without clear social ranking or institutionalized debt, or that have a conflicting mix of institutions that encourage social leveling and status differentiation in particular contexts.

Whitridge (1999: 23-24) correctly points out that Hayden likely over-emphasized a single-mindedly exploitative agency on the part of aggrandisers in their strategic manipulation of debt and coercion, hidden behind the cloak of honor, tradition or group identification. Whitridge observes that in the long run, such one-sided self-aggrandizing strategies also undermine effective alliances and disqualify the aggrandiser from the compliance or popular goodwill needed to ratify their presumptions of leadership. A range of other possible, consensual routes for authority are open to individuals through

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the demonstration of personal skills and expertise, such as skills in shamanic performance, special competence or knowledge of hunting activities or geography, ability to signify such competence through reputation or symbols, demonstrated generosity, accumulated life experience and the size or productivity of one's kindred group (Whitridge 1999: 26-27). Because these attributes influence alliance networks, competition is involved in the assumption of leadership roles and popular compliance with leadership is limited by standards of propriety and group interest.

Nevertheless, Hayden's work is useful to this study as it illustrates the scope of competitive political action in transegalitarian societies that may be accomplished through manipulation of production and exchanges of material goods. Food, sumptuary goods and wealth can constitute a kind of currency in negotiations of prestige. Individuals and family units capable of producing surpluses may disproportionately accumulate scales of social authority. Further, the effective pursuit of social differentiation by even a few entrepreneurial individuals requires the diversion of labour and resources from others, and a degree of economic inequality results. Finally, Hayden clearly places critical importance on resource surpluses as prerequisites for the elaboration of social roles and status.

Summary Statement

The issues underlying the definition of complex hunter-gatherers and transegalitarian societies provide a way to interpret many of the phenomena linked with the 18th century Labrador Inuit and the communal house. They supply hypotheses regarding the means by which surpluses and wealth were accumulated and used, the handling of social competition and community tensions, and the development of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

relatively complex social roles combining leadership in ritual, subsistence task groups, and mediation of trade, that are readily applicable to the communal house period in Labrador. In return, the Labrador Inuit and the case study of the communal house are an example of the employment of economic and competitive social strategies that lead to enhanced leadership and limited hierarchies in a "marginal" environment (relative to the temperate and tropical contexts of most complex hunter-gatherers) or, alternatively, of the adaptive benefit of generalized reciprocity in such a society. The Labrador Inuit might be best considered a "somewhat complex" foraging society with both status-producing and egalitarian institutions demonstrated in particular circumstances, in a heterarchically organized social structure.

Applying Historical Ecology as a Research Framework

Finally, this project is of disciplinary interest for its use of a complex set of archaeological, ethnohistorical and high-resolution palaeoenvironmental data in a multidisciplinary, historical ecology study. I have attempted to situate the subsistence activities and other cultural actions of the Labrador Inuit in a detailed history of the manifestations of Labrador's coastal ecosystems, with sufficient resolution in both lines of inquiry to examine contingency rather than simply long-term trends. In so doing, I attempt to build upon the existing corpus of cultural ecology-oriented archaeological work in Labrador by reinforcing the dimension of historicism, and the approach of historical ecology, to the investigation human-environment interactions in Labrador.

Historical ecology is a relatively recent and open-ended approach focused on disciplinary integration; it is concerned with the history of ecosystems and the "empirical

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

investigation of relationships between humans and the biosphere in specific temporal, regional, cultural, and biotic contexts" (Balée 1999: 3; see also Crumley 1994: 6). Fundamentally, historical ecology seeks explanations in dialectical rather than deterministic interrelationship of humans and ecosystems. It adopts fine scales of analysis of landscape history, social agents in culture change, and ecological praxis (the forms of human activity that structure use of the environment (Whitehead 1999: 30) as well as systems and evolutionary change (Balée 1999: 5).

A Tradition of Culture Ecology Research in Labrador Archaeology

Historical ecology owes much of its inspiration to cultural ecology (Balée 1998: 3). Cultural ecology is concerned with investigating the influence of the environment on society. This investigation is accomplished by examining the relationship between environment and the technology used to exploit or produce resources, by the analysis of behaviour patterns used to obtain resources in a particular area with a particular technology, and by determining the extent to which behaviour patterns involved in exploiting the environment affect other aspects of culture (Steward 1955: 40-41).

Steward saw culture as a self-reinforcing system whose characteristics were inextricably interlinked with environment through associations, so that change in the environment would necessarily result in accommodating changes in the cultural core, the elements of a cultural system most closely associated with subsistence and economic arrangements (Steward 1955: 37). Environmental variables have effects upon the technologies used to extract resources, on the means and kind of activities involved in appropriation, and ultimately upon other aspects of culture. The purpose of a cultural ecology investigation then is to determine how cultures change, or adapt, to their

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

environment. By identifying common adaptations demonstrated by different cultures in similar environmental circumstances, Steward sought to define cultural types of sociocultural integration; a culture's developmental process from one level of integration to another was one of evolution (Steward 1955: 42).

As it presented an empirically oriented method and mechanism for explaining culture change and the evolutionary development of social forms and practices through adaptation to environmental context, cultural ecology caught on in cultural anthropology and archaeology (Trigger 1989: 280). Cultural ecology rapidly became a dominant theoretical perspective in Arctic archaeology and anthropology during the 1960s and 1970s. A number of studies of that period developed an empirical focus on environmental perspectives and, in some cases, original applications of the developing methods of environmental archaeology. For example, Robert McGhee (1969/1970) and Dennis Stanford (1976) undertook to explain the rapid spread of Thule peoples across the North American Arctic in terms of environmental changes and their influences on specific elements of Thule subsistence. Though their explanations were directly opposed to each other, both considered or generated palaeoenvironmental data and attempted to link cultural phenomena to the complex interrelationship of environment to the culture core. Ecological themes and the methods of cultural ecology run through many ethnographies and ethnohistories of Arctic peoples, including Robert Spencer's study of inland and coastal adaptations of the North Alaskan Eskimo (Spencer 1959) and J. G. Taylor's study of contact period Labrador Inuit (Taylor 1974).

Much of the archaeology conducted in Labrador since the 1960's is also very much in keeping with this tradition. Peter Schledermann's (1971, 1976a) exposition of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador Inuit culture change is, of course, explicitly phrased in terms of cultural ecology, both in tracing changes in house form to economic arrangements and thence to ecological change, and in its evolutionary, group selection argument. In his pioneering Hamilton Inlet Project, Fitzhugh (1972) used regional settlement pattern data and locational studies to examine changing subsistence-settlement systems over long time scales, which he linked to long-term patterns of environmental change. Fitzhugh defined several types of subsistence-settlement systems that he related to generalized modes of adaptation, cultural groups and to dynamic environmental conditions. He also synthesized a broad reconstruction of palaeoenvironmental data in support of his investigation.

Fitzhugh's study has had a long-lasting influence on arctic archaeology, and especially on Labrador archaeology, as subsequent researchers who worked there often emulated his approach. Cox (1977) conducted a similar study in the Okak Bay region, reconstructing Palaeoeskimo, Neoeskimo and Indian settlement patterns and generalized subsistence activities through survey and exploratory excavations, and applying subsistence-settlement systems to palaeoenvironmental data. In her doctoral dissertation, Kaplan (1983) also used extensive survey data to reconstruct Inuit subsistence-settlement systems from Killinek to Hamilton Inlet. Locational analyses backed up by detailed regional resource geographies and ethnohistorical documentation were Kaplan's primary sources of subsistence data, and she derived pertinent palaeoenvironmental data from archival sources.

The central objective of Kaplan's project was to examine the culture history, economic and social developments of the Neoeskimos of Labrador, which she interpreted

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in terms of ecological adaptation and cultural contacts with Europeans and Indians (Kaplan 1983: 32). The timeline of Neoeskimo settlement and European contacts in Labrador is fairly compact, and Labrador's remarkably rich array of ethnohistorical sources and studies provide a number of detailed and well-dated accounts of Inuit social life, activities, and of particular individuals. Because of this, Kaplan was able to consider social and economic change at much finer time scales than those used in previous adaptation-oriented archaeological studies in Labrador, and to consider the activity of individual actors. In attempting to merge this interest in relatively short-term history, rapid rates of change, individual behaviour and adaptation, Kaplan encountered significant limitations inherent in the cultural ecology approach (Kaplan 1983: 35-36). These problems form central elements in long-standing critiques of cultural ecology (Adams 1974; Brumfiel 1992; Ellen 1982).

Critics of cultural ecology have pointed out that the approach is limited as a method of explaining culture change on several fronts. Among these, cultural ecology employs a normative definition of culture and applies group selection arguments to attribute changes in the relationships between whole populations and their environments to evolutionary processes. The effect of this is to obscure the agency of individuals and of social sub-groups with competing interests, activities or consciousness, limiting understandings of economy, and of the vital importance of alliances and politics in the processes of culture change (Brumfiel 1992: 553, 1994; see also Adams 1974; Bender 1985; Hodder 1982 5-6). Additionally, culture ecology has tended to underestimate the importance of the human contributions to environment/human interactions, such as information and objectives, resulting in a deterministic skewing of explanation in favour

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of environmental factors to the detriment of internal, social causes of change (Brumfiel 1992: 553; Ellen 1982: 64).

A final problem is that in its evolutionary objectives, cultural ecology fosters a gradualist model of change in culture, the environment and their interrelationships. The evolutionary model of change is problematically applied to contexts of rapid, radical change, instability or short term history, if not, in fact, an inappropriate method to do so (Adams 1974; Kaplan 1983: 36). Aside from the gradualist assumptions inherent in evolution itself, this problem is also partly one of scale (Crumley 1999: x), recalling the motto to "*Think globally, act locally*".

Until recently, many records of environmental change were often of very long, geological, duration with such coarse resolution of time scale as to preclude their effective application to time scales more sensible to human experience, to the time scales involved in culture change or even some archaeological time series. These records are also often based on phenomena with direct relevance to specialized aspects of environmental change, but that have only oblique relevance to variables which are of social or economic importance in a particular cultural case study. It is often very difficult, therefore, to establish linkages to environmental and cultural information (Crumley 1999: x). Without an effective means of representing environmental history in scales compatible with human activity, the explication of human/environment interactions necessarily depends on time-averaged, coarse records of gradual environmental change. The historical components of human/environment interactions thereby fade from consideration and deterministic, evolutionary explanations result.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Historical Ecology as a Balanced System-Centered and Subject-Centered Approach

Brumfiel (1992) argued that archaeology should balance its focus on evolution, ecosystem, and whole adaptive behavioural systems with approaches that examine positioned social agents operating under ecological and social constraints, in order to better accomplish its task of explaining social change. Both subject-centered and system-centered perspectives are needed to understand the relationships between social and ecological variables, behavioural strategies, their implementation and the social and ecological results of their implementation (Brumfiel 1992: 559; 1994: 6-7). How to accomplish this goal is one of the greatest challenges facing archeology following the new archaeology and postprocessual movements, but nonetheless a requirement for an historical ecology.

Use of multidisciplinary approaches is a critical part of the goal of building an historicized ecology for it is essential to have a functional understanding of environmental processes and states, historical processes and accidents, and socially situated values and action (Crumley 1994, 1999: x). Scalar compatibility of data sets and of the human and environmental components modeled in manifestations of ecosystem change are also requirements of historical ecology (Crumley 1999: x).

The Problem of Scale

The example provided by the *Annales* school of history has been applied in archaeology as a model for merging diverse types of evidence and for handling ecological and historical processes operating at different time scales (Bintliff 1991; Crumley 1999: ix-xii; Knapp 1992). The broad temporal framework of *événement*,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

(event) *conjoncture* (cultural and historical context) and *longue durée* (long-term history) used by the *Annalistes* allows short term and long term phenomena to be placed in an interpretive context (Braudel 1972; Crumley 1999: xiii; Knapp 1992: 14; Smith 1992: 25). Nevertheless, the *Annales* school too is vulnerable to the critique of ecological gradualism as it conventionally places environmental influences within the domain of the *longue durée*, or long term history. At this scale, the environment is thought to operate in slow cycles of centuries, or as a structural constant that constrains history, rather than as a dynamic variable (Knapp 1992: 10; Smith 1992: 25). In order to pose the environment in dynamic terms, Smith (1992: 25-26) called for the employment of temporal units of 200-400 years duration, time scales sufficient to encapsulate the accomplishment of major technological, political or economic transformations.

Smith's proposal appears to be appropriate but it is not, in itself, a sufficient solution to the problem of scales of environmental and social change. Palaeoenvironmental research has, in recent years, experienced significant methodological improvements that allow for the construction of proxy records of palaeoclimate and other aspects of palaeoenvironments with extraordinary high levels of resolution. Some ice core palaeoclimate records are sufficiently well preserved and dated to be resolved to annual and seasonal scales and some can extend back as far as 100,000 years or more (Mayewski 2002). Ice cores and other high-resolution proxy climate records such as tree ring records (D'Arrigo 1996; Overpeck, et al. 1997) demonstrate a remarkable degree of climate change in the past occurring in long-term cycles and also in extremely rapid and dramatic events.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The most remarkable example of these rapid climate change events was the Younger Dryas, a 1300 yearlong phase of near-glacial conditions that ended about 11,640 BP. Ice core evidence form the Greenland Ice Sheet Project 2 (GISP2) core indicated that the Younger Dryas began and ended with radical temperature swings of approximately 25°C ± 5.4° on the Greenland ice Sheet itself, the largest climate change events of the Holocene. These climate shifts were each accomplished within the span of a decade or less (Mayewski, et al 1994; Meese, et al. 1993). These climate changes obviously were catastrophic, both in the sense of their severity, ecological ramifications and rapidity. A series of rapid climate change events followed the Younger Dryas in multiple cyclical intervals (O'Brien, et al. 1995) and while these were not quite as severe as the Younger Dryas, they were equally rapid. In addition to these epochal rapid climate change events, palaeoclimate records also show a considerable degree of climate variability in decadal and interannual scales with important ecological ramifications.

The readily recognized implication of this new climate change research is that environments, too, have history, both in the sense of a narrative of change through time, and in the sense of contingency. States and events in climate systems in particular places or points in time are derived from events in previous times or other places (Hurrell 1995, 1997; Mayewski 2002; Mayewski, et al. 1997). The *longue durée*, or even time intervals of 200-years as proposed by Smith (1992) are far too long time intervals to adequately address the nature of such rapid climate changes, their ecological manifestations, or their effects on human populations. Environmental change should therefore be included as a significant actor in short-term histories of the event and cultural context as well as in long-term histories of trends and processes.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

An additional, unexpected and ironic complication brought by new palaeoenvironmental research is that some environmental histories can be, and are now, documented with far greater temporal resolution and accuracy than most archaeological culture histories or archaeological sites. A new scale issue is thereby introduced in attempts to apply most coarsely resolved archaeological time series dated though conventional techniques (often with resolutions of decades to centuries), to palaeoenvironmental records with annual resolution. One readily applied solution is to "smooth" palaeoenvironmental records with the use of statistical means, a remedy that obscures the signature of variability and events. In order to make use of data pertaining to events and variability in short-term environmental histories, archaeologists must make renewed efforts to date sites and contexts more precisely. With dates provided by multiple methods, including absolute, calendrical and historical methods whenever possible, archaeological datasets may be situated in reference to records of environmental events as well as of social actors.

Summary Statement

In this study, I attempt to meet the objectives of an historical ecology study by writing a multidisciplinary history of landscape, which is defined as the spatial manifestation of relations between humans and the environment (Marquardt and Crumley 1987: 1). Here, landscape will be examined in a physical sense, in terms of key ecological components and structures (such as ecotones and indicator species), their histories, spatial configuration and variability. As well, landscape is addressed in more abstract sense, in terms of patterns of Inuit use of the environment and the social goals of their action. In so doing, I integrate both natural science and social science data and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

approaches. The issue of data comparability is addressed by focussing on subsistence and environmental and ecological factors closely related to it. Issues of scale in environmental and historical data sets are addressed with the application of multiple methods capable of dating archaeological contexts to within decades, and of applying archaeological datasets to short term environmental history.

An excellent opportunity exists for the application of an historical ecology perspective to the archaeology of the Labrador Inuit. For the first time, a body of critical kinds of data to support this endeavor now exists. These data include: multiple high-resolution palaeoenvironmental records pertaining to complimentary aspects of environment, ecology and subsistence; subsistence data provided by zooarchaeology, archaeobotany and ethnohistory; rich ethnohistorical data concerning the context of culture contact and social actors; theoretical perspectives on culture change and hunter-gatherer complexity useful to address situated social action and agents and, finally, dating methods sufficient to resolve scale problems relating archaeological data to high resolution environmental records. In this study, I have been concerned primarily with building a landscape history considering the histories of particular ecotonal landscape features (Woollett, et al. 2000), of ecosystems in a more general sense, and of Inuit subsistence-related activities within these ecosystems. This work lays the groundwork for on-going research employing a more specific agent-centered perspective.

Thesis Plan

This dissertation is organized as a work of ten chapters. An outline of the content and intent of these chapters follows. In the present, introductory, chapter, I outline the objectives and problem orientation of the dissertation as a multidisciplinary analysis of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador Inuit subsistence and culture change, specifically changes associated with the adoption of communal winter houses. As well, I review the significance of the dissertation research, in relation to the culture history and anthropology of Labrador and the eastern Arctic, to studies of hunter-gatherer economy and social organization, and as an example of the coordination of zooarchaeological data with high-resolution ethnohistorical and palaeoenvironmental data in an historical ecology project.

In Chapter 2, I summarize elements of Neoeskimo culture history, settlement patterns and social organization that are pertinent to this dissertation, along with the history of Inuit-European contact in Labrador. In addition, I present a review of the architecture and history of Inuit communal houses in Labrador and Greenland, and the various models devised to explain their origin and function. In order to establish a guiding framework for the dissertation's analyses, I raise a set of research questions that facilitate evaluation of major models of culture change based on their economic implications. Finally, methods that are useful for seeking answers to these questions using zooarchaeological and palaeoenvironmental data are presented.

Chapter 3 is a review of large-scale climate processes that have significant influence on Labrador's environmental characteristics and its ecosystems. These factors include global and hemispherical scale ocean-atmosphere interactions that structure terrestrial ecosystems and sea ice climatology. They also are the dominant forcing factors causing climatic and ecological variability. I summarize aspects of Labrador's physical geography, seasonal climate, the nature and distribution of terrestrial climate zones and ecological zones, sea ice climatology and variability in sea ice extent. As well, current research regarding specific linkages between these environmental factors and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

large-scale variations in the climate system, such as the North Atlantic Oscillation, is presented.

The characteristics of local landscapes and seascapes of the Okak Bay, Nain and Hamilton Inlet regions are examined in greater detail in Chapter 4. In particular, this discussion considers local sea ice conditions and variability thereof, and the ecology and life histories of animals with significant importance in Inuit subsistence economies. The usefulness of some of these species as indicator species in palaeoecological analyses is argued. Finally, patterns of contemporary and traditional Inuit land use in the Okak, Nain and Hamilton Inlet regions are reviewed, as documented in published ethnohistorical and oral history studies and derived from the author's own research.

In Chapters 5, 6 and 7, I describe the archaeology of the sites that contributed faunal assemblages used in this project. In Chapter 5, I discuss general rationales and methods of new fieldwork conducted during this project. As well, I present the results of previous research conducted by Richard Jordan at several sites in the Hamilton Inlet region, and review the dates attributed for those sites. I then describe the results of new archaeological fieldwork undertaken as part of this project at the winter settlement sites of Oakes Bay 1, on Dog Island in the region of Nain, and Uivak Point 1 in Okak Bay 1 in Chapters 6 and 7, respectively. I present descriptions of the setting and layout of these sites, as well as the characteristics of house structures present at them, and the results of excavations of houses and middens. The stratigraphies of excavated areas are also reported in detail. Initial analyses of artifacts recovered in excavations, conducted for the purposes of dating, are also reported, along with other dates obtained through radiocarbon and dendrochronological dating methods.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The techniques and objectives of laboratory methods used to analyze archaeological collections in this study are outlined in Chapter 8. These methods include those used to identify faunal remains and quantify zooarchaeological data, as well as those used to prepare thin sections of archaeological seal and dog teeth and to identify and count incremental growth structures in them. In addition, procedures for analyzing artifacts and archaeobotanical and palaeoentomological remains are presented.

In Chapter 9, I present the two major sources of data used to address the research questions set out in Chapter 2. A summary of recent, high-resolution palaeoeclimatic data and proxy sea ice data, all derived from tree rings, ice cores and archival sources, is presented. Then, the results of analyses of faunal remains from the sites in Hamilton Inlet, sites, Uivak Point and Oakes Bay 1 are presented and discussed. These data are then applied in responses to the major research questions.

Chapter 10, the concluding chapter, is a recapitulation of the project objectives and methods employed in pursuit of its goals. The major results of the project are reviewed and questions raised as a result of this work are discussed.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 2

NEOESKIMO CULTURE HISTORY IN LABRADOR AND THEORIES OF THE DEVELOPMENT AND FUNCTION OF COMMUNAL HOUSES

Introduction

In this chapter, a summary of previous work concerning the prehistory of the Thule and Inuit people in Labrador is presented, touching upon their culture history, technology, architecture, economy and contact history. From this review, a discussion of the development of Labrador Inuit house forms is developed, making reference to research concerning related house forms in Greenland. The distinctive architectural features of the communal house and social relations it entailed are examined, and the major theories explaining the development and function of this house form are reviewed. Finally, a set of key questions for evaluating these explanations in terms of subsistence economy and palaeoenvironmental history are proposed for use later in this dissertation.

A Brief Review of the Thule Culture in Labrador

The Thule culture is conventionally thought to have originated in northern Alaska from antecedent Birnirk or Punuk cultures, or an admixture of influences thereof, in the 10th century AD (Maxwell 1985: 252; Morrison 1989: 59). Radiocarbon dates of Canadian Thule sites provide strong evidence that the initial Thule migration was underway by about AD 1000, and that there was a second migration from Alaska into the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

High Arctic at about AD 1200 (McCullough 1989; Morrison 1989). These migrations were apparently very rapid, as the earliest Thule sites in Greenland have calibrated radiocarbon dates with central tendencies of about AD 1010 to 1220 (Morrison 1989: 72-73).

Thule migrants appear to have reached northern Labrador by the late 13th century AD. Radiometric dates of three wood and charcoal samples from Thule houses at the Staffe Island 1 site in northernmost Labrador, reported by Fitzhugh (1994: 253), had 2-sigma calibrated ranges of between AD 1000 and 1410, with averages aged dates of AD 1170, 1277 and 1283. Accepting the averages as reasonable estimates of dates, they suggest that the Thule migrants arrived at the very end of the Palaeoeskimo Late Dorset occupation of Labrador, or very shortly thereafter. The Late Dorset culture was the final phase of a long sequence of Palaeoeskimo cultures, which were not directly related to the Thule. The overlapping dates of the late Dorset and Thule occupations elicits obvious questions about the possibility and nature of Dorset-Thule contact, a much contended proposition in recent arctic archaeology.

Description of Thule Culture

In his original description of the Thule archaeological culture, Therkel Mathiessen (1927: 4-6) associated the Thule with a broad set of technological and material culture traits. Among their distinctive traits was their use of a diversified and specialized hunting toolkit, noted especially in particular forms of harpoons, lances, seal scratchers, darts and floats related to hunting on fast ice, at the ice edge and from boats in open water, as well as bird darts, barbed fishing spears, bows and arrows, and bolas. Distinctive tools and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

household items included bow drills, crescentic end-bladed women's knives (*ulos*), soapstone oil lamps and cooking pots, and widespread use of ground slate. Their transportation facilities included small and large wood-framed skin boats, dog sleds and harness devices, as well as items like snow goggles and ice probes that used when travelling. Finally, they used both permanent sod winter houses and snow houses. This toolkit is the broadest of all the prehistoric Arctic peoples and it implies an unparalleled capacity to travel and make use of all the major subsistence resources of the Arctic in all seasons (Maxwell 1985: 249).

Beyond simple extreme cold or extended periods of darkness, the most challenging aspect of adapting to the Arctic environment likely lies in coping with the distribution of most resources in patches and pulses that are sequestered in time and/or space (Freeman 1984: 43). This patchiness is a challenge to subsistence security as irregular yields or unpredictable availability of a spatially or seasonally limited staple resource may cause serious shortfalls that persist until the next resource pulse is available. Ecological knowledge, mobility and/or food storage are needed to bridge these gaps between resource pulses.

More than previous Arctic people, the Thule were able to emphasize broad-based ecological knowledge, mobility and technology as elements as a general strategy of logistical mobility in which a broad range of resources were used, and the most plentiful resources were keyed upon (Kaplan 1980; Maxwell 1985: 250; Savelle and McCartney 1988, 1990). With dog sleds, Thule people could travel relatively quickly with cargoes over land and on sea ice in winter, and by boat in open water, moving to intercept resource pulses and capable of returning bulk resources to residential sites. They could

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

hunt seals in all seasons, their access being limited more by weather than ice conditions, and so could make use of these essential resources in their accustomed habitats during their seasonal "pulses" of abundance. Similarly, the Thule had effective methods, tools and built installations for hunting caribou and birds, and for fishing.

Finally and most significantly, the Thule are also associated with hunting of very large sea mammals, of the largest seals, walrus and especially whales. Mathiassen (1927: 2, 182, 184), along with many subsequent writers, portrayed the Thule as practitioners of a whale hunting economy learned on the northern coast of Alaska. McGhee (1970) and McCartney (1977) considered whale hunting activities during the moderate Neo-Atlantic climatic period (or Medieval Warm Period) to have been the driving force behind Thule expansion. While other researchers, notably Stanford (1976), have disagreed with these writers and stressed the importance of more broad-based foraging practices, much of Thule archaeology since the 1970s has attempted to assess the importance of whale hunting in Thule economy.

Freeman (1979) advanced several cogent arguments why the universal importance of whale hunting during the Thule period may have been overemphasized by archaeologists. He noted that, historically, whale products were often obtained by scavenging beached carcasses as well by pursuing live whales. Archaeologists therefore needed to distinguish whale *hunting* peoples from whale bone *using* peoples as whale bones were curated and recycled for use in house structures. As well, Freeman doubted that many Thule sites did not clearly indicate residence groups of sufficient size to man one or more whale crews of the size known from North Alaska ethnography, nor did they show evidence of involvement of ritual in whale hunting. Freeman also observed that

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

deliberate, intensive whale hunting, with a high probability of failure (or high risk) when conducted with a small number of skin boats and harpoons, must be funded by the accumulation of a preexisting surplus of food and therefore requires a stable subsistence base (Freeman 1970: 282), surpluses which were not clearly demonstrated in the archaeological record.

Nevertheless, archaeologists have since developed means of distinguishing whale bone assemblages curated for use building houses from those from carcasses processed for meat and blubber (Savelle 1997; Savelle and Friesen 1995), for distinguishing hunted from stranded whale assemblages through osteometrical age analyses (Savelle and McCartney 1994). As well, archaeologists have identified specific localities in the Central Arctic where baleen whales were certainly hunted, sometimes at a large scale, as indicated by numbers of large, sedentary villages, temporary camps and whale butchering camps associated with substantial whalebone scatter (for example, Qariaraqyuk (Whitridge 1999; see also Savelle and McCartney 1999)). As well, Savelle and McCartney (1994) demonstrated that Thule period whale hunters the Central Arctic selectively pursued and captured smaller and less wary yearling bowhead whales. Even as an irregular, opportunistic practice, whale hunting represents a tremendous difference in the economies of Thule and Dorset peoples and in their capacities to generate subsistence surplus.

Thule Settlement Patterns and Subsistence in Labrador

Thule sites dated between the late 13th and the 17th century, are limited in distribution to the northern half of Labrador between Killinek and Nain, though this may

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

reflect the distribution of intensive archaeological surveys (Kaplan 1980, 1983: 216, 325). Most of these sites are sod house settlements or temporary camps with multi-tiered stone structures or tent rings (Kaplan 1983: 220-224). The sod house sites are interpreted conventionally as winter sites and often consist of a dozen or more structures. Nevertheless, initial indications at sites such as Iglosiatik Island (Kaplan 1983: 462) and Staffe Island 1 (Fitzhugh 1994: 258), are that only a limited number of these houses were occupied simultaneously.

Studies of large Thule era sod house villages elsewhere in the Canadian Arctic have suggested that winter settlements may have commonly seen four synchronous house occupations (McGhee 1984). Assuming these conclusions are correct, Thule winter settlements in Labrador were not particularly large, having at most several family units (Fitzhugh 1994: 246; Kaplan 1983: 337). Excavations of further houses and establishment of better site occupational histories are required to understand the nature of Thule settlement organization and settlement pattern.

Most Thule sites, including winter settlements, are located in the mouths of bays and on outer islands or in proximity to polynyas (open water areas with se ice masses) (Kaplan 1980: 648, 1983: 217, 218, 227). This settlement pattern suggests that the Thule employed a maritime-oriented economy, with extensive use of marine mammals found on the coastal fast ice during the winter and at the *sina* (the seaward of coastal land-fast sea ice in winter and spring). Seasonal migrations of marine animal (seals, whales and fish) were important in the open water season, while interior resources might also have been collected in the summer (Fitzhugh 1994: 246; Kaplan 1983: 218).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

On the basis of locational analyses, winter and spring subsistence resources likely featured walrus and seals hunted at the *sina,* as well as beluga whales and bowhead whales in some areas, and ringed seals taken on the fast ice (Fitzhugh 1994: 246; Kaplan 1983: 218, 288). Migratory harp seals and sea birds, such as eiders and alcids, were also likely of great importance in the outer coastal zone in spring. Inland resources that were accessible by dog team and boats included caribou, fish and perhaps berries and wood, though a lack of inland sites leaves the importance of these resources an open question (Kaplan 1983: 298). In the fall, the outer island sites are well placed to intercept the fall migrations of marine animals, such as whales and harp seals and birds. Kaplan (1980, 1983: 218) suggested that several of the important species in this economy (whales, walrus and caribou if not others) were likely hunted with cooperative methods. With relatively sedentary residential sites and effective transportation facilities used to exploit specific locations and seasonal resources, the economy of the Thule in Labrador was structured around strategies of logistical mobility. Furthermore, their economy was, in the terminology of Fitzhugh (1972), a specialized coastal adaptation with year round "modified maritime" subsistence-settlement system.

Few Thule sites in Labrador have yielded appreciable faunal assemblages. Limited zooarchaeological analyses of a few small faunal collections from Thule sites confirm this seasonal round (Kupferschmidt, n.d.; Woollett n.d.), and while in other sites, the bones of large seals and walrus are reported (S. Kaplan, personal communication 2002). Substantial analyses of Dorset sites in similar locations lend extra support to this economic interpretation (Cox and Spiess 1980; Spiess 1978).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Thule House Forms

Sod houses documented in Thule sites in Labrador were lobe-shaped constructions dug into raised sandy beaches, walled with earth, stone, and stacked turf, and covered with a roof of turf or animal skin over a pitched framework of timbers and whalebone. The early structures were quite small, often in the order of 5m length and 12 to 20m^2 of floor area, and oval to subrectangular in plan (Kaplan 1983: 220-223). Most had floors paved in flagstones, a single raised sleeping platform as well as a single lamp stand for light and cooking, while some had cooking or storage areas in small side alcoves (Kaplan 1983: 234). All had long, tunnel-like entrance passages with cold traps, designed to insulate the living chamber. Thule houses were quite variable in their shape, ranging from round, to ovoid, trapezoidal and subrectangular floor plans (Kaplan 1983: 220). In a typology of Labrador Neoeskimo sod houses he excavated from the Avertok site (Hopedale) Bird (1945) termed these structures as Type 1 houses.

Thule sod houses were home to relatively small groups, presumably small family units consisting of about five individuals per household (see, for example Maxwell 1985: 288; McGhee 1976; Taylor 1968: 211; 1974: 68-69). Some larger "cloverleaf" structures employed by the 14th century and afterwards consisted of two or more distinct house units with sleeping platforms conjoined by a passage or a common floor area. This type of house was reported at the sites of Staffe Island 1 (Fitzhugh 1994; Kaplan 1983: 791), Ikkusik (Schledermann 1971), Green Island 6 (Cox 1977: 123-125), Iglosiatik Island 1 (Kaplan 1983: 455, 457) and Avertok (Bird 1945: 132) among other sites. Conjecturally, these might represent more complex residential units possibly consisting of two nuclear families or multigenerational extended families.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador Inuit during the Historic Period

Sometime after the initial Thule migrations had run their course, by about the 16th century AD, Thule populations throughout the Eastern Arctic began to adopt increasingly specialized and distinctive adaptations to their respective regional territories (McGhee 1994: 588). The descendants of these populations are the modern Inuit and Inuvialuit peoples of northern Alaska, Canada and Greenland. Dialect differences, stylistic design differences in material culture, and technological specialization distinguish these derivative regional groups from the Thule culture and from each other (McGhee 1994: 567). Regional economic changes and specializations also came about, such as the adoption of specialized, mobile interior caribou hunting in various portions of the Central Arctic and North Alaska, and the decline of whale hunting over much of the Eastern Arctic (Schledermann 1975, 1976a).

Several authors have considered the role of climate change (specifically the onset of the Neo-Boreal cooling phase, or "Little Ice Age"), as a primary cause of this widespread and rapid change (McCartney 1977; Petersen 1969/70; Schledermann 1975, 1976a, 1976b). More recently, however, McGhee (1994) has proposed that contact with Europeans, and demographic crises resulting from epidemic diseases spread by these contacts, were causal factors breaking down continuity with Thule stylistic modes, loss of elements of the Thule toolkit, and increased isolation and divergence of regional groups.

Much as in other regions, a differentiated and specialized Inuit culture developed in Labrador, from roots in the Thule culture. Archaeology and several ethnohistorical

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and historical sources inform us about several aspects of the early Inuit culture in Labrador, including settlement range, demography, economy and social structure.

Settlement Expansion

While the initial Thule settlement reached as far south as the Nain region if not farther, the Inuit continued to expand much further south. The pace of this movement as yet unclear because of limited archaeological research. Nevertheless, surveys and excavations conducted by William Fitzhugh (1972) and Richard Jordan (1976, 1977) identified a 16th century Inuit sod house settlement at Eskimo Island 3 in Hamilton Inlet, the earliest Inuit site yet identified south of Nain.

There are relatively few Inuit sites yet dated to the 17th century identified anywhere in Labrador (Kaplan 1983). While this situation may simply be an artifact of how and where archaeological fieldwork has been conducted, or how sites have been dated until the present, Kaplan (1983) also raised the possibility that Inuit populations may have been reduced in the 17th century. There are numerous 18th century sites from northernmost to southern Labrador; the number of sites and apparent size of the populations living in them, along with some provisional census data lead Jordan (1977) and Kaplan (1983) to conclude that Inuit populations were growing during in the 18th century.

Later, by the 18th century, the Inuit are known to have ventured into southernmost Labrador and the Strait of Belle Isle, to the northernmost end of Newfoundland, and possibly along the north shore of the Gulf of St. Lawrence. Sod houses of possible Inuit construction were identified at Red Bay (Auger 1991: 23-24), and on Degrat Island in Newfoundland (Auger 1991: 25). Cartwright (1794) reported the presence of sod houses

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in Sandwich Bay. Historical records also report that Inuit made trips to southern Labrador (especially Sandwich Bay and Chateau Bay in particular) on at least seasonal basis, in order to conduct trade (Cartwright 1794; Gosling 1910; Hiller 1968; Taylor 1974). Scattered archaeological finds and boulder structures in the Strait of Belle Isle and north shore of the St. Lawrence have been attributed to the Labrador Inuit. Though the dates, contexts and significance of these materials have been the objects of debate, it seems apparent that the Inuit made attempts to establish at least temporary settlements in this region during the 18th century (Clermont 1980; Martijn 1980; Taylor 1982).

18th Century Inuit Settlement Patterns and Subsistence

The late Thule people maintained their long-established outer island settlement pattern in Labrador into the 17th century. Nevertheless, settlement patterns following the 17th century changed considerably. Many winter settlements with communal houses were established in new locations in sheltered portions of the coast or in inner bays, placing winter settlements in proximity to a more diverse marine and terrestrial environments (Kaplan 1980: 1983; 298).

Most of these settlements consist of fewer houses than are reported at Thule sod house sites, but communal houses were substantially larger than their Thule antecedents, perhaps the equivalent of an entire Thule village assuming that these villages consisted of four contemporaneous households of four to five persons each. Taylor and Taylor (1977) report Moravian Mission census information that in the late 18th century, many winter settlements had two or more communal houses occupied at the same time. The winter settlement populations implied by this number of large households (some in excess of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

100 people) implies either that many communal house sites contained the population equivalents of several of the old Thule villages, or that Labrador Inuit populations had grown substantially since the Thule period (Kaplan 1983: 299).

Kaplan (1983) reconstructed Inuit subsistence patterns of the 18th century on the basis of archaeological locational analyses, ethnohistorically documented subsistence activities, and a limited number of small zooarchaeological studies. Taylor (1969, 1974, 1977) also reconstructed subsistence patterns of the period in a detailed ethnohistorical study based on Moravian Mission records. On the basis of their work, it seems that the 18th century Labrador Inuit maintained a strongly maritime-oriented economy supplemented with use of terrestrial resources. Like that of the Thule, their subsistence economy was organized in favour of logistical mobility strategies, with semi-sedentary seasonal settlements linked with ancillary temporary camps and task-specific extraction locations by extensive use of transportation facilities. As well, their economy reflects a "modified maritime" subsistence-settlement system with specialized and semi-sedentary, year-round coastal adaptation, and limited short-term inland occupations (Fitzhugh 1972).

The inner island/bay environments in which most of the 18th century winter settlements were located represent intermediate zones between the exposed islands and *sina* of the outer coast and the terrestrial environments of the mainland. As such, inner island/bay localities provide sheltered places for semi-sedentary residential sites with access to diverse terrestrial, coastal and outer coastal environment. Semi-permanent winter settlements were usually placed in locations with extensive and stable winter fast ice at hand and with access to the *sina* readily within the range of a hunting task group

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

traveling with a dog sled. As well, some sites were located near polynyas or other open water areas. Hunting in the winter and spring would therefore have been focused on the variety of large and small seals and walrus found at the *sina*, and on ringed seals and fish in their fast ice habitat. Short-term camps on the ice or on islands were used during multiday hunting trips farther than about 8 miles from winter settlements (Taylor and Taylor 1977: 62). Later in the spring, migrating harp seals, belugas and sea birds, as well as walrus, bearded seals and ringed seals drew people to the *sina* for longer trips (Kaplan 1983: 272). Tent camps were established on islands in proximity to the ice edge, eventually emptying the winter settlements by about late April (Taylor and Taylor 1977: 62).

In summer, the Inuit moved to inland ends of bays to fish for arctic char during their seasonal runs, and to hunt seals, bears and terrestrial animals (Kaplan 1983: 272). Large social gatherings comprising most members of the local group were also held at these summer fish camps (Taylor and Taylor 1977: 69). Later in the summer, many family groups traveled into the interior to hunt caribou in cooperative drive hunts; these trips lasted until the fall. Caribou hides were required to make winter clothing (Taylor 1974: 57). Those families that did not travel inland remained on the coast, primarily fishing for cod and hunting the limited number of caribou that are normally found on the coast (Taylor 1974: 59).

In the fall (mid-October) families returned to their winter settlements and repaired or rebuilt their sod houses prior to freeze up (Taylor 1974: 51). From these sites, the Inuit hunted harp seals during their southward fall migration, from shorelines and kayaks. Harp seals were very plentiful at this time of year, and surplus carcasses were cached for

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

winter use (Taylor 1974: 51). Southward-migrating bowhead whales were also hunted in the fall, especially in November (Taylor 1974: 24). Surplus meat provided by the whales was stored for winter feasts that were usually held in the community of the successful harpooner in January (Taylor 1988). With the onset of freezing, fast ice began to form in the bays, initiating the onset of the winter subsistence mode of seal hunting on fast ice and at the *sina*.

With the introduction of new technology through contact with Europeans came changes in the seasonal round. Firearms, which were available in increasing numbers through the 18th century, made some forms of hunting more productive, especially individual caribou hunting. Fish nets obtained from Europeans were important in increasing the harvest of arctic char, salmon and codfish (Kaplan 1983: 298). European wooden boats were also used as improved cargo-carrying transportation facilities (Kaplan 1985). Furthermore, once the Moravian Missionaries had garnered Inuit converts, they attempted to encourage cod fishing, as a means of building up stores of food for the winter (Taylor 1974: 30).

The Moravian Missionaries also lent seal nets to their converts to improve their fall harp seal catch and the quantity of food stored for winter (Taylor and Taylor 1977: 61). The effectiveness of this technique, which seems to have been introduced by about 1805 (Taylor and Taylor 1977: 62) lead to the employment of temporary fall seal netting camps at particular locations, by the Inuit who had made their winter homes at Mission sites. Finally, baleen whale hunting was almost entirely abandoned in the early 19th century, likely due to the depletion of whale stocks in the western North Atlantic by

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

European and American whalers (Kaplan 1983: 299; Stoker and Krupnik 1993: 602; True 1906).

19th Century Inuit Subsistence and Settlement Patterns

During the early decades of the nineteenth century, winter settlement and residence patterns changed again throughout most of Labrador, likely due to a complex of economic, ecological, and contact-related social factors. Two new kinds of settlements emerged at this time. Many new settlements clustered around Moravian Mission sites and, by the mid-19th century, at trading posts operated by the Hudson's Bay Company and other companies (Kaplan 1983: 299-300). Others took the form of small, dispersed settlements of only one or a couple of houses occupied by single families (Kaplan 1983: 248).

Important subsistence activities included fishing, seal hunting and beluga hunting in some areas (Kaplan 1983: 300). Terrestrial activities were more important than in pervious periods and caribou and furbearers were important resources. European goods were obtained from trading posts and Moravian Mission centers, and consumed in quantities. Items such as firearms, fishing nets, seal nets, and traps are all commonly used in subsistence activities. With these technologies and direct relationships with trading establishments, Inuit became involved in a cash economy focused on fur trapping and later in the 19th century, on fishing as well (Brice-Bennett 1977; Kaplan 1983: 252; Richling 1978). Dispersed settlement patterns, commercial relationships with traders and the new technologies used in production encouraged cooperation at the family, rather than community level.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House Architecture of the Historic Inuit Era

The small Thule house form was used in Labrador up to the late 17th century as demonstrated by a limited number of sod house villages that have been identified and excavated (Kaplan 1983: 231). Artifacts of European manufacture are often reported in excavations of 17th century sod houses, especially in southern Labrador, suggesting that this was a period of incipient and growing European cultural influence (Jordan 1978: Kaplan 1983: 234). Nevertheless, some of the excavated 17th century houses, especially in northern Labrador, lack European manufactured goods and so are thought to predate extensive local contact influences (Schledermann 1971: 67). Indigenous material culture and traditional sod house forms used into the 17th century reflect continuity with precontact Neoeskimo traditions, whether European goods were available or not (Kaplan 1983: 234).

The late 17th century was, however, a period of experimentation by the Neoeskimos in the forms of their winter houses. Some houses were built with multiple sleeping platforms (noted in excavations at Eskimo Island 3 (Kaplan 1983: 420) and Avertok (Bird 1945), and with larger floor plans, as may be demonstrated at Iglosiatik Island 1 (Kaplan 1983: 462). The archaeology of this particular point in time is as yet poorly understood, as few late 17th century houses have been excavated or, at least, soundly dated. More soundly documented and dated excavations and historical references demonstrate that by the early 18th century, the Labrador Inuit were building much larger sod house structures with multiple sleeping platforms (Jordan 1977; Kaplan 1983: 238; Schledermann 1971).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The new house form, generally termed by arctic anthropologists as a "communal house" (Schledermann 1971: 103), and by Bird (1945) as a "Type 3" house, was a much larger structure than a Thule sod house and is considered a multifamily dwelling. Examples in Labrador measure between 7m by 6m in dimension up to about 16m by 8m (Kaplan 1983: 238) and have floor areas of up to 128m^2. These houses were commonly sharply rectangular to subrectangular in form and had many of the features of their Thule era antecedents, such as long entrance passages, cold traps, and paved floors (Kaplan 1983: 238). These houses were dug out into sandy banks, their thick walls were constructed of earth, turf and stone and apparently were roofed with a layer of turf and or animal hides laid over a frame of timber posts, pole and rafters. Brush and skins were used to line their interiors (Kaplan 1983: 238).

Some communal houses had substantial alcoves built into their entrance passages that were used for storage or cooking areas, further increasing the interior space of these dwellings (Bird 1945: 132; Kaplan 1983: 550). They generally had, as well, extensive sleeping platforms running along the entire rear house wall, or multiple platforms placed along two or more walls made of banked sediment, sometimes braced with stone or timber sills. Sleeping platforms may have been partitioned by screens into smaller units, as 19th century Greenlandic communal houses appear to have been (Crantz 1820). Platforms also often have lobe-like extensions jutting into the floor area (Schledermann 1972: 78). Multiple lamp stands for light and heat, and possibly cooking areas, may have been placed on the sleeping platforms and platform lobes (Bird 1945; Kaplan 1983; Schledermann 1972; Taylor 1968: 194).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

While Bird (1945) also noted an uncommon form of conjoined, two-room house, most were one-room structures with sleeping platforms facing a large, open, shared space. The majority of communal houses were, therefore, different from Thule houses primarily in terms of scale. The 18th century Labrador Inuit built multifamily dwellings by amplifying (and multiplying) the traditional, simple, single chamber house design and by creating extra family spaces within a single, large, shared public space, rather than by building a complex warren of distinct and private family spaces. Artifacts from communal house excavations in Labrador routinely include both traditional Neoeskimo material culture and quantities of European manufactured goods, firmly linking them with the contact period and the consumption of diverse goods from European sources (Jordan 1978; Kaplan 1983: 240; 1985. Ethnohistorical sources also date these structures to the late 17th to early 19th century (Kaplan 1983; Taylor 1974).

These communal sod houses are very reminiscent of contact period sod house forms used in Greenland. While the architectural details of communal houses in Labrador need not have been identical to those of Greenland, the architecture of the Labrador houses were not so well described in contemporary historical sources. Therefore, an examination of the Greenlandic communal house may provide some useful insights into the architecture of the Labrador houses.

Inuit Communal Houses in Greenland

The communal house was first identified, and recognized as a distinctive Inuit house form in itself, in Greenland. Several Danish, English and Dutch writers (reported by Gulløv 1997: 89-98) described the use of large winter houses in West Greenland by

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1720. The houses they reported were built of stone, turf, and, commensurate with availability, wood and whalebone and are often referred to as "longhouses" (Gulløv 1997: 96). These houses had rectangular or trapezoidal floor plans with an entrance passage and gut-skin windows set into the front wall. Archaeological excavations and ethnohistorical descriptions provide evidence that at least some of the large houses of West Greenland had a small kitchen area located in an alcove in the entrance passage (Gulløv 1997: 96). A long sleeping platform was built along the rear wall and, often, smaller platforms along the side or front walls as well. Hans-Christian Gulløv (1997: 387) states that the average 18th century communal houses of west Greenland were, on average, 8-9m long and from 2.5m to 3m wide, though the largest houses were considerably larger. Roofs over these large structures were constructed of skins (sometimes from skin boat coverings) stretched over a frame of whalebone or wood, supported by posts and covered in turf blocks (Egede 1818:115; Gulløv 1997: 92-93). The roof's peak, with a ridge beam, ran along the length of the house.

The large sleeping platform along the rear wall of communal houses is often described as being a raised shelf with wood planking, divided into a number of stalls or "rooms" by posts supporting the roof (Egede 1818: 115). Each of these rooms was the living space of one of the families occupying the house. An illustration accompanying Hans Egede's *Description of Greenland*, written in 1741, (Egede 1926: 90), represents these stalls as being separated by hanging skin screens, with an open side facing the interior of the house. Bedding made of seal skins or caribou skins, a drying rack for skin clothing and cooking pots were placed in the stall, and a large oil lamp on a lamp stand was placed in front of the platform, one lamp for each stall. Seal skins were also used to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

line the interior of the house (Egede 1818: 115). According to Egede (1818: 115), these large houses were home to as many as seven or eight families, and were heated and light by ten to twenty lamps.

Echoing Egede's narrative, Crantz (1820i: 129-130) described Greenlandic winter sod houses of the later 18th century as large structures "twelve feet in breadth, and from eight to twenty-four yards long, according to the number of inhabitants" and thick house walls made of stone and turf. The sleeping platform, along the rear wall, was divided into a series of stalls by seal skin partitions. The original English translation of Crantz (1820i: 130) included a cutaway illustration of a winter house with its sleeping platform subdivided into stalls, each with a lamp stand. This illustration is reminiscent of that presented in Egede's *Description of Greenland.* Drawing upon his own experience in west Greenland in the mid-19th century, Henrik Rink also reported the use of large winter sod houses with sleeping platforms that were divided by screens into compartments for use by different families (Rink 1974: 178).

On the basis of descriptions by ethnohistorical sources and archaeological excavations, Petersen (1974/75) and Gulløv (1985: 77; 1997: 95, 375, 385) date the original adoption of communal houses in West Greenland to between AD 1650 and 1700, where they remained in use there into the 19th century. The earliest use of communal houses is currently thought to have occurred in central West Greenland and to have subsequently spread north, south and east from there (Gulløv 1997: 385-386).

Gustav Holm (1914) and William Thalbitzer (1912; 1914), early ethnographers of the Ammasalik Eskimos, reported that communal houses were in widespread use in southeastern Greenland as well, though smaller sod house forms were also used. Later

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

archaeological and ethnohistorical research demonstrated that communal houses were in use there by the 19th century, and were retained until about 1940 (Gulløv 1997: 388; Petersen 1974/75).

The Ammasalik communal houses were large rectangular to trapezoidal turf and stone structures with entrance passages, peaked roofs and long sleeping platforms opposite their entrances. They conform to the plan of west Greenland communal houses with the exception that some houses had entrances in their gable ends and had greater depth than length (Thalbitzer 1912: 363). Also in keeping with the west Greenland house, sleeping platforms in these houses were divided into multiple sections by screens of hanging skins (Thalbitzer 1912: 363). These structures housed 8 to 10 families, with individual families occupying different sections of the sleeping platform (Thalbitzer 1912: 721).

Labrador Inuit Houses of the 19th Century

Large, communal houses were used in Labrador into the early 19th century and later in some more isolated regions (Kaplan 1983: 244). After this point, they were replaced by smaller semi-subterranean sod houses indicative perhaps of smaller family units, with simple entrances and single or multiple sleeping platforms (Kaplan 1983: 244). Inuit winter settlement patterns became increasingly focused on European missionary and trading establishments in the 19th century. During this time, Inuit incorporated more European materials in house construction and built smaller above-ground houses with stone foundations and wood and/or turf superstructures and cast iron stoves burning wood or coal were in use (Kaplan 1983: 244).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Considering the Development of the Communal House

Inuit communal houses have received a degree of scholarly attention in large part because they are considered an atypical mode of winter residence (Thalbitzer 1914: 721). Rather, on the basis of ethnographic and archaeological evidence, small winter houses are generally considered typical of Neoeskimos. During the 18th to early 20th century, small winter sod house or snow house forms were widely used by Inuit groups throughout eastern and central Canadian arctic and parts of Greenland. As well, from the time of the pioneering archaeological research by Therkel Mathiassen, it was apparent that Thule sod houses in the eastern Arctic and Greenland were also relatively small structures. Smaller households, along with dispersed settlement patterns, were often assumed to convey a measure of social and economic flexibility, and therefore adaptive benefit, for nomadic arctic hunter-gatherers (see, for example, Birket-Smith: 1928: 78). Nevertheless, large winter houses were also described by early historical observers and by early archaeologists and ethnographers. Since the late 19th century, researchers have struggled to explain the diversity and derivation of these different winter house forms (see Holm 1914; Thalbitzer 1914).

The development of communal houses in Labrador may be regarded as part of a broad trend of increasing size of winter houses in the Eastern Arctic through the last four centuries (Schledermann 1971: 108). Large, single-room, multi-family winter dwellings, very similar in form to those of Labrador, were adopted by the late Thule people of southern Greenland in the 17th century, and were used in western and eastern Greenland well into the 19th century (Gulløv 1985, 1995, 1997; Petersen 1974/75). Large winter households consisting of separate lobe-shaped chambers were also built in West

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Greenland in the 16th century (Gulløv 1985) and in southern Baffin Island during the 19th century (Schledermann 1975). Climate change, whale hunting and trade have all been proposed as causes for the trend to multifamily houses. Nevertheless, Prehistoric Late Dorset and Maritime Archaic people in arctic Canada also made use of multifamily "longhouses" through both harsh and mild environmental conditions, though these seem to have been warm-season structures. The Late Dorset houses have been seen as evidence of communalism, as well as ceremonial centers occupied during seasonal band aggregations (Damkjar 1990).

In the following section, I review the various theories that have been advanced to explain the origin and function of communal house forms. Scholars first turned their attention to the communal houses of Greenland, and their theories inspired many of those applied later on to Labrador. Accordingly, this discussion is organized thematically rather than geographically.

The Environmental Theories for the Development of the Communal House: Climatic Changes and Regional Developments in Greenland

Robert Petersen (1974/75) proposed a two-part argument that linked the development of communal houses (Petersen uses the term "longhouse") in different part of Greenland to variable climatic conditions and their accompanying ecological effects. Petersen dated the development of communal houses in West Greenland to about 1650 and referred to the then brand-new, pioneering oxygen isotope palaeoclimate studies of the Camp Century ice core, taken from the Greenland ice sheet (Dansgaard, et al. 1969).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In this record, the period from 1650 to 1700 was one of severe cold that was followed by a period of much milder conditions.

Petersen reasonably hypothesized that increased cold would have been associated with increased coastal sea ice. As demonstrated in a remarkable palaeoecological study by Christian Vibe (1967), greater accumulations of sea ice would likely have diverted bowhead whales from the coast of Western Greenland, to the extent that the West Greenlanders would have had to replace this particularly important economic resource. Whales were used for food and for fuel and the products of whale hunting were communally distributed. Without access to whales, the West Greenlanders needed to focus on animals that were still available, specifically seals. Unlike whales, which were common property, seal meat and skins were generally shared within, rather than between households and so, while households with active hunters prospered, those without successful hunted suffered for want of meat, fuel and clothing. According to Peterson, a solution for these postulated community imbalances was for the hungry households to join with the successful ones in large multifamily households which ensured that no one went without adequate food, clothing, heat or light. Physically larger households accommodated and encouraged this adaptive egalitarianism.

Petersen also argued, conversely, that the adoption of the communal house in southwest Greenland came into use after 1700, which was determined to be a period of climate moderation, which reduced sea ice and cause the ice edge to come much closer to shore. After about 1700, the Inuit of the region moved from outer island settlements where they hunted at the ice edge, to settlements on the mainland shore, where open water conditions required them to hunt from kayaks through the winter. This mode of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

hunting requires frequent maintenance of kayaks, which is difficult to accomplish in freezing conditions. The larger communal houses were therefore useful for repairing kayaks indoors.

While this latter explanation has largely faded from attention, Petersen's climate cooling argument for the development of communal houses in West Greenland has had lasting influence, especially on Peter Schledermann's research concerning the development of the communal house in Labrador.

Climatic Change and the Communal House in Labrador

Using Petersen's discussion of the near-contemporaneous adoption of communal houses in Greenland as a model, Peter Schledermann (1971, 1976a, 1976b) hypothesized that the development of the communal house in Labrador was an adaptive response to climatic cooling and increased sea ice. Like Petersen, Schledermann referred to the new palaeoclimatic reconstructions of the day, which identified an extended period of severe climatic cooling (the Little Ice Age) beginning in the late 16th century and lasting into the 18th century (Dansgaard, et al. 1970). This phase included the most severe cold episode demonstrated in these records for the last thousand years.

Schledermann concluded from his archaeological research in Saglek Bay that communal houses in Labrador likely came into use during this cold phase. Following Vibe's linkage of sea mammal biogeography to sea ice and climate change (Vibe 1967), Schledermann proposed that the Labrador coast would have been affected by increased sea ice accumulation during the Neo-Boreal phase, and animal distributions would accordingly have changed. Just as Petersen (1974/75) argued, Schledermann suggested

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

that bowhead whales were prevented by increased sea ice from feeding and traveling in Labrador's coastal waters. Their range was diverted to the south and offshore, while the habitat of ice-tolerating seal species was increased.

Schledermann argued that the bowhead whale was a critical resource for the Thule people in Labrador, as a hugely lucrative source of communally apportioned fuel and food. Just as in West Greenland, the collapse of dependable whale hunting in Labrador would have posed a serious provisioning problem for less productive households as the smaller species of seals that would have been available to replace whales in the subsistence economy would were typically shared within households (Weyer 1962). Households unfortunate enough to have fewer or less capable hunters were therefore more vulnerable to starvation. In this model of group selection and adaptive primitive communism, co-residence of separate family units would have offered an opportunity to buffer economic insecurity by allowing a more efficient and broad distribution of the surplus of successful hunters throughout the local population, as economic effort necessarily became focused on seal hunting.

Schledermann regarded the communal house in Greenland and Labrador as near-contemporaneous independent parallel inventions, and the result of similar adaptations of peoples sharing common cultural institutions, to similar environmental influences. He acknowledged the presence of Europeans and European manufactured goods in Labrador, but specifically discounted the importance of contact as a factor motivating these culture changes (Schledermann 1971: 110-111). By stressing egalitarianism and group selection, Schledermann was able to consider the communal house in strictly adaptive and evolutionary terms.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Barnett Richling recently reconsidered the environmental model in a review of the communal house phase in Labrador (Richling 1993). Richling proposed that it was short-term variability in the timing of fall freeze-up and spring ice break-up, which altered animal biogeography and Inuit hunting patterns (Richling 1993: 69). Citing Taylor (1974: 32-34), Richling pointed out that late eighteenth-century annual whale hunting records show that the numbers of whales taken and found dead was irregular and averaged less than one whale per year in many areas of northern Labrador. An increased degree of annual variability in ice conditions might account for the inconsistent and apparently low rate of success in whale hunting and, Richling (1993: 71) surmised, would have rendered walrus and harp seal hunting unreliable from year to year. In Richling's view, the failure of traditional means of staple food procurement required the use of two risk-minimization strategies. These involved pooling of food-sharing networks and relocation of winter settlements to inner bay environments where secondary resources (especially caribou) were available (Richling 1993: 71, 74).

Social Theories for the Development of the Communal House

Traders, Middlemen and Whale Hunters

Contrary to Schledermann, Richard Jordan considered the development of the communal house in Labrador to have been the largely influenced by contact with Europeans. Specifically, he argued that multi-family households formed around entrepreneurial individuals who earned wealth and prestige as middlemen in trade with Europeans or as whale hunters (Jordan 1974, 1977). Jordan drew his conclusions from

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

his excavations of a number of 17th, 18th and 19th century winter houses in the Hamilton Inlet area, which showed a dramatic increase in house size during the 18th century followed by a reduction in size in the 19th century. Trade goods were recovered in all these excavations and were especially plentiful in the 18th and 19th century houses (Jordan 1974). Jordan saw these middlemen as people who utilized existing social roles of authority to organize the production of their kin, dominating exchange activity and accumulating wealth (Jordan 1977).

Trading opportunities were limited by lack of permanent local European establishments in northern Labrador before the later 18th century and by the short list of local goods desired by Europeans, including baleen, whale oil and furs (Brice-Bennett 1990; Cartwright 1792; Kaplan 1985). Consequently, transportation facilities and capacity to secure tradable surpluses would have given particularly able and enterprising individuals opportunities to dominate external trading activities and to themselves negotiate the distribution of trade goods. The essential talents required of such aggrandizers were personal hunting skills, a history of leading successful whale hunting ventures, and extensive alliance networks useful to marshal the surplus production of others. Asymmetrical exchange operating in association with limited trading opportunities and the expectation of reciprocity would have been a means of promoting indebtedness and inequality even in an egalitarian society (Hickey 1984).

This model of brokerage has also been applied to Labrador by other researchers, and is frequently employed in studies of culture contact situations elsewhere in North America (Fitzhugh 1985; Paine 1971; Thistle 1986; Trigger 1985). Using records kept by Moravian Missionaries, J. Garth Taylor (1968, 1974, 1988) demonstrated that

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

multifamily households residing in communal houses were often virilocal extended families built through polygynous marriages, and centered on male household heads. Usually, households were structured on intergenerational lines with a senior male living with his wives, sons (or sons in law or nephew) and their families, and associated adherents and dependants; some of these households comprised, on average, 20 people and represented three or four generations of an extended family (Taylor 1974: 75). Less frequently (in about a third of the cases reported by Taylor (1974: 75), households comprised the families of two brothers or brothers in law. These households tended to be short lived as brothers split up to form their own households or join others.

Assuming that kinship directives frequently expressed in other Inuit societies obtained in this case, it is reasonable to assume that these multifamily households were usually structured with age and sex-related hierarchical tendencies. *Naalaqtuq* directives involve obedience and respect owed to intergenerational elder kin, while *ungayuk* directives involve relationships of closeness and affection for one's siblings and other intragenerational kin (Stevenson 1997: 248). These two idealized complimentary structures are played out in different modes of relations; hierarchy and reciprocity. Accordingly, most of the communal houses described by Taylor would seem to have been inherently hierarchical structures, with the senior father/husband in a position of clear authority by virtue of claims to respect. They would also tend to perpetuate positions of authority through habitual assumption of leadership roles in activities outside the house and by exerting ownership or control over items of critical property , such as boats.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Taylor also determined that these household heads also frequently identified as boat owners and whale hunting leaders, shamans, middlemen in long-distance trade networks, and arbiters in conflicts (Taylor 1974). They also usually had several wives. More than males with single wives, these men headed larger networks of social alliances obtained through polygynous marriages. They gained access to larger and more versatile labour pools capable of managing household production tasks such as food preparation and sewing skin clothing, food gathering, hunting small game and of crewing *umiat* (sing. *umiak*), the traditional multi-person, rowed, open skin boat (but see Taylor 1979). These household heads appear to have been capable individuals who assumed *angajuqqaq* (senior productive hunter) leadership positions in a variety of economic spheres from whale hunting to trading expeditions and who translated economic authority into the more generalized social authority of the *isumataq* ("one who thinks" see Oosten 1986; Stevenson 1997) through kin relations, spiritual leadership, alliances, displays of wealth and personality. They resemble, in some respects, the Alaskan *umealiq*, or whaleboat owner (see Spencer 1959), and meet many of the qualities of an aggrandizer.

Susan Kaplan (1983, 1985) built upon the work of Jordan and Taylor by amalgamating ethnohistorically documented changes in economic practices with regional settlement patterns and resource distribution studies to make the first study of changes in Neoeskimo economy through time. Kaplan made use of her economic reconstructions, artifact studies and ethnohistorical sources to define the functioning of long distance trading networks maintained by prominent Inuit middlemen. These individuals used European boats to move local products including baleen, oil, skins and feathers to southern Labrador where European trading posts and other establishments were to be

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

found, and then returned European goods north. They recruited others to participate in these ventures, which sometimes took on aggressive raiding tactics as well (Kaplan 1983; Taylor 1979)

Historical descriptions of several of these individuals exist. Tuglavina, who owned a two-masted sloop and lived near Nain in the 1770's, had at one point four wives (more than any other man in Labrador) and was both a shaman and a middleman (Crantz 1820: 311; Taylor 1974; 1979a). On one trading expedition in 1782, Tuglavina traveled to south to Chateau Bay with a group of men on his boat to trade items such as baleen for trade goods including firearms and gunpowder, with which he returned to the northern coast (Taylor 1979). Another example is provided by Apkajunna, who was a noted whale harpooner in northern Labrador around 1783 (Taylor 1990). After this time, Apkajunna began to spend his winters in Hamilton Inlet where he could conduct direct trade with Europeans and acquired a wooden boat. In 1794 he again moved, this time to Nukasorsuktok in the Nain region, were he worked to find partners to join him in new trading trips south using his boat. Some women, such as Tuglavina's wife Mikak, were also able to develop roles as intermediaries with traders and other Europeans (Taylor 1979b).

Trade and Travel Networks in Greenland

Hans-Christian Gulløv (1982, 1985) also proposed that the use the communal house in West Greenland was an indirect result of indigenous long distance trade networks. He demonstrated that travelers came to West Greenland from south Greenland in order to acquire raw materials for which they exchanged furs and driftwood. Middle

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

men were involved as nodes in this exchange system, through the maintenance of exchange partnerships and housing visitors. After the advent of a European whaling presence in West Greenland, European trade goods also were incorporated into this network (Gulløv 1985: 93). The use of the communal house is thought to have spread from south Greenland with these travelers. It was used by groups of travelers while en route to trading and hunting areas, and by visitors from southeastern Greenland to south Greenland (Gulløv 1995). A degree of prestige was held among the southerners in the scale of these houses (Gulløv 1982, 1985).

Some ethnohistorical evidence suggests that communal houses in Labrador were also useful in hosting of visitors. Winter season feasts sponsored by households that had successfully landed a whale drew guests from considerable distances , some of whom might find shelter in the big sod house (Taylor 1985). Trade-related networks in Labrador would also have encouraged the need to host visitors. As described by Kaplan (1983) and Taylor (1974), middlemen traveled extensively in Labrador with their families and partners. Whale hunting also encouraged travel on the part of those who sought to join the boat crews of others. An example is provided by Millik, who lived in several different locations in the Nain area in the 1770's (Taylor 1974). Desiring to participate in whale hunting activities, Millik moved himself and his family to the Okak area in 1781, where he lead a whale hunting crew. Many other descriptions exist of people moving between settlements and joining new households. Communal houses would have been helpful to facilitate social networks beyond the level of the local group which were vital to allow people to travel to, or join, different communities and to establish inter-regional economic ties

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Social Success and Stress

More recently, Kaplan and Woollett (2000) suggested that the use of communal houses, at least in the later 18th century, might also have been related to social stresses resulting from economic success and the expression of social resistance against increasing European presence in Labrador. Arguing that the subsistence and trading activities of the 18th century brought a new level of economic prosperity, these writers also observed this success resulted in unforeseen social problems through social conflicts over, for example, shared surpluses gained from whale hunts, increasingly competitive access to wives brought by widespread polygyny, displays of wealth and resentments accumulated by would-be aggrandizers. Lacking effective modes of generalized leadership or means of institutionalized dispute resolution, these stresses were a certain problem and lead to feuds and other strife (Taylor 1974; 1979a).

The growing influence of Europeans, including missionaries in the later 18th century, arguably deepened these stresses, by accelerating the material goods economy, weakening the role of shamans and by breaking down aid and sharing networks . The continued preference for the living arrangements of the communal house in the later 18th century is seen as part of a general societal display of symbols coding conservative values of "Inuitness" (including economic success, wealth, hunting prowess and cohesion) while the everyday reality of Inuit life was changing with a quickening pace. In this context of unease and change, the communal house provides a venue for cementing alliances and achieving social cohesion through the extension of the most powerful preexisting modes of leadership.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Diffusionary European Influence

William Thalbitzer (1914: 721) raised the possibility that the development of longhouses in Greenland was due to the imitation of medieval Norse long houses of the Eastern Settlement of Greenland, and therefor dated the adoption of the house form to about 1500. In a similar fashion, Mathiassen (1939) speculated that contacts with European whalers were the inspiration for the communal house. Neither of these theories gained wide acceptance as the Norse long house was of much different structure than the communal house and late work showed a considerable time gap between the collapse of the Norse settlements and development of the communal house. Similarly, these theories left the question the nature of diffusionary influences unattended.

Bird (1945), however, speculated that the communal house in Labrador was a defensive reaction to hostile relations with Europeans. Bird did not explain the value of communal structures in such a situation and the theory did not gain wide acceptance.

Key Questions for Evaluating the Communal House Models

To date, these explanatory hypotheses have been evaluated only with architectural, artifactual and site catchment data. The continued plausibility of the competing models suggests that these lines of evidence, at least as they stand today, are insufficient to resolve the communal house debate by themselves. However, both models propose or assume specific economic activities and environmental conditions, and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

zooarchaeological analysis offers an excellent opportunity to further examine the expectations of these hypotheses.

Question #1: *Is the time period associated with the communal house (the late 17th to early 19th century) a period of environmental degradation or unpredictability?*

Peter Schledermann's model is based on an assumption of changes in the ranges and migration routes of sea mammals due to increased sea ice severity and a lengthened seal ice season, caused by an extended period of climate cooling during the Little Ice Age. Similarly, Barnett Richling's revision of the environmental model poses that simple unpredictability in sea ice formation and clearance dates, and in ice severity, would be sufficient to hinder harp seal migrations and in so doing, cause subsistence stress. Both propositions originally rested on palaeoclimate (specifically, temperature) reconstructions of the early 1970's which did not specifically model sea ice conditions. Since that time, however, a number of independent high-resolution temperature records, historical and glaciochemical proxy sea ice records pertinent to the Easter Arctic and the Labrador Sea have been developed. These records are directly pertinent to the issues of trends and variability in temperature and sea ice climatology. They are used to verify the assumptions of the proponents of the environmental model.

The question may be approached by demonstrating whether climate and sea ice conditions were notably colder or warmer, and sea ice conditions more or less severe and more or less variable, during the communal house period than the periods preceding or following it.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

As an additional dimension to the environmental issue, the social arguments imply that environmental conditions were good, or at least moderate and predictable enough to encourage a degree of economic prosperity and security. The veracity of the proposition may be may be addressed by identifying moderate sea ice conditions and reduced degrees of interannual sea ice variability.

Question #2: A*re the economies associated with specialized hunting of ice-adapted species?*

This question addresses whether faunal assemblages associated with communal houses show trends toward lessened economic role for whales and seals associated with open water conditions, and increased roles for ice-adapted seals. The environmental model specifically predicts that whales and open-water seals would have avoided the Labrador coast during periods of heavy sea ice. The only species that would have been regularly available to Inuit hunters in these conditions would have been ringed seals. Accordingly archaeological faunal assemblages should be clearly dominated by ringed seals.

Question #3: *Is there evidence for a maintained or increased role of whale hunting at communal house sites?*

The importance of whale hunting goes to the heart of the social models for the development of the communal house. Whales represented an extraordinary resource for Inuit, in terms of the huge volume of meat even a single animal provided, for the blubber and baleen that Europeans prized in trade, and for the social capital both invested and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

realized in a successful whale hunt. Feasting, shamanic performance, dancing, alliance-building and food sharing were all part of a hunt; whale hunting therefore was a nexus of renewal of social relationships, reinforcement of group membership, and demonstrations of unity and prowess in the face of a growing European colonial presence. The nature and importance of whale hunting is a difficult question for zooarchaeology to address (see Freeman 1979), but element frequencies and epiphyseal fusion patterns provide important clues to the kinds of whales represented in an assemblage and how they were used (Savelle 1997; Savelle and Friesen 1996). As well, zooarchaeological data may be compared with existing ethnohistorical data concerning whale use in Labrador.

Question #4: *Is there evidence for food shortages or economic hardship in the archeological record?*

This question addresses an essential part of the environment model, namely that the change in residential patterns represented by the communal house was an adaptive response to economic shortfalls accompanying a switch to seal hunting (specifically ringed seal hunting). Recognizing such stress poses a complex problem for zooarchaeology, but there are several practical approaches in this case study. The presence of stress might be indicated by seasonal shortfalls of primary prey species, such as lower than expected representation of harp seals caught in the fall. Species counts, seasonality data, and comparisons to other sites and to ethnographic land use data provide means to identify these shortfalls. The degree to which subsistence was generalized or specialized and the extent to which secondary prey species were used might also indicate stress. In this case study, fish, molluscs and caribou were all potential resource

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

alternatives to sea mammals during the winter. Coincident shortfalls in primary prey species accompanied by switches to these secondary species, identified in faunal assemblages, or changes in the density of deposition of species may mark periods of economic hardship, as might site abandonment.

Finally, an experimental means to identify food shortfalls lies in the examination of the mortality patterns of sled dogs through analyses of cemental annulations in teeth. Dogs were the only domesticated species maintained by Inuit and, though vital for hunting and travel in winter and spring, were competitors with people for food during periods of shortfall. In normal circumstances, excess pups and aging dogs might be culled to maintain a healthy team with a mix of strength, experience and youth. Culling during times of serious shortfalls would reflect needs to minimize the food requirements of the dog team, and therefor see a catastrophic age profile in the death assemblage, as all but essential dogs were culled.

Summary

This chapter provided an overview of Neoeskimo culture and culture history pertaining to Labrador and of the communal house as a distinctive development in Labrador and Greenland. Major theories explaining the development and function of the communal house in these regions in terms of environmental and socioeconomic variables were reviewed. A set of questions was posed in order to provide a test of the explanatory theories later in this dissertation. These questions regard the environmental context in which a distinct Labrador Inuit tradition developed and the nature of subsistence economies associated with the use of communal houses. Accordingly, the following

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

chapters are concerned first with the environmental characteristics of Labrador, with the ecology and patterns of recent Inuit land use within selected regions of Labrador and finally with a program of archaeological research carried on to investigate Labrador Inuit subsistence and the communal house.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 3

LABRADOR IN THE NORTH ATLANTIC CLIMATE SYSTEM: OUTLINE OF PHYSICAL ENVIRONMENT

Introduction

Just as with many examinations of history and culture in other parts of the Arctic, environmental variables have been given central importance in most archaeological explorations of prehistoric culture change in Labrador. An understanding of current research concerning the environmental characteristics of Labrador is required to make use of these archaeological studies. Specifically, Peter Schledermann (1976a, 1976b) posited that severe environmental conditions obtained for Labrador through the Communal House Phase, with particular ecological and biogeographic effects sufficient to bring about a manifest change in subsistence. Nonetheless, the alternative explanations of the Communal House Phase also have implied palaeoenvironmental correlates of moderate and predictable modal environmental conditions amenable to the accumulation of sufficient surpluses to engage in trade and feasting. To resolve questions about environmental influences in cases of culture change, it is necessary to understand how Labrador's climate system works and what ecological changes are likely to result from physical climate changes. Accordingly, a review of several pertinent aspects of Labrador's climate system is presented in this chapter.

The chapter begins with a review of the geography of Labrador, including the physical landscape, topography and hydrology of the region. Variability in Labrador's

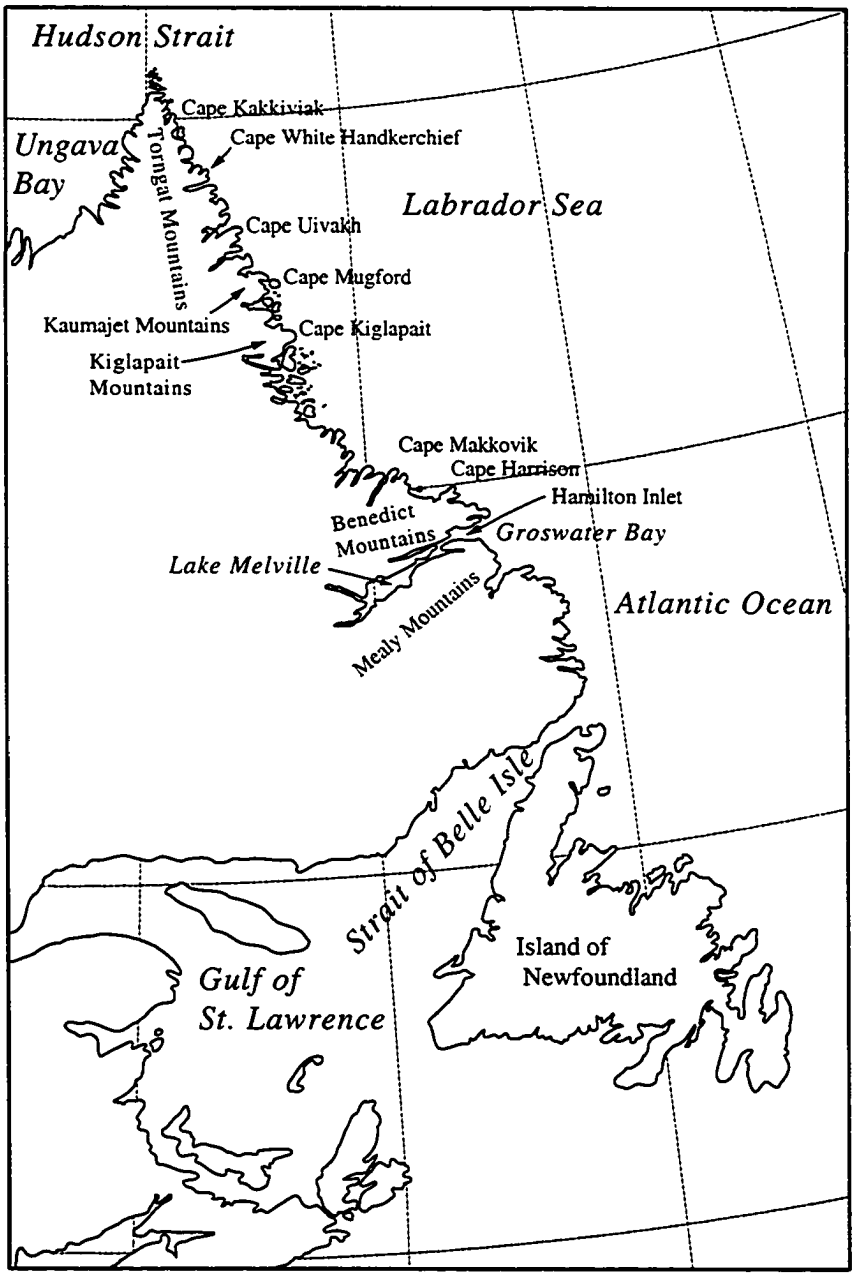
Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

climate is primarily related to meteorological processes operating in the Arctic and North Atlantic. Accordingly, the chapter's discussion then passes on to modal atmospheric circulation patterns and their climatic effects on Labrador are discussed. The basic climatic characteristics of temperature and precipitation, and gradients in these variables, are surveyed and then summarized in the form of climate normals and climate zones. Next, terrestrial ecological zones, and their fluctuations with regard to climatic changes, are examined.

Sea ice is a critical aspect of the marine environment of Labrador as it shapes coastal marine ecosystems and animal biogeography through much of the year, and has direct influence on terrestrial climate and on Inuit subsistence economy. The kinds of sea ice environments found in Labrador's waters (pack ice, fast ice and enclosed open water patches) are discussed, along with their spatial distribution and seasonal schedules of formation, transport and clearance, and interannual variability in these characteristics. Finally, the sources of this variability are examined. Primarily, sea ice variability is related to patterns of air temperature, wind strength and wind direction. These variables are, in turn, determined by fluctuating modes of atmospheric circulation including hemispherical and global scale variability in atmospheric circulation, the North Atlantic Oscillation and the El Niño/Southern Oscillation. Driven by these processes, sea ice conditions are seen to vary considerably in the short term with cyclical patterns, as well as the long term. Similar patterns of variability of sea ice conditions likely occurred in the past, with accompanying seasonal biogeographic changes for sea mammals and seals. Further, cycles of sea ice variability may also be modeled with proxies sensitive to large-scale atmospheric circulation patterns.

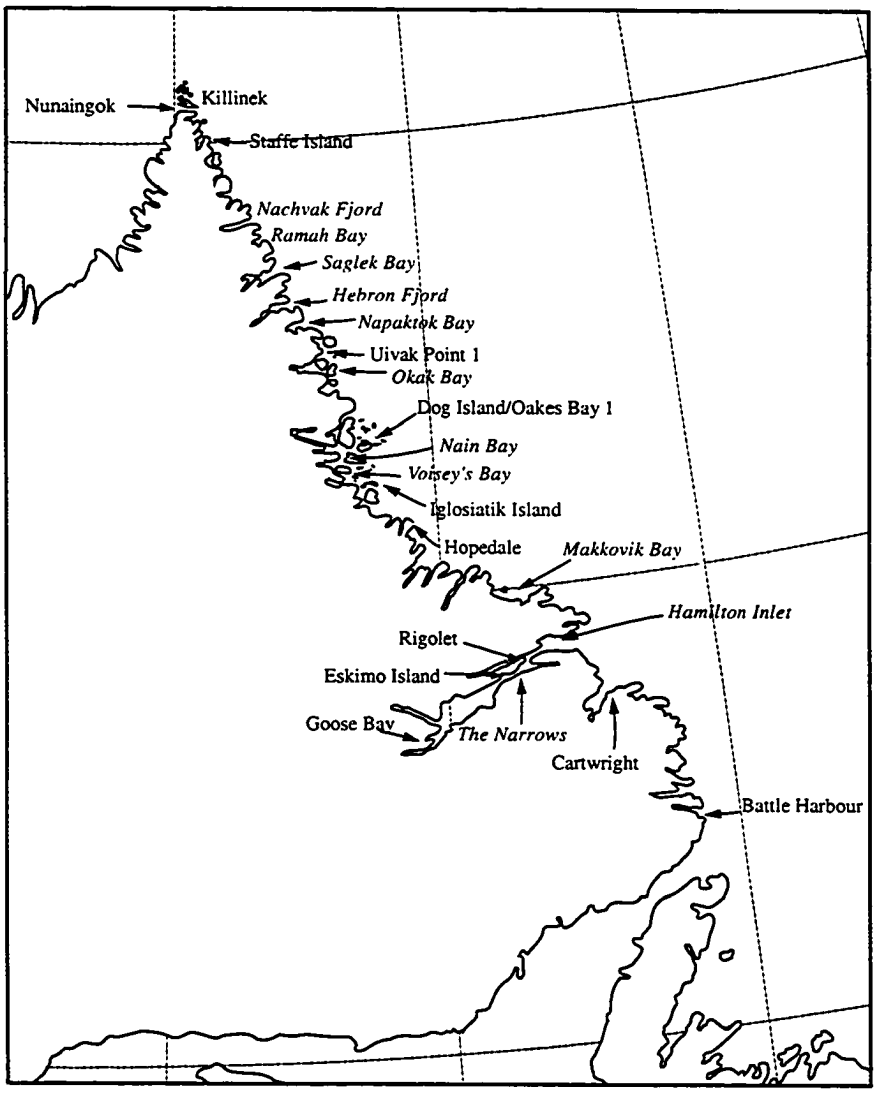
Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 3.1 Map of Major Geographical Features of Labrador



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 3.2 Map of Major Labrador Place Names



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Overview of the Geography of Labrador

The Ungava-Labrador peninsula comprises the northeastern-most extent of the North American continental landmass. The west coast of this peninsula faces Ungava Bay, while its northern tip juts into Hudson Strait, which separates Hudson Bay and the Labrador Sea. The east coast of the peninsula extends a straight-line distance of over 1200km from the Button Islands at approximately 60°30'N to L'Anse au Claire at 51°20'N, and is bordered by the Labrador Sea and the Strait of Belle Isle. A map of the major landforms and marine geography associated with Labrador is presented in Figure 3.1, while a map showing the locations of major place names is presented in Figure 3.2. A provincial boundary defined by the height of land divides the peninsula north of the 52°N parallel. The western portion is part of Québec while the eastern portion, which is properly termed Labrador, is part of the province of Newfoundland and Labrador.

Labrador and the Labrador Sea constitute a continuous coastline that bridges the distance between the Davis and Hudson Straits, the North Atlantic Ocean and the Gulf of St. Lawrence. Moreover, the climatic influences of these regions are commingled in Labrador and render it a zone of transition between arctic and subarctic climates. Cold seawater and sea ice, borne by the Labrador Current from Baffin Bay, Davis Strait and Hudson Strait cool Labrador greatly. Polar air masses also cool Labrador, especially in winter. As a result of these forces, Labrador represents the southernmost projection of the arctic climate system. Nevertheless, elements of temperate climate systems also have definite influences on Labrador's environment. Most notably, Labrador's relatively southerly latitude brings warming through insolation and the introduction of warmer

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

southern air masses from spring through fall. As a result, Labrador's climate has great seasonal variations.

Because of its proximity to these different climate regimes, Labrador constitutes an ecotone between tundra and boreal ecological zones. A diverse array of species of plants and animals have range limits that begin or end in Labrador and some of these limits, such as the tree line, are visibly and starkly defined. Ongoing fluctuations in climatic variables bring shifts in the ranges of species and of ecological zones through time, generally along a north-south axis. Labrador acts, therefore, both as a refugium for species whose ranges contract due to climatic change, and a frontier for those able to exploit expanded niches. Seasonal climatic variations produce a similar effect on a smaller scale, as many species in Labrador are present as seasonal migrants.

The transition from arctic to subarctic environments in Labrador is not entirely smooth, however. Labrador's geography creates further environmental gradients ranging from interior highlands and plateaus, to mountainous and lowland coasts, and to islands off the outer coast. The geography of Labrador's coastline is exceedingly complex and includes an estimated total length of coastline of 19,792km and 4,122 islands (Woodward-Clyde 1980: 5.2). This coastline is itself segmented into a number of bays and fjord systems that are separated by headlands. Each of these basins has distinctive ecological characteristics and support particular plant and animal populations. Collectively, these bays are home to the most productive ecosystems and most diverse biological communities in Labrador.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Topography of the Labrador Coast

Much of the Ungava-Labrador peninsula is composed of hilly or mountainous country of low to moderate relief. A central core of highlands and mountains run generally northwest to southeast along the western border of Labrador. In addition, the region north of Nain is particularly mountainous and includes three major mountain chains that are located along the coastline. The coast of Labrador, from its northern tip to Hebron Fjord, is dominated by the Torngat Mountains, an extensive range of tall and sharp peaks that reach over 1500m asl (Woodward-Clyde 1980). Many of these mountains are located on the coastline and form numerous headlands extending into the Labrador Sea.

The Torngat Coast

Because of its dramatically high relief and relative lack of sheltering islands, the Torngat coast is dominated by headlands that are exposed to currents, strong tides, ice and high-energy waves. As a result, most of this coast has steep shores of exposed bedrock and lacks substantial coastal flatlands or wide intertidal zones (Woodward-Clyde 1980: 5.7). Several narrow valleys trending east to west were eroded or enlarged by glaciers (Woodward-Clyde 1980: 3.3) and have become fjords and river valleys. Most of the fjords are relatively limited and narrow features with steep sides. Nevertheless, the largest of these, Hebron Fjord, Saglek Fjord and Nachvak Fjord are between 40km and 60km long. Several substantial rivers drain into these fjords, and the Saglek and Hebron fjord systems receive a small degree of shelter from small numbers of offshore islands.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The Okak Bay Region

Further south, the Kaumajet Mountains form a massive headland that separates the Okak and Hebron regions. Mountains in this range reach elevations of up to ca. 1100m asl. The Kaumajets extend offshore and produce a number of substantial and very mountainous islands. A third chain of mountains of up to ca. 1100m asl, the Kiglapaits, form another prominent headland (Cape Kiglapait), between the Okak and Nain regions.

A large, glacially eroded basin, Okak Bay, is located between the Kaumajet and Kiglapait Mountain ranges. The Okak Bay region has moderate topographic relief, extensive and relatively wide interior valleys drained by several rivers, and a mixture of steep exposed bedrock shorelines and pocket beaches and shoreline flats with unconsolidated sediments (Woodward-Clyde 1980: 5.7). As well, ecologically important intertidal zones are relatively wide in this region. Three large islands (including, notably, the Okak Islands) and several smaller islands fill most of the inner portion of Okak Bay, providing a great deal of shelter for those waters and moderating the energy of waves in the inner bay. Numbers of widely spaced islands are found in the outer portions of Okak Bay and its approaches, and lying off the seaward side of the Okak Islands. This scattered group of islands extends as far as 20km east of the Okak Islands and as much as 65km from the innermost portions of Okak Bay, and provide additional sheltering barrier for this stretch of Labrador's coast.

Another body of water, Mugford Bay, conjoins with the northern entrance of Okak Bay. The northern and eastern edges of Mugford Bay defined by a long headland, Cape Mugford, which is a seaward extension of the Kaumajet Mountains. These tall and steep mountains, and a trio of islands in its entrance, protect the waters of Mugford Bay.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Unlike Okak Bay, the shores of Mugford Bay are generally steep and a smaller basin without extensive inland valley systems drains into it.

Nain Bay and Surrounding Regions

South of the headland formed by the Kiglapait Mountains is a second major basin and embayment, the Nain region. This region comprises a number of deep fjords each over 30km long that are formed by glacially eroded tunnel valleys and linear ridges and that run predominately from east to west. These valley systems continue far inland and are drained by several sizeable rivers and streams. The linear uplifts extend offshore and produce a great number of islands that effectively isolate the fjord mouths from the outer coast. In the inner portions of the embayment, where relief is greater, these islands tend to be large (and some quite large) and mountainous. Nevertheless, many islands and large stretches of the mainland of this region have shallow shoreline slopes or flatlands with unconsolidated sediment along their shores and relatively wide intertidal zones (Woodward-Clyde 1980: 5.7). Regular, grid-like waterways between these islands are formed by the structure of the tunnel valley and uplift systems. Because of the shelter provided by these islands, wave energies in the shallow passages of the inner bay are greatly moderated compared to those of the outer coast.

The coast outside of the Nain embayment includes a plentiful archipelago of islands, islets, skerries and reefs that reaches far off the coast, as much as 50km east of the fjord mouths and, in some cases, over 100km east of the heads of the fjords. While the islands and islets of the outer coast are spaced widely and erratically, their numbers provide further protection for the coast, even in offshore areas. During winter, these

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

islands anchor very extensive areas of land-fast ice. Narrow passages between particularly close islands produce numerous stretches with strong tidal currents, termed rattles. These areas frequently have thin or weakened ice, or are ice-free entirely, during the winter. Yet further out to sea, an extension of the continental shelf, the Nain Bank, lies off the Nain area and Cape Kiglapait. This submerged plateau produces an area of shallow water extending up to 150km off the coastline.

The Hopedale and Makkovik Regions

South of the Nain region, the interior highlands lie far away from the coast and trend northeast to southwest. The bulk of the broad expanse of southern Labrador east of the interior highland is composed of high, eroded plateaus, rolling hills and lowlands. While the coastline of the southern half of Labrador is, in general, less mountainous than the northern half, there is sufficient relief on the coast to form several headlands and numerous fjord systems.

Linear eroded chains of hills and low mountains in the Hopedale and Makkovik regions create numbers of long, narrow, and steep-sided fjords extending from broad embayments, and a series of headlands. These fjords range in length from 35km to over 65km. Substantial rivers and streams drain these valleys and broad areas inland of them. Like the Nain area, there are numbers of islands lying off this stretch of coast, both around the mouths of the fjords and around the headlands. The coast of the Hopedale region is, in particular, sheltered by numbers of islands.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The Hamilton Inlet Region

A very large headland south of Makkovik is created by the Benedict Mountains, a group of mountains up to ca. 1000m in elevation. This headland (including Cape Harrison and Cape Rouge) frames the entrance to the Hamilton Inlet fjord system. A second group of mountains border the southern edge of Hamilton Inlet, running east to west. Mountains in this relatively eroded range, the Mealy Mountains, reach maximum elevations of approximately 1100m asl.

Between the Benedict and Mealy Mountains is a very large glaciated basin that stretches deep into the interior of central and southern Labrador. The eastern portion of the basin forms a broad linear valley that is filled by a fjord system over 200km long, with two other long fjords feeding into it. The mouth of the fjord is a large and relatively exposed bay with strong tidal currents that is protected by only a limited number of islands. Shorelines in this area are rocky and much steeper than those of the inner fjord (Woodward-Clyde 1980: 5.7). Islands and a very narrow strait congest the entrance to the inner portion of the fjord and shelter this region from the higher wave and tidal energy of the bay environment.

Unlike much of the rest of coastal Labrador, the shores of the Hamilton Inlet fjord are dominated by alluvial processes (Woodward-Clyde 1980). The inner fjord takes on a strongly estuarine character because several major rivers drain into it, depositing alluvial sediment, and because of the inner fjord's isolation from the outer coast. Especially in its western end, the straight shores of the fjord are mostly shallow slopes, flat terraces of sand and mud, sand beaches and wetlands (Kindle 1924: 64-65; Woodward-Clyde 1980: 5.16, 5.39).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The Southern Labrador Coast

South of Hamilton Inlet, the coastline is composed of eroded plateaus and fjords separated by headlands, formed in glaciated valleys. These fjords are generally shorter than those of Hamilton Inlet and the Hopedale and Makkovik regions, ranging from 10 to 40km in length. Numerous islands lie close to shore in this region, especially in the fjord mouths. However, islands are mostly absent from the headlands and so these areas are typically very exposed. Most of the shores of southern Labrador are rocky and lack beaches (Woodward-Clyde 1980: 5.7).

Marine Hydrology of the Labrador Region

Labrador's very extensive coastline contacts three bodies of salt water. The southernmost coast borders the Strait of Belle Isle. The long eastern coast faces the Labrador, while the northernmost tip of the Ungava-Labrador peninsula contacts the margin of the Hudson Strait. Of these, the Labrador Sea has by far the strongest climatic influence over Labrador.

Marine Circulation in the Northwest North Atlantic

The surface waters of the Labrador Sea are themselves influenced by their proximity to a large counter-clockwise gyre in the northwest North Atlantic, between Labrador and the southwestern coast of Greenland. The western arm of this gyre is the Labrador Current, a very strong stream of cold and low-salinity water that flows from

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

north to south along the Labrador coast (Mertz, et al. 1993). The Labrador Current eventually passes into the Strait of Belle Isle and past the island of Newfoundland's northern coast into the Grand Banks, where it mixes with the much warmer, northeast flowing waters of the North Atlantic Current (Farmer 1981: 61). Along this route, the Labrador Current flows over the shallow continental shelves of Labrador and Newfoundland, and the several submerged banks that lie off their coasts (the Saglek, Nain, Makkovik, Hamilton, Belle Isle and Grand Banks).

The West Greenland Current composes the eastern component of the North Atlantic gyre. This current is drawn ultimately from the east Greenland coast and flows north along Greenland's western coast. Some of this water is drawn off by the northern edge of the gyre in the Davis Strait. The remainder of the West Greenland Current continues north into Baffin Bay, where it mixes with the very cold waters of the Canadian Current that flow from the Arctic Basin, southward along the eastern coast of Baffin Island, into Davis Strait (Gustajtis 1979: 89). The North Atlantic gyre draws the West Greenland Current, the Canadian Current and water from Hudson Strait together in Davis Strait and propels them south along the Labrador coast as the Labrador Current. Water from the West Greenland current tends to form an offshore stream for the Labrador Current, while water from the Canadian Current composes an inner stream that hugs the Labrador coast.

Because of this complex group of current interactions, the Labrador Sea is closely linked to Davis Strait, Greenland and Baffin Bay, and receives a large part of its water content directly from these areas. Along with its water content, the Labrador Sea derives

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

a number of its physical characteristics from these regions as well. These include its flow rate, temperature, salinity and sea ice content.

The Labrador Current

The Labrador Current is the major outlet of the Arctic water mass in the Eastern Arctic. Its volume of flow is estimated to be as much as 5.3 x $10^6 m^3$ per second, approximately one tenth of the volume of flow of the Gulf Stream, which is the dominant water mass of the Atlantic Ocean (Farmer 1981: 61). The forcing of the Labrador Current through the relatively constrained waters of the continental shelf produces a very strong current of approximately 15cm/s at subsurface depths; storms and tidal effects can increase its rate of flow in surface waters to between 20 to 75cm/s (Gustajtis 1979:108). Surface currents are especially strong along the coast of north of Hamilton Inlet and reach velocities up to 40cm/s; current velocities are also tend to moderate during the winter ice season (Gustajtis 1979:114).

The water of the Labrador Current's inner stream is quite cold and has low salinity (Mertz, et al. 1993). The water in its subsurface flow has narrow ranges of temperature (0°C to 3°C) and salinity (approx. 32.5ppt) that change little through the year (Farmer 1981: 66; Gustajtis 1979: 91-97, 105). However, at its surface, the Labrador Current varies in temperature between its winter minimum of –1.5°C to approximately 9°C in summer. Within sheltered bays and estuaries, the thin layer of surface water in intertidal zones may be rendered warmer and yet less saline (as low as 20 to 22ppt) through the sun's radiation and the introduction of runoff water (Farmer 1981: 66; Gustajtis 1979: 92).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The inner stream of the Labrador Current is consistently cold and fresh throughout the year because it is draws most of its volume from, and is constantly refreshed by, the introduction of cold, low-salinity water from the Canadian Current. The Canadian Current, in turn, includes very cold and very low salinity Polar water from the Arctic Basin (Mertz, et al. 1993: 290). Beginning in the spring, the inner stream gains volume from melting sea ice and terrestrial runoff, creating a body of very fresh coastal water close to shore and a front of sea water dilution that moves north through the spring and summer (Farmer 1981: 66-67). Farther offshore, the subsurface waters of the Labrador Current's outer stream range between 1°C and 7°C, and have salinity levels upwards of 34 to 35ppt (Gustajtis 1979: 92). These waters come primarily from the West Greenland Current, which is less cold and more saline than the Canadian Current.

The Labrador Sea also receives quantities of sea ice from Baffin Bay and Davis Strait. Once ice floes begin to form in these areas, the Canadian Current transports pack ice south (Skidmore 1979: 165). Most of this ice is thin, first-year ice; nevertheless, floes of thicker second-year and multi-year ice and icebergs are also transported into the Labrador Sea. Ice floes reach Cape Chidley at the northernmost tip of the Ungava-Labrador peninsula by November and are present in the Labrador Sea by January, reaching Groswater Bay in February (Skidmore 1979: 165).

The transportation of pack ice south continues until their sources in Davis Strait and Baffin Bay are depleted or dispersed. Nevertheless, in recent years, pack ice has been transported as far south as the Grand Banks, as late as the month of July (Skidmore 1979: 163), and icebergs have been present in the Labrador Current throughout the year. The quantity of pack ice transported south and the duration of that transport varies

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

considerably from year to year in relation to regional climate changes. In combination with easterly winds, the chilling effect of the Labrador Current may delay the onset of summer conditions by maintaining cold, foggy air masses and pack ice along the coast.

Climate and Atmospheric Circulation Patterns of Labrador

Patterns of atmospheric circulation around Labrador have direct and profound effects on temperature, precipitation and sea ice in the region. In general, the northern North Atlantic region is one of predominantly low atmospheric pressure with cool to cold temperatures. In contrast, the Mid-Atlantic is a zone of hot, high-pressure air. The pronounced temperature differential between the arctic and tropic regions creates strong winds and tendencies to storminess in intervening regions such as Labrador, especially during the winter. In the northern hemisphere, low-pressure systems are associated with counter-clockwise airflow. Thus, the locations of the centers of low pressure are of great importance in determining the direction and strength of surface winds. These variables, in turn, influence surface temperature, precipitation, ocean currents and the formation and clearance of sea ice. Accordingly, modal locations of air masses are critical variables shaping regional climate systems.

The Icelandic Low

From November until April or May, the dominant atmospheric circulation pattern is that of a deep low pressure system centered in the Labrador Sea or between southern Greenland and Iceland (the latter is termed the *Icelandic Low*) (Banfield 1979: 89; 1993:

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

15; Newell 1996: 66; Gustajtis 1979: 128). The Labrador Sea low pressure system draws very cold northerly to northwesterly winds into Labrador from Ungava, Baffin Island and ultimately from the Arctic Basin. The Icelandic Low encourages the flow of cold northerly to northeasterly winds over Labrador. It is during the long period of dominance of very cold air brought by these systems that sea ice forms off the Labrador coast and in Davis Strait and Baffin Bay.

In addition to the normal northerly patterns of airflow, common wintertime storm tracks enter Labrador from the west, bringing cold air and snow from the continental interior. Alternatively, storms with relatively warm and moist air may come from the southwest, originating on the low latitudes of the continental east coast (Banfield 1979: 85). The strength of normal flow patterns and of storms are accentuated by the depth of low pressure masses and pronounced temperature differences between the polar and mid-continental latitudes during the winter season (Banfield 1979: 85; Gustajtis 1979: 127). This increased degree of storminess is manifest in greatly increased wave strength during the winter, as well as wind and precipitation (Gustajtis 1979: 120, 131-133, Skidmore 1979: 164).

After March, the low latitude high-pressure zone begins to drift north, while the North Atlantic low-pressure systems weaken and become less predictably distributed (Banfield 1990). Newell (1990) grouped North Atlantic low-pressure systems demonstrated in the month of May between 1950 and 1989 into five major categories, each of which has particular and significant influences on springtime climate of Labrador. These types of circulation are reviewed below, using Newell's terminology.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The Icelandic Low remains as the most frequent circulation pattern in the spring, especially during its earlier months (Newell 1996: 147). This type of low pressure system, with its centre approximately 500km south to southeast of Iceland, brings chilly northerly winds to the Labrador Coast and northerly and easterly winds to Davis Strait (Newell 1990: 149-150). A ridge of relatively high pressure extending across Greenland and Davis Strait is associated with the southern displacement of the Icelandic Low in spring and it, along with the easterly winds in Davis Strait, tends to isolate Baffin Bay from Davis Strait and the Labrador Sea.

The South Greenland Low

Placement of the centre of low pressure over southern Greenland or the Greenland Sea is another common mode of circulation (Newell 1990: 144-145). The South Greenland Low draws strong and cold, northerly prevailing winds to Labrador. These winds come directly from Davis Strait and Baffin Bay, and so the South Greenland Low is associated with the persistence of arctic air in Labrador.

The Labrador Sea Low

The Labrador Sea Low is located in the eastern Labrador Sea or the northwestern-most North Atlantic, with its mean centre is approximately 700km east of Hamilton Inlet (Newell 1990: 151-152). As well, this type of system is associated with a long trough of low pressure extending up the West Greenland coast. The Labrador Sea Low produces strong northerly winds in Davis Strait, and cold northerly to northwesterly winds in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador (Newell 1990: 151). In some spring seasons, a similar low-pressure system develops relatively close to the eastern coast of the island of Newfoundland. This system, the Newfoundland Low, is a broad and relatively weakly-developed low pressure system and is often associated with a ridge of relatively high pressure extending across southern Greenland, Davis Strait and southern Baffin Island (Newell 1990: 151). The Newfoundland Low is distinguished by damp and easterly to northeasterly winds, off of the Labrador Current, to Labrador and reduced northerly winds in the Labrador region (Newell 1990: 151-153).

The Hudson Strait Low

Finally, low-pressure zones are frequently located in the southern Baffin Island, Hudson Strait, and northern Ungava region (Newell 1990: 156). This system, the Hudson Strait Low, may be associated with a secondary, weak low-pressure system south of Iceland and relatively high pressure over Greenland. Together, these pressure systems bring warm and dry westerly and southwesterly winds to Labrador, and southerly winds to Davis Strait (Gustajtis 1979: 129; Newell 1990: 156-157).

During the summer, atmospheric circulation patterns in the western North Atlantic are usually dominated by high-pressure systems that develop in the hot low-latitude regions. The centers of these systems drift northward until late June, when their maximum northward distributions reach Bermuda (Banfield 1993: 15). At the same time, cool low pressure systems develop with centres northwest of Labrador, in the regions of Ungava Bay, Hudson Strait or southern Baffin Island (Banfield 1979: 84; Newell 1990: 23). These low pressure air masses produce a strong prevailing westerly to southwesterly

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

flow of dry and warm air from the continental mid latitudes, to Newfoundland and Labrador, and admit southwesterly to southerly winds into Davis Strait and Baffin Bay (Banfield 1993: 15). Alternatively, a weakening of the Baffin-area low-pressure system and a strengthened low-pressure zone west of Iceland (the Icelandic Low) brings northerly and northeasterly winds to Labrador (Newell 1996: 66). These winds come directly off the Labrador Current and are cold and damp, delaying the dispersal of coastal ice and the onset of warm, continental summer conditions.

The strengths of southern high-pressure air masses decreases in the fall, while those of low-pressure systems north of Labrador increase, allowing quantities of cold arctic air to move into Labrador once again (Banfield 1993: 15). During the fall, the location of the centre of the northern low-pressure air mass has considerable influence over the climate of the Labrador Sea. The most frequent fall circulation pattern is similar to that of summertime circulation, with the centre of a low-pressure mass situated in southern Baffin Island, and the presence of prevailing westerly winds in Labrador (Banfield 1979: 84). These winds become increasingly cold as the season wears on. When the centre of low-pressure is located over Davis Strait or southern Greenland, the prevailing winds in northern Labrador are cold northerlies and northwesterlies. Finally, the presence of a center of autumn low-pressure in the Ungava region produces easterly winds originating from the North Atlantic in Davis Strait and in northern Labrador, and westerly to southwesterly winds in southern Labrador (Gustajtis 1979: 127). These prevailing winds deflect the encroaching influence of arctic air masses from the north, delaying the onset of winter conditions (Crane 1978:442).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The Climate of Labrador

Because of the variable and seasonal influences of atmospheric circulation patterns and ocean currents, a variety of climatic zones, from arctic to temperate, are represented in Labrador. Most parts of Labrador are relatively cold and have annual mean daily temperatures near or below freezing. Annual average daily mean temperatures for four climate data collection sites are presented in Table 3.1; the sites themselves are labeled on Figure 3.1. Of these, the most southerly location, that of Battle Harbour in the Strait of Belle Isle, has the mildest annual mean temperature, just above 0°C. All areas further north (including Goose Bay, which has in relative terms a mild, boreal environment) has annual average daily mean temperatures less than 0°C. Hopedale, the northernmost location in this comparison, has a daily average daily mean temperature of -2.2°C, the lowest in the sample. Hopedale is located nearly at the midpoint of the Labrador coast, and places further north have mean air temperatures up to 7°C colder in winter and 5°C colder in summer (Banfield 1993: 19; McManus and Wood 1991: Plate 6).

Table 3.1 Annual Average Daily Mean Temperatures (°C) (data from M.S.C. 2002)

Site	Latitude	Annual Avg. Daily Mean Temp.
Battle Harbour (1957-1983)	52°15'N	0.3°
Goose Bay A (1941-1990)	53°19'	-0.3°
Cartwright (1934-1990)	53°42'-N	-0.3°
Hopedale (1942-1984)	55°27'N	-2.2

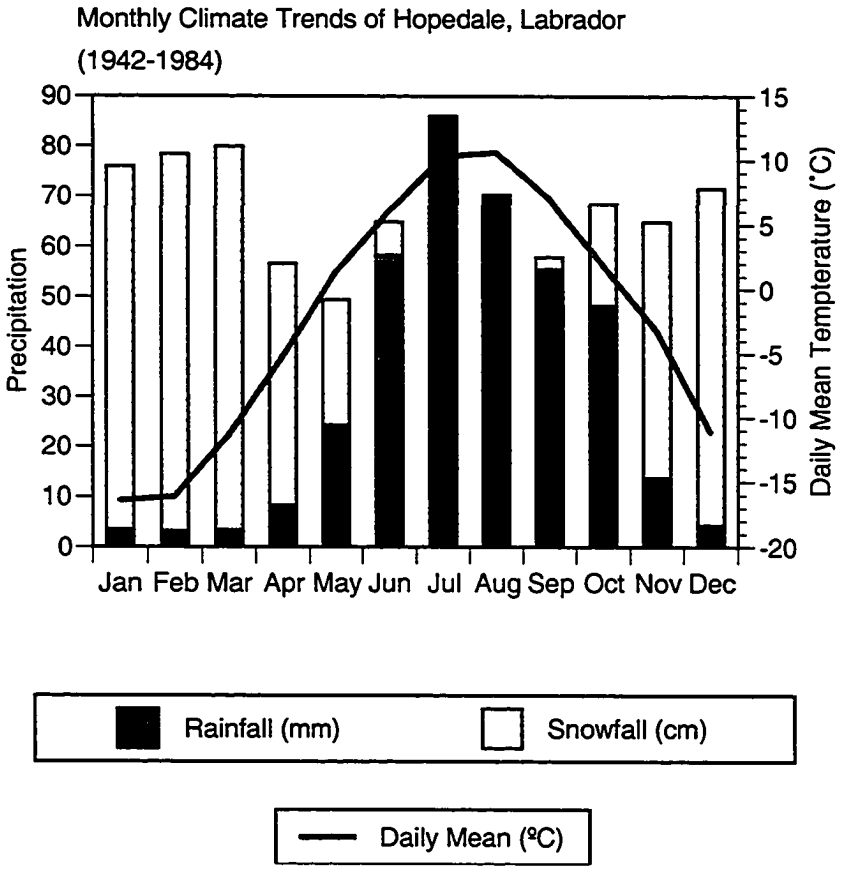
Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador is a cold place in comparison to the rest of North America as well. Mean winter temperatures in Labrador are as cold, or up to approximately 3.5°C colder than mean winter temperatures for other continental regions of the same latitude (Gustajtis 1979: 126). More notably, mean summer temperatures are up to 5.5°C colder in Labrador than for areas of similar latitude. The coldness of Labrador is remarkable, given its southern latitude. Hopedale and Battle Harbour are of the same approximate latitudes as Belfast and London, respectively, places that are heated by insolation, southern air masses and the Gulf Stream. These cities have much warmer climates than those of Hopedale of Battle Harbour, and lack sea ice. The presence of the Labrador Current and the frequency with which Labrador is exposed to arctic air masses are key factors that render Labrador the southernmost extension of arctic climate systems.

The extent of seasonal variability in Labrador's climate is demonstrated in climate normals for the town of Hopedale, which are presented in Table 3.2 and graphed in Figure 3.3. These data are derived from Canadian Meteorological Service records for the years 1942-1984 (M.S.C. 2002). Modern daily mean temperatures for Hopedale, averaged by month, range between –4°C and –16°C from November to April, and rise to between 6°C and 11°C from June to September. The warmest months are July and August, while January and February are the coldest months. Extreme temperatures may range between approximately –35° to –40°C in winter and 33°C in summer.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 3.3 Monthly Mean Temperature and Precipitation for Hopedale, Labrador (data from M.S.C. 2002)



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 3.2: Monthly Climate Normals for Hopedale, Labrador (data from M.S.C. 2002)

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Max. (°C)	-12.3	-11.6	-6.9	-1.1	4.6	10	14.4	14.3	10.2	4.5	-0.6	-7.8	1.5
Daily Min. (°C)	-20.7	-20.8	-16	-9.4	-2.1	2	6.2	6.9	3.8	-0.8	-5.9	-14.8	-6
Daily Mean (°C)	-16.4	-16.1	-11.4	-5.2	1.3	6	10.3	10.6	7	1.9	-3.2	-11.2	-2.2
Extreme Max. (°C)	5.6	7.2	10	11.8	28.3	31.1	33.3	29.4	25.6	20.6	12.9	8.9	33.3
Extreme Min. (°C)	-40	-40	-35	-28.2	-17.2	-5.6	-1.1	1.1	-5	-12.2	-20.6	-30	-40
Mean Days With Max. Temp. >0°C	2	2	6	12	28	30	31	31	30	28	13	4	218
Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	3.5	3.2	3.4	8.3	24.2	58.3	85.4	70.2	55.5	48.2	13.7	4.3	378.1
Snowfall (cm)	72.4	75.2	76.5	48.3	25.2	6.6	0.6	0	2.4	20.2	51.2	67.2	445.8

Hopedale is located at the approximate midpoint of the Labrador coast and of Labrador's north-south climate gradient. Monthy mean air temperatures for the Nain and Okak regions are approximately 1° to 2° C cooler than those of Hopedale in all seasons (Banfield 1993: 19). For the Torngat coast, monthly mean temperatures are from 5°C colder than those of Hopedale, in both winter and summer (Banfield 1993: 19). Similarly, the climate of Battle Harbour, on the southern Labrador coast, is approximately 3° to 6°C warmer than that of Hopedale in winter, but very similar in summer (Banfield 1993: 16; M.S.C. 2002)

The extended seasonal duration of winter conditions is apparent in the graph, as only six months have mean temperatures over 0°C and snow may fall in all months

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

except August. The first snowfalls that produce snowcover usually arrive in the first two weeks of October and substantial snowfalls usually continue into May (Banfield 1993: 27). A substantial amount of snow falls in Labrador; mean annual snowfalls for Hopedale for 1942-1984 amount to 445.8cm per year. From December to March, a relatively consistent amount of snow falls, 70-75cm per month. This pattern reflects the stability of winter circulation of northerly airflow into Labrador, with major storm tracks from the west. Total annual snowfalls are generally lower with north latitude (Banfield 1981: 112).

Precipitation in the form of rain may fall throughout the year as well. Mean total annual rainfall for Labrador is also substantial, 378.1mm. In general, southern Labrador is wetter and has more rain than northern Labrador (Banfield 1981: 116). The bulk of rain, by far, falls between June and October, the months with strongest southwesterly airflow. The trace amounts of rain that fall between December and April are due primarily to uncommon storms that originate in low latitudes and travel north along the North American east coast, bringing rain and freezing rain along the way.

Regional Climate Zones of Labrador

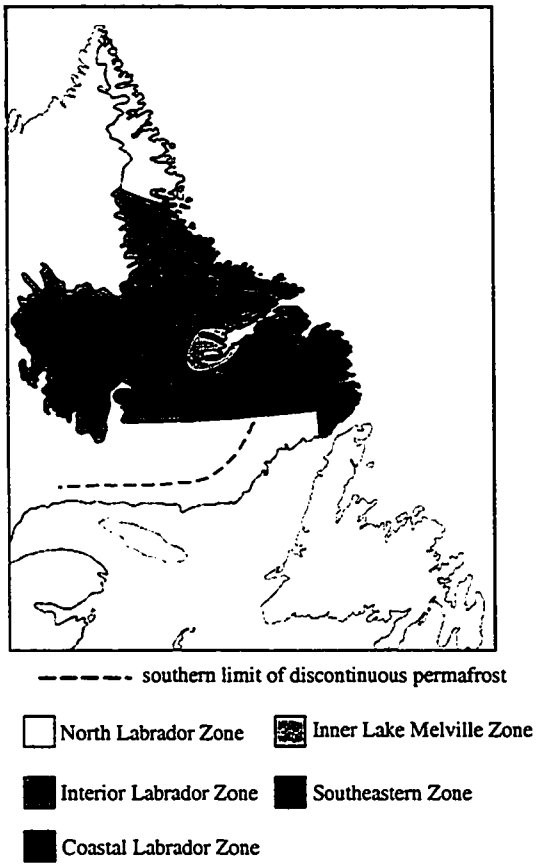
Banfield (1979) defined five major climate zones in Labrador, comprising coastal and interior, arctic, boreal and temperate environments. These climate zones are presented in Figure 3.4, and their characteristics are summarized below, following Banfield (1979: 129).

The Northern Labrador Zone includes coastal and highland areas from the Torngat Mountains of northernmost Labrador to the Nain region. These areas have an Arctic

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

climate with maximum monthly mean temperatures less than 10°C and receive between 850mm and 1000mm mean annual precipitation, the lowest mean precipitation for any area of Labrador (Banfield 1979: 129). Summers are short with less than 70 frost-free days (McManus and Wood 1991: Plate 6). The variegated mountain and fjord topography of the region tends to create complex variations in local weather patterns.

Figure 3.4 Climate Regions of Labrador (After Banfield 1979)



The Coastal Labrador Zone includes the long strip of coastal territory from south of Nain to the Strait of Belle Isle and includes the towns of Hopedale and Battle Harbour.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

This region is characterized by increased humidity and precipitation, (up to 1000-1300mm mean annual precipitation), in comparison to more northerly or interior regions (Banfield 1979: 129). This region also tends to be relatively windy and stormy, especially along the southeastern coast. Summers are relatively short with between 70 and 110 frost free days (McManus and Wood 1991: Plate 6), and are warm in the context of westerly air flow, or cold and damp when receiving northerly or northeasterly air.

The Interior Labrador Zone comprises broad areas of the interior, including highlands and lowlands. This region has continental environment with moderate precipitation (900-1000 mm of mean annual precipitation) (Banfield 1979: 129). Winters tend to be long and cold, with extended periods colder than –15°C and substantial snowfall. Summers are short in this region, with 90 or fewer frost-free days and tend to be cool with brief periods of hot weather brought by southwesterly airflow (Banfield 1979: 129; McManus and Wood 191: 1991).

The Inner Lake Melville Zone includes a relatively small basin at the western extreme of the Hamilton Inlet-Lake Melville fjord system, into which several large rivers drain. This inland region also has a continental environment with shorter winter and warmer summers than the Interior Labrador upland zone (Banfield 1979: 129).

The Southeastern Labrador Interior Zone includes a broad area of uplands extending from the Mealy Mountains into Québec. The relatively high relief of the region and its proximity to high winds and storm tracks that frequent the Strait of Belle Isle region result in higher humidity and greater mean annual precipitation (between 1000 and 1200mm) (Banfield 1979: 129). While winter temperatures are moderated in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

comparison to those of the Interior Labrador upland zone, snowfalls are greater (McManus and Wood 1991: Plate 6).

Variability in Climate Zones

Banfield's climatic zone boundaries are based on contemporary conditions. Significant maintained regional fluctuations in temperature and precipitation would result in shifts in these boundaries and perhaps the introduction of new climate regimes. Arctic climates of the Northern Labrador Zone would spread further south and into areas of lower elevation if circulation systems such as the Icelandic Low and Labrador Sea Low, which bring arctic air and cold conditions south, dominate Labrador for long periods of time. The occurance of these types of circulation as modes would lengthen the duration of snow cover and reduce the number of frost-free days. The Labrador Sea Low would also tend to reduce precipitation as prevailing winds would be cold, continental northwesterlies. Over a sufficiently long period of time, the limit of continuous permafrost and the tree line would tend to move south. The pocket of moderate continental conditions of the Inner Lake Melville zone would also decline.

Extended periods of warmth brought, for example, by prevailing southwesterlies coming with a modal dominance of the Hudson Strait Low, or by increased summer presence of warm mid-Atlantic air accompanying a weakened Icelandic Low, would tend to moderate Labrador's climate. Snowcover would remain for a shorter period of time, the growing season would increase, the limit of permafrost and the tree line would both tend to drift north. The more moderate climatic zones would tend to spread to higher

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

elevations, northwards and along the coastline, while the arctic environments would be increasingly restricted to pockets further north and at higher elevations.

The Sea Ice Environment of Labrador

Labrador's climate is greatly influenced by the presence of sea ice along its entire coastline for much of the year, as well as by atmospheric circulation and ocean currents. Sea ice has a profound effect on weather, on the temperatures of air and seawater, and on the physical structure of coastal seascapes and landscapes. As well, sea ice conditions vary from year to year in relation to large-scale climate processes, with direct effects on the ecosystems of coastal Labrador.

Expanses of sea ice have chilling effects on neighbouring air masses and water bodies. While the open sea tends to be relatively dark and so absorbs heat from solar radiation, sea ice is relatively light in colour and reflects a greater proportion of solar radiation without absorbing its heat (Wadhams 2000: 88; Walsh 1983: 230). Through this albedo effect, large areas that are covered with sea ice tend to remain significantly cooler than areas of exposed ground or open water. As well, air and seawater may be cooled simply by contact with large quantities of sea ice. Onshore winds that blow over sea ice expanses chill downwind regions, while the coastal waters of Labrador are kept cold by the melting of sea ice and ice bergs. In Labrador, these different effects combine to maintain cold weather well into the year, slowing the ablation of sea ice and delaying the onset of summer conditions.

Sea ice is also important for it changes the structure of physical landscapes and seascapes in coastal regions. It creates a highly specialized environment that effectively

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

excludes most species from large areas of their annual range, forcing them to be seasonal migrants. At the same time, a few species are able to exploit sea ice effectively for habitat, feeding areas or breeding territories. For these species, sea ice represents a protected ecological niche in which they have few competitors or predators. Just as the terrestrial landscape may be defined in terms of ecological zones, the marine environment includes a set of ecological zones defined by the presence and nature of sea ice. These include open ocean, coastal land-fast ice, the edge of land fast ice, different kinds of pack ice, and open water areas encompassed by ice.

Stable sea ice effectively links the opposite shores of bays and links islands with the mainland. In so doing, it provides an easy and convenient travel route for terrestrial mammals, especially humans, to varied terrestrial landscapes and to the habitats of animals living offshore. It provides a platform from which humans can forage for a range of marine species that might otherwise be out of reach (Boas 1888: 417; Jacobs, et al 1975). By the same token, however, unstable ice, whether it be newly forming fall sea ice, shifting pack ice, or the melting, rotten ice of late spring, may effectively exclude humans from productive hunting or fishing areas that would be accessible in boats or on foot over stable ice. Accordingly, the formation, dispersal and decay of sea ice add complex dimensions of seasonality to Labrador's environment and ecology.

Properties of Types of Sea Ice

Air temperature and the characteristics of seawater (Prinsenberg, et al. 1997) drive the formation of sea ice. Very cold arctic air and the process of evaporation cool surface seawater to its freezing point. Most seawater freezes at about–1.8°C (Wadhams

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

2000: 40), although the precise temperature varies with salinity. The coastal waters of the Labrador Current are relatively low in salt and so freeze more readily than does average seawater. The surface waters of the inner reaches of the Labrador coast are yet less saline than those of the Labrador Current, and freeze at somewhat higher temperatures (Skidmore 1979: 153; 1980: 70).

Pack ice, land fast ice and icebergs constitute the three general types of sea ice, and all of these are present seasonally in Labrador's coastal waters. These kinds of sea ice have distinct characteristics that result from the manner in which they are formed and the environment in which they do so. They have, as well, different spatial distributions and schedules of formation and clearance in Labrador. The characteristics, distribution and schedules of formation, dispersal and transportation of fast ice and pack are reviewed below. Ice bergs, large fragments of glacial ice transported form Greenland and Baffin Bay, are not a significant component of the marine ecosystem as considered in this study and so are not considered here.

Pack Ice

Formation of Pack Ice

On the open sea, ice develops as unanchored and free-floating masses of pack ice. In circumstances of calm water, tiny ice crystals accumulate in a thick, slushy layer termed *frazil ice* that consolidates as *nilas*, a thin, continuous sheet of transparent ice 5cm to 10 cm thick (Wadhams 2000: 41). Nilas gradually thickens as new ice accumulates on its under surface, but is also brittle and easily breaks up into floes through wave-induced

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

stress. These floes may drift under the influence of wind and currents, or amalgamate once again into large sheets through the formation of new nilas (Skidmore 1979: 154).

Continuous nilas ice sheets cannot form in energetic water environments. Disturbed by turbulence and collisions, frazil ice consolidates and freezes into rounded cakes called *pancake ice*. Pancake ice may start out as bodies only a few centimetres in diameter, but grow into larger ice pans with widths of a few metres as frazil ice continuously freezes to their edges and by merging with other ice pans (Wadhams 2000: 42). With continued freezing, these masses themselves consolidate to form drifting floes many metres to hundreds of metres across. Ice floes often become incorporated within extensive sheets of consolidated pack ice cemented by frazil ice or nilas until these are broken up once again by rough water (Wadhams 2000: 42).

Pack ice floes in their first winter of development (termed *first year ice*) usually grow to between 1m and 2m thick in Labrador (Skidmore 1979: 154). Pack ice that does not decay in its first summer goes through another winter's cycle of accumulation and is termed *second-year ice,* while ice floes that persist longer are termed *multi-year ice* (Wadhams 2000: 41, 59). This type ice can reach thickness of 3m to 4m in the Arctic region (Skidmore 1979: 165).

Masses of pack ice are tremendously dynamic and mobile. Wave energy tends to break up ice sheets and large ice floes (Skidmore 1979: 164). Similarly, winds and currents constantly push the pack ice, transporting floes great distances and shifting the boundaries of pack ice masses. Winds and currents also disperse and concentrate ice floes within the mass of pack ice, increasing or reducing the area of open water accordingly. When pack ice is concentrated, collisions between floes are more frequent

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and result in a thickening of the ice mass through the compression and stacking of floes (Wadhams 2000: 42). The density and thickness of ice cover are important ecological variables, as they determine the suitability of pack ice as a habitat for algae, plankton and the animals that fed on these organisms. Finally, currents and especially winds are also the most important agents in the clearance of pack ice during the spring, pulling pack ice down the Labrador coast, and pushing pack ice out to sea or against the coastline itself (Crane 1978; Newell 1990).

Schedule of Pack Ice Formation

Pack ice begins to form in open water when offshore daily mean air temperatures drop consistently below freezing, conditions brought by the advent of cold northerly and northwesterly winds. Ice floes first form in the coastal waters of northern Labrador by November (U.S.N.O.O. 1965: 42) and winds and currents constantly transport ice floes south along the Labrador coast. Between November and mid-December, pack ice is present in varying concentrations (from 1/10 to 10/10 sea surface coverage) and forms locally along the entire coast (C.I.S. 2001: 26, A-71, A-73; U.S.N.O.O. 1965: 42). After pack ice forms in coastal waters, it spreads out to sea, with open pack ice (having low densities of sea ice representing 1/10 to 3/10 sea surface coverage) extending as far as 300km offshore by the middle of December (C.I.S. 2001: A-74).

By late December or January, close pack ice (with greater than 8/10 coverage) is usually present in all coastal waters from northernmost Labrador to the Strait of Belle Isle (C.I.S. 2001: A-7). Also by late December, open pack ice usually extends into the Strait

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of Belle Isle, to the northern Newfoundland coast and up to approximately 300km offshore into the southern Labrador Sea (C.I.S. 2001: A-7, A-75).

The consistently cold air temperatures of winter foster the ongoing formation of new ice floes and slow the rate of melting at the ice edge, which is the seaward boundary of the pack ice (Prinsenberg, et al. 1997). Accordingly, locally formed pack ice continues to accumulate through the winter, normally reaching its maximum density and extent by mid to late March. At the period of maximum ice extent in most years, the waters along the entire coastline and up to 40km or more offshore are completely ice-filled (10/10 coverage), with isolated local exceptions (C.I.S. 2001: A-19). Close pack ice of 9/10 or greater coverage usually extends as far as 150km off the Labrador coast, along the northern Newfoundland coast and into the southwestern Labrador Sea, the Strait of Belle Isle and the Gulf of St. Lawrence. Open pack ice (under 4/10 coverage) is normally present up to about 325km offshore (C.I.S. 2001: A-17, A-18). In exceptional years, sea ice coverage may extend as far as 350km to 500km into the southeastern Labrador Sea, well into the Grand Banks and throughout the Gulf of St. Lawrence (C.I.S. 2001: A-87).

Transported Pack Ice in the Labrador Sea

In addition to locally formed pack ice, a significant portion of the pack ice present in the Labrador Sea after early January is formed in the Arctic Ocean, Baffin Bay, Davis Strait and Hudson Strait. This ice is transported into the Labrador Current, via the Canadian Current and Hudson Strait Current, and begins to arrive in northernmost Labrador in early January (Skidmore 1979: 165). By mid-February, transported pack ice reaches Groswater Bay and then drifts into the southern Labrador Sea and along north

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

coast of Newfoundland, accompanied by locally formed pack ice (C.H.S. 1988: 196; Symonds 1986; U.S.N.H.O. 1965: 117). While the bulk of the transported pack ice is first-year ice, some of it is second year or multi-year ice that originated in Baffin Bay or the Arctic Ocean, via Baffin Bay (Skidmore 1979: 165; C.I.S. 2001: A-112).

Increased solar heating, the overall weakening of polar circulation and the retreat of the Arctic Front north in later March and April cause pack ice formation in the Labrador Sea to cease and increase the rate of melting at the ice edge, preventing further expansion of pack ice. During April, pack ice dissipates quickly at the ice edge over 250km east of the Labrador coast, in the southeastern Labrador Sea, along the northern Newfoundland coast and in the Gulf of St. Lawrence (C.I.S. 2001: A-2). Nevertheless, pack ice usually persists in the Strait of Belle Isle and northernmost Labrador, while the extent of pack ice in the Labrador Sea remains relatively static until May because of ongoing transport of pack ice from more northern regions into these areas (C.I.S. 2001: A-22, A-25; Newell 1990: 33). As well, sea ice also tends to melt or disperse early in the spring in a limited number of inner coastal areas such as Groswater Bay and inner Hamilton Inlet as far west as the easternmost end of Lake Melville, which have strong tidal currents and substantial freshwater outflow. In normal conditions, large patches of open, ice-free water are present in these areas by mid to late April (C.I.S. 2001: A-23, A-24, A-25).

Maximum Pack Ice Extent and Pack Ice Clearance

By late May, low-pressure systems often develop in the Hudson Strait region, bringing more frequent warm southerly to southwesterly winds to Labrador and Davis

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Strait than occur in winter and early spring (Newell 1990: 179). These circulation patterns allow more rapid warming in southern Labrador and impede southward ice transport. Due to these factors, pack ice usually disappears from the Strait of Belle Isle and from almost all of the interior coastal waters south of Groswater Bay, though a residual mass of open pack ice usually remains off the shore of southernmost Labrador (C.I.S. 2001: A-28, A-29). Large areas of loose pack ice are present in Lake Melville, as that ice sheet breaks up as well. Pack ice is usually entirely dispersed from all of the coast south of Groswater Bay and Lake Melville by early to mid June though, in the most severe ice years, these areas may retain open pack ice until July (C.I.S. 2001: A-31, A-32, A-138).

North of Groswater Bay, the thick body of pack ice that accumulates during the winter normally diminishes only gradually during April and May, and the ice edge shifts slowly toward land. The entire coastline normally remains icebound until mid to late June, when the strengthening southerly and southwesterly winds brought by developing low-pressure systems around Hudson Strait take their toll on the ice pack and ice transport (C.I.S. 2001: A-32; C.I.S. 2002: A-11; Newell 1990: 177; Crane 1978). Until then, close pack ice of 8/10 to 9/10 coverage usually extends approximately 100km or more offshore with loose pack ice with 6/10 or less coverage extending about 200km or more offshore.

In late June, a band of open water opens along the inner coast south of Hopedale and gradually expands north, leaving a wide body of mixed pack ice ranging from 9/10 to less than 3/10 coverage lying offshore (C.I.S. 2001: A-33, 2002: A-12). Without the barrier of ice in the inner coast, this pack ice drifts freely and widely with prevailing

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

winds; it disperses seaward with westerly winds, while easterlies compress the pack ice into the coastline. The mean clearing date of waters off Makkovik (55°N) between 1954 and 1983 was July 11, with a standard deviation of two weeks (Newell 1996: 64). North of Nain, however, a wide mass of mixed to dense pack ice (up to 7/10 or great coverage) about 100km to 150km wide persists into late June (C.I.S. 2002: A-11). Normally, this remaining body of pack ice rapidly disperses into an offshore mass of 3/10 or less coverage in July, however, and the southern limit of pack ice shifts north. By the third week of July, the Labrador coast is usually entirely free of pack ice (C.I.S. 2001: A-35, 2002 A-2, A-15)

During exceptional years, pack ice may persist throughout the entire Labrador coast past the middle of July and into August (CI.S. 2001: A-104; U.S.N.O.O. 1965: Figure 19). The most severe of these summer ice seasons described in historical records is that of 1816, the infamous "Year Without a Summer". During the summer of that year, the Labrador coast was too congested with pack ice, even as far south as Hopedale, to allow the approach of ships before late August and September (Elton and Ashburner n.d.: 12-13; Newell 1990: 325). While this is the most extreme example of an extended season of coastal pack ice, Canadian Ice Service Regional Ice Charts indicate that up to 15% of the years between 1971 and 2000 had pack ice remaining in southern Labrador in mid July (C.I.S. 2001: A-104). Similarly, historical navigational records reviewed by Newell (1990: 104) indicated the presence of pack ice in waters south of Hopedale in approximately 22% of the years between 1870 and 1919.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Pack Ice as an Ecosystem

The persistence of coastal pack ice is a very important ecological variable as it restricts the range of marine animals. For example, very dense coastal accumulations of pack ice prevent animals such as harbour seals from coming close into shore, and may divert the migrations of harp seals and whales offshore. Very dense shifting pack ice (or, alternatively, extremely light pack ice and early ice clearance) in the southern Labrador Sea, Strait of Belle Isle, and Gulf of Saint Lawrence regions may also disrupt harp seal whelping. These conditions can restrict appropriate whelping patches or eliminate them altogether, and cause excessive mortality among pups caught by rafted ice (Sergeant 1991: 81). Heavy pack ice conditions therefore pose economic difficulties for human populations, as these animals become scarce or unavailable to hunters. Economic difficulties arise even when pack ice is not heavy enough to wholly exclude prey species, as it may hinder the use of boats in coastal waters. Dense, shifting pack ice may be too dangerous and unpredictable to be readily traversed in boats, by dog sled or on foot. In conditions such as these, hunters find it very difficult to gain access to prey species such as harp seals or ringed seals, even when they are present (Sergeant 1991: 38; Williamson 1997: 41).

Landfast Ice

Sea ice that forms in shallow coastal waters usually becomes anchored to shorelines or is grounded by submerged shallows. This type of ice is termed landfast ice, or simply, fast ice. Because it is grounded, fast ice is stationary and is not moved by tides, currents or winds. It is this quality of stability that makes fast ice useful as a

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

transportation route for terrestrial animals and people, and as a platform from which to hunt sea mammals.

Formation of Fast Ice

Fast ice is usually the first type of ice to form in the winter because waters of the inner coast tend to be fresh. It begins to form in early November in northern Labrador and in the inner reaches of deep inlets such as Lake Melville (Skidmore 1979: 158). In southern Labrador, fast ice develops a little later, in early to late December. Fast ice forms in relatively calm coastal waters as slushy frazil ice solidifies into thin sheets of nilas that freeze to an ice foot that accretes along shorelines (Wadhams 2000: 69). The expanding edge of the young ice sheet quickly infills bays and inlets, spreads offshore, and merges with the fast ice that forms around island shores. As well, amalgamated pack ice may be incorporated into a growing fast ice sheet.

Freezing air temperatures propels the development of fast ice and marked cold weather leads to quick, and thick, fast ice formation. The ultimate thickness attained by fast ice is limited, however, by the accumulation of snow cover, which insulates the ice sheet from freezing air. Around Labrador, undisturbed fast ice is usually a maximum of 1m to 2m thick (Skidmore 1979: 154; A.E.S. 1992: 28, 64). Substantial early winter snowfalls may result in thin fast ice (Wadhams 2000: 293), ice that is vulnerable to breakup through subsequent storms.

The seaward edge of fast ice, the ice edge (termed sina in Inuktituut) is fragile, especially in the early stages of ice development, and is readily eroded or broken up by wave action or wind driven pack ice. Compression of the ice edge by pack ice creates

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

pressure ridges of piled up ice, whose submerged keels may themselves become grounded on shallow sea bottoms (Wadhams 2000: 71). Grounded ridges serve as anchors that encourage further offshore development of fast ice, into areas without dry land.

Fast Ice Distribution and Extent

Fast ice is scarce or absent around the prominent headlands of Labrador because of compression by wind-driven pack ice, currents and the lack of coastal shallows to ground ice in these areas. In other areas with bays, coastal islands and shoals that provide multiple anchoring points for ice, fast ice may extend great distances offshore, as far as 40km to 60km from some shorelines. As well, the precise location of the *sina* in every region varies throughout the year as fast ice develops, retreats or is broken up by storms. Similarly, the modal location of the sina varies from year to year in relation to ice thickness and regional temperatures, snow cover, storms, and the frequency and strength of onshore winds (specifically northeasterly winds) that compress the ice edge with transported pack ice.

The maximum extent of fast ice in Labrador is attained in March (C.I.S. 2001: A-52; C.I.S. 2002: A-5; Skidmore 1979: 159). In the Torngat region, fast ice is limited to expanses of approximately 4km to 20km offshore by the frequency of exposed headlands. The larger ice extents are located in the mouths of Saglek Bay and Hebron Fjord, which have small numbers of protecting islands offshore (Brice-Bennet 1977: Map 23). Further south, are several embayments between Okak Bay and Hamilton Inlet that are protected

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

by island clusters. These areas have large sheets of fast ice that extend as much as 30km to 50km off the mainland shore (C.I.S. 2002: A-5).

Because many of the inlets and fjords in northern and central Labrador stretch far into the interior, the total extent of fast ice from the innermost fjord to the *sina* is considerable; approximately 80km in Okak Bay, over 100km around Nain, and over 150km in Hamilton Inlet (Brice-Bennet 1977: Map 31; Ames 1977a: Map 103). Islands, shoals and long fjord shores provide profound protection for most of the fast ice expanse of the inner coast. Nevertheless, fast ice is poorly developed and frequently broken around the prominent headlands of these regions, especially around Cape Mugford, Cape Kiglapait, Cape Makkovik and Cape Harrison. Rather than attempt to cross these unstable ice areas, travelers usually choose overland routes past these headlands (Brice-Bennet 1979: 113, 155; Nain Resident 1998: personal communication). South of Hamilton Inlet, the total extent of fast ice decreases to distances of 15km or less, and is confined primarily to the mouths of embayments (C.I.S. 2001: A-53). Fast ice is very limited or absent along the Strait of Belle Isle coast.

Fast Ice Clearance

Fast ice begins to deteriorate slowly in the spring, as albedo and snow cover insulate ice from warm air and solar radiation. In southern Labrador, the attrition of fast ice begins in April and early May and spreads into northern Labrador later in May (C.I.S. 2001: 27; Skidmore 1979: 157). The process of attrition begins with the pooling of water from melting snow cover on top of the fast ice sheet, which gradually reduces the reflective capacity of the ice and causes the ice to thin (Wadhams 2000: 57-58). Melt

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

water also weighs down the ice and widens cracks or creates holes as it drains. Terrestrial runoff may weaken ice around the shore and pool on the ice as well. The ice finally becomes unable to resist stresses brought by tides, currents and storms, and cracks further. Tides weaken the connection between the ice sheet and the ice foot, creating large cracks parallel to the shore and a gap of open water and loose ice which removes much of the grounded foundation of fast ice (Brice-Bennet 1979: 121). As well, ice at the *sina* cracks and shifts due to tides, currents, wind and compression.

Beginning in the exposed expanses in outer bays, around headlands, and in between widely separated islands, sections of the ice sheet separate and disperse. Once it is sufficiently compromised by consistently high air temperatures, melted snow cover, widening cracks and the loss of its shoreline ice foot, the fast ice sheet quickly fragments and disperses (Skidmore 1979: 157). At this point, the pans of fragmented ice remain inshore and melt, or join the coastal pack ice. Fast ice usually persists until mid-May to early June in southern Labrador, and until mid-to-late June in northern Labrador (Skidmore 1979: 157). Travel on the rotten fast ice is possible until late May to early June in the Nain and Okak regions (Brice-Bennet 1979; 121; Nain Resident 1997: personal communication).

Fast Ice as an Ecosystem

A variety of fish, algae and zooplankton live under fast ice. Nevertheless, few animals are capable of living on or above it. Ringed seals are the most important of these species. Alone of Labrador's seals, adult ringed seals habitually maintain breathing holes in fast ice throughout the winter. Females construct birthing dens amongst cracks and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

snowdrifts. Ringed seals and bearded seals haul out to bask on fast ice in late winter and spring. Predators, such as polar bears and humans hunt ringed seals on fast ice. Wolves may hunt caribou on fast ice as well. Several species, including humans, wolves, foxes and caribou travel over fast ice to reach hunting grounds, to scavenge carcasses or to forage on islands.

In contrast to the relatively proscribed niche represented by fast ice, the *sina* is relatively rich and diverse ecological zone (Williamson 197: 41). All species of seals in Labrador, as well as walrus, whales, sea birds, fish and terrestrial mammal predator and scavengers may all be found at the *sina*, presuming appropriate ice conditions. Harbour seals tend to prefer open, ice-free water, while the other species favour the presence of pack ice in varying concentrations. Because of the predictable occurrence of diverse marine mammals and waterfowl at the sina, it has also been a very important hunting area for the Inuit and their predecessors (Kaplan 1983; Williamson 1997: 41)

Pack ice at the *sina* is quite dynamic as currents, tides and winds constantly manipulate masses of floes. The size of ice floes present and their concentration is therefore usually in flux. Animals that prefer pack ice have more habitat once quantities of pack ice accumulates in the mid-winter and when prevailing winter and spring winds are northerlies or northeasterlies, such as those resulting from the Icelandic Low and Newfoundland Low. Westerlies of the Hudson Strait Low push ice floes offshore and open flaw lead polynyas off the *sina*; these areas are ideal habitat for harbour seals and allow harp seals to migrate as close to shore as possible.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Ice-Free Areas: Polynyas and Leads

Near-shore ice-free areas represent a third component of Labrador's winter marine environment. While they occupy only a small areal proportion of Labrador's coastal environment, ice-free patches have considerable importance as diversifying influences that bring both open water and ice-covered marine environments into closer proximity with terrestrial environments. Ice-free areas are habitats for a broader range of permanent species than those fostered by fast ice alone, they provide refuges for migrant species and they are localized hunting grounds for predators, including humans.

Areas of open water often fall close to land because of the irregular structure of the ice edge, which trends close to shore in the vicinity of exposed headlands and in the unsheltered mouths of open bays. Poorly grounded and exposed to storms, waves and currents, the fast ice that forms in these areas is limited, vulnerable and usually short-lived. While the ice edge is closer to shore in these regions, the instability of the fast ice platform and strong currents of such areas limits their suitability as habitat for many species and hinder human access to them.

Polynyas

More ecologically and economically significant areas of open water may occur amidst expanses of sheltered, in-shore fast ice in the form of *polynyas* and *leads*. Polynyas are generically defined as areas of open water surrounded by ice or shorelines, which remain ice-free for all or part of the winter (Stirling 1981: 5; Wadhams 2000: 73). Some polynyas are manifest only seasonally; in most years, they are covered in thin fast ice, new ice or pack ice during the winter and clear in the spring. Polynyas form because

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of the local influence of winds, tidal currents and upwelling of relatively warm bottom water (Dunbar 1981: 29; Wadhams 2000: 73-77) that removes or ablates, or prevents the formation of sea ice.

Latent Heat Polynyas and Rattles

While they are as yet poorly documented, the polynyas found in Labrador appear to be predominately *latent heat polynyas*, structures that form through the continuous removal of newly formed ice from freezing water by the action of winds or currents (Smith, et al. 1990: 9462). Polynya formation in the Arctic is generally considered to be primarily a wind-driven process (Dunbar 1981; Smith, et al. 1990; Wadhams 2000: 128). Given the notable strength of the winds that frequent Labrador, it is likely that winds also have a role in the formation of at least some polynyas there. A polynya in a very windy location in the inner reaches of Nachvak fjord may be such a wind-driven structure (Kaplan 1983: Fig. 14b). Nevertheless, currents seem to be the most important factor contributing to polynya formation in Labrador. The majority of Labrador's polynyas form in constricted waterways with exceptionally strong tidal currents, locally termed *rattles*. The turbulent and rapidly flowing water in a rattle sweeps forming ice from its surface and inhibits the development of complete pack ice or nilas coverage. Nevertheless, many rattles in Labrador may be temporarily covered by thin ice and snow during the height of winter and thereby present a considerable hazard to travelers who are unaware of their presence.

Unlike many of the well-known polynyas of the high Arctic, which may reach over one hundred kilometres in length, the polynyas associated with rattles in coastal

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador are small structures ranging from tens of kilometers to (most commonly) less than a kilometre in length. Some of these polynyas are completely surrounded by fast ice and so may be termed *flaw polynyas* (Smith and Rigby 1981: 7). Others are limited by shorelines as well as fast ice, and are categorized as *shore polynyas.*

Locations of Rattles

Rattles and the polynyas that form within them are located in places where coastal bathymetric features funnel tidal currents, specifically in narrow channels between islands or between islands and the mainland shore that separate wider bodies of water. Most rattles in Labrador are located, therefore, in the midst of island clusters in embayments and in the mouths of fjords. They are most frequent in the bays around Nain and Hopedale, which have dense clusters of closely spaced islands and numbers of fjords. A substantial shore polynya also forms due to very strong tidal currents in the Narrows strait, between Lake Melville and Groswater Bay (Fitzhugh 1972: 18; Ames 1977a: 279; C.N.S. 1988: 206; U.S.N.H.O. 1965: 117). Few polynyas are present north of Okak Bay because the northernmost coast has much fewer islands (Kaplan 1983: Fig. 14, 15). However, another large shore polynya forms in McLelan Strait, a narrow waterway between Killinek Island and the northernmost tip of the Labrador-Ungava peninsula, also because of exceptional tidal currents of approximately seven knots (C.H.S. 1988: 297; Kaplan 1980: Fig. 16).

Most polynyas associated with rattles are recurrent polynyas, features that form in the same locations every winter. However, some smaller polynyas may occur only intermittently, given interannual variability in local temperature or winds. During years

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in which thickened fast ice forms due to severe cold and high northerly winds, greater concentrations of pack ice may be present within polynyas. Some small inshore polynyas may freeze over and new polynyas may form further offshore as well, when the limit of fast ice expands into more marginal zones. Conversely, the formation of thinner fast ice during winters with moderated winter air temperatures may result in new flaw or shore polynyas in inshore areas, and previously "seasonal" spring polynyas remaining open through the winter. Variations in air temperature and ice thickness would also affect the date when polynyas that are ice covered during the winter actually loose their ice cover during the spring.

Polynyas as Ecosystems

Polynyas are biologically important areas as they are "windows" in the marine environment that, because of greater capacity of photosynthesis, encouraged water mixing through wind energy and salinity and temperature differences, often are much more productive environments for algae and zooplankton than surrounding, ice-covered waters (Dunbar 1981: 29; Stirling 1997). This productivity attracts a richer and more diverse range of predatory such as fish, sea birds, seals and polar bears. In addition, polynyas act as refugia for animals such as seals that may become trapped in coastal waters by episodes of rapid ice formation, and for migratory seabirds.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Leads

Leads represent a second general type of open water areas that are bounded by sea ice. Leads are gaps in ice cover that are formed and maintained by the pushing action of winds, which separate ice floes or cracked and dissociated sea ice sheets (Stirling 1981: 5). Leads take the form of long and thin linear strips of open water between ice floes. They are dynamic structures because ongoing wind stresses keep adjacent ice bodies in motion; shifts in wind direction will close leads while consistent winds may widen the gap between ice masses. Leads are most frequently features of the springtime ice environment. When they form in winter, nilas and then young ice forms quickly again, through the exposure of seawater to cold air. Leads are important for biological communities as they also encourage local water circulation, photosynthesis, zooplankton growth and allow communication between the ice edge and fast ice areas of the inner coast, to the advantage of migratory animals (Dunbar 1981; Stirling, et al. 1981; Wadhams 2000: 276).

Flaw Leads

For the purposes of this study, the most important type of leads are *flaw leads* (sometimes termed flaw lead polynyas), which develop at the seaward edge of fast ice due to offshore winds (Wadhams 2000: 75). These winds push pack ice away from the ice edge, creating long strips of ice-free water running parallel to the shoreline. Flaw leads are commonly found throughout the arctic and form most frequently in the spring (Wadhams 2000: 75). In Labrador, their development is especially frequent as springtime prevailing winds have a stronger westerly component, which transport pack

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

ice seaward. Flaw leads are also dynamic features, as shifts to prevailing onshore winds (northeasterly winds especially) will push the pack ice back up against the edge of fast ice.

Flaw Leads as Ecosystems

The presence or absence of flaw leads is a matter of considerable ecological importance in Labrador, as sea mammal habitats are largely defined by ice conditions. All species of seals, walrus and whales are attracted to open flaw leads, along with seabirds and polar bears. A mix of ice conditions with areas of both loose and dense pack ice provides habitat for the broadest range of sea mammals. Uniformly very dense pack ice excludes many species of sea mammals, such as bowhead whales and harbour seals (Stirling, et al. 1981). Walrus, bearded seals, harp seals, ringed seals and sea birds will all tolerate more dense concentrations of pack ice. Inuit ice edge hunting may be most practical in calm, clear conditions (Williamson 1997: 41) with varied pack ice concentrations suitable for a range of sea mammal species, and ample open areas for boat travel. Accordingly, calm to moderate offshore winds and the formation of consistent flaw lead systems are a certain economic benefit for Inuit hunters. Easterly, onshore winds in Labrador tend to close flaw polynas and compact drifting pack ice against the ice edge, forcing most prey species to remain further offshore in inaccessible areas and hindering boat travel (Williamson 1997: 41).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Interannual Variability in Sea Ice

Several important aspects of sea ice in the Labrador Sea region vary from year to year, including the schedule of ice formation and ice clearance, ice thickness, the volume of various types of ice and ice extent. These attributes are interrelated and depend on the same environmental factors, primarily air temperature and winds (Crane 1978; Prinsenberg, et al. 1997; Walsh 1983). Through regional wind and air temperature patterns, sea ice responds to global short- and long-term climate change processes.

Variability in Fall and Winter Ice Formation Dates

The timing and rate of sea ice formation and sea ice extent during the fall are all dependent to a large degree on atmospheric circulation patterns. Air temperature has direct influence over the local formation of sea ice, while the strength and direction of wind controls the areal distribution of sea ice, as well as the volume of ice transported into and through the Labrador Sea. Wind and temperature in Labrador are themselves symptomatic of regional atmospheric circulation patterns in the North Atlantic and respond to fluctuations in these patterns.

Crane (1978) specifically associated the date of ice formation and advance in the Davis Strait-Labrador Sea region with modes of atmospheric circulation. In his study, Crane (1978: 442) identified years with documented early ice advance in this region with the presence of deep low-pressure systems centered over southern Greenland, the Greenland Sea or Baffin Bay during October and mid-November. These types of low-pressure systems bring prevailing cold northerly to northwesterly winds to Labrador

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

which reduce daily mean temperatures, hastening the date of first ice formation and the accelerating the rate of subsequent ice formation in Labrador's coastal waters.

Another common fall atmospheric circulation mode has a low pressure system centered over Ungava has a more "summer-like" pattern of circulation with prevailing easterlies in Davis Strait (Crane 1978: 442) and southerly to southwesterly winds in southern Labrador (Banfield 1993: 14). These winds are relatively warm and delay the onset of freezing conditions in the Labrador Sea. They also impede the transport of early season pack ice from Baffin Bay until the more typical winter-pattern of deep lows over the Greenland Sea or Baffin Bay.

Winds and air temperature are primary influences on ice conditions in the Labrador Sea during the winter months as well. As in the fall, cold northwesterly winds propel the southward transport of pack ice and seaward expansion of ice extent (Prinsenberg and Peterson 1992; Prinsenberg, et al. 1997: 32). Furthermore, the cold air transported by these winds stimulates ongoing local production of ice in the Labrador Sea. The winter extent of pack ice in recent decades has been demonstrated to correlate most strongly with air temperature, while in some years the strength of local northwesterly winds appears to be more significant (Prinsenberg, et al. 1997: 32). It is possible that wind strength is the more important factor in southern Labrador as the region collects ice from a larger area than northern Labrador, and has a shorter local ice formation period. The extent of pack ice around Northern Labrador, by contrast, might be more indicative of air temperature.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Variability in Spring and Summer Ice Clearance Dates

The potential causes of delayed ice clearance are varied and involve the volume of the incumbent winter ice mass, air temperature and winds. Several researchers have noted that both late winter ice extent and spring/summer clearance dates are positively related to ice extent earlier in the winter. Peterson, et al. (2000: 5) reported that between 1963 and 1998, the extent of ice in the Labrador Sea south of 55°N (the approximate latitude of Makkovik and Cape Harrison) in May to July correlated with ice extent in winter (from January to March). Similarly, Newell (1996: 64) noted a statistically significant, though weak, correlation between sea ice extent anomalies in the Labrador Sea/Davis Strait region and the dates of clearance of sea ice off the Labrador Coast between 1958 and 1988.

Air temperature is another important factor determining the spring ice extent and date of ice clearance in the Labrador Sea region, just as it is in other regions of the Arctic (Walsh and Johnson 1979). Winter pack ice accumulation, both in the Labrador Sea and in regions further north is driven by winter air temperature. Accordingly, the volume of ice present in the Labrador Sea at the beginning of spring, or being transported there, is also determined by winter air temperature. In turn, the rate of melting, and the timing of the onset of melting are determined primarily by spring and summer air temperatures (Crane 1978: 441; Peterson, et al. 2000)

The extent of ice in the south Baffin Island-Davis Strait (north of 58°N) from March to June is statistically correlated with negative air temperatures from March to May in that region (Peterson, et al. 2000: 12). The volume of pack ice in the Davis Strait has a direct and positive influence on subsequent spring and summer ice conditions in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador, as much of this ice is transported to the Labrador coast. The extent of spring and summer sea ice north of 48°N (the Labrador Sea and Newfoundland shelf) is also associated with earlier regional temperature. In this case, sea ice extent from April to June is strongly correlated with air temperatures from March to May and November to February, as measured at Cartwright (Peterson, et al. 2000: 21).

Wind is a third important factor determining spring ice extent and the date of ice clearance. Winds influence local air temperature and, in so doing, affect local ice formation and melt rates. Furthermore, as the primary agent propelling pack ice into the Labrador Sea (Prinsenberg, et al.1997), wind determines the volume of transported ice and ensures the presence of ice in the Labrador Sea long after local ice formation has ceased. Accordingly, the capacity of the Labrador region to form and retain sea ice, as well as the amount of transported ice it receives, varies directly in response to variability in the strength and direction of winds.

Crane (1978) linked the date of ice clearance in the Davis Strait and Labrador Sea to summer atmospheric circulation patterns. Crane (1978: 441-442) observed that atmospheric circulation patterns in years with late ice clearance had, in the months of June, July and August, weakly developed low-pressure systems located over Baffin Bay in particular. These low–pressure systems are associated with relatively frequent northerly winds and, to a lesser degree, with reduced wind velocity, and hence with delayed ice clearance.

In contrast to those with late ice clearance, Crane (1978: 444-445) determined that years with early ice clearance were associated with the presence of low-pressure systems centered over the region of Foxe Basin, Ungava, and the Hudson Strait during June, July

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and August. This mode of circulation brings more days with prevailing warm southerly winds to the Labrador Coast and reduces the number of days with cold northerly winds. These conditions increase melting and speed removal of coastal pack ice by pushing it out to melt in the relatively warm water of the Atlantic (Crane 1978: 443).

Newell (1990: 178, 1996) demonstrated that summer ice clearance dates in the western Labrador Sea were also related to regional atmospheric circulation patterns during the preceding spring, and specifically to the mean May pressure sea level gradient across Davis Strait. The Davis Strait pressure gradient is significant because it indicates the strength and direction of winds in the Davis Strait and therefore the scale of wind-driven transport of pack ice through Davis Strait into the Labrador Sea.

Common patterns of May circulation include low-pressure systems centered in the regions of southern Greenland, the Greenland Sea, Iceland, the eastern Labrador Sea and east of Newfoundland (Newell 1990: 144-154). These circulation modes tend to produce prevailing cold northerly, northwesterly and northeasterly winds in the Labrador region and inhibit ice melting. In addition to their cooling effects, the Labrador Sea and South Greenland low-pressure systems in particular produce strong northerly winds that increase transport of ice from Baffin Bay and Davis Strait against the Labrador Sea (Newell 1990: 144, 149-151, Fig. 34). Prevailing northeasterly winds associated with some examples of the Newfoundland low also tend to drive pack ice into the Labrador coast (Newell 1990: 133, Fig. 30). These patterns of circulation inhibit melting while facilitating transport, influencing the quantity of sea ice present in the Labrador Sea at the beginning of summer.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Like Crane (1978), Newell (1990) related examples of early ice clearance primarily to regional circulation patterns dominated by the presence of a low-pressure zone centered in the region of Foxe Basin, Ungava and Hudson Strait. Low-pressure centers in these areas create strong and warm southerly winds in the Labrador Sea, Davis Strait and Baffin Bay that impede the southward movement of pack ice. Accordingly, southerly winds reduce the volume of pack ice transported into the Labrador Sea after May, and accelerate the ablation of ice that is present at that time, facilitating earlier clearance of pack ice. In addition, the presence of low-pressure systems centered south of Iceland is also associated with moderately early ice clearance in the Labrador Sea (Newell 1990: 148). The Icelandic Low fosters an easterly wind component along with its prevailing pattern of northerly wind in the Davis Strait region. Although these easterly winds are cold, they impede the southward transport of pack ice out of Davis Strait, thereby reducing the volume of ice present in the Labrador Sea in the summer (Newell 1990: 148-150).

The relationships demonstrated between ice clearance dates, atmospheric circulation and temperature are significant for this study, as they emphasize that spring ice conditions in the Labrador Sea are not simply local phenomena. They reflect trends in general springtime climate conditions elsewhere in the northwest North Atlantic and ice conditions earlier in the winter. These interrelationships provide opportunities to model past ice conditions through the use of proxies, and suggest that ice indices derived primarily from season-specific observations may have demonstrable, broad relationships to ice conditions defined in more general seasonal or regional fashions.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Influences of Hemispherical and Global-Scale Circulation Patterns and Climate Systems on Sea Ice

Variability in sea ice characteristics in the eastern Arctic are also linked to hemispherical and global scale climate processes, such as the North Atlantic Oscillation and the El-Niño-Southern Oscillation (Prinsenberg, et al. 1997: 32-33; Walsh 1983). As discussed earlier, inter-annual variability in sea ice characteristics such as volume, thickness and extent in the Labrador Sea are largely related to temperature and wind patterns, which are determined by atmospheric circulation in the North Atlantic and Eastern Arctic regions. In turn, regional circulation patterns are components of, or respond to, much larger circulatory systems linking hemispheres and continents. Fluctuations in these larger systems of atmospheric circulation have ripple effects on both the immediate climate of Labrador, and on sea ice in the region. Shifts in the dominant modes of these large-scale climate systems may as well produce long-term trends in sea ice conditions.

The North Atlantic Oscillation and Sea Ice Variability

Most immediately, sea ice conditions in the Labrador Sea are linked to the North Atlantic Oscillation (NAO), the region's most significant climate forcing agent. The strongest elements of sea level atmospheric circulation in the North Atlantic are a low pressure system centered in the Iceland/Greenland Sea region (the Icelandic Low) and a high pressure system at sea level around the Azores (Hurrell 1995). The relative strengths of these paired systems are conventionally expressed in terms of the NAO

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

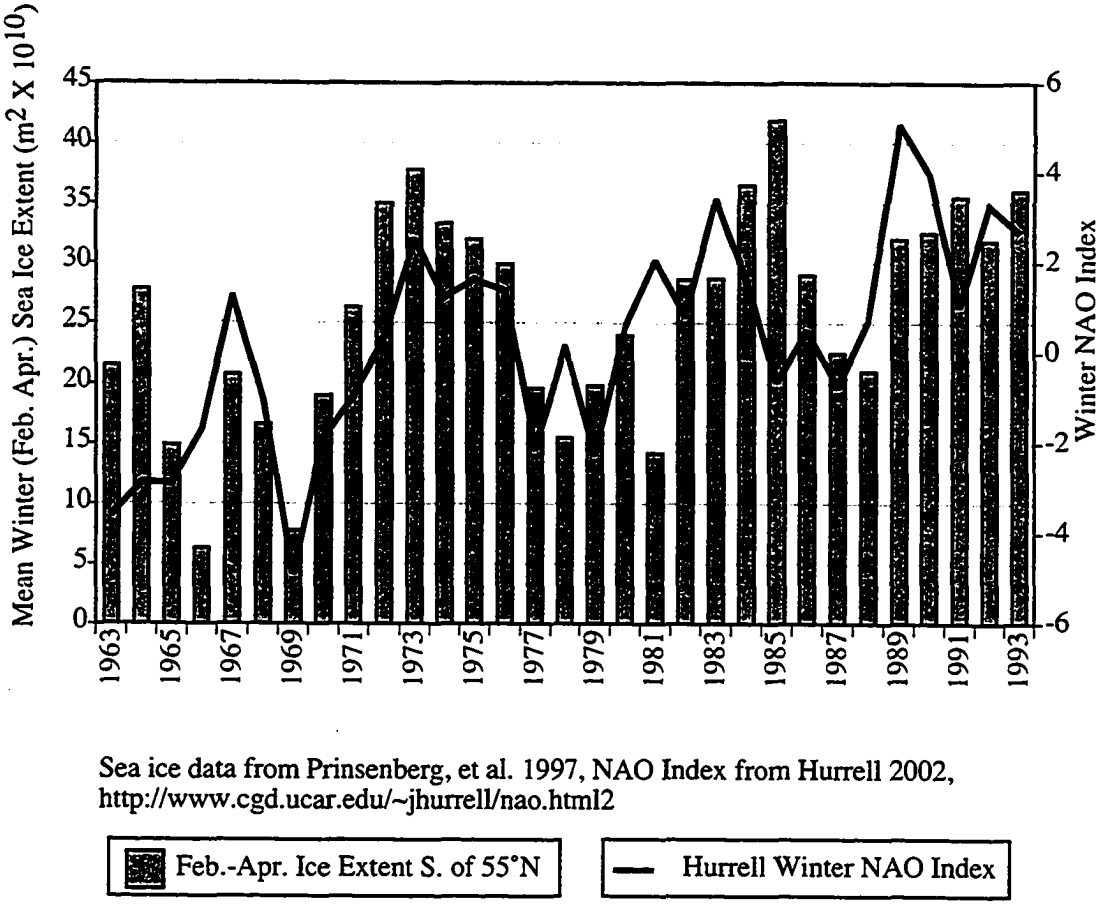
index, calculated from the difference in mean sea level pressures in the Iceland and Azores regions (Hurrell and Van Loon 1997:73).

A positive NAO index reflects vigourous circulation in the North Atlantic produced by a pronounced Azores High combined with a deepened Icelandic Low (Hurrell 1995: 676). These conditions lead to strong prevailing warm westerly winds in the eastern North Atlantic and Europe and reduced sea ice extent in the Greenland Sea (Prinsenberg, et al. 1997). Also during periods with high NAO index values, the western North Atlantic and eastern Arctic regions experience decreased air temperatures while eastern Arctic regions experience decreased air temperatures and increased severity of sea ice (Hurrell 1995: 676; Mysak, et al. 1996; Prinsenberg, et al. 1997; Wang, et al. 1994).

Conversely, a lower NAO index is associated with moderated circulation in the atmosphere of the North Atlantic. Both the Icelandic Low and the Azores High weaken, while prevailing northerly winds bring greater cold in the eastern North Atlantic and Europe, and increased sea ice in the Greenland Sea (Hurrell 1995: 676; Hurrell and Van Loon 1997: 306; Power and Mysak 1992). Sea ice in the western North Atlantic tends to decrease during periods demonstrating low NAO indices (Hurrell 1995; Prinsenberg, et al. 1997). This see-saw effect in temperature and sea-ice conditions between the eastern and western North Atlantic is due to the transfer of prevailing arctic air flow from one side of Greenland to the other, in relation to the varying strength of Atlantic circulation. Regional climatic trends toward decreased air temperature; increased sea ice formation and sea ice transport follow the path taken by arctic airflow.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 3.5 Time Series of Mean Winter Sea Ice Extent (Feb.-Apr.) South of 55°N and Winter Mean North Atlantic Oscillation (NAO) Index (adapted from Prinsenberg, et al. 1997).



Sea ice data from Prinsenberg, et al. 1997, NAO Index from Hurrell 2002, http://www.cgd.ucar.edu/~jhurrell/nao.html2

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The NAO influences temperature and sea ice conditions in the Labrador Sea, as well as the general North Atlantic region. Some of the sharpest temperature anomalies produced by the NAO are in the Labrador Sea. During the winter, the NAO index has a significant and strong positive correlation with prevailing northwesterly winds, air temperature and sea ice extent in the Labrador Sea (Peterson, et al. 2000: 15-17; Prinsenberg, et al 1997: 35). Increases of ice formation and ice transport in this region are linked to the positive mode of the NAO. Mean winter ice extents (based on February to April) south of the Makkovik region (55°N) (C.I.S. 2000) and the winter NAO index for the years between 1963 and 1993 are graphed in Figure 3.5 (Hurrell 1995, 2002).

The graph shows that the trend of winter ice extent during this period is very closely related to the winter NAO index, as increases in the NAO index are matched by increased ice extent, or vice versa, in almost all these years. In particular, high NAO index values accompanied by increased ice extent are noted for the early 1970s, mid 1980s and early 1990s. Extreme positive and negative NAO index values are consistently matched by increased or decreased sea ice, respectively.

The association between the winter NAO index and ice extent demonstrated in Figure 3.5 is not always straightforward, however. During some years with moderate NAO index values, the index and sea ice extent are out of phase. As well, the precise extent of ice is not a standard ratio of the NAO index. Despite the demonstrated positive relationship between sea ice extent and the NAO index, Peterson, et al. (2000: 15) reported that winter sea ice extent was most closely correlated with temperature and wind pattern. This suggests that the NAO index is predictive of broad hemispherical trends, and that sea ice conditions in any specific region are most directly responsive to local

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

temperature and wind variables (Peterson, et al. 2000: 21; Prinsenberg, et al. 1997: 32). Other potential variables that influence sea ice extent include salinity (Mysak, et al. 1990), solar activity (Hill and Jones 1990) and other global scale atmospheric circulation phenomena.

The extent of sea ice during the spring is also positively, although less strongly, correlated with the winter NAO index (Prinsenberg, et al. 1997: 33, 35). This relationship most likely reflects the lag of winter sea ice that remains in the Labrador Sea at the beginning of spring, the quantity of which is directly related to the winter NAO index. Spring ice extent is not, however, statistically correlated with the spring NAO index (Prinsenberg, 1997: 33, 35).

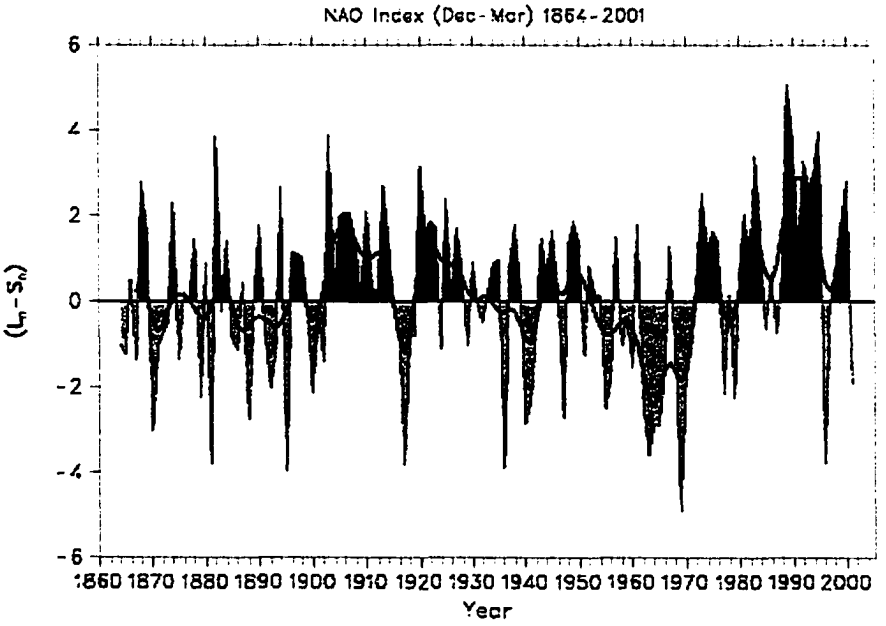
The NAO index shows a great deal of interseasonal and interannual variability and frequently fluctuates between positive and negative modes. Nevertheless, the mean winter NAO index has been shown to vary on approximate biennial and decadal scales (Hurrell and Van Loon 1997). The winter NAO index from 1864-2001 is graphed in Figure 3.6, illustrating the degree of variability on these scales. Such variability is significant for it means that the one mode of the NAO may dominate in winter for consecutive years, along with associated sea ice conditions. Medium-term climate and sea ice trends may result when consecutive decades are dominated by a particular mode of the NAO. It is apparent that particular modes of the NAO have dominated large spans of time since the late 19th century.

Between approximately 1900 and 1930, and since about 1980, the positive mode obtained in winter with only a small number of exceptions. Similarly, the negative mode of the NAO was manifest from 1950 to 1970, with only isolated, single-year occurrences

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of mean winter positive NAO modes during that period. NAO-related variability in atmospheric circulation is capable, therefore, of forcing long-term sea-ice trends in the Labrador Sea. A final point of note lies in the transitions between long-term positive or negative modes of the NAO seen in Figure 3.5. Many transitions, such as those of ca. 1900, 1915 and 1920, are often very rapid and abrupt, even when considering the smoothed curve of normalized sea level pressure anomalies. This kind of staccato transformation suggests that climate change in the North Atlantic may operate more in the fashion of thresholds punctuated equilibrium rather than of gradual trends.

Fig. 3.6 North Atlantic Oscillation Time Series: Winter (Dec-Mar) NAO Index based on the difference of normalized sea level pressure (SLP) between Lisbon, Portugal and Stykkisholmur/Reykjavik, Iceland since 1864, SLP anomalies normalized (black line) by division of each seasonal mean pressure by the long-term mean (1864-1983) standard deviation. Graph from Hurrell (2002)



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The El Niño/Southern Oscillation and Sea Ice Variability

The El Niño/Southern Oscillation (ENSO) is a second global-scale influence on atmospheric circulation and sea ice in the eastern Arctic and the Labrador Sea. This influence was identified relatively recently (Rogers 1984; Wang, et al. 1994) and accordingly it is still only partially understood. Nevertheless, the relationship between the ENSO, sea ice and atmospheric circulation in the Labrador Sea is complex and variable in terms of period, seasonality, location and strength of each ENSO event (Power and Mysak 1992; Newell 1996: 63).

Several researchers (Power and Mysak 1992; Mysak, et al. 1996) have noted that strong ENSO episodes in the later 20th century were associated with decreased winter air temperature and increased accumulation of pack ice in Baffin Bay, Hudson Bay, the Labrador Sea and adjacent northwest North Atlantic Ocean (regions north of 50°N). During strong fall to winter ENSO episodes, the influence of the Pacific North American teleconnection pattern tends to intensify a high pressure zone over central Canada which, in turn, strengthens northerly winds over Hudson Bay and the Labrador Sea (Mysak 1996: 315; Wang et al. 1994). These northerlies encourage sea ice formation earlier in the winter, and both ice formation and transport throughout the winter, and may reinforce the winter Icelandic Low. In addition, ENSO episodes may produce lower sea level air pressures and temperature in the Gulf of Alaska that move eastward and may encourage sea ice development in throughout the Canadian Arctic (Mysak, et al. 1996: 315). Through these processes, strong ENSO episodes may have the capacity to increase the effect of a coincident positive winter NAO phase (Mysak, et al. 1996: 315).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Newell (1996) demonstrated a link between ENSO events and the date of spring/summer ice clearance in the Labrador Sea south of 55°N, though this relationship appears to be more complicated than that of the winter. Using a long-term data set of ice clearance dates, Newell found that strong ENSO events were correlated with early ice clearance dates during most of the 20th century, while years with reduced Pacific circulation were correlated with late ice clearance dates. In particular, Newell's study suggested that ENSO episodes in the late autumn and early winter (especially September to December) lead to a weakened or removed Icelandic Low during May (Newell 1996: 66), a month in which atmospheric circulation tends to be in flux between winter and spring modes.

A weakening of the Icelandic Low in May allows an alternative low-pressure system to develop in the Hudson Strait-Ungava region. As discussed earlier, the Hudson Strait Low brings warm southwesterly air flow into the Labrador Sea and Davis Strait, blocking the southward advection of pack ice, increasing melting and hastening the clearance of ice (Crane 1978; Newell 1990). Conversely, a maintained Icelandic Low allows northerlies typical of the winter to continue to prevail in Baffin Bay and the Labrador Sea into May, facilitating southward pack ice transport and delaying the onset of melting.

Based on this work, it seems that the influences of ENSO on sea ice conditions in the eastern Arctic-western North Atlantic regions are seasonally and spatially variable. In winter, strong ENSO episodes contribute to declining temperatures and encourage sea ice formation, especially in more northern latitudes. Fall and winter months with ENSO episodes are associated with a weakened Icelandic Low in May and ultimately encourage

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

earlier ice clearance in the southern Labrador Sea by blocking the transport of pack ice from more northern regions with increased southerly air flow. During years when ENSO events coincide with positive winter NAO modes, particularly cold air temperatures and severe ice conditions may result in the Labrador Sea and neighbouring regions. Like the NAO, the frequency of ENSO episodes is variable, with moderate to strong events that occur between 1 to 10 years during the 20th century.

Summary

The purpose of this chapter has been to examine the major aspects of Labrador's physical geography, climate and the influence of large-scale climate systems on Labrador. In this chapter, the topography of Labrador, seasonal and latitudinal variations in temperature and precipitation, ocean currents and modes of atmospheric circulation were surveyed. As well, the sea ice environment of Labrador was described in terms of the characteristics of pack ice, fast ice and open water areas, the annual schedule of ice formation and dispersal, and the extent of ice coverage. Finally, the nature of interannual and long-term variability in climate and sea ice conditions was reviewed.

Labrador is a zone of transition between arctic, subarctic and temperate environments. This transition is not smooth, however, as Labrador's extended coast is divided by mountain chains, headlands, embayments and island clusters, creating a series of protected environmental pockets. While it is only of moderately north latitude, marine and atmospheric circulation patterns bring strong arctic influences to Labrador. The average daily mean temperature for all but the extreme south of Labrador is below freezing and sea ice is usually present on the coast from as early as November to as late

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

as July. Arctic influences are particularly strong in winter, when deep low-pressure systems draw constant streams of air from more northern latitudes. In the short summer, weakened arctic circulation allows mid-latitude influences and warm air to move into the region, though these are always vulnerable to rejuvenated arctic circulation.

The climatic situation of Labrador is related to hemispherical and global scale circulation process (the NAO and ENSO) as well as to regional circulation effects. Accordingly, basic aspects of the environment, such as temperature, precipitation, sea ice formation and extent, and polynya formation vary within and between years, in relation to external influences. These factors are all of importance to the ecology of Labrador, for they influence animal and plant habitats, range limits and breeding territories. They are also of direct importance to the human inhabitants of Labrador, through their influence on subsistence, modes and routes of travel, as well as other aspects of cultural life. Large-scale trends in the NAO and ENSO circulation modes may foster the maintenance of particular climatic conditions in Labrador over extended periods of time, with accompanying ecological and biogeographic trends. Equally, meteorological research concerning the function of the NAO in the recent past suggests that marked climatic variations in annual and decadal scales are also part of the North Atlantic climate system. The transitions between longer-term states of the NAO may also take the form of short and sharp breaks rather than gradual transitions.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 4

ECOLOGY OF LABRADOR AND LOCAL-SCALE LAND USE

Introduction

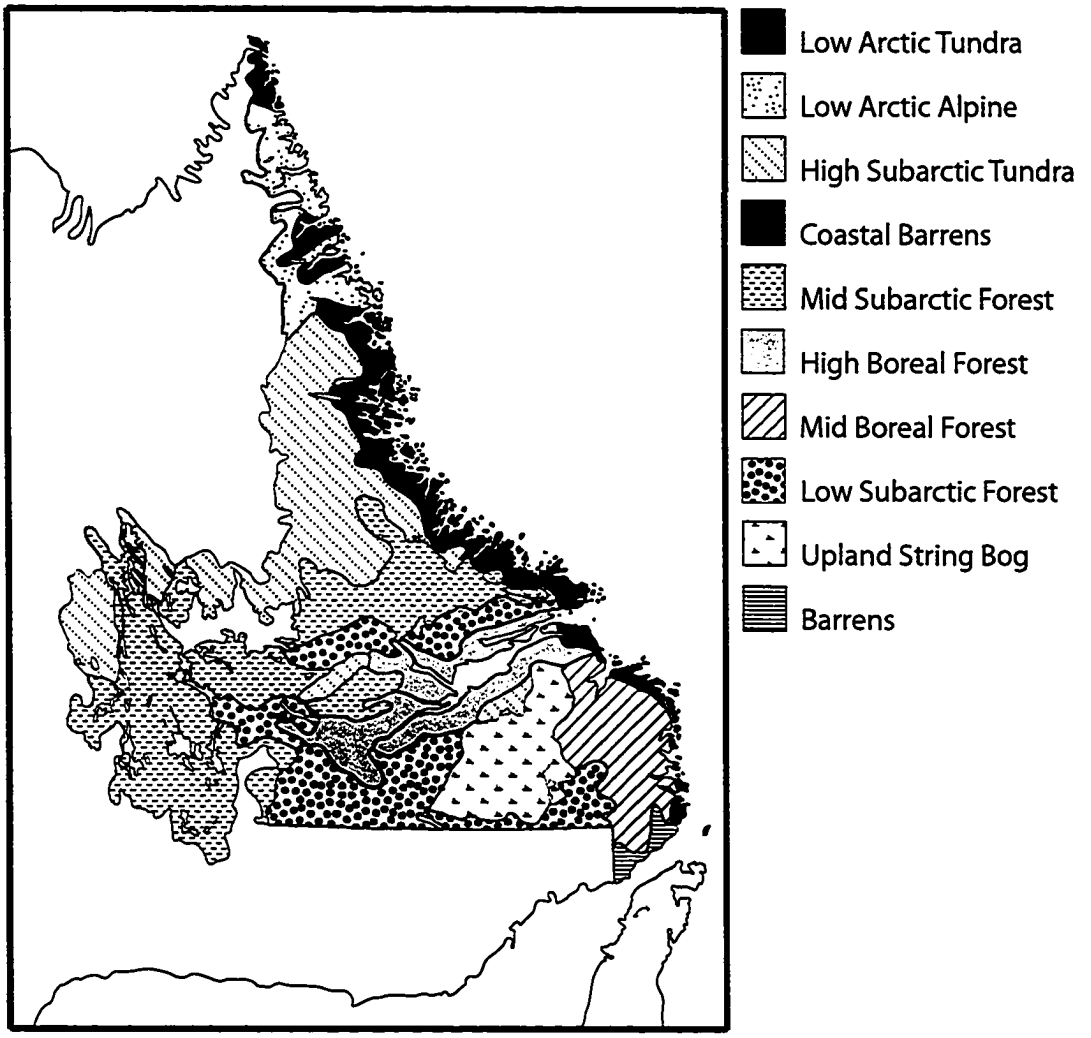
This chapter has two major objectives. First, it presents a description of the ecological characteristics of Labrador's landscape and seascapes, as defined at a regional scale. Regional ecological zones are mapped and described and summary descriptions of the species of plants and animals found in these ecological zones are presented. The impact of climatic variations on ecological boundaries, range limits and life histories of these species are also considered. Then, a discussion of landscapes and seascapes within particular localities that are importance in this study is presented. These areas include Hamilton Inlet, the Nain Bay/Dog Island locality and Okak Bay, areas that contribute zooarchaeological data used in this study. This discussion touches upon patterns of recent Inuit land use by Inuit in these areas. The characteristics of sea ice formation, extent, dispersal and variability in these localities are also reviewed.

Terrestrial Ecological Zones

Broadly defined ecological regions for Labrador were outlined by the Province of Newfoundland and Labrador Department of Forestry, on the basis of climatic data and phytogeography (D.F.R.A. 2002), and are presented in map form in Figure 4.1.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 4.1: Map of Terrestrial Ecological Zones in Labrador (adapted from D.F.R.A. 2002; McManus and Wood 1991: Plate 17)



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A description of these ecological zones, as defined by the Province of Newfoundland and Labrador Department of Forestry, follows. Along with vegetational communities, these zones reflect the structure of Labrador's landscape in terms of elevation, soil, precipitation, drainage, geology, and climate. The ecological zone boundaries mapped in Figure 4.1 are very similar to the climatic zones illustrated in Figure 3.3, and it is apparent that climate is of decisive importance in shaping the distribution of vegetation communities.

In general, Labrador's ecosystems grade from arctic tundra to subarctic forest (or *taiga*) to boreal forest environments in a north-south continuum. A west to east gradation of continental to marine-dominated environments is also noted, with accompanying changes in vegetation communities. Forests are taller and more productive in continental regions, while in coastal regions, forests are shorter, open and limited to sheltered areas while rocky and shrubby barrens and bogs are common.

Low Arctic Alpine and Tundra Regions

The northern third of Labrador is composed of low arctic alpine and tundra regions. These areas have generally high relief, a very short growing season which decreases with northerly latitude, permafrost, and minimal soil development. In addition to unvegetated bedrock or sediment, vegetation communities include lichens, mosses, sedge meadows and, in more sheltered places, dwarf trees and shrubs such as willow (*Salix arctica, S. arctophilia, S. argyrocarpa*), dwarf birch (*Betula glandulosa*), and woody shrubs such as crowberry (*Empetrum nigrum*) and blueberry (*Vaccinium angustifolia*) (D.F.R.A. 2002; Lamb 1984: 38-39; McManus and Wood 1991: Plate 17).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Subarctic Tundra and Subarctic Coastal Barrens

The entire coastal region south of Okak Bay to the Strait of Belle Isle and a large portion of Labrador's northern and western interior and isolated highlands are subarctic barrens or subarctic tundra environments. These areas have long, severe winters, short, cool summers and continuous to patchy permafrost. The coastal areas are composed mostly of barrens vegetated with crowberry, blueberry and other berry shrubs, palsa bogs (with frozen peat substrates) and shoreline salt marshes. Lower slopes and sheltered areas in the coastal region have open, fire-prone forests of dwarf shrubs and low black spruce (*Picea mariana*) and, further north, white spruce (*Picea glauca*) with moss understories (D.F.R.A. 2002; Lamb 1984: 40). Krummholz spruce trees, which grow with branches running along or near the ground because their growth of straight leaders is limited by winter winds, snow cover or grazing, are common in coastal regions (Lamb 1984: 43).

The northern edge of the Subarctic Coastal region is the continuous treeline which, at present, runs through the Okak Bay region. There are, as well, two isolated patches of spruce and larch (*Larix laricina*) forest in the deep sheltered valleys draining into Hebron Fjord and Napaktok Bay (McManus and Wood 1991: Plate 17). These isolated forest patches within the low arctic tundra may result from a southward drift of the treeline or localized loss of intervening woodlands through non-climatic agents.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

High Subarctic Tundra

Interior lowland portions of the subarctic region are classed as the High Subarctic Tundra region. These areas have extensive closed black spruce and larch forests restricted to valley bottoms and sheltered lower slopes (D.F.R.A. 2002). Open black spruce forests with *Cladonia* lichen groundcover grow on flat terraces and permafrost peat bogs are present in depressions. Higher upland areas have vegetation similar to that of alpine tundra areas.

Mid-Subarctic Forest

A very continental subarctic climate characterizes the mid-subarctic forest region, which occupies a broad arc of central and southern Labrador between approximately 55°N, the region of Groswater Bay and the southwestern Labrador interior (McManus and Wood 1991). This region comprises a mix of barren uplands and lowlands with numerous lakes, watercourses and bogs. Much of the area is vegetated in low open forest of black spruce, larch, jack pine (*Pinus banksiana*), trembling aspen (*Populus tremuloides*) and, in the north of the region, white spruce, along with a lichen understory (D.F.R.A. 2002). Low-lying wetlands have peaty string bogs bordered by black spruce forest with moss understory. Both open and closed black spruce forests dominate the hilly regions north of Hamilton Inlet.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Boreal Forest

The lowland areas around Lake Melville, the Churchill River, and interior valleys of southeastern Labrador have continental Boreal Forest environments with relatively long growing seasons up to 140 frost-free days (McManus and Wood 1991). They are the most moderate and, in terms of plant life, the most productive and diversified terrestrial environments in Labrador (D.F.R.A. 2002). A variety of tree species are presented in the close canopied forests of this region, including predominately balsam fir, white birch *(Betula papyrifera)*, trembling aspen and black spruce. In areas of higher elevation, open black spruce and lichen woodland dominates. Fens are present in upland depressions, while peat bogs are present along coastal flats.

The interior highland region south of Hamilton Inlet is composed of Low Subarctic Forest and extensive string bog areas. The vegetation of these areas is a mix of sparsely forested heath, extensive areas of open, stunted black spruce and balsam fir forests, and rocky exposed upland barrens (D.F.R.A. 2002). As well, plateau areas and low peaty wetlands have string bogs and mossy fens containing alders (*Alnus crispa*), Labrador Tea (*Ledum groenlandicum*) and scrub black spruce (Lamb 1980).

Finally, boreal coastal barrens are present along the Strait of Belle Isle coast. This ecological region has extensive areas of exposed bedrock, crowberry barrens, bogs on slopes and stands of scrubby spruce and larch (D.F.R.A. 2002; Lamb 1980, 1984: 40). The Strait of Belle Isle region is very windy, stormy and has a reduced growing season, despite its southerly location (McManus and Wood 1991).

Climate changes have direct effects on the boundaries of these ecosystems. First of all, cooling and warming trends will directly effect the permafrost limit, with

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

concordant effects on soil development and phytogeography. As demonstrated in an analysis of pollen in lake cores from around Hamilton Inlet (Jordan 1975), southern Labrador and both interior and northern Labrador (Lamb 1980, 1984, 1985), prolonged warming phases encourage the movement of the tree line to more northerly latitudes and higher altitudes. This type of change indicates a northward shifting of ecological zone boundaries. In general, species diversity increases during warm phases and woodland tend to expand toward the north and west (Jordan 1975: 109). Black spruce appears to be a significant colonist species in the expanding of woodlands (Jordan 109-110).

Conversely, cooling phases in prehistory have brought apparent southward contraction of the tree line and its reduction in altitude, expansion of tundra environments south, formation of krummholz spruce woodlands, and reduced overall species diversity (Jordan 1975; Lamb 1984; 1985). Several phase of forest advance and contraction have occurred since the spread of the first woodlands after 9000 BP (Jordan 1975; Lamb 1980, 1984, 1985). These changes appear to have been slow in cultural terms, nevertheless the dating of the lake cores was not precise to precisely define rates of change.

A Brief Survey of the Animals of Labrador

Terrestrial Animals: Nunamuitak

Like most arctic and subarctic regions, Labrador's terrestrial ecosystems lack a diversity of vertebrate species. Few terrestrial mammal species are present in the region, while many bird species are migratory. A brief survey of terrestrial animal species follows, concentrating on species with particular ecological significance and those of importance for Labrador Inuit subsistence.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Small Herbivores

Herbivore species are in particular poorly represented in Labrador. Of these, rodents are the most well-represented mammal family and include a variety of marmots, squirrels, mice, lemmings and voles, such as American Red Squirrel (*Tamiasciurus hudsonicus*), Marmot (*Marmota monax candensis*), Deer Mouse (*Peromyscus maniculatus maniculatus*), Northern Bog Lemming (*Synaptomys borealis*) and Collared Lemming (*Dicrostonyx torquatus*. These species live variously amidst moist grasses, sedge bogs, lichen and moss forest understories, subarctic coniferous forest and barren tundra (Banfield 1974: 141, 165, 190, 195). Most of these species are generalist foragers that eat seeds, buds and new leaves, grasses and sedges, berries, twigs bark, insects and shoreline flotsam. These particular species are not of direct economic importance for Labrador Inuit. Nevertheless they are, in their numbers, a fundamental part of the terrestrial ecosystem as prey for a variety of predators. Many rodent species are also subject to cyclical population variations from season to season and from year to year, which also have consequences for the size and health of predator populations. Some have specialized niches, and so are sensitive indicators of ecological circumstances.

Some of the larger rodent species are of additional interest. American Beaver (*Castor canadensis*) are aquatic mammals and occupy forested wetland areas and riparian woodlands in the southern half of Labrador (Ames 1977a; Banfield 1974: 161) and play an important ecological role maintaining wetlands. The range of beavers is currently expanding north; formerly very rare around Nain, they are now commonly reported there (Williamson 1997: 28). Muskrats (*Ondatra zibethicus*) are also aquatic mammals and are

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

found in wetlands, lakes and rivers from southernmost Labrador into the tundra regions of the Torngat Mountains (Banfield 1974: 200). Both of these species are large enough to be useful resources for human subsistence and were extensively trapped in Labrador for their pelts during the 19th and 20th centuries (Ames 1977a).

Porcupines (*Erethizon dorsatum*) are large rodent herbivores and, as primarily arboreal forest dwellers, their range closely follows the tree line (Banfield 1974: 234). Nevertheless, in northern Labrador, porcupines are also found in coastal environments with mixed tundra and low scrub woodland. They forage for leaves, needles and bark of perennial green plants, shrubs and trees from the ground in low open woodlands and shelter in rocks and brush. Porcupines are also hunted for food by the Inuit (Ames 1977a: 285), and are a prey species of wolverines. Like the beaver, porcupines are seen in increasing numbers in northern Labrador in Labrador, suggesting that their range is expanding north (Williamson 1997: 28).

The Snowshoe hare (*Lepus americanus*) and Arctic hare (*Lepus arcticus*), lagomorph herbivores, are both found throughout most of Labrador. Both feed on leaves, buds, grasses, berries and woody plants; the snowshoe hare is associated with forested areas, while the arctic hare is dwells in tundra environments (Banfield 1974: 82, 87). Both are an important prey species for animals such as foxes and wolves, and are hunted by Inuit for food (Williamson 1997: 50). They are also subject to sharp cyclical population variations, with a modal periodicity of about 10 years (Banfield 1974: 82).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Large Herbivores

The largest terrestrial herbivores in Labrador are members of the Cervidae family, including caribou (*Rangifer tarandus*), moose (*Alces alces*) and white-tailed deer (*Odocoileus viginianus*). Only the periphery of the white-tailed deer's range extends into the boreal coastal regions of southeastern Labrador, while that of moose includes the subarctic forest of southwestern Labrador (Banfield 1974: 394, 397). Nevertheless, in recent years, moose have been observed more often in the heads of bays in the vicinity of Nain and their range appears to be expanding north (Nain Resident 1998: personal communication; Williamson 1997: 27).

Caribou

The range of caribou extends throughout Labrador and includes arctic and subarctic tundra and subarctic and boreal woodland habitats (Miller 1982: 923-925). Caribou feed on *Cladonia* lichens and moss ground cover on tundra and in forest understories as well as upon the leaves of shrubs. Caribou are of tremendous economic importance to the Inuit of Labrador, both in the present and the past (Brice-Bennett 1977: Williamson 1997: 25-26). Caribou are quite large animals, and those of Labrador are somewhat large in comparison to caribou of other regions (Miller 1982: 925). Adult females weigh in excess of 90kg, and males weigh over 100kg (Banfield 1974: 385), and provide large amounts of food in the form of meat, marrow, fat and bone grease. Williamson (1997: 26) reports that adult caribou in Labrador, dressed out, yield in the order of 50kg to 100kg of food.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Caribou carcasses also provide a wide range of raw materials that were essential to traditional Inuit material culture. Skins were used by the Inuit generally for clothing and bedding, sinews for thread, and bone, antler and hooves were used for making a myriad implements used in daily life, from antler harpoon heads to skin scrapers made of bone (Stenton 1991: 56). Caribou are most healthy and fat, and therefore most desirable as food, in the summer and fall. By early spring, after the deprived diet of winter and the exertions of calving and milking, many caribou are very lean. The most useful caribou skins are taken from animals killed in the fall, when they have a thick, warm coat.

Banfield (1974: 387) and Miller (1982: 923) identified all the caribou in Labrador as belonging to the subspecies *Rangifer tarandus caribou*, or woodland caribou. Nevertheless, there are distinct caribou populations in Labrador, which are defined by physical characteristics, behaviour and the tundra or forest habitats they occupy. These are the Labrador Barren Ground Caribou, of northern Labrador, and the Eastern Woodland Caribou, which are linked with southern Labrador (Harper 1961).

The caribou of northern Labrador are part of the immense George River caribou herd, which numbered approximately 750,000 individuals in 1993 (Williamson 1997: 25). This herd ranges widely through Ungava and Labrador north of Hamilton Inlet and Lake Melville, and uses a mix of tundra and taiga environments. Because grazing lands suitable for caribou are scarce in the low arctic cordillera of the Torngat mountains, caribou are much more scarce there than further south (Harper 1961: 134, 136).

The George River herd is in fairly constant movement throughout the year. In general terms, within Labrador, caribou of this herd migrate between coastal areas in summer and the interior in winter and tend to follow established migration routes.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Nevertheless, this herd does not act as a single, cohesive, social unit and there is a great deal of variability in the migration patterns of caribou in different regions (see Brice-Bennett 1977b: Map 46, 47, 48; Williamson 1997: 26). During the winter, these caribou forage primarily on lichen, evergreen foliage, shrub twigs and graminoids on the interior plateau, where snow cover tends to be thinner and feeding easier (Brice-Bennett 1977b: 151; Miller 1982: 929, 932-933). Winter groups tend to be widely dispersed, small (between 5 and 30 individuals) and are segregated on the basis of sex and age (Miller 1982: 930-931).

In the spring, females and numbers of juvenile caribou band together in great numbers and move to habitually–used calving grounds. After calves are born in late May or June, females and calves move to summer feeding grounds that are often near the coast (Brice-Bennett 1977b). There they join males and juveniles and form large aggregations of hundreds to thousands of individuals (Miller 1982: 930). During the spring and summer, these herds disperse again as caribou seek out fresh foraging areas where they feed on *Cladonia* lichens, green leaf buds, mosses, sedges in woodlands and meadows, and on seaweed and grasses along shorelines (Brice-Bennett 1977b: 161; Miller 1982: 932). Caribou also shed their winter coat during spring and summer (Banfield 1974: 384).

Herds consisting of numbers of females, calves, juveniles and mature males form in the fall in time for the rut in October and November (Miller 1982: 930). After the rut, the herds divide into segregated male and female-juvenile groups that they maintain through the winter. The thicker winter coat forms in the fall as well (Miller 1982: 925).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In some areas, caribou are present on or near the coast throughout the year, especially in the Kiglapait mountains and in the Torngat mountains, an area which lacks extensive interior over-wintering regions (Brice-Bennett 1977b: 155). During winter, small groups of these caribou are often observed on the land fast ice around the islands of the inner coastal zone and near the shores of sheltered bays and fjords (Williamson 1997: 25). The relatively lightly utilized food resources of the larger islands are likely part of the particular attraction of the coastal zone.

There are several distinct caribou populations in Labrador, as well. These populations are much smaller than the George River herd and migrate within much smaller areas. The largest of the southern herds, the Mealy Mountain herd, lives in the region of south of Lake Melville and Groswater Bay. This group over-winters in interior upland tundra areas of the Mealy Mountains themselves (Ames 1977a: 107). In spring, the herd moves to the coast between Hamilton Inlet and Sandwich Bay, where females bear their calves. With the coming of all, these caribou return to the upland tundra area where they gain their winter coats, have their rutting season agglomerations and disperse into winter forging groups. In some winters, caribou of the Mealy Mountain herd cross the sea ice in the eastern approaches of Groswater Bay or Lake Melville, occupying Henrietta Island and the Double Mer region. (Ames 1977a: Map 107).

Two other small herds of caribou occupy the relatively rich boreal forest areas around the Churchill, Naskaupie and Beaver River drainages, northwest of Goose Bay (Harper 1961). These caribou are reported to remain in dispersed small groups throughout much of the year, occupying the forested areas during the calving season and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in summer, and migrating to more barren upland interior areas in winter (Fitzhugh 1972: 21).

Caribou populations in Labrador have fluctuated greatly in historical times. Prior to the 1940's until the 1980's, caribou were extremely scarce in Labrador, so much so that Inuit on winter hunting trips had to penetrate deep into the middle of the Québec-Labrador peninsula to find small, scattered herds (Harper 1961; Williamson 1997: 25). Before snowmobiles were available, these trips were undertaken with dogs teams and could last two to three months with a maximum cargo of perhaps 12 to 14 butchered and processed caribou per dog team (Bruce-Bennett 1977b: 155; Maggo 1999: 88). During the 20th century, caribou populations had fallen to such low levels that some biologists doubted the viability of the southern herds and the Mealy Mountains herd was protected from hunting in the 1960's (Ames 1977a: 301; Fitzhugh 1972: 21; Harper 1961: 137-138, 144).

Despite constant and intense hunting pressure, the depletion of caribou herds in the 20th century was probably part of long-term caribou population trends. By the 1990's, caribou populations in Labrador had recovered dramatically. Most notably, estimates of the size of the George River herd appears to have risen about four-fold between 1978 and 1993 and, during the mid to late 1990's, caribou were frequently observed along the coast of Labrador in winter (Miller 1982: 924; Williamson 1997: 25). Numbers of caribou were even available to hunters on the sea ice in Harmony Bay, just outside the Nain harbour, for several consecutive years, a situation without parallel in the current experience of Nain residents.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Periodic abundance and scarcity are due, in part, to long-term shifts in migration patterns as, from year-to-year, herds move away from recently- foraged areas and into unexploited areas. Labrador Inuit hunters have noted such an interannual drift in range in recent years (Williamson 1997: 25). Irregular abundance is also probably due to cyclical population growth. Caribou population cycles are rather well known both through ecological studies and traditional environmental knowledge. A variety of historical sources note previous boom-and-bust phases among Labrador caribou populations in the past. For example, caribou were abundant on the coast near Nain in the 1870s and 1880s, but were very scarce by 1917 (Williamson 1997: 25).

Meldgaard (1986: 59) documented a similar cycle of growth and collapse among caribou in Greenland. There, caribou populations have had, historically, relatively brief periods of maximum population for about 10 to 25 years, followed by phases with minimum population lasting between about 35 to 70 years, with transition phases of about 10 years in between. The Greenland caribou population cycle lasts between 65 to 115 years (Meldgaard 1986: 59), a time scale that seems consistent with the anecdotal information for Labrador. Labrador caribou populations, at least in the coastal region, appear to have entered the declining phase of a long-term population cycle in 1997 or thereabouts. Williamson (1997: 26-27) noted that in 1997, Inuit hunters in Nain expected the herd to decrease in size over the short term and that they anticipated having to shift their winter caribou hunting trips from the coast to more traditional hunting grounds in the interior.

Prior to the 19th century, caribou were hunted in any season when they were encountered, but especially by specialized hunting task groups who traveled to the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

interior plateau of Labrador to hunt caribou in summer and fall (Taylor 1974: 48). During these hunts, caribou were hunted with communal methods where herds were surrounded in valleys then driven into lakes, where they were hunted form kayaks (Taylor 1974: 48). Taylor (1974: 48) notes that women, children and aged people did much of the work surrounding and driving the herd, while adult males intercepted the caribou in kayaks and dispatched them with lances. In other places, caribou were intercepted at river crossings and defiles, and hunted with bows and arrows (Taylor 1974: 48). They were hunted opportunistically, by stalking and with bows and arrows.

As a mobile and generalist forager of tundra and taiga environments, the caribou have a degree of inherent adaptive resiliency with respect to climatic change. Nevertheless, the mixed vegetation types that provide their preferred diet and the forest regions in which they have calving areas are vulnerable to climate change. Thus, caribou migration patterns, ranges and population sizes do respond in negative fashion to episodes of prolonged episodes of winter warming and increased humidity that bring increased winter snow accumulation and icing, hindering feeding and travel. The effect of these conditions is to increase herd mortality and limit calving (Meldgaard 1986: 69). As well, Meldgaard (1986: 69) identifies human predation as a significant contributing factor to caribou population fluctuations.

Carnivores

A substantial proportion of Labrador's terrestrial mammals, in relation to the somewhat sparse range of herbivores, is composed of carnivore species. While many of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

these species are not primarily useful as sources of food, almost all have been pursued for their useful and commercially valuable hides.

The most diverse group of carnivores in Labrador is the Mustellids, the weasel family. Mustellid species present in Labrador include the American Marten (*Martes americana*), Ermine (*Mustela erminea*), the Least Weasel (*Mustela nivalis*), American Mink (*Mustela vison*), Wolverine (*Gulo gulo*) and River Otter (*Lutra lutra*). The habitats of the smaller of these species; martens, ermines, weasels and mink, collectively comprise tundra, coniferous and mixed forest, lake and river shores and wetland environments throughout Labrador (Banfield 1974: 317, 321, 326, 330). In general, these species are most common in Hamilton Inlet and southern Labrador (Low 1896: 314-315). While terrestrial lemmings, mice, voles and arboreal squirrels are the primary prey of the smaller mustellids, they also tend to be generalists. Muskrat, hares, fish, birds, insects, carrion and berries are also consumed by these species seasonally. Mustellids do not hibernate and so feed actively throughout the year (Banfield 1974: 316, 321, 330). Populations of the smaller mustellid species tend to vary in relation to the population cycles of major prey species and they are themselves hunted by canids, bears, lynx and birds of prey. Their ranges would expand north and to higher elevations in times of climatic amelioration, as their prey rodent species, and more temperate vegetation types that form habitat for these rodents, also spread.

The larger mustellid species present in Labrador include the Wolverine and the River Otter. The range of Wolverines (locally termed *carcajou*) extends throughout Labrador and especially northern Labrador, though they are now very scarce (Harper 1961: 118; Williamson 1997: 10). Their habitat includes tundra, alpine tundra and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

subarctic forest environments (Banfield 1974: 333). Wolverines are omnivorous and very capable hunters; their range of prey includes rodents (including beaver, muskrat and porcupines), hares, fish, birds and larger herbivores such as caribou (Banfield 1974: 333). As well, wolverines also forage for berries, eggs and insects and scavenge carrion, especially on shorelines (Wilson 1982: 638).

River otters are essentially amphibious mustellids and are present in bays, rivers, lakes and bogs throughout Labrador (Banfield 1974: 342-243). They were especially common in the Hamilton Inlet and Hamilton River regions (Low 1896: 316). River otters catch their prey in water and the majority of their diet is composed of fish, insects and aquatic invertebrates; rodents, including muskrats and beavers, represent a minority of their diet (Banfield 1974: 343). They are difficult to hunt in water and so are taken most readily with traps.

In general, mustellids were not of significant economic importance among Labrador Inuit except for their pelts, for which they were trapped and hunted by Inuit and Europeans by the latter half of the 18th century (Cartwright 1792). Trapping was practiced on increasing scales through the 19th and early 20th centuries as commercial interests such as the Hudson's Bay Company set up trading operations (Kaplan 1985; Zimmerly 1991). The pelts of otters and martens were particularly valuable (Hantzsch 1932). Some species, such as the marten, were very scarce by the 1970's, when trapping was largely given up in Labrador (Ames 1977a: 303; Williamson 1997: 27). Prior to the advent of commercial trade, some of these pelts were used to make clothing; for example, wolverine pelts were especially prized for making the ruffs around hoods of winter coats (Banfield 1974: 334).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Because of the avidity with which these notoriously hungry animals steal bait or break into caches and consume or spoil stored meat, mustellids and especially wolverines were often killed by the Labrador Inuit and Innu as pests or worse (Freuchen 1935: 98-99, 193-195; Low 1896: 315). According to Freuchen (1935: 97-98), wolverines pose the greatest threat to meat caches because of their great strength and digging ability that enables them to open caches covered with extremely large rocks.

Lynx (*Lynx lynx*) are the only felids in Labrador; they are primarily residents of the subarctic forest regions there, but also are found in tundra regions occasionally (Banfield 1974; Harper 1961: 151). They are fairly specialized predators who pursue hares for the most part, but also hunt birds small and medium sized rodents, foxes and caribou fawns, and scavenge carrion (Banfield 1974: 352). Populations of lynx are know to fluctuate sharply in size in cycles of approximately 10 years, which are directly related to similar cyclical fluctuations in hare populations (Banfield 1974: 352). Lynx were hunted and trapped for their pelts (Ames 1977a: 291: Brice-Bennett 1977b: 144).

Canids: Wolves and Foxes

A second diverse group of carnivores in Labrador are members of the Canid family, including foxes, wolves and domestic dogs. These species are generalist scavengers and carnivores.

Red Fox and Arctic Fox

The Red fox (*Vulpes vulpes*) is found throughout Labrador but is common primarily around inner bays. The Arctic fox (*Alopex lagopus*) is normally present and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

common everywhere, especially the outer coast, though it is not present on the southern and south-westernmost borders of interior Labrador (Banfield 1974: 297, 300; Brice-Bennett 1977b: 150-151; Hantzsch 1932: 11). Both are moderately sized species weighing under 7kg and are solitary animals except during the breeding season (Banfield 1974: 296, 299).

Foxes are truly omnivorous and eat whatever is available in season, including invertebrates, insects and plant foods, mice, lemmings, voles and larger rodents, hares, birds, rodents birds and fish (Banfield 1974: 296, 299, 300). Their population levels fluctuate in relation to population cycles in rodents (Banfield 1974: 296). They are also active scavengers of shoreline debris, the fecal matter of other animals and of carrion; in winter, arctic foxes are known to wander areas of fast ice looking to feed on the carcasses of ringed seals killed by polar bears, or caribou killed by wolves (Banfield 1974: 296, 300). They do not hibernate, and so are active all year. Foxes present a nuisance to Inuit as they too break into meat caches and steal or ruin possessions (Freuchen 1935: 130-131). Their populations are also periodically ravaged by, and vectors for, rabies (Banfield 1974: 301).

The thick pelts of both red foxes and arctic foxes caught in winter were of considerable commercial value and so they have been energetically trapped and hunted since the late 18th century until the 1970's in Labrador (Ames 1977a; Brice-Bennett 1977b; Cartwright 1792; Williamson 1997; Zimmerly 1991). White arctic fox pelts were the most important resource of the fur industry in northern Labrador in the early 20th century (Hantzsch 1932: 11). More valuable yet were the unusual "blue" or dark winter phase of the arctic fox, the "cross" grey-brown phase of the red fox, and especially the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

"silver" or frosted black phase of the red fox (Banfield 1974: 298, 301; Hantzsch 1932: 11). Foxes are not considered a suitable food item except in times of famine (Brice-Bennett 1977b: 151. However, prior to contact with Europeans, foxes were also hunted and trapped with stone deadfall traps for their pelts, which were used to make mittens among other purposes (Turner 1979: 54; Freuchen 1935: 132).

Gray Wolf

The gray wolf (*Canis lupus*) is the largest of the Canid species; adult wolves may reach up to 1.8m in length and from 45 to 80kg in mass (Paradiso and Nowak 1982: 461). Gray wolves live in both tundra and forest regions and are present throughout Labrador (Harper 1961: 159). Wolves are entirely carnivorous and are cooperative hunters. Their preferred prey are large mammals, especially, in arctic regions, caribou (Paradiso and Nowak 1982: 465). Secondarily, wolves prey on hares, rodents, foxes, birds, eggs, fish and insects. In Labrador, the numbers and movements of wolves closely follow those of caribou (Brice-Bennett 1977b: 155). They do not hibernate in winter.

Wolves were hunted extensively by Inuit in the historic period for their pelts which were used in trade and for the edging of parkas (Brice-Bennett 1977b: 155). Normally they were shot but were sometimes trapped as well (Freuchen 1935: 123; Williamson 1997: 20). Prior to the availability of iron traps, wolves were trapped in enclosure, pit or deadfall traps, or with folded strips of frozen baleen encased in blubber, which straighten and pierce the stomach of the wolf when ingested (Hawkes 1916: 85-86). Wolves were also killed as nuisances as they harry caribou and break into caches (Freuchen 1935: 120, 123). They also are vectors for rabies (Banfield 1974: 293).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Ursids: Black Bears and Polar Bears

The largest carnivores in Labrador are members of the Ursid (bear) family, of which the polar bear (*Ursus maritimus*) and the black bear (*Ursus americanus*) are the only species currently present in Labrador. Black bears are present and plentiful throughout all of Labrador except for the northernmost portion of the peninsula (Banfield 1974: 307; Hantzsch 1932: 34; Williamson 1997: 27). Black bears are most closely associated with wooded bays and subarctic forest areas of Labrador (Brice-Bennett 1977b: 140). Polar bears may be found, in winter, along the entire Labrador coast, into the north shore of the Gulf of St. Lawrence. They do not penetrate far into the interior of Labrador and in summer retreat to the capes and offshore islands of northern Labrador (Banfield 1974: 311).

Black Bears

Black bears are omnivorous and a large proportion of their diet is composed of vegetable foods, especially berries, leaf buds and young shoots (Banfield 1974: 306). They also forage for insects, honey, scavenge carrion and are opportunistic predators of rodents, hares, fish, and larger mammals. Black bears hibernate during the winter, and emerge from their dens in April to May in Labrador, often to feed on fish around open water in4 river ice or shoreline leads (Brice-Bennett 1977b: 123). During the summer and fall, they forage in coastal areas for fish, rodents and berries (Brice-Bennett 1977b: 140). Black bears tend to be solitary, though sows remain with their cubs for about a

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

year and bears may congregate at feeding places (Banfield 1974: 305). Cubs are born during January and February, while the sow is in hibernation (Banfield 1974: 306).

Black bears are usually hunted with firearms, but are sometimes caught in traps as well (Brice-Bennett 1977b: 140, 143). They are often hunted when they emerge from their hibernation in spring, and in the fall when they are in prime condition from feeding on plentiful berries (Ames 1977a: 295; Brice-Bennett 1977b: 123, 143). Black bears are hunted for their meat, which is considered flavourful, and their pelts both have some commercial value and are useful as robes or bedding material (Ames 1977a: 295; Brice-Bennett 1977b: 139-140; Hantzsch 1932: 34). Black bears are primarily associated with subarctic and forested areas in Labrador and much of their diverse diet of vegetable, small animal and scavenged foods are more plentiful in these regions. Expansion of forested environments in terms of latitude or altitude likely would result in an expansion of bear range, and of populations.

Polar Bears

Polar bears are technically considered the largest of terrestrial carnivores in Labrador. Nevertheless, polar bears are such highly specialized marine predators that they represent a very important component of coastal marine ecosystems Williamson 1997: 25). The primary prey of polar bears are ringed seals, while bearded seals, harbour seals, harp seals, hooded seals and young walrus are secondary prey species (Lentfer 1982: 561). As well, polar bears forage on land to a lesser degree, for small mammals, birds and eggs, and plant foods.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

While sea ice is present, polar bears spend most of their time on or around the ice, using it as a travel route and a means of gaining access to seal habitats. During the winter, polar bears hunt ringed seals at breathing holes and in birthing dens on fast ice. In the winter and spring, walrus, bearded seals, harp seals, harbour seals and eiders by stalking at the ice edge or by ambushes from underwater (Banfield 1974: 311; Freuchen 1935: 108). They are very strong swimmers and adept moving around and between ice floes (Banfield 1974: 311). Polar bears stalk seals once they begin to haul out to bask on fast ice or ice floes, later in the spring (Lentfer 1982: 561). When sea ice breaks up in more southern latitudes, polar bears follow the retreating ice margin north or search for sea birds, eggs, smaller mammals, marine invertebrates, carrion and berries along shorelines (Banfield 1974: 311). They are most frequently observed around outer islands and headlands (Brice-Bennett 1077: 121).

Polar bear cubs remain with sows for about a year but, aside for the brief estrous period in April or May, polar bears tend to be solitary animals and do not form social groups (Banfield 1974: 311). They are thinly distributed and travel constantly, covering great distances in search of food and following drifting pack ice (Freuchen 1935: 111; Lentfer 1982: 560-561). Male polar bears and non-parturient females do not generally hibernate, though they sometimes rest in shelters for shorter periods of time or during storms (Harington 1968: 16). Pregnant female polar bears, however, excavate dens in snow banks on land or in pack ice in the fall where, between November and January, they bear their cubs (Banfield 1974: 311; Harington 1968: 100-11; Lentfer 192: 560).

Polar bears are hunted by Inuit for food as their meat and organs, with the exception of the liver, are edible (Freuchen 1935: 119). Their thick hides were used

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

traditionally by Inuit in many parts of the Arctic to make warm winter pants. After the arrival of Europeans, polar bear hides became valuable trade items in themselves (Hantzsch 1932: 34). Polar bears were hunted on the fast ice or on land with the aid of dog teams, which could hold a bear at bay until a hunter shot it or dispatched it with a spear or a shot (Hawkes 1916: 83). Polar bears were also hunted from kayaks, when they were encountered swimming between ice floes or islands (Brice-Bennett 1977b: 121).

As specialized carnivores associated with coastlines and sea ice, polar bears are primarily linked with Arctic ecological zones. Nevertheless, their winter ranges include much of Labrador's coastline. In summers with heavy or enduring coastal pack ice accumulation, polar bears to linger in more southerly latitudes (Williamson 1997: 31). In the 20th century, polar bears maintained denning areas in offshore islands and on headlands along the coast north of Okak Bay (Brice-Bennett 1977: Map 27, Map 28). Because denning usually favours consistent and deep snow cover, moderated winter conditions may limit the range of viable polar bear populations. More particularly, greatly reduced winter fast ice extent or early spring melting that causes high ringed seal mortality threaten critical elements of the polar bears' diet and hence limits their range in Labrador (Stirling, et al. 1999).

Birds

A few species of birds that are associated with terrestrial environments were of economic importance for the Inuit. In particular, Spruce Grouse (*Canachites canadensis cance*), Willow Ptarmigan (*Lagopus lagopus albus*) and Rock Ptarmigan (*Lagopus mutus*

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

rupestris) have economic importance as they are common species that collectively occupy all of Labrador's ecozones, including arctic tundra and subarctic coastal tundra. These species occupy Labrador year round (through willow and rock ptarmigan undertake limited seasonal migrations within the region), are common in forested and sparsely forested regions of the inner coastal zone, and are remarkably passive and easy to hunt (Brice-Bennett 1977b: 177, 181; Todd 1980: 253-254, 264, 270, 272, 274). Ptarmigan are, and have been, an important secondary species for Inuit subsistence in Labrador and are taken in numbers during the fall and winter in particular (Ames 1977a: Map 109; Austin 1932: 80; Brice-Bennett 1977b: 194; Goss (1937, cited in Todd 1980: 272; Turner 1979: 11). Both ptarmigan species are subject to population fluctuations on an approximate 8-year cycle (Austin 1932: 75, 77; Todd 1980: 263).

Most of the birds in Labrador are seasonal migrants. Among these, a variety of ducks and geese pass through, or nest, in Labrador. Because of the numbers and size of these birds, they are seasonal subsistence resources. Canada Geese (*Branta canadensis*) nest in numbers in wetland areas and feed on shoots of grasses and sedges along shorelines along large stretches of the Labrador coast and islands in the spring and summer (Todd 1963: 124). The greater snow goose (*Chen atlantica*), black duck (*Anas rubripes*), mallard duck (*Anas platyrhynchos*), harlequin duck (*Histrionicus histrionicus*), Red-Breasted Merganser (*Mergus serrator*) and other ducks also breed, feed or migrate through this region, arriving in May or June while the sea ice still remains (Brice-Bennett 1977b: 123; Todd 1980: 132-133, 142, 147, 176). Lake Melville and the inner coast of the Hopedale, Voisey's Bay, the Nain area and Okak Bay are especially important

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

nesting and feeding areas (Ames 1977a: Map 104; Brice-Bennett 1977b: Map 30, Map 39; Todd 1980: 147; Williamson 1977: Map 4).

In the fall, many of these migrating species congregate in coastal areas and on islands as they being their southward migration, and usually depart by the end of September (Williamson 1997: 49). Ducks and geese are hunted intensively around watercourses and ponds on the coast and on islands at this time of year (Brice-Bennett 1977b: 140;Williamson 1979: 49)

Freshwater Fish

Several species of fish inhabit freshwater areas in Labrador. Whitefish (*Coreogonus clupeaformis*) are found in lakes and rivers throughout the interior of Labrador (Backus 1957: 284-285; Low 1896: 329). Brook trout (*Salvelinus fontinalis*) are widespread and common in streams and lakes into northern Labrador (Backus 1957: 292). Lake trout (*Salvelinus namaycush*) have a similar range but are less common (Backus 1957: 294). Some brook trout and lake trout are sea-run, or migrate seasonally to salt water; these individuals tend to be markedly larger fish (Backus 1957: 294-295).

Arctic Char

Most arctic char (*Salvelinus alpinus*) are also anadromous fish, though some remain in fresh water all year without migrating (Backus 1957: 290). Anadromous arctic char overwinter in lakes and migrate downstream in late spring, as river ice brings to break up (Brice-Bennett 1977b: 123). They congregate within inner bays and then move out to the outer bays, and in August and September, returning again to their original

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

drainages to spawn, and remain there over the winter (Brice-Bennett 1977b: 123, 135). Char spawn in drainages all along the northern Labrador coast, including the Okak, Nain and Lake Melville regions (Ames 1977a Map 112; Brice-Bennett 1977b: Map 35).

Arctic char have been a very important subsistence resource for Inuit in Labrador, into the modern era, and became an important commercial commodity in the later 20th century. Traditionally, arctic char were caught at four times of the year. Along with brook trout and lake trout, arctic char were caught on jigged hooks and lines, through holes in lake ice in late fall and in the early spring (Brice-Bennett 1977b: 123, 143, 177). As well, nets were set through holes in lake ice to catch whitefish. Later in the spring, when the ice in river mouths breaks and char begin their spring migration down stream, char were caught with *kakkivaks* (leisters) and baited lures (Brice-Bennett 1977b: 123). In summer, after char have moved into bays, they were caught in nets set in shoreline shallows (Brice-Bennett 1977b: 135). This fishery was has been an economic mainstay of Inuit in Labrador since the cod fishery declined after the 1950's (Brice-Bennett 1977b: 135, 137; Northland Associates 1979: 256).

Marine Animals: Imanimuitak

Fish and Marine Invertebrates

The bulk of biomass in Labrador's marine ecosystem is composed of plankton; tiny pelagic organisms including algae, jelly fish, fish eggs, echinoderm larvae, and crustaceans including copepods and euphasids or (also termed krill) are the foundation of Labrador's marine ecosystem. Plankton are abundant in cold polar seas, especially where

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

they are nourished by nutrients borne by water mixing processes including freshwater discharge and upwelling due to thermoclines and currents. As well, thermocline and halocline differences in seawater at the seaward edge of fast ice and among pack ice masses create zones of water mixing and, with photosynthesis, seasonally and spatially limited zones of enhanced algae and zooplankton growth (Wadhams 2000: 276). Polynyas and other open water areas create pockets of abundance of photosynthetic algae and the zooplankton that feed on them (Wadhams 2000: 276-277).

Benthic, filtre-feeding and scavenging invertebrates, such as echinoderms, molluscs, polychaete worms and shrimps (Remmert 1980: 210-211) and benthic and pelagic fishes, are some of the most significant foragers and predators of these organisms are fish. Fish and invertebrates have, therefore, a very important ecological role in translating the primary production of the marine environment into biomass accessible to the rest of the marine food chain; to piscivorous fish, sea birds, sea mammals and humans.

A variety of plants and small animals from the intertidal zone are collected and consumed by other animals and Inuit. These animals include filtre-feeding blue mussels (*Mytilus edulis*) and clams (including *Mya arenaria*), grazers such as sea urchins and periwinkles, and scavengers and predators, such as crabs, sculpins and sea gulls. Foxes, wolverines, black bears and polar bears also scavenge littoral detritus and carrion. Mussels and clams, in particular, were gathered for food by Labrador Inuit, and were considered tasty food items (Brice-Bennett 1977b: 128; Nain Resident 1997: personal communication). Mussels might be gathered by all Inuit, but are obviously a resource readily available to those not directly involved in hunting activities, such as children or

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

aged people; women likely contributed to mussel collecting as well. In somewhat deeper water, larger benthic animals such as shrimps, scallops and snow crabs are the subject of modern commercial fisheries and important prey for benthos-feeding sea mammals such as walrus and bearded seals.

Ecologically and economically important fish present in Labrador's coastal waters include capelin, smelts, Atlantic cod, Polar cod, Greenland cod, Atlantic salmon and Arctic char. The capelin (*Mallotus villosus*) is a small, oily fish of the smelt family. They are widespread in the circumpolar region and, in recent history, have been very abundant on the banks lying off of Labrador and throughout the Labrador coast (Northland Associates 1979: 353). After the breakup of sea ice in June and into July, schools of capelin enter inshore waters, driven by predators and finally to spawn (Brice-Bennett 1977b: 128; Northland Associates 1979: 353). At this time of year, numbers of capelin wash ashore and perish in the intertidal zone. In the first half of the 20th century, capelin came ashore in huge numbers and were gathered with rakes or nets. Capelin were eaten fresh or were dried on the shore to be stored or to be used as dog food (Ames 1977a: 285; Brice-Bennett 1977b: 128; Hantzsch1931: 195). More recently, the numbers of capelin that come ashore in northern Labrador have declined drastically and their catches are reduced (Nain Resident 1997: personal communication).

In addition to being harvested by Inuit, capelin are primary prey for most piscivorous animals in Labrador, including other fish, seals and sea birds, and are scavenged by terrestrial carnivores during their spawning runs. American smelts (*Osmerus mordax*), larger than capelin, are also found in numbers in portions of the southern Labrador coast, especially the protected bays within Hamilton Inlet (Backus

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1957: 295). In the 20th century, smelts were typically harvested in the winter in these areas (Ames 1977a: 293; Low 1896; 329).

Gadids: The Codfish Family

Several species of cod are found in Labrador's waters, all of which prey on crustaceans (including amiphipods), small fish (especially capelin) and benthic invertebrates. Polar cod (*Boreogadus saida)* are found in ice-covered waters throughout circumpolar and North Atlantic waters, including those of Labrador, and are present in inshore areas during the summer and in winter (Backus 1957: 298; http://www.fishbase.org). The relatively small Rock cod (*Gadus ogak*) and Atlantic tomcod (*Microgadus tomcod*) live in rocky and soft-bottomed coastal waters respectively in Labrador, especially near shorelines and in fjords (Backus 1957: 299; http://www.fishbase.org). Tomcod move into shallows in the inner bays to spawn in the spring (Brice-Bennett 1977b: 123). Both of these species are common in the Lake Melville area (Backus 1957: 299) and are often fished in spring, during their spawning run, by jigged handlines, through holes in the ice of shallow bays in the spring (Brice-Bennett 1977b: 123).

Atlantic Cod

Atlantic cod (*Gadus morhua*) were extremely abundant in the western North Atlantic, in the coastal waters of Newfoundland and Labrador and especially on the banks lying off the shores of these regions. Prior to the collapse of their populations in the late 20th century, the Atlantic cod fishery was the most important fishery, and industry, of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Newfoundland and Labrador. Most Atlantic cod remain in offshore in the relatively deep water of the continental shelf and were traditionally unavailable to Labrador Inuit fishermen until seasonal movements brought numbers of cod into the islands and bays of the inshore waters in July and August (Brice-Bennett 1977b: 132). During the 19th and 20th centuries, these months were ones of feverish work for Inuit families labouring at the tasks of jigging, netting or trapping cod, and of preparing and drying them in vast quantities, which they used as commercial commodities as well as food (Brice-Bennett 1977b; Maggo 1999).

The scale of the cod fishery in Labrador historically was vast, though smaller than that in the inshore waters of Newfoundland and the Grand Banks. Basque cod fishermen were active on the southern Labrador coast by the16th century, Breton, Portuguese and English fishermen followed in the 17th century and Newfoundlanders, mainland Canadians, Americans, and others in the 18th and 19th centuries (Pope 1997; Turgeon 1998). By the late 19th century, thousands of schooners came to Labrador to participate the floating cod fishery. Packard (1891: 198, 240) reported that 500 to 800 vessels per year stopped at Hopedale in the 1870's, and that 1000 to 1200 vessels from Newfoundland alone, with about 30,000 crewmen, were present in Labrador for the summer fishery. Wilfred Grenfell (cited in Kleivan 1966: 118) estimated that, in 1893, over 1500 vessels visited the region north of Hopedale. During the 19th century, Moravian Missionaries successfully exerted their influence to engage the Labrador Inuit to participate in the summer inshore cod fishery themselves (Brice-Bennett 1981; Taylor 1974). In 1880, the dried codfish exports from Labrador fishermen to Newfoundland

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

were estimated at about 724 tonnes; those caught by Newfoundland fishermen were estimated at some 19,988 tonnes (Hatton and Harvey, quoted in Packard 1891: 241).

In 1975, approximately 635 tonnes of cod were landed in Labrador by a total of up to 819 licensed resident inshore fishermen in 438 boats (Drew 1979:249, 260), most of whom were non-indigenous fishermen in southern Labrador as the cod fishery in northern Labrador had largely failed by that date (Brice-Bennett 1977b: 111). The inshore fishery was a tiny fraction of the whole, as offshore Newfoundland trawlers annually landed an average of over 4000 tonnes of groundfish (primarily cod) between 1974 and 1976 (LeDrew 1979: 267). Furthermore, the Newfoundland trawlers represented only 3.9% of the vessels actually working in offshore Labrador in all seasons during those years, as 564 of 568 vessels were of foreign origin (LeDrew 1979: 265).

Atlantic Salmon

Atlantic Salmon (*Salmo salar*) were also common on the Labrador coast and in terrestrial freshwaters until the late 20th century. Some salmon are land-locked and do not leave fresh water lakes and rivers. The majority of adults, however, are anadromous and spend most of the year in inshore waters and on the continental shelf, returning to the rivers of their birth to spawn in the late spring to mid summer whereupon they return to the sea (Brice-Bennett 1977b: 137; LeDrew 1979: 253). The most productive spawning rivers are located south of Nain to the Strait of Belle Isle (LeDrew 1979: 253). Nevertheless, salmon were caught in quantity around offshore islands as far north as Mugford Bay (Brice-Bennett 1977b: 187).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Atlantic salmon were usually caught in nets set along the shorelines of bays near spawning rivers or around outer islands in northern waters (Brice-Bennett 1977b: 137, 177, 187). A commercial salmon fishery exporting pickled and tined salmon existed in Labrador by the 19th century (Packard 1891: 242). Salmon fishing gained much more importance for commercial fishermen once the cod fishery declined in Labrador (Brice-Bennett 1977b: 137). Atlantic salmon stocks eventually collapsed in turn and were protected from commercial exploitation in the 1990's (Williamson 1997: 47).

Sea Birds

Sea birds are plentiful in Labrador and a broad variety of sea bird species are present there. Several species of gulls with holarctic or circumboreal distributions are present including, most notably, Herring Gulls (*Larus argentatus smithsonianus*), Glaucous Gulls (*Larus hyperboreus*, Ivory Gull(*Pagophila eburnean*), Iceland Gull (*Larus glaucoides glaucoides*), Great Black-Backed Gull (*Larus marinus*) and Bonaparte Gull (*Hydrocolœus philadelphia*) (Hantszch 1931; Todd 1983: 362-363, 368, 377, 386, 388). These gulls are highly omnivorous and eat pelagic cephalopods and fish such as capelin and salmon, char and cod fry, benthic invertebrates from shallows, birds, eggs, vegetable foods, and carrion at sea, on sea ice and on the land (Austin 1932: 111-112, 128; Bursey and LeDrew 1977: 28-29, 125-136). Some gulls are migratory and come to Labrador in to nest in sea cliffs or on rocky islands in May and June, or pass through Labrador on the way to their own nesting areas. Others, especially the Ivory, Iceland and Glaucous Gulls are present during the winter and are associated with pack ice (Austin

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1932: 120; Bursey and LeDrew 1977: 28). Gulls were trapped and hunted by Inuit for food and their eggs were especially prized as food items (Austin 1932: 116, 118, 120).

Alcids

Another diverse family of sea birds present in Labrador is that of the alcids, which includes Murres, Dovekies, Guillemots and Puffins. Most common are the Razorill (*Alca torda torda*), Thick-Billed Murre (*Uria lomvia lomvia*), Dovkie (*Plautus alle alle*), Northern Guillemot (*Cepphus grylle arcticus*), Atlantic Puffin (*Fratercula arctica arctica*) and in the past, Atlantic Murre (*Uria aalge aalge*) (Austin 1932; Todd 1980: 403, 407, 410, 414, 418, 425; Turner). Prior to its extinction, the Great Auk (*Pinguinus impennis*) may also have been at least an occasional visitor to Labrador, as its primary breeding colony in the western Atlantic was on Funk Island, off Newfoundland (Todd 1980: 403).

All of these species feed on smaller pelagic fishes and benthic crustaceans and spend much of their time floating on open water, diving to feed, or nesting (Austin 1932: 139; Bursey and LeDrew 1977: 25-26). Excepting the Black Guillemot, they nest primarily in massive rookeries on sea cliffs, talus slopes or offshore islands (Austin 1932: 137). Many, such as the Razorbill, Thick-Billed Murre, Northern Guillemot and Atlantic Puffin are primarily resident during the spring and summer, while they breed (Austin 1932: 129, 136, 140). They migrate south with the advance of sea ice. Nevertheless, dovekies are an arctic species primarily associated with pack ice, and cross the Hudson Strait into coastal Labrador in greatest numbers in January, along with pack flowing south from Davis Strait (Austin 1932: 135). In addition, some murres and puffins remain

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in the Labrador Sea through the winter, at the ice edge or among pack ice (Bursey and LeDrew 1977: 25, Table 4) and around open water areas at rattles in winters with moderate ice conditions (Austin 1932: 130, 140).

Alcids were hunted and trapped by Inuit and by visiting fishermen in considerable numbers as food items (Austin 1932: 136, 139, 143). As well, their eggs are prized as food items and were gathered in huge numbers from the massive rookeries of the colonially-breeding species (Austin 1932: 143; Brice-Bennett 1977b: 123, 129; Nain Resident 1997: personal communication).

Anatids: Geese and Ducks

Eider ducks, including the Northern Eider (*Sommateria mollisima borealis*), American eider (*Sommateria dresseri dresseri*) and King Eider (*Sommateria spectabilis*) are also ecologically and economically important sea bird species on the Labrador coast, having been abundant historically and a preferred prey item for Inuit (Austin 1932: 49-54; Hantzsch 1931: 197; Packard 1891: 435; Todd 1980: 178; 180-181, 188). Eiders are the largest members of the duck family and live in coastal habitats, feeding on small fish, molluscs and other marine animals (Austin 1932: 52; Todd 1980 182). They are primarily summer migrants that breed in Labrador, or spring and fall migrants that travel through Labrador while *en route* to and from their breeding grounds (Austin 1932: 49, 52-53, 55; Hantszch 1931: 197. In some regions, and in season, Eiders were the most common species of duck in Labrador (Todd 1980: 183).

Eiders typically breed in large colonies on barren offshore islands; adults nest in June and chicks hatch in July to early August (Austin 1932: 51). King eiders appear to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

breed over wide areas, perhaps with concentrations in the North Aulatsivik Island in the Torngat coast region (Austin 1932: 54-55; Hantszch 1931: 197). The Northern Eider breeds widely on small islands throughout the northern Labrador coast, including seaward islands in the Hebron Fjord, Okak Bay, Nain (including clusters of small outer islands north and south of Dog Island), Hopedale and Groswater Bay regions (Austin 1932: 51, 52; Ames 1977a: Map 122; Brice-Bennett 1977b: Map 29, 30, 38).

The American Eider may be more frequent in Labrador south of Hopedale (Todd 1980; 180). Eiders usually arrive in the spring between early March and early May, and reside on the sea ice, near the ice edge or around holes in the ice until the build bests in June (Austin 1932: 50). They migrate south in mid September to November. Austin (1932: 50) noted, however, that in some years, Eiders remained on the Labrador coast throughout the winter, presumably when air temperature and sea ice formation rates were moderate. Conversely, Eiders are vulnerable to catastrophic mortality in unusually early and rapid onset of freezing temperatures and ice formation in the fall (Austin 1932: 50).

Eiders have been considered "the most important food bird on the coast, both for its flesh, and it eggs" (Austin 1932: 52). Before conservation measures were imposed by governmental authorities and local councils of Village Elders in the mid-20th century, Eiders were hunted on a very large scale by Inuit, Settlers and visiting fishermen (Brice-Bennett 1977b: 165; Todd 1980: 179, 183; Williamson 1997; 50). As a result, their numbers had been in a serious decline. The fall has been an important hunting season for Eiders in recent years and adult males still are hunted in the fall (Brice-Bennett 1977b: 177; Williamson 1997: 50). Labrador Inuit also collected Eider eggs in great numbers (Austin 1932: 52; Turner 1979: 39; Williamson 1997: 44-45).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

As specialized marine predators, sea birds are highly vulnerable to fluctuations in fish populations. They tend to cluster at the *sina* in when present in winter and spring. Accordingly, they are very vulnerable to fluctuations in weather, such as sudden storms, rapid freezing, and on-shore winds causing spring and summer pack ice accumulation and closure of ice-free areas (Gilchrist 2000; Williamson 1997: 35).

Sea Mammals

The sea mammals present in Labrador include several species of pinnipeds (seals) and cetaceans (whales). They are, collectively, the most important group of animals for the purposes of this study. Sea mammals in Labrador are carnivores and are significant for their positions at or near the summit of marine ecosystem food webs. They are also the most economically important group of animals for the subsistence of coastal Inuit peoples throughout the Arctic into the modern era, including Labrador (Brice-Bennett 1977: Williamson 1997).

Pinnipeds: Seals and Walrus

The seals in Labrador are all members of the order Pinnipedia ("wing-footed"), family Phocidae (termed and sub-family Phocinae (the northern phocids). There are six species of seals in Labrador; the ringed seal, harbour seal, harp seal, bearded seal, hooded seal and grey seal. These species are all of the Phocinae subfamily (or northern phocids) of the Phocidae family (the true seals, or earless seals) (Katona, et al. 1993; Reidman

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1990), and belong within the order Pinnipedia. An additional pinniped species, the Atlantic walrus (family Odobenidae) is also present in Labrador.

All of these species are distributed widely throughout the North Atlantic and/or the Arctic regions as well as Labrador (King 1964). In addition, each species has distinctive ecological niche requirements and ecologically structured feeding and breeding behaviours. These species are, accordingly, associated with particular habitats and geographical ranges, sometimes exclusively so. The link between of some of these species with particular habitats is sufficiently strong that they may be usefully considered indicator species; that is, their presence or absence in a locality serves as a means to signal or monitor broad environmental conditions (Tynan and Demaster1997).

Harbour Seals

Harbour seals (*Phoca vitulina*) are the most widespread of all the pinniped species. They are range from temperate waters (and more rarely sub-tropical waters) in the mid latitudes of Europe, east Asia and North America, to subarctic and arctic regions in Asia, North America, Greenland, the north Atlantic Islands and Europe (Bigg 1981: 7). In general, harbour seals inhabit littoral waters and feed primarily on pelagic fish such as capelin, salmon and cod (Bigg 1981: 9; Boles, et al. 1980: 70). They are relatively small seals. On average, adult males range in mass from approximately 90 to 100kg and measure about 160cm in length. Females average 143cm in length and 70kg in mass. (Bigg 1981: 2; Katona, et al. 1993: 205).

Harbour seals are present in varying numbers along the entire coast of Labrador. In summertime, they are concentrated in the major embayments and around coastal

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

islands, where they may spend much time basking on rocks (Boles, et al., 1980: 67-68). They appear to have been particularly frequent in the Hopedale, Hamilton Inlet and Sandwich Bay regions (Templeman, et al. 1957: Fig. 23, cited in Fitzhugh 1972: 174). Though small populations of harbour seals were reported in the Torngat region, they are not so common there as in the southern coast (Hantzsch 1932: 34), probably because that region lacks broad shallow bays, extensive coastal island clusters and numbers of large estuaries.

Presently, harbour seals frequent several areas in Labrador, including Killinek Island and some of the major fjords of the Torngat region (especially around Eclipse Channel), the shoreline between Napaktok Bay and Cape Mugford, the inner reaches of embayments west and south of the Okak islands, the outer islands, inner bays and major rivers of the Nain district, inner bays and island clusters around Hopedale and sheltered waters within the Hamilton Inlet/Lake Melville fjord system (Ames 1977a: Map 103; Boles, et al. 1980: 69; Brice-Bennett 1977b: Map 31, 32, 33; Williamson 1997: Map 4). Harbour seals breed in all of these regions. Though they do not migrate on an inter-regional scale, harbour seals move from the inner coast to open waters beyond the ice edge during winter months (Boles, et al. 1980: 55). In areas such as Groswater Bay, where the ice edge lies near to shore, harbour seals may remain close to shore throughout much of the winter. Conversely, when the fall freeze-up comes rapidly, harbour seals may be trapped within bays and be forced to crawl over ice to open water (Boles, et al. 1980: 68).

Harbour seals do not migrate over large distances, but do undertake limited seasonal movements trending northward in summer and southward in winter. Atlantic

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

harbour seal populations typically avoid pack ice and fast ice in winter and so move to ice free areas or to the ice edge (Boles, et al. 1980: 68). They lack the tremendously well-developed foreclaws and wooly neonatal pellage (*lanugo)* characteristic of some of the ice-dwelling phocids, and usually pup too late to take advantage of the sea ice platform while it is stable (Bigg 1981: 4: Reidman 1993: 104). In late spring and early summer, they seek out inner bays and estuaries during the late spring and summer, where they pursue runs of spawning fish, and where females bear their pups (Katona, et al. 1993: 211). Pupping occurs in April to May in southern Labrador, and as late as June in central Labrador (Boles, et al. 1980: 67). Harbour seals prefer to bear their pups on protected shorelines in these areas and may travel up rivers to find hauling out places for pupping. They may also use islets or skerries in areas where they are disturbed or intensively hunted (Boles, et al. 1980: 67; Brice-Bennett 1977b: 173). Males reach sexual maturity at 5 to 6 years, while females may reproduce at ages of 3 to 4 years (Katona, et al. 1993: 205). Harbour seals may live in excess of 30 years (Bigg 1981: 9).

Although they swim and forage individually, harbour seals are social animals and often haul out in small groups averaging 18 individuals, though these groups sometimes comprise many more individuals (Bigg 1981: 12). Because they are not migratory and because adults tend to remain in breeding territories, harbour seals are relatively vulnerable to local extirpation through overhunting and local populations may be slow to rebuild through recruitment from neighboring areas. Overhunting, encouraged by government bounties, lead to marked declines in harbour seals populations throughout much of Labrador during the 20th century (Ames 1977a: 287; Brice-Bennett 1977b: 173).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Harbour seals were a valuable prey species for Inuit for their meat and for their hides, for which a commercial market existed in the 20th century (Williamson 1964:19). Harbour seals were hunted from kayaks with harpoons in open water and at the ice edge, as well as with firearms (Brice-Bennett 1977b: 128-129). Harbour seals basking on rocks were especially vulnerable to hunting with firearms. Harbour seals have also been hunted in Labrador with nets, particularly in spring (Brice-Bennett 1977b: 128-129).

With their strong association with open water conditions, avoidance of fast ice, and their practice of spring pupping on beaches and skerries rather than on ice, the range of harbour seals is sensitive to climatic change. Increased severity of sea ice in spring may cut off access to breeding and feeding territories and so render local groups vulnerable. Similarly, decreased winter ice extent and shortened ice seasons may allow harbour seals to remain, and feed, in inner bays for more of the year. They are also liable to fluctuations in prey fish species.

Grey Seals

Grey Seals (*Halichoerus gryphus*) are very large phocids. Female adults measure up to 270kg in mass and 215cm in length, while males may measure up to 450kg in mass and 244cm in length (Katona, et al. 1993: 212). They feed primarily upon pelagic fish such as salmon, herring and cod, and benthic crustaceans and molluscs (Katona, et al. 1993: 217).

Grey seals are present throughout the North Atlantic, including all of Labrador, and especially in temperate and subarctic waters around Newfoundland and the Gulf of St. Lawrence. They are uncommon in general (though their numbers are increasing in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

recent years) and they are more common in southern than northern Labrador, and are most frequent around offshore islands (Boles, et al. 1980: 78-79; Brice-Bennett 1977b: 185, 256). In the late spring and summer, grey seals move into waters around coastal islands in Labrador in pursuit of fish and tend to move northwards (Brice-Bennett 1977b: 128).

Core summer areas for grey seals include headlands and inner reaches of Groswater Bay headlands and bays around Hopedale and outer islands in the Nain and Okak Bay regions (Ames 1977a: Map 103; Brice-Bennett 1977b: 179, Map 33). Grey seals move offshore as coastal waters freeze and remain around the ice edge and pack ice in the Labrador Sea through the winter. They bear pups on the fast ice or on ice floes or on rocky shores far offshore between mid-December and February (Katona, et al. 1993: 214). Winter seasonal concentrations of grey seals may be found in the open water areas within Groswater Bay, especially around islands (Ames 1977a: Map 103). Increased ice severity causing closure of open water in coastal areas will restrict Grey seals' access to the coast in winter. Similarly, the distribution of offshore pack ice affects the location of pupping areas, and likely pup survivorship as well.

Grey seals were hunted in the 20th century because they are serious competitors with fishermen for fish and because they rob and destroy nets (Katona, et al. 1993: 217). They were not generally important subsistence resources for Labrador Inuit in the 20th century (Boles, et al. 1981: 79; Brice-Bennett 1977b: 173, 179, 185) in part because of their relative rarity and large size. Very large seals are difficult to haul onto an ice floe or into a boat (Ames 1977a: 293).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Harp Seals

Harp seals (*Phoca groenlandica*, also frequently termed *Pagophilus groenlandica*), are broadly distributed through the North Atlantic and wide areas of the Arctic (Sergeant 1991: 32). The breeding population of the western North Atlantic ranges from the Gulf of St. Lawrence and Newfoundland regions to Hudson Bay and the Canadian Arctic Archipelago, Baffin Bay and Greenland (Katona, et al. 1993: 219; Sergeant 1991: 32-33). They feed primarily on pelagic fish and invertebrates, especially capelin, polar cod, shrimps and krill (Sergeant 1991: 65).

Harp seals are common animals; in the late 1980's, within about 15 years of the introduction of quota restrictions on commercial harp sealing, the western North Atlantic population was estimated to include some 2.5 million individuals (Sergeant 1991: 101). During their migrations, they are the most common large mammal species in Labrador. Harp seals are also highly gregarious animals. They often travel in groups of about 15-30 animals (and up to about 75 individuals), and congregate in the thousands during parts of their migratory and breeding cycles (Sergeant 1991: 15, 42). Adult male harp seals weigh, on average, about 135kg in mass and measure up to 190cm in body length (Ronald and Haley 1981: 60). Females are not significantly smaller than males as they weigh, on average, about 120kg and measure up to 183cm in body length. Harp seals are, therefore, the largest of the smaller phocid species of the North Atlantic. Both male and females may live to be over 30 years old; females reach sexual maturity at the age of six and males at eight years (Sergeant 1991: 17-19).

Harp seals are associated with sea ice and have many adaptations, such as powerful foreclaws and coats of warm neonatal hair, or *lanugo*, which enable them to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

exploit sea ice habitats (Sergeant 1991). They are most firmly associated with pack ice, rather than fast ice. Although they can, and do, make breathing holes in thin new ice and amidst moving pack ice floes, they do not make or maintain breathing holes in fast ice, as some other species do (Sergeant 1991: 39). Accordingly, harp seals must vacate summer feeding grounds during the fall, and migrate south, ahead of the front of fast ice expanding southward and seaward from coastal shorelines. The southward migrating herd reaches Labrador in the fall, between late September and early December, most commonly in November (Brice-Bennett 1977b: 144). While open water persists on the coast, harp seals will tend to travel through and feed within bays and the inner coast (Brice-Bennett 1977b: 144).

The fall migration lasts until late December or early January, when the last harp seals must travel offshore, skirting the edge of fast ice that usually covers the coast by that date (Ames 1977a: 298; Boles, et al. 1980: Figure 10; Brice-Bennett 1977b: 144). They may be trapped within bays during sudden cold spells that bring rapid formation and have to crawl to reach open water (Brice-Bennett 1977b: 144; Nain Resident 1997: personal communication). In years with early onset of autumn cold weather and ice formation or late dates of migration, harp seals to travel further offshore (Brice-Bennett 1977b: 144).

A small number of harp seals may over winter on the northern Labrador coast, at the ice edge or within rattles with open water (Williamson 1997: 31), or amidst pack ice off of southern Labrador (Sergeant 1991: 39). Nevertheless, the vast majority of harp seals overwinter between Labrador south of Hamilton Inlet, Newfoundland and the Gulf of St. Lawrence. During March, harp seals haul out in huge groups numbering in the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

thousands on drifting pack ice floes in discrete areas within these regions to have their pups (Sergeant 1991: 44). Following this, harp seals drift with the pack ice, moult and breed. Adult harp seals fast through much of the spring reproduction and moulting phase. Accordingly, they are in a depleted state with low body fat at this time of year and tend to sink when killed in the water (Sergeant 1991: 14, 46).

Once the sea ice in the more southerly latitudes begins to melt and disperse in May, harp seals resume feeding and begin to migrate north again, following the retreating margin of pack ice, flaw leads at the fast ice edge and shore leads (Boles, et al. 1980: 71; Sergeant 1991: 45). This migration may last well into June. The initial northward migration of young-of-the-year seals tends to take place relatively far offshore because of the lingering presence of coastal fast ice, while late-migrating adults move into open water of the inner coast (Boles, et al. 1980: Figures 12, 13; Brice-Bennett 1977b: 128). Spring capelin runs are an important reason for depleted adult harp seals to enter coastal waters. Harp seals feed in all of Labrador's bays in search of food, especially outer bays, sea ice conditions permitting (Brice-Bennett 1977b: Sergeant 1991: 67).

In situations where dominant easterly winds prevent the development of flaw leads at the *sina*, and inhibits the formations of shore leads, the northward migrating herd travels further out to sea and may be less accessible to hunters (Brice-Bennett 1977b: 129). Harp seals continue to travel north in June and July, eventually reaching their summer feeding grounds around Baffin Island, Baffin Bay and the Greenland coast (Sergeant 1991: 46).

Harp seals were hunted by Labrador Inuit in great numbers, and relatively easily, during both of their migrations and were one of their most important subsistence

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

resources. In many areas, the fall harp hunt provided the largest catch of any hunting activity of the year. Prior to the fall freeze-up, harp seals were hunted in open water in kayaks or shot or harpooned from shore (Brice-Bennett 1977b: 128, 144; Taylor 1974: 46). After the 19th century, nets set in narrow channels were often used to catch seals; nets were a highly effective means of catching large numbers (up to hundreds) of harp seals (Boles, et al. 1980: 75-76; Brice-Bennett 1977b: 144; Williamson 1997: 19). With the development of slob ice and fast near the shore, fall harp seal hunting activities were moved to the islands of the outer coast, except where groups of harp seals remained trapped in isolated patches of open water. As long as the new ice could be traversed, and their migration continued, harp seals were hunted at the ice edge, from kayaks and with nets (Brice-Bennett 1974: 147).

In the spring, Inuit hunters venture out to headlands and outer islands to hunt migrating harp seals at the flaw edge. They were commonly hunted in cooperative fashion by pairs of hunters in kayaks, or were shot or harpooned from shore, stalked while basking in ice floes, or caught with nets (Brice-Bennett 1977b: 121, 128). Kayaks were especially useful to allow hunters to paddle to, and harpoon harp seals in places where they were feeding on schools of capelin (Brice-Bennett 1977b: 128). Once fast ice began to crack and shore leads formed later in the spring, harp seals were able to move into the bays, and could be hunted closer to the mainland (Brice-Bennett 1977b: 129). Harp seals enter all of Labrador's bays once the fast ice breaks (Brice Bennett 1977b: 123). While the spring harp seal hunt was generally an important and productive activity, those killed in the spring tend to be much leaner than those of the fall hunt. Accordingly,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

they have less caloric value and are more likely to sink when killed and be lost. As many as 50% of harp seals killed in the fall may be lost in this fashion (Sergeant 1991: 14).

Harp seals were one of the most important economic resources available to the Labrador Inuit. They were a very importance source of food by the sheer volume of seals that could be taken and because of the timing of the fall and spring hunts. The products of successful fall hunts in the 20th century were in excess of immediate subsistence needs (Brice-Bennett 1977b: 144, 148) and were cached for later use. Ames (1977b: 221) reports that hunters in the Postville area attempted to hunt enough harp seals to last the winter, without the necessity of hunting at the *sina*. During the 18th and early 19th century as well, such surpluses were indeed cached for winter consumption (Taylor 1974: 51). These surpluses would also have been useful as dog food, necessary for maintaining dog teams during the winter (Brice-Bennett 1977b: 148). The harp seals caught in the spring hunt were also important subsistence resources as, in spring, harp seals are by far the most common mammals available to Inuit hunters. The plentitude of harp seals in spring follows a period of relative paucity of prey species during the late winter. The hides of harp seals were also useful for making boots and items such as kayak covers (Cartwright 1792a: 99), boots, as well as trade items in the form of raw hides or finished stitched goods (Ames 1977b: 221).

Hooded Seals

Like harp seals, hooded seals (*Cystophora cristata)* are associated in particular with pack ice and are found in subarctic to arctic waters throughout the western North Atlantic from the Gulf of St. Lawrence to the Davis Strait, to Baffin Bay, Greenland, Jan

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Mayen and Svalbard (Reeves and Ling 1981: 174). Hooded seals are very large animals. Adult males may weigh up to approximately 360 kg and measure up to 260 cm in length, while females may weigh up to 300 kg and measure up to 220 cm (Katona, et al. 1993: 224; Reeves and Ling 1981: 172). They feed primarily on small and large pelagic fish such as capelin, halibut and cod, as well as cephalopods and crustaceans (Reeves and Ling 1981: 181).

Hooded seals are seasonal inhabitants of the Labrador Sea, arriving with drifting floes of multi-year pack ice in February (Boles, et al. 1980: 80). They tend to remain far offshore in the pack ice, where they pup in March, after which time the adults mate again, moult and begin their northward migration to Greenland in April (Katona 1993: 226; McLaren and Davis 1982: 87). They may be encountered in small numbers amongst pack ice near the edge of land fast ice, as well (McLaren and Davis 1982: 88). Despite a relative degree of abundance (the northwest Atlantic populations were estimated at about 400,000 individuals in the late 20th century (Katona (1993: 227)), hooded seals are seen rarely by most coastal residents in Labrador (Boles, et al. 1980: 80; Hantzsch 1932: 34). They were reportedly hunted in the Killinek region, however (Brice-Bennett 1977b: 147). Young hooded seals sometimes come toward to Labrador shore in spring, or are (rarely) encountered as strays in other seasons (Brice-Bennett 1977b: 147). Because of the inaccessibility of their normal heavy sea ice habitat, hooded seals were not of appreciable economic importance to the Labrador Inuit.

The hooded seal's habitual association with offshore pack ice requires that their range shifts over time with modal distribution of pack ice in the Labrador Sea; when heavier ice conditions are close to the *sina*, hooded seals are likely to be more common

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

there, to remain around the coast and thereby become more readily available to Labrador's inhabitants. Their numbers and pup survivorship rates are likely not particularly vulnerable to the dispersal of the pack ice pupping environment, as pupping occurs at the height of the pack ice season. Reduction of pack ice would result in a more northerly limit of pack ice, and pupping in waters closer to Greenland.

Ringed Seals

Ringed Seals (*Phoca hispida*) are distributed widely in arctic and subarctic waters and throughout the circumpolar region (Frost and Lowry 1981: 31). Ringed seals are present, year-round, along the complete coast of Labrador, though they are much more common in northern Labrador than in the south (Boles, et al. 1980: 20). They do, however, move frequently up and down the coast during the year (Brice-Bennett 1977b: 121). Labrador is the southernmost extension of the ringed seal's normal range in the North Atlantic and it is possible that the shorter ice season south of Hamilton Inlet makes that region a more marginal environment for them.

For the most part, ringed seals feed on pelagic fish such as Arctic cod, rock cod, sculpins and capelin, as well as cephalopods, amphipods and euphasiids, and benthic invertebrates (Boles, et al. 1980: 24; Smith 1987: 45). Ringed seals are the smallest of the North Atlantic pinnipeds; adult males measure up to 136cm and may weigh up to 113kg, while females may measure up to 132cm and weigh 111kg (Frost and Lowry 1981: 38-39). Ringed seals live for approximately 20 or more years and both males and females reach sexual maturity reach sexual maturity at between four and seven years of age (on average, at six to seven years) (Frost and Lowry 1981: 41).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Ringed seals, considered at the level of a whole species or population, are ecological generalists within the perspective of arctic environments. They occupy both open water and pack ice and, unique among the pinnipeds, habitually occupy fast ice environments as well. In most areas, however, ringed seal ranges and habitats are defined by segregated sex and age sets (Smith 1987: 7, 15).

During the summer and fall open water season, ringed seals are common but disperse and travel widely along Labrador's coast, feeding in bays and around outer islands (Brice-Bennett 1977b: 149, 179, 185). When sea ice forms in coastal waters and many other seal species begin to move south, sexually immature juveniles and undersized adults (termed "starvelings") move seaward, generally avoiding the expanding edge of the fast ice (Boles, et al. 1980: 23). Adult ringed seals, however, remain within the bays, and make breathing holes in the new ice with their large claws. They maintain these holes throughout the winter, and so may remain within bays that are entirely ice-covered. The capacity of ringed seals to inhabit fast ice environments provides them with a unique ecological niche, nearly uncontested and stable feeding grounds and breeding territories in coastal waters and a degree of protection from predators (Smith 1973; 1987: 15).

Female adults excavate lairs within pressure-heaved, hummocked or cracked fast ice covered in snowdrifts, where they give birth to, and suckle, their young (Smith 1987: 15; Smith and Stirling 1975; Smith, et al. 1991). Males, too, sometimes construct similar lairs in which they haul out and rest (Smith 1987: 18). While yearling or starveling ringed seals sometimes penetrate fast ice areas, these seals are generally excluded from breeding territories through aggressive intraspecific fighting (Smith 1987: 19). Finley, et al. (1983) noted that in portions of Baffin Bay, females maintain birthing lairs in offshore

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

pack ice. However, in Labrador, the more typical pattern of adults dominating fast ice habitat and immature and starveling seals being confined to the ice edge and pack ice, obtains (Ames 1977a: 287).

Pups are born in their lairs in March and April and are often weaned in late May (Boles, et al. 1980: 24; Brice-Bennett 1977b: 149; Smith 1987: 42). The timing of weaning coincides with the melting out of birthing dens and the beginning of the breakup of fast ice (Smith 1987: 42), which varies from year to year. Also by April or May, ringed seals haul out through their melting breathing holes, at rattles and at the *sina*, to moult and to bask on the fast ice or on ice pans (Boles, et al. 1980: 23, 25: Brice-Bennett 1977b; Williamson 1997: 44). They continue to haul out until the sea ice has dissipated.

Due to their presence in coastal waters throughout the year, ringed seals have long been a very important subsistence resource in Labrador, and have remained so into the modern era (Boles, et al. 1980: 20; Brice-Bennett 1977b; Williamson 1997: 30). They were and are used as a primary source of food for people and dogs and their hides were used extensively for waterproof clothing such as boots and coats, and were sold as trade items (Williamson 1997: 19, 44)

Ringed seals are hunted throughout the year though a variety of means. During the summer and fall open water season, ringed seals may be hunted from boats with harpoons. In the historic period, firearms and especially nets have been productive seal catching methods. Narrow channels within inner bays and around the outer islands generally provide the best seal netting areas (Brice-Bennett 1944; Maggo 1999: 119; Williamson 1997: 49).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Nets were also used to catch seals after freeze-up, around the edge of new thin ice. Ringed seal breathing holes are clearly visible in clear new ice and once the new ice is strong enough to be walked upon, hunters can harpoon or shoot seals at their holes Brice-Bennett 1977b: 147). Adult ringed seals are hunted at their breathing holes throughout the winter. This may require great deal of effort, as the holes are difficult to spot if covered in snow. Lone hunters may lie in wait for a seal to enter another hole (Brice-Bennett 1977b: 149). This may involve a long wait, as ringed seals have dive times approaching 20 minutes (Reidman 1993: Table 1) and ringed seals maintain a number of holes. To aid breathing hole hunting, dogs were often used to sniff out holes and hunted in cooperation with others, that more holes could be watched (Brice-Bennett 1977b: 149; Taylor 1974: 44). Hunters also caught ringed seals at the *sina* from kayaks and on foot with harpoons. With fair weather and westerly wind creating a flaw lead, this means of hunting was quite productive and predictable. Nevertheless, Brice-Bennett (1977b: 149) notes that in the Nain and Okak regions, heavy pack ice and storms often came in March, jamming the edge of fast ice with dense pack ice, hindering travel and preventing hunting at the *sina.*

Springtime was a very important period for hunting ringed seals, as seals bask in numbers on the ice around breathing holes, rattles and the *sina.* They are readily visible and were typically hunted by stalking with a blind, then being harpooned or shot (Brice-Bennett 1977b: 121). Hunters might also catch females and their pups in their birthing dens. Kayaks were used to hunt ringed seals in leads, at the *sina* and in the bays, as the sea ice deteriorated, and to allow hunters to travel and hunt within the pack ice beyond

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the *sina* (Williamson 1997: 44-45). Because of their small size, ringed seal are easily hunted, retrieved and transported by single hunters.

As pointed out above, ringed seals are generalized predators and can occupy all of the coastal ecological niches of Labrador. They are, capable, therefore, of adapting to normal variation in ice conditions in Labrador. To the extent that increased ice conditions increase the area and stability of fast ice along the coast, without rendering too thick for breathing holes or birthing dens, and exclude competitor predators, ringed seals are likely to receive benefit from increased ice conditions. Extremely severe ice conditions may, however, hinder feeding and reduce ovulation and body condition due to poor nutrition (Harwood, et al. 2000).

Ringed seals are, however, vulnerable to exceptional disturbances of springtime fast ice in breeding and pupping territories, rapid unseasonal thaws and early ice clearance in the weaning period (Harwood, et al. 2000; Smith 1973, 1987). Premature melting of insulating snow cover of birthing dens causes higher pup mortality. Mothers wean and abandon their young when fast ice breaks up, to begin their own feeding. Early fast ice dispersal therefore results in retarded pup growth, exposes pups to predators and the elements, causing much greater pup mortality. The continued occurrence of these conditions could deplete or threaten local ringed seal populations.

Bearded Seals

Bearded Seals (*Erignathus barbatus)* are the most widespread large phocid species in the circumpolar region. They are rare in southern Labrador but are found more commonly in northern Labrador (Boles, et al. 1980: 56). Bearded seals are the largest of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the northern phocid species. Adult bearded seals have similar sizes, and may grow up to maximums of 264cm in length and weigh up to 423kg; females often somewhat larger than males (Burns 1981: 151; Katona, et al. 1993: 234). Males reach sexual maturity at between age six to seven, while females are mature by age five to six (Katona, et al. 1993: 234). Bearded seals may live up to 20 to 31 years (Burns 1981: 155-156).

Bearded seals are present in many areas of the Labrador coast, in particular the large embayments of the Torngat coast and the seaward islands off of Okak Bay and Nain Bay, Hopedale and in ice edge areas within Groswater Bay (Ames 1977a: Map 103; Brice-Bennett 1977: Map 31, 32, 33). In winter, they frequent off shore pack ice areas and the *sina*; they often haul out on ice floes (Katona, et al. 1993: 237). They prefer loose, shifting pack ice with open water areas and they can, as well, make breathing holes in thin fast ice (Burns 1981: 152-153). In summer, they remain in coastal and off shore areas where they feed in relatively shallow water (Burns 1981: 161; Katona, et al. 1993: 237). They are benthic feeders, feeding primarily on molluscs, crustaceans and worms living in and near the sea bottom (Burns 1981: 161-162).

In the spring, bearded seals haul out to pup on pack ice between mid-March and May, whereupon they lactate and breed, until about late may (Burns 1981: 154). Bearded seal pups are precocious; they are weaned quickly and start swimming and feeding on their own quickly, without an extended nursing period hauled out on ice floes (Burns 1981: 154). They also haul out to bask on pack ice, near the *sina* and around cracks and leads.

Bearded seal distributions in Labrador are sensitive to climatic variations, as they avoid thick fast ice and heavy, solid pack ice. They will drift up or down the Labrador

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

coast, however, where these conditions can be found near shallow water feeding areas. Bearded seals are frequently hunted at the *sina* in winter and spring, as well as when they bask on fast ice. Their thick hides are useful for making durable hide goods, such as boot bottoms, line, and kayak and umiak covers; their large carcasses are also provide large volumes of food, which may be used to feed dogs. Because they are very large animals, pairs of hunters in kayaks, or groups of hunters, may hunt bearded seals at the *sina.* They are difficult for lone hunters to retrieve from the water, or transport (Nain Resident 1997: personal communication).

Atlantic Walrus

The Atlantic Walrus *(Odobenus rosmarus)* is currently rare in Labrador, though they were once found more frequently in areas of the Torngat coast, around offshore clusters of islands in Okak Bay, the Dog Island and Iglosiatik Island regions of Nain, island offshore of Hopedale, and in Groswater Bay (Brice-Bennett 1977: Map 27, 28; Fitzhugh 1972: 176; Gosling 1910). They were also common in the Gulf of St. Lawrence and around Sable Island but were extirpated in these areas by historical era hunting by European and American fishermen and whalers (Katona, et al. 1993: 238).

Atlantic walrus are the largest pinnipeds, reaching lengths of 3m and weighing 1200kg (Katona, et al. 1993: 238). They are very social animals, often present in large groups and hauling out in herds numbering several thousand in the North Pacific, during the breeding season (Katona, et al. 1993: 238). They are benthic feeders, foraging primarily on molluscs in soft-bottomed shallow waters (Banfield 1974: 364). Walrus haul out on ice floes or shore lines to mate in April or May, and pup in May to June after

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

a year-long gestation (Banfield 1974: 365). They also haul out to rest on ice floes on a daily basis, after feeding (Banfield 1974: 363). Walrus are primarily associated with shallow waters and so remain in coastal areas until fast ice forces them offshore. In winter, they favour moving pack ice and the *sina*, clustering around offshore islands with shallows (Banfield 1974: 363). Their winter range is therefore sensitive to climatic changes which affect coast ice distributions, as they will migrate to locations were pack ice may be found near feeding grounds.

During the early contact period, walrus were hunted by the Labrador Inuit from kayaks and with the use of harpoons and floats, and at the *sina*, with the use of harpoons and drag anchors (Taylor 1974: 36). Walrus were not animals of primarily subsistence importance though, on occasion, they were hunted in substantial numbers around the outer islands in spring; Taylor (1974: 36) related that in 1778, 30 walrus were taken between early February and mid-March among the islands of outer Okak Bay. Brice-Bennett (1977: 121) reports that the islands of outer Okak Bay and Hebron were good hunting areas for walrus, who frequented the *sina* after February until as late as June.

Cetaceans

Several species of toothed and baleen whales are present at least seasonally in Labrador's coastal waters. Among these, belugas, humpback, bowhead and right whales have been of particular economic importance for the Labrador Inuit.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Odontocetes: Beluga Whales

Beluga whales (*Delphinapteris leucas*), also known as 'white whales" are relatively small piscivorous toothed whales up to about 5.7m long and weighing as much as 1600kg (Katona, et al. 1993:135). They have a diverse diet of pelagic fish and cephalopods, and benthic fish, crustaceans, molluscs and worms (Banfield 1974: 250) and are well-known to frequent estuaries and coastal shallows to feed on seasonal fish runs. They migrate north along the Labrador coast in the spring and summer and south again in the fall (Brice-Bennett 1978). Belugas migrating north follow the *sina* and seek out open water patches in the decaying fast. Once open leads are present, they enter estuaries to feed in char during their run to the sea and some pregnant females also bear their calves at this time (Brice-Bennett 1978). Belugas are often observed, in small numbers, in the offshore islands and estuaries of the Hopedale, Nain and Okak Bay regions (Brice-Bennet 1977: Map 26, Map 27, 1978; Williamson 1997: 31).

Historically, belugas were hunted in the spring with the use of kayaks, likely in cooperative drive hunts (Taylor 1974: 47). In more recent years, nets were sometimes used to snare belugas around outer islands, during the fall southward migration (Brice-Bennet 1978). Belugas appear to be much less common now than in past years (Brice-Bennett 1978; Hantszch 1932: 8; Williamson 1964: 21).

Baleen Whales

Several species of whales, large and small, are observed on the Labrador coast. Many of these, such as the sei, fin and sperm whales, though relatively common, are too large and active to have been hunted effectively by the Inuit and so are not discussed

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

here. Other species are quite rare in Labrador. Some of the smaller species, such as minke whales, porpoises and killer whales are also difficult to hunt with traditional techniques because of their activity and, in the case of the killer whale, their aggressiveness (Brice-Bennett 1978: Taylor 1974: 25). Nevertheless, dead whales of all these species turn up as stranded carcasses on the Labrador Coast. The baleen, bones and, if possible, the flesh of these animals were thoroughly used by Inuit in the past, including those species that were not hunted (Taylor 1974: 25-26, 32. Because of their behaviour, bowhead whales and humpback whales are the most likely candidates for Inuit whaling in the contact period.

Bowhead Whales

Bowhead whales (*Balaena mysticetus*), also known as the Greenland Right Whale, are large, ice-adapted baleen whales measuring in length up to 20m and weighing 60 to 100 tons (Fontaine 1998: 178). As baleen whales, they prey primarily on copepods and euphasiids (Lowry 1993) and sometimes on benthic organisms (Reeves and Brownell 1982). Bowheads are present throughout the North American Arctic, North Pacific and North Atlantic. In the eastern Arctic, bowheads are concentrated around Davis Strait and migrate in accordance with the seasonal distribution of sea ice; moving from summer feeding areas as far north as Smith Sound, Lancaster Sound and Baffin Bay around northern Baffin Island and Greenland, to wintering areas in Disko Bay, the west coast of Greenland, Foxe Basin, southeastern Baffin Island and in the Labrador Sea as far south as (Moore and Reeves 1993: 362-364; Reeves and Brownell 1982: 437). Therefore some members of the Davis Strait population migrate along the Labrador Coast.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Little is known conclusively about the range and behaviour of bowheads in Labrador, as they are presently very rare there. Southward migrating bowheads reach the Labrador coast in October, with the bulk of animals arriving in November (Taylor 1974: 24), traveling to overwintering areas in open water as far south as the Strait of Belle Isle (Moore and Reeves 1993: 361). They travel north again in spring as pack ice disperses. While bowheads are associated with pack ice environments, they tend to avoid fast ice and close pack ice and so their migration routes may be altered by pack ice concentrations (Dyke, et al. 1996). It is possible that the animals that migrated to Labrador were mostly adults, as Taylor notes a 19th century report that only larger whales traveled close to the shore of Baffin Island on their southward ward migration. More recently, Finley (1990; cited in Moore and Reeves 1993: 366) reported that bowheads summering in the Isabella Bay region of Baffin Island were mostly large adults, with few calves or subadults.

Bowheads are gregarious, slow-moving whales that often travel near the surface at speeds of about km/h (Fontaine 1998: 179). They are also are reported to attempt to escape, upon being harpooned, by diving vertically for up to 40 minutes instead of swimming away, allowing hunters to remain within pursuit distance of the whale when it returns to the surface (Taylor 1974: 25). Bowheads would appear to have been excellent candidates for Inuit whale hunting efforts in Labrador because of these traits and because of their apparent habit of traveling in coastal waters, assuming that Inuit could successfully capture and land.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Right Whale

The Right whale (*Eubalaena glacialis*), or North Atlantic Right whale, is a close relative of the bowhead and alike it in many respects, though it is a species of cold temperate areas, not arctic waters (Reeves and Brownell 1982: 415). The right whale grows to lengths of 18m and weights of 30 to 100 tons. Right whales feed on copepods and euphasiids with the help of baleen filters, in coastal waters. They are also slow swimmers, making them vulnerable to whale hunting (Fontaine 1998: 182).

Right whales are presently rare in the Newfoundland and Labrador waters, but had been quite common in these areas and in the Gulf of St. Lawrence prior to large-scale hunting conducted by Europeans after the early 16th century (Barkham 1978, 1980; Reeves and Brownell 1982: 428). It is likely that the northern summer range of the right whale overlapped with the winter range of the bowhead whale, and both were hunted by Basque enterprises in the Strait of Belle Isle in the 16th century (Moore and Reeves 1993: 361). In this case, it is likely that right whales occupying the Labrador Sea in the summer would migrate south in September to October, prior to the arrival of the bowheads.

Humpback Whales

Humpback whales (*Megaptera novangeliae*) are a third possible candidate for Inuit whaling in Labrador. They are smaller than bowhead whales, measuring up to 16m long and weighing up to 30 tons (Fontaine 1998: 203). Humpbacks are also feed on zooplankton and pelagic fish (Fontaine 1998: 205). These whales have mostly temperate to tropical ranges and have wintering, breeding and calving grounds in the Caribbean; some have summer feeding grounds on the Newfoundland-Labrador and southwestern

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Greenland regions (Katona, et al. 1993: 53). Winter sightings of humpbacks around Newfoundland are rare (Lein 1985: 24). Hawkes (1916: 82) reported that Labrador Inuit of Nachvak Fjord hunted humpback whales into the early 20th century. Inuit peoples in other parts of the eastern Arctic hunted humpbacks after bowhead stocks declined in the 19th century, as did other aboriginal people in North America (Stoker and Krupnik 1993: 599).

Whale Hunting Techniques

The methods used by the Inuit of Labrador to hunt whales in the 18th century was described in texts compiled by Moravian Missionaries, and resemble those used Inuit peoples in other parts of the Arctic region (Boas 1964: 91-92; Crantz 1820; Egede 1926; Rink 1974). As in other parts o the Arctic, Labrador Inuit whale hunting was deeply imbued with ritual significance, and accomplished with shamanic ceremony, obeying of taboos, use of amulets and especially with feasting (Taylor 1990). Large baleen whales appear to have been hunted during the fall and especially November, while migrating whales were most common prior to freeze up (Taylor 1974: 25). Savelle and McCartney (1994) have argued that Thule (and presumably Inuit) whale hunters selected primarily small, young bowheads as they were less wary of humans, easier to tow once captured; their osteometrical analyses of bowhead remains from Thule whaling sites in the central Arctic showing preponderance of young individuals supports this proposition. Nevertheless, Taylor (1974: 25, 1979: 295) expressed the opinion that the Labrador Inuit were able to hunt larger bowheads as well as small individuals.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Inuit hunted large whales through cooperative efforts of many people and with the use of an *umiak*, the large open skin boat, or "women's boat" having space for 9 to 13 rowers, someone to steer and an harpooner (Hawkes 1916: 68-69; Taylor 1974: 31, 1979: 294). These boats were made of thick seal or walrus skins stretched over wood a frame, had oarlocks, a rudder, sometimes a sail, and were substantial enough to hold several people and substantial goods for trading trips and seasonal migrations, as well as whale hunting trips (Boas 1888: 119-121: Hawkes 1916: 68-69).

Having closed with a whale rising from a dive, an harpooner would throw a heavy harpoon attached to a float and drag anchors which, when successful embedded, impeded the wounded whale and guided the crew to the location of an escaping whale once it submerged again (Taylor 1979: 295; Stoker and Krupnik 1993: 587). Upon resurfacing, the whale would be harpooned again, until it was sufficiently exhausted to allow the umiak crew to draw alongside and dispatch the whale with lances. Ideally, the hunt was conducted with multiple whale crews and umiaks, as cooperative hunting allowed greater probability of successfully pursuing and harpooning the whale (Taylor 1974, 1979: 1988). As well, the immense bulk of a whale required considerable labour to tow and land it on a shoreline where it could be butchered. Kayaks too were used to hunt whales in Labrador, in combination with numbers of other kayaks and umiaks, and apparently were useful for hunting smaller, young baleen whales (Taylor 1979: 295). Stevenson (1997: 253) also described the use of kayaks to hunt whales by the Cumberland Sound Inuit of Baffin Island.

Once a killed whale was brought to shore near the settlement of the man who threw the first successful harpoon (Taylor 1990: 127), hunters wearing special waterproof

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

seal skin or gut skin clothing flensed the floating carcass. The labour of whole communities was used to aid in butchery and recovery by flensing, by hauling on ropes to pull the carcass out of the water, and by carrying the skin, blubber and meat ashore (Taylor 1979: 297, 1990; Stoker and Krupnik 1993: 588). Some of the foodstuffs were eaten immediately by the participants, while the remainder would be divided amongst the households of the community under the oversight of the successful harpooner (Taylor 1990: 128) and then cached. Feasts would follow successful hunts, though in Labrador, these appear to have occurred after the November hunt, later in the winter once the development of fast ice allowed guests to travel easily by dog sled (Taylor 1974, 1990: 129). After the whale hunting season was over, the baleen was extracted from the carcass and distributed (Taylor 1990: 128).

The meat, fat and skin of a successful hunt provided great quantities of food for communities and dog teams, used through the winter, while blubber was also an important lamp fuel (Stoker and Krupnik 1993: 607; Taylor 1974: 25). Baleen was a very valuable item in trade with Europeans into the 19th century and useful in traditional material culture. Blubber too was a trade item in situations where it could be stored in bulk and readily collected by traders, as was the case in Danish Greenland (Rink 1974: 280) and in Labrador once trading operations were established at the Moravian Mission posts (Brice-Bennett 1990: 228, 231). Bones were also used to construct houses and to make any number of everyday items of material culture. Naturally beached carcasses of all species of whale were also used as sources of these same materials when encountered. If fresh enough, their meat was used for human or dog food and blubber for fuel (Taylor 1974: 25, 32). Most of the baleen whales and the right whale and bowhead whales in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

particular had been hunted on a massive scale by European and American ship-borne hunters from the 16th to the 20th century. By the late 18th century, bowheads and right whales had become quite scarce in much of the western Atlantic including the Labrador Sea (Stoker and Krupnik 1993: 600).

Ecological Description and Land Use in the Hamilton Inlet Region and The Narrows

Measuring over 240km in length, Hamilton Inlet is the largest and most complex of Labrador's many fjord systems. Its has two major components, Groswater Bay and Lake Melville, as well as a few smaller tributary fjords. Groswater is the eastern portion of Hamilton Inlet. This is a very large, open, bay lacking the shelter of numbers of offshore islands, such as those that protect the coastline of the Nain region. Those that do exist are located in the northern half of the bay. Groswater Bay is up to 30km wide and extends some 70km into the mainland interior. Lake Melville comprises the western portion of the fjord system. Lake Melville is a very large and relatively shallow tidal lake 140km long and up to 35km wide, and is fed by several large rivers that drain into its western end, in the region of the modern town of Happy Valley-Goose Bay.

The fjord channel is constricted between Groswater Bay and Lake Melville, where it passes through a region of sharp topographic relief and deep linear valleys. This 35km long strait, termed the Narrows, creates a dramatic threshold between the specific environments of the bay and the lake. The Narrows is itself divided by a large and a small island (Henrietta Island and Eskimo Island respectively), in its western portion. The modern village of Rigolet lies at the eastern end of the strait. Though deep, the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Narrows is less than 2km wide in places, and this bottleneck produces a strong tidal current that runs between 3 to 5 knots in most areas (U.S.N.H.O. 1941: 146) and as fast as seven knots (Ames 1977a: 279). The tidal currents around Eskimo Island are particularly strong (up to 6 knots) and this area is prone to strong crosscurrents and tidal rips (U.S.N.H.O. 1965: 127-128).

Two smaller fjords, Double Mer and the Backway, join Hamilton Inlet in the vicinity of the Narrows. The Backway, near the southern end of the Narrows, follows a relatively broad valley 35km east. Double Mer is a long, narrow and steep-sided fjord that joins Hamilton Inlet at the northern end of the Narrows, and runs about 80km west.

Sea Ice

Sea ice conditions in Hamilton Inlet are complex because of the region's diverse topography. Lake Melville's waters are the first in the region to freeze because of the low salinity of the surface water layer and earlier onset of freezing temperatures in this continental region (Ames 197: 279; C.H.S. 1988: 209). While, in recent years, regional ice formation dates vary from two to four weeks, ice usually forms in shallow Terrington Basin, the westernmost end of Lake Melville, in late October (C.N.S. 1988: 216). By mid-November, fast ice normally covers that area and has spread into the rest of Lake Melville, covering it in fast ice by the middle of December (C.N.S. 1988: 66, 196, 216; U.S.N.H.O. 1965: 128; Roche, et al. 1978: Figure 3). Between 1961 and 1990, the maximum thickness of ice in Lake Melville was 122cm (Cote 1992: 56).

Presently, fast ice begins to form in Groswater Bay along the coastal approaches to Hamilton Inlet by the middle of December (C.I.S. 2001: A-6; U.S.N.H.O. 1965: 117).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

While a large area of the southern portions of Groswater Bay are usually swept free of ice by tidal currents, a large patch of fast ice develops along the northern shore of the middle of the bay (Ames 1977a: 279), though this ice not be well developed until February (C.I.S. 2001: A-47).

The floe edge meets the northern shore of Groswater Bay shore in the vicinity of Big Black Island (Ames 1979: 279). It then extends south to Saddle Island, which anchors a large tongue of fast ice in the middle of the bay, over 10km from the northern shore. From this point, the floe edge runs directly west until it meets the northern shore again at Tikoralik Head (Ames 1979: 279, Map 103). A sizeable area of fast ice also develops amongst the Smoky Islands lying off the headland of northern Groswater Bay (Roche, et al. 1978: 27, Figure 5).

By mid-February, pack ice transported from Baffin Bay arrives off of Hamilton Inlet (C.H.S. 1988: 196; U.S.N.H.O. 1965: 117). Winds frequently fill Groswater Bay with quantities of pack ice and press the pack against the thin seaward margin of fast ice in the Bay. The edge of the fast ice is thereby compressed into rough, stacked, semi-consolidated floes, and cracks and leads may also be formed (Roche, et al. 1978: 27).

Currently, fast ice fills the Double Mer and Backway fjords in December. The Narrows, from Tikoralik Head to Eskimo Island, however, is kept free of ice in most circumstances by its strong tidal current (Ames 1977a: 279; C.N.S. 1988: 206; Roche, et al. 1978; U.S.N.H.O. 1965: 117). Therefore, the Narrows provides a corridor that brings open water, and the sina ecosystem, from Groswater Bay deep inland to the margin of Lake Melville. Fast ice in Double Mer usually ends near the entrance of the fjord into the Narrows, adjacent to Double Mer Point (Ames 1977a: Map 103). Similarly, fast ice in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the Backway may extend from Back Bay Cape (the eastern shore of the entrance to the Backway) to the easternmost point of Henrietta Island, extending all along the southern shore of that island to Lake Melville and Eskimo Island (Ames 1977a: Map 103). During milder ice years, most of the channel south of Henrietta Island may be free of ice and the edge of fast ice in the Backway runs squarely across its entrance (Woollett, et al. 2000).

A third ice edge within the Narrows is located at in the northern channel of its western (termed the *Cul de Sac*). The fast ice covering Lake Melville usually terminates in this area, in a shelf extending approximately from Caravalla Cove to the southern shore of Eskimo Island and east to southern Henrietta Island (Ames1977: Map 103). While the precise location of the ice edge in the Narrows fluctuates from year to year and during the winter and spring, there is a predictable and stable connection of the Lake Melville fast ice to Eskimo Island every year as well as open water touching upon the island (Rigolet Resident 1998: personal communication). In the early spring of 1998 (a year of mild ice conditions), much of the channel south of Henrietta Island to the entrance of the Backway was ice free, but a strong and broad spit of Lake Melville fast ice remained anchored to Eskimo Island.

Sea ice may cover the Narrows in particular circumstances. Despite its strong currents, the strait sometimes freezes over entirely during protracted spells of exceptionally cold weather, as happened during the winters of 1909 and 1920 (Ames 1977a: 279; U.S.N.H.O. 1965: 128). The dynamics of coastal pack ice can also affect the region. Groswater Bay and the eastern entrance to the Narrows may become choked with ice floes when strong tides or easterly winds push pack ice inshore and continuing onshore winds may clog the Narrows itself with pack ice (Ames 1977a: 279). The

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

presence of pack ice in the Narrows or its entrance isolates the area from the sina ecosystem as local ice free areas are covered in floes and the sina moves farther east in Groswater Bay, well offshore. Similarly, the development of continuous fast ice within the Narrows also extends the local floe edge eastward and, in effect, incorporates the strait into the more uniform ice environment of Lake Melville.

A switch of prevailing winds from cold northerlies to warmer southerlies and westerlies marks the beginning of spring in Labrador (Crane 1978; Newell 1990). As with the onset of fall freeze-up, the springtime breakup of ice begins at the western end of Hamilton Inlet and proceeds east. Ice usually begins to break up in Terrington Basin in western Lake Melville by mid to late May, while ice elsewhere on the lake begins to clear by one to two weeks later (C.H.S. 1988: 216; C.I.S. 2001: A-28, A-30). Hamilton Inlet is usually free ice by early June, though it may persist as late as June 18 (C.I.S. 2001: A-30; A-102). Fast ice in the rest of Hamilton Inlet begins to clear in early June, though clearance dates may vary from two to four weeks (C.H.S. 1988: 196).

The westerly winds that initiate the melting of fast ice also clear the coastline of pack ice by the middle of June (C.N.S. 1988: 196). Nevertheless, quantities of pack ice remain near the coast well into the summer. The pack ice is usually sufficiently thick to prevent navigational access to Lake Melville until late June (U.S.H.N.O. 1965: 128). As late as July (and, in some years, August); easterly winds may blow the remaining pack ice back into shore in sufficient quantities to hinder or prevent navigation and interfere with sea mammal migrations (C.N.S. 1988: 196).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Biological Communities of Hamilton Inlet

Hamilton Inlet is the most richly varied of Labrador's ecological regions because of the area's highly varied topography, the confluence of a number of major drainages, and because of the ameliorating climatic effect brought by the penetration of the marine ecosystem deep into the continental interior (Ames 1977a; Fitzhugh 1972: 19-20). Pockets of nearly all the environments characterizing large regions of Labrador may be found around Hamilton Inlet (Fitzhugh 1972: 15). Nevertheless, the division between coastal and interior, as well as upland and lowland, environments in the region is stark (Kindle 1924: 23).

Within its interior, Hamilton Inlet is a basin dissected by watercourses and framed, north and south, by extensive highlands. A broad range of vegetation is found in these areas. Most notably, thick stands or relatively tall black and white spruce as well as larch and balsam fir grow in the extensive lowlands and valley bottoms and along the margins of water bodies (Ames 1979: 279). Bogs and lichen woodlands are also common. Hardwoods, and especially birches, grow as fire climax species in burned areas (Ames 1979: 279, Fitzhugh 1972: 20). A variety of berry species (blueberry, bakeapple, partridgeberry, cranberry, blackberry and raspberry) also grow plentifully in the interior. In the most sheltered interior areas around Lake Melville, the treeline reaches elevations of 450m, and 120m in the vicinity of the Narrows. Above these elevations, are lichen heaths and barrens.

The vegetation of the coastal zone is remarkably less diverse than that of the interior. Vertical zonation of vegetational communities is much more sharply defined on the coast, where the treeline ranges from 70m to sea level (Fitzhugh 1972: 19). As a

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

result, tundra and lichen woodlands are most common near the coast, along with bogs in valley bottoms and some smaller, isolated forest patches in sheltered pockets. Exposed portions of the coastline and islands tend to be barren and rocky.

A Brief Survey of the Animals of Hamilton Inlet

Terrestrial Animals

Terrestrial animals in Hamilton Inlet show the same pattern of diversity and distribution as the plant communities; a greater variety of terrestrial mammal, sea mammals and birds are found in the region than anywhere else in Labrador. Porcupines and rabbits may be found in most areas (Ames 1977a: 293). Both woodland and barren ground caribou are present in Hamilton Inlet; herds are present in the Mealy Mountains south of Lake Melville, the barrens and lichen woodlands north of Hamilton Inlet, and in the Beaver River and Romaine River drainages west of Lake Melville (Ames 1977a: Map 107; Fitzhugh 1972:21). Caribou migrate to coastal areas north and south of Groswater Bay to feed and calve in June (Ames 1977a: Map 107, 293) and usually overwinter deeper in the interior, distributed over very extensive ranges. On occasion, caribou from the Mealy Mountains migrate north in winter, crossing the ice on eastern Lake Melville and the mouth of Groswater Bay (Ames 1977a: 297).

Caribou have long been an important economic resource in Hamilton Inlet, and typically were hunted from fall to spring. The valley east of the Backway and the Mealy Mountains were significant caribou hunting areas south of Hamilton Inlet for Inuit in the Rigolet region, in the twentieth century. Extensive areas of north of Double Mer and Groswater Bay have been used as hunting areas in both summer and winter. On

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

occasion, Henrietta Island and mainland between the Narrows and Double Mer (immediately northwest of Eskimo Island) have been used as hunting areas as well (Ames 1977a: map 107).

Carnivores

Black bears commonly forage along the shorelines throughout the Hamilton Inlet region, from eastern Lake Melville, through the Narrows, Double Mer and the Backway, well into Groswater Bay (Ames 1977a: 287, Map 107). They are known to make winter hibernation dens in the northern Groswater Bay area and usually are hunted opportunistically in spring and fall.

A broad range of fur-bearers inhabits Hamilton Inlet. The region is also home to several species of fur-bearers and trapping was one of the economic mainstays of the Rigolet region until the later 20th century (Ames 1977a: 284, 303). Arctic fox, red fox, mink, lynx, otters and beavers are found in Groswater Bay and the Narrows, especially in sheltered coastal valleys and along watercourses (Ames 1977a: Map 113). Foxes are ubiquitous along the coast, especially on the sea ice in winter, and are the only furbearer present in many more exposed coastlines and islands. Within the more sheltered and continental Lake Melville, Backway and Double Mer areas, fox, lynx, mink, marten, otter, muskrat and beaver are found; many of the better trapping areas for the water-dwelling species and the carnivores (excepting foxes) lie within these areas (Ames 1977a: 303, Map 113).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Birds

Seabirds, too, are common in the Groswater Bay and the Narrows. Most species are seasonal migrants; important among these are gulls and alcid species (puffins, murres, razorbills, black ducks and black guillemots) that feed and nest in large areas of the Narrows and especially the islands in the inner and outer portions of Groswater Bay (Ames 1977a: Map 104, 105). Canada Geese and a host of duck species are some of the most common and economically important summer and fall migrants (Todd 1980). While Canada Geese range very broadly from inner Groswater Bay to western Lake Melville, considerable numbers of geese nest, feed and moult in wetland areas north and south of Groswater Bay, the inner bay and along the shores of the Backway (Ames 1977a: Map 105). The more sheltered waters of the Backway and Double Mer are also frequented by surf scoters and black ducks. Eider ducks are common year-round residents of Groswater Bay and nest on its islands as well.

Willow ptarmigan live year round in interior forested areas while rock ptarmigan frequent heath and highland tundra areas; both these species are very common and hunted intensively in fall and winter (Ames 1977a: 295; Todd 1980). The northern side of Double Mer and valley bottoms around the Narrows are favoured hunting grounds for willow ptarmigan, while rock ptarmigans are often hunted in tundra areas south of inner Groswater Bay (Ames 1977a: Map 109).

Fish

Several species of fish are found in Hamilton Inlet. In general, fish are most common in Groswater Bay, the Narrows, Double Mer and the Backway, and eastern Lake

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Melville, and much less abundant in the remainder of Lake Melville (Ames 1977a). Traditionally, capelin were very abundant in Groswater Bay and on the Hamilton Bank, which lies southeast of Groswater Bay. While they also spawn in deep water, capelin come into coastal shallows and beaches in great numbers to spawn. Capelin have long been harvested from shore and dried for human subsistence. They are, however, most important as a foundation of the marine food chain as they are the preferred food item for cod, salmon, and char, as well as several sea bird and sea mammal species (Northland Associates Ltd. 1979: 253).

Atlantic cod have been plentiful in Groswater Bay and on the north shore of Hamilton Inlet (Ames 1977a: 301). Until stocks were depleted in the later 20th century, a commercial cod fishery was practiced in the region, and there were several fishing harbours in outer Groswater Bay. By the 1970's, however, few people from Rigolet participated in this fishery and the bulk of the boats involved in this fishery were foreign vessels or from Newfoundland (Ames 1977a: 201; Northland Associates Ltd. 1979: 251). Atlantic Cod are apparently not present in the Narrows (Kindle 1924: 38).

Salmon were the subject of the most important local fishery. Salmon are found most abundantly throughout Groswater Bay and the Narrows, as well as the eastern portion of Lake Melville. Fishing efforts in the 20th century concentrated on the shores of the Narrows and Henrietta Island, coves on the north and south shores of Groswater Bay, and the mouths of several streams in which salmon spawn (Ames 1977a: 301). Char too are fished in streams or along saltwater shorelines. Brook trout are also common and are fished in streams and their outlets in all seasons, including streams around Double Mer and the Backway (Ames 1977a: 301). Additionally, rock cod and smelts were fished on

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

occasion in all seasons. Rock cod are caught in any coastal area and can be easily jigged through holes in the ice during winter (Ames 1977a: 301). Smelts are found in great numbers in the eastern end of the Backway. They are easily fished in all seasons, though they too are most frequently fished in winter (Ames 977: 302).

Sea Mammals

Seals are the most common type of mammal in Hamilton Inlet and have always been of primary importance for subsistence in the area. Almost all the species found in the north Atlantic are permanent or seasonal residents of Hamilton Inlet, barring only the hooded seal. Ringed seals are the most widespread seal in the area and are present on the Labrador coast throughout the year. Despite reports that there is a limited summer migration of ringed seals from south and central Labrador to northern Labrador (Boles, et al., 1980: 34), at least some ringed seals remain within Hamilton Inlet during the summer months. In summer and fall, they range freely in pursuit of prey, such as capelin and young cod (Boles, et al., 1980: 40). Double Mer and Groswater Bay are noted summer hunting areas for people living in the Rigolet area although, in summer and fall, ringed seal hunting is mostly done opportunistically while fishing or travelling (Ames 1977a: 287, 298).

Once coastal waters begin to freeze over, ringed seals change their distribution and engage in range exclusion based on age class. Reproductively mature males and females seek out new fast ice areas and scrape out breathing holes to maintain themselves under the ice. These areas include eastern Lake Melville, Double Mer, the Backway, and the northern shore of Groswater Bay (Ames 1977a: Map 103). Immature ringed seals

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and smaller mature individuals (starvelings or "outside jars") move to open water and pack ice covered areas in the Narrows and Groswater Bay. Both are core areas for hunting these seals from boats in winter during recent years (Ames 1977a: 298). In Groswater Bay, there are two preferred hunting places at the sina. One is adjacent to Big Island in the inner portion of the bay, while the other is in the outer bay in a pocket of open water lying between tongues of fast ice forming around Black Island and Saddle Island (Ames 1977a: Map 103).

By early spring, female ringed seals make birthing lairs in areas of cracked or hummocked fast ice with deep snowdrifts where they have their pups in late March and April. Lake Melville and the Backway are preferred places for the construction of birthing lairs (Ames 1977a: 287, Map 103). From late April to early June, warming temperatures melt out breathing holes and birthing dens and, during this time, ringed seals haul out to bask on the ice. Traditionally, the spring seal hunting in the area concentrated on birthing dens and especially on mature basking seals and pups, on Lake Melville and the Backway (Ames 1977a: 287). Nevertheless, immature ringed seals were also hunted from boats in the Narrows at this time of year.

Seal nets, made of heavy gauge line with a wide mesh, are also commonly used to hunt all the smaller seal species in all seasons. Nets are usually placed along coves and points in places frequented by seals and wok by entangling and drowning the seal. Residents of the Rigolet region have commonly placed seal nets along the north shore of Groswater Bay (and especially in the inner bay), in the southern entrances to the Narrows, the entrance to Double Mer the head of the Backway and in eastern Lake Melville (Ames 1977a: Map 110).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Nets may also be placed at the edge of ice-covered shores. One local resident, Rigolet Resident 1998: personal communication), informed the author that he and his son used to set a seal net all winter in the water off of Caravalla Cove, his family's home at the western entrance to the Narrows, on the mainland immediately west of Eskimo Island. His nets were oriented parallel to the ice edge, or were inserted under the ice and drawn along under it, perpendicular to its edge, by use of a rope, pole and a series of holes cut through the ice. The effectiveness of seal nets could apparently be unpredictable; a resident of Rigolet once harvested a total of 96 ringed seals with his net during one winter but recovered only a single ringed seal during the following winter (Rigolet Resident 1998: personal communication).

Harp seals are very common in Hamilton Inlet during their seasonal migrations. Their spring migration takes harp seals through Groswater Bay in May and June and they pass through the area again at the beginning of the ice season, in December and January (Ames 1977a: 287, 298). The usually travel in small groups of 15-20 animals, previously these herds were larger (Ames 1977a: 287). When Hamilton Inlet is open, harp seals may travel as far west as Lake Melville, however they are most commonly found, and hunted, in the western portion of Groswater Bay, in the Narrows to Eskimo Island, and in the Backway (Ames 1977a: 298, Map 103). In the fall, recent hunters have pursued harp seals with guns as the seals are fat and easily retrieved while they but were also taken in nets around the Narrows. In the spring, harp seals are lean enough to sink when killed and so were often caught with nets (Ames 1977a: 287).

On occasion, some harp seals may linger in the area into, or through, the winter and may be hunted at the sina in Groswater Bay, between Big Black Island and Little

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Black Island (Ames 1977a: 298; Rigolet Resident 1998: personal communication). They may also tarry within Hamilton Inlet and can be trapped by rapid or early ice formation in eastern Lake Melville or Groswater Bay. These trapped seals seek out open water holes in the ice, where they are readily hunted. These animals, termed "crawlers" may attempt to return to the sina by crawling over the new ice; the effort is futile for most crawlers as they easily become lost and perish on the way (Rigolet Resident 1998: personal communication).

Harbour seals are not currently as common in Hamilton Inlet as are ringed or harp seals, but they have local breeding areas and remain in the Rigolet region the year round. In spring, once ice has sufficiently cleared, harbour seals seek out the discharges of rivers where they feed on fish. They pup in early June in several rivers in northern Groswater Bay and Byron Bay and Jeanette Bay (immediately north of Groswater Bay), and in Double Mer (Ames 1977a: 287; Rigolet Resident 1998: personal communication). During the summer, harbour seals are widely distributed in the area and often travel up rivers into freshwater lakes. Most notably Seal Lake, northwest of western Lake Melville, has a resident population of harbour seals (Harper 1961: 127; Low 1896: 317). They are most commonly encountered, and hunted from boats in Valley Bay (in easternmost Lake Melville), Double Mer, in shallows waters in northern Groswater Bay and in Jeanette Bay and Byron Bay, north of Hamilton Inlet (Ames 1977a: Map 103).

During the fall and late into the year, harbour seals are hunted throughout western Groswater Bay and the Narrows from boats and with nets until the time coastal ice formed (Rigolet Resident 1998: personal communication). Harbour seals are also hunted during the fall in the Backway, during their mating season (Ames 1977a: 287). When the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

inner portions of Hamilton Inlet freeze over, harbour seals move to the sina in Groswater Bay, where they have been hunted in the vicinity of Big Black Island and Little Black Island (Ames 1977a: 287, 298, Map 103; Boles, et al., 1980: 68; Grenfell 1913).

Kindle (1924: 38) reported that harbour seals were abundant in Hamilton Inlet. In the 1950's and 1960's, however, a Canadian Government bounty had been placed on harbour seals because they hindered the salmon fishery. Ames (1977: 215) observed that this hunting, coupled with long-term subsistence hunting, appears to have lead to over-hunting and a decrease in numbers of this species generally in Labrador. Many residents of coastal Labrador echo this observation or offer that animals like the harbour seal have become scarce in their accustomed habitats because of disturbance by noisy speedboats and firearms, and now seek out quiet islands farther offshore or in isolated locations (Brice-Bennett 1977b: 173; Rigolet Resident 1998: personal communication).

If these observations are indeed the case, current harbour seal population in the area may not be an accurate indication of their past numbers or range. A lifelong resident of the Rigolet area (Rigolet Resident 1998: personal communication).suggested to the author that hunting for the bounty and pelts had almost destroyed the harbour seal population around Rigolet. He also noted that their numbers are currently rebounding now that the bounty has been rescinded and market for seal hides is lost.

Bearded seals are present in Groswater Bay. Mature bearded seals, or *udjuk*, are primarily associated with winter pack ice lying outside the sina. They do not appear to enter Hamilton Inlet far enough to frequent the Narrows (Rigolet Resident 1998: personal communication). On occasion, mature bearded seals are still hunted in Groswater Bay but, without dog teams needing meat or a market for their hides, there is presently little

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

interest on the part Rigolet hunters to pursue these large animals. Nevertheless, immature bearded seals, *udjuasuk* or lassies, do come close to shore during the fall in the Rigolet region and have been hunted in numbers in some recent years (Rigolet Resident 1998: personal communication).

Grey Seals are often seen in the mouth of Groswater Bay in summer and fall, especially around the Big and Little Black Islands. During September and October, they tend to travel further into shore in search of fish, as far as islands in the inner portion of the bay (Ames 1977a: 293, 298). They are sometimes hunted at these times but are not often sought because of their immense size (Ames 1977a: 293). Despite the existence of a government bounty, in the years of 1977 and 1979, only two bounties were paid in Rigolet for grey seals (Boles, et al. 1977: 79). Hooded seals, the other large North Atlantic seal found on the Labrador coast (Boles, et al. 1980: 80), are rarely seen in coastal waters and residents of Rigolet do not report seeing them locally.

Walrus are not presently observed in inner Groswater Bay/Hamilton Inlet (Rigolet Resident 1998: personal communication). This is somewhat surprising given the Inuktituut name for the region, Ivuktoke ("place of the walrus", see Fitzhugh (1977:22)), and that walrus were once common along the Labrador coast and as far south as the Gulf of St. Lawrence and Nova Scotia (Busch 1985: 315; Low 1986: 316). Furthermore, suitable feeding grounds for walrus were probably available in shallows within Groswater Bay and offshore (on the Hamilton Bank, for example).

Walrus have been hunted on a large scale for adjunct commodities to replace or supplement cargoes of codfish or whale oil in western North Atlantic since the arrival of Europeans. In the 16th century, St. Malo cod fishing crews became erstwhile walrus

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

hunters around Newfoundland (Busch 1985: 46). In 1766, Joseph Banks (in Lysaght 1971: 148-149) described a regular and large-scale commercial walrus hunt was conducted in the Magdalene Islands, to obtain ivory and oil from their rendered blubber. Scoresby (1969a: 508) also mentions commercial whale hunting in the Magdelene Islands, and describes the destructive nature of this hunt in Svalbard. These hunting activities largely destroyed the large walrus populations in Nova Scotia and the Gulf of St. Lawrence by the 18th century (Busch 1985: 215) and it is likely that walrus were hunted out in southern Labrador and Hamilton Inlet during the 18th and 19th centuries. According to Hallock, who visited southern Labrador in 1861, walrus were extirpated in Hamilton Inlet in the early 19th century (1861: 747).

Minke whales are frequently observed feeding on capelin close to shores in western Groswater Bay and the Narrows, and especially around Rigolet and Henrietta Island, but do not enter Lake Melville (Kindle 1924: 38; Rigolet Resident 1998: personal communication). Many published sources make very sparse comment about the presence of large baleen whales in Hamilton Inlet, presently or in the past, or have considered it unlikely that Inuit made much effort to hunted whales in the region (see, for example, Fitzhugh 1972: 55; Woollett 1999). Nevertheless, there are several reasons to conclude that whales may have been available to Inuit hunters in the past. Currently, humpback whales feeding on capelin in western Groswater Bay and in the Rigolet area in the summer in most years, sometimes in groups of several animals (Rigolet Resident 1998: personal communication). Capelin, a primary food source for baleen whales in Labrador, were very common within Groswater Bay until the later 20th century. Baleen whales may have been relatively widespread in central and southern Labrador as a whole.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Southern Labrador was the scene of a long-term whale fishery conducted by Basques by the early 16th century (Barkham 1978), and English whalers continued to hunt along the Labrador coast into the 19th century while on their way to Davis Strait (Scoresby 1969b: 385-386). Whales were apparently relatively common in the Hopedale district to the north of Hamilton Inlet and the region's Inuktituut name, Avertok, is translated as "place of the whales". Similarly, a map of Hamilton Inlet made by Moravian Missionaries on the voyage of the Hope in1765 also names the region lying off the headland separating southern Groswater Bay and Sandwich Bay as *Arbatok*, or "whale place" (Lysaght 1971: Plate 41).

On the basis of this circumstantial evidence, large baleen whales may have been present in Groswater Bay and possibly the Narrows prior to the 19th century, and accordingly may have been available to Inuit hunters during the open water season. Nonetheless, as Fitzhugh (1972: 55) points out, George Cartwright's journal makes no mention of Inuit whale hunting in southern Labrador, despite the particular interest its author took in describing the subsistence economy of the Inuit he encountered. Cartwright (1792b: 278), in fact, sought to establish contacts with "whale hunting tribes" further north through Tuglavina, an Inuit middle man, as he believed that Inuit in southern Labrador did not hunt for whales, but themselves obtained baleen from the north or from stranded carcasses.

Ecological Description and Land Use in the Nain Bay/Dog Island Region

One of the archaeological sites considered in this study, Oakes Bay 1 is on Dog Island, a mountainous outer island in the Nain region with patchy terrestrial resources. In

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

modern times, berries were harvested from several portions of the island (Williamson 1997: Map 7). Open stands of spruce are found on sheltered slopes in several locations, especially near the Oakes Bay 1 archaeological site in a sheltered, west-facing inlet on the northern half of the island (Williamson 1997: Map 6). While these are presently open, spruce forests comprising mostly krummholz trees, ample evidence for cutting during the historic period provide indications that these forests were more dense and extensive in the past. The presence of these woodlands on an outer island (and so close to the sina) is, today, quite unusual in northern Labrador.

Caribou are a second important terrestrial resource on the island (Brice-Bennett 1977: Map 47) where they are presently hunted in fall and winter (Williamson 1997). Wheeler (1953:70-71) translated the Inuktituut placename of the settlement, *Parngnertokh*, as "place of many caribou stags." Foxes make dens on Dog Island and were both hunted and trapped on the island during the twentieth century (Brice-Bennett 1977: Map 44; Williamson 1997: Map 4).

The waters around Dog Island present a more varied and rich range of resources. In the twentieth century, arctic char and atlantic salmon were commercially fished throughout the region, including inlets adjacent to the Oakes Bay 1 archaeological site (Brice-Bennett 1977: 135, Map 35; Williamson 1996: Map 5). During the winter, fast ice envelopes Dog Island and provides a substantial area of ringed seal habitat extending through a chain of islands extending over 25km to the north of Oakes Bay 1 (Brice-Bennett 1977: Map 31).

In recent years, the sina has generally been located about 15 to 19 km east of Oakes Bay 1 and has reached the eastern tip of Dog Island itself (3 to 4 km east of the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

site) during the mildest recent winter sea ice conditions (Brice-Bennett 1977: Map 31, Williamson 1997: Map 4). The location of Oakes Bay 1 therefore affords ready access to sea mammals found at the ice edge, chiefly ringed seals and bearded seals. Dog Island sits amidst the routes traveled by migrating harp seals in spring and especially in the fall (Brice-Bennett 1977: Map 31). The eastern side of Dog Island, and especially Evilik Bay, has a number of places noted as excellent locations from which harp seals were hunted from shore, or taken in nets (Brice-Bennett 1977: 144, Map 41).

Ecological Description and Land Use in the Okak Bay Region

In this section, the characteristics of the Okak Bay region's landscape, and the economically important species of plants and animals within it, are reviewed. Biological surveys provide much of the information for characterizing the modern ecology of the region. Where appropriate, studies of Inuit land use in the region since the late 19th century are used to illustrate which resources have been important to recent Inuit, when and where these resources were available, and how it was feasible to obtain them.

Resources of the Terrestrial Environment

In the present day, the northernmost extent of the continuous tree line runs through coastal Okak Bay and, in general, the inner portion of Okak Bay has more diverse terrestrial ecological communities than the outer coast. Spruce forests grow in several sheltered valley systems to the north and west of Uivak Point. Stands of relatively tall and straight spruce are presently found as close as 6km west of the site. As well, isolated dwarf and krummholz spruce, as well as dwarf willow, birch and a variety

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of berry species, presently grow around the site itself. Black bears, porcupines and fur-bearers range in these valleys (Brice-Bennett 1977) while seasonal herd movements can bring hundreds of caribou through the area on game trails or on the sea ice.

Resources of Freshwater and Marine Environments

Brook trout and lake trout are found in tributary streams and lakes within the inner sections of Okak Bay (Brice-Bennett 1977: Map 38). Arctic char spawn in many of these same areas in mid-August to September (Brice-Bennett 1977: 123). In the twentieth century, Inuit caught char in the Okak region with a leister (or *kakkivak*) or were jigged through holes in river or lake ice during winter and spring. In summer, char were caught with nets set along particular shorelines and stream mouths, within the bays and among the outer islands (Brice-Bennett 1977: 132-135). Tom cod and Rock cod are also found in these bays in springtime, near river mouths, leads and thin ice, and during the open water season (Backus 1957: 299).

A range of other marine species may be found within outer Mugford Bay and Okak Bay. While Atlantic salmon do not spawn in these areas, they feed in the bays and around headlands and islands in July and August. Salmon were caught with nets along the shores of portions of inner Okak Bay (Ogaksiukvik Bay and Okak Harbour) and many of the outer islands east of Okak Bay, during the twentieth century (Brice-Bennett 1977: 139, Map 38). Prior to the late 1960's, Atlantic cod were also found in great numbers in the bays and among the outer islands. In summer, cod were jigged from small boats all around northern Okak Bay, the Okak Islands, Mugford Bay and the outer

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

islands, while cod traps were used along the western shore of Cod Island near Mugford Tickle, and in several locations amongst the outer islands (Brice-Bennett 1977: Map 35).

Along with these fish, a range of seal species is found in Okak and Mugford Bays. Currently, harbour seals are not very common in the Okak Bay region; they are, for the most part, concentrated around river mouths and the vicinity of Kikketak Island and Martin Island, in the most protected part of inner Okak Bay (Brice-Bennett 1977: Map 31). Harp seals are present in great numbers in the bays during their seasonal migrations. The southward fall migration, which occurs in November to late December in this region (Brice-Bennett 1977: 149; Williamson 1997: 9), was typically of greater economic importance in the twentieth century as it brought numbers of prime-condition harp seals closer to shore to feed until freeze-up (Brice-Bennett 1977: 144-148).

In May and June, harp seals tend to be deprivated after fasting, breeding and pupping, (Sergeant 1991: 14-15) and these spring migrants tend to travel farther offshore due to persistent coastal pack ice (Brice-Bennett 1977: 128-129). Harp seals passing through Mugford Bay and Okak Bay travel past Uivak Point. In this locality, they are vulnerable to hunting from shore, from boats in open water, or with nets. Several places in the region are known to have been good harp seal netting locations. One of the best seal hunting and netting sites in the Okak district was at Parkavik Island, 5km north of Uivak Point (Brice-Bennett 1977: 147, Map 41; Kohlmeister and Kmoch 1814: 10). People established many camps of varying sizes at this site in the late 18th and early 19th centuries, reportedly in all seasons (Taylor and Taylor 1977).

Ringed seals are present in the region throughout the year and are the most common resident seal species in Labrador (Boles, et al. 1980). Mature ringed seals

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

maintain breathing holes and make birthing dens in protected fast ice areas throughout Okak Bay, Mugford Bay and around the offshore islands (Brice-Bennett 1977: Map 31). Beginning in May, these seals and their pups haul out beside their breathing holes to bask. Both immature ringed seals and smaller "starveling" or "outside" ringed seals spend the winter and spring at the ice edge (Brice-Bennett 121, 149). Winter and spring ringed seal hunting areas therefore extending 30km or more in all directions around Uivak Point.

Migrating baleen whales, as well, venture into the bays and around headlands in open water conditions to feed near the shore, and come close to Uivak Point and other sod house sites in the region when they do so. For example, Moravian Missionary accounts describe whales being taken off of Sungilik Point, just outside the entrance to Okak Harbour, about 4 km from Uivak Point and immediately adjacent to two other settlements (Taylor 1974: 31, 43). Baleen whale hunting seems to have been mostly a fall activity during the 18th century, likely because spring pack ice kept these animals away from the shore during the their northward migration. In contrast, beluga whales were hunted most frequently during the late spring and summer. Belugas may enter Okak Bay, especially around river mouths, in numbers when the sea ice begins to break up, to feed on fish (Brice-Bennett 1977: 123, Map 27). A variety of historical records summarized by Brice-Bennett (1979: Table 6) suggest that beluga hunting has been almost entirely a late spring to summer activity, throughout northern Labrador since the early 19th century.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Sea Ice in the Okak Bay Region

Okak Bay and Mugford Bay are broad and complex bodies of water. Their inner reaches are sheltered by the Okak Islands and the mountainous bulk of Cape Mugford, while a loose chain of islands protects their outer portions. Sheets of land-fast ice form in these bays between late November to late December and usually last well into June (Brice-Bennett 1977: 149; Skidmore 1979: 157). Within the inner bays, fast ice is well anchored and very stable. In the outer bay, fast ice extends about 2km offshore from the exposed end of Cape Mugford and as much as 24km east of Uivak Point, where the *sina* is stabilized by the easternmost outer islands (Brice-Bennett 1977: Map 31). Ice conditions at the *sina* are highly variable as easterly winds push drift ice against the ice edge, creating a barrier of highly unstable rough ice, while westerlies push the drift ice back offshore.

On occasions of severe cold in early winter, the outer bay areas may be the first the freeze and do so quickly, leaving temporary areas of open water within the inner bays in the early winter (Brice-Bennett 1977: 147; Nain Resident 1997: personal communication; Nain Resident 1998: personal communication). Seals caught within the bays by the ice cluster in these open water patches until they negotiate their way to the ice edge. When these patches of open water occur, they remain excellent hunting sites until they freeze over. Nevertheless, several Nain residents who hunt in the Okak Bay region reported to the author that these conditions are uncommon and fast ice is nearly continuous during the winter. The few areas of open water in the area are limited to small rattles near Moores Island, Nutak, Shark Tickle (between Shark Island and Coopers

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Island, southeast of Uivak Point) and Mugford Tickle, all between about 10 and 20km from Uivak Point.

Unlike the Nain region, where clusters of large and small islands provide a dense network of anchors for fast ice, the islands lying off of Okak Bay are fewer in number and relatively widely-spaced. As a result, strong tides and winter storms have greater potential to break up bodies of fast ice in more exposed areas of the outer bay (Skidmore 1979: 157, 162), as happens frequently around the headland of southern Cape Mugford. Occasionally, especially severe storms may break fast ice further into the bays. Such a circumstance occurred in 1997, when a storm with strong northeasterly winds broke up fast ice deep into northern Okak Bay, west of Uivak Point. Residents of Nain attributed this event to mild temperatures and heavy snows in the early winter that insulated the developing ice, rendering ice in the area thin and weak and more vulnerable to storms and waves (Nain Resident 1997: personal communication).

Coastal fast ice thins and weakens with the arrival of warmer southerly winds in late May and June (Brice-Bennett 1977: 121; Crane 1978). During this time, meltwater pools on the surface of the fast ice and long cracks form along shorelines and between points and islands, while pack ice borne south from Davis Strait by the Labrador Current grinds up the seaward edge of the fast ice. Eventually, the fast ice sheet breaks down into drifting ice floes that may be added to the pack ice, hugging the coast until they are blown out to sea. Usually, the pack ice is dispersed by early to mid July but easterly winds can keep the entrances to bays sufficiently clogged with ice to hinder to prevent navigation until August (Elton and Ashburner n.d.; Kmoch 1858: 10; Teillet 1988; Newell 1983, 1990).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Chapter Summary

Following the description of the physical environment of Labrador in Chapter 3, this chapter has presented a discussion of Labrador's ecological characteristics and Inuit land use of particular regions. In the first section of the chapter, regional-scale ecological zones defined by environmental characteristics and vegetational communities were identified and described. Then, significant aspects of the behaviour, range, migration patterns and life history of the major species of the terrestrial and marine environments were reviewed. As well, the methods by which the Labrador Inuit procured and the uses they made of these species in the historic period were discussed. Finally, the possible effects of environmental change upon the spatial limits of ecological zones and animal ranges, populations and life histories were examined. It is apparent that environmental changes do impact Labrador's landscape and seascape by changing the distribution and characters of arctic, subarctic and temperate ecological zones and species. Prolonged cooling, for example, reduces the ecological diversity of Labrador, shifting the limit of continuous permafrost and the tree limit south and to lower elevations, thereby diminishing woodland and increasing the areas of arctic and subarctic tundra environments. In coastal waters, such cooling may also extend the sea ice season, result in greater ice accumulation and transport, and impact the range, population size and behaviour of marine animals with specific ecological niche requirements. These ecological changes have direct impacts on Inuit populations in Labrador by altering the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

landscape and seascape and by restructuring the spatial and temporal distribution of critical resources.

In the second section of the chapter, local scale surveys of the ecological characteristics of Hamilton Inlet, Nain Bay and Okak Bay were presented, along with summaries of historical patterns of Labrador Inuit land use in these localities. The three areas represent different points in the arctic-subarctic ecotone represented by Labrador's coast and three different sea ice environments. Hamilton Inlet is an ecologically complex area with a very moderated, subarctic to temperate environment. This area includes a substantial, though fluctuating, ice-free area which introduces the *sina* environment to an interior region during periods of moderate ice conditions, and which is closed to the *sina* when ice conditions are heavy. This locality offers an opportunity to monitor the ecological effects of sea ice fluctuations in the past, and sea ice dynamics themselves, through zooarchaeological data. The Nain Bay/Dog Island and Okak Bay localities are more northerly areas subject to stronger arctic ecological influences, but also having seasonal abundances of ecologically sensitive migratory sea mammal species and protected terrestrial environments. These two areas comprise extensive and stable fast ice areas but have different access to the *sina* and somewhat different suites of locally available species. The different settings of these three localities therefore offer opportunities to examine Inuit land use as applied to different environments.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 5

FIELDWORK METHODS AND THE ARCHAEOLOGY OF THE NARROWS REGION OF HAMILTON INLET

Introduction

This dissertation's central objective is to conduct a regional, comparative study of contact period Labrador Inuit subsistence economies in northern Labrador. The additional project goal of evaluating the roles of environmental and social causes of culture change is predicated on the availability of detailed regional reconstructions of Inuit subsistence practices. The essential requirement of this project is to secure data that are capable of supporting subsistence reconstructions. Finding and applying such information is not a simple matter, however. Ethnohistorical studies and catch records represent somewhat problematic sources of economic data as they are vulnerable to the vagaries of inconsistent or incomplete reportage and limited by the historically situated field of view of the observer. Locational analysis approaches used by Fitzhugh (1972) and Kaplan (1983) provide readily comparable inferences of subsistence practices but require verification and are too general for the purposes of this study. Zooarchaeology, however, does provide a practical opportunity to collect proxy economic data for specific places and, though use of multiple assemblages distinguished in space and time, affords the opportunity to make both regional and temporal economic comparisons.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A number of recent zooarchaeological research projects conducted in the North Atlantic and the Eastern Arctic, including several sites in Frobisher Bay (Henshaw 1995), Qeqertasussuk (Böcher and Fredskild 1993; Grønnow and Meldgaard 1991), Assivisuit (Grønnow, et al, 1983), at Nipaitsoq and Niaqussat (Buckland et al, 1983, McGovern, et al 1983), Svalbard (Amorosi 1992) and elsewhere in the North Atlantic (Amorosi, et al 1996) illustrate the potential scope of subsistence studies based on analyses of faunal assemblages that are of sufficient size, stringently collected and bolstered by supplementary palaeoenvironmental analyses. The methods used in those studies were applied as guides in this project, in order to provide data for subsistence reconstructions. Prior to this project, reasonably sized faunal assemblages had been collected from only a handful of sites in Labrador. Of these, a set of collections recovered by Richard Jordan during excavations of several sites in The Narrows, in Hamilton Inlet, were selected as the most appropriate for use in this study, as they were reasonably large assemblages from reported and dated contexts including communal houses. Nevertheless, because these sites represent only one idiosyncratic region of Labrador, and because the manner in which they were collected does not completely conform to the ideal standards laid out above, the sites from The Narrows are insufficient, in themselves, to meet all the objectives of this study. It was necessary, therefore, to undertake new archaeological fieldwork projects to obtain suitable faunal collections from communal house sites, to conduct the comparative subsistence studies at the core of this project.

The task of the remainder of this chapter, and the two that follow, is to outline how suitable zooarchaeological data sets were obtained and to document the archaeology of the sites that contributed these data. First, the rationale for selecting particular sites for

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

study is reviewed, followed by a discussion of the methods used to test and excavate these sites. The results of previous work in The Narrows are reviewed, then those of new fieldwork conducted at Oakes Bay 1 and Uivak Point are presented. Emphases placed on site plan, house architecture, midden stratigraphy, descriptions of finds and dating in these reports.

Rationale and Methods of Fieldwork

Site Selection

The fieldwork undertaken for this project was intended to ensure an opportunity to examine, through zooarchaeology, the nature and range of subsistence economies associated with communal houses. This study is focussed on communal house sites in three regions; Hamilton Inlet, Nain and Okak Bay. These regions were selected as study areas because of their varied environmental contexts and long histories of culture contact. Comparisons of faunal assemblages from these sites provide opportunities to assess the degree of variation in Inuit winter subsistence economies and their relations to ecological and historical factors. Additionally, existing archaeological and ethnohistorical research related to these areas provide useful frameworks that aid reconstruction of subsistence economies.

The Hamilton Inlet region is of interest because of its complex and variable local sea ice regime, with extensive areas of both fast ice and open water. The region also includes some of the most diverse and rich bird, terrestrial animal and freshwater fish communities in Labrador. The Inuit occupation of Hamilton Inlet is well documented through archaeological and ethnohistorical research, as is the region's long history of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Inuit-European contact. A number of archaeological sites are known in the region, representing the complete span of known Inuit settlement in Hamilton Inlet. Richard Jordan excavated several of these sites during the early 1970's and produced the most complete regional, diachronic sample of excavated Inuit sites available in Labrador. Jordan also recovered a set of reasonably large faunal assemblages that were incorporated into this study. Due to all of these factors, the Hamilton Inlet region provides a unique opportunity to examine changing subsistence patterns over time.

These faunal assemblages also have analytical limitations, however, due to their somewhat limited sample sizes, varied states of preservation, dating and context control, and the methods used to recover faunal assemblages. As well, neither bulk sediment samples nor ecofacts were recovered in these excavations. In order to provide as detailed a study of subsistence as possible, and to make full use of existing high resolution palaeoenvironmental data, faunal assemblages should also be well-preserved and recovered from well-dated, stratigraphically-controlled excavations. Sieving must also be used to standardize small bone recovery. New excavations that employed these methods were needed.

The Nain and Okak regions of northern Labrador were selected for new excavations for several reasons. Winter hunting grounds in both of these areas are structured primarily by extensive shelves of coastal fast ice and are therefore sensitive to ice extent and stability. Lacking large polynyas or rattles, the ice environments of these regions contrast with that of Hamilton Inlet. As well, both of these areas had histories of intensified culture contact during the 18th century and a considerable amount of archaeological and ethnohistorical research has been accumulated, outlining Inuit

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

settlement in these regions. The names and locations of a number of 18th and 19th century settlements in these areas are known from Moravian Mission documents (see Taylor 1974). Furthermore, very extensive coastal surveys have already identified numbers of archaeological sites with communal houses, middens, well preserved faunal remains and, in some cases, permafrost (Kaplan 1980, 1983; 1985b). Historical records suggest that during the 18th century, whale hunting was practiced in the Okak region but was impractical in the Nain region. Accordingly, it is possible to evaluate differences between subsistence economies that may have been associated with whale hunting with those that were not, through comparison of faunal assemblages from sites in these two regions.

Working from ethnohistorical and archaeological survey information, two sites were selected for new archaeological investigations. First and most important was Uivak Point 1 (HjCl-9), a substantial settlement consisting of several communal houses in the northern entrance to Okak Bay, identified as Uivakh by the Moravians. Excavations of varying scales were undertaken in two houses and four middens at this site over four seasons, and very large collections of well preserved faunal remains were obtained in these excavations.

Extensive testing of two houses and one midden was undertaken at Oakes Bay 1 (HeCg-8), a large sod house settlement on Dog Island, north of Nain. Taylor (1974) identified this site as Pangnertokh, a place described by Moravians as a good seal hunting area but a place where whales were not usually available. While these excavations were not extensive, a reasonably large and well-preserved faunal sample was obtained from a

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

midden at the site. This sample is large enough to be included in an intersite comparison of subsistence.

Crew, Logistics and Permits

Fieldwork for this project was conducted by the author as a component of two larger research programs directed by Dr. Susan Kaplan; the Bowdoin College Labrador Archaeology Project and the Tree Ring Dating of Inuit Sites in Labrador Project. Fieldwork was accomplished in four seasons with crews of between four and nine people in trips lasting between four and seven weeks. The MV *Cape Rouge* and her skipper, Henry Webb, provided transportation between the town of Nain and the field sites. Field crews were composed primarily of undergraduate students from Bowdoin College and Labrador Inuit high school students from the towns of Nain and Makkovik, selected and hired with the aid of the Torngasôk Cultural Center of the Labrador Inuit Association. Undergraduate and graduate students from the Memorial University of Newfoundland, the University of Alberta, Hunter College CUNY, the University of Massachusetts at Amherst and Leicester University also participated. The fieldwork was conducted under permits from the Newfoundland Museum held by Dr. Susan Kaplan.

Fieldwork was conducted with the approval of the Torngasôk Cultural Center. Support for the author came from a National Science Foundation Office of Polar Programs (NSF OPP) (Division of Social Science) Dissertation Improvement Grant, a Canadian Circumpolar Institute BAR grant, and a CUNY Graduate Center Summer Travel Award. Additional support came from two NSF OPP grants, and a Kane Lodge Foundation Inc. award held by Susan Kaplan, and from Bowdoin College.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Site Sampling and Excavation Procedures

The primary interest of fieldwork undertaken for this project was in locating and excavating middens clearly associated with communal houses to recover faunal remains. Nonetheless, excavations within houses were also needed to sample house floor deposits and for architectural and dating information, and to recover material culture collections. Once on site, a four-stage program of investigation was employed leading to the identification and excavation of associated houses and middens, including survey, sub-surface sampling, test-pitting and full-fledged excavation. These are standard archaeological practices and have been used effectively by other archaeological projects in the North Atlantic to expedite the identification and focused excavation of middens (see McGovern 1985).

Visual Survey

The first step of fieldwork was to undertake a thorough foot survey of the archaeological site and to begin compiling a site map. All visible structures and features were located, the nature of the physical landscape was noted and traces of disturbed or eroded midden deposits were documented. As well, house ruins were inspected for evidence of multiple, superimposed structures. Site maps were made through several means, including the use of a transit and stadia rod, sighting compass and tapes, hand level and a laser rangefinder.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Sub-surface Sampling: Prospecting for Middens

Once houses were defined, sub-surface soils and deposits were tested with an Oakfield soil sampler with a 1 1/4 inch tube bit, to determine the presence and limits of midden deposits. Tests were made as individual spot samples and in regular transects placed outside and along house walls, beside entrance passage walls or downhill of the entrance passage walls if they were located on slopes, adjacent to house entrances, in house floors and in flat or low areas between houses where refuse might accumulate. Excepting lucky circumstances, this method does not effectively locate actual concentrations of bones, *per se*, because the tube bit is too narrow to retrieve large objects. It is effective, however, for identifying dark, organic-rich soils and deposits containing charcoal, wood remains, mollusc shell fragments and periostracum and inorganic refuse, amongst which bones may be found. Soil cores are also used effectively to define the approximate stratigraphic and spatial limits of these deposits.

Test Pitting and Excavation

Where soil cores identified probable midden deposits, small shovel-sized test pits were excavated to determine if concentrations of bones were present, their state of preservation and the depth of the deposit. Specific house and midden areas were then selected for excavation with priority given to the areas demonstrating greater quantities of well-preserved bone and deeper, stratified midden deposits. As well, contexts that had apparently unambiguous occupation histories (avoiding clearly superimposed houses) and clear relationships between house and midden were favoured for excavation in order to simplify interpretations of stratigraphy and site formation processes. Finally, the depths

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of deposits overlying house floors were considered, as preservation of organic materials in shallow floor deposits was generally poor.

House and midden areas with relatively straightforward occupational histories and that lacked obvious trace of multiple superimposed occupations were targeted for additional investigation. Palimpsest occupations indicated by superimposed houses are likely to produce multiple middens or middens with multiple components that can provide time depth useful for a zooarchaeological study of palaeoeconomy. Nevertheless, establishment of relationships between specific midden components to particular house occupations can be a difficult task. Despite the likelihood that houses with simpler and shorter occupational histories may have middens that span shorter intervals of time, they may be preferable as sources of workable datasets. Concentrating excavation efforts on houses with clearer occupational histories simplifies the work of relating house occupations to midden stratigraphy and of dating excavations in general.

As an anecdotal aside, excavating House 7 at Uivak Point proved to be a powerful aid to the interpretation of the dates and stratigraphy of its associated midden. Dates obtained for the House 7 occupation offer the possibility of dating the House 7 Midden deposits through stratigraphic association as well as though their artifact or ecofact content. The House 7 Midden was relatively deprived of artifacts in comparison to House 7 itself, as were other middens excavated as part of this project. Accordingly, more precise dates for the House 7 Midden could be inferred through reference to the house. As well, the nature and origin of specific stratigraphic layers observed in the midden excavation's profiles were more readily explained in reference to the occupational history of House 7.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Excavation Methods

Houses appropriate for detailed examination were excavated at varying scales. Small trial excavations at Uivak Point and Oakes Bay 1 comprised pits as small as $1m^2$ while, in House 7 of Uivak Point, a large, long term excavation over $30m^2$ was undertaken, involving the majority of the house including walls, entrance passage and cold trap, sleeping platforms and large areas of the floor. Excavations were dug by trowel in 5cm or 10cm arbitrary levels. Artifacts identified *in situ* were mapped in three coordinates with depth measurements taken from the units' northeast corners. All sediments were sieved through a 4mm mesh to standardize bone recovery and maximize artifact recovery. Bones were collected from the screen and by hand from the excavations, and bagged by unit and level. Floor plans and profiles for at least one wall were drawn for each unit in house excavations. As well, bulk sediment samples from sampling columns in the Uivak Point House 7 excavations, as spot samples from specific contexts and from off-site control locations (usually from 1 to 4 litres each) were collected in an effort to recover insect remains and plant macrofossils.

Middens were also excavated on varying scales, ranging from small units measuring $2.25m^2$ in area (such as the Uivak Point 1 House 6 Midden and Oakes Bay 1 House 3 Midden excavations) to a large, multiple-unit trench $14m^2$ in area in the Uivak Point House 7 Midden, which was incorporated into the House 7 excavation grid. All the midden units were excavated by trowel in 5cm arbitrary levels following the bedding angles of natural stratigraphy. Individual $1m^2$ units in the larger midden excavations were excavated simultaneously, so that all were kept in phase with the same 5cm level.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

This manner of digging approximates the results of standard stratigraphic excavation but is speedier to conduct in a midden with thin lenticular deposits, as it does not rely on the excavator to recognize minute sediment changes. The major house and midden excavations at House 7 of Uivak Point 1 were linked with continuous profiles to establish stratigraphic relationships between the two areas. The smaller midden excavations at Uivak Point 1 and Oakes Bay 1 were, however, not directly linked with pits in the associated houses.

The large trench of Uivak Point House 7 Midden excavation was excavated to a width of 2m wide using a 1m grid system, in order that all units would have at least one profile to guide excavation by arbitrary levels and to allow more complete documentation of midden stratigraphy. A soil pH meter was used regularly to check soil acidity, in order to monitor bone preservation conditions.

All sediments from midden excavations were dry-sieved through 5mm mesh to ensure standardized recovery of bones and of small artifacts. Faunal remains collected in the pits or from the screen were bagged by unit and level and, in some circumstances, on the basis of unit quadrants as well. A 5mm mesh is sufficient to recover the bones of most of the mammal species found in Labrador, as well as medium and large-sized fish, medium-sized birds (such as ptarmigans), the cranial elements of small rodents and mollusc shell fragments. The 5mm mesh size is not sufficient to guarantee recovery of representative samples of all skeletal elements of smaller fish species, lagomorphs, small mustellids, small birds or the post-cranial skeletons of rodents. Accordingly, the recovered faunal assemblages may be biased by an artificial exclusion of these species.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Nevertheless, the bones of fish, birds and rodents were not frequently observed during excavations.

Sediments were not wet-screened in the field, but some bulk sediment samples were wet-screened through 1.5mm mesh in the laboratory in order to check the recovery rates of small bones. These trials failed to turn up evidence of an overlooked fraction of small bones. As well, specialist analysts conducted very thorough programs of wet sieving, floatation and microscopic examination of substantial volumes of bulk sediment samples. Only a scant number of small bones were identified by these analyses, suggesting that reduction of mesh size or in-field wet sieving would not have substantially changed the absolute numbers of small fish, mammals or birds recovered. The additional effort required to use these small mesh sieves would, however, have created a processing bottleneck in the field or in the lab, hindering the analysis of these collections.

Artifacts recovered in situ were mapped in three coordinates. Samples of well-preserved wood and unidentified burnt organic matter were kept. Bulk sediment samples between 1 to 4 litres in volume were collected systematically from each level in selected portions of the middens, and as spot samples from contexts of specific interest. These samples were used for geoarchaeological, archaeobotanical and palaeoentomological analyses.

Summary of Fieldwork Methods

The methods by which sites were identified and investigated in the field, and faunal collections recovered, were outlined in this chapter. Faunal collections from

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

preexisting excavations in The Narrows region were already available to this study; therefore two new sites in northern Labrador, Oakes Bay 1 and Uivak Point were selected for new programs of excavations. These sites were selected for investigation on the basis of environmental context, regional representation, economic details derived from ethnohistorical sources and previous archaeological survey work that offered the possibility of well-preserved faunal remains in midden deposits. Techniques of soil core testing and test pitting were used to locate midden deposits and to determine the quality of bone preservation, with the objective identifying houses linked with middens and which both have good organic preservation. Similarly, collecting faunal remains by level and with systematic use of screens ensured control over context and standardized recovery of small specimens. Bulk sediment samples were also collected from house and midden contexts in column samples and as spot samples; these samples were used to conduct palaeoentomological, archaeobotanical and geoarchaeological studies in support of the faunal analyses.

Through the excavation of the Uivak Point and Oakes Bay sites, with the legacy of excavated sites provided by Jordan's Hamilton Inlet project, this project was able to obtain a set of faunal collections that facilitate comparisons from various environmental and socio-economic perspectives. These sites offer an opportunity to compare economies in different environmental contexts; two of these sites are located in proximity to predominately fast ice/ice edge environments while the Hamilton Inlet sites are associated with a polynya. They also present an opportunity to compare sites from the perspective of economies associated with whale hunting and trade, as ethnohistorical and archaeological sources suggest that whale hunting was a practical possibility of at least

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

one of these sites and impractical at others. Finally, the Hamilton Inlet sites comprise the most complete regional sample of excavate Inuit sites in Labrador and so allow a diachronic examination of subsistence within a tightly defined region.

Having outlined the potentials of these sites and the methods used to investigate them, it is appropriate now to review the work conducted by Jordan in The Narrows and to describe the excavations at Oakes Bay 1 and Uivak Point. Because several sites are represented in this comparison, and the details associated with site and house plans, excavations, finds and dating are complex, the following discussion in necessarily extensive and detailed. First, Jordan's Hamilton Inlet project is reviewed. Recent excavations conducted at Oakes Bay 1 and Uivak Point are then presented in the subsequent pair of chapters.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Archaeology Of The Hamilton Inlet Region And The Narrows

Overview of Previous Research in Hamilton Inlet

A number of Neo-Eskimo archaeological sites have been identified in Hamilton Inlet, and several of these dot The Narrows, the constricted passage separating Groswater Bay and Lake Melville. The bulk of these sites were identified by archaeological projects conducted since the late 1960's. Nevertheless, some of the more substantial settlement sites were already known to visitors or remembered by residents of the Rigolet region.

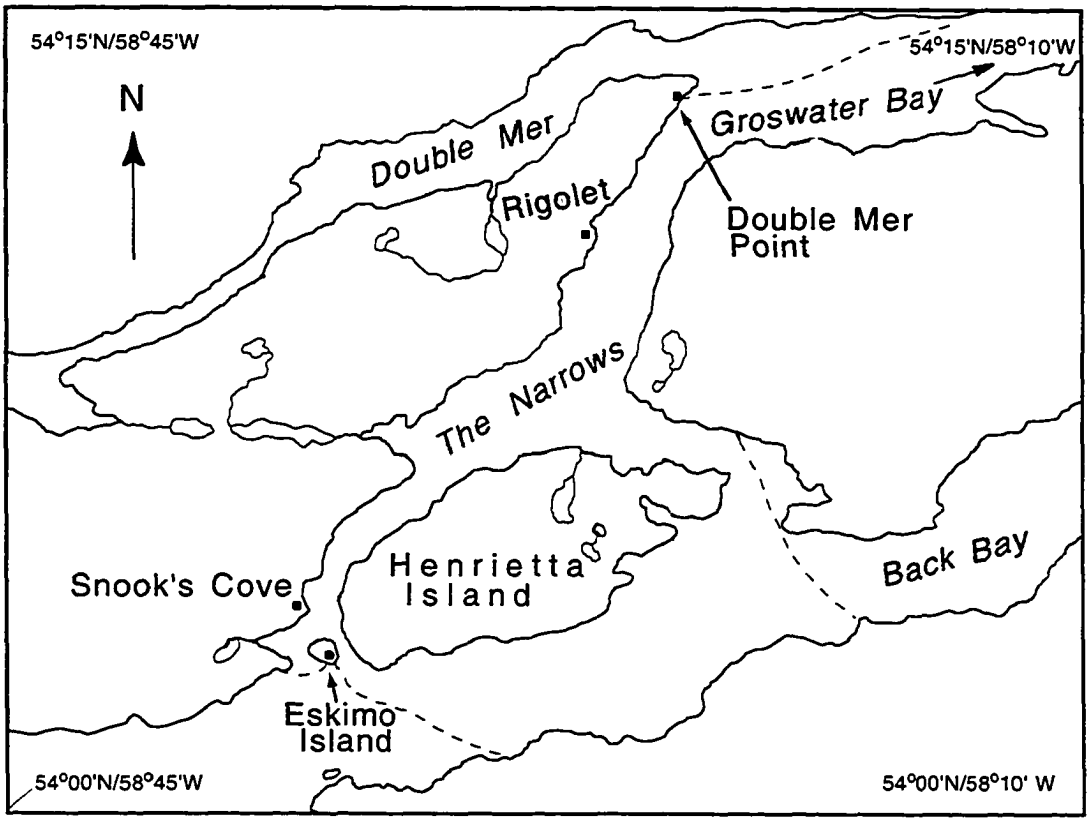
Archaeologists first examined the region in the 1950's and 1960s. Donald MacLeod surveyed Maritime Archaic sites west of Lake Melville in 1967-1969 (Fitzhugh 1972: 2). Jørgen Meldgaard visited the area in 1956 while surveying for Norse settlement sites and Helge and Anne Stine Ingstad followed with their own Vinland survey in 1962. Nevertheless, excavations were not undertaken in the area by either project (Fitzhugh 1972: 82).

William Fitzhugh's Hamilton Inlet Project, 1968-1969

In 1968 and 1969,William Fitzhugh (1972) made thorough surveys of most of Hamilton Inlet, including all of the Narrows and the northern portion of Groswater Bay, and conducted the first formal archaeological excavations in the region. In his study, Fitzhugh reconstructed the culture history and ecological adaptations of the region's diverse inhabitants, from its Maritime Archaic occupation to the twentieth century. This work remains the most comprehensive study of the archaeology of the region.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 5.1 Map of Archaeological Sites in The Narrows Region, Hamilton Inlet



In his project, Fitzhugh identified several Thule/Inuit sod house sites in the Narrows and Groswater Bay, and provided the original description of the Hamilton Inlet sites that are considered in this study. Sod house sites were identified at Double Mer Point (GbBo-2), Snooks Cove (GaBp-7) and at Eskimo Island, where there were three discrete clusters of houses, each defined as an archaeological site (GaBp-1, 2 and 3, also termed Eskimo Island 1, 2 and 3) (Fitzhugh 1972: 82-84). The houses in Eskimo Island 1 were exceptionally large, while those of Eskimo Island 3 were much smaller in size; Fitzhugh judged the latter houses to be the oldest on the island. Test pits were excavated

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in midden areas outside several houses, demonstrating the presence of trade goods in all house clusters as well as well-preserved bones and other organic materials. Four test pits were excavated in a rich midden deposit (Eskimo Island 4) between Eskimo Island 1 and 2, while a stone cairn grave (Eskimo Island 5) was observed near Eskimo Island 3.

Neither Snooks Cove nor Double Mer were tested at this time (Fitzhugh 1972: 84-85); however, Fitzhugh surveyed other Neo-Eskimo sites in Groswater Bay. On Tikoralak Island at the eastern entrance to the Narrows, he described several clusters of tent rings (including approximately 30 tent rings) with cairn graves (Fitzhugh 1972: 85-86). Fitzhugh excavated test pits in tent ring clusters on the island's western shore and reported finding preserved seal bones and historic artifacts. He concluded that these tent rings were derived from an early, large summer camp, and it was perhaps a place where numbers of families came for gatherings (Fitzhugh 1972: 85).

In a brief survey of Pompey Island in western Groswater Bay, three boulder structures were identified on the island's summit (approx. 100m asl) (Fitzhugh 1972: 89). These structures measured between about 2.5m to 6m in diameter and were constructed of very large, lichen-covered boulders. Fitzhugh (1972: 89) proposed that the structures might have been camps situated to observe and intercept caribou travelling over ice in the area during the winter. The structures were not dated because no artifacts were recovered within them, though their lichen growth suggests a relatively old date of construction (Fitzhugh 1972: 89).

During his brief survey of Big Black Island, in eastern Groswater Bay, Fitzhugh observed several sites with tent rings, looted cairn burials, fox traps, duck blinds and stone structures (Fitzhugh 1972:91). These sites were tentatively dated to the historic

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

period as European trade goods were recovered in test pits placed within several tent rings, while traces of chipped stone tools were not found. Fitzhugh (1972: 91) interpreted these sites as components of a summer gathering place. The island is located very near the sina and, in recent years, has been an excellent hunting place for seals and sea birds in most seasons of the year (Ames 1977a). Further survey of the island might demonstrate evidence of a wider range of seasonal occupations.

Fitzhugh (1972: 90) also observed that Big Black Island is possibly the location where, sometime between 1774 and 1778, the skeletons of a large number of Inuit people were found. These individuals may have died in a smallpox epidemic and were believed to have included the woman Caubvik and her family (Cartwright 1792b: 424). In 1776, George Cartwright took a small party of Inuit back to England, including Caubvik. On their return voyage in 1773, Caubvik herself contracted and survived smallpox. She returned to her family upon arrival and Cartwright last reported meeting her in September of 1773; a gift given to one of her party while in England was identified amongst the bodies (Cartwright 1792a: 277; 1792b: 424).

Richard Jordan's Project In The Narrows, 1973-1975

Richard Jordan followed Fitzhugh's survey with a large-scale project in which he undertook excavations at all the major sod house sites that were identified in the Narrows. Between 1973 and 1975, Jordan (1974, 1977) excavated several houses in each of the Eskimo Island 1, 2, and 3 sites, and tested the sites of Double Mer Point and Snooks Cove. Furthermore, Jordan mapped two previously unidentified 19th century sod sites at Tikoralak Head (GaBn-9) and Moliak Cove (GaBp-8) that were interpreted as the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

dwellings of Inuit, and conducted limited tests of them (Jordan 1974). Jordan recovered faunal remains from all of these excavations. These assemblages were collected entirely by hand, however, as sieves were not used as part of the excavation methodology. Nor were the assemblages subdivided by stratigraphic context. Both of these factors imply losses of data, from the unrepresentative proportion of smaller sized elements and species in the recovered assemblage, and through possible mixing of different occupational phases.

Jordan presented summaries of all of these excavations and of initial phases of his analyses in four publications (Jordan 1974, 1977, 1978; Jordan and Kaplan 1980). Susan Kaplan (1983) produced a second and more detailed compilation of Jordan's archaeological program and results. She reanalysed major portions of the material culture recovered from these sites and modified the site chronology Jordan originally proposed, based on inventories of trade goods. Accordingly, only a summary of the archaeology conducted in the major excavated sites of the Narrows is provided in this dissertation, based on these published accounts and Jordan's unpublished excavation notes. This discussion focuses on the sites that furnished faunal assemblages for the present study. The first three sites reviewed below are the three components of a complex palimpsest site at Eskimo Island, perhaps more properly considered a locality. Descriptions of the Double Mer Point and Snooks Coves follow thereupon.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Eskimo Island 1, 2, 3 (GaBp-1, 2, 3) 54°03.5'N/58°37.5'W 5989600N/397500E

Overview of Eskimo Island

The main effort of Jordan's project was directed toward understanding the nature of the three substantial sod house sites that William Fitzhugh had surveyed on Eskimo Island, a small, low island at the western entrance of the Narrows. Most of the Inuit sod houses in the Narrows identified by Fitzhugh's and Jordan's surveys were located on this island. Eskimo Island is possibly the most southerly large Inuit sod house settlement in Labrador, at least until the early 19th century (Kaplan 1983: 410; but see Auger 1991 and Clermont 1980).

A number of ecological and social factors likely encouraged the selection of this place for a settlement. Trade provided one certain incentive. The location of the site in the Narrows is close enough to the coastline to have provided opportunities to engage in a "floating trade" with European ships. Furthermore, beginning early in the 18th century, a series of European trading posts were established in territories that were close to the Narrows or within reach of a summertime expedition.

By the middle of the 16th century and until the late 19th century, Europeans set up a number of posts in southern Labrador that provided centres for trade with Inuit. Basque whalers had permanent facilities on shore in southern Labrador as early as the middle of the 16th century (Barkham 1980). In 1705, Augustin de Courtemanche, as the "Commander of Labrador" for France, established a settlement at Bradore Bay near present-day Blanc Sablon (Zimmerly 1991: 36-37; Kaplan 1983: 166). Courtemanche and other French settlers there traded with Inuit, though they were not the first French to do so. Louis Fornel established a trading post at Northwest River, in western Lake Melville, in 1743 (Miquelon 1979: 224; Zimmerly1991: 39). George Cartwright established a post at Cape Charles in 1770 and moved to another establishment at

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Sandwich Bay in 1775 (Cartwright 1792a, 1792b; Zimmerly 1991; 42). At the same time, a number of other English individuals and firms (such as Phippard, Coghlan and Noble and Pinson) operated fishing, furring and sealing operations with shore establishments in southern Labrador, in competition with Cartwright (Cartwright 1792b; Zimmerly 1991: 43). Pierre Marcoux, from Québec, started yet another trading post at Rigolet between 1785 and 1788, which was subsequently purchased in 1836 by the Hudson's Bay Company (Ames 1977a: 279-280; Zimmerly 1991: 43). Other independent traders and smaller companies, such as Hunt and Henley, also established posts in Hamilton Inlet during the middle of the 19th century.

The ecological characteristics of the Eskimo Island locality certainly present another significant invitation for Inuit settlement. Areas of salt and fresh water, land, and in winter, open water and fast ice, converge at the western end of the Narrows, and at Eskimo Island in particular. During spring and fall, the waters of the Narrows and the sheltered bays around it attract a variety of sea mammals, migratory fish and seabirds. In winter, fast ice covers Lake Melville and extends to the western shore of Eskimo Island, joining the island to a huge territory in which mature ringed seals overwinter and make birthing dens. Additional fast ice areas lie close by as well, in the protected fjords of the Backway and Double Mer. Fast ice also provides a highway for travel by dog team to caribou hunting territories in the interior north and south of Hamilton Inlet.

Currently, the Narrows strait remains ice free during winter in most conditions, as far to the west as the northern and eastern shores of Eskimo Island. While it is open, the Narrows is, in effect, an extension of the ice edge environment far inland, from Groswater Bay to Eskimo Island. Except when it is jammed with pack ice or frozen over, the strait is accessible to the animals found at the *sina* (in this case, immature ringed seals and some harbour seals). This complex local environment affords Eskimo Island a variety of travel routes and foraging areas in all seasons, making it perhaps the prime settlement location for Inuit in Hamilton Inlet.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Eskimo Island 1, 2, and 3 are located on two small hillocks on the south side of the island, between 40m and 50m from the shoreline. The sites comprise three dense clusters of houses and all three sites lie within a small area 170m long. The propinquity of the sites is probably due to the island's topography. This portion of the island is relatively sheltered from winds and, during the winter, it is close to the edge of fast ice leading to Lake Melville and the Backway, and to open water. Even in years of light ice formation, such as that of 1997-1998, a bridge of fast ice from Lake Melville extends to Eskimo Island's shore, immediately west of the sites, and fast ice often joins the island's southern shore to the ice of the Backway. The island's northern and eastern shores and part of the western and southern shores remain ice free, bringing open water as close as 40m to the site. The sites therefore sit at the intersection of travel routes and near place where boats could be hauled out of the water all winter.

While the opportunity to engage in trade may have been a specific incentive that drew Inuit to settle in Hamilton Inlet, they were expanding into a territory that had long been occupied by the Innu and their ancestors. Historical sources (Gosling 1910; Kleivan 1966; Turner 1979) suggest that Inuit-Innu interaction was at least sporadically overtly hostile. If the Inuit were on a defensive footing in the region, Eskimo Island might have presented a defensible place for a settlement, and one that was relatively removed from Innu settlement (Jordan 1974: 85). Settlement in otherwise attractive sites in other places might have been excluded because of this territoriality.

Eskimo Island 1 (GaBp-1)

Eskimo Island 1 lies in the middle of the group of sites, near the top of a low hill, the highest point of the island, and approximately 50m from shore. It consists of three very large, sub-rectangular, semi-subterranean sod houses with substantial walls, arranged in a linear cluster. The back wall of House 1 measures 10.2m and the side wall

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

measures 6.9m; those of House 2, the largest house identified in the region, measure 12.3m by 8.4m; and House 3 measures 9.3m by 7.2m (Kaplan 1983: 413). Jordan (1974: 85) gives slightly larger measurements for these structures. Both Houses 1 and 3 share walls with House 2 and might possibly be older structures that were truncated by the construction of House 2. The entrance passages of all the houses extend downhill, toward the shore, and are remarkably long, ranging between 10.8m and 16.2m in length (Kaplan 1983: 413).

Jordan did not test Houses 1 or 3. He excavated a large portion of House 2, however, including $32m^2$ of its floor and $12m^2$ of its entrance passage (Jordan n.d.). The floor of the house had been dug into a layer of peat and was paved with stones. Over the floor was a thick deposit of cultural material and sediment, up to about 45cm thick.

Table 5.1 Dimensions of Sod Houses at Eskimo Island 1 (data from Kaplan 1983: 413)

Eskimo Island 1	Back Wall	Back Wall	Total Area
House 1	10.2	6.9	~$70.4m^2$
House 2	12.3	8.4	~$103.3m^2$
House 3	9.3	7.2	~$70.0m^2$

Two layers of floor pavements were found in the southwest corner of the house, suggesting that the house had seen multiple phases of occupation. Large numbers of animal bones and artifacts were recovered in this deposit. Many of the artifacts were recovered near the paved floor; some (beads and knife blades in particular) were recovered in the cracks between rocks in the paved floor (Jordan n.d.). Animal bones were also found crammed into nooks and crannies amongst rocks in constructions within the house. A layer of peaty soil overlaid the floor deposit. This layer, too, contained

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

cultural material, including bone and wood, suggesting that these archaeological deposits had been reworked and were redeposited after the collapse of the roof, or that refuse was deposited on top of the ruined house after its abandonment.

Large patches of the floor deposit were saturated with putrefied and congealed sea mammal fat. Soils beneath the paved floor were also saturated with fat (Kaplan 1983: 413), suggesting that substantial quantities of fat had been deposited upon, and soaked through, the pavement. A depression in the floor of the southeast portion of the house had a particularly thick and rich deposit of fat. Jordan and Kaplan (1980: 42) proposed that these fat deposits might have been the by-products of blubber-rendering activities conducted within the house, though they might also be derived from an older house floor or activity area under the excavated house. Lampstands of stacked rock, associated with thick residues of charred and congealed, were found along the edge of the sleeping platform and beside the entrance.

The house had raised sleeping platforms about 20cm to 30cm tall running along its back wall and both of its lateral walls (Kaplan 1983: 413). The platforms were made of compacted, peaty soil and were, in places, covered with layers of tree boughs (Jordan n.d.). Sawn wood planks were also found running along the edge of the platform. Several lamp stands made of piled stones had been erected at the edge of the platforms, some of which were encrusted with charred fat (Jordan n.d.; Jordan and Kaplan 1980: 42; Kaplan 1983: 413). Numbers of wood timbers were found lying within and near the top of the floor deposit, in the house and the entrance passage, and are probably the remains of the roof structure.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A substantial collection of artifacts, consisting mostly of European goods, was recovered during the excavation of House 2. Most notably, nearly 9000 glass beads of many different types were recovered, along with buttons and other ornaments. The list of other artifacts includes fragments of glassware, ceramics, tiles, a coin, pewter spoons, files, gaffe hooks, fish hooks, lead weights, knives, an axe head, parts of two swords, gun parts and ammunition, and about 600 nails and spikes (Jordan and Kaplan 1980: 42). A fragment of a clay roofing-tile, resembling those from 16th to 17th century Basque whaling sites in Labrador, was recovered. Nevertheless, the other diagnostic artifacts were dated to the 18th century and were of French origin (Jordan and Kaplan 1980: 42).

Traditional material culture items included parts of kayaks and dog sleds, bone and wood hunting implements, pieces of stitched hide, part of a wooden bucket, strips of cut or drilled baleen, whetstones and soapstone vessel and lamp fragments (Jordan and Kaplan 1980: 42). Many trade goods had been reused as raw materials for more traditional implements. Spikes and nails were hammered out to make harpoon endblades, arrowheads, knife blades and ulu blades, while a pewter spoon was refashioned into a pendant (Jordan and Kaplan 1980: 42).

Excavators in both Jordan's and Fitzhugh's projects (Fitzhugh, n.d. 1974; Jordan n.d.) reported that deposits were rather wet and partially or permanently frozen within the house and in its middens. Bones recovered from these excavations were relatively well preserved and in some areas very well preserved, with fragments of hide and fur also recovered.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Eskimo Island 2 (GaBp-2)

The Eskimo Island 2 site is located about 30m east of Eskimo Island 1, amidst a stand of spruce on the lower slopes on the same low hill as its neighbour does. The site consists of three semi-subterranean sod houses and some extensive midden areas. Like those of Eskimo Island 1, these houses are sub-rectangular in plan and have entrance passages leading south, toward the shoreline. Two houses (Houses 4 and 5) were built in a line and shared a sidewall, while the third (House 6) was located by itself, a short distance up the slope. The houses are distinct from those of Eskimo Island 1, however, by having interior partitions and for their smaller size. Nonetheless, Jordan (177: 44) considered Houses 4 and 5 to be communal houses.

Published sources provide inconsistent accounts of the actual size of these structures. Working from Jordan's field maps, Kaplan (1983: 416, 419) calculated dimensions for the three houses, based apparently on the centre of their walls, as follows: House 4 measured 10.5m along its back wall and 8.7m along its side walls; House 5 was 9.3m long by 7.2m wide; and House 6 was 8.7m long by 6.3m wide. The entrance passages of the three houses were all about 7.5m long. By these measurements, the Eskimo Island 2 houses are shown to be smaller than the big communal houses of Eskimo Island 1, though not remarkably so.

It is difficult to define house size based on Jordan's excavation notes and Jordan's published site map (1978: Figure 2) fails to provide precise measurements for houses or well-defined outer margins for their walls. Nevertheless, based on the map, the Eskimo Island 2 houses are obviously shown to be smaller than the Eskimo Island 1 houses. This

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

impression was reinforced by the author's own informal visual inspection of the site, made in 1998 while the houses were still partially snow-covered.

The interior dimensions of these houses, including the areas clearly within the walls as mapped on Jordan's original site plan, are as follows: House 4 measures 8.5m within its back wall and up to 6.5m along is side walls, House 5 measures up to 9m by 8m and House 6 measures 6m by 6m. These dimensions are reduced dramatically (to areas of approximately 6m by 6m and smaller) once the partitioned areas are subtracted from the floor space. By these house size estimates, the Eskimo Island 2 structures plainly appear to be smaller than those present at Eskimo Island 1. A new attempt to map the site with surveying instruments is required to provide a less equivocal description of the basic architectural features of these structures.

A brief description of each house follows. The layout of each house is described and the work that Jordan carried on within each is summarized. Where excavations yielded artifacts, faunal remains or noteworthy contexts, these materials are reviewed along with conclusions regarding their dating.

Houses 4 and 6

Jordan excavated Houses 4 and 6 on a very limited scale, placing one test in the entrance passage of House 4 and test pits in the floor, entrance passage and midden areas of House 6 (Jordan n.d.). A small assemblage of faunal remains was recovered from the House 6 tests, along with small collection of artifacts. These included a range of European trade goods such as roofing tile fragments, trade beads (especially Cornaline d'Aleppo beads), sherds of glass and ceramic items, a padlock and key, iron semilunar

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

knives, and a French gunspall (Kaplan 1983: 419). A human calvarium was also recovered in the entrance passage roof deposit. Remarkably, it was partially filled with Cornaline d'Aleppo trade beads and had been considered by Jordan as evidence of violent conflict at the site (Jordan 1977: 44). It is more likely, however, that the house was disturbed by human visitors. Jordan (1974: 87, 1977: 44) dated the House 6 generally to the first half of the 19th century on the basis of the artifact assemblage.

During her reanalysis of this collection, Kaplan (1983: 419) identified several items that challenged Jordan's chronological interpretation. Numbers of Cornaline d'Aleppo beads, which have been dated broadly from the late 17th to the early 19th centuries, had been recovered. As well, she demonstrated that the recovered padlock was of a pattern used during the later 18th century (Kaplan 1983: 419). Kaplan therefore suggested that Eskimo Island 2 House 6 was occupied during the 18th century.

House 5

A much more thorough project was initiated at House 5; fully 28m^2 of the house interior and 8m^2 of its entrance passage was excavated. The house was dug into a body of peaty soil, down to bedrock in some places. Excavations showed that it had a stone-paved floor and sleeping platforms running along its rear and side walls. A concentration of fir boughs and three broad planks were found laying on the surface of the sleeping platform while another was set on its side at the edge of the platform. Several lamp stands, associated with fatty deposits, were observed.

A layer of sediment, in places exceeding 70cm depth, overlaid the paved floor. Excavation of this deposit yielded numbers of poorly preserved wooden timbers from the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

roof structure, charcoal, and a large collection of faunal remains and substantial numbers of artifacts. Soil conditions within the house were relatively wet. Accordingly, bone preservation ranged between good and poor in quality. In some limited areas, floor deposits were saturated with fat. These fat deposits were not as extensive as those observed in Eskimo Island 1 House 2, nor were soils beneath the house floor saturated with fat.

A partition wall running north to south divided the eastern portion of the house. Traces of the wall were observed in excavation profiles as blocks of turf and rock, and were associated with timber sleepers and posts (Jordan n.d.). No apparent entrance linked the main room of House 5 with the side chamber created by the wall. The apparent base of the partition wall, as defined by the turf blocks, is situated within the upper portion of the cultural deposit, perhaps as much as 40cm above the paved house floor. Numbers of animal bones were recovered along this wall as well.

While new excavations are required to verify the means of construction and precise stratigraphic position of the partition wall, it appears to have been a late addition to House 5, constructed after a considerable amount of sediment and cultural refuse had accumulated over the house floor. In this case, House 5 had at least two discrete (and perhaps widely separated) phases of occupation, wherein a smaller dwelling had been constructed within the walls of an older, larger structure. If this is true, the size of the second house suggests reoccupation by a much smaller population of householders. A partition wall was observed within House 4 but excavations are required there, as well, to better understand the history of occupation and renovation of that house.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 5 Artifact Assemblage

A substantial artifact collection was recovered from House 5, including items of traditional Inuit design made of steatite, wood, antler and bone. The clear majority of artifacts were, however, trade goods of European origin. These included clay tile fragments, ceramic vessel sherds, glassware, kaolin pipes, over 1500 glass trade beads, 16 gunflints, parts of flintlock firelocks, ammunition, nails, knives, iron pot fragments, fish hooks and cod jigs, 220 iron nails and spikes, and assorted other metal goods (Kaplan 1983: 417). Jordan considered that House 5 (like House 6) was occupied roughly between about 1810 and 1860, based on his initial analysis of these trade goods (Jordan 1974: 87).

Kaplan (1983: 417-419) reexamined the House 5 artifact collection and reported that while the majority of diagnostic artifacts were consistent with a Jordan's early to mid 19th century date, several artifacts did not conform to this attribution. The clay tile fragments were identical to roofing tiles seen in Double Mer Point and in the Eskimo Island 1 houses, and to those recovered in 16th to 17th century Basque whaling sites in Red Bay. The ceramics included fragments of slip-decorated earthenware vessels and decorated creamware plates, and both of these types of ceramics are associated with later 18th century. Cornaline d'Aleppo beads and a type of wound purple glass bead were recovered and these bead types are dated to the late 17th to the early 19th century. An English "TD" pattern kaolin pipebowl was of a type manufactured in the latter half of the 18th century. Similarly, the gunflints and fragments of flintlocks' firelocks all may be dated to the 18th to early 19th century and were likely of French origin.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 5 Dating

Kaplan's analysis clearly shows that a significant proportion of the artifact assemblage recovered from House 5 dates to the late 18th to early 19th century. This suggests that House 5 is a complicated structure that was used over a long period of time. The structure may be composed of a smaller 19th century house built on top of another house of the late 18th century to early 19th century. It is also possible that the turves and sediment that were used to build the 19th century house (Houses 5 and 6) were cut from a cultural deposit containing earlier artifacts which were intermixed with later artifacts once these structures fell into decay. Further excavations paying special attention to the stratigraphy and house floors of the Eskimo Island 2 houses are required to resolve the chronology of this site.

Eskimo Island 3 (GaBp-3)

Eskimo Island 3 consists of a group of four semi-subterranean sod houses located on a low rise 45m to 80m from the island's shore. The site is approximately 85m northwest of Eskimo Island 1. This site is distinct amongst the Eskimo Island sites for it includes only discrete, widely spaced houses; there are no linear house clusters or houses with shared walls. All four houses were relatively small structures and together represented most of the smallest houses on the island. Three houses had entrance passages leading south while the fourth was an indistinct structure. Jordan (n.d.) reported that deposits in and around were quite wet, with seeping groundwater filling some pits while they were open. Permafrost was also encountered in extensive areas in these

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

excavations.

House 1

House 1 measures 8m along its back wall with sidewalls 5m long, and a 4m long entrance passage. Jordan excavated approximately 70m^2 of this house, including almost all of its interior and entrance passage, portions of its walls and midden areas lying outside its walls and alongside the entrance passage (Jordan 1978: Figure 3). The house had been dug into peat overlying sterile beach gravel. Its floor, and that of the entrance passage, were leveled and paved with courses of stone. Near the entrance was a lamp stand made of piled rock and covered with putrefied and charred fat. A 67cm deep storage pit was placed in the floor adjacent to the lamp stand. The walls of the house were built of sod and rock; a natural gravel bank formed the foundation of one of the walls. A sleeping platform ran along the rear wall of the house. Wood shavings, tree boughs, fragments of hide and charcoal and some artifacts were recovered from the platform's surface.

A dense layer of poorly preserved timbers overlaid the floor deposit within the house and in the entrance passage (Jordan 1978: 81). These timbers belonged to the collapsed roof and many proved to be of paper birch (*Betula papyrifera*). Jordan believed that the roof was constructed with poles running the length of the house, supported by posts, and were fastened with nails and lashed. Smaller timbers sloped down from the edge of the roof at the east and west ends of the house. The entrance passage was roofed with long poles that ran the length of the passage, and these were covered with sod (Jordan 1978: 81).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Midden deposits were identified all around the perimeter of the house and on the house walls. The deepest deposits were found along the outer walls of the entrance passage (Jordan 1974: 81), these reached 65cm in depth. Jordan reported that bones recovered from the midden were generally well preserved, in large part because permafrost was encountered at lower depths. As in the other sites, the faunal collection from House 1 was completely handpicked and sieves were not used to standardize recovery of bones. Some kinds of remains, notably mussel shell, were noted in small quantities in the midden, but were apparently not collected. Furthermore, the middens were excavated as single stratigraphic units, so it is impossible to subdivide the recovered assemblage into temporal phases.

House 1 Artifact Assemblage

A large assemblage of artifacts was recovered from House 1. These included a somewhat larger proportion of traditional Inuit material culture items of wood, antler, bone and soapstone, than the other sites in Hamilton Inlet considered here. Stone items included semilunar soapstone lamps with raised wick stands, square soapstone cooking pots, whetstones, abraders, ground slate fragments and chipped stone knives and sidescrapers. Bone and wood sled and boat parts were recovered. Among types of Inuit hunting implements, a bow fragment, a harpoon foreshaft and bladder nozzle fragments were represented. Pieces of stitched hide and a boot sole were also recovered, as were fragments of a wood and baleen bucket.

Many European manufactured goods were recovered, and most of these were, in Jordan's words, "...strictly functional in nature with almost nothing of an exotic nature

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

indicative of extensive trade" (Jordan 1974: 983). A number of these had been modified to make conventional elements of Inuit toolkits. Most notably, iron nails were cold hammered to make endblades, an iron harpoon, rivets, knife blades, and *ulu* blades. Red clay tile fragments were modified for use as abraders (Kaplan 1983: 420). Other European goods were consumed without modification, including square-shafted hand-forged nails, glass and ceramics, ammunition, an iron axe, and scissors. Lead and copper fragments were also identified, as well as a piece of woven cloth, lead pendants, and glass trade beads.

House 1 Dating

Based on these trade goods, Jordan (1974: 83) attributed a date of the middle of the 17th to early 18th century for the occupation of House 1. He concluded that trade during this early period was intermittent and was occasioned through expeditions to southern Labrador. Kaplan (1983) reanalyzed the artifact collection recovered from House 1 and confirmed the date Jordan had attributed to it. Specifically, Kaplan (1983: 420) identified clay tile fragments as roofing tiles similar to those described in Basque whaling sites in Red Bay, which were dated to the 16th and 17th centuries, and compared the ceramics and ironwork recovered at the site to Basque artifact types. As well, the type of semilunar soapstone lamp observed at the site was identified as an early lamp form (Kaplan 1983: 420).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 2

House 2 is the largest of the Eskimo Island 3 sod houses, having a .6m long rear wall, side walls 5.4 long and entrance passage 9.3m long (Kaplan 1983: 420). The house is a complex structure as it has a second chamber extending from its southwest corner. It lacks any obvious entrance passage of its own and perhaps was accessed through the House 2 entrance passage. It has a rounded shape and measures about 7.5m by 7m. Because the side chamber does not obviously conform to the floor plan of the of the main chamber, it may actually be an older structure that underlies House 2 (Jordan n.d.). Alternatively, House 2 may be a bilobed sod house, which are relatively rare in Labrador.

Jordan excavated a test pit in the midden immediately east of the entrance passage, and three more within the side chamber of House 2. On the basis of its artifact collection, Jordan (1974: 85, 87) dated the side chamber's occupation to between the late 16th to the early 17th century, representing the oldest occupation of the site and the earliest evidence of Inuit settlement in Hamilton Inlet.

House 3

House is a somewhat rounded semi-subterranean structure measuring 6m by 4.8m, with a 6m long entrance passage (Kaplan 1983: 425). Jordan dug small test pits in midden areas adjacent to the entrance passage walls and in the house floor (Jordan n.d.) but did not report recovering diagnostic artifacts. He tentatively assigned a broad date from the late 17th century to very early 18th century for the occupation of House 3, on the basis of its architectural similarity and proximity to Houses 1and 2.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 4

House 4 is a small, rounded sod house without apparent traces of an entrance passage. It measures about 8m by 8m and has poorly preserved and indistinct walls. An area of forty-four square metres was excavated within the house, along with initial test pits. Approximately 200 artifacts were recovered, including soapstone and bone artifacts with early Neo-Eskimo characteristics and European goods that are similar to late 16th century to early 17th century Basque artifacts (Kaplan 1974: 425). According to this attribution, House 4 was occupied at about the same time as the side room of House 2, and these houses together represent the evidence of earliest Inuit settlement at the site. The ground within the house was very wet and excavators reported that the animal bones recovered were poorly preserved (Jordan n.d.).

Double Mer Point (GhBo-2), 54°13.2'N/54°23.5'W 6008700N/409400E

Immediately south of the tip of Double Mer Point, at the junction of the northern end of the Narrows and the opening to the long fjord of Double Mer, is a group of three semi-subterranean sod houses and five tent rings that are named after the point. The site is located on a shallow, grassy and tree-covered slope, approximately 30m from the shore of the Narrows (Kaplan 1983: 436; Figure 100). Much like the Eskimo Island sites, Double Mer Point is located at the doorstep of diverse environments. Tide-agitated water in this stretch of the Narrows attracts a variety of animals in all seasons and provides direct access to open water during the winter. A very large area of winter fast ice, with its specialized hunting environment, meets the Narrows at the opening of the Double Mer

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

fjord, barely a kilometre from the site. Relatively thickly forested areas extend west and north of the site.

The sod houses at Double Mer Point 1 are arranged in a linear row and were numbered consecutively, one to three, from west to east. Houses 1 and 3 have back walls 9m long and sidewalls 7m long. House 2 measures 6m along its rear wall and 4m along its sidewalls, which abut those of Houses 1 and 3. All three houses have entrance passages about 5m long extending south, toward the shore. Test pits were placed within each house and entrance passage and in midden areas adjacent to the entrance passages of each house (Jordan n.d.; Kaplan 1983: 436-444).

House 1

Within the entrance passage of House 1, Jordan's test pits uncovered roofing timbers and a 25cm thick cultural deposit containing seal bone and mussel shell overlaying an unpaved, sandy floor (Kaplan 1983: 438). A variety of trade goods were recovered from the midden, including ceramics, glassware and iron goods, a glass bead dating between 1699 and 1836 and fragments of curved red clay roofing tiles resembling those recovered from 16th and 17th century Basque whaling sites (Kaplan 1983: 438). A bone wedge and a broken harpoon with a riveted iron endblade were also recovered.

House 2

Wood roofing timbers were also found in a test pit placed within the entrance passage of House 2, along with a French gunspall dated to the 18th century (Kaplan 1983: 441). Two layers of floor pavement were observed in tests placed in the house floor.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Fragments of bottle glass, iron goods, an iron trap, and trade beads (including Cornaline d'Aleppo beads that were common in the 18th to early 19th centuries) were found in these excavations (Kaplan 1983: 441). A variety of trade goods were also recovered in a test pit placed in a midden west of the entrance passage. There, lead shot, iron items, a glass trade bead, a clay roofing tile fragment that refits with one recovered in House 1, were recovered.

House 3

The entrance passage of House 3 was paved with stones. Lead shot, bottle glass and a harpoon head fashioned entirely of metal, apparently a trade item, were recovered in a test pit in the entrance passage (Kaplan 1983: 441). A test pit placed in the house floor identified three layers of stone pavement. Notable quantities of well-preserved animal bone and mussel shell were recovered in this small excavation (Kaplan 1983: 444).

Tent Rings

Jordan mapped two groups of round and subrectangular tent rings along the Narrows shore, 30m and 90m southwest of the sod houses (Jordan 1974: 85; Kaplan 1983: 444). Several test pits were excavated around these tent rings. The tent rings are considered historic period structures as metal fragments and a kaolin pipe bowl were found in these tests, along with other objects and bone (Kaplan 1983: 444).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Chronology of Double Mer Point

The available artifact assemblages from these houses suggest that they were all occupied during the 18th century. The presence of multiple floor pavements in Houses 1 and 3 suggest that the site had been occupied repeatedly. Allowing that more extensive excavations are required to prove the specific chronological relationships of these structures, Kaplan (1983: 444) hypothesized that all three houses may have been occupied concurrently. The similar state of revegetation of the house ruins, their architectural similarity and their conjoined walls all provide indications that the houses were occupied simultaneously.

Snooks Cove (GaBp-7), 54°04.25'N/57°34.3'W 5992700N/396750E

Snooks Cove is a small cove on the northern shore of the Narrows, immediately northwest of Eskimo Island. This site has ready access to a range of environments. While the Narrows remains free of ice in the winter, a small shelf of fast ice covers the calmer water within the cove itself. Lake Melville, with its fast ice and ringed seal habitat, lies a short distance to the west. To the north of the site are extensive areas of forest and freshwater streams, and Double Mer is within reach of an overland trip. A trading post was built on the site by 1853 by "Mr. Browsnan", an independent trader and, after being acquired by the Hunt and Henley company, the post ended up in the hands of the Hudson's Bay company in 1865 (Jordan 1974: 85; Kaplan 1983: 431-432). Also present at the site are the remains of a recent salmon fishing camp and the ruins of two sod semi-subterranean houses. The latter two structures are relatively small, measuring

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

5.3m by 4.4m and 5.3m by 5m each, and both had entrance passages and rear sleeping platforms.

House 1

Outside the western house (House 1), Jordan excavated two pits placed in midden areas on either side of the entrance passage walls. A variety of trade goods recovered in the tests suggested that House 1 had been occupied in the later 19th century (Kaplan 1983: 428). Relatively few animal bones were recovered in these test pits.

House 2

A $20m^2$ area within House 2 was excavated, along with another $16m^2$ of its entrance passage, representing the majority of the passage structure. Three test pits were placed in apparent midden areas outside the house (Jordan n.d.). The entrance passage contained numbers of wooden beams from its collapsed roof and a plentitude of trade goods that also indicated occupation of the house during the late 19th century (Kaplan 1983: 430). These goods included glass beads, mochaware and pearlware ceramics, glassware, iron work, gunflints and cartridge cases; only a few items of traditional Inuit material culture were recovered. Historical accounts speak of Inuit associated with Browsnan's post living at the site and, apparently, resident Inuit were associated with the Hunt and Henly operation as well (Kaplan 1983: 431). On the basis of this information and the general dates provided by the artifacts, it is likely that the sod houses were occupied contemporaneously with the trading posts.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Summary of Jordan's Archaeological Project in The Narrows

Building upon William Fitzhugh's original survey of the Hamilton Inlet region, Richard Jordan identified and excavated five major sod house sites in the Narrows region. All of these sites are in locations with local access to a variety of wintertime hunting areas and travel routes, on fast ice, in open water, and on land. Jordan excavated test pits in almost all the houses in these sites, in their entrance passages and associated middens. In most cases, at least one house in each site was excavated on a much larger scale. Organic remains were well preserved at these sites, and ample collections of faunal remains were recovered at each. Most of these samples are of sufficient size to support detailed zooarchaeological analyses.

At Eskimo Island, portions of three sites were excavated. Eskimo Island 3 is a sod house village with four to five relatively small houses. Jordan excavated one of these houses (House 3) almost completely and sampled the others on varying scales. These houses have, on average, dimensions of about 8m by 6m and generally resemble Thule house forms. Three have subrectangular or sub-rounded floor plans while the other two may be superimposed structures or a bilobed house reminiscent of Bird's Type 1c house form. The Eskimo Island 3 houses are dated broadly from the late 16th century to the very early18th century and include the earliest evidence for Neo-Eskimo settlement in the Hamilton Inlet region. The goods of European origin were, in the majority, utilitarian items or items refashioned into standard types of Neo-Eskimo material culture. Diagnostic trade goods were most likely of Basque origin, and obtained from Basque whaling and cod fishing operations in southern Labrador.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Eskimo Island 1 included three very large sod houses built in a linear cluster with adjoining walls. These are communal house structures of Bird's Type III, averaging 10.6m by 7.5m, with long entrance passages. Jordan tested only House 2, the largest of these houses. This house was dated to the 18th century on the basis of its artifact assemblage. Excavations showed that the structure had multiple lamp stands and extensive sleeping platforms. Several layers were present within the deposit, implying many phases of house occupation. Sea mammal fat saturated its floor and soil underlying the floor, enough to suggest that blubber had been rendered within the house. Along with a considerable assemblage of faunal remains, a large inventory of European goods was recovered from the house, many of which appear to have been French origin. These included functional articles and large numbers of ornaments, especially beads. As well, many items such as nails had been refashioned into such items as harpoon endblades, knife blades, and clothing ornaments. The quantity and increased diversity of types of trade goods present was considered to represent a greatly increased scale and frequency of trade (Jordan and Kaplan 1980).

Three houses were identified at Eskimo Island 2; one of these was a smallish isolated structure while two others were constructed in a linear cluster. These houses averaged approximately 9.5m by 7.4m or less in dimension, and had subrectangular floor plans, sleeping platforms and long entrance passages. Jordan interpreted the two larger houses as communal houses. Turf partition walls are present within these two of these structures; these walls appear to represent smaller, later houses that were built within the original houses.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Jordan excavated a large part of one of these houses and made small scale test excavations in the other two houses. A broad range of trade goods were recovered in these excavations, indicating intensive trade in both utilitarian and luxury goods. Some of these artifacts were dated to the later 18th century, while the majority of items were identified as belonging to the early to mid 19th century. The disparity in artifact dates supports the idea that these houses had two major phases of occupation and that Jordan's excavation of House 5 concentrated primarily on deposits belonging to the later occupation. The faunal assemblages that Jordan recovered from these houses likely represent a similar range of dates, with the majority derived from 19th century deposits.

Double Mer Point consists of three communal houses built in a row. Two of the three houses measure 9m by 7m. Jordan excavated a small number of test pits within the houses and in the middens associated with them. The small sample of trade goods recovered in test pits in House 1 identified this as an 18th century site. As well, a small faunal assemblage was recovered, mostly from midden test pits.

The Snooks Cove site includes two sod houses associated with the remains of a 19th century trading post. The sod houses are relatively small, averaging 5.3m by 4.7m in size, and have sleeping platforms and entrance passages. One of the houses was extensively excavated, while test pits were excavated in the other and in midden areas. The site is dated to the later 19th century on the basis of historical records and the artifact assemblage recovered in excavations, which was almost entirely one of trade goods. A small assemblage of faunal remains was also recovered.

Over twenty-five years after its completion, the excavation and data recording procedures used by Richard Jordan's project in the Narrows provide frustratingly little

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

aid for some questions being asked by current researchers. Nevertheless, in several ways, his project in the Narrows was ahead of its time and remains a foundation of Neo-Eskimo archaeology in Labrador. Jordan was one of the first in Labrador archaeology to merge the regional unit of analysis used by Fitzhugh in his Hamilton Inlet study, with large-scale excavations of several Inuit sites. In so doing, he established a chronology of Inuit settlement in Hamilton Inlet and developed a comprehensive regional study of architectural change and material culture change from first settlement to the late contact period. In addition, Jordan's project was one of the first in Labrador to make a deliberate attempt to recover substantial collections of faunal remains for the purpose of reconstructing subsistence economy. Despite limitations derived from his collection methods, Jordan's project provided the only multi-site, diachronic, sample of large Neo-Eskimo faunal collections yet recovered from a single region in Labrador.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 6

ARCHAEOLOGY OF OAKES BAY 1 (HeCg-8), 56° 40.04'N/61° 08.24'W 6281700N/613800E

Description and Setting of Oakes Bay 1

Oakes Bay 1 is a sod house site located in an unnamed inlet on the western side of Dog Island (which is also termed High Island), directly west of Evilik Bay on the island's eastern coast. The locality shows evidence of repeated occupations, from Maritime Archaic, Intermediate Indian and Pre-Dorset lithic scatters to 20th century fish camps (Fitzhugh 1977). The site consists of seven semi-subterranean sod houses dug into a boggy slope above a small cove along the north shore of the inlet, about 1.5km east of the inlet's entrance. The houses form a cluster extending approximately 80m north-south by 40m east-west, bordered by two small streams to the east and west, a beach terrace and the foreslope of Alagaiai Hill to the north, and the cove's shore to the south (see Figure 6.1).

Open stands of spruce are found on the slopes above both sides of the inlet, especially the north side (see Williamson 1997: Map 6). The scarcity of the present forest and the high frequency of dwarfed and krummholz trees suggest that Dog Island has been a marginal environment for spruce. Nevertheless, the stumps of 138 trees felled with axes were counted in a 30m by 80m survey area near the site in 2000. Initial dendrochronological studies of these stumps indicates extensive cutting during the first half of the twentieth century (R. D'Arrigo 2001: personal communication), a period when numbers of fishing camps and several houses were established in the area, especially in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Evilik Bay and Natsatuk Island (Brice-Bennett 1977: 135). Wood was of considerable importance to Inuit as a source of raw materials and fuel. The propinquity of stands of forest at Dog Island to the ice edge and winter seal hunting grounds, uncommon in Labrador, was likely of importance in drawing Inuit to establish winter settlements in this location. The present forest appears to be a sparse remnant of its predecessor both in terms of extent and density. Also, historic cutting has had a serious impact on this landscape.

Archaeological Research at Oakes Bay 1

Oakes Bay 1 was first surveyed in 1966 by J. Garth Taylor, who identified it as the Inuit settlement of Parngnertokh on the basis of Moravian Missionaries' descriptions dating from the winter of 1771-72 (Taylor 1974; Taylor and Taylor 1977). Subsequent surveys were undertaken during projects directed by William Fitzhugh in 1974, 1980 and 1984 (Fitzhugh 1977; Kaplan 1985b), and during a second project directed by Susan Kaplan, involving Jim Woollett, in 2000. Taylor identified six sod houses arranged in a cluster, while Fitzhugh mapped an additional small structure in the center of the house cluster. Three of the houses mapped by Fitzhugh were large communal houses covered in lush vegetation, while the others were much smaller structures with lower walls.

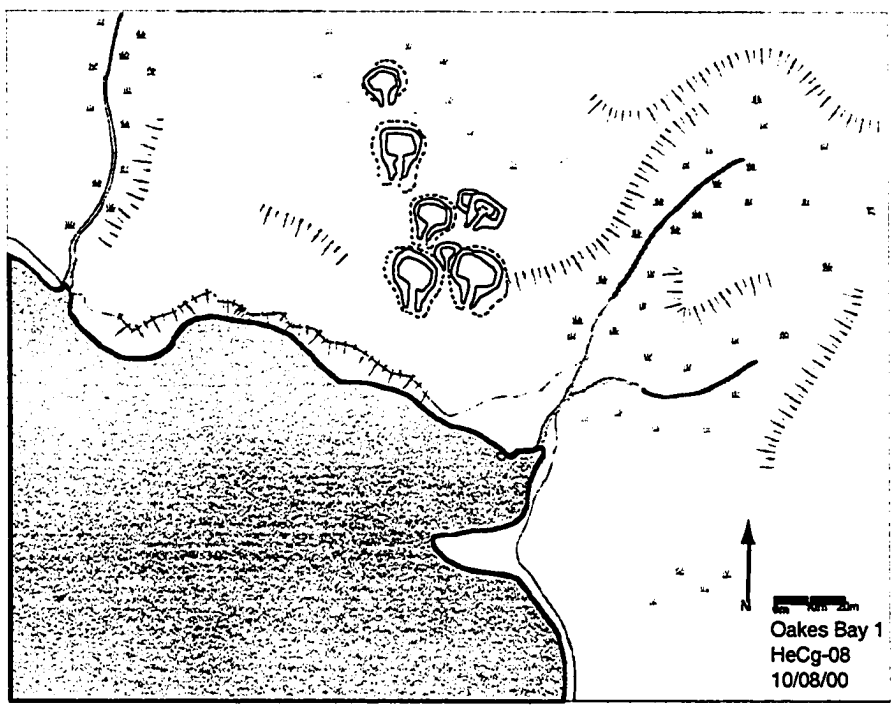
The number of houses present at the site, and the variety of house forms represented, provide initial indications of an extended history of occupation of this site. Nevertheless, Moravian Mission records researched by Taylor (1974, 1977) report only a single use of the settlement of Parngnertokh; one house was occupied in the winter of 1771-72. The Moravians maintained a constant presence in this region after the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

establishment of the Nain Mission in 1771 and they reported the use of other sites in the region long after this date. The absence of further records of occupation argues that the winter of 1771-1772 represents the site's final occupation. Thus, any extended occupation of the site must precede the 1700's. The smaller houses open the possibility of a pre-18th century occupation.

In 2000, a survey crew lead by Susan Kaplan and the Jim Woollett visited the site, testing several houses with a soil core sampler, and making test excavations in three houses and one midden. A map of the site made during this visit is presented in Figure 6.1. The results of the 2000 project are presented below, in the form of description of each house and the work carried on in each.

Figure 6.1 Map of Oakes Bay 1



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 1

House 1 is a very large, one-room, semi-subterranean communal house structure dug into a shallow raised beach terrace. It has dimensions of 13.5m by 11m at the height of its walls, 10m by 7m in its interior and an entrance passage about 10m long. Its interior has a sub-rectangular shape, though the outer margins of its walls express a very rounded shape. The walls of the house are massively constructed of earth and presently are about 1.5m tall relative to the interior floor. Structural stones are visible in the walls of the entrance passage and around the entrance's lintel. Soil cores placed in the floor encountered rock, probably from a pavement, below 10-20 cm of soil. Raised banks of turf within the house suggest the presence of platforms along the rear wall and both side walls, although excavation is needed to verify this proposition. Recent rodent burrowing has disturbed the surface of much area around the entrance passage walls. Fragments of animal bone and quantities of wood fragments, many charred, were observed in piles of disturbed soil and may point to the location of midden deposits flanking the entrance passage walls.

A 1m x 1m test pit was placed in the south wall of House 1 in 2000, in order to determine details about the house's construction. The unit was excavated to a depth of 66cm through wall and over-wall deposits. Materials recovered included stone and wooden structural components of the walls, quantities of animal bones (especially in the over-wall deposits), two soapstone vessel fragments and one body sherd from a small, undecorated, white-glazed earthenware cup.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 2

House 2 is another very large, semi-subterranean, communal house structure, located alongside House 1 and dug into the same low raised beach terrace. This sod house measures approximately 15m by 9m at the height of its walls, with interior dimensions of 11.5m by 7m and a 9m long entrance passage. It is more clearly rectangular in shape than House 1 and has several substantial rocks that were used as structural elements along the interior walls of the entrance passage, at the entrance lintel, and reinforcing the edges of platforms within the house. Well-built platforms with several lobe-shaped projections run along the four walls of the house. The walls and slope adjacent to the entrance passage are presently covered in a dense growth of fireweed, grasses and moss. The ground surfaces of the southern house walls and the entrance passage walls were both disturbed by recent rodent burrowing. Wood, charcoal and bone fragments were noted in this disturbed soil. While House 2 was not excavated in 2000, a small test had been placed in the southwest corner of the floor, in 1974.

House 3

House 3 is the third large sod house at Oakes Bay 1. It is located approximately 20m north of House 1 and a little higher up the shallow slope. The house measures approximately 12m by 8m at the crest of its walls and 9m by 5.5m in its interior dimensions. The entrance passage is approximately 9m long. A cavity in the north end of the western wall of the entrance passage may indicate the presence of an alcove; at its exterior opening, the passage curves toward the west. Banks of turf within the house suggest the presence of broad sleeping platforms along the west wall and the north wall. Somewhat more ambiguous narrow turf banks that run along the east and southeast walls

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

may also represent sleeping platforms. A low, lobe-like projection juts from the north wall and may represent a platform extension running into the middle of the room. Several large rocks, part of the lintel, are present.

In 2000, a thick mass of fireweed was growing over the house walls. Some surficial soil disturbance, likely from rodent burrowing, was noted along the walls of the entrance passage. Soil core tests around the walls demonstrated patches of frozen ground at depths of about 50 cm below surface.

In 1984, William Fitzhugh's survey crew excavated a small test pit on the floor of the eastern end of the house, adjacent to the projecting platform (Kaplan 1985b). In the unit, a layer of parallel-lying wood timbers, ca. 10-20cm in diameter, was uncovered under 15cm of turf. These timbers were interpreted as the remains of the collapsed roof as they overlaid a thin (2-4 cm thick) deposit of black-brown soil with preserved animal bone, which itself overlaid stone floor pavements 25-35cm below surface. Another small shovel test was made in 2000, on the house floor about 3m to the north of the 1984 test, and showed remarkably similar stratigraphy.

As well, in 2000, another two 1m by 1m units were excavated in the walls of House 3 in order to examine their construction. One unit (Test 1) intersected the edge of the southern house wall and the entrance passage wall, indicated by a row of stones, timber and a whalebone scapula. Permafrost was encountered at depths of 60-70cm. The excavation was terminated at a depth of 98cm below the unit datum. A floor layer was found at this depth, comprising a compacted black, organic-rich deposit containing twigs, bone and some gravel. Beneath this deposit was a layer of sterile sand, the beach deposit substrate into which the house was dug. Artifacts recovered in this test excavation

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

include fragments of steatite vessels, whetstones and worked bone, including a sled runner fragment. Trade goods recovered included an iron key, and iron rod, forged iron nails and spikes, glass sherds, one small white glass trade bead and another larger glass trade bead.

A second test (Test 2) was placed in the walls of the northwestern corner of the house. It was excavated to a depth of 40-45cm below surface and revealed a series of thin lenses of dense peaty soils, greasy black humus and coarse grey sand, as well as flat-lying decomposed wood, some artifacts and animal bone. The small size of many of the lenses visible in the profile and their compacted and discrete nature suggests that at least the upper portions of the wall was built with turf blocks. Artifacts in this unit consisted of several fragments of steatite lamps and vessels, a hand-forged iron spike and a fragment of worked bone.

H3 Midden

Soil core tests identified midden deposits with well-preserved bones and patches of frozen ground on both sides of the entrance passage opening. A 1.5m by 1.5m test pit was excavated in the midden area east of the entrance passage wall, 7m south of the cold trap and inner entrance to the house. The unit was excavated in 5 cm arbitrary levels with bedding planes following natural stratigraphy; all sediments were sieved though 4mm mesh.

The top 5cm to 15cm of this unit is a zone of loose sandy grey soil and root mat, with fragments of charcoal, wood and bone, and lenses of yellow-tan sand. This stratigraphic level is disturbed, likely through rodent's burrowing. Beneath this layer there are several layers of grey and brown turfy soil alternating with deposits of hard,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

massive, crusty red/brown organic material. The turfy soil layers include wood fragments, charcoal and concentrations of preserved bone, and there is no evidence of further rodent burrowing at this depth, except for a single void in the northern end of the east profile.

There are four pairs of these midden/organic deposit layers visible in the unit's east profile; some organic layers are as thick as 5 cm. Chemical tests are currently being conducted to determine the nature of the crusty organic material, but it is currently thought to be burnt and congealed animal fat. The scale of the organic deposits and their reoccurring nature may be suggestive of the disposal of waste or spillage from episodes of blubber-rendering rather than daily waste from seal oil lamps. The lower contacts of the organic deposits bear the negative imprint of the underlying substrates and, in some examples, encapsulate small fragments of wood and charcoal and matted grasses.

The deepest layer of organic matter terminates at a depth of 33-38cm below surface. Below this is the original grey-brown sandy midden layer. A layer of fine, black soil, very rich in soil organic matter, underlies the midden deposit and itself overlies a sterile layer of coarse sand, sub-angular pebbles and cobbles, in which the excavation terminated. Some bones, fragments of charcoal, and small masses of burnt fat were found at the top of this layer. This black soil appears to have been both the original soil that developed on the underlying beach deposit and the active soil horizon when midden accumulation began outside House 3.

Bone preservation conditions were relatively good in the House 3 midden. Soil core tests located frozen soils in the vicinity of the entrance passage wall, near the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

midden. Nevertheless, these frozen soils seem to have been patchy or thin, however, as they were not encountered in the midden test excavation.

Over 3000 bone fragments were recovered from the midden excavation. Soil pH in the midden deposit layers ranged from 6.0 to 6.8, a moderate degree of soil acidity that encourages bone preservation. Nevertheless, the effect of attritional processes is apparent in the recovered bone assemblage. Many bones were fragile, hollow shells of compact bone characteristically recovered from wet soil conditions. The recovered assemblage included numbers of more dense skeletal elements; seal auditory bullae and phalanges were most common. Bones in lower levels (especially the deepest midden layer and the underlying humus-rich soil horizon) were generally more poorly preserved. The 35-40cm below surface level provided an exception to this observation, as a cluster of well-preserved small bones, including bird and fish bone, was found in a sheltered pocket created by a large rectangular stone running across the floor of the unit, perpendicular to the dip angle of the slight slope.

Table 6.1 Soil Acidity of Deposits in House 3 Test Pit 3 Midden Test

Depth (cm below surface)	PH	Description of Deposit
20-25	6.6	Midden deposit with brown, organic-rich sandy, turfy soil
30-35	6.0	Dense midden deposit with grey to brown turfy sandy soil.
35-40	6.8	Fine black, organic rich soil with thin midden scatter at top

House 3 Midden Artifact Assemblage

A number of artifacts were recovered in the House 3 midden excavation, though few of these were clearly diagnostic artifacts. The artifacts included a number of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

fragments of soapstone lamps and vessels, some had been repaired with iron staples and several bear thick encrustations of burnt fat. Some European trade items were also recovered, including a white metal pendant or earbob, a number of hand-forged iron nails, spikes, blade fragments, an awl, reworked iron objects, lead sheet and lead casting waste. Three sherds of flat tinted glass were recovered. In the 20-25 cm level, a single Cornaline d'Aleppo bead was also recovered.

Dating of House 3

While few artifacts recovered in the House 3 or midden excavations suffice as clear temporal markers, some artifacts provide general dating information. Trade goods were found from top to bottom in the midden, indicating that the period of midden deposition fell within the contact period. Significant among these is a Cornaline D'Aleppo bead, which dates to the late 17th to early 19th century (Stone 1974: 108). The general framework does not conflict with the occupation record of 1772 derived from Moravian Mission accounts and acceptably places House 3 and its midden within the 18th century.

House 4

House 4 is a sub-rectangular sod house 12m by 9m at the height of its walls, with interior dimensions of 9m by 5.5m. House walls presently stand about 0.5m tall and have low growths of birch, willow, moss and some thin grasses. The entrance passage leads south-southwest, following the direction of the slope, and is approximately 6m long. The

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

presence of a sleeping platform may be indicated by a low, broad bank of turf running against the north and east walls. Soil core tests revealed patches of frozen ground or permafrost within and around the house at about 35cm below surface, with some traces of bone, charcoal, decomposed wood and organic-rich black soils along the south wall and entrance.

In 2000, a 60m x 30m test excavation was undertaken in the southern floor of House 4, in line with the entrance passage. The excavation encountered 17 cm of thick peat overlying waterlogged peaty soil. The lower, wet, deposit contained substantial wood remains and was very cold, most likely because of permafrost which turned up at depths of about 26 cm below surface in soil cores within the house.

House 5

This house is a smaller, very rectilinear sod house structure about 15m north of House 2 and 10m east of House 4. Its walls are low and support low birch and willow rather than the rich growth of grass and fireweed seen on Houses 1, 2 and 3. The house structure measures approximately 11.5m by 8m at the height of its walls, with interior measurements of 7.5m by 4m. The presence of a sleeping platform is probably indicated by a high, raised bank of turf 1.5m deep, filling the eastern end of the house. A much lower bank of turf runs along the western wall as well.

The entrance passage of House 5 is about 7m long. A concavity in the western wall of the passage, near the entrance to the house itself, may indicate the location of an alcove. The house is superimposed over a previous house structure; an older and lower wall extends 2 to 3m west of the most recent house wall. The older house likely follows

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the general orientation of the more recent house. The house has not been excavated.

House 6

House 6 is the northernmost house at Oakes Bay 1, located about 15m north of House 3 and 85m from the shoreline. At this elevation, the site begins to encroach upon a bog. House 6 is a relatively small, rectilinear sod house structure with very low walls covered in sparse grass and low birch and willow vegetation. Unlike most of the other houses at the site, House 6 shows very little development of a turf mound, suggesting that the house had a short occupational history. House 6 measures 9m by 6m at the height of its walls with interior measurements of 7m by 4.5m. Its entrance passage is about 6m long. During W. Fitzhugh's survey of the site in 1984, a small test pit was placed within House 6. This test found a paved floor, a very thin potential floor deposit and sparse artifacts (Kaplan 1985b).

House 7

House 7 comprises a very small oval ring of turf, which closely resembles a small sod house and entrance passage, located amidst the cluster of Houses 1, 2, 4 and 5. W. Fitzhugh identified the structure as a possible house ruin in 1984 and, while the area was not tested in 2000, it seems likely that this identification is correct. If so, House 7 is an older structure that was truncated by the subsequent construction of Houses 1 and 2. Its very low and amorphous walls lie partially underneath the very substantial walls of these two structures, while its entrance passage extends between these walls and currently drains the gully between Houses 1, 2, 4 and 5.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Summary of Archaeology at Oakes Bay 1

A limited survey project was conducted at Oakes Bay 1, a large site with seven discernable sod houses in 2000. The site is located on Dog Island, a location that offers access to excellent seal hunting areas through proximity to seasonal harp seal migrations along the outer coast, to winter fast ice areas and to the ice edge. As part of this project, the site was mapped and soil core tests made in all of the sod houses at the site, identifying several contexts with permafrost and excellent organic preservation. Test excavations were conducted in two large communal houses (Houses 1 and 3) and in a smaller sod house structure (House 4). In addition, a larger test excavation was placed in a midden adjacent to the entrance of House 3. This latter excavation is the object of interest of this study.

The House 3 Midden was clearly stratified, revealing layers of dense concreted organic matter. Excavations in it produced a large collection of well-preserved faunal remains. An initial analysis of artifacts from the midden and from House 3 was indicative of an 18th century date for both contexts.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

AN HISTORICAL ECOLOGY OF LABRADOR INUIT CULTURE CHANGE

by

JAMES M. WOOLLETT

Vol. 2

A dissertation submitted to the Graduate Faculty in Anthropology in partial fulfillment of the requirements of the degree of Doctor of Philosophy, The City University of New York

2003

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 7

ARCHAEOLOGY OF UIVAK POINT (HjCl-9)

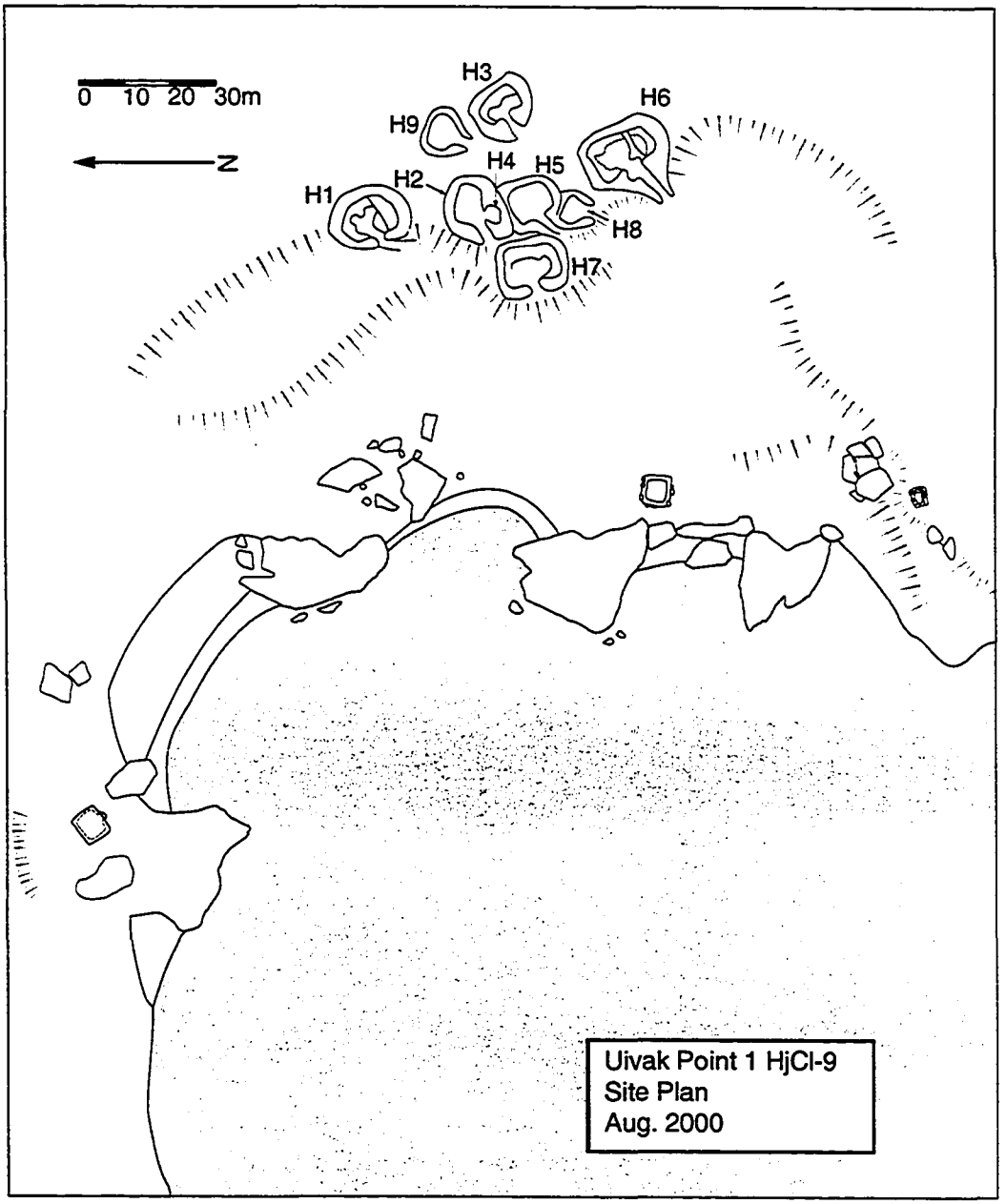
57°37.2'N/61° 54.5'E 6386800N/565500E

Description and Setting

The site of Uivak Point is located in a cove in the south-western side of a peninsula separating Mugford Bay from northern Okak Bay, 7 km northeast of the abandoned Okak settlement and Moravian Mission station. Missionaries of the Moravian Church documented the occupation of the Uivak Point during the later 18th century and described it as one of the largest communities in the Okak Bay region, having at its peak up to 125 residents (Taylor 1974; Taylor and Taylor 1977: Table 1). Traces of its occupation are visible for some 200m along a saddle between Inuksulukuk Hill and a promontory leading to the south. The ruins of up to nine, very large, semi-subterranean sod houses are visible in a cluster at the center of the site, dug into a pair of raised beach terraces, located 8m and 11m above sea level respectively. The ground around many of these houses is remarkably mounded, suggesting that the area saw repeated house building episodes as well as ongoing deposition of refuse and transported sediment. Lush vegetation, mostly sedges, grasses and mosses, grow on and around the houses. Several cache structures were built into rocky outcrops at the northern and southern ends of the cove. Numbers of graves were built on the hillsides and hilltops overlooking the settlement, testifying to the density of Inuit settlement in the area. Similarly, numbers of conspicuous *inuksuit* (stone cairns used for various purposes) these hills and the higher slopes of Inuksuluk Hill point to the scale of Inuit traffic beyond the house cluster itself.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.1 Map of Uivak Point 1



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The field of view from Uivak Point extends almost 360 degrees, from Mugford Bay and Cape Mugford in the north, east to the *sina* and the open Labrador Sea, and south to the inner reaches of northern Okak Bay. Accordingly, Uivak Point is an excellent location from which to observe and intercept game on the open ocean and in protected inner bays, including harp seals and whales migrating in the fall, and ringed seals basking on winter fast ice.

Uivak Point sits, as well, in the midst of the Okagmuit cultural landscape in the northern Okak Bay region. The majority of late 18th century seasonal settlements of the region, as described by Moravian Missionaries (Taylor 1977: Map 19), were located within 20km of the site. The general locations of Okak and Kivalekh, the two other major 18th century sod house settlements in the Okak Bay region, as well as several important temporary fall and winter encampments lay within sight of Uivak Point. Traces of other occupations are also visible in the immediate vicinity of Uivak Point 1, including the foundations of two wood houses, along with Neoeskimo tent-rings and several stone graves. Four prehistoric tent-rings and extensive scatters of prehistoric lithic debris were found at the top of the saddle above the site (Uivak 1, HjCl-11).

A Summary of Fieldwork at Uivak Point

J. Garth Taylor visited Uivak Point in 1966, and conducted the first limited test excavations in several of the houses there (Kaplan 1983: Taylor 1966, cited in Fitzhugh 1977). Taylor identified the site as "Uivakh" (also variously spelled as Uibvak and Uivak), which was described by Moravian Missionaries as a whale hunting center and one of the principal winter settlements in the Okak region between the years 1776 and 1807, and perhaps later (Taylor 1974: 17; Taylor and Taylor 1977: 60). Setting out on their exploratory voyage to Ungava Bay in June 1811, the Moravian Brothers

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Kolhmeister and Kmoch observed that two or three winter houses were standing on the site (Kohlmeister and Kmoch 1814: 9). Survey crews from the Smithsonian Institution's Torngat Archaeology Project (TAP) revisited Uivak Point in 1977 and 1978 (Kaplan 1983: 529). They noted the remarkable size of the site's communal houses as well as the presence of substantial middens containing whalebone associated with the houses. The TAP survey crews also identified Maritime Archaic lithic assemblages associated with tent rings at the Uivak Point 1 site (HjCl-11) located in the saddle uphill from the sod house settlement.

The discovery of large communal houses with whalebone and excellent bone preservation at Uivak Point 1 made it a significant site for the objectives of this project. In addition, J. G. Taylor's ethnohistorical research provided information about several aspects of Uivak Point's occupational history, including census data, and identified the site as a whale-hunting center. The availability of this ethnohistorical documentation and the presence of large 18th century houses with substantial middens at the site offered an opportunity to examine the roles of whaling, trade and economic stress in 18th century Inuit social change, through convergent lines of evidence. As well, the proximity of the site to the northern extent of the contemporary tree line and to the distribution of permafrost suggested the possibility of good bone preservation in frozen, non-podzolic soils, at this site. Accordingly, in 1992, Kaplan proposed making Uivak Point the focus of a program of intensive house and midden excavations, and initiated a formal project in 1993.

Between 1993 and 2000, fieldwork was conducted at Uivak Point by the Bowdoin College Labrador Archaeology Project, under the direction of Dr. Susan Kaplan and Jim

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

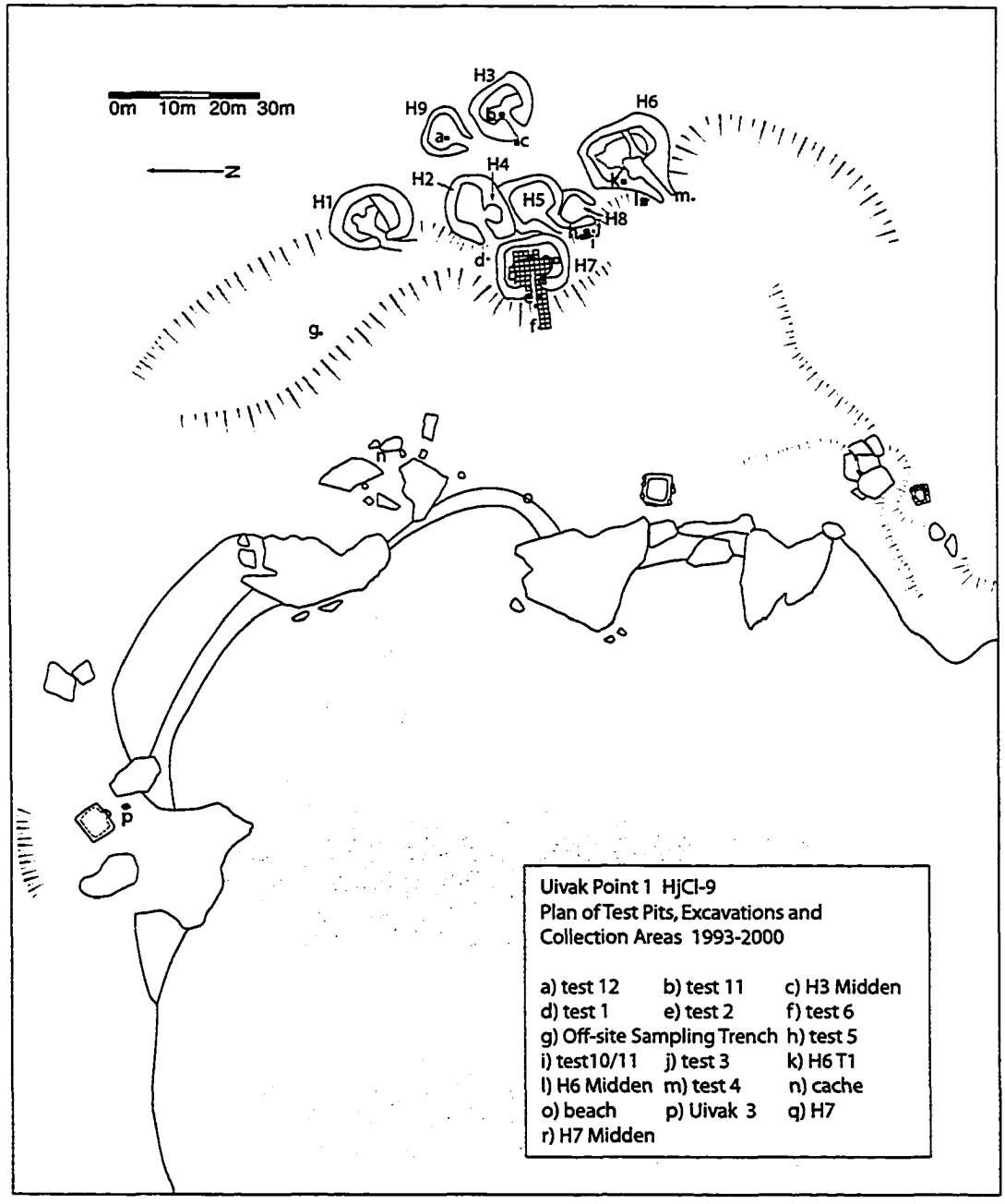
Woollett. The central objectives of this project were to undertake detailed studies of architecture, material culture and subsistence economy associated with 18th century communal sod houses. Most previous archaeological investigations of Neo-Eskimo sites in Labrador had relied upon limited test excavations conducted within houses and, prior to the present project, there had been few well-documented, systematic or complete excavations of communal houses in Labrador which had made a priority of recovering substantial faunal assemblages. Furthermore, very few midden excavations have been attempted at communal house sites aside from a small number of limited test excavations. Consequently, the paucity of faunal assemblages suitable for detailed analyses has hindered the evaluation of linkages of communal houses to whale hunting and economic hardship, as proposed by various authors.

Recent Fieldwork at Uivak Point

Kaplan and Woollett began initial archaeological fieldwork at Uivak Point with the intention of identifying sod house structures and defining associated midden deposits. Houses were mapped with tape and compass, and the depths of their floor deposits were determined by probing with an Oakfield soil core sampler using a one-inch peat head bit. House 7 was demonstrated to have deep floor deposits and appeared to be a structure with clearly identifiable walls lacking obvious evidence of rebuilding; the house was therefore considered a priority for excavation. Areas outside the house walls and entrances were also tested with the soil sampler in order to locate midden deposits. These tests were made at one to two metre intervals along parallel transects running down slope from the house walls and entrances.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.2 Map of Areas Excavated at Uivak Point 1



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The locations of several midden deposits were identified through this method, beside or adjacent to the entrances of House 1, 2, 5, 6, and 7. These middens were characterized by black to dark grey-brown organic-rich soils, charcoal, and preserved wood and were for the most part cone-shaped deposits on terrace slopes. Because most of the houses at Uivak Point were built on the edge of steep-sided beach terraces, refuse was likely cast down the slopes near the houses, accumulating in debris piles on the slopes, beneath house entrances. Several tested deposits exceeded 35 cm in depth, suggesting that these were indeed relatively long-term, accretional deposits, rather than thin sheet middens with widely broadcast debris piles. While midden deposits such as these represent secondary or tertiary archaeological contexts, they offer the possibility of effective stratigraphic controls in locations where ground topography provided loci for the accumulation of debris and where the steepness of slopes discouraged foot traffic, trampling and disturbance.

Eight small shovel tests measuring less than 50 cm per side were dug adjacent to Houses 2, 5, 6 and 7, in order to more precisely determine deposit depth and bone preservation conditions in areas where soil cores indicated particularly organic-rich soils, charcoal or traces of bone (see Fig 7.2). The tests provided strong indications that extensive and, in some cases, deep middens are preserved at Uivak Point. Animal bones recovered in these tests were well preserved and some areas contained patchy permafrost. As well, a further $1m^2$ test excavation was made in a midden adjacent to the Uivak 3 house.

Shovel tests on slopes beneath Houses 5, 7 and 8 demonstrated that these areas were particularly promising areas for larger midden excavations. These tests determined

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

that House 7 and its midden were ideal candidates for intensive excavation due to the depth of floor deposits, preservation conditions in the midden and the clear association of the two contexts. Accordingly, these areas were selected for more extensive excavations in 1993. A 3m by 1m excavation was undertaken between Houses 5 and 8. A 7m by 2m trench was opened in the midden associated with House 7. Six $1m^2$ excavations were begun within House 7, in the entrance passage and floor areas. These excavations were conducted employing 5cm or 10cm arbitrary levels in different contexts, following the natural bedding planes of visible stratigraphy. All the units were excavated entirely with trowels and finds were plotted in three coordinates. All excavated sediments were sieved through 4mm mesh to standardize recovery of bone and small finds.

During the 1994 field season, Kaplan and Woollett completed a trench that ran from the rear wall of House 7, through the entrance passage and bisected the midden. In addition, 15 new 1m by 1m units in the house, including the entrance passage, portions of the floor, sleeping platform and walls were excavated. Combined with those made in 1993, these excavations provided a 16m long profile that spanned the entire width of the house and established a stratigraphic link between the house and the midden. Finally, much of the site was mapped with the use of a transit and stadia rod.

In 1996, the excavation of House 7 was expanded by 16 new 1m by 1m units, exposing extensive and contiguous areas of the paved floor, sleeping platforms, walls and entrance passage. Several units left unfinished in previous seasons were also completed. Large bulk sediment samples were taken systematically from selected units within House 7 and from a column in the House 7 midden, to support analyses of macrobotanical and palaeoentomological remains.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Two new series of soil core tests were made around the entrance passages of Houses 1 and 6, and further defining midden deposits around these structures. A 1.5m by 1.5m excavation was completed in the midden associated with House 6. In addition, a survey of the beach area west of the site was undertaken. Lithic debris from the intertidal zone was recovered, as were several cobble-sized lumps of concreted sea mammal fat and sand from the beach above the normal high tide line.

Kaplan and Woollett returned briefly to Uivak Point 1 in 2000 to sample wood remains in house walls for dendrochronological dating. During this visit, two new units were excavated within House 7 and two units begun in earlier seasons were re-opened. These units were all located within the house walls, adjacent to the entrance passage walls. Several substantial timbers, structural parts of the house walls and debris deposited outside walls were removed from these units for dendrochronological dating. An additional 1m by 1m unit was placed in a similar location in the walls of House 6. Finally, soil cores suggested that a thin midden deposit was present in wet ground outside the entrance to House 3 and a 1m by 50cm test pit was excavated in this area.

Descriptions of Houses at Uivak Point

House 1

House 1 is a trapezoidal to oval-shaped structure perched on the edge of the 11m asl beach terrace. It has very tall and thick walls, and the western walls have a very steep slope down to the 8m asl terrace. It is the northernmost house in the house cluster and, measuring 15m by 11m at the height of its walls, it is one of the largest as well. The interior of the house measures 12m by 8m. The floor is quite wet and has a thin layer of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

moss covering an extensive stone floor pavement. A tall, well-defined bank of turf suggests the presence of a platform in the south end of the house while a lower, multi-lobed platform may be indicated by another bank of turf extending along the north, east and south walls. The lobes projecting from this platform may represent multiple lamp stands or work areas. A 3m to 4m long ramp extends south from the middle of the west wall, creating a trail leading across the steep foot of the wall. While this is the entrance passage area, a well-defined turf wall is lacking where the west wall of the passage would have been. This suggests that the entrance passage may have been fairly short or that portions of the wall may have slumped down the steep terrace slope.

House 1 was not excavated. Soil core tests within the house identified only stone pavements and thin layers of wet, moss-rich peat. Some large and partially buried whalebones are visible on the slopes below the western walls and entrance. Soil core tests placed in these areas identified a limited midden deposit containing dark, organic-rich soil, mussel shell, bone fragments and charcoal. Large numbers of rocks near the surface hindered effective testing with the soil corer.

Houses 2 and 4

House 2 is a rectangular structure built on the edge of the 11m asl terrace. It measures approximately 12m long and 10m wide at the height of its walls, with interior dimensions of 8m by 6m. The entrance passage extends 4m from its western wall. Its turf walls are quite thick and tall; the western walls of the house stand about 3m to 4m above the floor of House 7, which lies immediately to the west on the lower terrace. The house walls are also higher than those of House 5 and appear to impinge upon that

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

structure's northern wall. For this reason, House 2 may be a more recent structure than House 5.

House 2 is an unusual structure in comparison to the others at Uivak Point because its long axis has a general east-west rather than north-south orientation and because its entrance passage is set into its shorter wall. This house is rendered yet more unusual by the presence of another structure (termed House 4) within its rather massive southern wall. House 4 is a small rectilinear turf structure approximately 4m long by 3m wide. House 4 may represent a corner of an older house underlying House 2. Alternatively, House 4 may simply be an alcove or side-chamber belonging to House 2. House 4 has no exit except into the interior of House 2 and, while both structures have very substantial outside walls, they are separated from each other by a relatively low and thin turf wall. If Houses 2 and 4 are contemporaneous structures, this would be a rare example of a two-room communal house form.

Neither House 2 nor House 4 were excavated. Soil core tests made within House 2 floor showed that its floor had a thin layer of wet peat overlying a rock pavement. Cores placed west of the entrance of House 2 produced evidence of a midden deposit. A test pit (Test 1) was dug approximately 3m west of the entrance of House 2 and excavated to a depth of 40 cm though dense, dark, organic rich, turfy soil. Some wood and bone remains were recovered in this test. The excavation was terminated in a layer of poorly preserved whalebone that could not be recovered. House 4 was not tested with the soil corer.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 3

House 3 is located at the eastern edge of the cluster of sod houses, on level ground above the crest of the higher beach terrace. The ground into which the house was built is almost continuously wet; thick moss, *Empetrum*, and dwarf *Betula* vegetation cover most of the house and its walls. *Equisetum* and frost-heaved hummocks around the house indicate the presence of extensive local permafrost. The house is a sub-rectangular structure with very low walls; the outside margins of its splayed-out wall deposits are, in places, indistinct due to the hummocky ground. At the height of its walls, the house measures approximately 11m by 7m, and 9.5m by 5m within its interior. The entrance passage is built into the western wall. It measures about 4m long, but is especially ambiguous at its termination. A sleeping platform within the house is suggested by the presence of a low turf bank running along the eastern (uphill) wall and possibly along the north wall as well.

A test pit was excavated in the house floor in 1996, which uncovered a stone pavement under a thin layer of very wet organic-rich soil. Despite the use of hand pumps, water filled the unit too quickly to excavate further. No artifacts were recovered in the unit, although wood remains were identified.

A 50cm by 50cm test pit was excavated in 2000, outside the house walls and immediately west of the opening of the entrance passage. Soil core tests had indicated the presence of charcoal, wood and bone debris in this location and the test pit was dug to determine if a midden could be identified outside the house.

The unit was excavated to a depth of 35cm below surface. The upper 25cm to 27cm of this unit was composed of culturally sterile layers of rhizomes, dense and poorly

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

decomposed peaty soil and sandy soil. A black turfy deposit was present from 25-27cm to 27-32cm below surface. This layer was the only trace of a midden that was found and contained sparse charcoal, rotten wood, sparse bone fragments and a trace number of artifacts. Below this layer were further layers of sterile turfy soil and sand. The few artifacts recovered consisted of a small number of lithic debitage fragments, two soapstone vessel fragments and a hand-forged iron spike. In addition to a few small and poorly preserved bone fragments, a small amount of mussel chitin, two small shreds of baleen and two feathers were recovered.

The different vegetation and poorly defined walls of this house provide circumstantial indications that House 3 may represent the earliest phase of site occupation. Alternatively, the low walls and lack of a recognizable mound around the house might be indicative of a short period of occupation rather than erosion and relative age. The single thin midden layer observed in the test pit supports the proposition that the house had a short history of use, most likely overlapping those of the other sod houses on the site. In this case, the apparently poor (very wet and relatively exposed) building site explains the short occupation history. While no clearly diagnostic artifacts were recovered in these very limited test excavations, the presence of a hand-forged iron spike in the midden test is consistent with a contact-period date of occupation.

Houses 5 and 8

House 5 is a subrectangular, almost square, sod house built in the 11m asl terrace, immediately south of Houses 2 and 4. It measures 11m by 10.5 m at the height of its walls and has interior dimensions of 9 by 7m. The entrance passage is placed in the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

western wall, it is about 7 m long and curves southwest, avoiding the southwest corner of House 7. Abutting the south wall of House 5 is House 8, a much smaller sod structure built at a slightly lower elevation. House 8 has a rounded floor plan with maximum wall dimensions of 9m by 9m and interior dimensions of approximately 6m by 5m. The structure has an opening leading to the south, but its diminutive size and unclear western wall suggest that it may be the remains of an older house that was partially covered and obliterated by subsequent construction of House 5. Unlike Houses 2 and 4, there is no passage between Houses 5 and 8. Because neither house was excavated, the chronological relationship between these structures remains unclear.

Soil cores indicated that the floor of House 5 was composed of a thin layer of moss and peat overlaying stone pavements. Portions of the floor deposit are very wet, often with visible standing water. Soil core tests identified organic-rich sediments with charcoal, wood and animal bone, indicative of midden deposits and outside of the entrance passage, and west of the walls of House 8,

A test pit (Test 3) was excavated below House 8's western wall, and about 10m south of the end of House 5's entrance passage. A midden deposit consisting of wood, charcoal, mussel shell, seal bones and whalebone fragments was encountered at a depth of 30-50 cm below surface. Permafrost was present in the lower portions of this test. Bedding planes of the lower deposits dipped sharply (at about 25 degrees) to the west, following the dip angle of the underlying terrace. A second shovel test (Test 5) was placed approximately 5m southwest of Test 3, immediately down-slope of the western walls of House 8. This unit encountered a rich deposit of bone, mussel shell and wood

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

fragments near the ground surface. The observation of quantities of bone in these two tests suggests the presence of a deep and extensive midden on this slope.

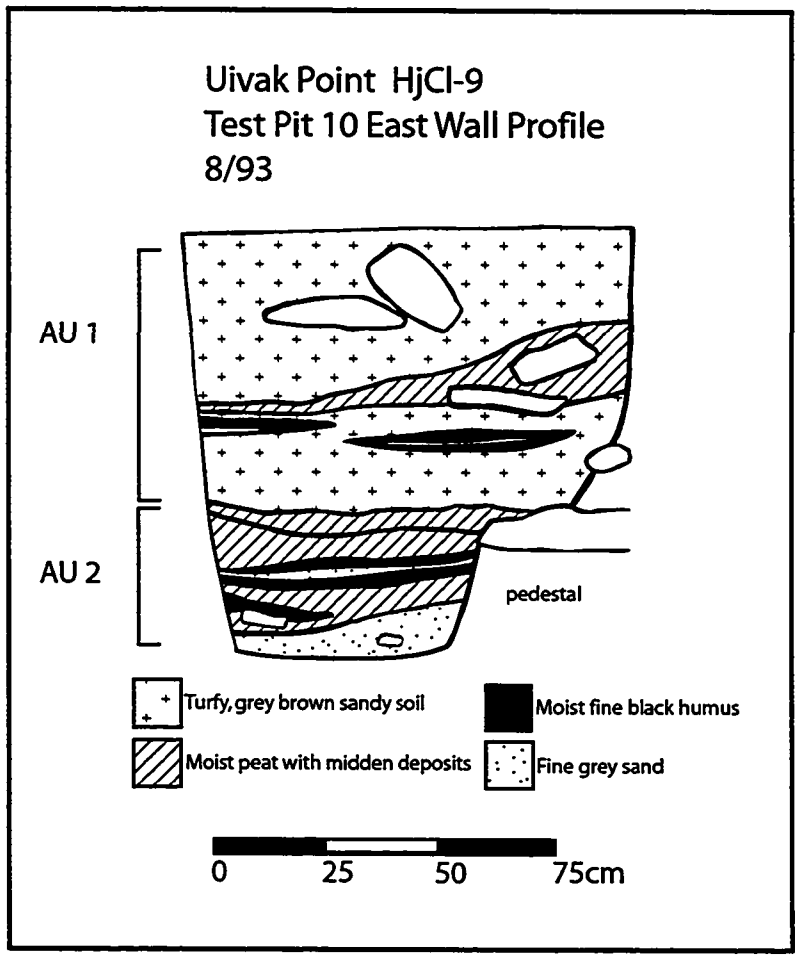
Test Pits 9, 10 and 11

In 1993, three 1m square test units (Tests 9, 10 and 11) were dug in the vicinity of Test 3 in order to obtain a sample of faunal remains from the midden area around Houses 5 and 8, and to determine if the permafrost observed in Test 3 was extensive. The units were placed in an L-shaped arrangement, of which only the central unit was excavated to a significant depth. The uncovering of a very large boulder which nearly filled the floor of Test 9 forced the closure of this unit very near the surface. Similarly, excavation of Test 11, the eastern-most (and highest) unit, also was terminated when a concentration of rocks was uncovered at a depth of 10 to 30cm below surface. This concentration consisted of several tabular paving stones lying flat (rather than following the dip angle of the slope), bordered by larger angular stones. Animal bones were found in association with the rocks, while deposits of fine-grained charcoal were found in cracks between rocks. The structure forms a bowl-shaped feature approximately 75 cm wide and likely represents a buried hearth or cache structure.

Test 10 was free of rock obstructions and was excavated through cultural deposits to a depth of 98 cm below surface. A profile of the unit's north wall is presented in Figure 7.3. The upper 22cm to 41cm of the profile consists of an overlying layer of grey-brown turfy soil containing charcoal, mussel shell and well-preserved animal bone. The bowl-shaped stone feature described above is part of this stratigraphic unit. Underneath this is a layer of lighter grey sandy soil with wood and bone remains, terminating at 42

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.3 Uivak Point 1 Test Pit 10 North Wall Profile



cm below surface. From 42cm to 70 cm below surface are two layers of very dense, wet, dark brown peaty soil with limited frozen areas. Bone and wood remains were recovered from these two levels, especially from the lower one. As well, lenses of black humus associated with grey sand were identified in the profile in the lower level.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Below the turfy soil layers, dense midden deposits were encountered. Black, organic-rich, sandy deposits with bone remains, intermixed with lenses of fine black humus and light grey sand were excavated between 65cm to 98cm below surface. A further layer of dark grey to black organic-rich sediment with charcoal, wood, rock and bone was found at the bottom of the excavation, at depths of 86cm to 98 cm below surface. Both these layers were very wet and had patches of frozen ground within them. Intact bones were recovered from these layers. These bones were spongy, soft and flattened due to their waterlogged condition. Because of the difficulty of working in wet deposits in a deep and narrow "telephone booth" pit, excavations were terminated in this unit at a depth of 98 cm below surface, without encountering a sterile substrate.

Stratigraphic Interpretation of Test Pits 9, 10 and 11

The stratigraphy of Test 10 suggests that the area around Houses 5 and 8 had a relatively complex history of site formation. While much of the unit's profile comprises midden deposits and bone remains were recovered in all levels, the two midden deposits were separated by a thick layer of peaty soil with relatively sparse bone remains located in the middle of the profile. This peaty soil was fairly uniform in texture and resembled peaty soils that comprise the walls of sod houses in other parts of the site. Two significant lenses of humus and sand were noted within this middle stratigraphic unit and these may be indicative of turf blocks cut from thin peat horizons overlying sand. If these bodies are decayed turf blocks once used as building materials, the middle stratigraphic layer may represent colluvium and water-borne detritus from the walls of a previous house structure located uphill from Test 10 or, potentially, house walls

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

themselves. Whether or not the peaty soils directly or indirectly indicate the presence of a nearby house, it seems likely that upper midden deposits are contemporaneous with the most recent occupations of Houses 5 and/or 8 while the lower midden must be derived from an earlier occupation.

A total of 99 artifacts were recovered from test pits 9, 10 and 11. Items representing traditional Inuit material culture include: seven fragments of worked wood; six pieces of worked soapstone; two soapstone vessel fragments; one piece of stitched animal hide; one fragment of ground slate; and 14 flaked stone tools and pieces of debitage. The majority of artifacts were European-made goods, especially iron objects. These goods were recovered from upper and lower portions of the excavation and include: 20 hand wrought nails, spikes and tacks; three unidentified iron fragments; one iron point; two copper rods; one copper sheet; one lead musket ball; six lead shot; three green bottle glass fragments; the base of a clear glass bottle; two plate glass fragments; six trade beads, 10 ceramic sherds; nine kaolin pipe fragments; and one ground slate fragment. One kaolin pipe stem fragment had been refashioned into a tubular bead, with its broken ends smoothed and polished. This apparent bead measured 39.7mm long, 6.6mm wide, and has a bore diameter of 2.1mm.

Five short cylinder-shaped, composite, white trade beads were identified as Kidd Type IVa13 beads. These artifacts measure 4.9mm to 3.1mm in length, 1.6mm to 3.6mm in width with bore diameters ranging between 2.2mm and 0.9mm. The "Cornaline d'Allepo" bead was a Kidd Type IVa6 bead with a pale green translucent core, measuring 7.2mm long, 6.8mm wide and a 1.5mm bore diameter. This type of bead is usually

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

termed "Cornaline d'Allepo" or "Green Heart" bead, and was made in Venice (Brain 1979: 106).

While it includes few clearly diagnostic artifacts, the artifact assemblage obtained from these tests provide a broad chronological framework. Based on the presence of European trade goods, both the upper midden deposit and underlying turf layers can be dated to the contact period. Several hand wrought nails had rose heads and assemblages of such nails are generally associated with 18th century colonial sites (Stone: 1974: 241). Neither cut nor wire nails of plainly later design were identified. A kaolin pipe bowl from a depth of 41 cm had the letters "T" and "D" stamped singly on opposite sides of its flattened heel. This is an English pipe form that has been dated to the latter 18th century to early 19th century (Walker 1971: 65; 1983: 37).

The Cornaline d'Aleppo bead was found at 50cm to 60cm below surface, just above the contact of the lower midden deposit. Such beads are associated with the late 17th to early 19th century (Stone 1974: 108). Similarly, the several Kidd Type IVa13 beads are dated to the later 17th to early 19th century (Brain 1979: 105).

On the basis of these finds, the upper midden deposit and intermediate layer of turfy soil likely date between the late 17th and early 19th century and probably (or at least partly) within the latter half of the 18th century. The lower midden deposit lacks both trade goods and diagnostic traditional material culture items and so its age remains ambiguous.

House 6

Located at the southern end of the house cluster on the 11m asl terrace, House 6 is the largest house ruin at Uivak Point. It is a rectangular structure measuring 17m by

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

10.5m at the highest point of its walls and its floor measures 13m by 8m. A well-defined entrance passage extends about 9m southwest from the structure's west wall. Two alcoves were built into the entrance passage, one on either side of the cold trap and entry to the living chamber. The largest alcove is a substantial area, measuring approximately 3m long and 1.5m deep. A turf platform rings the entire perimeter of the floor and appears to have at least one projecting lobe representing a lamp stand or work area.

A substantial turf partition was built across the southern portion of the house. The partition cuts across the platform and there is no obvious point of access to the side chamber from the main portion of the house (or, for that matter, an independent exit out of the house). Therefore, it seems likely that the partition was an alteration made to reduce the size of the house during a phase of re-occupation, while retaining the existing walls and entrance passage. The second entrance passage alcove is built into the partition and therefore is dated to the later period. The interior dimensions of the renovated house are 9m by 8m.

In 2000, a test pit was placed in the west wall of the house, at the juncture of the house and northern entrance passage, for the purpose of identifying the presence of wood and whalebone used as structural elements of the wall. Numbers of bones were recovered in some of the overlying wall deposits. These bones may have been constituents of fill layers used in wall building, or, more likely, tertiary refuse deposits. Periodic renovations of the house made in preparation for the winter's habitation may have included the removal and rebuilding of the roof and excavation of floor deposits remaining from earlier occupations. In the absence of the roof, the easiest way to dispose of floor cleanings would be to shovel them over the walls. This pattern of periodic removal of floor deposits would account for the accumulation of midden deposits over house walls in places that are not convenient to the entrance. The bone assemblage recovered from excavations within House 6 during the 2000 excavation was not included in this study.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 6 Midden

In 1993, a test pit was placed in a flat area of rich grass growth, 5m south of the termination of the entrance passage. While a few pieces of Ramah quartzite debitage and iron-stained sand were observed in the unit, no trace of wood, bone or charcoal was identified. A more thorough soil core survey in 1996 concentrated on the slope below the northern wall of the entrance passage and found evidence of a large midden there, in the form of black organic-rich sediment with dense charcoal, wood remains, mussel shell and bone fragments.

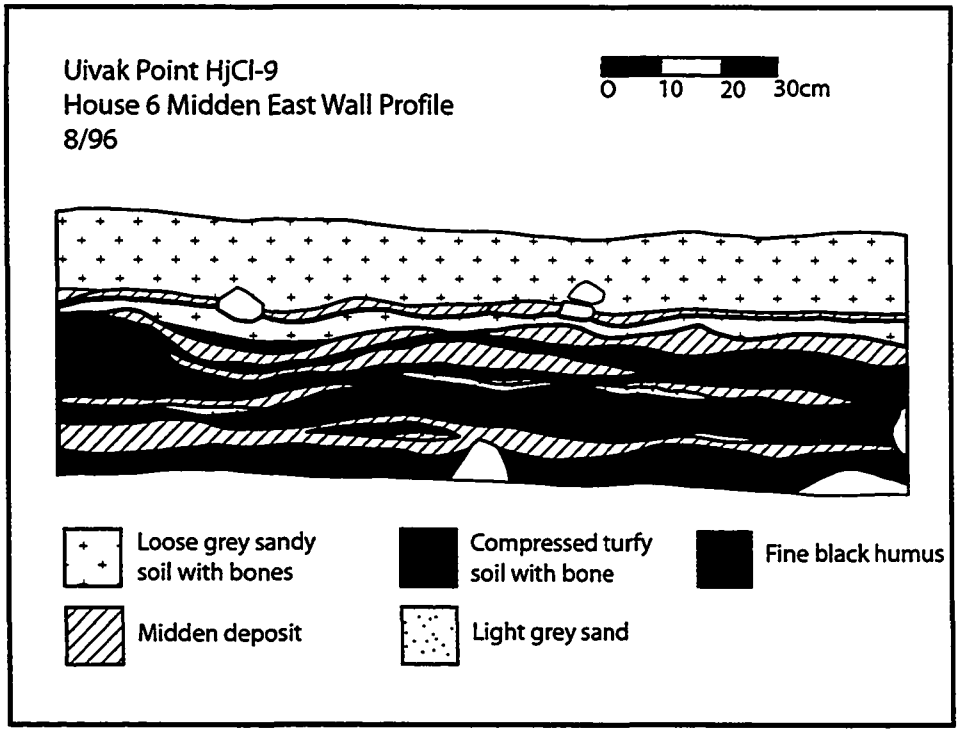
A 1.5m by 1.5m unit was excavated on a slope west of the entrance passage walls (see Fig 7.2). The unit was dug completely with trowels in 5cm arbitrary levels that followed the stratigraphic bedding angles. All excavated sediments were screened through 4mm mesh for recovery of bones and small finds.

The unit was excavated to sandy substrate at depth of up to 45 cm below surface. A drawing of the unit's east profile is presented in Figure 7.4. The upper 10cm to 15cm of the east profile was composed of dense medium grey sandy soil, the currently active soil horizon. A thin, continuous midden layer was located beneath this level, which included fragments of bone, wood, burnt fat and vegetative matter. This layer was followed by a loose, grey, sandy midden deposit with bone fragments, which terminated between 17cm to 21cm below surface. From 17cm to 38 cm below surface were three major levels of dense, dark grey-brown turfy soil containing bone remains and lenses of fine black humus alternating with five lenses of dense midden deposit consisting of burnt fat, wood, charcoal, plant remains and bone. Two of these midden lenses included concentrations of mussel shell along with bone and relatively little sediment. Much of the shell is preserved in excellent condition, with chitinous periostracum still attached to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

intact shells. As well, many shells were stacked together in dense, flat-lying masses, suggesting that the midden has seen little disturbance since deposition.

Figure 7.4 East Wall Profile of House 6 Midden Excavation



Animal bones were very well preserved in the middle and upper midden layers. The quality of preservation is due to the neutral pH of the midden deposits (pH=7.0). This pH is remarkable because soil pH is mildly acid in most other locations at the site. Bones were exceptionally well preserved within the lenses that contained dense mussel shell, which also contained numerous well-preserved bones of small mammals, fish and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

birds. The calcium carbonate content of the shell buffers humic acid as well as other acids associated with organic refuse present in the soil, and so may be the root cause of the neutral soil pH and excellent bone preservation conditions.

The lowest midden deposit, from 33cm to 42 cm below surface, contained bone, charcoal and chunks of burnt wood, burnt fat and a layer matted grasses at its lower contact. The deepest midden layer was much wetter than those above; accordingly, the bones contained within this deposit were not quite so well preserved.

A thick layer of fine, black, highly organic-rich, humus containing a few chipped stone flakes underlaid the midden deposit, from 35cm to 45 cm below surface. This layer was mildly acid and was likely the active soil horizon at the time of original midden accumulation. The deepest strata observed in the profile was a layer of clean, well-sorted light grey sand with stained or weathered tan and reddish patches. Isolated flakes of chipped stone debitage were recovered from the upper surface of this sand. Flat-lying cobbles were found on the surface of the sand, along with the top of a buried boulder or bedrock outcrop.

Stratigraphic Interpretation of House 6 Midden

In general, the stratigraphy of the unit's profile suggests that the midden accumulated in spurts during a series of discrete episodes. These are represented by pairs of strata, an underlying dense midden deposit with lots of bone and other debris and relatively little sediment, and an overlying deposit comprising lots of compacted turfy sediment or loose sandy sediment and reduced densities of bone. There are five such pairs demonstrated in the profile, and these may represent up to five cycles of rapid midden deposition followed by slower midden accumulation and perhaps local soil development. Whether or not these cycles are linked to annual reoccupations and renovations of the house is unclear.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The dense midden accumulations are all lenses and most are relatively thin; some might, therefore, represent limited dumping events within a single season of occupation. The turfy and sandy layers separating dense midden lenses could represent periods of soil development. It seems more likely, however, that the turfy layers are at least partially derived from larger-scale accumulations of sediment and debris during house rebuilding and floor cleaning episodes preceding house occupations, and from on-going contributions of household refuse and human fecal waste through the winter.

There may have been at least two periods without active midden accumulation, as demonstrated by layers or lenses of fine black humus with well-sorted fine sandy parent material. The first is the soil horizon underlying the midden, the second is a large lens overlying compacted turfy sediment at about 30cm depth below surface. Both of these bodies of humus are quite uniform in texture, have relatively low mineral sediment contents and lacked obvious traces of disturbance. Unless it is transported by human activity as fill or as part of a turf block used in house building, humus takes time to develop through *in situ* soil formation processes or through the gradual accumulation of fine particles of soil organic matter by waterborne transport down the slope. The middle humus lens may therefore represent a hiatus in midden accumulation, and presumably in the occupation of House 6 or a preceding structure. For the purpose of analyses of material culture and faunal remains, stratigraphic layers of the House 6 midden were grouped into two analytical units; 1 comprises all levels from surface to 25cm below surface, while 2 comprises the remainder of the unit, from 25cm to 45cm below surface.

Artifacts Recovered from the House 6 Midden

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A total of 108 artifacts were recovered during the excavation, with most having come from between 10cm and 25 cm below surface. Only prehistoric lithic artifacts, debitage, and fragments of worked bone and baleen were found below 35cm below surface. Items of traditional Inuit material culture were important parts of the assemblage. These included 10 fragments of worked soapstone or soapstone vessel fragments; 22 pieces of worked bone, ivory and antler representing craft-working debris, sled runners, paddle tips and edges, a knife handle and a pendant; and several pieces of worked wood.

Numerous items of European origin were also recovered. Of these, iron objects were most common. A total of 42 iron objects comprised numerous spikes and nails, re-worked nails, wire, rods, and fragments of iron sheet. As well, one fragment of lead sheet, one piece of lead casting waste and one ornamental lead drop, of a type discussed by Karklins (1992: Fig. 119), were recovered. Also identified were six creamware sherds, one rimsherd from a utilitarian salt-glazed stoneware cup and a single, flat, green-tinted glass fragment.

Four glass trade beads were covered in the midden. One polychrome composite bead is a doughnut-shaped specimen measuring 4.1mm long by 7.3mm in width, with a bore diameter of 2.6mm. The bead has a pale green, translucent glass core covered by a layer of brick red glass and a thin outermost layer of clear glass. Following the bead typology developed by Kidd and Kidd (1970), the bead is classified as Kidd Type IVa6. This type of bead is commonly termed a Cornaline d'Allepo bead. Nevertheless, Francis (2002) considers that this term properly refers to a similar trade bead with an opaque white glass core and prefers the term "Green Heart" as a distinctive name for the green-

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

cored form. This type of bead was manufactured in Venice and Brain (1979: 106) dates it from 1600 to 1836, with a mean date of 1727.

A single small opaque white seed bead of Kidd Type IIa14 was found. The bead measures 1.6mm long, 2.3mm wide and has a bore diameter of 0.9mm. A fragment of a turquoise globular bead measured approximately 6.8mm long, 7.1mm wide and had a bore diameter of 1.5mm. This bead was classified as Kidd Type IIa31, which has been dated widely between 1600 and 1836, with a mean date of 1737 (Brain 1979: 103). A final bead was a large, translucent pale apple green specimen that could not be identified to type. The bead is highly patinated and is crudely wound bead with an irregular ellipsoid shape. It measures 21.4mm long, 12.2mm wide and has a bore diameter of 2.2mm. Finally, a small fragment from a mottled grey gunflint was also collected.

House 6 Midden Chronology

None of the artifacts recovered in the midden were highly indicative of a precise time period. Prehistoric lithic debris was found throughout the midden. These lithics are probably of Paleoeskimo or Maritime Archaic provenience, but were likely incorporated within turves used as building materials and therefore removed form their original context. While traditional Neo-Eskimo material culture items were recovered, none of these items were diagnostic of any particular time period.

The presence of trade goods throughout the midden shows that all of its deposits were accumulated during the contact period. The nails and spikes recovered were rose-headed handwrought specimens, suggesting an 18th century date (Hume 1984: 252-253; Stone 1974: 229). Creamware ceramics were developed in the mid-18th century and were extremely commonplace in the late 18th to early 19th century (Godden 1966: xv-xvi; Hume 1991: 121, 124-125). Stonewares were made as early at the 16th century and plain

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

white salt-glazed types were popular in England from about 1730 to 1777, when they were replaced by creamware (Godden 1966: xiv-xv; Hume 1991: 115, 277-278). Cornaline d'Aleppo seed beads are commonly linked, in North American sites, with the late 17th to early 19th century, up to about 1820. None of these items provide precise dates but the overlap of their time spans suggests a later 18th century to early 19th century date for the entire House 6 midden. This time span is consistent with the Moravian Missionaries' accounts of the occupation of Uivak Point (Taylor 1974: 17; Taylor and Taylor 1977).

House 7

House 7 is located on the 8m asl terrace, directly west and downslope from Houses 2, 4, 5 and 8. It is a very regular, rectangular structure with its long axis aligned roughly north to south. House 7 is one of the largest houses at the site, measuring 14m by 10m at the crest of its walls and 11m by 8m across its interior. A short entrance passage extends southwest from the midpoint of the west wall. The entrance passage may have been as little as 3m long or has been obscured, as little trace of turf walls was found on the steep terrace slope below the house. A depression in the floor indicates the presence of a cold trap just within the entrance area. Turf banks suggest the presence of sleeping platforms running along the length of the eastern wall of the house, along the south wall and perhaps along parts of the north and southwest walls.

Unlike several of the houses immediately to the east, the floor of House 7 was relatively well drained and had few rocks protruding through the turf. Several large pieces of partially exposed whalebone were visible in the floor of the house and in the west wall. Soil core tests showed that floor deposits were quite deep in portions of the house, ending on top of a layer of rocks at depths of as much as 30-40cm below surface. Additional soil core tests below the western walls of the house showed the presence of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

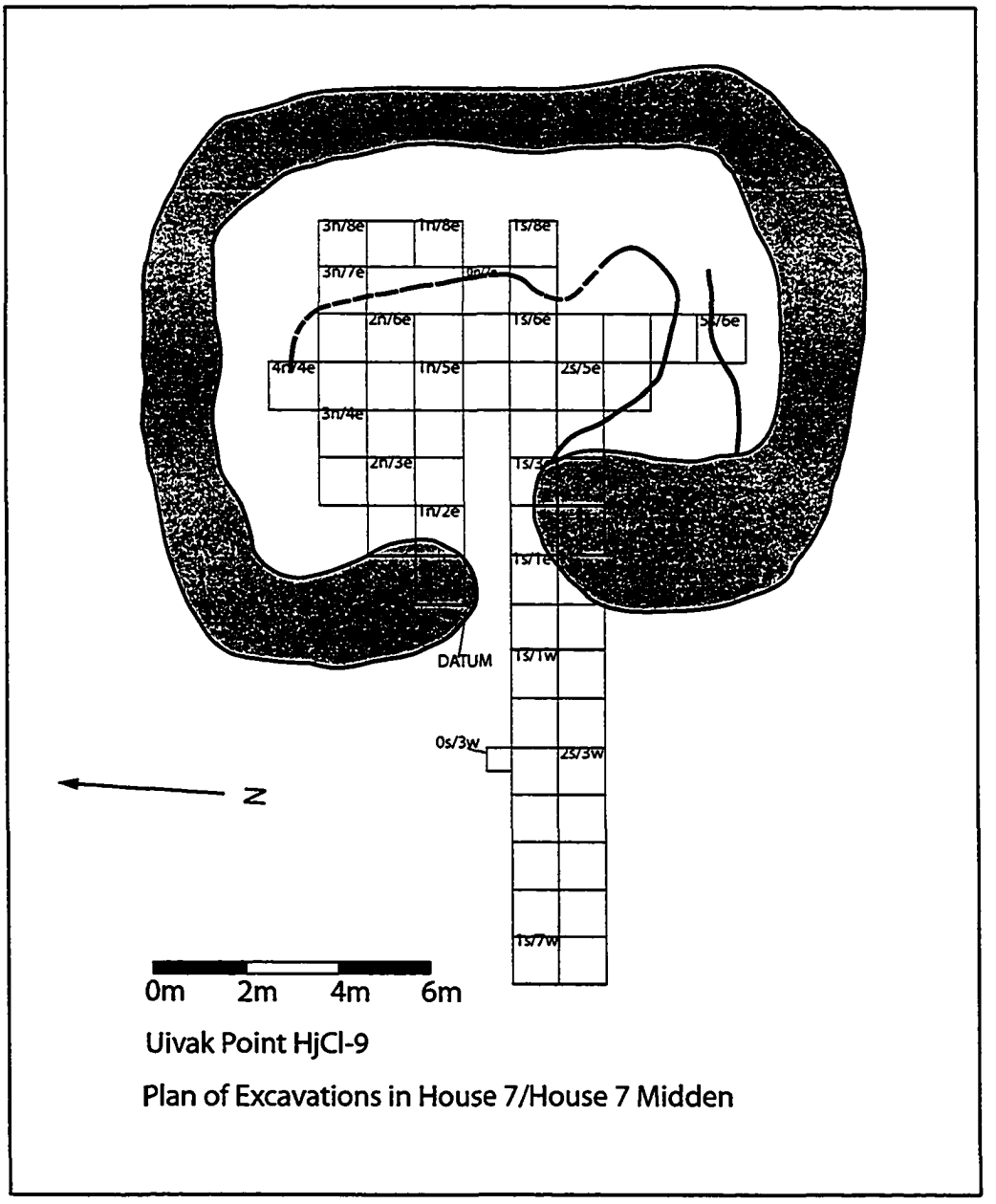
midden deposits. Exposed pieces of large whalebones were visible on this slope, downslope of the northern portion of House 7's west wall. As noted earlier, extensive areas of the house were excavated between 1993 and 2000, including areas of the walls, entrance passage and cold trap, and platforms along the inner walls.

Excavations within House 7

House 7 was excavated on a large scale, with 40.5m^2 of area excavated in all areas of the house. These excavations were intended to define architectural features of the house, which are described in detail below and illustrated in Figure 7.5. Excavation units were defined by a one metre grid system with axes oriented approximately to magnetic north. The spatial coordinates of these units within the grid were used as identifying labels; the datum for the grid was a point outside the western house wall, north of the entrance passage. For example, the northeast corner of the unit named 1N/5E lies one metre north and five metres east of the grid datum. After the removal of the turf layer, all units were excavated by trowel in 5cm or 10cm arbitrary levels. All sediments were sieved through a 4mm mesh for recovery of small bones and artifacts that were not collected *in situ*. All units were backfilled after each field season to prevent damage to the house or degradation to buried artifacts and ecofacts through erosion, animal burrowing, dessication or thawing.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.5 Uivak Point 1 House 7 and House 7 Midden Excavation Plan



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Walls

The walls of turf structures are readily remodeled and obscured by slumping and soil mixing processes. Accordingly, areas in the north, south and west margins of House 7 were excavated in order to determine if the currently visible turf walls are those of the original structure. The eastern wall of the house is clearly delineated, having been cut into the terrace slope, and so was not tested. The northernmost unit in the house (4N/5E) intersected a low turf bank, but excavations there found only slumped sediment from the turf walls overlying a platform and failed to identify the wall structure. The crest of the present turf wall is 1m to 2m north of this unit and it likely marks the core of the house wall.

A 50cm tall bank of turf running east to west through unit 5S/6E was a possible indication of the inner edge of the southern house wall. Nevertheless, the bank proved to be a slump structure derived from the large-scale movement of the turf wall into the house, rather than the wall itself (the core of the wall appears to lie 1.5m further south). Mixing and movement of soil within the bank was clearly demonstrated by the excavation of flat rocks lying on edge and by the presence of a lobe-like stratigraphic structure in the upper levels of the west and east profiles of 5S/6E. This lobe shows plastic deformation of the wall deposit and its flow into the interior of the house, rolling over and engulfing the active soil horizon overlying the floor along with its vegetative mat. The highest portion of the south wall lies about 1.5m south of unit 5S/6E.

Substantial and broad turf banks that dominate the slope west of the house constitute the west wall of House 7. These walls are very eroded, however, and are low in comparison to the north and south walls. At most, they stand only about half a metre

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

above the level of the house floor before its excavation and slope gradually into the house interior.

Details of the wall's construction were revealed in a cross-section through the majority of the west wall, obtained by excavating three units (2S/2E, 2S/3E, 2S/4E), about 1m south of the entrance. A foundation of piled rocks was found at a depth of about 60cm below surface in unit 2S/3E. The rock pile was part of a fill deposit that overlaid sand. Amongst these rocks were two substantial timbers and a large whale vertebra lying flat on its centrum. Long timbers up to 35cm thick (likely from local krummholz spruce) were laying over these rocks in the south end of the unit and extended west into unit 2S/2E. A jumbled cluster of large whalebones lying on their sides, commingled with rocks and wood, was found over the rocks in the north of the unit. These additional whale bones included a scapula, a segment of a maxilla, a section of a mandible, a radius and a rib. All these bones were from very large whales and measured between 80cm and 115cm in length.

The timbers and whalebones appear to have been upright posts bracing the interior side of the west house wall and the south wall of the entrance passage. The radius was found lying immediately adjacent to a conspicuous hole dug into the sandy substrate. This hole is large enough to accommodate the broad end of the radius and it closely resembles a posthole. As they were recovered lying more or less flat, these posts likely fell north and west as the turf walls slumped west and downhill, east into the house interior and north into the entrance passage. The whale rib may have been a rafter supporting the roof of the entrance passage, adjacent to the interior house entrance. The mandible section was located in the area of the lintel between the house and entrance

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

passage; it has a deeply notched end which would have made it an ideal post supporting a beam or lintel over the entrance passage.

An additional cluster of rock and large timbers was found at a depth of 35cm to 60cm in unit 2S/2E. The timbers in this structure were 15cm to 25cm thick and were lying flat, parallel to the general north-south orientation of the walls. A thick lens of reddish-tan sand was associated with, and covered much of the rock and timber, creating a mound. The feature may represent a footing that reinforced the outside edge of the turf wall, or rubble from an older house, over which the turf wall was built. Between this possible footing and the whale bone and timber posts in unit 2S/3E is a space of about 1m, which was filled with highly-mixed dark grey-brown silty loam with small lenses of grey, white and yellow-tan sand with small bone fragments, rock and wood detritus. The small sand lenses may represent sand incorporated into the root masses of turf, and so define individual turves within the wall. The same poorly sorted yellow-brown sand underlies the entire wall construction in both 2S/2E and 2S/3E.

A similar section was excavated through the house walls 1m north of the entrance passage. A group of five units (1N/1E, 1N/2E, 1N/3E, 2N/2E, 2N/3E) provided a section from the paved floor through the bulk of the wall in this area. This portion of the wall was constructed of alternating layers of turf, earth and sand visible in the upper profiles of units 1N/1E, 1N/2E and 2N/2E, and which were present in 1N/3E. At its highest point in unit 1N/1E, the preserved portion of the wall comprises approximately 60cm of these layers, with individual turf blocks preserved and clearly defined in unit profiles. Some animal bones were present within these layers, but without clear evidence for multiple

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

building phases within this turf wall, it is likely that the bulk of these materials were incorporated into the wall within turf blocks.

Unlike the wall south of the entrance passage, no whale bone posts were observed in this area. A single whale vertebra was found, however, at the intersection of units 1N/2E, 1N/3E, 2N/2E, and 2N/3E. Like the comparable vertebrae found in 2S/3E, this vertebra was sitting flat on its centrum amidst a cluster of stones and had been carefully leveled with stone wedges. The layered turf and sand deposits indicative of the wall extend around the western and southern sides of the vertebra, while floor or a low platform was found north and east of it. This suggests that the vertebra was placed within an interior corner of the wall adjacent to the entrance lintel, and may have been used to brace the wall.

Many substantial pieces of wood exceeding 10cm in diameter were excavated in these units, especially in 1N/2E and 1N/3E. These timbers were uncovered lying flat and most were oriented in general east-west and north-south directions, parallel to the general trend of the house wall or that of the entrance passage. The ends of several timbers abutted the whale vertebra described above; these were found lying in east/west and north/south directions and may have been part of the structure of the house and entrance passage wall. As well, a number of timbers were found in the lowest portions of the turf wall, and these also appear to have been part of the wall. Finally, a group of well-preserved timbers extended from the south wall of 1N/2E into the entrance passage; these may have been posts or cribbing used to reinforce the inner entrance passage wall.

Excavations within the wall also provided evidence for an earlier occupation beneath the existing house floor. The north and west profiles of unit 2N/2E showed that

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the most recent floor and wall, as represented by the stacked turf and sand layers, were constructed over a stratigraphic unconformity. The construction of the house had truncated an older stratified midden. The lower contact of this midden dipped very sharply to the west, suggesting that it was deposited on an older terrace slope or overtop of an older wall. The presence of the unconformity suggests that prior to the construction of the excavated house structure, the top of the terrace in this area had been leveled and the edge of the terrace may have been extended with these reworked sediments.

Underneath the midden deposit were two layers of compressed turfy soils overlying a terminal layer of sterile, densely-packed reddish sand, visible in the western profile of unit 2N/2E. These turf layers may indicate the presence of earlier turf walls under the house. Further excavation beneath the existing house floor is necessary to verify this hypothesis but, if it is correct, the midden deposit observed in 2N/2E would represent one deposited over top and outside an existing house wall rather than one that was deposited directly on the terrace slope, away from the house.

Entrance Passage

A trench was excavated through the lintel, cold trap and entrance passage that extends southwest from the western wall of House 7. This trench runs parallel to that of the House 7 midden excavation and links the house and midden with a continuous, 16m long profile that includes the northern entrance passage wall. Five units were located within the entrance passage itself.

The entrance passage was paved with large, flat flagstones and inclined to the east in a series of small steps. Two large and heavily built steps linked the cold trap to the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

lintel and house floor in units 1S/3E and 1S/4E. The passage and cold trap areas were covered by as much as 70cm of floor deposit and fill from slumping walls. The interior of the passage's northern wall passed through the trench in units 1S/0W to 1S/2/E; the wall was composed of earth and turf reinforced by timbers running parallel to the passage wall, by large rocks and a whalebone vertebra. Three substantial timbers were found lying north to south in 1S/2E, just above and across the width of the paved passage floor. These timbers might be part of a sill reinforcing the entrance passage, or roof timbers that collapsed onto the floor. A large cut whale rib was recovered in the vicinity of the lintel (in unit 2S/4E) and may be a rafter for the entrance passage roof. The outer edge of the entrance passage wall was visible in the form of stacked turf blocks and a group of well-preserved, flat-lying large timbers in the western profile of unit 1N/2E.

While many Thule and Inuit sod houses elsewhere in the Arctic have long, stone-lined walls and entrance passages (Gulløv 1997; McGhee 1985; Park 1988), the entrance passage for House 7 was relatively short and lacked substantially built stone walls. In fact, it was difficult to discern traces of built-up passage walls by inspection of the ground surface alone, though a shallow trough leading diagonally, south-west form the house entrance suggested the trend of the passage. Stones suitable for building materials are easily found in the area, so the availability of wood as a building material may be one reason for the lack of a substantial wall. Another reason for the lack of an obvious wall is probably the placement of House 7 and its entrance passage at the edge of the terrace slope, which may have been too steep for substantial stone constructions. The entrance passage was partially dug into, rather than built upon, the terrace slope, forming a shallow and short stone-paved trench running obliquely across the direction of the slope

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

rather than parallel to it. Sediment and debris moving downhill from the collapsing walls of House 7 after its abandonment readily covered much of this low structure.

Floor and Roof

The majority of the floor was excavated, especially in its northern and eastern portions. The floor sloped gently toward the west and was carefully (and almost completely) paved with flat flagstones throughout most of the excavated house interior. Floor deposits ranged from approximately 15cm to 40cm thickness. In general, this deposit consisted of two major layers throughout the excavated area. The upper floor layer, which is the currently active soil horizon, consisted of disturbed dark grey-brown sandy soil with dense root pack, rocks and some charcoal and poorly preserved wood and bone. The layer represents *in situ* soil development and sediment produced by the decay of turf walls, as well any materials that might result from the collapse of the roof after the last occupation of the house.

Several authors disagree about whether Thule and Historic Inuit sod houses were constructed with thick turf roofs, double-lined tent roofs filled with vegetative insulation, or single-layer skin "tent" roofs (see Park 1988; Gulløv 1997: 92-94; see also illustrations and descriptions in Crantz 1820 i: 129; Hawkes 1916: 60-62; Hutton 1912: 307-308; Leiber 1861 in Loring 1998; Packard 1891: 206-207; Rink 1974: 177). It is, as yet, difficult to determine the nature of the roof House 7 with certainty. While there were thick sediment deposits overlying platforms and the margins of floor areas adjacent to the walls, the deposits covering the center of the paved floor were much thinner, as little as 15cm deep. This suggests that the majority of sediment that currently overlies the floor came from the walls, while the roof itself contributed relatively little sediment to the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

floor. As well, the excavated floor deposit lacked obvious remnants of turf blocks. Accordingly, it is possible that the structure was roofed with skin supported by wood and whalebone. Further work is required before the characteristics of the house roof will be known.

The lower floor layer was a compacted, dark red-brown to dark grey-brown sandy deposit that was very rich in organic matter and had occasional isolated, small, thin lenses of white or tan coloured,clean sand. The lower layer represents sediment and other material that accumulated directly on the floor and potentially some material from the roof. It included cobble and boulder-sized rocks, charcoal, many bone fragments, small chunks of wood, large timbers and small concentrations of branches and twigs of crowberry, spruce and birch, and artifacts. Beneath the pavement, or in areas without pavements, relatively loose tan sand and highly compacted red-brown sand deposits were visible. The compacted red-brown sand is sterile and is considered to be sand substrate comprising the beach ridge underlying the house; its discolouration is due to staining by iron oxides and wet, reducing conditions. In other locations around the beach terrace, both around and outside the house cluster, reddish-brown sands constitute weathered parent materials for peaty cryosolic or podzolic soils.

Bulk sediment samples were collected systematically from specific units on the floor and as spot samples from noteworthy contexts. Archaeobotanical analyses of these samples indicate that crowberry leaves and spruce needles were present in floor deposits generally (Zutter n.d.), and that boughs of spruce, birch and crowberry may have been used as a material to cover the floor.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Only one layer of pavement was uncovered despite limited shallow probing beneath the pavement. While this pavement represents a single continuous floor construction, there is evidence suggestive of multiple living floors and multiple occupations above it. Within the basal floor layer in unit 1N/5E, two floor deposits were visible. The lower deposit overlaid the paved floor and was separated from the upper thin layer by a thin lens of tan coloured sand. The upper layer was, in turn, overlaid by a group of large, flat-lying rocks and the active soil horizon. This stratigraphy suggests a period of disuse or a phase of partial renovation at some point during the occupation of House 7, as sediment was introduced to the interior of the house (naturally or as fill) and a new living floor was established on top of it.

A considerable amount of wood was recovered from the floor, including several large timbers that may have been parts of the roof (rafters, ridge poles or supporting posts). As well, at least three clusters of stones were found lying on the paved floor. These formed a loose row running along the long axis of the house, in its approximate center, and may have been supports or footings for posts.

Platforms

Areas along the inner edges of all of the house walls were excavated and evidence for various forms of platforms was found along each wall. The most substantial platform runs along the length of the rear, or eastern, wall. Smaller platforms are located along the north and south walls, while traces of low platforms were found along the western wall south of the entrance passage and perhaps north of it as well.

The large platform along the east wall is approximately 10 m to 12m long and between 1m and 2m wide. It is composed of a bank of sand and soil piled against the rear

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

wall, reinforced by a rock and whalebone retaining wall 20cm to 25cm tall, and a substantial timber placed at the platform edge. The platform's surface was composed of several layers of turf and twigs with small and thin intervening lenses of pale brown and grey sands. In 1S/8E and 3N/8E, these layers amounted to a deposit up to 35cm thick, suggesting that the platform had an extended period of use and saw many phases of resurfacing and leveling through periodic (and presumably seasonal) additions of new beds of turf and brush. A semicircular stone structure abuts the platform in 1S/7E and 2S/7E and is likely a lobe-shaped extension of the platform.

The northernmost end of the platform was covered with two flat boards; these were milled and had squarely-sawn ends. The larger of these measured 117cm long by 38cm to 48cm wide. The second board was 1m long by 15cm wide and was found lying flush alongside the larger board. Several flat-lying rocks were found on the sleeping platform, especially along its eastern edge, but there was no solid rock pavement over the platform as has been described in many Palaeoeskimo and Neo-Eskimo sod houses elsewhere in the Canadian Arctic and Greenland (see, for example, McGhee 1985; Gulløv 1997).

At the northern end of the platform (3N/8E), adjacent to the portion covered in boards, a fat-encrusted, flat-lying stone with a sizeable deposit of burnt fat was found surrounded by soil indurated with fat indicating the presence of a lampstand. Two other similar, flat-lying, stones within the turf layers of the sleeping platform further south in units 1N/8E and 2N/8E may also indicate lamp stands. Greasy, sooty, black soils were also found in these units.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Artifacts and conspicuous amounts of plant remains were recovered by these deposits, along with numbers of animal bones and chunks of burnt animal fat. The large quantity of waste materials, such as animal bones, within living spaces has been frequently noted in Thule and Inuit sod houses by archaeologists and by eyewitnesses (see, for example, Fritz Leiber's rather dramatic description of the superfluity of refuse in a 19th century Labrador Inuit sod house (cited in Loring 1998); see also George Lyon's descriptions of Inuit sod houses at Igloolik (cited in Park 1988: 169); see also Hawkes 1916: 60-61; Hutton 1912: 307-308). It seems that House 7 at Uivak Point was no exception to this pattern.

Excavations in the northern end of the house identified a platform structure. This was a relatively low semicircular arrangement of stones approximately 2m across, placed roughly along the central axis of the floor. As yet it is unclear whether this feature is a semicircular platform or an extension of a platform that lies a little further north. Sand and mixed soil were used as fill within the stone semicircle and are visible as lenses in the northern profiles of units 3N/3E, 3N/4E and 3N/5E.

Another platform was observed in excavations in unit 5S/6E in the southern end of the house. This platform was a low earthen construction overlying sand and flat-lying wood and rock. A compacted deposit of between 20cm and 34cm thickness, consisting of at least three layers of dense, moist, dark-brown, turfy, organic-rich soil with small bone and whale bone, charcoal, burnt fat, artifacts and wood covered the underlying sand. Several timbers larger than 5cm in diameter overlaid the upper surface of this deposit. Most of these were found lying in general east to west orientations and may be parts of the collapsed roof structure. As well, dense concentrations of flat-lying twigs and foliage

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

from both coniferous and deciduous woody plants were found in association with pockets of black humified soil, within the platform deposit.

A substantial amount of refuse was incorporated into the platform deposit. Notably, this included ceramic and glass fragments, cloth and worked hide fragments, a fox skull and a coprolite. The skull was intact and had a spruce bough lying directly over it, suggesting that it had been well buried in platform deposits before it could be crushed. Because of the presence of this refuse on the platform, the annual addition of turf and brush seems to have been a more important part of the preparation of household living spaces for occupation than periodic large-scale cleaning. Bulk sediment samples were taken systematically from the platform deposits in this unit (as well as the coprolite) in order to identify their ecofact content. These analyses are discussed in Chapter 9.

The platform seems to have been rebuilt and extended at some point. The first platform construction likely extended to a cluster of stones in the northern end of unit 4S/6E; the floor of this unit consisted of sand, while the stone floor pavement extends as far south as the southern edge of 3S/5E and 3S/6E. The platform's edge was extended north at a later date, terminating at a conspicuous line of stacked stones laid over floor deposit over 5cm above the pavement, east to west in the middle of unit 3S/6E. The space between the two platform edges was filled with sand and black-brown sandy soil containing both bones and artifacts.

Two possible platforms built of earth and sand run along the western house wall on either side of the entrance. Excavations adjacent to the wall in unit 2S/4E, immediately south of the entrance, showed that stone floor pavement ended in the eastern half of this unit. West of the pavement was a linear stone feature bordering a mound of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

yellowish sand and rock that extended up to the wall. Further excavations are required to determine the total extent of this possible feature and it lacked the compacted layers of turf, bone and twigs that characterized platform surfaces elsewhere in the house. Nevertheless, the surface of part of this platform was covered with flat rocks, forming a built surface between the floor and wall.

Excavations north of the entrance showed a similar gap of about 1m to 1.5m between the edge of the paved floor and the wall in the vicinity of units 1N/3E and 2N/3E. This space was filled with an organic-rich dark-brown turfy soil bearing artifacts and bone remains that is typical of much of the house interior, and a lens of loose grey-tan sand in the eastern portions of units 1N/3E and 2N/3E. A large whale vertebra with chop and cut marks on its superior epiphysis was found at the northwest corner of 1N/3E, extending into the neighbouring units. This vertebra was placed in a deposit of fill and braced with rock placed under and along side it. The vertebra, fill and sand appear to be located at the edge of the wall, in a corner formed by the junction of the western wall and entrance passage wall. As such, the area would represent a low platform with the vertebra being a working surface or a brace for the corner of the wall.

Description of the House 7 Artifact Assemblage

A sizeable assemblage of artifacts, numbering 2653 items (excluding fragments of unretouched lithic debitage) was recovered from House 7. Summaries of the frequencies of artifact types in this assemblage are presented in Appendix 1. The frequencies illustrated in the table are based on preliminary analysis of all the artifacts recovered from the house between the 1993 and 2000 field seasons. A thorough examination of this assemblage is beyond the scope of this dissertation and awaits presentation in a future

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

publication. The following discussion therefor is focussed particular types of artifacts that are useful for dating and for illustrating aspects of trade and economic and social life. An overview of the assemblage is presented first, followed by a more detailed report of the trade goods useful for dating the archaeological assemblage.

Artifacts pertaining to nearly the complete range of the Inuit economy were recovered and identified, including such activities as land and marine hunting, fishing, transportation, house building, manufacturing, food preparation and consumption, and sewing. Many of these were items of traditional Inuit design constructed from locally available materials. Many others, however, were European goods or items reworked into more traditional forms of material culture. Fully 1860 items, (or approximately 67% of the artifact assemblage recovered from House 7) is composed of non-local goods, excluding those items that had been fashioned into more traditional implements and things like iron or copper pegs and rivets, used to manufacture or repair other items. While the proportion and diversity of European goods in this assemblage does not approach that of the Eskimo Island sites, for example, it does demonstrate considerable use of imported material culture, even within traditional task toolkits.

Items used in hunting activities included numerous elements of complex harpoons and associated hunting paraphernalia. Two incomplete harpoon heads were recovered in the house. One was small fragment of undetermined type with a line hole, while the other was a thin, closed-socketed Thule Type 4 head with a line hole parallel to the endblade slot and a single dorsal spur. The other harpoon parts recovered included six hammered iron endblades, one moveable antler foreshaft, a fragment of an ivory foreshaft socket, a harpoon ferrule/ice pick and two finger rests. A drag handle, four seal bladder

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

nozzles, a wooden float mending plug and one wound plug account for the remaining seal hunting equipment that was recovered. Seal bladder nozzles are used to inflate seal skin floats needed in kayak hunting, while float plugs and moveable harpoon shafts are also part of the equipment of kayak-based open water seal hunting. Drag handles are used to haul or tow carcasses once they are retrieved; wound plugs, drag handles and ice picks are important parts of the tool kits associated with hunting and traveling on sea ice.

A single artifact, a possible bone wrist guard, was linked with the use of bows for terrestrial hunting. Firearms were multipurpose hunting implements, useful for hunting birds, terrestrial mammals and sea mammals. Evidence for the use of firearms came indirectly from ammunition, including a number of gun flints and lead shot, rather than part of firearms themselves. The gunflints are of both gunspall and platform types, and of grey to milky white, black and honey coloured types of flint; the majority are milky-white to grey, wedge-shaped gunspalls. The small lead shot measured approximately 4.4mm in diameter.

Fishing equipment recovered included a traditional bone fishhook incorporating iron parts and a number of barbed iron fish hooks with flattened heads lacking line holes. Along with the hooks, one large piece of lead had a hollow core and might have been a jig or line weight. Seven pieces of cork were also found, and may have been originally parts of floats used in European fishing apparatus.

A modest number of items related to Inuit transportation technology were identified in the House 7 assemblage. Three fragments of kayak paddle edges were found. These items are thin bone strips with small, drilled holes for pegs or rivets, and they are fitted to the edges of wood paddles in order to protect the paddle edges from

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

being damaged by sea ice. Items used in the construction of *komatiks* (dog sleds) and harnesses for the dogs used to pull the sleds were also present in the house. Nine pieces of sled shoes, strips of highly polished whalebone with highly polished surfaces and drilled holes, were identified. Three trace buckles and three toggles, used to join rawhide lines in dog harnesses, were found.

A variety of articles in the house related to the processing and consumption of food and to manufacturing of material culture were also identified. These included men's knives with bone or wood handles and straight iron blades; parts of *ulus,* women's knives with crescentic or semi-lunar blades, for preparing hides and sewing; soapstone lamps and wick trimmers for heat, light and cooking; soapstone vessels also for cooking; both traditional and imported vessels for serving food; and a wide range of traditional and imported tools and oddments used to make other artifacts and to build houses. Some knife handles were made from a single piece of bone and had recessed lashing holes and a socket to accept the blade tang. Other handles had two scales of bone that were fastened with iron rivets.

Three general patterns of knife handles were found: a straight, rectangular handle with a broad, round or oval pommel, an "hour-glass" shaped handle with broad pommel and socket end, and a simpler, straight to slightly concave handle. Many had drilled suspension holes in their pommels. These types were similar to knife handles Bird (1945: Fig. 19, 25) collected from sites at Avertok (the pre-contact Inuit settlement at Hopeadale) and described by Schledermann (1972: Plate 13) at the Ikkusik site in Saglek Bay.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

European goods permeate this list of household implements, especially in the form of complete knives and iron knife blades; copper alloy thimbles, ceramic crockery and glass vessels (including the base of two glass goblets); iron tools, parts and bulk raw materials. Forged nails and spikes were particularly common in the assemblage; some of these were recovered embedded in wood, while others showed evidence of cold hammering, the result of the use of nails as raw materials for other articles such as endblades.

European goods are, as well, very well represented amongst the artifacts related to clothing, personal ornamentation and diversion. Artifacts grouped within these categories consisted of fragments of woven cloth, metal buttons and fasteners. Several types of ornaments worn on clothing are represented, including a lead drop bangle and a large number of glass trade beads. A number of styles of beads that are diagnostic of their period of manufacture were identified; these beads are examined in greater length later. One remarkable find from the entrance passage was a single, loose, amythest-coloured glass rhinestone 9.5mm in diameter. This item probably originated in a piece of costume jewelry or an elaborate button. It may have seen heavy use as its facets showed considerable wear and edge damage. Two fragmentary imported combs were present. A number of kaolin pipe fragments recovered in the house point to the practice of smoking. Finally, an iron mouth harp was also recovered.

Along with the imported objects, a number of traditional adornments were also represented. These included two small globular bone pendants with tangs perforated for suspension, an ivory pendant and five perforated tooth pendants, one of which was made from a walrus post-canine and four from fox canines. Also among these were pendants

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

made from hammered and perforated copper strips. One hammered strip of copper with a curved, perforated end was probably a pendant or the end of a headband. Copper headbands were widely worn by Inuit women in the Canadian Arctic, including those of Labrador (see Karklins 1992: 195, Fig. 114).

Two kinds of traditional playthings were found in House 7. The "cup" portion of an *ajagaq* (cup and pin) game was found. In the *ajagaq* game, contestants attempt skewer, with a pin, a perforated object that is tossed into the air. This particular specimen was made from a seal radius that had several small holes drilled through it. A carved wood bear figurine that measured approximately 10cm long was recovered. This carving is the only example of naturalistic artwork recovered at the site to date.

Two hundred and twenty nine items in the assemblage are pieces of minimally worked wood, antler, ivory and especially bone, and may be described as debris resulting from the production of traditional Neo-eskimo material culture items. As well, the assemblage includes 18 small fragments of baleen (some cut, drilled or knotted), 35 small fragments of animal hide, several clumps of hair and bark, some of which was stitched. One fragment of coal was recovered, suggesting possible experimentation with this type of fuel.

Descriptions of Diagnostic Artifacts

A more detailed study of some of the artifacts recovered in House 7, specifically the European goods, is presented below. This initial artifact analysis was conducted, in large part, to provide relative dates for the occupation of the house. The following review accordingly is focused on the typological details of diagnostic artifacts and the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

dates documented for their manufacture or those associated with their presence at other archaeological sites. The discussion is organized on the basis of categories of artifacts.

Ceramics

Fully 577 ceramic vessel fragments were found in the house; ceramic sherds are the single most common type of artifact in the House assemblage. The recovered ceramic sherds were highly fragmented (few exceeded 5cm in length) and many probably were trampled. A few sherds had drilled holes adjacent to their fractured edges, indicating attempts to mend broken vessels and implying that care was taken to conserve ceramic vessels. Portions of bowls were identified along with cups, plates, jars and crock-like vessels.

A variety of types of ceramics were represented in the collection. By far the majority of the ceramics are of creamware with transparent glaze bearing faint rose, green or blue tints. Other types of ceramics included pearlware; white, grey and buff-coloured stone ware; dry-bodied black stoneware; coarse and fine-tempered red, brown, tan and grey coloured earthenwares; and a few pieces of porcelain.

Many of the earthenware sherds represented flat dishes and jar-like vessels. Some had brown, yellow-tan or cream-coloured glazes. Several fragments of fine-tempered, wheel-made, dry-bodied red earthenware jars or jugs with glossy black glaze were found. These ceramics are examples of a widely-produced English type of earthenware generically termed "Jackfieldware".

Most of the creamware fragments had little or no decoration though some had simple banded lip or rim decorations in coloured glaze. A small number of creamware and pearlware fragments had transfer-printed floral or pictorial decorations (including

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

"blue willow" Chinese-style images). A number of "annular ware" pearlware and creamware sherds were recovered, with decorations in the form of linear bands of pale blue, brown and gold coloured glazes with brown or black slip filling incised bands. Six stoneware sherds had red-orange, grayish or spotty brown salt-glaze finishes over grey bodies.

A number of other fragments of stoneware had white salt-glazing with messily-applied "scratch blue" floral and linear patterns rendered in cobalt blue glaze applied over incised decorations. One fragment of a thin-walled, wheel-made vessel made of fine, dry-bodied, black stoneware was also found. This piece was decorated with a rolled, basket-like or reeded, stamp design and likely represents a type of vessel derived from the materials and manufacturing techniques popularized by "Blue Jasper" ware and Josiah Wedgwood's "Black Basalte" ware. One fragment of porcelain with hand-painted, abstracted, curvilinear decoration was also recovered.

Stonewares date generally between the 16th century and the present (Hume 1991: 277). English types of plain white or grey stoneware vessels with orange-red, buff or grey salt-glaze, identified in the House 7 assemblage, were popular from about 1730 to about 1777, when they were replaced by creamware vessels (Godden 1966: xiv-xv). A variety of "Jackfield ware" style earthenwares were produced by a number of English workshops over an extended period of time and were most commonly used between the 1740s and the 1780s (Godden 1966). Creamware ceramics were first made in the mid 18th century and were widely distributed and consumed from about 1755 to early 19th century (Godden 1966: xv-xvi; Hume 1991: 123-125). Pearlware ceramics were developed in the 1760s and were commonly used, especially in the early 19th century

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

until ca. 1820 (Hume 1991: 129-130). Varieties of "scratch blue" salt–glazed stoneware ceramics were made between the middle to late 18th century (Hume 1991: 117-118). The "scratch blue" sherds found at the site resemble English-made varieties of this type of ceramic, having cobalt glaze applied messily over and around incised decorations. According to Hume (1991: 118), the English-made "scratch blue" stonewares were made from the 1760s up to about 1790.

Annular decorated pearlware ceramics were made as early as ca. 1785 and were popular from ca. 1795-1815 (Hume 1991: 131-132). Several sherds of one distinctive annularware type, with alternating gold and black-brown bands, were found in different parts of the house. Another annularware sherd was a bowl fragment with a wide, pale blue band and segmented bands of black slip, was found on the sleeping platform at the north east corner of the house. The fragment was found in the lower layers of the thick deposit of wood, twigs and turf that comprise the surface of the sleeping platform, less than 10cm above underlying sand substrate. Since this area represents one of the earliest sleeping platform layers, this find gives a *terminus ante quem* date of about 1785 for the construction of the house, or at least the most recent phase of construction represented in the bulk of the excavated portion of the house.

Josiah Wedgwood first popularized dry-bodied black stonewares in the 1760s. Godden (1966: xix) and Hume (1991: 121) report that Wedgwood's fancy "Black Basalt" vessels and his new manufacturing techniques were widely copied by both large and small pottery makers producing both fancy wares and more common-place chinaware, including wheel-made vessels. Some types inspired by "Black Basalt", such as "Blue Jasper" stonewares, were made well into the early 19th century. The archaeological black

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

stoneware specimen recovered from House 7 is likely from one of these more common wares produced in the fashion of "Black Basalt" or "Blue Jasper" stoneware. Godden (1966: 31) depicts an elaborate "Blue Jasper" teapot, dated to 1800-1810, with a rolled stamp design on its body that mimics basketry. This design is identical to that present on the archaeological specimen, which was found the floor deposit of House 7. While the archaeological specimen is certainly from a much plainer vessel, and such designs may have been in use for extended periods of time, this specimen might therefore date as late as ca. 1810.

Ceramics represented in the House 7 assemblages were decorated by simple glazing, hand-painting and transfer prints. Methods of decorating ceramics through transfer printing were developed in the 1750's. As well, Chinese-style underglazed blue decoration s seen in this assemblage were popular in the late 18th century (Hume 1991:128).

Glass and Brick

Other kinds of glass and brick artifacts as well were found within the house. Twenty fragments of relatively thin, clear and flat, glass sherds were identified, likely window glass. Sixty-six fragments of red brick were also recovered. The brick fragments were made of red clay with coarse white sand temper.

Buttons

The metal buttons included single-piece, flat, cast types, stamped buttons and buttons with composite constructions combining metal with cloth, leather or bone. They were sewn to clothing with perforations through their bodies, perforated shanks, and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

soldered wire loops. While some were made of unidentified metal, almost all of the buttons were made of copper alloys. All the button types represented in the house were consistent with common button types identified by South in excavations of 18th and 19th century contexts in Brunswick Town and Fort Fisher, N.C. (South 1964, cited in Hume 1991: Fig. 23).

A remarkable flat, cast brass button was found on the sleeping platform along the eastern wall of the house, in one of the upper layers of twigs, turf and debris covering the platform. The button, had a detailed emblem stamped on its front face and a perforated shank and mould seams on its reverse face. This emblem consisted of a Phyrgian cap on a pole over top of a Roman-style bundle of fasces, surrounded by a wreath of oak branches, and around the margin of the button are the words "Republique Francaise" and a rouletted ring bordering its edge. The use of Republican Roman symbols (rather than traditional royalist symbols such as the fleur de lis) on this button, its obvious label and its construction indicate that this is a French button dating after the French Revolution in 1789.

The button is identical to types adopted for the uniforms of line infantry, light infantry and dragoon regiments of the army of Republican France in October, 1792, illustrated in Figure 7.6 (Fallou 1997: 82, 97, 138). These patterns were in regulation use only until 1793, when new patterns bearing regimental numbers were adopted during a phase of military reforms. Subsequent button patterns maintained the regimental number device or bore emblems of the First Empire such as a rampant eagle or the Napoleonic "N" cipher. While it is certain that older uniforms were only gradually or partially replaced and that useful items like buttons probably remained in use among soldiers or

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

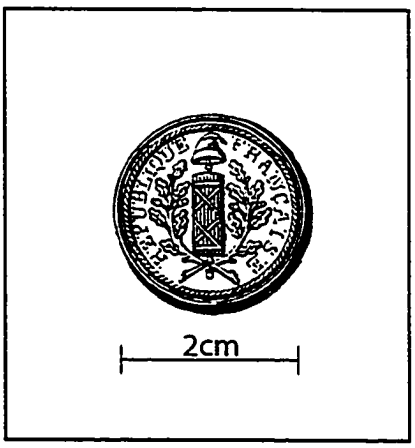
civilians for extended periods of time, it is much less likely that button manufacturers would have continued to produce obsolete forms once the army required newer patterns. Therefore, the manufacture of this button type may be dated very tightly between 1792 and 1793.

As an aside, the means by which this particularly curious item reached Labrador remains an interesting but unresolved question, as French commerce and fishermen were officially barred from the region since 1763 when, at the conclusion of the Seven Year's War, the terms of the Treaty of Paris confined the French fishery to the Gulf of St. Lawrence and excluded it from Labrador. It is likely that a clandestine French fishery and trading presence continued in Labrador, which was a concern to the British Governor of Newfoundland, Sir Hugh Palliser (Gosling 1910: 176). More mundane and commonplace explanations may lie in an unofficial trade between British fishermen with the French in Gulf of St. Lawrence or the transport of second-hand clothing on British ships, as clothing for sailors or as charitable aid to the incipient Inuit congregations of the Moravian Missions.

Finally, the button might be related to a French naval expedition of the Republican era. In August of 1796, a small squadron of eight warships under Admiral Joseph de Richery was dispatched from Cadiz, to raid and destroy British fishing interests around Newfoundland (Gosling 1910: 191; Prowse 1895: 271). After an aborted approach of the harbour of St. John's, Richery raided the Strait of Belle Isle and detached a force of three warships to raid fishing establishments on the southern Labrador coast (Prowse 1895). This latter group attacked the major fishing port of Temple in Chateau Bay. All told, Richery's expedition destroyed or captured as many as 100 merchant and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.6 Illustration of French Military Button Similar to Artifact #1436, from Uivak Point 1 House 7, based on Fallou (1997)



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

fishing vessels, destroyed many shore stations, and seriously harmed the British fishery (Prowse 1895). The French button might well have been "introduced" to Labrador during this event as Inuit frequently traveled to Chateau Bay in order to trade.

Lead Drops and Beads

Three tri-lobed lead drops were found. Lead drops were commonly used as fringe decorations on skin clothing and amulets, much as were more traditional perforated teeth (Karklins 1990; Turner 1979: 35). Beads were also used to ornament clothing and to make such items of jewelry as women's ear pendants. A total of 276 beads were recovered in the house and were one of the most common types of artifacts.

Most of the beads were simple, monochrome, seed beads that measure approximately 5mm in diameter or less. A variety of polychrome, composite beads were also represented, along with a bead made from a bone cylinder and another of metal. An initial analysis of glass bead types represented in the house was conducted following the bead typology developed by Kidd and Kidd (1970) and is summarised below. Published analyses by Brain (1979), Ross (1990) and Stone (1974) were used as sources of data for identification and dating. A summary table of bead descriptions is presented in Table 7.1.

Most of the beads recovered were relatively plain, white specimens. Six of these were plain, wound, "barleycorn" beads of opaque white glass, identified as Kidd Type WIc1 (measuring 11.9mm long, 7.5mm wide, 1.7mm bore diameter). These beads are dated from ca. 1700 to 1833, with a mean date of 1789 (Brain 1979: 109). Two tubular drawn, compound, white beads were identified as Kidd Type IA5 beads. These specimens had an opaque white glass interior and a thin transparent glass exterior layer;

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

they measure from 6.5mm to 9mm long, between 3.5mm and 5mm wide, and had bore diameters of approximately 1mm. This type of bead is dated broadly between ca. 1650 and 1835, with a mean date of 1748 (Brain 1979: 105).

Ninety-two specimens of Kidd Type IVa13 beads were identified. These compound, white, drawn, beads were found in seed bead and necklace bead sizes (ranging between 1.8mm and 5.7mm long, 2.4mm to 7mm wide, and had bore diameters of 0.8mm to 2mm), in short cylinder and doughnut shapes. A thin outer layer of transparent, glossy glass covers the opaque white glass core of this type of bead. All these beads had been reheated and tumbled in order to round their edges. This type of bead is dated to between 1600 and 1890, with a mean date of 1754 (Brain 1979:106). While most of the specimens from House 7 are quite small, 4 specimens measure up to 7mm in diameter. Brain (1979: 106) notes that in Floridian archaeological sites, specimens of equivalent size date most frequently between 1740 and 1767, occurring rarely after 1767 and not at all after about 1836.

Another type of white bead found is a represented by a set of six wound, globular or ellipsoidal beads that measure from 5mm to 10mm long, 4.9mm to 7.1mm in width and have bore diameters of 1.2mm to 2.1mm. These are made with an opaque, milk-white glass with a satiny surface, and exhibit coarse circumferential striations. This bead type most closely resembles Stone's type CII,SA,T1,Vd beads (Stone 1974: 114), which is dated to ca. 1700-1750. As well, Ross (1990: 49) identified very similar beads at Fort Vancouver using the Kidd typology (as modified by Karklins) as Type WIc-bops-2, suggesting that this type of bead was also in use between 1829 and1860.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A large number of the beads recovered were blue seed beads. Eighteen of these were very small purplish-powder blue beads that are similar to Stone's type CI,SA,T1,Vx (Stone : 111). Ross (1990: 41) also identified this type of bead at Fort Vancouver, Washington and labeled them Kidd type IIa-ops-14. These small beads measure from 1.0 to 1.5mm long, 2.2mm to 2.6mm wide, with bore diameters less than 0.8mm. 14 of these beads were found in a concentration in the entrance passage and likely had been strung together. In addition, one specimen of Kidd type IIa37, a short, cylindrical aqua blue bead was identified. The bead was 3mm long, 3.6mmwide and with a bore diameter of 1.1mm. Stone (1974: 111) described a similar bead recovered from excavations at Fort Michilimackinac, (Type C1,SA,T1,Vf).

The majority of blue monochrome beads, 32 specimens, were small opaque turquoise beads of Kidd Type IIa40 and IIa41. These beads were small to very small in size (1.5mm to 7.6mm long, 3.0mm to 6.0mm wide, and with bore diameters ranging between 0.8mm and 1.5mm), had square, oval or doughnut shapes, rounded, tumbled edges and, in most cases, glossy exteriors. Brain (1979: 102-103) dates such beads to the period 1600-1836, with a mean date of 1737.

Two drawn beads in the assemblage, including one large necklace bead (12.8mm long, 8.4mm wide, bore diameter 2mm), and one seed bead (2.8mm, 3.2mm wide, bore diameter 1.4mm), were made of translucent, glossy, cobalt blue glass and were identified as a Kidd Type IIa55 and IIa56 respectively (dated to ca. 1600-1890, median age of 1749). Another large cobalt blue bead was pentagonal in shape with pressed facets, and had a very large hole (bead length of 12mm, diameter of 12.5mm, bore diameter of 4.6mm). This type (Kidd type WIIc12) of bead has been found widely in archaeological

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

sites in North America (Brain 1979: 110), and in communal houses in Greenland (Gulløv 1997: 286) and in Richard Jordan's excavation of the Eskimo Island 1 House 2 communal house. Karklins (1975) considers that this type of bead was manufactured in Amsterdam during the middle of the 17th century to early 19th century.

Fragments of three opaque turquoise beads were found. Two were larger globular specimens of Kidd Type IIa31 that measured approximately 7.6mm long, 6.7mm wide, and with bore diameters of approximately 1.6mm. The third fragment was part of a small doughnut shaped bead approximately 2.6mm long, 3.4mm diameter, with a bore diameter of 1.5mm. Beads of these types have been dated widely between 1600 and 1836, with a mean date of 1737 (Brain 1979: 103).

Four monochrome reddish glass beads were found. These included one small wound globular bead (3.4mm long, 3.9mm wideland bore diameter of 1.8mm) and two ellipsoidal, wound beads. One of the latter beads was a weathered, fragmentary specimen with a round cross section, while the other (measuring 7.5mm long, 5mm wide, bore diameter of 1.3mm) had paddled sides and an irregular trapezoidal cross section. All three beads had obvious striations resulting from the winding process, a maple to amber red colour and a resinous, patinated, texture. These are tentatively classified as Kidd Type Wib8 and Wic6 beads. Brain (1979: 111) describes a similar type of bead (WIIA10), which he was unable to date. Similar beads were also identified by Ross (1990: 49, Plate 3ff, gg) at Fort Vancouver, Washington; this site was dated between 1829-1860 though it is likely that beads of this type were previous to this date. Red and purple-hued beads of this type were also recovered from contexts in the Eskimo Island 2 site, dated to the late 18th and 19th centuries. The final red bead was a fragment of a small

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

doughnut-shaped bead the colour of opaque dark brick-red. The bead measures 2.8mm long, 3.9mm wide, with a bore 0.9mm in diameter. The bead is categorized as a Kidd Type IIa2 bead. Ross (1990: 41) identified similar specimens at Fort Vancouver (which he identified as Type IIa-ops-4 using Karklin's modified Kidd typology).

A single glossy, colourless, transparent glass bead was found. This doughnut-shaped bead had a length of 6.9mm, a diameter of 6mm and bore diameter of 3.4mm and was decorated with paired diagonal lines pressed in pairs into the molten glass' surface. One dark amber coloured, translucent seed measured 2.2mm long, 2.5mm wide and had a bore diameter of 0.8mm. This doughnut-shaped bead is similar (being somewhat larger) to a bead from Fort Vancouver described by Ross (1990: 41), which he classified as Kidd type IIA-ops-3.

A number of beads were constructed with multiple layers of coloured glass. The most common of these were 71 beads with cores of transparent, pale green glass covered with a layer of brick-red opaque glass and a thin outermost layer of transparent clear glass. These beads range from 1.6mm to 4.1mm in length, 2.2mm to 4.5mm in width and have bores 0.8mm to 1.5mm in diameter. They have doughnut and "semi-barrel"(short cylinder) shapes and have been tumbled to smooth their edges. One cluster of eight beads found on the House 7 sleeping platform included four of these beads with four IVa13 beads suggesting that these two bead types were strung or stitched together on some object.

These beads fall within the definition of Kidd Type IVa6 and are commonly termed by archaeologists as "Cornaline d'Aleppo" or "Green Heart" beads. Francis (2002) nevertheless, believes that this term properly refers to a similar trade bead with an

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

opaque white glass core and prefers the term "Green Heart" as a distinctive name for the green-cored form. This type of bead was manufactured in Venice and Brain (1979: 106) dates them between 1600 to 1836, with a mean date of 1727.

A single wound polychrome bead had a milky white opaque glass core with many small bubbles, six brick red stripes on the side of the bead, and a covering layer of clear glass. The stripes run parallel to the length of the bead and are placed irregularly with a slight diagonal slant. The bead is doughnut shaped and measures 4.7mm long, 6.9mm wide and has a bore diameter of 1.5mm. It is classified as a Kidd Type IIb'5 bead on the basis of the six slanted stripes. Similar beads were recovered at the Eskimo Island 2 site, dated to the late 18th to 19th century.

Five beads were lamp-wound "barleycorn" beads made of opaque white glass decorated with combed loops of dark blue to sky blue translucent glass running along the circumference of the middle of the bead. These beads measure 10.9mm to 11.4mm in length, 6.5mm to 7.4mm in width, and have bore diameters of 1.5mm to 1.9mm. They are classed as Kidd Type WIIIb-bclc beads and, except for the colour of the looped decoration, are very similar to Stone's type CII,SC,T1,Vb bead (Stone1974: 106) which he dated to1670-1760.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 7.1 Bead Types Recovered in House 7

Bead Type	Description	Decoration	Shape	Size (Length/ Width/Bore) in mm	#	Date (see text for ref.)
Wic1	Wound, White opaque	Striated	"barleycorn" ellipsoid	Large 11.9/7.5/1.7	6	1700-1833 (1789)
Ia5	Drawn, compound, opaque white core, transparent outer layer	Tumbled	Cylinder	Medium to Large 6.5-9.0/3.5-5.0/1.0	2	1650-1835
Iva13	Drawn, compound, opaque white core, transparent outer layer	Tumbled, glossy	Short cylinders, doughnut	V. Small to Large 1.8-5.7/2.4-7/0.8-2	91	1600-1890 (1754)
WIc-bops-2	Wound, opaque milk white,	Satiny texture, striations	Globular or ellipsoid	Medium to Large 5.0-10.0/4.9-7.1/1.2-2.1	6	1700-1860
IIa-ops-14	Drawn, opaque, purple-tinged powder blue	Dull	Short cylinder, Doughnut shaped seed bead	V. Small 1.0-1.5/2.2-2.6/<0.8	18	1829-1860 and earlier
IIa37	Drawn, opaque aqua blue	Tumbled	Short cylinder seed bead	Small 3/3.6/1.1	1	18th century
IIa40/IIa41	Drawn, translucent turquoise	Tumbled, dull to glossy	Short cylinder or doughnut shaped	V. Small to Medium 1.5-7.6/3.0-3.6/0.8-1.5	32	1600-1830 (mean 1737)
IIa55	Transparent cobalt blue	Glossy, smooth	Ellipsoid	Large 12.8/8.4/2	1	1600-1890 (1749)
IIa56	Transparent cobalt blue	Glossy, smooth	Short cylinder seed bead	Small 2.8/3.2/1.4	1	1600-1890 (1749)
WIIc12	Transparent cobalt blue	Glossy, smooth with pressed facets	Pentagonal, doughnut	Large 12/12.5/4.6	1	1650-1833
IIa31	Opaque turquoise	Dull	Globular	2.6-7.6/3.4-6.7/1.5-1.6	3	
Wib8	Wound, amber red	Striated, dull, resinous	Ellipsoid	7.5/5/1.3	2	18th-19th century
Wic6	Wound, amber red	Striated, dull, resinous	Globular	3.4/3.9/0.8	1	18th-19th century

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 7.1 (con't) Bead Types Recovered in House 7

Bead Type	Description	Decoration	Shape	Size (Length/ Width/Bore) in mm	#	Date (see text for ref.)
IIA-ops-3	Translucent, dark amber	Smooth	Short cylinder	2.2/2.5//0.8	1	18th-19th century
Iva-6, "Cornaline d'Aleppo", Green Heart	Wound+Drawn, clear glass over opaque red-brick glass, over pale green translucent core	-	Short cylinder, doughnut	1.6-4.1/2.2-4.5/0.8-1.5	71	1600-1836
IIa2	Drawn, opaque, dark brick red	Smooth	Doughnut	2.8mm/3.9mm/0.9mm	1	18th?-19th century
Iib'5	White opaque, frequent bubbles	6 slated red stripes, smooth	Short cylinder	4.7/6.9/1.5	1	
WIIIb-bclc	Wound, white opaque	Combed translucent blue combed, looped stripe around circumference	Barleycorn ellipsoid	10-9-11.4/6.5-7.4/1.5-1.9	5 (7)	1670-1760 18th-19th century
Stone CII,SC,T2 ,Vb	Dark burgundy (black), translucent	White and green eyes	Globular	9.7/9.5/2	1+?	1700-1750
?	Black opaque	Dull surface, yellow glass crosses, white eyes	Ellipsoid	9.3/8.7/1.9	1	?
WIIIA3	Dark Burgundy (black)	Spiraling white stripes	Globular	-/11/2	1	1700-1833 (mean= 1749)
?	White ceramic (?), opaque, pressed in mould? Three join lines	Red, brown, blue, yellow glass flakes embedded on surface	Globular	7.2/ 6.5/ 1.1	2	?

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Ross (1990: 52) described parallel, but not identical, bead types at Fort Vancouver, which therefore were in circulation after 1829. Francis states that this type of bead was made in Venice (Francis 1994: 64). One large wound globular bead measuring 9.7mm in length, 9.5mm in width, with a bore diameter of 2mm was of very dark burgundy coloured glass with round white eyes with green centers, similar to Stone's type CII,SC,T2,Vb bead (Stone 1974: Table 27). A similar bead measuring 9.3mm in length, 8.7mm in width and a bore diameter of 1.9mm was decorated with a yellow cross pattern and white eyes applied on a black body. Another fragmentary, large, very dark burgundy bead (11mm in width, 2mm bore diameter) had a spiraled white design conforms to Kidd Type WIIIA3. Beads of this type have been dated to ca. 1700-1833, mean date 1744 (Brain 1979: 112).

Two ceramic beads were identified. These beads were globular in shape and were made from white opaque glass with many small flakes of rose, brown, blue and yellow glass. Both beads have three clearly defined sections that probably result from the application of three blobs of paste into a mold to make the bead before it was fired. The beads were identical in shape and size, and measured 7.2mm long by 6.5mm width, with bore diameters of 1.1mm. While they appear to have been relatively rare, ceramic beads were circulated in North America. Ross (1990: 56) described a single molded ceramic bead at Fort Vancouver indicating that beads were manufactured in this manner from ca. 1829 to 1860.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Combs

Fragments of two poorly preserved combs made from thin single sheets of ivory were recovered form House 7. While fragmentary, these appeared to be double-sided combs with thin, closely set, and very uniformly cut, teeth. The Inuit made single-sided combs with large, irregularly cut and widely spaced teeth. Thus, the combs in House 7 appear to be imported articles.

Kaolin Pipes

A total of 112 kaolin pipe fragments were found throughout the house and especially on the house floor. Of these artifacts, 72 were pieces of shattered pipe stems while 40 were pipe bowl fragments. The larger bowl fragments indicate that the bowls were relatively broad, widest at the mouth, and had a somewhat bellied profile on the side facing away from the smoker. A flat-ended heel was present on the underside of some bowl fragments, at the junction of the bowl and the stem. When the heel was present, the letters "T" and "D" were stamped singly on its opposite sides. A small number of bowl fragments bore a stamp with the letters "TD" surrounded by laurels and a rouletted circle on the side facing the smoker.

These decorations and, to a lesser degree, the form of these pipes, mark them as the original type of "TD" pipes, which were probably made by Thomas Dormer, a pipe manufacturer in London (Walker 1983:36-37). This particular type of pipe was widely distributed in North America. On the basis of their distribution in other archaeological

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

sites, TD pipes are considered to date between ca. 1755-1830 (Walker 1971: 65; 1983: 37).

Musical Instruments

A single musical instrument, an iron mouth harp, was recovered from House 7, from the platform along the southern wall of the house. The artifact measures 5cm long with a maximum width of approx. 25mm. It has a circular head and tapering, converging tangs. The specimen is similar to mouth harps identified at Fort Michilimackinac (Stone's type SA,TB,Va) which have been dated between the 17th to the 19th century (Stone 1974: 141-144).

House 7 Midden

House 7 occupies a central position on the 8m asl raised beach terrace within the Uivak Point house cluster. Gullies in the terrace slope to the south and especially the north are much wetter and have a cover of moss and low birches. The portion of the terrace occupied by the midden and House 7 is built up somewhat and extends west from the neighboring terrace edge. As a result, the area is well drained and supports a luxuriant growth of grass. Gullies located south and especially north of the midden are usually wet and have moss, and low birch and willow vegetation.

A test pit (Test 2) was excavated in the steep terrace slope 3m west of the house entrance. The test was excavated to a depth of 40 cm. Its upper layer (from 0cm to about 25 cm below surface) was composed of dense, grey-brown, turfy, soil with wood debris. The lower layer (25cm to 40cm below surface) consisted of dark grey-brown sandy soil

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

accompanied by lenses of black organic-rich soil. Fragments of charcoal, wood, a whalebone dog trace buckle, and quantities of animal bone (including seal mammals, dogs, mussel shell, small mammals and birds) were recovered from this layer. An additional shovel test (Test 6) was excavated at the foot of the terrace slope below Test 2 (approx. 6m west of Test 2), where the slope runs out into a flat, boggy meadow. Similar layers of dark brown sandy soil containing quantities of animal bones were found in Test 6, though the midden deposit at the bottom of the slope was much thinner and contained less bone than that observed in Test 2. The presence of midden deposits in both of these test pits suggested that a very large midden was present in this location, extending approximately from the entrance of House 7 to the bottom of the terrace slope.

A trench spanning the space between the entrance of House 7 and the foot of the terrace was excavated in 1993 and 1994. The trench measured 7m by 2m and probably subsumes as much as a third of the total midden area adjacent to House 7. The trench was subdivided into one metre square units and was incorporated into the grid system used in the excavation of House 7. Unit labels were applied on the same basis of spatial coordinates that was used for the house excavation; midden units had coordinates ranging from 0m south to 2m south, and from 1m west to 7m west. The midden trench was excavated with trowels in 5cm arbitrary levels following the bedding angles of visible natural stratigraphy. The trench was excavated as a whole unit by these levels in order to maintain the consistency of the depth and dip angle of the arbitrary levels. Recovered finds were plotted in three coordinates while all excavated sediments were sieved through 4mm mesh to standardize recovery of small bones. Bulk sediment samples were collected from major stratigraphic units and midden deposits on an unsystematic basis.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

An additional 50cm by 50cm sampling column adjoining the north wall of the midden trench (unit 0S/3W) was excavated in 1996 for recovery of bulk sediment samples and ecofacts. A total of 20 bulk samples of between 5 and 7 litres each were collected systematically in this column, drawing one from each 5cm arbitrary excavation level. Portions of the midden were again re-opened in 2000 for recovery of block soil samples.

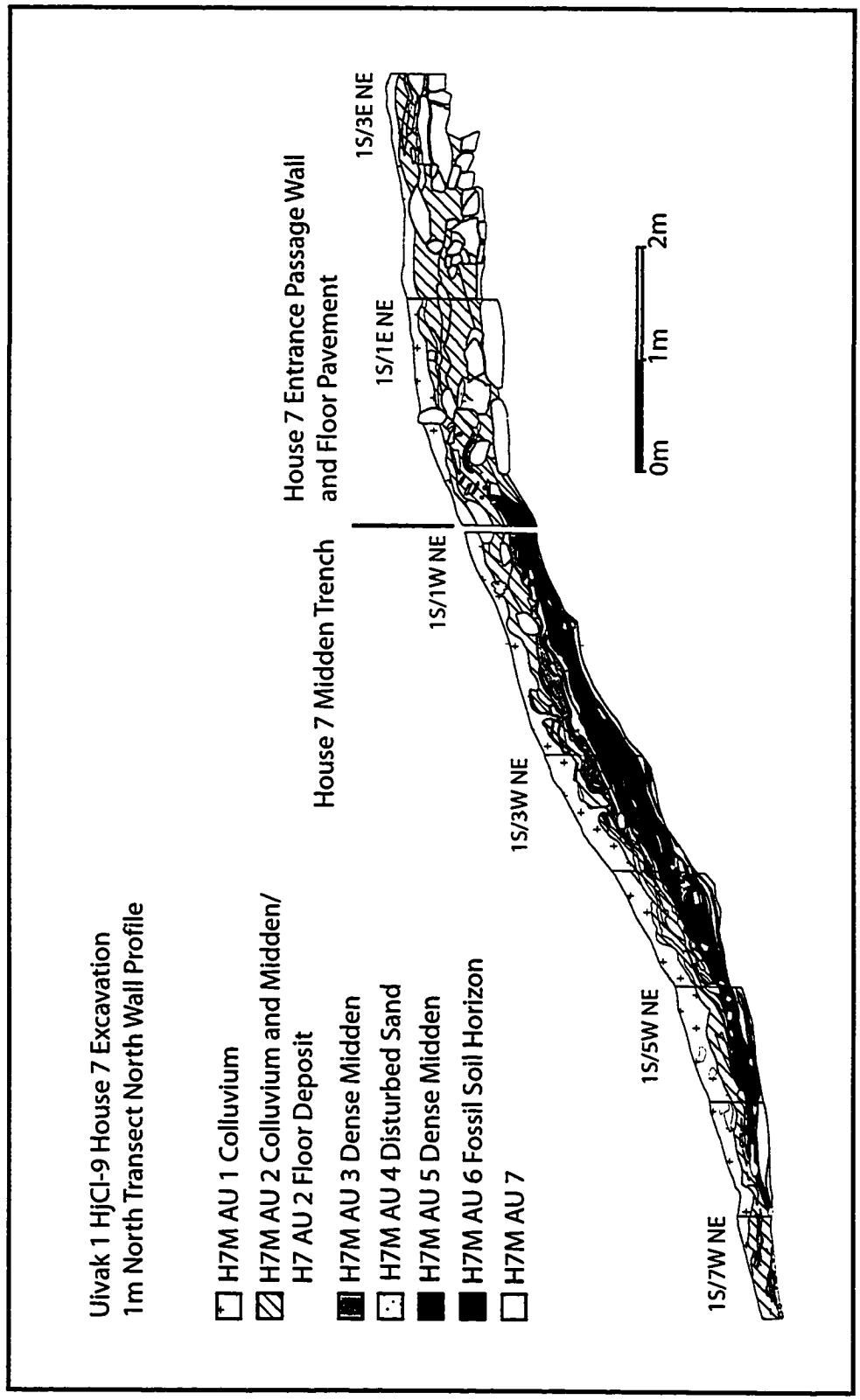
The terrace slope dips very sharply to the west in the area, dropping 2.65m over its entire 7.0m length for an average 38% grade. The eastern half of the midden trench was the steepest part of the midden, with a maximum grade of 60%. Because it is located at the bottom of the slope, the western half of the midden had a minimum grade of 15%.

House 7 Midden Stratigraphy

In this section, a summary of the House 7 midden stratigraphy is presented. In general, the midden consists of a large number of lens-shaped deposits, as illustrated in Figures 7.7, 7.8 and 7.9. Only a few layers extended throughout the midden, and thus there were few simple, continuous stratigraphic breaks. Nevertheless, these lenses can be grouped into seven major analytical units on the basis of sedimentological and pedological characteristics and shared stratigraphic contacts. The contacts of these analytical units do, for the most part, run the length of the midden profiles and allow clear stratigraphic segregation of the midden deposits.

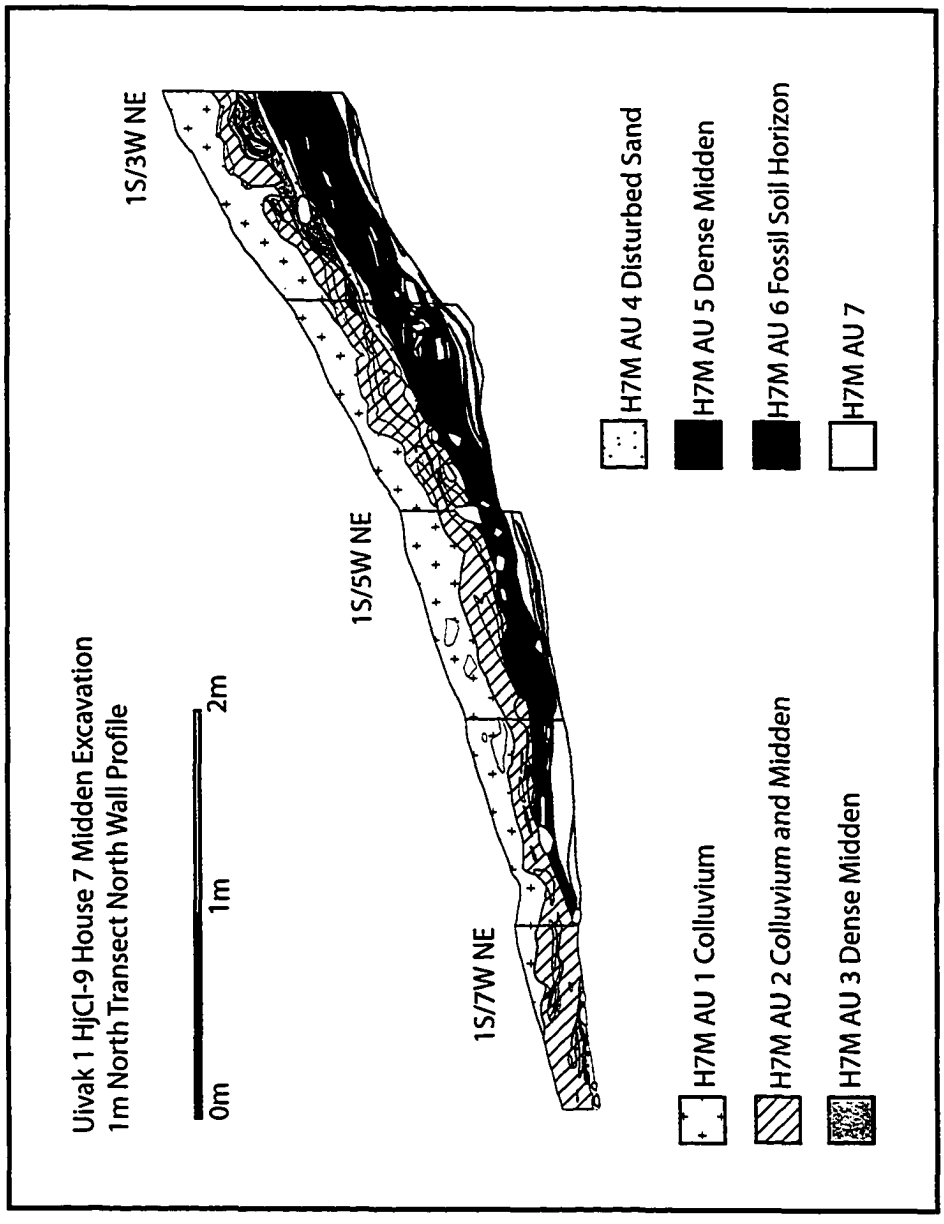
Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.7 Uivak Point 1 House 7 Midden North Wall Stratigraphy



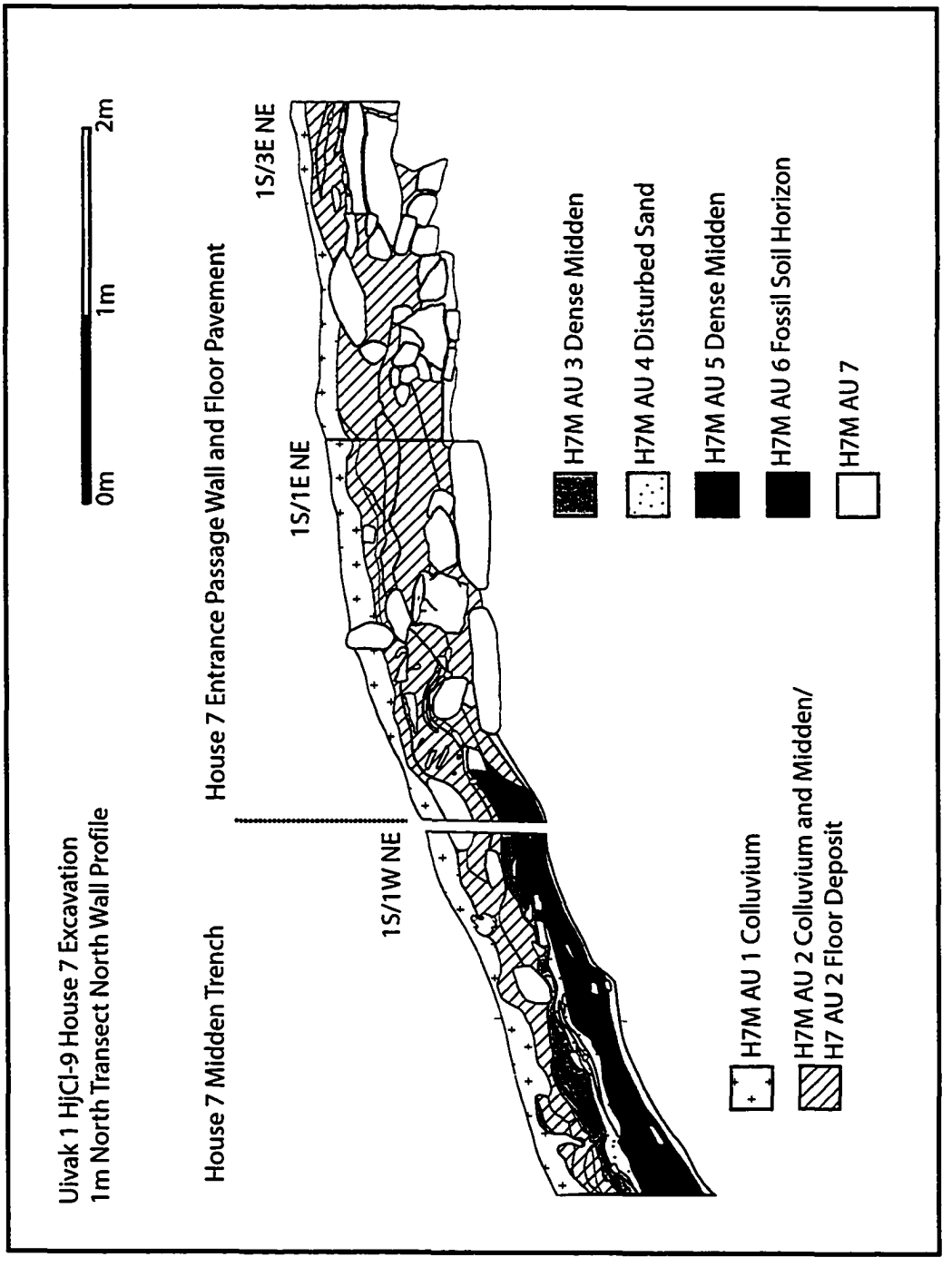
Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.8 Uivak Point 1 House 7 Midden North Wall Stratigraphy, Unit 1S/3W to 1S/7W



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.9 Uivak Point 1 House 7/House 7 Midden North Wall Stratigraphy, Unit 1S/2W to 1S/3E



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Analytical Unit 1

A.U.1 is the uppermost unit in the midden section and consists of a thick layer of mixed grey-brown, sandy, sediment (Stratigraphic Unit 1, or S.U.1) that extends the length of the midden. S.U.1 includes the currently active A and H (leaf litter, see C.S.S.C. 1978) soil horizons and is similar in colour and fabric to the uppermost soil layer overlying House 7 and other parts of the site. Loss on ignition analyses (LOI) showed that S.U.1 has a high organic matter content (21% OM). Within S.U.1, tiny sand lenses, fragments of wood debris, charcoal and poorly preserved bones are common. It is also very densely penetrated by root masses of grasses and sedges growing on the ground surface. S.U.1 is very irregular in thickness (ranging from about 10cm to 30cm thickness) and its upper surface has several sharp undulations that resemble slump blocks. Accordingly, S.U.1 likely represents *in situ* soil development within a dynamic and highly mixed layer of colluvium derived from the decaying walls of House 7, and therefore postdates the occupation and abandonment of the house.

Analytical Unit 2

A.U. 2 closely conforms to the contour of A.U.1, but is a more complex group of stratigraphic units. A.U. 2 consists mostly of lenses of woody or turf debris derived from House 7 and its walls; it overlies the intact portions of the entrance passage wall. One of the largest components of this group is a thick lens of very coarsely fibrous, woody

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

material directly underlying A.U. 1 in units 1S/1W and 1S/2W. While this material is moderately decomposed and likely was partially disturbed by past rodent burrowing, the consistent orientation of massive fibrous particles in the lower parts of the lens suggest that these are the remains of at least one large timber. This timber may have been part of entrance passage structure. Cobbles and animal bones within a grey-brown sandy peaty soil matrix are also found within this lens.

Several turf blocks were excavated in the eastern portion of the midden, in A.U.2. Two blocks, each measuring over 30 cm long, are preserved in the northern walls of units 1S/2W and 1S/3W. These blocks are composed of medium brown, sandy, peaty soil with strongly decomposed fibrous organic matter. Peaty soils with similar colour and texture are present in damp areas around the site. Blocks cut from these peaty soils were observed within the walls of House 7. As well, excavations in House 7 showed that house walls were constructed of multiple layers of peat separated by layers of sand; several blocks excavated in the midden contained similar sand and turf layers. On the bases of these similarities, it seems likely that the turf blocks observed in the midden were derived from the collapsed walls of House 7.

Several lenses of darker, organic-rich peaty soil are part of A.U.2. One extends east of the midden excavation and occupies the same stratigraphic position as the decomposed wood deposit. This lens contains rock and wood debris and overlies the remaining foundation of the entrance passage wall. It is interpreted as the turf portion of the collapsed passage wall, slumped downhill.

Others lenses of peaty soil are located down slope from the woody deposit. These lenses are rich in organic matter content (as high as 33% OM), have strongly to very

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

strongly decomposed organic matter, neutral soil acidity, and contain artifacts, large wood remains, and animal bone. Fewer turf blocks were excavated in this area and the detritus-rich lenses likely represent thin midden layers or re-worked midden deposits. The more decomposed, organic-rich peaty lenses represent the accumulation of fine organic matter in the form of sediment transported downslope with cobbles, bones and wood detritus, rather than the more massive bodies of debris found closer to the house. As well, a more rapid and rich development of soil would have been encouraged by the accumulation of fine decomposed organic matter at the bottom of the slope.

A.U.2 was, as well, subjected to soil movement through slumping and colluvial earth flow. Several slump block features are visible in the midden's northern profiles. The upper contact of A.U.2 in the midden's four eastern units is marked by a fairly rhythmic undulation suggesting slumping and rolling of surficial deposits over the steepest parts of the midden slope. Because A.U.2 overlies the intact portions of the entrance passage wall, the unit must be considered to be contemporaneous with, and to post-date, the final occupations of House 7. A.U.2 contains archaeological materials now in secondary and tertiary context, which originally pertain to the occupation and construction of House 7, as well as a small amount of refuse accumulation in primary context. Some disturbed sediment and detritus originally from A.U.3 might also be incorporated within A.U.2.

Analytical Unit 3

A.U.3 is another diverse group of stratigraphically associated deposits including midden deposits. The lowest part of this analytical unit is a set of peaty soil lenses

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

situated on the lower half of the slope. These lenses contained fine-textured, highly decomposed organic matter and suggest that *in situ* soil development and gradual accumulation of organics as transported sediment produced the deposits of the lower slope in this unit.

Three lenses of loose, sandy midden deposits are located up the slope from the peaty soil lenses and in a stratigraphically higher position. These contained wood remains, charcoal, quantities of animal bone and numerous tiny lenses and mottles of pale grey sand. The presence of small sand patches in these deposits suggest that they had been mixed with underlying unconsolidated sand deposits in A.U.4.

A turf block associated with sand lenses and a lens of hard, partially carbonized organic matter provides a stratigraphic break between the sandy midden deposits. The latter material appears to be a crust of flexible, concreted animal fat that was deposited in a layer from 1cm to 5cm thick. It may result from the disposal of a quantity of burnt fat from lamp cleanings or residues from large scale processing of sea mammal fat. The sand lenses themselves have included patches of different coloured sand, suggesting that they, too, are disturbed sediments. Because this disturbed deposit is limited in depth and lateral extent, it seems likely that the interruption in midden accumulation was short and may have been related to renovation or deterioration of House 7.

A final midden deposit (S.U.18), consisting of dark grey -brown sandy soil with some coarse, poorly decomposed wood and plant remains, charcoal and bone, occupies the uppermost stratigraphic position in this analytical unit, at the highest end of the slope. The fairly neutral soil pH of 6.8 of this deposit seems to have encouraged good bone preservation conditions. S.U.18 is also stratigraphically the highest portion of dense,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

intact midden deposit observed in the excavation and is overlain by sediment and decayed wood derived from the collapsed entrance passage wall. Therefore, SU18 represents the last major phase of midden accumulation and is associated with the later occupation of House 7.

Analytical Unit 4

A.U.4 is a relatively thin, lenticular unit found in the steepest parts of the terrace slope. The unit is composed primarily of a number of sand lenses of varying thicknesses that are clearly visible in northern excavation profiles from 1S/1W to 1S/4W. The sand lenses each range between about 3cm to 8cm thick. At its maximum, the unit measures about 12cm thick. Stratigraphically, the lowest portion of this unit is a lens of disturbed, mottled, light grey, very sandy soil in 1s/1w and 1S/2W. Above this lens are two lenses of yellow-tan, loose, fine to very fine sand containing bone extending into 1S/4W. In addition, there is a small, isolated lens of poorly sorted gravel and tawny-coloured sand in 1S/4W. The two uppermost stratigraphic units included a lens of hard, well-sorted, blonde sand containing flecks of charcoal and a lens of disturbed, mottled ashy sand mixed with grey-brown soil and charcoal. While pH levels in these deposits are close to neutral (pH of 6.8 to 6.9), organic matter content is quiet low (around 6.0%).

Had a large-scale erosion event with water-borne sediment transport produced the sands observed in A.U.4, they would likely have produced a relatively uniform, well-sorted sand deposit and perhaps evidence of erosional intrusion into substrate sediments. Neither of these conditions are evident, however, in the midden excavation's north wall profiles. The various sand lenses are characterized by distinctive colours and grain sizes,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

indicating different sources of sediment or different modes of deposition. These sediments could have been transported during the course of renovations to House 7, especially if portions of its floor were re-excavated, and dumped down the slope, on top of the midden. In this case, trampling could account for the mottling and intermixed soil and sediment, as well as household refuse in lenses at the upper and lower boundaries of A.U. 4.

A.U.4 is not a thick unit and does not form a continuous layer throughout the midden excavation. Nor does it include layers with organic sediment or soil horizons indicative of stable ground surfaces. A.U.4 likely represents a series of rapid depositional events that occurred over a short period of time. Anthropogenic transport of beach terrace sediments, such as digging, is a likely source for these lenses. Accordingly, the A.U.4 sand lenses may have been produced during a phase of house building or renovation. Despite its short depositional history, A.U.4 it is of specific importance to this study as an unamibiguous stratigraphic marker delineating upper and lower portions of the House 7 midden.

Analytical Unit 5

A.U.5 consists of multiple lenticular midden deposits that overlie the entrance passage wall in 1S/0W and extend to the bottom of the terrace slope in 2S/7W, below the sand deposits of A.U.4. Sediments in these deposits include medium grey/brown to black, organic-rich sands. All deposits in A.U.5 are associated with numerous pebbles and cobbles, wood fragments ranging in size from timbers to small fragments, charcoal, large and small animal bones, gastropod shells and artifacts. The midden deposits range

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

from mildly acid to neutral (pH from 6.1to 7.0) and all are composed of between 20% and 30% organic matter as determined by loss on ignition analyses. Aside from bones and wood fragments, this organic matter is in the form of coarse to fine grained, poorly to strongly decomposed particles. Lenses of fine black humus, sand mottles and small lenses of pale grey sand are common in the midden deposits.

A very large boulder sits in the midst of the midden excavation in the 2S and 3W rows of units. The midden deposit in A.U.5 (and in the excavation as a whole) is most substantial in the area immediately around the boulder (up to 45cm thick). The boulder has acted as a retaining wall, damming sediments uphill of it and creating a void for infilling sediments below it. Several dense lenses of clast-supported shell and bone deposits lacking substantial soil fractions and several other relatively dense concentrations of bone were excavated in the deep midden deposits around the boulder. Some concentrations have clear boundaries and may be taken to represent discrete dumping events. These include four thin lenses of densely packed flat-lying mussel shell that are visible in the north profile of1S/1W, 1S/2W, and 1S/3W, and a quantity of animal bone, wood and charcoal in an area of very dark grey sandy soil in the north wall profile of 1S/3W and 1S/4W.

Other than these dense bone and shell lenses, there are few discrete dumps of household refuse in most of the A.U.5 midden deposits (as well as those elsewhere in the excavation). This is perhaps to be expected, as gravity, trampling, scavenging and other forms of bioturbation would seem to be sufficient to mix and redistribute surficial refuse deposits. As well, large-scale redeposition of layers of household occupational litter during periodic floor cleanings or renovations would have produced large, mixed and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

relatively undifferentiated midden deposits rather than small lenses representing primary depositional contexts.

Snow cover should also be considered an important factor in the formation of midden deposits on Uivak Point's terrace slopes. Winds from the north and east deposit large quantities of snow onto the southern and western sides of Uivak Point. In the winter of 1996, large drifts were observed to cover the walls of all the sod houses at the site. The two terrace slopes upon which the sod houses were built were completely buried by drifted snow up to about 2m deep. Household refuse disposed in single basket dumps during the winter would have to be deposited upon such drifted snowbanks. Even if specific dumps were originally segregated stratigraphically by snow layers during the winter, the contents of individual dumps would necessarily have been intermixed in a lag deposit once the snowbanks melted away. Only relatively early fall occupations would be likely to produce discrete dumps of refuse deposited directly on uncovered ground, or preserve them in original context.

Accordingly, the few such deposits that were preserved in the House 7 midden (namely the thin, dense, mussel shell lenses observed in the north profiles of 1S/1W and 1S/2W north profiles) might well represent refuse deposited during the fall. The bulk of the A.U.3 and A.U.5 midden lenses, however, should be assumed to be more broadly time-averaged deposits representing, at best, single years of deposition if not several years of accumulation.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Analytical Unit 6

A.U. 6 comprises a group of thin humus and peaty soil lenses that directly underlie the midden deposits of A.U.5 in most portions of the excavation. Collectively, the lenses measure from 2cm to 13cm thick. The humus lenses have almost neutral pH (6.8) and are very rich in organic matter (30% soil O.M,), which is very fine grained and highly decomposed. These humus lenses are present primarily on the lower terrace slopes, in places where organic matter would collect as sediment. Brown peaty deposits are present as well in most parts of the excavation. These generally have highly decomposed, compacted, turfy organic matter and are accompanied by small quantities of charcoal, bone and contact-period artifacts. The sediments of A.U.6 are wet and bones recovered in this analytical unit tend to be poorly preserved.

A buried Ah soil horizon is present at the lower contact of A.U.6 in excavation unit rows 1w to 4w, directly overlying sands found in A.U.7. The layer is composed of a dense, flattened, mat of very densely packed, poorly decomposed grass, with a small amount of more decomposed red-brown organic matter. This soil horizon is poorly developed as it was less than one centimetre thick and peeled cleanly off of its clean sand substrate. Mixed with this soil horizon were a small amount of pea-sized gravel, some poorly preserved, dog-chewed animal bone fragments and a few iron artifacts indicating that this ground surface dates within the contact period occupation of Uivak Point 1. Also of interest is that the buried soil horizon preserves the contour of an older terrace slope which, despite minor undulations and the mass of built-up sediment and cultural debris deposited over it, closely approximates the shape of the modern terrace slope.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The sediments of A.U.6 appear to have been soil horizons and deposits of detrital organic matter characteristic of slow rates of accumulation and relatively stable ground surfaces. Following this interpretation, A.U.6 likely represents a young ground surface upon which the first middens of A.U.5 were deposited, a surface that is contemporaneous with, or predates, the construction of House 7. Because it is completely capped by the midden deposits of A.U.5, A.U.6 certainly predates the occupation of the house. The contact-period provenance of artifacts in A.U.6 implies that this area of the site was used in a non-intensive manner prior to the construction of House 7 itself.

Analytical Unit 7

Underlying the midden deposits of A.U.5 and artifact-bearing peat and humus lenses in A.U.6, are a series of sand and soil lenses that are grouped together here as A.U.7. The upper contact of this group is as deep as 85cm below surface and it is the basal analytical unit of the midden excavation. These layers are quite damp and permafrost was encountered in the deeper portions of the excavation. Up to 25cm of A.U.7 sand and humus lenses were exposed in portions of the midden profile; no standard midden lenses with dense household refuse deposits are present within the group. Nevertheless, lenses of burnt organic matter indicating cultural activity were found in A.U.7. The only artifacts recovered in these layers are flakes of lithic debitage, probably of prehistoric origin.

The uppermost component of A.U.7 is an extensive lens of compacted, yellow-brown, sand cemented by a small amount of organic matter in 1S/0W and 1S/1W. This deposit extends under the entrance passage wall and occupies the same stratigraphic position as large stones paving the floor of the entrance passage. In the eastern end of the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

midden excavation, soft, light grey to white sands underlie the compacted yellow brown sand and these, in turn, overlie mottled gold-brown sand and, finally, compacted, poorly sorted gravel. The lower sediments are geological elements of the raised beach terrace; the gravel and gold-brown sand are part of its underlayer stained by iron oxides and reduction, while the grey loose sands are its weathered and remodeled surface layer. Analogues for these sediment types are visible in exposed and excavated parts of the beach terrace elsewhere on the site.

Further west and down the terrace slope in the 3w and 4w unit rows, the highest layers in A.U.7 are lenses of stained and transported beach sand with very thin lenses of dark brown peaty soil. In 1S/3W and 2S/3W, the uppermost sand lens is disturbed and contains both charcoal flecks and a substantial concentration of pebble-sized lumps of crusty organic matter. This material is apparently burnt fat and was deposited in the hollow immediately west of the large boulder that sits amidst the midden excavation. Beneath these lenses was a final body of wet, compacted, grey beach sand with gold-brown streaks and mottles.

In the westernmost portion of the excavation, A.U.7 consists of multiple thick lenses of very fine, wet, black humus alternating with a thick lens of very hard, coarse , red-brown sand and many thin lenses and laminae of white and grey sand. Flakes of lithic debitage were recovered in the white sand layers, including flakes of Ramah quartzite. Units 1S/7W and 2S/7W extend into the flat boggy meadow beneath the terrace slope. There is limited natural or anthropogenic sediment accumulation in this area and, as a result, sterile substrates grouped within A.U.7 were encountered within 15cm of surface in the western limit of the excavation. These sediments include a lens of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

dense, hard, red-brown sand and an underlying layer of poorly sorted red sand and gravel with rounded pebbles and cobbles, which is another deposit of beach sediment.

A.U.7 represents a zone of transition between geological deposits composing the raised beach and the remodeled terrace slope upon which House 7 was built and its midden deposited. *In situ* beach gravel substrates were uncovered in the western and eastern extremes of the midden trench. A layer of sand drift overlies these gravels throughout the terrace. The various sand deposits in A.U.7 likely all are derived from this drift. The coloured sands are stained by oxidized iron , periodic reduction or by illuviated organic matter while the white and grey sands are weathered beach sands.

It is apparent that the terrace slope has not been entirely stable. There are multiple sand lenses from both terrace substrates and drift deposits represented on the terrace slope, indicating periods of substantial or rapid sediment deposition. Thin lenses of peaty soil and thick humus lenses that are indicative of more gradual processes of sediment accumulation separate these sand lenses. As well, some of the overlying sand deposits in A.U.7 show evidence of disturbance or mixing through human as well and geological agencies. Finally, there is evidence of direct contribution of charcoal and burnt fat (comprising either waste from blubber processing waste or household fuel waste) to A.U.7 sediments.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 7 Midden Artifact Assemblage

Description of the Artifact Assemblage

The House 7 midden assemblage is the subject of ongoing research. Accordingly, only a brief summary of the preliminary analysis of the assemblage will be presented here. Frequencies of artifacts classes by type are presented in Appendix 2. The collection is substantial, and consists of approximately 839 artifacts, not counting lithic debitage.

Just over a third of the assemblage is made up of shavings, chips, and trimmings bone, ivory, wood and hide. A very large part of the midden assemblage (343 artifacts or 40% of the assemblage) was composed of European-made goods. As well, imported iron and copper goods, such as nails and sheeting, were reworked to make a large portion of the artifacts of more traditional design, such as harpoon endblades, or were used as components, such as rivets, in complex artifacts.

A small number of articles related to sea mammal hunting in open water and on sea ice were found in the midden. Equipment for open water hunting included seal bladder nozzles, float mending plugs and a pair of harpoon foreshaft sockets. Items used specifically in ice hunting included a harpoon finger rest and a drag handle. Among other sea mammal hunting implements were three ivory harpoon heads. One was a complete example of a flat form, Thule Type 5 harpoon with a hammered iron endblade secured by an iron rivet, a line hole parallel to the endblade, and a closed shaft socket. Its base is broken but appears to have had two dorsal spurs; one of these spurs remains. The harpoon measures 55.1m along its length (73.6mm with the endblade) and 16.2mm

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

across its greatest, but incomplete width and resembles Type 5 harpoons from Greenland described by Gulløv 1997: 446).

Another complete harpoon specimen is closed socketed Type 4 harpoon head with a single dorsal spur and endblade slot parallel to the line hole (Gulløv 1997: 446). This specimen measures 90.8mm long and 5.9mm wide. Fragments of three other harpoons were recovered; one had a fragmentary iron endblade, another appears to be the dorsal spur of a harpoon head with a parallel line hole, while a third was a mid-section fragment with a line hole. Two iron items, probably nails, had been hammered to make projectile points that may been intended as endblades.

Terrestrial hunting items included the nock end of a bow and arrow points (or portions thereof) made of iron, wood and antler. Two loose projectile points or endblades were made of hammered iron. Firearms and their related equipment accounted for the remaining hunting implements. These items included gunflints, a single musket ball (14.35mm or 0.565 inches diameter) and one large shot (11.2mm 0.44inches). Three fragments of cork were identified. Some of these fragments were too large to have been from bottle stoppers and might have been a part of imported fishing equipment.

Objects related to transportation were derived from both dog teams and boats. These included bone paddle tips and paddle edge strips, one komatik slat and eight sled shoes, as well as trace buckles and toggles used in dog teams' harnesses.

Several kinds of items typically associated with the building and maintenance of houses and the making of material goods were found in the midden. These included head and handles of mattocks and picks, used for excavating sod houses and for chopping holes through ice, parts of bow drills and bone scrapers and fleshers. A number of other

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

tools were trade goods, including an iron axe head, a chisel, a file, an awl, a large number of forged iron nails and spikes (which are the most common of all artifact types in the midden) were found. Several intact and well-preserved specimens displayed rose-type heads. The shanks of many nails and spikes were encrusted in shreds of wood that had been impregnated with, and preserved by, iron oxides, indicating that they were discarded while embedded in scrapped wood.

A variety of ironmongery, and battered pieces of lead and copper or brass parts, tubes, strips and sheet were also recovered, along with wood and bone pegs and wedges. The assorted broken metal items appear to be the remains of larger objects that were broken up in order to gain access to their constituent parts. While iron and copper are readily refashioned by cold hammering, lead is especially easy to cast and a small amount of lead casting waste was found in the midden.

One *ulu* handle and six knife blades were identified in the midden, along with wood and bone handles for thirteen other knives. The knife handles were for straight-bladed knives, representing both traditional patterns of "men's knives" and European knives. Many of the handles have sockets and drilled holes and recessed lashing grooves for hafting blades, and suspension holes drilled through the butt end of the handle. Different forms of handles were present but in general they are remarkably similar to knife handles recovered by Bird from his excavations at Avertok (see Bird 1945: Figure 19b, c, d, n; 25c). Some handles were made from one piece of bone or antler but others were made of two matching scales that were riveted together.

Other household implements were used in tasks of food preparation and serving food, which was a major part of the labour traditionally performed by women. A number

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of these artifacts were fragments of soapstone vessels and lamp and wick trimmers used in the cooking of food, and the heating and lighting of houses. Along with lamps, quantities of charred fat were found in the midden, the residue of the cleaning of oil lamps. Fragments of a wood ladle were recovered. Three round to ovoid wood discs, measuring between 20cm and 50cm in diameter, were the bases of cups or other types of small containers. These discs and were circular to somewhat oval in shape. The bulk of items related to serving of food were, however, glass and especially ceramic vessel fragments; 38 ceramic vessel sherds and 6 glass vessel fragments were identified, making these collectively one of the frequently represented categories of artifacts in the midden.

Only one object from the midden was clearly related to clothing, a single fastening hook from a European garment. Ornaments and personal objects were much more commonly represented, however. Among these were one wood and one ivory comb (both are European-made goods). Eight perforated animal teeth were collected; these were used as pendant ornaments and in fringes on clothing (Karklins 1992: 205); most of these were made from fox canines, a few others were made from those of dogs and seals. Four small globular bone items with perforated tangs were recovered; these resemble items from the Brooman Point site that were identified by McGhee (1984: 151) as pendants. A small number of fragments of clay pipes were also recovered.

Four playthings, a bone *ajagaq* toy, a wooden doll and a miniature soapstone pot and lamp, were recovered. The *ajagaq* piece is a plain cylinder made from a walrus baculum with multiple drill holes. The doll was made from a billet of wood about 11cm long, it has very plain rectangular body without arms and or legs, and a spool-like head with smooth face. At the top of the head is a woman's hair-bun. The doll is rather like

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

some described by Gulløv in the Greenlandic Thule sites of Kangek (L13.3407 304) and Illorpat 3(igd 3536 and 3667) (Gulløv 1997: 217-218, 304).

The midden assemblage included two notable fragments of carved ivory. These were strips of ivory that were carved on one side and left flat and smooth on the other. These are somewhat similar to ivory pendants from the Brooman Point Thule site (McGhee 1984: 151) and the Ruin Island Early Thule site (McCollough 1989) elsewhere in the Canadian Arctic, although the specimens from Uivak Point lack suspension holes (one is fragmentary). The silhouette of the complete specimen vaguely resembles an abstracted whale or seal body, with a concave flipper or tail at one end. McCullough (1989: 206) identified somewhat similar carvings in site on Ruin Island and noted that they resemble miniature needle cases (McCullough 1989: 206). It is possible that these items are similar objects, perhaps used as ornaments on clothing.

Descriptions of Diagnostic Artifacts

Having described the House 7 midden artifact assemblage in a general fashion above, a typological study of selected artifacts, specifically the trade goods, is presented below. This limited analysis was conducted in order to provide dates for the midden deposits and to related the midden to the occupation of House 7. In this section, detailed descriptions of artifacts with diagnostic potential, particularly buttons, ceramics and beads, is presented, along with available data pertaining to their commercial sources and the date ranges with which they are associated, derived from documentary sources or other dated archaeological sites.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Ceramics and Glass

Most of the recovered ceramics were plain, undecorated creamware vessel sherds. Nevertheless, a variety of other types of ceramics were also represented in the midden, including pearlware, annular ware, red earthenware, red earthenware "Jackfieldware", plain stoneware with red-orange, buff and grey coloured salt-glaze, and "scratch blue" stoneware sherds of English manufacture. Some sherds were decorated with Chinese-inspired painted patterns in blue glaze. An annular ware sherd was decorated with parallel brown and gold glaze bands, an identical pattern was observed on annular ware sherds found in House 7. One red earthenware sherd had white glaze on the interior surface, and brick-red glaze with a white glaze band on the exterior surface.

Creamware ceramics were originally marketed after approximately 1740 –1755 in the mid-18th century and were especially popular in the late 18th to early 19th century (Godden 1966: xv-xvi; Hume 1991: 123-125). Similarly, "Jackfield ware" style ceramics were most popular between about 1740 and 1780 (Godden 1966). Pearlware ceramics were marketed by about 1760 and were especially common from about 1800 to 1820 (Hume 1991: 129-130). Plain salt-glazed stonewares were produced widely in England from about 1730 to 1777 (Godden 1966: xiv-xv). English "scratch blue" stoneware ceramics were made from about 1760 to 1790 (Hume 1991: 118). Annular wares were first circulated in the 1780's and were most common between about 1795 to 1815 (Hume 1991: 131-132).

A total of 12 glass fragments were also retrieved. Of these, six were from vessels (especially green bottle glass) and two were clear, flat glass fragments. Eleven fragments

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of red clay brick and tile were also found. Some of these items bore traces of abrasion and were likely collected for use as whetstones and abraders.

Clothing and Adornments

Two fragmentary combs were present in the midden assemblage. One of these specimens was made from a thin plate of ivory, the other from wood. Both had numerous teeth, regularly spaced teeth and are similar in form to comb fragments found in House 7. One relatively complete double-sided specimen measures approximately 5cm in length and has a trapezoidal center section with teeth of different size cut into its opposite sides; the teeth were 1mm to 0.5mm wide, set 0.6 to 0.3mm apart. The other had teeth 0.5mm wide set 0.2mm apart. The fineness and uniformity of these combs suggests that they, and the others recovered from the site, are imported, manufactured articles. A wooden comb identical in form to the larger of these combs, identified as a lice comb, was recovered in the wreck of HMS *Pandora*, which sank in 1791 (Gesner 2000: 125). Hume (1991: 174-175) describes the use of such combs from the 17th to the 19th century.

Beads

A total of 40 beads were recovered in the midden and are reviewed in Table 7.2. Thirteen of these were polychrome beads with brick red opaque glass overlaying pale green or clear glass cores. These beads were shaped as short cylinders measuring from 1.5mm to 2.8mm long to 2.7mm to 4.2mm wide, with bore diameters of 1mm to 1.4mm. They are classified as Kidd Type IVa6 beads and are commonly termed "Cornaline d'Aleppo" or "Green Heart" beads.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Twelve white beads with opaque cores and glossy translucent exteriors were found. These beads were classified as Kidd Type IVa13 beads and measure 1.5mm to 5.1mm long, 2mm to 5.1mm wide and have bore holes 0.7mm in diameter. Two other yellowish-white opaque beads with dull finishes were found. These two were classed as Kidd Type IIa13 beads and measured 5.1mm to 8.0m long, 5,1mm to 6.4mm wide and have bore diameters of approximately 1mm. A fragment of a white ellipsoidal bead made of wound, opaque glass was found. This specimen was most similar to Stone's Type CII. SA, T1,Vd bead and to a type that Ross (1990: 49) classed as Kidd Type Wlc-bops-2.

One small globular bead was of very dark burgundy, almost black, translucent glass. The bead measures 3.1mm long, 4.4mm wide and its bore has a diameter of 1.3mm. It is classed as Kidd Type IIa7. Brain (1979) described a similar bead (variety IIA5) which he dated between 1600 and 1890, with a mean date of 1745. A larger, dark green, translucent globular bead measured 7.9mm long, 9.2mm wide and had a bore 2.6mm in diameter. This bead was classed as Kidd Type IIa28. Four turquoise beads with globular, short cylinder and doughnut shapes were found. These measured between 0.4mm and 3.0mm long, 0.6mm to 3.4mm wide and had bores 0.8 to 1.5mm in diameter. These beads were classed as Kidd Type IIa40 and IIa41.

Two doughnut-shaped seed beads were made of clear, bright aqua glass. These beads measured 1.7mm long, 2.8mm wide, and had bore 0.9mm in diameter. They are classed as Kidd Type IIa45 beads. A similar-shaped seed bead was made of translucent cobalt blue and is classed as Kidd Type IIa56. This bead measures 1.8mm long, 2.9mm wide and has a bore 0.9mm in diameter. This specimen was found in association with a

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 7.2 Bead Types Recovered in House 7 Midden Excavations

Bead Type	Description	Decoration	Shape	Size (Length/ Width/Bore) in mm	#	Date (see text for ref.)
IIa13	Drawn, white opaque with yellowish tinge	Rounded, dull	Short cylinder	Large 5.1-8.0/1-6.4/1	2	?
IVa13	Drawn, compound, opaque white core, transparent outer layer	Tumbled, glossy	Short cylinders, doughnut	Very Small to Large 1.8-5.7/2.4-7/0.8-2	12	1600-1890 (1754)
IIa7	Drawn, very dark burgundy (black) translucent	Smooth, dull	Globular	Small 3.1/4.4/1.3	1	1600-1890 (mean =1745)
IIa28	Drawn, dark green translucent	Smooth, dull	Globular	7.9/9.2/2.6	1	?
IIa40, IIa41	Turquoise translucent	Smooth, glossy to dull	Globular, short cylinder, doughnut	Very Small to Small 0.4-3.00/0.6-3.4/0.8-1.5	4	?
IIa45	Bright aqua blue, clear seed bead	Smooth, glossy	Doughnut	Very Small 1.7/2.8/0.9	2	?
IIa56	Cobalt blue, translucent	Smooth, glossy	Doughnut	Very Small 1.8/2.9/0.9	1	?
IIa23	Bright green, clear seed bead	Smooth, glossy	Doughnut	Very Small 2.4/2.8/1.2	1	?
WIc-bops-2	Wound, opaque milk white,	Satiny texture, striations	Ellipsoid	Medium to Large 5.0-10.0/4.9-7.1/1.2-2.1	1	1700-1860
IVa-6, "Cornaline d'Aleppo" Green Heart	Wound and Drawn, composite construction with clear glass over opaque red-brick glass, over pale green translucent core	None	Short cylinder, doughnut	1.6-4.1/2.2-4.5/0.8-1.5	13	1600-1836
WIIIb-bclc	Wound, white opaque	Combed translucent blue combed, looped stripe around circumference	Barleycorn ellipsoid	10-9-11.4/6.5-7.4/1.5-1.9	1	1670-1760, 18th-19th century
?	White ceramic (?), opaque, pressed in mould? Three join lines	Red, brown, blue, yellow glass flakes embedded on surface	Globular	7.2/ 6.5/ 1.1	1	?

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

white Type IIa13 seed bead; the two may have been strung together. One small doughnut shaped seed bead of bright green clear glass measured 2.4mm long, 2.8mm wide and had a bore diameter of 1.2mm. This bead was classified as Kidd Type IIa23.

One fragment of a wound bead of opaque white glass decorated with blue translucent combed glass loops was found. The bead fragment measures approximately 38.5mm in length, 7.5mm in width and has a bore diameter of 2.0mm.This artifact was classified as a Kidd Type WIIIb-bclc bead, several of which were recovered from the House 7 excavation.

A fragment of a milky-white opaque globular bead with a glossy surface was found. This bead is decorated with flakes of brown, pink, yellow and blue glass embedded in its surface. It is a ceramic bead with three obvious join lines, made from three lumps of paste pressed in a mold and then fired. This bead was not classified to type but two identical beads were recovered in excavation of House 7.

Kaolin Pipes

A total of 8 kaolin pipe stems and 9 pipe bowl fragments were identified. Two plain bowl fragments had the letters "T" and "D" stamped on the left and right sides, respectively, of their heels. Identical pipes are quite common in Anglo-American archaeological sites in North America that date to the 18th and 19th centuries. Iain Walker associates the simple TD pipe with a London pipe-maker named Thomas Dormer and dates their period of use from ca. 1755 to ca. 1830 on the basis of archaeological evidence, though copies with similar shapes were made until the 20th century (Walker 1971: 65; 1983: 36-38).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 9

House 9 is a smallish rounded turf structure located immediately north of House 3, in boggy ground just up the slope from the 11m asl beach terrace. The house has very low walls and in places its plan is obscured by frost-heaved hummocks. The house's outer walls measure about 10m by 7m, while its interior dimensions are 7m by 6m. The entrance passage extends 3-4m from the southwest-facing wall.

Like House 3, House 9 is covered in low growths of *Empetrum*, *Equisetum*, dwarf *Betula* and *Sphagnum*. Soil cores placed within the house encountered very wet peat overlying floor pavements while wet peat and permafrost were identified south and west of the house. In 1994, a 50cm by 50cm test pit was placed in the western portion of the house floor. This test came upon pavements within 15cm of the surface and quickly filled with very cold water, suggesting proximity to permafrost. No artifacts or animal bones were recovered.

Dating Uivak Point 1 and Excavated Archaeological Contexts

Dates for the occupation of Uivak Point 1 may be obtained through several independent methods. In most studies of contact period archaeological sites in Labrador, primary dating evidence has come from contemporary historical descriptions and analyses of diagnostic artifacts. These methods have also been practically applied to the dating of excavated contexts at Uivak Point, along with radiocarbon and dendrochronological dating methods. Results of these studies are summarized below.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Historical Documentation

Descriptions of the Uivak Point site appear in several historical sources, most of which were chronicles kept by missionaries of the Moravian Church, especially those of the Okak Mission. The first permanent Moravian Mission settlement north of Nain was established in 1776 at Okak Harbour, only 7.5km south of Uivak Point. Missionaries living there wrote official diaries that described aspects of the local environment, the secular and spiritual life at the Mission, and the activities and settlements of the Inuit who lived in the region. These records were kept from the start of the Mission to its closure in 1919 and have been extensively studied by ethnohistorians, notably J. Garth Taylor (1974), Carol Brice-Bennet (1977) and Hans Rollmann (1985).

Working from the various Okak Mission diaries and records, J. Garth Taylor and Helge Taylor (Taylor 1974, 1988,1990; Taylor and Taylor 1977) demonstrated that Uivak Point was occupied every winter between 1776 and 1798 (see Table 7.3). The site was not occupied in 1799 but was reoccupied between 1800 and the winter of 1806-1807 (Taylor and Taylor 1977: 60-61), giving the site a documented occupation span of at least 31 years. While they reported that precise population data for Uivak Point 1 was only irregularly recorded in Mission diaries, Taylor and Taylor (1977: 61) were able to summarize the available data in a table, which is reproduced below. During the years for which there is appropriate data, at least two and as many as four houses were occupied each winter. During these winters, the size of the population residing at Uivak Point 1 ranged between 35 people and an estimated 125 people, representing up to 25 nuclear families.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

It is impossible to determine the earliest date of occupation of Uivak Point 1 on the basis of these data, as the site was already in intensive use when the Okak Mission station was established in 1776. Neither is it possible, as yet, to date specific houses exclusively with these data. Nevertheless, it is clear that several of the houses were occupied simultaneously and therefore have contemporaneous components that date to 1784 or later. Given that there are ruins of only nine sod houses at the site to account for all the documented occupations, these data also imply that most, if not all, of the nine houses were most recently occupied between 1776 and 1806.

Taylor and Taylor (1977: 61) report that no records exist for the occupation of the site after the spring of 1807. Because the Moravians continued to make comparable records for the Inuit settlement that developed around the Okak Mission after this date, it seems likely that the spring of 1807 is a reasonable estimate for the final occupation of the site.

Relative ages for some of these houses may be tentatively inferred based on this documentation and the superposition of house structures. House 2/4 appears to have been one of the most recent occupations and is perhaps one of the houses occupied after 1800, as its walls intrude upon those of neighbouring houses. Houses 5 and 8 appear to have had structures constructed over their walls and therefore appear to have been older dwellings, perhaps occupied before the documented occupation of the 1770's and later. Houses 1,3,6,7 and 9 are isolated structures and, accordingly, their relative ages cannot be assessed simply on the basis of superposition. Nevertheless, House 7 may be another recent structure as it is cut into the turf bank below Houses 2,4,5 and 8 and its floor lacks obvious traces of midden deposits originating from these structures.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 7.3 Populations Occupying Uivak Point 1 between 1776-1799 as Described in Moravian Mission Diaries (data from Taylor and Taylor 1977: Table 1).

Year	Date of Count	# of Houses	# Families	Population
1776-1777	23 Dec.	2		59
1777-1778	31 Dec.	3		73
1778-1779				Occupied
1779-1780				Occupied
1780-1781	31 Dec.	2		39
1781-1782	31 Dec.	3		65
1782-1783	31 Dec.	3		70
1783-1784	31 Dec.	4		64
1784-1785	31 Dec.	3		56
1785-1786	31 Dec.	3		59
1786-1787	31 Dec.	3		52
1787-1788	?			Occupied
1788-1789				Occupied
1789-1790				Occupied
1790-1791	31 Dec.			35
1791-1792	31 Dec.			50
1792-1793	31 Dec.			(80 estimated)
1793-1794				Occupied
1794-1795	31 Dec.		25	(125 estimated)
1795-1796				Occupied
1796-1797				Occupied
1797-1798				Occupied
1798-1799				Abandoned
1799-1800				Occupied
1801-1802				Occupied
1802-1803				Occupied
1803-1804				Occupied
1804-1805				Occupied
1805-1806				Occupied
1806-1807				Occupied

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Dates from Artifact Assemblages

Relative dates for the occupation of Uivak Point 1 may be obtained through analyses of the artifacts recovered in the various excavation contexts. In this initial analysis, a range of artifacts proved useful for building chronological frameworks, including primarily European trade goods such as kaolin pipes, buttons, beads and ceramics. Some traditional technologies and material culture items, such as worked stone and harpoon heads, are potentially useful dating tools as well. The dates associated with the manufacture of use of these artifacts were presented in earlier discussions of recovered material culture assemblages. The distributions of dates for trade goods types recovered in the different excavation contexts are presented graphically in Figures 7.10, 7.11, 7.12 and 7.13.

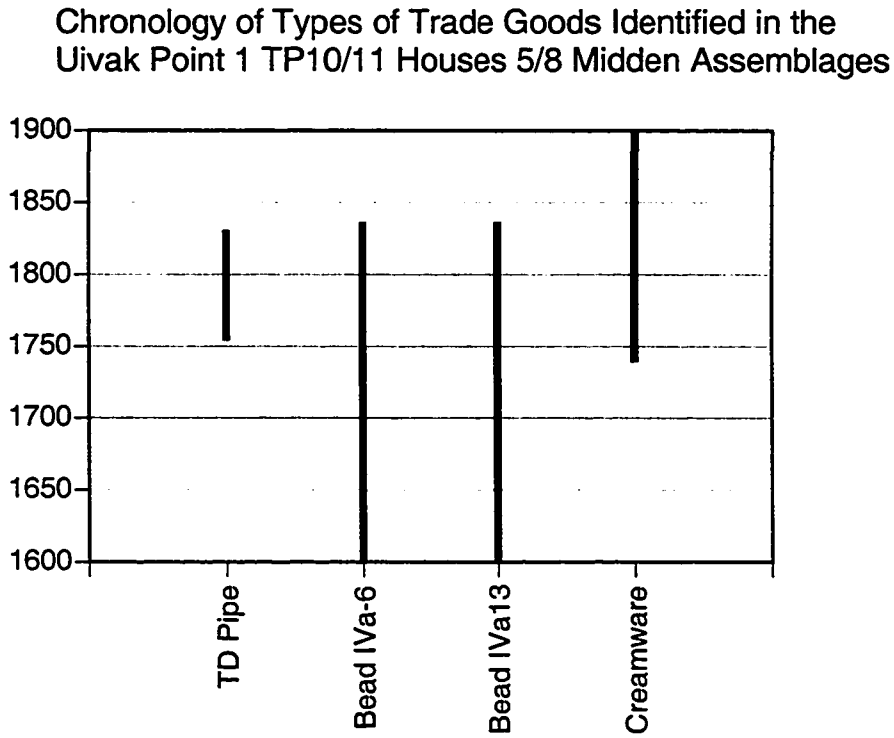
As seen in all these figures, many types of artifacts, especially some bead types, were made and used over long periods of time and are, at best, coarse dating tools most useful to distinguish 18th and 19th century contexts from those dating to the 16th to 17th centuries, or those predating European contact. By this measure, all the contexts excavated at Uivak Point 1 may be dated to the Contact Period (ca. 1500 and later). Nevertheless, the presence of more traditional material culture items, such as lithic tools, point to earlier but unidentified Thule, Palaeoeskimo or Prehistoric Indian occupations as well.

All the excavated areas of Uivak Point had European artifacts that dated broadly between ca. 1600 and 1850. Kaolin pipes, buttons, ceramics and some types of beads had tighter date ranges and allow the attribution of more highly resolved dates that indicate

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

occupation of Uivak Point by the later 18th century to the early 19th century. Artifact dates for each context will be discussed below.

Figure 7.10 Uivak Point 1 Test Pits 9, 10 and 11. Distribution of Artifact Dates



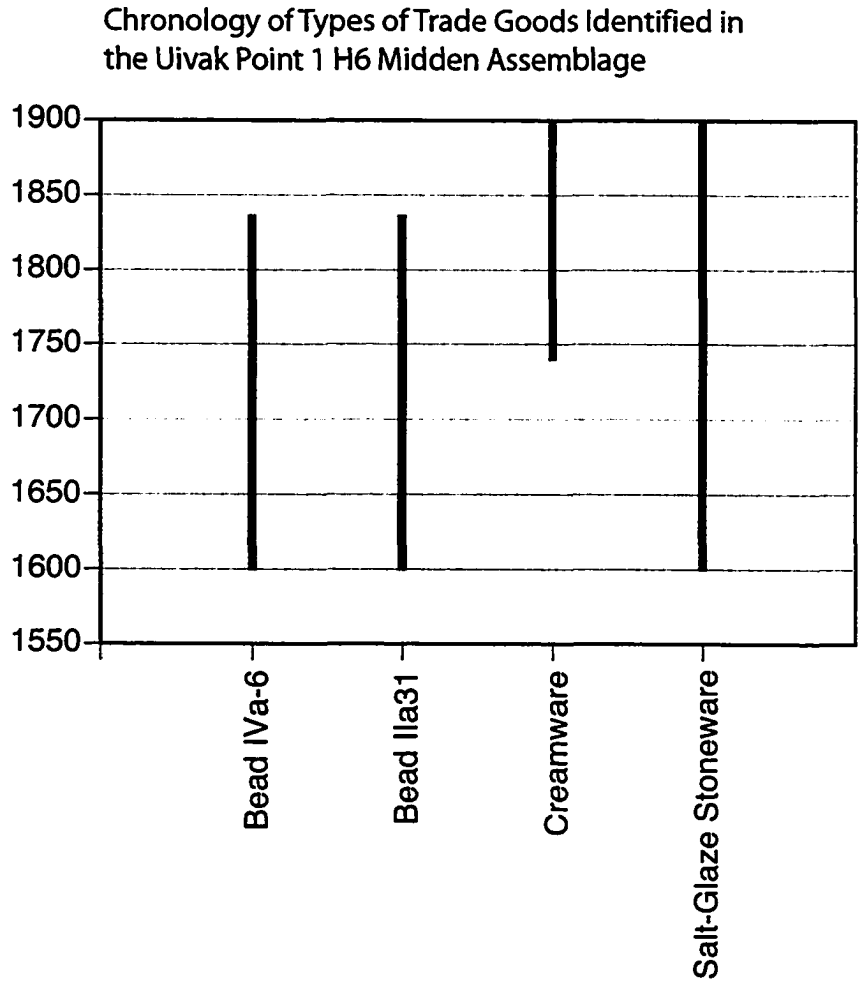
House 5/8 Midden – Test Pit 10/11 Artifact Dates

A small artifact assemblage was recovered from this unit and as a result, this dating exercise depends on a narrow range of types and a small sample of specimens. The presence of European-made goods in the upper stratigraphic units in this midden indicates that it was accumulated during the Contact Period, after ca. 1500. Bead types

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

recovered in the upper layers of the unit (A.U.1), including Type IVa6 beads (which is the "Green Heart" or older type of "Cornaline d'Aleppo" bead), suggest dates between ca. 1600 and 1836 (see Fig. 7.10). Creamware sherds and fragments of TD pattern kaolin pipes refine this date to ca. 1750 to 1830, a span that accommodates the Moravians' historical site descriptions. The lower layers (A.U.2) lacked artifacts and accordingly cannot be dated.

Figure 7.11 Uivak Point 1 House 6 Midden. Distribution of Artifact Dates



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 6 Midden Artifact Dates

As with the House 5/8 midden excavation, the dating framework that can be established for the House 6 midden on the basis of artifacts is not detailed because only a limited assemblage of diagnostic artifacts was recovered. European-made goods, including numbers of forged nails, were found throughout the depth of this midden deposit, indicating that the entire midden deposit accumulated after ca. 1500 (see Figure 7.11). Types of beads found in the midden, including Type IVa6 beads, date the deposit to between ca. 1600 and 1836. The presence of creamware sherds in A.U.1 further refines this range to ca. 1750 to the early 19th century. An uncalibrated radiocarbon date of 180 ±50 years BP was obtained from a sample of charred wood found near the bottom of A.U.1, in the 15-20cm level (see Table 7.6). This date is consistent with those attributed to these artifacts and historically documented dates for the occupation of Uivak Point. A stoneware sherd found at a depth of 25cm indicates that the lower portion of the midden (A.U. 2) may date as early as ca. 1730 to about 1775. These dates fall within the two standard deviation range of ±50 years of the charred wood sample found in A.U. 1, the date of which will be discussed below.

House 7 Artifact Dates

The large and diverse artifact assemblage recovered from House 7 provides a broad range of artifacts that may be used to date the structure's period(s) of occupation. A number of types of artifacts (including double-sided bone combs, a mouth harp, several

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

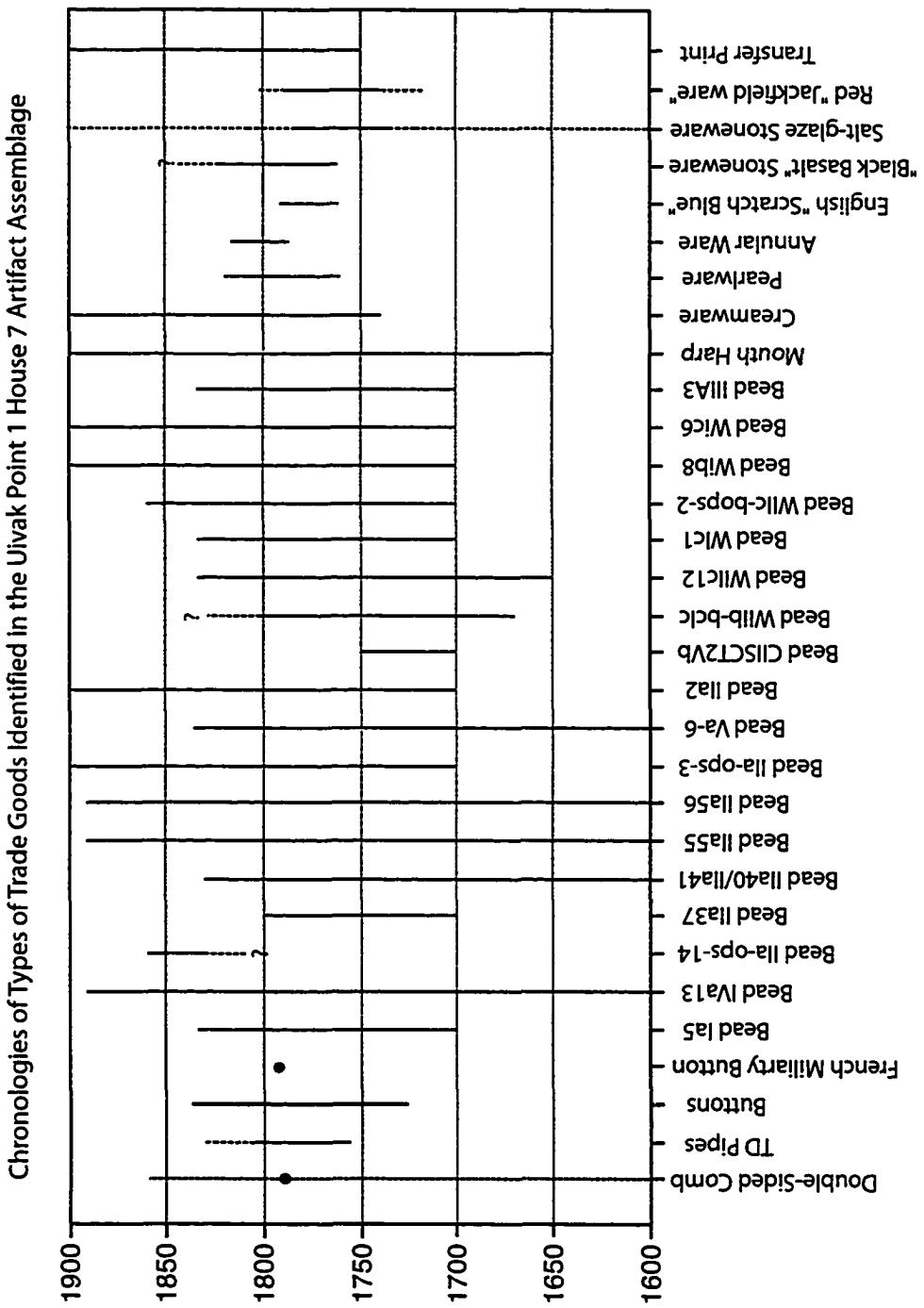
kinds of beads and earthenware and stoneware vessels), are goods that were made and used over a long period of time, from at least the 17th century to the 19th century (see Figure 7.12). Most of the diagnostic artifacts, including metal buttons and the bulk of the bead varieties, have been dated from the early 18th century to the middle and late 19th century at other archaeological sites. None of these types of artifacts had *terminus ante quem* dates earlier than ca. 1750. On the basis of the assemblage of trade goods, therefore, there is no clear evidence for a 16th of 17th century component to the House 7 structure, though it is possible that there was a Thule era component to the Uivak Point 1 site itself.

Several fragments of ground slate, including portions of harpoon endblades, ulu blades and flaked nephrite, were found in House 7. These types of artifacts are primarily associated with the period preceding contact throughout the eastern Arctic. Iron, once it was available through trade or from rare meteoric sources, was widely used for cutting edges and projectile points and ultimately replaced ground slate in the Neoeskimo toolkit. The presence of ground slate and nephrite in the House 7 assemblage provides some initial evidence for an undated pre-contact occupation of Uivak Point 1. Such evidence is inconclusive, however, as both iron and ground slate may have been used simultaneously for some time into the Contact Period. As well, no undisturbed contexts with *in situ* artifacts that clearly pre-dated European contact, were identified.

More precise dating evidence for House 7 comes from a smaller range of consumer goods that were produced after the middle to late 18th century, many of which were early commodities of the Industrial Revolution. These artifacts include a variety of new kinds of ceramics that were developed after 1730 and which

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.12 Uivak Point 1 House 7 Distribution of Artifact Dates



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

rapidly replaced many more traditional types of ceramics. A few of these were, in turn, soon replaced in the market by newer tradewares that gained greater popularity. This situation of accelerating industrial innovation, use of new materials, and adoption of new styles makes the artifacts of the later 18th and 19th centuries easier to use as dating indicators.

The bulk of the ceramics recovered from the house were fragments of plain creamware vessels, which were first made in the 1740's and became exceedingly popular from about 1755 to the early 19th century. "Jackfield ware" had a somewhat similar time range, having been common from about 1740 until the 1780s. Transfer printing techniques, present on several sherds, were developed by about 1750. Buff, grey and orange-red salt glazed stonewares, examples of which were found in the house, declined in popularity in the 1770s. Pearlware, English "Scratch Blue" stoneware and dry-bodied black stoneware were all made after ca. 1760. Annular ware was in use after about 1785 and was popular from about 1795 to 1815. Most of these types of ceramics fell out of production or common use between 1790 and 1815, though dry-bodied black stonewares were in use until about 1820 or later. TD pattern kaolin pipes have a time range of about 1755 to 1830, identical to those of the ceramics described above. Taken together, the dates associated with these artifacts suggest that House 7 might have had an early phase of occupation by ca. 1750-1760 and was certainly in use by ca. 1770-1790.

Dates for the later occupations of House 7 are somewhat more easily obtained, especially through artifacts associated with the large sleeping platform along the eastern wall of the house. One annularware sherd was found very near the bottom of the sleeping platform deposit of turf and twigs, indicating that much of the feature dates after ca.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1785. A copper alloy military uniform button from Revolutionary France was recovered in the upper layers of the same sleeping platform deposit, less than a metre away from the annularware sherd. Buttons of this type were manufactured for only a short time, between 1792 and 1793 and it thereby provides a well-defined *terminus post quem* date of 1792, or afterwards, for one of the last uses of the platform and presumably one of the last occupations of House 7.

The dates attributed for these artifacts found in the top and bottom layers of the sleeping platform effectively bracket the use of the sleeping platform between ca. 1785 at the earliest, and sometime after 1792 at the latest. Therefore, the most recent phase of the occupation of House 7 occurred between ca. 1785 and 1806 and the entirety of the house as seen today (including the sleeping platform and the upper portion of the floor deposit) was in use, constructed or deposited within this time span. This suggests that House 7 was one of the structures occupied relatively late in Uivak Point 1's documented history, and likely one of those occupied after 1800. This thickness of the deposit on the sleeping platform suggests that the house was occupied intensively or regularly during that period.

However, these dates should not be taken to indicate that House 7 was occupied exclusively after ca. 1785. It is likely that parts of the house, including the platform, were periodically rebuilt. Limited tests made in 2000 in the western house wall around the entrance passage suggested that an older structure (or structures) may lie underneath the extant House 7 ruin. Further excavations probing the areas beneath the excavated floor and walls are necessary to better establish the history of construction in this location.

The artifact assemblage provides no clear evidence for occupation of the house beyond the last historically documented occupation during the winter of 1806-1807.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

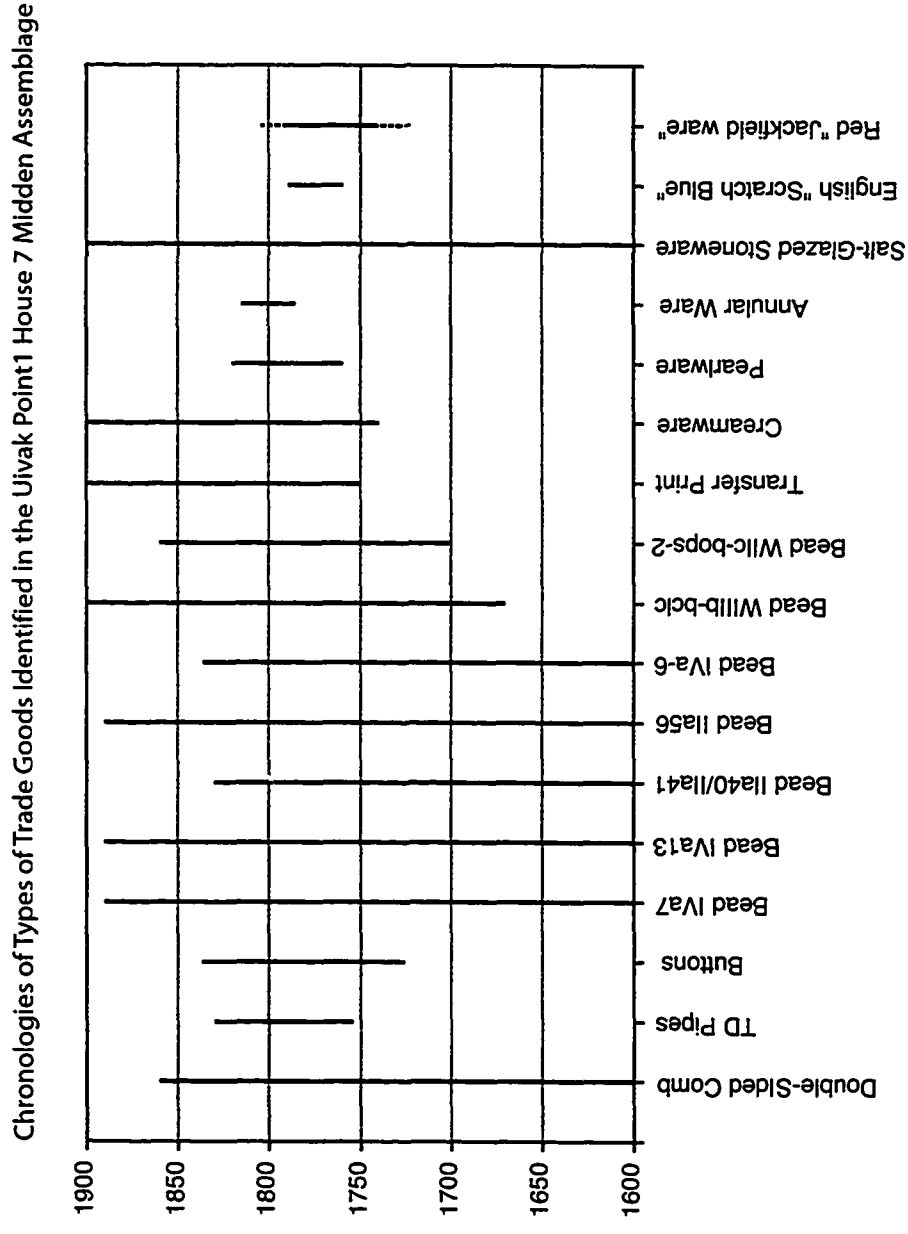
Several types of beads, metal buttons, and stoneware and creamware ceramics found in the house were in circulation after this date but are not precise dating tools because they were produced over long periods of time or lack well-defined histories. Significantly, none of the artifact types that were developed after ca. 1820 that are frequently encountered on historical sites, (such as cut or wire nails, percussion cap or cartridge ammunition, "White Heart" Cornaline d'Aleppo beads, late-pattern kaolin pipes or soldered tin food containers, to name a few), were identified in the House 7 assemblage. This suggests that Taylor and Taylor's (1977) date of 1806-1807 for the last occupation of Uivak Point derived from Moravian Mission records is indeed accurate. The lack or more recent types of artifacts also implies that floor deposits in House 7 were not mixed with, or capped by, intrusive deposits related to the documented reuse of the Uivak Point locality for fishing settlements during the 19th and early 20th centuries.

House 7 Midden Artifact Dates

Just as was the case in the House 7 assemblage, a number of chipped stone and ground slate artifacts were recovered in the House 7 midden excavation. Some of these were plainly prehistoric artifacts (belonging to Paleoeskimo, Maritime Archaic, or Intermediate Indian cultures) and are considered to be out-of-context finds. These items were perhaps incorporated into the midden along with turf blocks cut from soils bearing older archaeological deposits, or they may have been contained in underlying sediments that were disturbed by house building. Also, several fragments of ground slate were found, including harpoon endblades, indicating that the site might include a pre-contact Thule component as well. No evidence of a prehistoric or obviously pre-contact structure or *in situ* feature was discovered in the midden excavation.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 7.13 Uivak Point 1 House 7 Midden Distribution of Artifact Dates



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The time ranges associated with diagnostic trade artifacts identified in the House 7 Midden assemblage are plotted in Figure 7.13. This plot resembles that of House 7 in several respects, except that it is based on a smaller total artifact assemblage and includes a less diverse range of diagnostic artifacts. Accordingly, the dating scheme of the midden is somewhat less finely resolved than that of House 7.

The bulk of the midden's diagnostic artifact types (double sided combs, several bead types and salt-glazed stoneware) are associated with long periods of manufacture and use, and can only place the site within a broad framework from between the 17th century and the 19th century. Nevertheless, some of the same artifact types that proved useful in dating House 7 point to a date of the late 18th century to earliest 19th century date for the House 7 Midden assemblage.

These artifact types include metal buttons, creamware, pearlware, "scratch blue" stoneware, annular ware and TD pipes. Creamware, red-bodied "Jackfield ware", annular ware and "scratch blue" stoneware sherds were present in A.U.1 and A.U.2, the uppermost group of stratigraphic layers in the midden. As well, TD pipe bowls were identified in both A.U.1 and A.U.2. The presence of these artifacts suggests that the midden may date as early as ca. 1740 and that active deposition in the midden continued into the 1790's or later.

Matching types of ceramics were identified in both assemblages provides tentative typological links between the midden and house. Identical ceramic types were found in both of these contexts, including some earthenware vessels, red-bodied "Jackfield ware" and sherds of a small annularware vessel with distinctive parallel brown and yellow glazed bands.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

As well, fragments from several ceramic vessels were refitted, and directly link excavated portions of the house with A.U.1 and A.U.2 in the midden. Yellow-brown glazed red earthenware fragments in A.U.1/A.U.2 refitted with sherds found in deep floor deposits in the south end of the house. Refitting fragments of a "Jackfield ware" vessel were found in A.U.1/A.U.2 in the midden and in units located in the west wall of House 7. A.U. 1 is obviously a disturbed and mixed unit that includes, almost exclusively, colluvial debris from the erosion of House 7's walls and re-worked midden deposits. A.U. 2 also consists of disturbed colluvial material, including sediment and turf blocks and reworked midden deposits. Based on the stratigraphic position of A.U.2, and the presence of refitting ceramics, it is likely that A.U. 2 includes sediment, artifacts and faunal remains that are contemporaneous with the final occupations of House 7 (House 7's A.U. 2), either in primary or secondary context.

Salt-glazed stoneware sherds dated to the 17th to the 19th century were found in A.U. 3 and A.U. 5, the two major midden deposits. As well, wrought iron nails, glass and glazed red earthenware sherds were found in the lowest portions of A.U.5. Because A.U.3 and A.U.5 are interpreted as being zones of midden accumulation rather than colluvial mixing, the artifacts found in these deposits are probably representative of their real age. These finds indicate that the entire midden was deposited in the contact period, likely after ca. 1730. No artifacts indicative of the middle or late 19th century were identified in the midden assemblage.

In summary, the House 7 Midden may in general be dated to the 18th to early 19th century through its artifact assemblage. The date when midden accumulation began (and the date of A.U. 5) is as yet unclear, but it may have been as early as 1730. The upper

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

intact midden layer (A.U. 3) is equally difficult to date independently as it lacks sufficient artifacts that may be readily dated with relative precision. As it is the uppermost deep midden layer and is capped by A.U. 2, which contains sediment derived from the abandoned house, A.U. 3 is the midden layer that is most readily linked to the later occupation of House 7 and would therefore be dated by association to ca. 1785 onwards. A.U. 2 contains a small amount of midden deposit and a substantial amount of reworked sediment and detritus from House 7 and possibly A.U. 3. A.U. 2 likely spans the final occupation(s) of House 7 sometime before 1807, and the subsequent abandonment and collapse of the structure.

Radiocarbon Dates for House 7 and House 7 Midden

Samples of wood and charcoal were collected from the House 7 and House 7 midden excavations. Eight of these samples were selected for radiocarbon dating analyses, which were conducted by Beta Analytic Inc. These samples were analysed following Beta Analytic's standard radiometric techniques. Acid/alkali/acid pretreatments were used and C13/C12 ratio estimates were based on values typical for wood. Summaries of the results of these analyses are presented in Table 7.4.

Radiocarbon Dates for House 7

Radiocarbon dates were obtained from a large, well-preserved timber in the western wall of House 7, from wood lying on its sleeping platform and from twigs recovered in A.U. 2 on the house floor. These dates clustered fairly tightly between 330

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

to 200 ± 60BP (uncalibrated), an age range that is consistent with a 16th to 19th century house occupation and that accommodates the historical dates for the Uivak Point 1 settlement and the artifact dates obtained from House 7. The oldest date among these was obtained from the twigs lying on the house floor, which might have been a context that encouraged sample contamination.

Radiocarbon dates for House 7 Midden

Dates for five samples obtained from the midden range widely between the 5th century and 19th century AD. Unfortunately, these do not significantly resolve the dating of the midden. The oldest date (1440 ± 70 BP; or ca. 510 AD ± 70BP; uncalibrated) is from a sample of charcoal and predates, by far, the Thule migration into Labrador or even its occupation by Late Dorset peoples. It is the only date of this age for the Uivak Point site and, if accurate, it is may be too old to represent a tree that was still alive during the 17th or 18th century. The early date might possibly indicate that the sample was contaminated, that it was derived from driftwood, or that the Uivak Point 1 Inuit site disturbed an earlier occupation, contemporaneous with the Point Revenge culture, a late prehistoric Indian culture. No traces of structures belonging to this culture were observed around the Uivak Point houses. Nevertheless, chipped stone artifacts made of Ramah quartzite and chert that might be attributable to Point Revenge cultures were recovered in the Uivak Point 1 excavations, and were observed nearby at the Uivak 1 (HjCl-11) tent ring site.

The three more recent dates in the range cluster in the latter 19th century but, considering two standard deviations in estimated age, these samples may date

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

approximately from between 50 ± 50years BP and 60± 60 years. The earlier portion of the 2-sigma ranges of these dates readily agrees with the historically documented late 18th century occupation. Nevertheless, the later part of the range does not seem to be a reasonable estimation of the site's age. The Uivak Point locality was occupied for the final time around the late 19th to early 20th century, but the dated samples were buried between 45cm to 70cm deep in a midden without signs of stratigraphic disturbance and were not associated with artifacts indicative of the later 19th century.

Table 7.4 ^{14}C Dating of Wood Remains from Uivak Point

Sample #	Provenience	Context	Material	Conventional ^{14}C Age
Beta-125815	HjCl-9 H7M 98-01	2S/3W 65-70 midden	Wood and charcoal	60 +/- 60 BP
Beta-125816	HjCl-9 H7M 98-02	1S/4W 50-55 midden	Wood and charcoal	90 +/- 50 BP
Beta-125817	HjCl-9 H7M 98-03	2S/5W 50-55 midden	Charcoal	1440 +/- 70 BP
Beta-125818	HjCl-9 H7M 98-04	1S/1W 45-50 midden	Wood	50+/- 50 BP
Beta-125819	HjCl-9 H7M 98-05	2S/4W 50-55 midden	Wood (large Spruce timber)	420 +/- 50 BP
Beta-125820	HjCl-9 H7 98-06	1S/7E 30-40 house floor	Twigs	330 +/- 60 BP
Beta-125821	HjCl-9 H7 98-07	1S/2E 54cm bd house wall	Wood	260 +/- 60 BP
Beta-125822	HjCl-9 H7 98-08	1S/8E 37bd platform	Wood	200 +/- 60 BP
Beta-125823	HjCl-9 H6M 98-11	H6M 15-20 Midden	Charred wood	180 +/- 50 BP

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Interpretation of Radiocarbon Dates

The results of these analyses are somewhat equivocal and it is not difficult to specify several reasons for this ambiguity. One important factor is the relatively recent anticipated date of these materials. Radiocarbon dating techniques are most effectively applied to materials that are older than a few hundred years of age. The anticipated age of these samples (considering the Moravian Missionaries' description of a late 18th century site occupation) strains the practical limit of radiocarbon techniques. Furthermore, even relatively well-dated samples have standard deviations representing two or more human generations and fit only clumsily within the highly resolved historical chronologies of the recent past.

Sample contamination before and during excavations is an important source of error. Midden samples may be particularly vulnerable to contamination if the wood was deposited in contexts with high concentrations of residues of sea mammal tissues. Carbon from marine ecosystems tends to have lower ^{14}C ratios in comparison to those of similar age from terrestrial sources (Arundale 1981; Taylor 1987). Terrestrial-source organic matter that assimilates quantities of sea mammal fat, for example, may therefore be interpreted as erroneously old due to this contamination. Furthermore, a trace amount of coal was found in excavations within the house. While there is presently no archaeological indication that quantities of coal were present on the site, or that it was burned as an important fuel, small particles of coal may bias radiocarbon dates. Finally, despite attempts to collect samples quickly and correctly, and storage of samples within

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

plastic bags and in dark conditions, mold growth while in transport or storage may have had some contaminating effect on carbon isotope ratios.

Another anticipated source of dating error lies in the unpredictable use life of timbers as building materials. There is a lag between the felling of a tree and its final incorporation into the archaeological record due to its use life as fuel or timber. While wood was relatively plentiful in portions of Okak Bay, strong timbers from older houses or house building phases would likely have been reused in new house constructions. Similarly, even weathered or otherwize compromised timbers would have been useful as wall footers and as fill.

Compounding this problem is a practical tendency to preferentially sample the heartwood of timbers. The outermost layers of wood are often missing from archaeological specimens, having rotted or split away. As well, the inner parts of a wood specimen are less likely to be contaminated and therefore more likely to be used in the preparation of samples for radiometric dating. Because of the relatively slow growth rate of conifers in northern Labrador, sample location can have a significant effect on the estimated age of an archaeological timber. Black spruce in northern Labrador may take one hundred or more years' grow to have a trunk diameter exceeding 15cm diameter, a size that is useful for house building. Preferential sampling of heartwood for dating purposes may therefore systematically skew estimates of household occupation dates.

Dendrochronological Dating of House 7

Cross sections of a number of large timbers that were recovered from House 7 are currently being examined by Dr. Roseanne D'Arrigo and Dr. Brendan Buckley of the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Tree Ring Research Laboratory, Lamont-Doherty Earth Observatory, in order to identify their age through dendrochronological analyses. Most of these timbers came from excavated portions of the western wall of the House 7, especially in the vicinity of the entrance passage. Preliminary dates for three timbers are presented in Table 7.7; final results of these analyses were not available at the time of writing as these studies are ongoing.

Dendrochronological dates are obtained by matching patterns of rapid and slow growth in sequences of growth rings in archaeological samples with a regional master sequence (Baillie 1982). The master sequence is built by overlapping the growth sequences of extant old, living trees with those of recently dead trees and preserved, older, dead trees. Once individual years can be cross-matched, the year in which the tree began life can be calculated and, if bark is still visible, it is possible to determine the precise calendar year in which the tree died or was felled. In cases where bark or outer wood layers of substantial timbers are rotten or missing, the terminal growth ring provides a minimum *terminus post quem* estimate of the year in which the tree died and therefore for the archaeological context in which the sample was found.

While it can be a tremendously effective dating technique for archaeological sites, dendrochronology has specific requirements that must be met for it to be useful (Baillie 1982). Master tree ring sequences for the region in question must be established beforehand. The master sequence must be pertinent to the archaeological sample, matching the species and source area; usually this precludes dating of driftwood, imported or exotic wood, and only wood harvested from local sources can be dated. Because tree rings are obliterated in rotten wood, preservation conditions in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

archaeological sites must be excellent for the dating method to work. Finally, the method is most effective when large samples of wood are collected, as it is likely many will be difficult to date due to compromised preservation or questionable context. As well, dating numbers of samples rather than single specimens refines interpretation, since outer tree rings are often incomplete or missing, confusing the actual year in which the sampled trees were felled.

Fortunately, at Uivak Point, the various requirements for dendrochronological dating of archaeological sites are met. There are local spruce forests and driftwood was not required for building materials. Preservation conditions are adequate for wood preservation, with permafrost conserving timbers in deep deposits. As well, excavations in House 7 uncovered numbers of large timbers between 10cm and 35cm in circumference, some of which were very well preserved. Tree ring sequences for white spruce have been established for most of Labrador through sampling of forests in Napaktok Bay and Pistolet Bay, Okak Bay (Okak, Medusa and Nutak), the Nain region (Salt Water Pond and Ittikauk Lake) (D'Arrigo, et al, 1993, 1996; Overpeck, et al, 1997). These sequences extend as far back as the mid-16th century and provide a very useful (but, until recently, underutilized) framework for dating local-source archaeological wood specimens in Labrador.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 7.5 Dendrochronological Dates for House 7

Sample Number	Provenience	Context	Description	Depth	Tree Life Span
2028	House 7 1N/2E	West wall, North of entrance	Spruce Timber *Picea glauca*	55-60	1686-1780
2029	House 7 2S/3E	West Wall, south of entrance	Spruce Timber *Picea glauca*	?	1673-1775
	House 7 2S/5E to 3S/5E	West Wall, south of entrance	Spruce Timber *Picea glauca*	?	1670-1772 (~1800)

The preliminary dates that were available for this study were derived from three timbers excavated within the west wall of House 7. Information about these samples and their dates are presented in Table 7.5. One was located just north of the northern entrance passage wall, in unit 1N/2E. The other two were found south of the entrance passage, in units 2S/5E and 3S/5E. All of these samples exceeded 10cm in diameter and all three proved to be fairly old trees with more than 90 years of visible growth.

The last identifiable growth ring in the sample from 1N/2E was dated to 1780 (R. D'Arrigo Jan. 18, 2001: personal communication to S. Kaplan). Notably, a ^{14}C date of 260 +/-60 BP was also obtained from a sample of this timber, which is consistent with the age of the sample's early growth rings. This timber was found deep in the bottom of that unit and was covered by a thick layer of turf and earth comprising the house wall. The last identifiable growth rings of two samples recovered from south of the entrance passage were dated to 1772 and 1775 (R. D'Arrigo Jan. 18, 2001: personal communication to S. Kaplan). The ages and patterns of growth of these two samples were very similar and are almost certainly drawn from the same timber. These samples

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

were also found under the deep deposit of turf, earth, wood and whalebone that comprise the house wall.

Because of the stratigraphic position of these timbers within the house walls and effectively below the floor, their dates provide a *terminus post quem* date for the construction of the house, or at least of the rebuilding phase during which these timbers were buried. The most recent wood sample was dated to 1780 or afterwards, indicating that a major part of the western house wall was built on or after that date. This date is consistent with the estimated dates for the construction and use of the sleeping platform (1785 or later, until sometime after 1792), based on artifacts and the estimated late 18th century to earliest 19th century occupation of House 7 indicated by its artifact assemblage as a whole. Because all of the timbers from within the walls have similar dates, it is likely that much of the currently visible house ruin is the result of a relatively recent, large-scale, building effort on or after the approximate date of 1785.

Summary of Uivak Point 1 Chronologies

The archaeological site of Uivak Point 1 was dated through dendrochronology, radiocarbon dating, artifacts and historical references. Flaked stone tools and debitage found in the various excavations testify to the prehistoric occupation of the site. Ground stone tools may indicate that the site was occupied during the Thule period, while several flaked bifacial tools made of Ramah quartzite suggest the presence of earlier cultures as well. A detailed study of the lithic assemblage is required to identify the cultural provenience of these early components. Early outlier dates of 420 $\pm$50 years BP and 1440 $\pm$ 70 years BP obtained from wood and charcoal samples recovered from the House

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

7 midden excavation may be indicative of the general time ranges these prehistoric occupations. Tent rings and mid-passage structures of apparent prehistoric age are present in the general Uivak Point locality, but no structures or *in situ* prehistoric deposits were identified within the immediate site area or in excavations. For this reason, the presence of prehistoric artifacts in the excavation is most easily explained by cultural disturbance of pre-existing sites, especially through the cutting of turfs from older sod houses, for building materials during later occupations.

Records accumulated by missionaries of the Moravian Church provide a general framework for the historic-era occupation of Uivak Point by the Labrador Inuit. The site appears to have been already in use at the arrival of the Moravians in 1776. Winter settlements were documented at the site every year between 1776-1777 to 1806-1807, with the single exception of the winter of 1798-1799. Several sod houses were built and used during this period, with as few as one house and many as four houses occupied each winter. Moravian diaries have proven to be generally accurate chronicles and, without any archaeological evidence for sustained occupation into the 19th century, 1807 is accepted as an accurate record of the last occupation of the sod house settlement for the purposes of this study. The Uivak Point locality apparently remained without settlement until the late 19th century to early 20th century, when two small wood houses were built near the shore. These houses appear to have been in use until 1918, a date confirmed by oral histories and a brief archaeological investigation.

Several sod houses and their middens were investigated to varying degrees, from very limited testing to full-scale excavations. Four of these excavations could be dated

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

through their artifact content, radiocarbon and dendrochronological methods. The chronology of these contexts is summarized below.

Test Pit 10/11

Test Pits 10 and 11, located in an apparent midden area adjacent to Houses 5 and 8, were dated on the basis of their artifact assemblage and stratigraphy. These houses appear to be the oldest components of an intermingled cluster of four sod houses. The excavation had several thick deposits that were separated into two general analytical units. The upper unit (A.U.1) contained European artifact types that are conventionally dated to between ca. 1740 and 1830. A.U.1 may be dated therefore between ca. 1740 and 1807, given lack of material evidence for occupation after 1807. A.U.2 lacked dateable artifacts or organic remains and therefore cannot be directly dated. While it predates A.U.1, A.U.2 may overlap some or none of this 1740 to 1807 time range.

House 6 Midden

A substantial test excavation adjacent to the entrance passage of House 6 found a deep midden with several stratigraphic layers that were grouped into two general analytical units. Artifacts from the midden suggest that it dates, in its entirety, from between the middle to late 18th century, to the early 19th century. Artifacts and a radiocarbon sample provide imprecise indications that A.U.1 dates from ca. 1770 to 1807. Based on this and its own artifact assemblage, A.U.2 may date from approximately 1730 to 1770.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 7

House 7 appears to be one of the more recently occupied sod houses. The occupation of the house was dated through radiocarbon and dendrochronological analysis of wood samples and artifacts. Artifacts and radiocarbon samples provide indications that the house (or an antecedent structure) was occupied by about 1750 to 1760. Artifacts and tree rings suggest on-going occupation through the 1770's. The house had a clearly identifiable late phase of rebuilding dated to about 1785 or shortly thereafter, and occupation that likely extended until, or nearly until, 1807.

House 7 Midden

The deep, stratified, midden deposit outside House 7 was divided into 7 distinct units for the purposes of analysis. A.U.1 and A.U.2 are dated after ca. 1807 as they consist of sediment and materials derived from collapse of House 7 into a ruin. A.U. 2 also appears to span the year(s) immediately preceding the abandonment of House 7. A.U.3 is the uppermost deep, intact midden layer and overlies a stratigraphic break that probably corresponds to a phase of house rebuilding. On the basis of its artifact assemblage, A.U.3 dates between ca. 1740 and 1830. Given that is the final midden layer and it overlies A.U.4, A.U.3 may be tentatively linked with House 7's later occupation phase, between ca. 1785 and up to 1807.

A.U.4 is a thin unit of sand and gravel lenses that may have been produced during an episode of house building or renovations. As such, A.U.4 may date to the House 7 rebuilding phase of ca. 1785. A.U.5 is the earliest midden deposit. It dates entirely to the contact period and has artifacts indicative of the general period of the first half of the 18th

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

century to the early 19th century. With its artifacts and the tentative identification of A.U.4 with 1785, A.U.5 is dated to between ca. 1740 at the earliest, to 1785. A.U. 6 is a thin layer that predates active midden deposition, though it is contemporaneous with site occupations that predate the actual occupation of House 7. A.U.6 contains a small number of contact era artifacts and so likely represents the 17th to 18th centuries, but it is difficult to be more precise without a more clearly identified early occupation date for House 7 or the site itself. A.U.7 consists of beach sands and thin black humus horizons of late Holocene age.

Uivak Point 2

Uivak Point 2 is an isolated square-walled structure located in wet, boggy ground near the shore, 40m southwest of the sod house cluster. The foundations of the house consist of a turf and stone wall footing measuring 5.5m per side. While the house was not tested, the house plan and the few artifacts visible on the surface around the house (including the bolt from a bolt-action rifle) suggest that these are the remains of a late 19th century to early 20th century wooden house (see Kaplan 1983: 244). The late Nain residents Gustav Sillet and Martha Joshua described the presence of houses at Uivak in 1918; these houses were abandoned following the influenza epidemic that ravaged settlements along the Labrador coast in that year (Saunders 1989: 5-9).

Uivak Point 3

The ruins of second isolated house (Uivak 3) are located about 135m north-northwest of the sod house cluster, adjacent to the shoreline at the north end of the cove.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

These house foundations are also square and consist of turf wall footings measuring about 4.5m by 6m, with a door opening and stone slab steps in the southern, seaward, wall. Parts of a cast iron stove or lamp were found on the ground surface around the house.

In 1993, a number of soil core tests were made around the house. Cores within the house found a thin organic deposit with bone, charcoal and metal artifacts. Further core tests in the yard located midden deposits south and southeast of the house entrance. A 1m by 1m test pit was excavated in the midden deposit about 5m south of the house door. This unit was excavated to a maximum depth of 32 cm and terminated in bedrock. Cultural refuse was found throughout this unit.

A small animal bone assemblage, predominately consisting of fish and some seal bone, was recovered with the aid of sieving. This collection was not analysed as part of the present study. Ninety-seven artifacts were also recovered and almost all were manufactured and imported goods. Items made of iron include wire, screws, spikes, many wire nails, and an iron vessel base. Many glass and ceramic fragments were collected. A small number of these items date to the 18th to 19th century, including kaolin pipe stems and creamware vessel sherds. Many of the ceramics bore transfer prints and probably date to the late 19th to early 20th century.

Four center-fire shell casings were recovered, stamped "WRACo - W.C.F.", (.44, .4065 and .30 calibers). These shells were produced by the Winchester Rifle Arms Company and date to the late 19th to 20th century (Heintzmann 1980). A single 16-guage shotgun shell, bearing the label "KYNOCH No 16 Birmingham", was also recovered. The house plan and artifacts suggest the attribution of a late 19th century to early 20th

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

century occupation for this house.

Uivak Point Site Summary

Uivak Point 1 is a complex site consisting of nine very large communal sod houses dug, in a cluster, into a raised beach terrace. In addition to the houses, graves, tent rings, caches and two recent historical house structures were also present in the vicinity of the site. Between 1993 and 2000, four archaeological field seasons were conducted at the site, with work including surveying, mapping, soil core testing and extensive excavations.

During this time, excavations were focused on one house, House 7, of which a very large part was excavated, including portions of the sleeping platforms, floor, entrance passage and walls. A large trench was also excavated in the midden associated with House 7. The midden deposit was extensive and deep, and provided a very large and well preserved faunal assemblage of many thousands of specimens. Bulk sediment samples were also collected for ecofact analyses. A large artifact assemblage was recovered from House 7 and its midden, showing considerable use of European goods and specialized hunting equipment used for seal hunting on ice and in open water. Two other stratified middens related to other houses were also excavated, and yielded substantial samples of faunal remains.

Dating of the excavated contexts was conducted through a variety of means including historical documentation, artifact typology, radiocarbon dating and dendrochronology. The lower House 7 midden layers and the two smaller midden tests all revealed mid to late18th century dates. The most recent phase of construction and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

occupation of House 7 and the upper midden layers very tightly dated to ca. 1785 to 1806.

Because of the relative precision of dating accomplished for this site, together with the size of the faunal assemblages (from multiple middens) and artifact assemblages recovered, along with ecofact sampling, Uivak Point is a uniquely thoroughly examined site in Labrador. The site provides the core data for this dissertation and is directly comparable to the Eskimo Island 1 and Oakes Bay 1 sites on the basis of its date.

Summary of Fieldwork

In chapters 5, 6 and 7, I have sought to explain the means by which I obtained zooarchaeological data for a study of Labrador Inuit subsistence during the Contact Period. Faunal assemblages considered in this project included recently excavated collections from new excavations at the sites of Uivak Point and Oakes Bay 1, and curated collections from several previously excavated sites in Hamilton Inlet. In chapter 5, I presented the rationale for selecting these sites and the methods used to excavate them. Then, the archaeological records of these sites were described in detail in order to assess the comparability of the contexts that yielded faunal assemblages, the house architecture and artifact assemblages of these sites, and their occupational histories.

The set of sites considered here are all substantial winter settlements with communal houses. Various dating techniques indicate that components of Uivak Point, Oakes Bay 1, Double Mer Point and Eskimo Island 1 were all occupied in the late 18th century and so facilitate a synchronic comparison of a number of site economies from different perspectives. These sites represent three of the major geographical regions of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador's northern and central coasts and present an opportunity to compare subsistence in different winter ice environments, ones dominated by a polynya and others associated with extensive fast ice and access to the *sina*.

Uivak Point is the most important single site in this study, as it provides very large, well-preserved and well-dated faunal assemblages from stratified middens, backed up with complimentary ecofact studies. Extensive and overlapping proxy palaeoenvironmental records for climatic and sea ice conditions exist for this time period, as well as ethnohistorical data that may supplement subsistence reconstructions. Similarly, these sites allow a comparison of variability of subsistence economies associated specifically with whale hunting and trade, as ethnohistorical and archaeological evidence indicates that these sites had different proximity to core whale hunting areas and sources of trade goods. Finally, the group of sites in Hamilton Inlet affords a unique opportunity to conduct a diachronic study of subsistence within a single, tightly defined region, as it remains the only regional, diachronic series of Thule/Inuit winter sites with faunal assemblages yet available for Labrador.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 8

METHODOLOGY OF LABORATORY ANALYSES

Introduction

A central objective of this project was to use archaeological methods to examine the nature of subsistence economies, and variability therein, associated with communal house sites in Labrador. In particular, the project goals were to determine how the use of communal houses may have been related to the pursuit of specialized whale hunting, seal hunting, or to more general economic orientations; whether communal houses were used in contexts of economic stress or success; and whether their use coincided with identifiable environmental trends. These subjects have only been addressed in indirect or implicit fashions in previous archaeological studies, as zooarchaeological data have not been applied as primary sources of economic evidence. The zooarchaeological data required to resolve these questions have not previously been reported or assimilated in rigorous, systematic manners. Similarly, the environmental reconstructions underlying earlier archaeological studies have not been reconsidered in light of recent developments in palaeoenvironmental science. New sources of economic data and syntheses of recent palaeoenvironmental reconstructions are needed to resolve the question of the economic function of communal houses in Labrador.

Accordingly, the central focus of this project was to obtain and analyse suitable faunal collections from several well-dated archaeological sites, through use of existing faunal collections and through new fieldwork. A second priority was to reconstruct

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

details of local environmental conditions through analyses of ecofact samples along with faunal remains, and by incorporating pertinent elements of recent palaeoenvironmental research. Finally, the dating of archaeological materials must be well-established and as precise as possible, in order to ensure the archaeological records and environmental records are contemporaneous and of similar scale. In this chapter, the application of methodologies of artifact analysis, palaeoentomology, archaeobotany, geoarchaeology, and zooarchaeology to resolve issues of dating, palaeoecological change, site formation and subsistence economy, are discussed. Particular attention is placed upon procedures of zooarchaeological identification and quantification, and on the analysis of incremental growth structures in mammal teeth as a means of estimating age and season of death.

Methodology of Artifact Analysis

An initial analyses of artifacts recovered during these excavations, reported in Chapter 5, was undertaken by the author, with the aid of student lab workers, at the Archaeology Laboratory of the Peary-MacMillan Arctic Museum and Arctic Studies Center, Bowdoin College. This limited study was descriptive in nature, consisting of identifications based on functional and stylistic types and raw material. These descriptive data are used to date the assemblages and their contexts, to illustrate the importance and role of European goods in Inuit material culture and to define the nature of specialized hunting and transportation technologies and toolkits represented at these sites.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Methodology of Stratigraphic and Geoarchaeological Analyses

A small range of conventional geoarchaeological tests were conducted on bulk sediment samples at the Geoarchaeology Laboratory of the Department of Anthropology, University of Alberta. The general granulometric characteristics of selected stratigraphic layers in the Uivak Point 1, House 7 midden excavation were determined through use of nested Tyler sieves and soil hydrometers. Concentrations of organic matter in stratigraphic layers were determined through Loss On Ignition analyses (LOI). Sediment samples were also dried to in a kiln, weighed, and then cooked at high temperature in an oven to burn off all non-mineral organic matter. Their non-mineral organic contents were determined by the net loss of mass of these samples, calculated after they were weighed again.

Soil organic matter content, excavation profiles, notes on soil and sediment colour, texture, consistency, and soil pH measurements taken in the field were used to describe stratigraphic units. Stratigraphic units with similar characteristics and stratigraphic position, and parent material were then grouped into analytical units (termed AU). Analytical units are used to aggregate archaeological data from chronologically and stratigraphically linked units and arbitrary levels. All zooarchaeological data from excavations made during this project are subdivided and summarized on the basis of context and AU. As well, decisions about sub-sampling these assemblages were made, in part, on the basis of A.U.'s.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Methodology of Palaeoentomological Analyses

A total of 51 bulk sediment samples, from 2 litres and 5 litres in volume, collected from the Uivak Point 1 House 7 and House 7 midden excavations were delivered to Dr. Allison Bain for palaeoentomological analyses. Many insect species have very particular habitat requirements and climatic tolerances. When identified to taxa, insect faunas can therefore provide useful information about the general environment of an archaeological site and about the particular characteristics of a living site, for example, identifying the presence of carrion, manure, rotten wood or standing water.

A selection of 17 samples representing the house floor, the sleeping platform and entrance passage, the midden and an off-site control sample, were processed and analysed at the Eastern Cereal and Oilseeds Research Center of Agriculture Canada. (Bain, n.d.) During processing, insect remains were separated from sediment and plant remains by kerosene floatation and identified to part and taxa by reference to the comparative resources of the Canadian National Collection of Insects, Arachnids and Nematodes. See Bain (1999, n.d.) for a full description of methodology.

Methodology of Archaeobotanical Analyses

Archaeobotanical analyses provide information about human uses of plants for food, fuel and raw materials, and about the nature of an archaeological site's local environment. A total of 44 two-litre bulk sediment samples from Uivak Point 1 were shipped to Dr. Cynthia Zutter for analysis at the Palaeoenvironmental Laboratory, Dept. of Anthropology, University of Alberta. Zutter processed and analysed 27 of these samples, representing floor and sleeping platform areas of House 7 and the House 7

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

midden (Zutter, n.d.). These samples were processed by wet sieving through 0.85mm and 0.65mm mesh screens to remove mineral sediment. Macrobotanical remains were separated from the retained sediment and examined under a low power microscope. Species identifications were made with the aid of seed references collections at the Palaeoenvironmental Laboratory and seed identification manuals (Zutter, n.d.). For a full discussion of analytical methodology, see Zutter (n.d.).

Methodology of Zooarcheological Analyses

Faunal remains recovered from new excavations and Richard Jordan's Hamilton Inlet project were shipped to the Peary-MacMillan Arctic Museum, Bowdoin College and the Bioarchaeology Laboratory, Department of Anthropology, Hunter College, where they were analysed by the author. The first step of analysis consisted of initial cleaning and sorting of bones, their identification to taxa and element, and description of secondary features such as state of epiphyseal fusion. The second stage of analysis involved recording these data on paper forms and computerized data analysis. The final part of the analysis, concerning the seasonality, age of death and life history of prey and managed animal populations, involved taking measurements on some bones, preparing thin sections from teeth and examining incremental growth structures in teeth thin sections under a microscope.

Rationale of Sub-sampling Faunal Assemblages

As a general rule, the sub-sampling of assemblages was avoided in this analysis in order to preserve sample size in smaller analytical units, for particular taxa, and for

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

particular elements that are used for osteometric or age and seasonality studies. Nevertheless, the faunal assemblage recovered from Uivak Point 1 was very large, exceeding 100,000 total fragments from all contexts, and was sub-sampled on a limited basis in order to streamline its analysis.

Of the faunal remains recovered from units in House 7, only those from a restricted number of units were analysed, representing portions of the entrance passage, floor and platform areas, and 21 of the total of 40 $1m^2$ units that were excavated in House 7 by 2000. Faunal remains were analysed from units 1S/0W, 1S/1E, 1S/2E, 1S/3E, 1S/5E, 1S/6E, 1S/7E, 1S/8E, 0S/5E, 0S/6E, 0S/7E, 1N/2E, 1N/3E, 1N/8E, 2N/8E, 3N/3E, 3N/4E, 3N/5E, 3N/6E, 3N/7E and 3N/8E. The resulting House 7 faunal assemblage was subdivided once again, as bones from overlying layers were set aside and only faunal remains from the basal platform and floor layers, underlying the debris from the walls and roof, were included in this analysis. All of the faunal remains from the House 7 midden, the House 6 midden and Test Pits 8, 10 and 11 were analysed, while those from excavations within House 6 and a test pit in a midden outside the Uivak 3 house were excluded from this study.

Because only initial excavations were undertaken at Oakes Bay 1 in 2000, the faunal assemblages currently available for this site are small in comparison to those of Uivak Point 1. Only animal bones from the midden excavation of House 3 were used in this study. Nevertheless, this restricted sample of bones was large enough for a useful comparative analysis, with well over 3000 fragments divided into two stratigraphically defined sub-assemblages. This collection was far larger than the minimal sample size

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

standards of ca. 400 specimens used in regional zooarchaeological studies elsewhere in the North Atlantic (Amorosi, et al 1996; McGovern 1985).

Richard Jordan recovered substantial faunal collections during his project in Hamilton Inlet. While the entire set of collections includes a total of approximately 13,000 fragments, this sum represents varying scales of excavations at five sites and 15 houses. In order to retain reasonable sample sizes and because of their lack of precise stratigraphic context information, none of the assemblages from Hamilton Inlet were sub-divided.

Methods of Identifying Faunal Remains

Faunal remains were sorted by general taxonomic category (bird, fish, mollusc, artilodactyl, etc.) and then identified by element and taxa, to the level of species wherever possible. Specimens that could not be positively identified to species or genus were counted in generic categories defined by type of animal, size and type of bone (for example: large fish vertebra, small terrestrial mammal vertebra fragment, medium sea mammal long bone). Highly fragmented long bones and especially crania, vertebra and ribs can be difficult or impossible to identify to species; all such specimens were counted in these generic categories. Specimens that were identified to species and element were counted in separate species-specific categories. Relatively complete vertebra, ribs and small long bone fragments with clear, diagnostic landmarks were counted with species-identified specimens. Additional observations were taken on the portion of elements represented, the state of epiphyseal fusion and the presence and location of traces of pathologies, carnivore chewing, cut marks, impact marks and burning.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Identifications of specimens to element and species were made with the aid of the comparative osteological collections of the Bioarchaeology Laboratory of Hunter College, the Peary-MacMillan Arctic Museum, the Zooarchaeology Laboratory of the University of Alberta and the Institute Maurice-Lamontagne, Dept. of Fisheries and Oceans, Environment Canada. Various published identifications manuals and osteological descriptions and illustrations were used to aid the process of identification, including Davis (1976), Evans (1993), Gilbert (1993), Kasper (1980), King (1964), Manning (1974), Ridgway and Harrison (1981), Schmid (1972), and True (1904). Unpublished identification keys for seal species devised by Thomas Amorosi, Douglas Stenton, Thomas McGovern, Arthur Spiess (1976) and especially Ulrike Møhl and Jeppe Møhl were also used and are gratefully acknowledged.

On the Art of Identifying Seal Bones

A central problem for zooarchaeology in the North Atlantic and eastern Arctic regions, and for this project in particular, is the task of identifying seal bones to species. While seal bones themselves are distinctive and easily recognized in a general sense, researchers commonly report difficulty attributing species identifications to the post-cranial skeletons of seal species in a reliable manner (McCullough 1989; McGovern 1985; Spiess and Hedden 1983, Møhl 1986). This is a significant challenge for zooarchaeologists working in the North Atlantic and eastern Arctic as six species of seals are indigenous to the region, and remains of all have been found in archaeological sites in Labrador. The three smaller species (ringed seals, harbour seals and harp seals) are particularly difficult to differentiate and typically are the most commonly hunted seals in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador. The bulk of the discussion following in this section applies to these species in particular.

Difficulties involved in distinguishing ringed seals, harp seals and harbour seals likely result from several factors. The size ranges of these species overlap, especially for sub-adults. As well, there is a general paucity of clear-cut skeletal landmarks on post-cranial elements. Relatively limited sexual dimorphism (relative to fur seals, for example), bilateral asymmetry, late epiphyseal fusion (Ericson and Storå 1999) and intra-species skeletal variation may also complicate the recognition of species differences in many elements. Variability in skeletal morphology and growth may be due, in part, to the buoyancy of seals' water environment and its reduction of the mechanical demands for load-bearing capacity and lightness, in comparison to the stresses to which land mammals are subjected. Regardless of its ultimate causes, the lack of means for distinguishing post-cranial seal bones hinders the identification and quantification of faunal remains by species, one of the basic tasks of zooarchaeology.

Faunal analysts have usually relied on a narrow range of cranial and post-cranial elements to identify seal species and place the bulk of their seal bones into a generic "Phocidae" category, often with subcategories for "large" and "small" seal specimens. Unfortunately, this practice greatly reduces the effective size of the species-identified sample and adds an extra problem in inter-species comparisons, as not all of these elements are distinctive of all six species.

Continued research on intra-specific and inter-specific variability in skeletal growth and morphology of pinnipeds may do much to resolve the problem of identifying seal remains. As well, the use of very comprehensive comparative osteological

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

collections that include multiple male and female specimens of all age groups, for all species, would likely help increase the number of useful species-diagnostic landmarks. The comparative materials that were available for this study represented five of the six seal species present in Labrador, including multiple specimens of the major seal species. These collections were entirely adequate for distinguishing species through conventional diagnostic landmarks. Nevertheless, these resources do not represent the sort of ideal comparative collection that is needed to broaden identification standards.

Seal species identifications were made on the basis of a limited number of non-metrical elements and features that are widely considered to be reliable species markers and that apply to all of the seal species involved in the study. The species Number of Identified Species counts (henceforth referred to as NISP) obtained by this method are therefore more readily compared with each other and with those reported by previous research. The distinctive elements include the auditory bullae, palate and maxillae, mandibles and humerus (Spiess 1978). These elements include several of the densest parts of pinniped skeletons (Lyman 1994) and therefore are relatively durable elements that are likely to be preserved and recovered.

The shape and thickness of bone around the auditory canal and the shape of the lateral portion of the bullae are considered diagnostic features of auditory bullae. Diagnostic landmarks for the palate and maxillae include the shape of the posterior edge of the palate, the location of foramena and sutures in the palate, the shape of the dental arcade, the size and shape of the teeth and the profile of the premaxillae and nasal region (see, for example, King 1983; Ridgway and Harrison 1981). Mandibles are distinguished on the basis of the size and shape of teeth, their orientation and spacing in the alvaeolus,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the shape of the ramus and the location of the mandibular foramen. Ulnae and femorae also are often considered to have diagnostic features but these traits are not uniformly applicable between species. Accordingly, these elements were not used to distinguish species in this study.

Use of a more narrow set of diagnostic criteria inevitably reduces the number of seal species counts in any study. In order to compensate for this problem, and to restrict the possibility of idiosyncratic small-sample skewing of these counts, every effort was made to recover very large faunal assemblages in the field. Similarly, faunal collections recovered from midden excavations were analysed in their entirety wherever possible, without sub-sampling. By avoiding extensive sub-sampling, the numbers of seal species counts were kept as large as possible, while the reliability and direct equivalency of the NISP counts of each species were retained.

Methods of Recording and Quantifying Zooarchaeological Data

All faunal analysis data were recorded on paper forms, retaining unit and level context information, and then the paper records were entered into a computer. Computer-based storage, compilation and manipulation of data was performed with the Nabone Zooarchaeological Archive template for the Microsoft Excel spreadsheet program (NABO 2001), with specialized modifications made by the author for its application to particular species and Apple Macintosh computers. This template provides a pre-set format for compiling data, produces summary statistics and calculates standard zooarchaeological quantitative measures. The program was used to sort fauna data by excavation unit and level and then to aggregate and summarize these data by

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

stratigraphically defined analytical units. The program was also used to conduct secondary analyses considering species frequency, taphonomy and economic anatomy.

On the Use of Quantitative and Qualitative Approaches to Zooarchaeological Analyses

Several quantitative measures were used to determine the composition of the faunal assemblages used in this study and to probe the relationship between the recovered archaeological assemblages and the death assemblages, and living communities from which they were derived. These included counts of Numbers of Identified Specimens (NISP), Minimum Number of Elements (MNE), Minimum Animal Units (MAU), Density of Deposition counts (DD), and Percent Relative Frequency calculations (RF). These measures were used for addressing particular research questions; their particular qualities and shortcomings are discussed below.

Before reviewing these quantitative measures, it is necessary to note that zooarchaeologists have long maintained a sharp debate over the efficacy and logic of the taxonomic measures they use (see Gautier 1984; Grayson 1984; Klein and Cruz-Uribe 1984; Lyman 1994; Ringrose 1993, among others). Some writers have pointed out specific difficulties in assessing taxonomic abundance in zooarchaeological assemblages due to the particular idiosyncrasies of the different counting methods (Ringrose 1993). Others have questioned the utility of making direct characterizations of life assemblages or death assemblages of animals based on zooarchaeological assemblages because of this quantification problem (Grayson 1981, O'Connell 2000; Ringrose 1993).

Compounding the problem of assessing species representation are the multiple ways in which bone assemblages may be selectively sampled and biased between death

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and analysis. With these complications, it is difficult to reconstruct with confidence an accurate sample of a death assemblage or the Life assemblage behind it. For these reasons, Grayson (1991) recommended that zooarchaeologists limit themselves to attribute data (such as species presence/absence lists) rather than use standard quantified data when palaeoecological reconstructions are attempted. Because it touches upon the reconstruction of death assemblages, Grayson's argument carries obvious implications for palaeoeconomic reconstructions as well.

One of the useful outcomes of this debate is that many zooarchaeologists have come to a widespread acceptance that the various measures of taxonomic abundance are sensitive to different zooarchaeological variables. For this reason, none of these quantification methods are suitable as a universal measure applicable to every assemblage or to any circumstance (Ringrose 1993). All have particular characteristics that render them more or less effective with different kinds of faunal collections, such as large or small assemblages, short-term kill sites or time-averaged midden deposits, and appropriate for different analytical goals. Similarly, the use of multiple quantitative measures may be used in the same analysis to examine different aspects of an assemblage.

A second, and probably only partially realized, outcome of this critique is a turning of attention away from treating zooarchaeological species abundance data, and whole assemblages, as simple or mechanical forms of subsistence or ecological data. One practical alternative is to consider the quantified zooarchaeological record, at best, as a *proxy* indicator of the animals that people of the past killed, used or lived amongst, and whose bones entered the archaeological record, rather than a source of direct counts of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

species present in the living community. Use of the zooarchaeological record as an indirect record allows the analyst to look for (general) patterns and trends, and obviates the need to translate bone counts directly into counts of ancient prey or stock animals (Amorosi, et al. 1996: 138-139). With this approach, it is the "shape", or trend, of proxy data that are of primary importance as indicators of ecological or economic conditions, rather than absolute values of quantified variables themselves.

At a practical level, trends or patterns in zooarchaeological data indicating ecological or economic processes may be illustrated through a variety of means. Conventional quantitative methods may be used to demonstrate trends through ordinal level or general comparisons of counts of different taxa, and with ratios of counts of similar or related taxa (Amorosi, et al. 1996). Following Grayson's critique, a second method is to use attribute data to examine species composing the living community and archaeological death assemblages. Going far beyond simple presence/absence lists, zooarchaeologists are increasingly capable of determining the age, sex, size or health of individual animals represented by archaeological specimens, of defining the seasonality of their deaths and the demographic structure of archaeological animal populations. These kinds of qualitative data allow zooarchaeologists to place particular species or populations of animals, and individual economic decisions, in contexts of place and time. Qualitative attribute data therefore constitute a source of powerful ecological and economic evidence.

Both quantitative and attribute data may be combined in focussed examinations of indicator species – species which, because of specialized niche requirements or culturally determined economic value, are linked to (or are proxies of) specific ecological variables

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

or economic activities (Woollett, et al., 2000). Trends in subsistence economies may be identified by the presence, frequency, demography or life history characteristics of indicator species, and explained in reference to the variables to which they are related. Finally, use of multiple independent lines of coherent evidence is necessary to strengthen arguments based on proxy indicators. Well-controlled dating, ethnohistorical subsistence data and high-resolution data concerning important ecological variables are all types of evidence that will significantly reinforce the interpretation of proxy zooarchaeological data.

Quantitative Measures of Taxonomic and Element Abundance

Several different means of quantifying taxonomic and element abundance are currently available to zooarchaeologists. These different methods are founded upon different analytical objectives and in some cases entail much different counting procedures. Different counts may produce rather different characterizations of the same assemblage. With no single "correct" method, zooarchaeologists must select quantitative tools appropriate for their task and for the sample involved. Ideally, multiple counting methods may be used to examine an assemblage from different perspectives, in so doing compensating for the limitations of particular quantitative measures. In the following section, the particular characteristics of the counting methods used in this study are reviewed in light of their strengths and applicability to the objectives of this project.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Numbers of Identified Specimens (NISP)

Number of Identified Specimens counts (or NISP) refers to the absolute numbers of specimens (a whole or fragmentary bone) identified to a taxonomic unit and to element. NISP counts are used to describe faunal assemblages in terms of the abundance of elements and taxonomic groups represented them (Grayson 1984: 17; Reitz and Wing 1999: 191-192). As well, NISP counts may be readily transformed into a range of other types of counts made at the level of taxon and element that are used to examine species abundance, taphonomy and economic decision-making.

NISP counts are one of the most commonly used zooarcheological quantitative measures. The usefulness of NISP counts lies in its conceptual straightforwardness, lack of transformation and its economical application to smaller assemblages. Nevertheless, the method has specific weaknesses as well (see Gautier 1984; Grayson 1984: 20-22; O'Connor 2000: 55-57; Ringrose 1993: 125-126, among others). NISP counts are sensitive to discrepancies between the preservation, recovery and identification rates of different elements, species or archaeological contexts. NISP counts may be skewed by selective cultural activities such as butchery and food processing, and by the activities of scavengers and other forces of attrition. The varying anatomies of different animals may also shape NISP profiles of whole assemblages, as some species simply have more countable bony parts than do others. These factors complicate the comparison of NISP counts between assemblages.

Because it treats all specimens as equivalent units (as if each represented a distinct individual), NISP counts are sensitive to sample interdependence, the presence of multiple specimens from the same original individual (Grayson 1984: 23; Ringrose 1993:

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

126). NISP counts may therefore be inflated when applied to contexts containing multiple specimens from the same individuals. Nevertheless, some researchers have concluded that attritional effects and bone scattering are sufficient to provide practical limits on the scope of real interdependence problems in most accretional archaeological bone accumulations, especially middens deposits that accumulated over long periods of time (Gautier 1984: 240, McGovern 1985). Carcasses of animals used by people are rarely introduced to the archaeological record as whole entities. Once butchered, their constituent parts may be widely scattered by transportation, food sharing and processing activities occurring in different locations, and eventually consumed and discarded serially rather than simultaneously. All these factors tend to commingle different skeletons and scatter single skeletons, rendering them less likely to be over-represented in single sampling areas, especially in long-term living sites.

Accepting this observation, NISP counts are most readily applied to contexts containing widely scattered remains of many individuals, and especially to depositional contexts that were accumulated over long periods of time (Gautier 1984: 244). Because this study is focused upon bone assemblages from middens deposited over multiple years, NISP counts appear to be appropriate for use in this study. While multiple bones from individual carcasses were certainly contributed to these middens, these carcasses were likely large in number and highly dissected by both humans and scavengers. Furthermore, only limited portions of the middens (perhaps up to one third of their area and often much less) were sampled.

Because of the limitations of NISP counts, many researchers have preferred to use Minimum Numbers of Individuals (or MNI) counts which extrapolate an estimated

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

number of animals required to produce a given assemblage, as measures of taxonomic abundance. Nevertheless MNI counts are also subject to their own range of problems. Among these problems are sensitivity to numbers of distinctive elements in skeletons, skeletal asymmetry within individuals, and the use of inconsistent methods of calculating counts by different researchers (Gautier 1984: 242; Reitz and Wing 1999: 196-197; Ringrose 1993).

Also significantly, MNI counts inflate numbers of uncommon taxa and are shaped by the way in which data sets are sub-sampled, aggregated or subdivided. Total MNI counts calculated for a single collection will be inflated if the collection was subdivided, and reduced if it is analysed as a whole (Grayson 1984: 27-49; O'Connell 2000: 60-61; Reitz and Wing 1999: 197). Assemblages deposited over long periods of time may require stratigraphic subdivision for meaningful analyses and so raise problems when analyzed with MNI counts.

Manipulations or numerical analyses of MNI counts to resolve aggregation problems or to compare assemblages are also problematic because they are estimates of minima, rather than finite numbers and particular to specific assemblages (O'Connell 2000: 61). Finally, as demonstrated by Grayson (1984: 62) and other researchers (Amorosi, et al. 1996, Crabtree 1990; Gilbert and Singer 1982), MNI counts correlate with sample size and therefore with NISP counts in large assemblages. Patterning in large assemblages indicated through use of MNI counts may therefore also be discerned with the use of NISP counts.

For all of the reasons outlined above, NISP counts were used in this study as the basic quantitative measures to describe the recovered samples. Because most of the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

deposits analysed in the study were middens or other types of accretional deposits, NISP counts are considered appropriate sources of basic species and element abundance data.

NISP counts were made at two levels of taxonomic detail in this study. As an initial step, all specimens in these assemblages are reported in terms of general categories including Molluscs, Fish, Birds, and Terrestrial or Marine Mammals (small, medium or large), and as representing shells, crania, vertebrae, or other broadly defined types of elements. The category of Small Terrestrial Mammals includes animals such as rodents and most mustellids found in Labrador. The Medium Terrestrial Mammals category includes foxes, hares, dogs and wolves, while that of Large Terrestrial Mammals includes bears and caribou. The smaller seal species (ringed seal, harbour seal and harp seal) comprise Small and Medium Marine Mammals, while bearded seals, hooded seals, grey seals, walrus, whales and porpoises represent the range of species in Labrador that fit within the Large Marine Mammal category. As a second stage, NISP counts are then presented exclusively for specimens identified to levels of genus or species. Species abundances in the recovered assemblages were compared as percentages and as ratios of NISP of associated species.

Several steps were taken to compensate for the particular limitations of NISP counts. To compensate for analytical bias resulting from selective recovery, standardized sieving techniques were used in all new excavations. In order to reduce obvious sources of interdependence problems, the few bones that were recovered in articulation were counted as single specimens, as were refitting epiphyses and diaphyses.

Due to their complicated identification, NISP counts of seal species were limited to a restricted range of universally diagnostic elements. Because the same elements were

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

used for counts, and these included mostly dense elements of the skull and jaw specimens that are unlikely to be differentially selected or fragmented through cultural or attritional agents, NISP counts for the smaller seal species, at least, are directly comparable. Similarly, NISP counts for blue mussels (*Mytilus edulae*) were based exclusively on fragments bearing the hinge or umbo, as the bodies and periostraca of these shells are prone to excessive sample inflation through fragmentation.

Finally, NISP counts were used specifically to describe general patterns in species representation, rather than to precisely reconstruct animal communities (Amorosi, et al. 1996; Gautier 1984: 24); Grayson 1984: 92; O'Connor 2000: 57). In order to examine these trends more thoroughly, and to verify that observed trends are not products of biases inherent in closed array comparisons, NISP counts were compared and checked with other taxonomic measures, including Percent Relative Frequency and Density of Deposition counts.

Percent Relative Frequency

Percent Relative frequency statistics (or %RF) are intended to compensate for the distorting effect that inter-species anatomical variability may have in shaping assemblage NISP profiles. Species with larger numbers of bones will tend to be over-represented relative to the numbers of original individuals, while those with relatively few countable parts will tend to be underrepresented. NISP counts will therefore provide only ambiguous insights into the real abundance of these species in an assemblage. It is possible to correct NISP counts to control for this distorting factor by dividing element NISP values by the number of times each element occurs in a complete skeleton (Hesse

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and Perkins 1974). %RF is the mean of these corrected frequencies and is an abstracted value useful for streamlining intra-assemblage or inter-assemblage comparisons by rendering species abundance counts more directly comparable.

Density of Deposition Counts

Density of Deposition counts; as applied by Jones (1982) and Bigelow (1984), are intended to clarify comparison of species abundance within and between assemblages. Typically, the frequencies of various species are compared within and between assemblages by converting raw frequency data into percentages; patterns in subsistence are demonstrated by the trend or differences in these percentages (Bigelow 1984: 124). Methods of standardizing raw bone counts are essential to simplify the presentation of data when assemblages comprising different sample sizes are used. Nevertheless, as demonstrated by Grayson (1984: 19-20), the use of percentages as the standardizing device can actually obscure the identification and interpretation of trends in data.

Because percentages are closed arrays, the sum of percent values for all species must equal 100. Changes in the absolute values of one species will result in changes in the percentages of other species, whether their actual abundance changed or not. It may be difficult, therefore, to determine if differences in percent frequency of species counts represent real changes in some or all of these species. The fewer the number of species involved in closed array percentage comparisons, the more closely interdependent are their percentage values (Grayson 1984: 20). Bigelow (1984: 124) defined the problems involved in interpreting closed arrays as follows:

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

> However, this procedure (the use of percentages to define the composition of a faunal sample) displays change or stability in the deposition of single species only by reference to change or stability in all the other taxa combined. For example; if fish and mammal bones each comprise 50% of the basal layer of a midden, and the uppermost layer displays an apparent "shift" over time to 80% fish and 20% mammal bones, it is unclear whether; a) fishbone deposition rose dramatically while mammal bone deposition was stable; b) mammal bone deposition substantially decreased while fishbone deposition remained the same; or c) fishbone deposition increased while mammal bone deposition decreased, both to a moderate degree. To distinguish which of these changes altered the proportions of species in the overall sample, it is necessary to define absolute shifts in the frequencies of bones of individual species in the separate midden units. The transformation of simple TNB (NISP) counts into percentages does not permit this.

Density of Deposition (or DD) counts can be used to compensate for the problem of indeterminacy and interdependence inherent in comparisons of percentages. DD counts are calculated by dividing the frequency of species-identified bone fragments in a specific assemblage by the volume of the stratigraphic unit from which the assemblage was recovered (Bigelow 1984: 125), or species NISP/m^3. DD species abundance counts may then be compared through ratios (DD of species *X*/DD of species *Y*) calculated for each assemblage to be considered in a comparative study.

Because they are calculated in reference to the volume of excavated strata, rather than the sum of species counts included in an assemblage, DD counts are standardized in relation to an independent variable. Comparisons of DD counts between assemblages are therefore not subject to the problems of closed array comparisons. DD counts of different species vary independently of each other and pertain directly to the absolute frequency with which bones of different species were deposited (Bigelow 1984: 125).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Minimum Number of Elements

Minimum Numbers of Element counts (MNE) are used to clarify the frequency of skeletal elements (or portions of elements) of particular species in archaeological assemblages, and to aid the application of zooarchaeological data to bone density and economic utility indices. Most of these indices use whole elements or element portions as their basic counting units. Nevertheless, simple NISP counts are often skewed through the differential fragmentation of specimens of different elements. Accordingly, skeletal element profiles based on simple NISP counts may bear little direct relationship to the actual number of skeletal elements represented in an archaeological assemblage. Sample inflation effects resulting from fragmentation may be filtered, at least in part, by estimating the minimum number of elements or element portions represented in an archaeological assemblage, or MNE.

In this study, MNE estimates are calculated on the basis of the number of complete skeletal elements required to account for the numbers of specimens with one or both articular ends, and the numbers of shaft specimens lacking articular ends (termed MNEcomp, see Bunn and Kroll 1986; Lyman 1993: 101). For the seal bone assemblages used in this study, these methods seem particularly effective counting methods as seal limb bones are relatively solid and do not tend to fragment into many small specimens representing less than one third of the circumference of a whole bone. As well, the long bones of seals are not hollow, and so are not so attractive as sources of marrow for humans or scavengers.

Once determined, MNE counts provide measures of the state of preservation of the faunal assemblages used in this study (through an index of fragmentation expressed

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

as a ratio of NISP:MNE, see Lyman 1993: 102). MNE counts also provide raw data for MAU counts that are used in detailed studies of element frequency (see below).

Minimum Animal Units (MAU)

In addition to fragmentation, applications of skeletal element profiles to taphonomic or economic indices may also be hindered by the frequency of skeletal elements in whole skeletons. Because they are structured to avoid this source of inflation, and use raw data that is itself filtered for distortion resulting from fragmentation, minimum number of animal units counts (or MAU) provide element frequency counts that are more readily applied to density and economic utility indices. MAU counts are calculated by dividing MNE counts of elements or element portions by the number of times each element or landmark is present in a complete skeleton. The resulting value expresses the quantity in which various portions of skeletons, and butchery units, are represented in an assemblage (Binford 1978: 70; Lyman 1993: 104).

In this study, MAU counts are used to compare archaeological element frequencies to bone density indices and economic utility indices, and in so doing, evaluate the roles of attrition and economic selection as factors shaping these faunal assemblages. Attrition among caribou bones was evaluated with the use of bone density indices developed by Chambers (1992, cited in Lyman 1993: Table 7.7 and Lyman 1993: Table 7.6), with the use of photon densitometry techniques. Evaluation of patterns of cultural selection of caribou assemblages for economic purposes was conducted with the aid of food utility indices devised by Metcalfe and Jones (1988).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Applying Qualitative Zooarchaeological Approaches: Sources of Seasonality and Life History Information in Zooarchaeological Data

Up to this point, a variety of means of characterizing archaeological bone assemblages and of assessing economic, ecological and taphonomic sources of zooarchaeological patterning through approaches of assemblage quantification have been discussed. Nevertheless, another and perhaps more effective approach for gleaning economic and ecological information from the zooarchaeological record lies in the use of qualitative or attribute data. The particular value of a qualitative approach is that it supplements methods of assemblage quantification by establishing details about assemblages that simple quantitative methods, with their well-documented problems and assumptions, cannot provide. These data define the attributes of animals present in the archaeological record and concern the demography, seasonality and life history of the animals present in archaeological assemblages. Reconstructions of seasonal rounds and selective hunting or herding practices depend on these types of data.

Attribute data are also vital for the application of zooarchaeological data to palaeoecological issues. Grayson (1981) originally defined attribute data in terms of the presence and absence of species in particular assemblages. However, simple presence/absence data may be qualified by considering seasonality and life history studies of individuals and species present in an assemblage. These data can be used to place particular kinds of animals within site territories and in specific environments at particular times of year, greatly elaborating the analytical possibilities of presence/absence lists.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

This approach is especially valuable when it is applied to species that have specific ecological niche requirements, migratory patterns, or complex range limits or territoriality behaviours defined by sex or age cohort. In suitable circumstances, these sensitive species may be used as *indicator species*, species that are closely related to, and indicative of, well-defined environmental conditions. Animal bones from archaeological sites that are located in sensitive, patchy or variable environments, such as polynyas, can provide useful (if incomplete) information about the character of those environments in the past. The presence or character of indicator species in sensitive localities in the past may be monitored through a combination of quantitative and attribute-based zooarchaeological approaches. When reinforced with parallel and independent environmental records, changes in the presence, age profile, seasonality, or life history attributes of indicator species can provide evidence for changing ecological structure of particular landscapes, or seascapes.

This is not to say that faunal assemblages can be directly translated as ecological records or simple census data for past animal populations. Faunal assemblages are samples of the preserved residues of the suite of animals raised, collected, hunted and used by people. They are, therefore, proxy records of humans' subsistence activities, several transforming steps removed from the living communities from which the original animals were drawn. A hunter's catch is not a "direct" or even random sample of animals present in the environment as it is shaped both by the accessibility of prey species and the capabilities and objectives of the forager.

Nevertheless, the wild animals present in archaeological assemblages can inform us about some of the animals that were present in an environment, just as the economic

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

decisions of foragers are guided by their knowledge of landscapes and the key resources within them. The frequency with which hunters take particular types of animals as prey (and presumably their frequency in archaeological assemblages) responds to the ecological factors of availability, accessibility, and presence of alternative resources, as well as to the culturally and economically phrased value of these species. Changes in the availability of resources due to ecological changes affects subsistence economies and ultimately therefore the contents of midden accumulations.

Zooarchaeologists have employed several methods to obtain data about the biological and life history attributes of animals represented in archaeological assemblages. Most of these are techniques borrowed from biology, forensics and veterinary medicine, and are related to various aspects of skeletal morphology and growth. Frequently used methods include identification of sex and pathology through osteometrical and morphological criteria, osteometric determinations of body size, and both relative and absolute estimations of age and season of death, based on epiphyseal fusion sequences, dental eruption and incremental structures in tooth dentine and cementum. These kinds of studies provide profiles of the ages and seasons of death of individuals in archaeological assemblages, and details about their growth and health.

Estimations of Age and Season of Death

Some of the most useful kinds of qualitative data used in zooarchaeological analyses are estimations of the season and age of death of individual animals based on archaeological specimens. These techniques are essential tools for archaeological reconstructions of both palaeoecology and subsistence. Age of death studies are needed

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

to define selective hunting, foraging or culling practices and to link hunting practices with particular environments, through ecological niche and habitat characteristics associated with the life cycles of prey species. Age and life cycle issues influence foraging and culling decisions through the behaviour or range of wild species, and through the qualities of managed populations (such as strength or endurance of domestic animals used for traction). Determinations of season of death are essential for reconstructing and validating economic seasonal rounds and for relating hunting, culling or foraging activities to particular phases of the annual cycle of prey species, and to cultural calendars.

Age of death profiles for archaeological populations can be formulated through several different methods. Relative age estimates can be made on the basis of skeletal and dental maturation represented in the eruption of deciduous and permanent teeth, the subsequent wear pattern of teeth and the pattern of epiphyseal fusion in bones. All these processes occur in predictable sequences in individuals' lives, with different teeth erupting or bones fusing within particular ages in a step-like process. A substantial body of osteological research has defined the schedules of maturation processes for many species. Age profiles for species represented in an archaeological assemblage are constructed by selecting a number of elements or traits that represent a range of stages in skeletal maturation, and determining the proportion of specimens that are judged to be immature or mature given these criteria. These are considered *relative* age estimations since they give only "younger than" or "older than" ages, and are made in reference to growth events that occur with variability at irregular time intervals.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Relative age of death estimates are useful to zooarchaeologists because they may be applied to a large portion of an assemblage and are obtained through simple observation. They suffer disadvantages in that they are not uniformly applicable to all age categories; the majority of age indicators relate to the immature skeleton and few are capable of making distinctions within adult age ranges. Those that are applicable, such as tooth wear patterns, require validation with sample populations that are relevant and comparable in terms of diet as well as taxonomy. Large samples of suitable control specimens of known age are difficult to obtain for many species.

Absolute ageing methods give estimates of chronological age in years without reference to fixed stages in skeletal maturation. Such estimates are based on on-going processes of growth that produce layered records in the tissues of bones and teeth; these recording structures (Klevezal 1996) are equally applicable to young, mature or old specimens, at least in theory. Some types of incremental structures, or visible growth layers, are related to annual growth cycles in dental and bone tissues are not remodeled or resorbed during life. These incremental structures provide accumulated records of these growth cycles. In practice, absolute aging requires the identification and counting of these incremental structures. Biologists and archaeologists commonly use incremental layers in the dentine and cementum of teeth for age and seasonality studies because they are not resorbed and are relatively easy to view under a microscope. They are the primary source of age and seasonality information for this study as well.

Absolute ages are very useful in zooarchaeology as they are very easily applied to population age profiles. However, they are typically obtained from only selected elements, are subject to preservation effects, and usually require time consuming and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

expensive preparation techniques and microscopic examination. In most circumstances, a large and well-preserved faunal assemblage along with specialized laboratory facilities are required to produce even a small sample of reliable age estimates. In addition, absolute age estimates are subject to a degree of error and are aided by validation with comparative samples of known age of death.

Season of death attributions are somewhat more difficult to make than those for age of death. Some species have variable skeletal morphologies, such as cervid antlers or bird medullary bone, that allow ready identification of seasonality, but these examples are exceptional. Incremental structures in teeth or bone can, however, provide potential sources of seasonality information for many mammal species. In circumstances where the deposition of distinctive incremental structures follows a predictable annual schedule, the final layer will reflect the season of death. Identification of the final growth layer usually requires examination with a microscope and may not be precise or accurate in all cases, depending on preservation, the experience of the observer, and intra-specific variability in patterns of formation of these incremental structures. Nevertheless, incremental structures remain one of the most widely applicable techniques for identifying the season of death of archaeological animal specimens.

Protocols for Aging by Dental Eruption and Epiphyseal Fusion

Epiphyseal fusion sequences for estimating dog ages on post-cranial remains came from work published by Schmid (1972) and Habermehl (1961), and Amorosi (1985), who condensed fusion sequences published earlier by Brunni and Zimmerl (1951)

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and Lesbre (1897). Miles and Grigson (1991:343) published dental eruption data for pigs used in the study.

Protocols for Identifying Age of Death Through Incremental Structures

Tooth thin sections were observed under low to medium magnification using binocular microscopes with transmitted light and polarizing filters, following procedures outlined in several published reports (Bowen, et al. 1983; Dietz, et al., 1991; Grue and Jensen 1979: Klevezal 1996; Klevezal and Kleinenberg 1969; Leiberman 1994; Smith 1973; Spiess 1980; Stirling, et al., 1977). Microscope facilities used in this study included those of the Peary-MacMillan Arctic Museum and Department of Geology of Bowdoin College, the Department of Anthropology of Hunter College, the Department of Anthropology of the University of Alberta and the Institute Maurice Lamontagne, Dept. of Fisheries and Oceans, Environment Canada, at Mont-Joli, Québec. Most of the tooth thin sections used in this study were examined in the AMICA microscopy facility of the Dept. of Anthropology, Hunter College, using a Leica-Leitz DMRX/E Universal microscope and a Leica Quantimet 600 High Resolution Image Analysis System for processing of digitized video output.

Age and season of death estimates involve the identification of distinct Incremental Growth Layers (IGLs) that usually form alternating opaque and translucent bands in dentin and cementum. A Growth Layer Group (or GLG) of two or three of these IGLs, represents, for many species, a year's cycle of dentin and cementum formation. IGLs may also be formed on a predictable seasonal schedule and so represent tissue formed during a particular span of months.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Estimations of age of death require the recognition of cyclically and rhythmically repeated groups of major IGLs formed throughout an individual specimen's life (Klevezal 1996; McCann 1993; Laws 1969). These repeated groups of IGLs represent an annual GLGs and may be counted to determine age of death. In some species, the duration of deciduous dentition may influence the formation of dental tissues, and a number of months or years may be added to GLGs counts of permanent teeth to obtain a more accurate estimate of an individual's actual age. Attributions of season of death require the examination of the final IGL and the identification of the seasonal growth phase of that layer, translucent or opaque. As well, the relative width of the final IGL, judged in comparison to the previous similar IGLs, may refine the attribution of season of death.

Several researchers have identified several sources of error that may bias reading and interpreting incremental structures in teeth. These errors relate to intraspecific variability in the regimen of dentin or cementum formation and to observer error (Albright 1993; Bowen, et al. 1983; Lawson, et al. 1992; Stewart, et al. 1996). In order to reduce sources of observer error in reading and counting GLGs and recognizing terminal IGLs, teeth were examined in multiple repetitive blind trials following protocols discussed by Bowen, et al. (1983), McCann (1993), Stewart, et al. (1996) and other researchers.

Each tooth section was examined a minimum of five times, with its species and provenience concealed and the modal result was accepted as the estimation of age. Sections that had widely varying GLG counts or whose modal counts were represented by two or fewer trials were rechecked. Specimens that could not be counted consistently

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

(due, for example, to false annulations, poor preservation or sample preparation) were omitted from the analysis. Identification of terminal IGLs for season of death attributions followed this same procedure.

The reliability of GLG counts and IGL identifications were also improved through the use of comparative collections of tooth sections from individuals of known date of death, following the recommendations of several authors (Bowen, et al. 1983; Goodwin and Ballard 1985: Grue and Jensen 1979; Klevezal 1996, among others). These collections were used to train the author to recognize and count GLGs and to verify the seasonal pattern of IGL formation in ringed seals, harp seals, bearded seals and harbour seals. As well, comparative collection tooth thin sections were also incorporated into the blind readings of archaeological seal teeth as tests of consistency. Comparative materials included teeth from 25 seals obtained from contemporary seal hunters from Nain, Labrador, and archived tooth sections kept at the Institute Maurice Lamontagne, collected by Canadian Wildlife Service biological surveys.

Methods of Preparation of Tooth Thin Sections

Different methods were used to prepare tooth thin sections for microscope analysis of both dentine and cementum. These sections were prepared from canines extracted from maxillae and mandibles that were identified to species. Where individual jaws held multiple teeth, only single teeth were prepared for sectioning.

Thin sections intended for reading incremental structures in dentine were "hard sections", prepared without decalcification or staining. Undecalcified sections were prepared by Mr. Dennis Carmel, of the Dept. of Oral Pathology, University of Alberta.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Preparation began with embedding teeth in a polyester mounting medium. Tooth crowns were then removed and transverse sections were cut from the middle of the embedded tooth root with the use of an IsoMet ™ wafering saw with a diamond blade. Tooth sections were ground to a thickness of 50 microns and polished. Polished sections were bathed in xylene, dried and then mounted on glass slides with Permount mounting medium and covered with glass cover slips.

Both undecalcified and decalcified thin sections were used for analyses of cementum annulations. Despite that many biologists appear to favour reading cementum increments from decalcified and stained thin sections, some researchers have discouraged preparing archaeological teeth with such methods, in order to avoid obscuring some growth layer distinctions and disintegration of teeth with poorly preserved collagen (Leiberman 1994). Preliminary work with archaeological seal and dog teeth conducted for this study suggested that staining can aid the resolution of cementum increments and that well-preserved archaeological teeth and cementum can often tolerate decalcification, though the effectiveness of these procedures was difficult to anticipate.

The process of tooth decalcification and staining of seal teeth was undertaken following protocols used by the Canadian Wildlife Service (Calvert nd; Stewart, et al. 1996). Dog teeth used in this study were prepared following the same protocols. Teeth selected for cementum analyses decalcified in a two step process involving initial immersion in a 5% nitric acid solution for 24 hrs, followed by removal of the tooth crown and a longer immersion in a buffered formic acid solution (500ml of 90% formic acid mixed with 500ml of distilled water, and 200g of sodium citrate mixed with 1000ml of distilled water) for approximately 36 hours. Decalcification is judged to be complete

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

when no calcium precipitate is formed when a 5ml sample of the formic acid bath is mixed with 1ml of 5% ammonium oxalate solution. Once the decalcification process is finished, the soft tooth body is rinsed in running water for 12-15 hours.

Decalcified teeth were embedded in Lipshaw M-1 embedding matrix for frozen sectioning, and sectioned in a Cryocut frozen tissue microtome at about –16°C. Multiple longitundinal sections approximately 10 microns thick were made from each tooth until the root canal was reached. Sections were collected and stored in a solution of distilled water, ethanol and glycerine. Suitable sections were selected and mounted on glass slides (albuminated slides or pretreated Fisher Superfrost™ slides) and allowed to air dry. Mounted sections were stained by immersion in a 0.032% aqueous solution of toluidine blue stain (80mg of toluidine blue 0 dissolved in 250ml of pH 8.5 water) for up to 15 minutes, checking regularly for overstaining. The stained slides and sections were then rinsed in water, covered with a wet-mounted glass cover slip and examined under a microscope while freshly stained.

Tooth thin sections used for cementum studies were prepared at laboratory facilities of the Dept. of Chemistry of Bowdoin College, the Department of Physiology and Biophysics of SUNY Stony Brook, the Dept. of Oral Pathology of the University of Alberta and the Institute Maurice Lamontagne, Dept. of Fisheries and Oceans Canada at Mont-Joli, Québec.

Use of Dentine as a Recording Structure

Dentine, which is composed of a mineral matrix of hydroxyapatite ($3Ca_3(PO_4)_2Ca(OH)_2$ or $Ca_{10}(PO_4)_6Ca(OH)_2$), other types of apatite, metallic ions,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

collagen fibres and other organic matter, is formed through the activity of odontoblast cells lining the pulp cavity of mammal teeth (Hillson 1996: 182, 219; Klevezal 1996: 6-7). Primary dentine is deposited during the original formation of a tooth and subsequently secondary dentine forms in layers covering the inner surface of the tooth wall. Over time, layers of secondary dentine gradually constrict and fill the pulp cavity. Fine, microscopic layers (Von Ebner's lines) are deposited in short term cycles representing as little as a few days' growth (Hillson 1996: 188-189). Von Ebner's lines are, in turn, part of larger (often macroscopic) layers that represent variations in the alignment of dentinal tubules and stress-related growth disturbances that affect the mineralization of dentine, and which are visible as alternating light and dark increments (Hillson 1986: 160-161; Klevezal 1996: 12; Klevezal and Sukhovskaya 1988).

The periodicity and regularity of deposition of dentinal increments varies between species. Nevertheless, research regarding dentine increments in many mammals including sea mammal species indicates that these layers are deposited in fairly predictable seasonal and annual schedules (Klevezal 1996; Laws 1961). Because they begin to form before birth or eruption and are not remodeled (except in the abnormal conditions), annuli provide a useful record of dentine growth during the lifetime of an individual, until the pulp cavity becomes constricted in later life. Analyses of these structures have become conventional and important sources of demographic data for wildlife biologists. They are, as well, very useful to archaeologists for they provide a continuous record of age and growth (as opposed to discontinuous record of age thresholds provided by dental eruption and epiphyseal fusion sequences) and are a vital source of seasonality information.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Tooth Cementum as a Recording Structure

Tooth cementum is a connective tissue that joins the tooth to the periodontal ligament (PDL) of the gum and is deposited on the exterior of a tooth root. It is formed as the PDL and cementoblast cells that line the surface of the PDL produce a mat of collagen fibres on the outside of the tooth; these fibres are then mineralized by hydroxyapatite precipitated by the cementoblasts (Hillson 1986: 163; Lieberman 1994: 525; Klevezal 1996: 13). Because the process of cementum formation is continuous throughout the life of a tooth and it is rarely resorbed, cementum accumulates in deposits with the youngest cementum on the outermost surface of the root (Klevezal 1996: 13-14; Lieberman 1994: 527).

Changes in the rates of cementum formation and degree of mineralization create layers within cementum. These increments are seen under transmitted polarized light as thick bands of translucent cementum alternating with thinner layers of opaque cementum. The translucent increments are poorly mineralized and are thought to relate to phases of relatively fast cementum formation, while the more thoroughly mineralized opaque increments are considered "rest lines" indicative of slowed cementum growth (Lieberman 1994: 527). Being less well mineralized, translucent layers take up more colour when stained (Klevezal 1996: 13).

The formation of paired bands in cementum occurs on an annual basis and provides a basis for estimating the age and season of death in individuals of many mammal species. Increments in cellular cementum, found primarily at the apex of the tooth root, are related to changes in mineralization and density of cementum that occur as

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

part of annual cementum growth, and so are useful estimators of age of death (Lieberman 1994: 533, 537). Acellular cementum, found primarily along the sides of the tooth root, towards the crown, also records age in its paired layers, but because it forms at a more gradual and consistent rate than cellular cementum, it can also provide an indicator for season of death. The increments found in acellular cementum are visually differentiated because of variations in the orientation of their collagen fibre matrices, variations which are in turn related to the varied masticatory stresses of changing seasonal diets (Leiberman 1994: 533, 537). Individuals and species that have diets that vary in terms of hardness or quality from season to season are more likely to have seasonally-correlated growth patterns in acellular cementum.

Readings of cementum increments were taken both from undecalcified thin sections and decalcified, stained thin sections. The majority of cementum readings were made on undecalcified transverse thin sections that were previously used for dentine analysis. These sections were taken from the middle of the tooth root and are suitable for reading acellular cementum deposits. A limited number of teeth of ringed seals, harbour seals and dogs were decalcified and stained in order to improve resolution of incremental stuctures and to verify results of readings of undecalcified sections.

Estimating Ages and Season of Death for Harp Seals

Based on a large sample of specimens collected during winter and spring, Fisher (1954) proposed that the deposition of light and dark layers in harp seals' dentine was part of an annual dentine growth cycle. Bowen, et al. (1983) tested Fisher's conclusion in a study of a large sample of specimens of known age and season of death, finding that

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

both absolute age and seasonality were indeed reflected in dentine growth. Bowen and his colleagues were able to define the normal schedule of the formation of incremental growth lines (IGL) for harp seals and concluded that dentine was a more reliable recording structure for age in harp seals than was cementum (Bowen at al 1983: 1432). A summary of this growth sequence follows, using the descriptive characteristics of increments as they appear when viewed under transmitted polarized light.

The GLG produced during a harp seal's first year of life includes, in order of deposition, a translucent IGL, followed by an opaque IGL. As well, a thin opaque layer (the neo-natal line) forms within the first translucent layer and represents the period of the seal's birth, or shortly thereafter (Bowen, et al. 1983: 1430, 1432). Beginning in the second year of life, the yearly dentine growth pattern of most harp seals consists of three IGLs. The first and outermost IGL within an annual GLG is of poorly mineralized interglobular dentine with a distinctly marbled texture; it is deposited in April and early May. The condition of both sexes declines during this time of year as regular harp seal feeding is arrested by moulting, lactation and other processes (Sergeant 1991: 13-14).

During May and June, and perhaps as late as early July, while harp seals migrate north along the Labrador coast, opaque dentine is deposited within the pulp cavity (Bowen, et al. 1983: 1436). Bowen, et al. (1983: 1434) demonstrated that a final IGL of translucent dentine is formed from June-July until March. This layer appears to grow most quickly between January and March and therefore individuals with thick, translucent terminal IGLs probably died during the winter. A substantial minority of harp seals two years old or older (38% of the study group) have a simpler, two-part GLG

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

pattern Bowen, et al. (1983: 1430). In these individuals, the GLG consisted of opaque and translucent IGLs and the interglobular IGLs were absent.

The formation of interglobular dentine has been associated with nutritional and health stresses in other mammals and has been enlikened to enamel hypoplasia (Hillson 1986: 161; 1996: 190). Accordingly, the regularity with which poorly mineralized dentine is formed in harp seal dentine during April and May suggests that it may be directly related to nutritional stress resulting from the harp seal's annual life cycle (Bowen, et al. 1983: 1439). Nevertheless, hormonal changes or other endogenous factors are also possible causes.

While Bowen, et al. (1983: 1434) found that, in general, counts of GLGs provided reliable estimates of absolute age in harp seals of known age, age estimates are sometimes inaccurate. Incorrect estimates may be due to observer error (Lawson, et al. 1992; see also Albright 1990) but can also result from the presence of "false" GLGs that interrupt the regular sequence of annual GLGs and, in so doing, inflate age estimates. In the study by Bowen, et al. (1983), where redundant readings were conducted by an expert analyst, age estimations of individuals four years old or less were quite accurate, with the age of between 100% and 70% of specimens of each age class identified correctly (Bowen, et al. 1983: 1439). The ages attributed for specimens beyond four years old reported were much less accurate; the ages of 60% or less of specimens in each age class between 5 and 10 years old were correctly identified. Much of this error is likely due to the difficulty of discerning false GLGs in the constricted annulations near the pulp cavities of old individuals (Bowen, et al. 1983: 1434)

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Despite the somewhat disappointing record of estimating age of death in older specimens, harp seal dental annuli retain definite value as recording structures for age of death and are considered the best source of age data for this species (Bowen, et al. 1983). Extremely few (1 in 135, or 0.74%) of the age estimations reported by Bowen, et al. (1983: 1439) were in error by more than one year, indicating that the range of error to be expected from this method is relatively narrow, even for age estimations of older specimens. Errors in average age estimations of harp seal based on dental annuli reported by Lawson, et al. (1992) also did not exceed one year, suggesting that inter-observer error effects, while present, need not disqualify the use of this method. Furthermore, estimated ages can be checked against the diameter of the pulp cavity and transparency of the tooth root itself, which become narrower and less transparent at predictable rates, as harp seals age (Bowen, et al. 1983: 1434). The significance of errors in age estimates may be further reduced if age distributions are evaluated by general age categories denoting yearling, immature and adult individuals, rather than by absolute estimated age (Grue and Jensen 1979; Klevezal 1996). These categories have as much intrinsic meaning for demographic studies as do absolute ages themselves because they reflect life cycle stages.

The range of error demonstrated in harp seal age estimates also implies that attributions of season of death based on identification of terminal IGLs are also subject to misinterpretation. Aside from simple observer error, inaccuracies most likely would arise from the difficulty of distinguishing false GLGs from real annulations in the teeth of older individuals. The presence of an unidentified and incomplete false GLG in the position of the terminal increments, adjacent to the pulp cavity might imply an erroneous season of death. Additionally, minor intra-population variability in the actual timing of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the shifts between the formation of different IGLs would tend to obscure the association of terminal IGLs with specific months (see Albright 1993: 11).

While these vagaries demonstrate that seasonality attributions for harp seals based on dental annulations are fallible, analysis of annuli remains an exceedingly useful zooarchaeological tool when used cautiously. A practical approach that is in keeping with the use of proxy data and of estimates with ranges of error is to avoid excessive precision when interpreting GLGs, attributing seasonality on general scales rather than on the level of a precise month or portion of a month. The central tendency of the archaeological seasonality distribution would therefore be defined by modal or generalized patterns in these broad temporal categories. Larger sample sizes would also help reduce the "noise" caused by uncommon, but unpredictable, occurrences of false GLGs.

The ultimate importance of errors in the attribution of seasons of death to a large archaeological sample may also be limited. Identification of false GLGs is a problem particular to the examination of older specimens but is easier in younger specimens with wider GLGs. Additionally, false annulations also appear to form over relatively short time periods. In the study reported by Bowen, et al. (1983), regularly patterned GLGs bracketed false GLGs. The formation of false GLGs did not disrupt the normal GLG growth schedule or create ongoing abnormal dentine growth as the false GLGs were followed by an IGL in correct seasonal phase. The disturbance indicated by a false GLG seems to be limited to a single IGL and therefore represents a period of time that is less than one season.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Some straightforward methodological solutions can improve the accuracy with which normal and anomalous GLGs are identified. Comparisons of archaeological teeth to those of modern individuals of known age of death, from the same study area, can also be a vital aid in the recognition of terminal GLGs (Gordon 1984; Grue and Jensen 1979; Klevezal 1996). Replicated blind readings of tooth sections provide a means of refining estimations of age and seasonality through modal GLG identifications, and of identifying and omitting anomalous specimens that cannot be consistently attributed (Bowen, et al. 1983: 1434). As well, available comparative samples can be mixed into the multiple blind readings to provide tests of the reader's consistency and accuracy. All these methods were used to attribute age and seasonality of death of harp seals in this study.

Estimating Age and Season of Death of Ringed Seals

Various researchers have studied the formation of incremental structures in the dentine and cementum of ringed seals. Both were used in this study, though for practical reasons, most observations were readings of dentine supplemented or cross checked readings of cementum layers.

McLaren (1958) applied studies of incremental structures in dentine to ringed seals, and these methods have since been used extensively in biological field studies concerning this species (Smith 1973, 1987). Through analyses of a large collection of ringed seals harvested throughout the year, McLaren (1958) and Smith (1973) correlated the deposition of specific IGLs in dentine with particular months of the year. As well, they used counts of dentinal GLGs to estimate the absolute age of death of ringed seals.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

McLaren (1958: 6) described a simple two-part GLG for ringed seal dentine. He documented the formation of a wide IGL of opaque dentine (as seen under transmitted light) from about mid-June to late March. A thin IGL of translucent dentine was deposited from late March to the middle of June. Smith (1973: 7) confirmed the timing of these phases in a study of ringed seals from eastern Baffin Island, though other research suggests that there may be regional variations in dentine growth schedules determined by latitude (Albright 1990: 11). Local comparative collections of sectioned ringed seal teeth of known season of death are needed to determine the dentine growth pattern pertinent to the archaeological research area.

Both Smith and McLaren noted the presence of vacuolated interglobular dentine layers in some individuals. Interglobular dentine often appears to be associated with either the opaque IGL or the late March boundary between opaque and translucent IGLs when it does occur. However, Smith (1973: 7) concluded that it was not a definite, consistently forming IGL.

Counts of dentine GLGs are one method used in this study to estimate age and season of death for ringed seals. Many previous archaeological studies have used analyses of dental annuli in ringed seals for this purpose (see Cox and Spiess 1980; Gordon 1984; Morrison 1983; Spiess 1978; Stenton 1980, among others). As with harp seals however, recent research has indicated that variability in patterns of ringed seal dentine formation complicates these kinds of studies (Albright 1993).

In particular, these studies suggest that dentine formation may be irregular over the lifetime of individual ringed seals and that dentine GLGs are relatively difficult to discern and count. Stewart, et al. (1996) compared dental and cementum GLG counts of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

ringed seal teeth and found that different age estimates were produced by the two methods when used on the same teeth. In particular, there was a strong tendency for dentine GLG counts to produce younger estimated ages, in relation to those based on cementum GLGs. These differences were particularly pronounced in the teeth of older individuals as the dental GLG counts under-represented individuals older than 20 years old while it over-represented individuals in the 5-9 years old age group (Stewart, et al. 1996: 396). Differences in age attributions were also noted in individuals less than 10 years old (Stewart, et al. 1996: 395-396). The results Stewart, et al.'s study strongly suggest that age profiles of ringed seals that are based on dental annuli will be skewed by artificially "young" age estimations, even if age distributions are considered in terms of general age categories. Counts of cementum GLGs are likely the more accurate means of estimating age of death of ringed seals.

As with harp seals, annuli in ringed seal cementum form as alternating translucent and opaque bands, with one pair of these bands per (Smith 1973; Stirling, et al.1977). The translucent band is wide while the opaque layer is thin. According to Stewart, et al. (1996) and Albright (1990), counts of ringed seal cementum GLGs yield consistently higher age estimates than counts of dentine GLGs, and more consistently replicable age estimates. Cementum GLG counts are therefore considered the preferable means of attributing age to ringed seal specimens.

Albright (1990: 9-10) reported difficulty making reliable identifications of the terminal cementum increment in ringed seals due to variability in the timing of growth schedules and because of a relatively large number of specimens with indeterminate terminal IGLs. Nevertheless, in the large sample of decalcified and stained teeth he

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

studied, Albright (1990: Figure 5) documented the formation of the thin, dark-staining band (which is translucent in unstained sections) from late March to late June. This schedule is broadly coincident with the deposition of translucent dentine layer and the period in which ringed seals breed and moult (Smith 1987). Because of the difficulties involved in reliably identifying terminal increments, Albright concluded that dentine was a preferable source of season of death information.

Age and Seasonality of Harbour Seals

Incremental structures are present in both the dentine and cementum of harbour seals. Mansfield and Fisher (1960) defined a two-part annual GLG sequence for harbour seal cementum, validating their conclusion with a single tooth from a known-age seal. This sequence includes a narrow translucent IGL and a wide opaque IGL. Mansfield and Fisher (1960: 93) associated the formation of the translucent band with the spring and early summer, which is the period in which harbour seals breed, moult and cease normal feeding. The wider opaque band then represents cementum formed during the rest of the year, from the late summer to late winter. They did not, however, define the type of microscopy used in their study, or whether they stained their sample. In a wider sample of teeth from harbour seals of unknown age, Mansfield and Fisher (1960: 93) also tentatively linked the number of growth layers in dentine with those in cementum. However, reliable age estimations based on dentine are considered to be difficult to obtain in specimens older than 4 years of age. By 10 years of age, the pulp cavity may be constricted with secondary dentine (Dietz, et al. 1991: 17).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Using transmitted, polarized light and a sample of decalcified and stained specimens of known age of death, Dietz, et al. (1991) verified that the paired opaque-translucent IGL sequence did represent an annual GLG. In a larger sample of teeth from seals of known date of death, they also associated the period in which the thin, dark-staining opaque cementum layer forms with the breeding and moulting season. Assuming this association of life history and histology is generally correct for harbour seal populations, harbour seals should form opaque cementum in late April and May in southern Labrador, and in June in central and northern Labrador (Ames 1977; Boles, et al. 1980)

Dietz, et al.'s thin spring-summer "opaque" IGL seems to be a rest line and it appears likely that it is actually the same IGL as Mansfield and Fisher's (1960) thin translucent layer. Differences in sample preparation and microscopy technique likely account for this discrepancy. When applying Mansfield and Fisher's conclusions to the interpretation of cementum increments in archaeological harbour seal teeth, Spiess (1976: 53) noted that the narrow band appeared to be darker than the wide translucent band when stained and viewed under transmitted light. Spiess (1976: 53) also associated the narrow, dark-staining band with the period of breeding and pupping.

On the basis of the growth patterns reviewed above, cementum GLGs are used in this study to estimate the age and season of death of archaeological harbour seals. Where needed, GLGs in dentine are also used, with the assumption that the formation of dentine GLGs in harbour seal teeth follows a similar schedule as those in cementum, the pattern documented for other pinniped species.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Estimating the Age of Dogs

Age profiles for archaeological dog populations were produced from examination of epiphyseal fusion patterns, tooth wear patterns and incremental structures in teeth. Bone fusion and tooth eruption and wear patterns provide some useful and readily applied frameworks for aging dog populations. However, because dogs mature relatively quickly in terms of dentition and skeletal growth, many of these aging markers apply only to the first two years of life (Brunni and Zimmerl 1951; Habermehl 1961; Hennet 1995; Hillson 1986; Miles and Grigson 1991; Schmid 1972). Working from a sample representing several German dog breeds, Habermehl (1961) constructed an age index based on incisor wear that distinguishes age classes for dogs up to 10 years of age. Despite its practicality and potential, it is unclear whether this index is directly applicable to Inuit sled dogs because of the differences in breed, dental morphology, handling and diet between sled dogs and those in Habermehl's study. A study of a large sample of jaws of known age is needed to verify the relevance of Habermehl's index to tooth wear demonstrated by sled dog populations. Because of the various limitations of tooth eruption, wear and epiphyseal fusion sequences in distinguishing the ages of individuals older than two years of age, and the general lack of precision inherent in relative aging methods, epiphyseal fusion patterns, tooth wear and incremental structures in teeth were used to provide age of death profiles for dog populations.

Relatively little research attention has been paid to examining the formation of incremental structures in the teeth of domestic dogs, despite the application of these techniques to wild wolf and fox populations, as well as to domestic cats (Goodwin and Ballard 1985; Grue and Jensen 1973, 1976, 1979; Klevezal 1996). Nevertheless, working

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

dogs, and sled dogs in particular, likely are excellent candidates for incremental studies. Ethnographic descriptions of the management of sled dogs by Inuit (Freuchen 1935), as well as modern anecdotal reports (Nain Resident 1997: personal communication; Nain Resident 1998: personal communication), note marked seasonal variation in their activity, nutrition and diet. These are all factors that have the capacity to influence the pattern of formation of incremental structures in cementum. In addition, the living environment of sled dogs in Labrador is also seasonally variable.

Given the importance of overall health and nutrition, diet hardness and mechanical stresses resulting from chewing in the formation of incremental structures in cementum (Leiberman 1994), it seems likely that incremental structures related to annual or seasonal cycles would form in the dental tissues of dogs, especially in cementum. Brief, preliminary studies have demonstrated that incremental structures were, in fact, present in the cementum of dogs' teeth (Grue 1976; Grue and Jensen 1979).

In Labrador, sled dogs were most active from December until June, when they are used to pull heavy loads for long distances and over extended periods of time and to aid the hunting of seals, caribou and bears (Hutton 1912; Nain Resident 1997: personal communication; Nain Resident 1998: personal communication; Taylor 1974: 38; Turner 1979: 81). During these months, sled dogs slept out of doors and were usually fed by their keepers and often with solid frozen meat or fish while on the trail (Freuchen 1935: 148-149). In times of plenty, dogs are well fed, but if worked too heavily or if fed too meagerly, dogs loose condition (Freuchen 1935: 175-177).

Sled dogs were usually less active during the summer. Other than bearing loads on trips inland, there was no work for dogs once the snow and sea ice disappear. During

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

the summer, sled dogs were often tethered if kept near settlements and fed scraps such as waste heads and offal from fishing activities (Freuchen 1935: 177; Nain Resident 1997: personal communication). Dogs were also left on small islands where they had to fend for themselves, or were given periodic feedings (MacRury 1991: 40). In Labrador, dogs were known to catch fish for themselves at high tides (Freuchen 1935: 177). The overall nutritional state of dogs left to themselves in this manner likely declined during the summer.

Grue (1976) and Grue and Jensen (1979), analyzed tooth thin sections drawn from a relatively small sample of modern household and working dogs. This sample included 18 household pets of known age of death and 24 Greenlandic sled dogs of known month of death. Grue (1976: 3-4) reported observing multiple opaque and translucent layers in the cementum of household dogs' teeth prepared by decalcification and staining. Conspicuously, these layers were generally irregular and indistinct, and counts of their GLGs did not match their known actual ages. By contrast, the thin sections of sled dog teeth showed clearly defined cementum GLGs and, in one individual of known age of death, the GLG count produced a correct age estimate (Grue 1976: 4). The sled dogs' GLG's were similar to well-developed cementum GLGs that have been observed in the teeth of other temperate and arctic canid species including wolves, coyotes and arctic fox (Grue 1976: 4-5). In these other species, cementum GLG counts are also directly related to age (Grue and Jensen 1973; 1976; Klevezal 1996).

Grue and Jensen (1979: 12) were also able to relate cementum growth patterns to seasonal cycles in their sample of Greenlandic sled dogs of known month of death. A thick layer of lightly stained cementum represented the bulk of a single year's cementum

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

growth. A layer of dark-staining cementum was formed or forming in the teeth of animals that died between September and December (Grue and Jensen 1979: 12, 14). The formation of the dark-staining increment therefore falls within, and represents the majority of, the open water season in coastal Greenland, during which time dogs are relatively idle and eating a different diet than that eaten during the winter.

Permanent canines erupt in dogs at about 125-141 days after birth (Hennet 1995: 95) and a canine from known 20 month-old Greenlandic sled dog pup observed by Grue (1976: 4) had one complete GLG. Accordingly, cementum accumulations on permanent canines represent every year of an individual dog's life, excepting only the short period of approximately four to five months before the eruption of permanent teeth.

However, the actual reckoning of age is complicated by the capacity of domestic dogs to bear their young at any time of year, not simply in one season. Since the presence of the thinner, dark-staining annual band is required to identify a complete GLG and this layer appears to be consistently deposited between September and December, the first GLG may be completely formed between approximately six months and 18 months of age (Grue and Jensen 1979: 11). Pups born between January and May will have permanent canines by the time the opaque layer is formed, and will therefore show an opaque layer in their first year of life. Dogs born in or after the month of July, however, might not record an opaque increment in the cementum of their permanent canines during their first winter because they will retain deciduous canines well into the winter. For these individuals, the first canine cementum GLG will be formed between September and December of the following year. Age profiles for dog populations that are based on

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

counts of whole GLGs must reflect the variable formation of the first opaque IGL in the first winter.

Grue and Jensen (1979) did not comment on the extent of variability in the dates of formation of dark-staining cementum; all the specimens with such terminal annulations in their limited sample fell between September and December. Variations in the schedule of cementum formation might result from different diets if dog cementum formation patterns are linked primarily to the hardness of seasonal diets. Klevezal (1996: 222-223) noted variability in the dates during which dark and light staining IGLs were present as terminal layers in the teeth of wild wolves collected from different regions of Siberia, though the majority of specimens conformed to general expected patterns. Klevezal (1996: 224) employed a practical method of estimating season of death for these wolves based on judging the type of IGL represented as the terminal annulation and its thickness relative to the previous similar IGL. Attributions of season of death were with reasonable accuracy through this method, allowing for variability in cementum formation with relatively coarse seasonal time units, rather than discrete months.

While further validation with specimens of known age is needed to clarify the relationship between cementum GLGs and annual and seasonal growth, Grue and Jensen's work suggests that life history does influence the development of cementum of dogs. In particular, the seasonal life history of sled dogs used by Inuit seems sufficiently varied to produce visible, age-related incremental structures in cementum. Because dentine grows on a continual basis within the teeth of dogs as it does for other species, annual increments might be observable in dentine as well. However, it appears that the schedule of dentine growth in dogs has not been investigated; almost all studies of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

incremental structures in the teeth of terrestrial mammals are focussed on cementum (Grue and Jensen 1976; Klevezal and Kleinenberg 1967).

For this study, ages of death for dogs were estimated following Grue's (1976) protocols, using counts of acellular cementum GLGs made on the sides of the roots of canine teeth. Where they were possible to make, general seasonality estimates for dogs are made following Klevezal's (1996: 224) mode of attributing season of death for wolves. Estimations of age based on cementum increments were also supplemented by studies of epiphyseal fusion patterns and tooth wear.

Summary

In previous chapters, I outlined the objectives and research questions of this dissertation and introduced the archaeological projects that provided data for this dissertation. I have presented, in this chapter, the methods with which I analyzed the data used to address these issues. In particular, these questions addressed the environmental history of Labrador, site chronology, the nature of the contact period Inuit hunting economy in Labrador (including the nature and diversity of species exploited and the seasonal schedule of resource procurement), and the presence of economic stress. A range of analytical methods was employed in response to these research goals.

In addition to the use of current published data, palaeoenvironmental conditions were approached through collaborative palaeoentomological and archaeobotanical studies reported here and with proxy indicator species. Basic economic questions regarding species choice and availability in hunting were addressed with conventional measures of taxonomic abundance using Numbers of Identified Specimens counts in conjunction with Percent Relative Frequency and Density of Deposition counts used to compensate for

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

sources of statistical distortion. Food utility and bone density indices were used to examine the roles of selective transport and density-mediated attrition in shaping faunal assemblages. Seasonality and age of death data were used to establish seasonal hunting schedules and define selective hunting patterns. These data were obtained from analyses of incremental growth structures in the dentine and cementum of seal teeth. The presence and importance of economic shortfalls were addressed through the proxy of culling patterns of managed sled dog populations, with the warranting assumption that food shortfalls would result in severe culling patterns and attrition of prime age individuals. Age of death profiles were based on analyses of incremental structures in dog cementum. Finally, archaeobotanical studies provided a means, hitherto almost entirely new in the Canadian Arctic, of assessing the role of plant foods in subsistence.

This suite of methods has been applied to obtain well-dated and multi-faceted subsistence and palaeoecological data in historical ecology-oriented archaeological research projects elsewhere in the Arctic. Nevertheless, the scale of zooarchaeological study undertaken here is unique in Labrador archaeology, as are the applications of archaeobotany, palaeoentomology and dendrochronology. The concordance of approaches, dating, trade materials, complimentary datasets, sample size, regional comparison and life history data available for this study are new in Labrador archaeology and present a real opportunity to gain a new perspective on culture change there. In the following chapter, the results of these analyses are presented so that these new data may be applied to the research questions regarding the environmental and economic contexts in which communal houses were used in Labrador during the 18th century.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 9

PALAEOEVIRONMENTAL DISCUSSION AND ZOOARCHAEOLOGICAL ANALYSIS

Introduction

Previous research concerning Neoeskimo adaptation and culture change in Labrador, and that concerning the origin and function of communal houses, has focussed primarily on architecture and artifact analyses and economic studies based on locational analysis. Large-scale, regional survey programs have provided a large portion of these data. Two major objectives of this dissertation were to add detailed subsistence studies based on analyses of faunal remains collected as part of more intensively site-focused projects to Labrador Neoeskimo archaeology, and to reappraise current palaeoenvironmental data. The purpose of this chapter, therefore, is to review recent palaeoenvironmental data pertinent to animal biogeography and Inuit land use, and to present analyses of faunal, plant and insect remains from excavated sites at Uivak Point, Oakes Bay and The Narrows region.

The survey of palaeoenvironmental research begins with reconstructions of regional and hemispherical palaeoclimate, based on ice core and dendroclimatological studies. Palaeoclimatological reconstructions support glaciochemical and archival reconstructions of sea ice conditions, which is a variable of primary importance for animal habitats and to Inuit subsistence from fall to spring. This study focuses upon palaeoclimate and sea ice conditions during the so-called "Little Ice Age" and attempts to define the nature and variability of climate and sea ice trends affecting Labrador during this time period, a key element in studies of Labrador Inuit culture change.

The faunal analyses presented here are intended to define diachronic and synchronic patterns of Inuit land use and hunting practices. The abundances of various taxa in zooarchaeological assemblages are described through the use of mutually-reinforcing

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

quantitative methods. Various utility and bone density indices are used to address questions of attrition, selection and use of particular species. Qualitative data pertaining to the seasonality of hunting practices, the seasonal presence of indicator species and life history of prey species are obtained through analyses of incremental structures. Finally, dog team management practices are considered with the use of skeletal aging and incremental studies, in order to evaluate the importance of economic stress in economic decision-making.

Summary data from faunal analyses are presented in this chapter. In the interests of brevity, the most basic raw data supporting these analyses are not presented but are available from the author. As well, summaries of pertinent aspects of archaeobotanical and palaeoentomological studies conducted on samples from Uivak Point 1 by other researchers are also presented. This body of multidisciplinary work provides an original set of data capable of adding resolution to reconstructions of Neoeskimo land use, and for addressing specific questions regarding the environmental context of, subsistence economy associated with, the use of communal houses in Labrador during the 18th century.

Environmental Change in Labrador during the Little Ice Age

The Little Ice Age (LIA), conventionally dated from the 16th to the 19th century AD (Grove, 1988), has been considered as an extended period of widespread climatic cooling and glacial advance in the North Atlantic region that followed the notably warmer Medieval Warm Period (MWP) of the 9th to the 14th century AD. New palaeoenvironmental research has shown that the cooling episode of the 16th to the 17th century was one of the most rapid periods of climate change during the Holocene (Mayewski, et al., 1994; Meese, et al., 1994; O'Brien, et al., 1995). The palaeoclimate studies of the Greenland Ice Sheet Project 2 (GISP2) and related research projects have also shown that, while the LIA was generally characterized by periods of increased cold and glacial advance, it was not a period of uniform cold (Bradley and Jones, 1993; Meese et al., 1994; Ogilvie and Jónsson 2001).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Several palaeoenvironmental records are reviewed in this section, in order to better understand current thinking about the environmental conditions of Labrador, the eastern Arctic and the northwestern North Atlantic during the last several centuries. These records include borehole temperatures, climate reconstructions based on glaciochemical proxies and tree ring records, and glaciochemical proxies of and archival records of sea ice conditions.

Ice Core Stable Oxygen Isotopes

Ratios of stable oxygen isotopes (^{16}O and ^{18}O) in water vary in relation to temperature and so have been used extensively by palaeoclimatologists as a type of palaeothermometer to measure local and regional temperature conditions, especially in precipitation sampled in glacial ice cores (Barlow 2001; Jouzel, et al. 1997). One of the original ice core studies in the Greenland ice cap, at Camp Century, included a pioneering analysis of $^{16}O/^{18}O$ ratios (Dansgaard, et al. 1969, 1970, 1975); this study had far-reaching influence in arctic palaeoenvironmental studies as it had great time depth and high resolution, and because the record was independent of traditional indicators of environmental conditions, such as glacial advances. The Camp Century temperature reconstructions have been widely used in archaeological studies of the environmental dimensions of Palaeoeskimo, Neoeskimo and Norse culture history (see, for example, Dansgaard, et al. 1975; McGhee 1969/70, Petersen 1974/75) and were of central importance to Peter Schledermann's analysis of Labrador Inuit culture change (Schledermann 1971, 1976a, 1976b).

The Camp Century oxygen isotope records have generally been published smoothed formats as they were not considered appropriate for very fine scale analysis (Dansgaard 1975: 25). In these formats, a general long-term warm period was defined for the 7th to the 12th century, with several limited if sharp cooling phases brought by century-scale temperature oscillations. By the mid-14th century, a protracted cooling phase was

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

demonstrated in the isotope record, lasting until the early 20th century. During this period, ^{18}O concentrations fell below the mean of the past 1400 years (and hence temperatures exceeded the mean) on only a few occasions of limited duration and amplitude. A phase of maximum cold was reached in the later 14th century, while additional periods of deep and extended cold were demonstrated in the later 15th, 17th and 19th centuries (Dansgaard, et al. 1970: Fig, 1; 1975: Fig. 2). This pair of generalized warm and cold phases were tentatively linked with the MWP and LIA respectively, which had already been identified and defined on other criteria elsewhere (Dansgaard et al. 1975: 26-27).

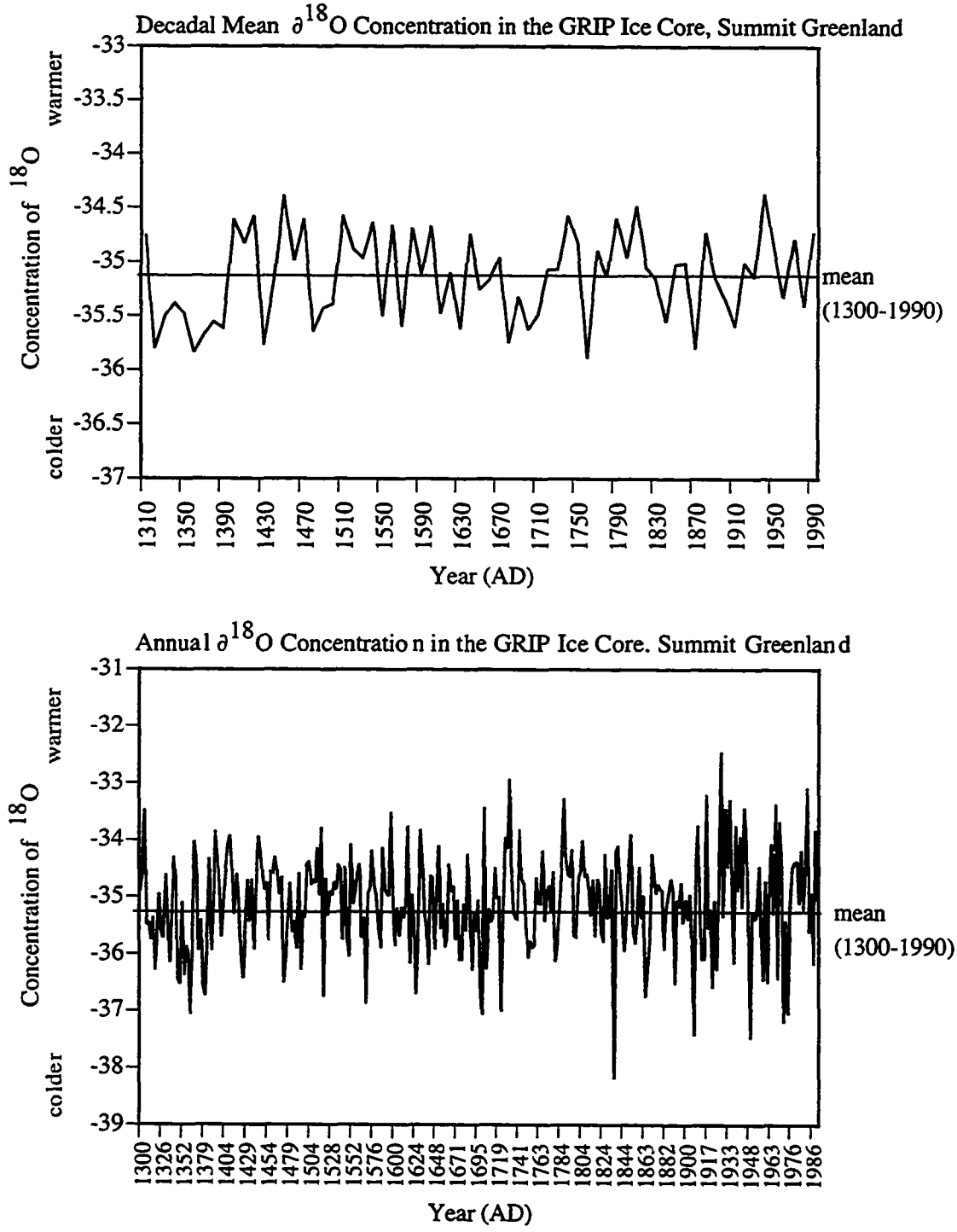
The Camp Century isotope record also indicated that temperatures did exceed mean values on several occasions, during the LIA, most notably during the 18th century, which appears to have seen the longest-term and most moderate climate conditions between the MWP and the 20th century. Revisions in the Camp Century isotope data and use of different statistical treatments in different publications have obscured the duration, timing and amplitude of this episode of reduced ^{18}O concentrations and hence moderated temperatures. Nevertheless, the period appears consistently as the most prominent moderation of LIA era cooling in all these publications.

Several subsequent drilling projects have produced longer and more reliably resolved ice core records for the Greenland Ice Cap. The GRIP ice core, from the summit of the ice cap, and the GISP2 core located 32km to the west, provided similar oxygen isotope records with annual resolution (White, et al. 1997: Table 1). Because of their high altitude settings the GRIP and GISP2 ice cores are considered to be responsive to regional North Atlantic climatic variations (White, et al. 1997).

Annual and decadal mean ^{18}O isotope concentrations of snowfall represented in the GRIP ice core between AD 1300 and 1990 are presented graphically in Figure 9.1. A substantial degree of year to year variability in ^{18}O concentrations is apparent in the lower graph, implying marked annual temperature variability in the atmosphere above the.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.1 $\partial^{18}O$ Concentrations in the GRIP Ice Core between 1300 and 1990 AD (Data from Johnsen, et al. 1997; Dansgaard et al. 1993; GRIP Members 1993; Grootes 1993; Dansgaard 1993).



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Greenland ice cap throughout this period. Interannual temperature variations appear to have been reduced during much of the 18th century, resulting in a smoother graph for that period

Trends in climatic variation are somewhat clearer when expressed in terms of decadal means of ^{18}O concentration in the upper portion of the figure. ^{18}O concentrations were high for protracted periods, indicating relatively consistent colder climates, during the 14thcentury, a portion of the 15thcentury, most of the 17th century and early 18th century and portions of the middle and late 19th century. Relatively warm conditions are indicated for the late 14th century, most of the15th century to 16th century, the 18th century and 20th century. While the state of temperatures below the mean of the last 700 years in most years between 1600 and 1910 might be taken as evidence of a LIA episode, this decline was not consistent. Save for a sharp cold spell during the 1760's, the bulk of the 18th century and early 19th century stand out as having the most consistently moderated conditions that contrast with those of the 17th and 19th century, between the 16th and the 20th centuries. The GRIP ice core data therefore verifies and clarifies the evidence for a climatic moderation in the 18th century, amidst general cooling trends in the 17th and 19th centuries. Post-15th century cooling and warming trends demonstrated in the GISP2 ice core $\partial^{18}O$ record coincides with those of the GRIP record (Barlow 2001).

Borehole Temperatures

Subsurface temperature profiles of glacial ice masses, drawn from the boreholes of ice core drilling projects, provide a kind of practical thermometer for measuring past glacier surface temperatures at drill sites (Alley 2000). Because of the insulating capacity afforded by the sheer bulk of accumulated snow, compressed into ice, in glaciers and ice caps, temperature signatures of long-term surface temperature trends may be extrapolated from

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

temperature gradients within ice core columns. These records are illustrative of long-term trends as short-term (annual) temperature variations are obscured (Dahl-Jensen 1998).

Temperature studies of boreholes of the GRIP and Dye 3 ice cores, located in high-altitude areas of the central and southern Greenland Ice Cap respectively, have provided 50,000 years and 7000-year palaeotemperature records (Dahl-Jensen, et al. 1998). These records are proxies for glacier surface temperatures and have been determined to covary with atmospheric temperatures (Cuffey, et al. 1994). These studies indicate a change in reconstructed mean surface temperatures of over 20°C between the glacial maximum and the warmest periods of the Holocene (Dahl-Jensen 1998: Fig. 3). They indicate a general trend of warming from ca. A.D. 1 to 1000, followed by a cooling phase that reached its nadir by about A.D. 1550 to 1600. Temperatures moderated again in the 18th century (and apparently reached modern mean temperatures in the later 18th century), followed by a second decline in temperatures in the mid 19th century. The scale of temperature change between maximum of ca. AD 1000 and the minima of 1550 to 1600 and 1850 appears to have been between 1.5°C and over 3°C (Dahl-Jensen, et al. 1998: Fig. 4). The amelioration of the18th century appears to represent an increase in mean temperatures, on the Greenland Ice Sheet, of the order of 1°C. Relatively greater amplitudes of temperature change were demonstrated in the Dye 3 borehole, which are thought in reflect the greater exposure of that drill site to variable atmospheric circulation patterns of the North Atlantic (Dahl-Jensen 1998: 271).

Dendroclimatological Temperature Reconstructions

Several tree ring series from Labrador have been used in dendroclimatological reconstructions of spring to fall temperatures (D'Arrigo and Jacoby 1993: 166) and may be used to bolster available ice core palaeoclimatological studies. Two of these, Saltwater pond and Okak (Jacoby and D'Arrigo n.d.) were drawn from within the embayments of two

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

archaeological sites considered in this study. Salt Water Pond lies southwest of Nain, in the very sheltered interior reaches of a deep fjord system. The Okak sample was drawn from the vicinity of Nutak amidst the Okak Islands which, though sheltered, is in an offshore setting and is relatively close to the ice edge in winter. These datasets are unpublished but available from a N.O.A.A. on-line data archive (Jacoby and D'Arrigo n.d). The proxy dendroclimatological records presented by tree ring sequences from these sites are presented in Figure 9.2, showing standard deviations of five-year means of tree ring density from the mean of the years 1615-1985.

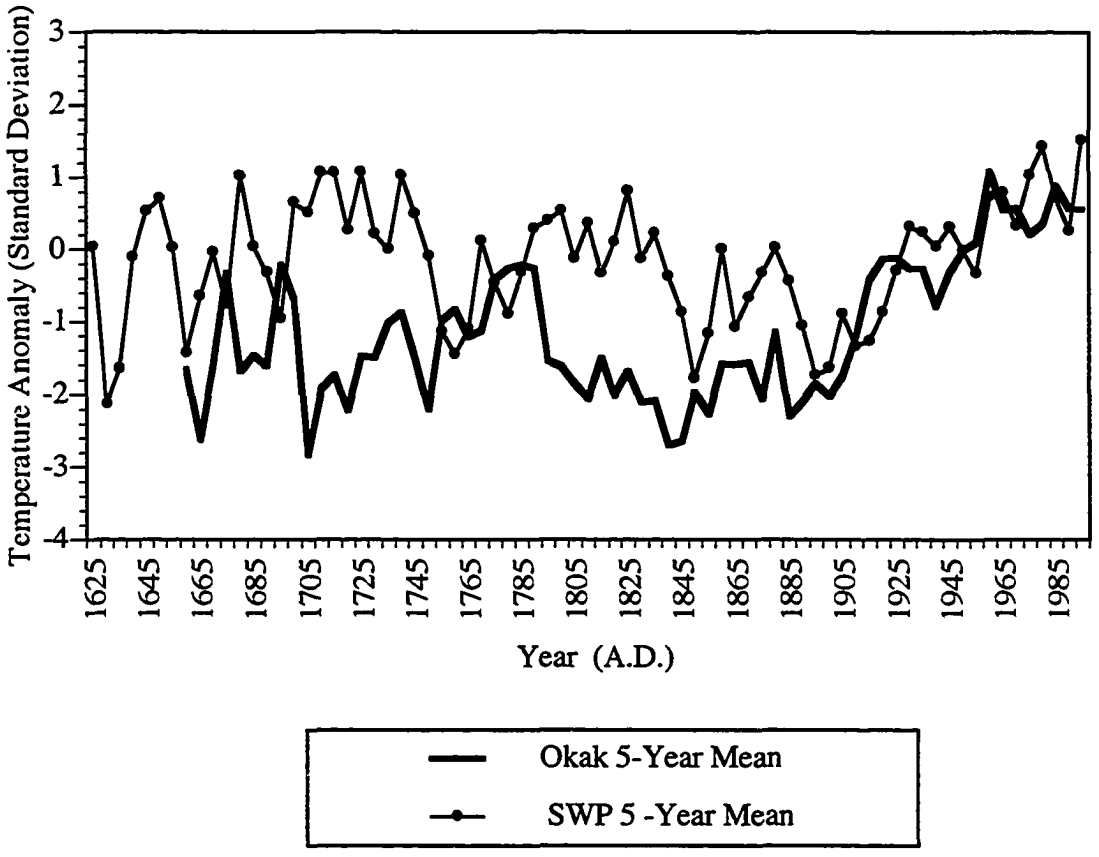
The Salt Water Pond series suggests that spring to fall temperatures in the 17th century fluctuated greatly, with deep maximum cold temperatures and short periods of relative warmth. Temperatures appear to have moderated through the late 17th century and18th century, with a decline from about 1750 to 1775. Temperatures appear to have entered into a period of instability and sharp decline from 1820 to 1850, and 1870 to 1900. Temperatures then rose quite consistently through the 20th century.

The Okak tree ring series also shows generally unstable temperatures with deep lows through the 17th century, followed by a fairly consistent and stable rise in temperatures from 1700 to 1780. Spring to fall temperatures in the Okak record declined sharply after 1780 and apparently remained low through most of the 19th century. Following this, temperatures rose dramatically and consistently through the 20th century.

While the Okak and Salt Water Pond records in general show similarities especially for the 17th, 19th and 20th centuries, they also show somewhat opposite temperature trends during the 18th century, in particular for the years from about 1740 to 1780. The reasons for this inverse relationship are unclear but may be related to the different inner bay and coastal environments of the two sampling locations. The differences point out the need for use of multiple datasets in climate reconstructions.

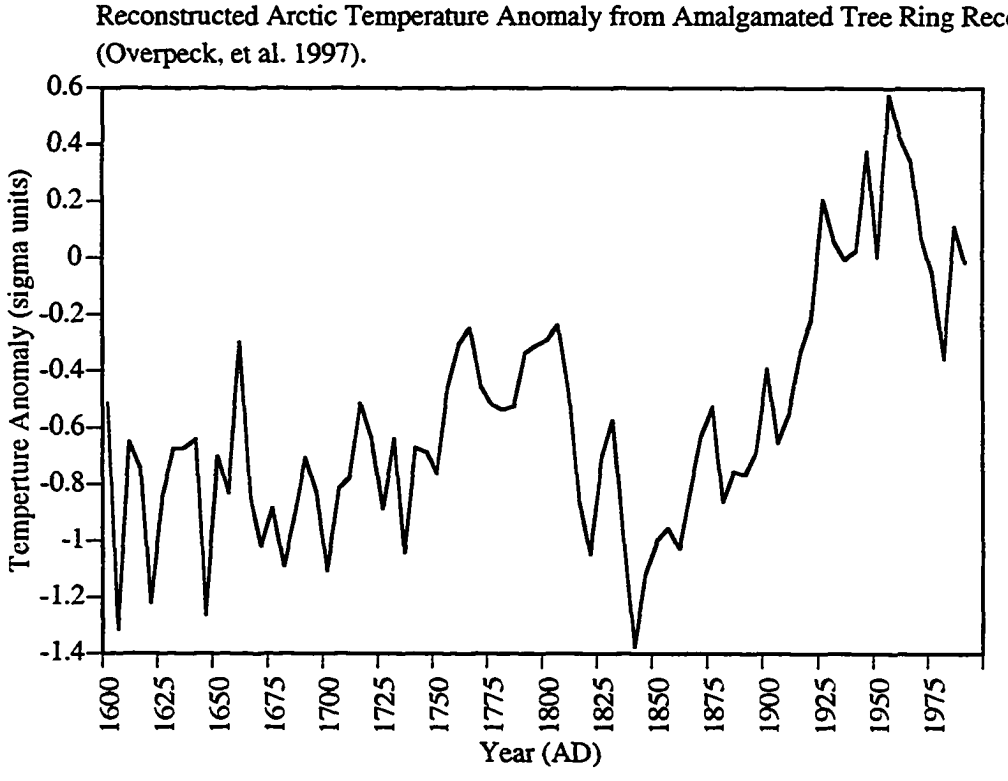
Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.2 Dendroclimatological Records of Temperature for Two Sites in Northern Labrador (data from Jacoby and D'Arrigo (n.d.)



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.3 A Dendroclimatological Record of Arctic Temperature Changes (after Overpeck, et al. 1997, data from http://www.ngdc.noaa.gov/paleo/scincepub/front.htm).



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hemispherical-scale reconstructions of high northern latitude temperatures based on multiple tree ring series (including the Salt Water Pond site), published by Roseanne D'Arrigo and Gordon Jacoby (1993, 1996) serve to link the Labrador record to large-scale climate tends. In these studies, a phase of cooling for arctic and circumboreal regions was indicated for the late 17th and early 18th century, followed by warming after about 1725. From about 1750 to about 1810, temperatures consistently or exceeded the mean for the years 1650 to 1973 (D'Arrigo and Jacoby 1993: Fig. 3). From the minimum of 17th century to the maximum of the 18th century, average temperatures in northern latitudes rose by up to 2°C. A clear and sharp drop in spring to fall temperatures of about 1.5°C occurred after about 1810 and consistently conditions with temperatures below the period's mean lasted until 1910, with a brief and sharp period of warming in the 1830's. After 1910, average temperatures rose over 1.5°C quickly and remained well above the period mean throughout the 20th century.

A similar dendroclimatological study based on multiple tree ring sequences, published by Overpeck, et al. (1997) concentrated on reconstructing past change in arctic temperatures. This study also incorporated many complimentary tree ring sequences from throughout the circumpolar and circumboreal regions, including the Salt Water Pond and Okak sites discussed above. Arctic temperature anomalies defined by this study, expressed in terms of standard deviations of five-year means, are presented in Figure 9.3.

Much as in the D'Arrigo and Jacoby (1993, 1996) analyses, reconstructed temperatures graphed in figure 9.3 were highly variable during the 17th and early 18th century. A trend of moderated temperatures began in the early 18th century and continued without serious interruption until after 1800. Temperatures declined rapidly in the early 19th century, with an accompanying increase in interannual variability, reaching maximum cold conditions for the study period around 1840. After this point, generalized arctic temperatures rose more or less consistently until the late 20th century.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In a third analysis of high latitude, northern hemisphere dendroclimatological temperature study, Briffa, et al. (2001) also documented a general trend of cooling temperatures in areas north of 20°N from the 15th century to the 17th century, with several significant episodes of sharp variability. The late 16th to mid-17th century appears to have seen consistent cold conditions, while the later 17th to early 18th century had repeated episodes of rapid cooling and warming. Shortly after 1700, temperatures warmed rapidly and remained significantly warmer than the maximum lows of the 17th century, until shortly after 1800. The coldest periods of the 17th century represent the coldest years between 1000 and 2000, as defined by Briffa, et al. (2001). The early 19th century tree ring records demonstrate episodes of sharp temperature declines, followed by stabilization in the later 19th century and rapid climbing temperatures in the early 20th century.

The records specifically pertinent to Labrador and neighbouring regions duplicate this pattern, showing a deep cold phase in the 17th century leading to a long warming trend from the late 17th century to the 1730's (Briffa, et al. 2001: Plate 2). A relatively consistent plateau of warm conditions, with minor variations, persisted from 1730 to 1810, reaching the mean temperature for the last millennium between 1790 and 1805. A phase of moderate cooling followed until the twentieth century, including two major and sharp cold-warm cycles occurred between 1810 and 1845, and another pair of cycles at about 1870 and 1900. Briffa, et al. (2001: Plate 3) found general concordance between their original study and several previously published studies, reinforcing the body of evidence for a marked and widespread moderation of temperature during the18th century, within the LIA. The redundancy with which this apparent phase of moderate temperature has been documented in ice core and dendroclimatological studies suggests that it was a real and widespread phenomenon in the northwest North Atlantic/eastern Arctic region if not in the northern hemisphere generally.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Glaciochemical Sea Ice Proxies

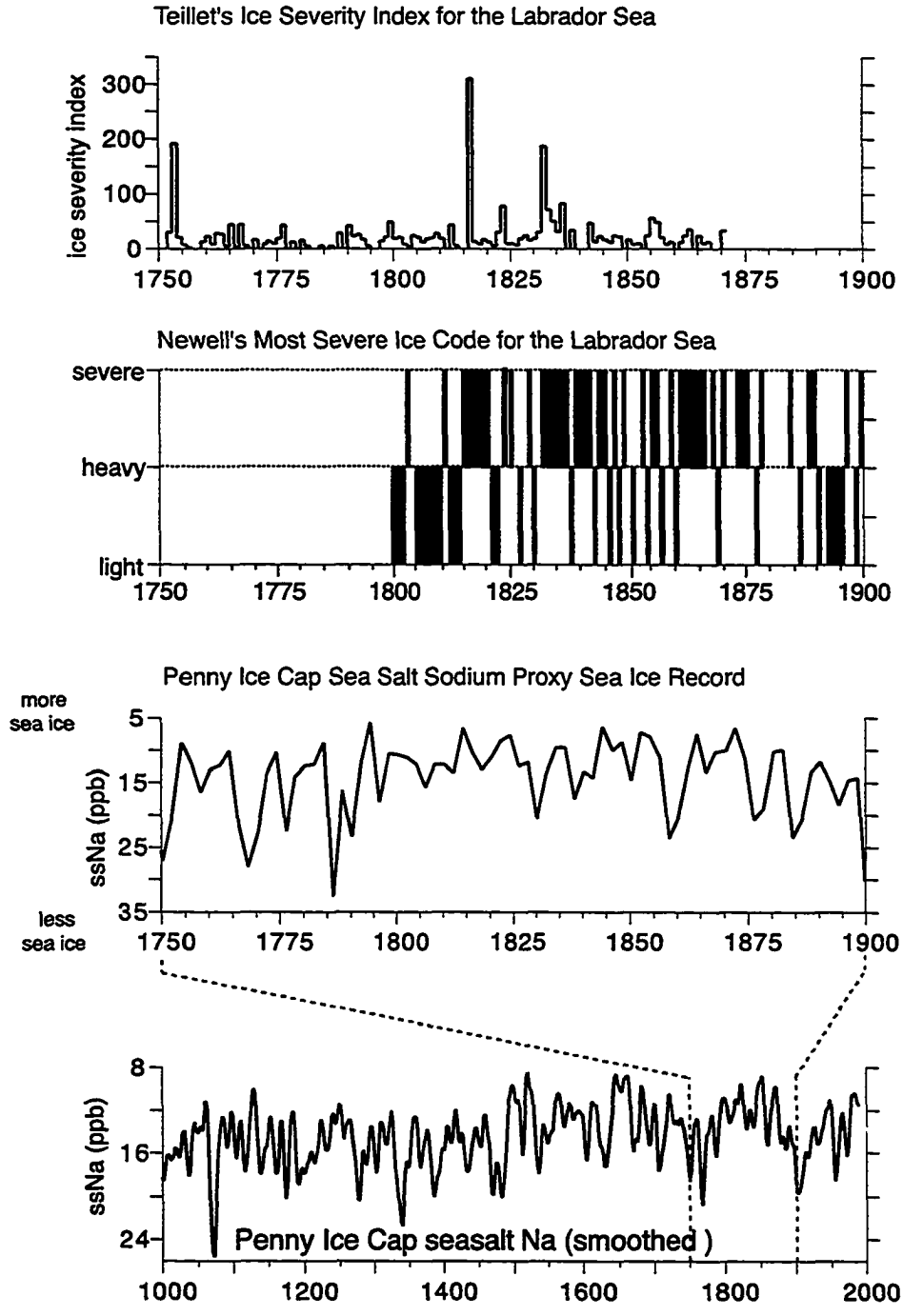
Along with more purely climate-oriented palaeoenvironmental research, several studies of past ice conditions broaden the range of palaeoenvironmental reconstructions pertinent to Labrador. Among these studies are reconstructions of sea ice conditions through glaciochemical proxies, and historical sea ice studies derived from archival sources.

Recent analyses of the sodium content of annual ice layers in the Penny Ice Cap (PIC), located on the Cumberland Peninsula, Baffin Island, have produced a useful, 600-year proxy record of sea ice conditions for Baffin Bay (Grumet 1997; Grumet, et al. 2001). This record is presented in Figure 9.4 and reflects general climate trends demonstrated in the GISP2 ice core on the Greenland Ice Sheet (Mayewski et al., 1994), the ice melt record of the Devon Ice Cap on Devon Island (Fisher and Koerner, 1994; Grumet, 1997), and average annual temperature trends derived from northern hemisphere dendroclimatological studies (D'Arrigo and Jacoby, 1992). These relationships suggest that sea ice trends demonstrated in the PIC proxy sea ice record are related to regional climate dynamics.

The Penny Ice Cap is a low-altitude ice mass and so is highly subject to winds and precipitation brought by local, sea level, weather systems. These winds contribute a range of particulate matter to the ice cap including airborne sodium, derived from sea salt in water droplets picked up from Baffin Bay by winds and storm activity (Grumet 1997: 47; Grumet, et al. 2001). Sodium concentrations on the ice cap surface and in annual ice layers may be considered a negative proxy indicator of regional sea ice extent as ice cover directly determines the surface area of open water in local water bodies from which aerosol sodium may be obtained. Reduction of sea ice in Baffin Bay increases the source region for wind-borne transport of sea salt onto the ice cap, while more severe ice conditions diminish the source region. In years of heavy ice accumulation, Baffin Bay may be almost completely covered in very dense pack ice through the winter and into the summer (C.I.S. 2002).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.4 Proxy Indicators of Historical Sea Ice Conditions in the Labrador Sea (after Woollett, et al. 2000)



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Both sea ice concentrations and transport of sea salt aerosols are linked to regional atmospheric pressure (Crane, 1978; Grumet, 1997). During the 20th century, dates of ice spring ice clearance in Baffin Bay were correlated with the strength of spring southerly winds, which are, in turn, related to NAO atmospheric pressure variability. Years with late ice removal have stronger westerly circulation and generally colder conditions associated with a deep Icelandic Low, while strengthened southerly winds brought by a weakened Icelandic Low create generally warmer temperatures and more rapid ice removal (Crane, 1978; Rogers and van Loon, 1979; van Loon and Rogers, 1978). Grumet (1997; Grumet, et al. 2001) demonstrated that the PIC sea salt sodium record was most closely related to spring sea ice extent and hence to spring circulation patterns and the NAO.

Ocean currents bring cold, low-salinity seawater from Baffin Bay into the Davis and Hudson along with pack ice, influencing both climate and ice conditions in southern Baffin Island. The Labrador Current brings this water and its accompanying ice load further south, along the Labrador coast toward Newfoundland. Therefore, the PIC record is an important potential indicator of past spring ice conditions in the Labrador Sea region.

The PIC sodium record shows a high degree of decadal to centennial variability in sea ice extent since ca. A.D. 1500, reinforcing the characterization of the LIA as a period of considerable variability rather than one of uniformly cold conditions and severe sea ice. Extended periods of generally light ice conditions are indicated for the early 14th, late 14th to middle 15th centuries and early 16th century. The middle 16th to middle 17th century is shown to have been a period of generally more severe ice conditions, after which cycles of moderating ice conditions persisted until the late 18th century. A rapid change to severe ice conditions came in the middle 19th century with a subsequent moderation indicated in the 1870's and 1880's.

Ice conditions in the opening decades of the 20th century steadily grew more severe until about 1916, after which they underwent rapid, short-term fluctuations between relatively moderate and heavy states until about 1940 (Grumet, 1997: 68). This pattern

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

generally corresponds with those established by independent palaeoclimate reconstructions such as temperature records derived from northern hemisphere dendroclimatological research and the Devon ice core percent melt records (Koerner, 1977; D'Arrigo and Jacoby, 1992, 1996; Overpeck, et al. 2001).

Archival Sea Ice Records

Archival studies of ice conditions in the Labrador Sea further bolster the descriptions provided by ice core research, of regional patterning of past ice conditions since the middle 18th century. John Newell's (1983, also Newell 1990) historical sea ice record for the 19th century Labrador Sea (presented in Figure 9.4) was derived mostly from spring and summer observations of ice conditions by ship and shore-based observers. The record expresses the severity of individual ice years after 1800 in relation to modern conditions. The short portion of Newell's record pertaining to the years before 1815 show primarily light ice conditions with brief periods of heavy to severe ice. Relatively uninterrupted periods of heavy to severe ice are indicated for 1815 to 1820, 1833 to 1843 and 1860 to 1868, with variable conditions indicated for the years between these periods (Newell 1983, 1990). The 1870's and 1880's appear to have seen moderated ice conditions.

An ordinal ice severity index for the Labrador Sea that spans the years from A.D. 1751 to 1870, developed by John Teillet (1988), demonstrates considerable interannual variability in the ranking of ice conditions of individual years (see Fig. 9.4). Teillet's index is based on observations of ice conditions in the northern Labrador Sea that were recorded in the log-books of ships traveling to and from Hudson Strait. While mild and severe years were indicated throughout the record, the years from A.D. 1751 to about 1815 generally produced low ice severity rankings. The clear majority of years with high ice severity

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

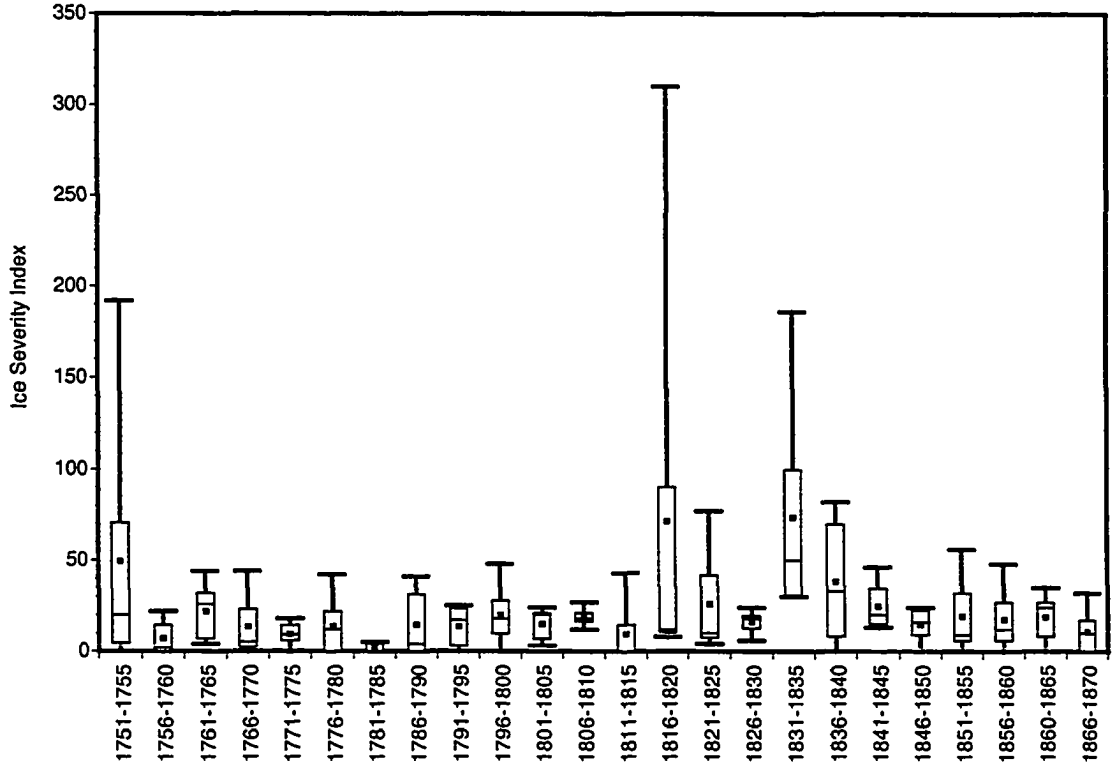
rankings came after A.D. 1815, with the decade of 1830 to 1840 having been particularly severe. In this record, conditions moderated again after the 1850's.

While year-to-year variability in ice conditions is readily apparent throughout these indices, the extent of variability in ice conditions was not constant. Figure 9.5 is a box plot, graphing variation in Teillet's ice severity index in 5-year intervals. The black squares indicate the mean ice severity index for each 5 year interval, while the top, center, and bottom lines of the boxes indicate 75th, 50th, and 25th percentiles of the range of rankings of years in each 5-year interval. The whiskers mark the 10th and 90th percentiles of the distribution of rankings.

The graph shows four intervals with marked variability in ice conditions, one in 1751-1755, and the others from 1816 to 1840. Two of these intervals (1816-1820 and 1831-1835) stand out as being extremely variable while having both high minimum and mean ice severity indices. Figures 9.4 and 9.5 strongly indicate that spring ice conditions were relatively moderate and relatively consistent through most of the later 18th century. Sea ice grew more severe and displayed more year to year variability from about 1816 to the 1850's, whereupon ice conditions returned to a more moderate and consistent pattern. Most notably, the data presented in Figure 9.5 suggest that, in terms of sea ice conditions in the Labrador, the last decades of the 18th century were some of the least variable and mild decades between 1750 and 1900.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.5 Variability in Teillet's Ice Severity Index: Standard Deviations of 5-Year Means



Summary of Palaeoenvironmental Data

The diverse palaeoclimatological studies reviewed here provide records of different aspects of the past climatic conditions of the North Atlantic and Arctic regions. While thereare, accordingly, differences between these records, there are some remarkable similarities in the timing, direction and amplitude of some climatic trends that are significant for this study and that clarify the nature of the LIA climate change episode.

The GRIP ice core ^{18}O data indicated that large stretches of the early 17th century to the early 20th century exhibited strongly cold conditions, often accompanied by considerable

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

interannual variability in mean annual temperatures. Nevertheless, the early 18th century to about 1815 stand out as a period of either moderating trends or temperatures above the means of the past 700 years. The 18th century warming trend was also traced in the GISP2 and early Camp Century ice cores. Borehole temperatures too mirrored this pattern, indicating a warming of 1°C or more during the 18th century, after a cooling phase of between 1.5°C and 3°C during the 17th century.

Dendroclimatological reconstructions of spring to fall temperature also provided evidence of hemispherical-scale cooling in the 17th century and warming in the 18th century, followed by a very sharp cooling phase by about 1810. The widespread nature of the climate changes indicated by syntheses of dendroclimatological records and their contemporaneity with climate changes in high altitude Greenland suggests that these changes are linked to hemispherical-scale circulation variations. It is likely that the moderated conditions of the 18th century might then have been related to the protracted dominance of the negative mode of the NAO, with direct effects on the climate of the entire North Atlantic and eastern Arctic, including Labrador (Barlow 2001; Hurrell and van Loon 1997; Mayewski, et al. 1994)

These palaeoclimate data suggest that the LIA was not an extended period of consistent cold conditions, but rather a complex set of fluctuations, with a phase of marked warming in the 18th to early 19th century. Several authors (see among others (Barlow 2001; Grove 2001; Ogilvie and Jónsson 2001) have noted and discussed the broad differences in dates assigned to the beginning and end of the LIA various places, based on different phenomena. They have also noted the irregular manifestation of cold conditions during the LIA, as strong and complex decadal and multi-decadal variations rather than consistent century-scale trends are noted. Some authors (see Ogilvie and Jónsson (2001) and Grove (2002)) have gone so far as to as to suggest that, due to this spatial and temporal inconsistency in expression, and to uneven nature of available palaeoclimate data, the term "LIA" may be of dubious value as a concept within which to situate examples of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

environmental change, outside of glacial advance. Neither does the "LIA" appear to have been a unique event in the Holocene. The cases reviewed here, pertinent to Labrador, clearly point to the significance of short to medium term variability and complexity of proxy records discussed by Ogilivie and Jónsson.

The complex set of sea ice data follow the pattern defined by the available palaeoclimate data. The PIC sodium record indicated an increase in average annual ice cover in Baffin Bay and adjacent regions in the 16th and 17th centuries, a marked and highly variable decrease in ice conditions in the 18th century. Heavy ice conditions resumed by about 1790, though interannual variability remained significant through the 19th century. Historical records of sea ice in the Labrador Sea also indicate a lessening in sea ice in the later 18th century, and a marked increase in the severity of ice conditions after 1815, especially in the 1830's. Ice conditions in the Labrador Sea appear to have been consistently moderate in the late 18th century and much more variable after 1815. The pattern of variability expressed in the historical sea ice records is somewhat contrary to that of the PIC sodium record. It may suggest that, due to transported ice loads, the Labrador Sea expresses light spring ice conditions more consistently than Baffin Bay, while pack ice tends to accumulate thoroughly and regularly in Baffin Bay, even in the relatively moderate 18th century. Trends of variability in spring sea ice cover in these regions may therefore be asynchronous. Regardless of these nuances, available evidence strongly suggests that ice conditions in the Labrador Sea were relatively mild in the 18th century until about 1816, and much more severe afterwards.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Analyses of Faunal Collections from Hamilton Inlet

Faunal collections from five archaeological sites in Hamilton Inlet are included in this study. These sites comprise the Eskimo Island 1, 2 and 3 sites (GaBp-1, 2, and 3), Snooks Cove (GaBp-7) and Double Mer Point (GbBo-2). Richard Jordan recovered all of these collections in excavation projects he undertook between 1973 and 1975, the most recent excavations at these sites. More detailed reviews of this work was published by Jordan (1974, 1977, 1978) and Kaplan (1983). As outlined in Chapter 4, the scale of these excavations ranged between that of test pits to complete house excavations. A general chronology of these sites is presented in Table 9.1, based on artifact analyses by Richard Jordan (1977, 1978) and Susan Kaplan (1983).

Table 9.1 Summary Information for Analysed Faunal Collections from Hamilton Inlet

Site	Borden Number	Approximate Date	Assemblage Size
Double Mer Point, Houses 1, 2, 3	GbBo-2	18th century	Small
Snooks Cove 1, Houses 1, 2	GaBp-7	Later 19th century (1853+)	Small
Eskimo Island 1, Houses 2, 3	GaBp-1	18th century	Medium
Eskimo Island 2, Houses 5, 6	GaBp-2	Late 18th to mid 19th century (mostly circa. 1810 to 1860)	Medium
Eskimo Island 3, Houses 1, 2, 3, 4	GaBp-3	late 16th century to the very early18th century	Medium

Characteristics of the Hamilton Inlet Faunal Assemblages

Several particular characteristics of these faunal collections effect their suitability for detailed, comparative analysis. Jordan did not use sieving methods to standardize recovery

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of faunal remains during these excavations and instead relied on recovery by handpicking of specimens Accordingly, all of these collections are probably biased by the differential recovery, if not exclusion, of small bone fragments and the bones of small animals. Because Jordan's field crews generally consisted of inexperienced student excavators, it is also reasonable to assume that some more poorly preserved bones were not recognized in the field and are underrepresented in these assemblages.

Several of the individual excavations were small tests and yielded faunal collections comprising less than 500 fragments, while other large excavations produced a thousand or more identifiable specimens. Very small samples may produce skewed, inaccurate estimations of taxa present in whole populations. Straightforward statistical comparisons of different faunal assemblages may therefore be problematic.

Finally, the bulk of Jordan's excavations, both test pits and large-scale excavations, were made in house contexts rather than middens. As pointed out by Stenton and Park (1994), faunal assemblages from Inuit sod houses often pose interpretive challenges as these structures were often constructed from turf and sediment containing older cultural materials, and abandoned houses or house pits represent convenient dumping sites for refuse from neighbouring houses. The association of faunal remains recovered in a house excavation to the actual occupation of that house should not be assumed and care must be taken in excavation to identify and separate intact floor deposits from disturbed deposits, penecontemporaneous intrusives or post-occupation refuse.

The problems inherent in using fauna from house excavations are most pertinent to the Eskimo Island collections. These assemblages are derived from three clusters of closely grouped houses; the clusters appear to have been occupied in a serial fashion from 17th century to the 19th century. While most of the houses within each cluster appear to have been occupied during broadly similar time frames, the current dating framework is far too imprecise to determine if the houses were occupied sequentially or contemporaneously. In this case, it seems prudent to assume that at least some of the closely placed houses within

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

each of these clusters contain post-abandonment refuse deposits derived from more recently occupied neighbouring houses. Nevertheless, Jordan did not systematically record detailed stratigraphic information, nor did he segregate his recovered faunal assemblages on the basis of stratigraphic context. For this reason, it is difficult to uniformly distinguish materials from overburden deposits or later phases of occupation from earlier occupations, in these collections.

To compensate for these limitations, faunal remains from Jordan's Hamilton Inlet project are not compared in a detailed, context-specific fashion in this study. For the purposes of this analysis, the individual house assemblages are amalgamated into generic site assemblages that reflect broad chronological divisions. The Eskimo Island 1 house collections are grouped together and compared with those of the approximately contemporaneous Double Mer Point site, the Eskimo Island 2 houses are grouped by themselves, those of Eskimo Island 3 compose another group and Snooks Cove constitutes a final comparative unit. While the opportunity for fine-grained comparisons of approximately contemporaneous house assemblages is lost through this process of amalgamation, it has the benefit of creating comparative units that are more robust in terms of dating and sample size, and less sensitive to biases introduced by the re-use of house pits as middens.

Description of Faunal Assemblages

Total Numbers of Fragments Counts (TNF)

Total numbers of fragments (TNF) for each amalgamated assemblage are presented in Table 9.2. These counts include all fragments that may be identified to general taxonomic categories; the most common specimens are typically heavily fragmented

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.2 Total Numbers of Fragments (TNF) Identified to Generic Taxonomic Level for Amalgamated Assemblages from Hamilton Inlet

Taxonomic Group	Eskimo Is. 3 late 16th to very early 18th cent.		Eskimo Is. 1/Double Mer Pt. 18th cent.	
	TNF	% TNF	TNF	% TNF
Molluscs	19	0.3%	17	0.7%
Fish	7	0.1%	5	0.1%
Birds	28	0.5%	15	0.3%
Land Mammals	385	6.4%	200	4.3%
Small to Medium Land Mammals	232	3.9%	147	3.2%
Large Land Mammals	153	2.6%	53	1.1%
Sea Mammals	5569	92.7%	4421	94.9%
Small to Medium Sea Mammals	5469	91.0%	4384	94.1%
Large Sea Mammals	65	1.1%	21	0.5%
Very Large Sea Mammals	35	0.6%	16	0.3%
Total TNF:	6008		4658	
	Eskimo Is. 2 very late 18th to mid 19th cent.		Snook's Cove 1853 to late 19th cent.	
	TNF	%TNF	TNF	%TNF
Fish	12	0.3%		
Birds	71	1.6%		
Land Mammals	123	2.7%	83	17.6%
Small to Medium Land Mammals	104	2.3%	11	2.3%
Large Land Mammals	19	0.4%	72	15.3%
Sea Mammals	4286	95.4%	389	82.4%
Small to Medium Sea Mammals	4217	93.9%	384	81.4%
Large Sea Mammals	44	1.0%	5	1.1%
Very Large Sea Mammals	6	0.1%		
Total TNF:	4492		472	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

portions of crania, teeth, ribs, long bones and flat bones that are identifiable to element but not to specific species. Some, such as ribs and vertebrae, are often difficult to identify to species, even when they are complete. The three major assemblages (Eskimo Island 1/Double Mer Point, Eskimo Island 2 and Eskimo Island 3) are all medium-sized collections comprising approximately 4500 to 6000 total specimens. The Snook's Cove assemblage is much smaller than the others, numbering only 472 specimens. By standards set by previous zooarchaeological research in the North Atlantic (Amorosi, et al. 1996; McGovern 1985), the Snook's Cove assemblage is, nevertheless, large enough to support basic, descriptive, zooarchaeological analyses. At a very basic level of examination, that of simply counting the numbers of bone fragments, all the assemblages show similar patterns of representation of major taxonomic groups. Comparisons of numbers of fragments by taxonomic category indicate that sea mammals are by far the most important class of animals represented in these assemblages, constituting between 82% to over 95% of the recovered bone fragments. Land mammal bones are consistently of secondary importance. Land mammal bones represent between 2.3% and 6.4% of the Eskimo Island 1, 2 and 3 assemblages. Land mammal bone fragments are most frequent in the smaller Snook's Cove assemblage, where they represent about17.5% of the total number of fragments, though fragmentation patterns might account for their relatively high frequency. Mollusc shells, fish and bird bones were recovered very infrequently; none of these groups represented more than two percent of any amalgamated assemblage or were absent altogether.

The apparent preponderance of sea mammals and paucity of molluscs, fish, birds and smaller mammal specimens in all these assemblages may be due, in part, to biased preservation of the bones of larger mammals and to the lack of a sieving programme to control bone recovery. Nevertheless, Jordan's handpicking recovery strategy was sufficient to recover hundreds of small bone fragments from these sites; even these included very few mollusc shells, bird or fish bones. The patterns of taxonomic group representation are quite

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

consistent in the four assemblages and provide initial indications that sea mammal hunting has long been the core of Inuit subsistence in the region.

Numbers of Identified Specimens Counts (NISP)

Frequencies of bone fragments that could be identified to species are presented for each amalgamated assemblage in Table 9.3. Three of these assemblages include 2500 or more specimens identified to species and qualify as medium sized faunal collections. The Snooks Cove assemblage numbers less than 300 total specimens, however. As a small assemblage, it cannot support detailed analyses. In total, twenty species (or other taxonomic categories) were identified in these assemblages.

Eskimo Island 3 NISP Counts

A range of sixteen species were identified in the Eskimo Island 3 assemblages, the most diverse of all the assemblages from Hamilton Inlet. Seal bones, comprising both those bones identified positively to species and all those identified generically as seal bones but not to species level, represented the great majority of specimens (over 93%). Almost all of these were bones of small to medium sized seals, with a tiny fraction of large seal bones, which are almost certainly those of bearded seals. In addition, small numbers of bones of other marine species, including whales and walrus and molluscs were identified. A single walrus post-canine tooth was identified.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.3 Numbers of Specimens Identified to Species (NISP) in Amalgamated Assemblages in Hamilton Inlet

Species	Eskimo Island 3 Late 16th to very early 18th century		Eskimo Is. 1/Double Mer 18th century	
	NISP	% NISP	NISP	% NISP
Blue mussel (*Mytilus edulis*)	11	0.3%	17	0.7%
Gastropoda sp. indet.	6	0.2%		
Waved Whelk/Dogwinkle (Buccinium undatum/Thais lapillus)	1	0.03%		
Caribou (*Rangifer tarandus*)	62	1.9%	40	1.6%
Arctic Hare (*Lepus arcticus*)	1	0.03%		
Bears (Ursidae sp. indet.)	1	0.03%		
Foxes (*Vulpes vulpes, Alopex lagopus*)	22	0.7%	50	1.9%
River Otter (*Lutra canadensis*)	28	0.9%		
Wolverine (*Gulo gulo*)	5	0.2%		
Dogs (*Canis familiaris*)	36	1.1%	36	1.4%
Small Seals (Phocidae sp. indet.)	3028	92.8%	2403	93.5%
Large Seals (*Erignathus barbatus*)	26	0.8%	9	0.4%
Walrus (*Odobenus rosmarus*)	1	0.03%		
Whales (Cetecea sp. indet.)	35	1.1%	16	0.6%
Total NISP:	3263		2571	

Species	Eskimo Island 2 1800-1850		Snooks Cove 1850-1900	
	NISP	% NISP	NISP	% NISP
Codfish (Gadidae sp. indet.)	2	0.1%		
Salmonid (Salmonidae sp. indet.)	2	0.1%		
Ptarmigan (*Lagopus* sp. indet.)	2	0.1%		
Caribou (*Rangifer tarandus*)	23	0.9%	40	15.3%
Bears (Ursidae sp. indet.)	2	0.1%	1	0.4%
Foxes (*Vulpes vulpes, Alopex lagopus*)	30	1.1%		
River Otter (*Lutra canadensis*)	13	0.5%		
Dogs (*Canis familiaris*)	37	1.4%	3	1.1%
Small Seals (Phocidae sp. indet.)	2543	94.2%	216	82.8%
Large Seals (*Erignathus barbatus*)	41	1.5%	1	0.4%
Whales (Cetecea sp.)	6	0.2%		
Total NISP:	2701		261	
Grand Total NISP	8796			

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The whale bone fragments include numerous shreds of baleen, small splinters of bone, a few fragments of larger than 5cm in diameter including a vertebra fragment, and no intact bone. Some fragments bear fractures with depressed margins or axe marks, suggesting that they are waste from butchering or bone working activities. These fragments could not be identified to species but the size of the vertebra fragment and presence of baleen points to sub-order of Mystecete, or baleen, whales. The mollusc fragments were mostly *Mytilus edulis*, the blue mussel, which is common on rocky shorelines and opercula of unidentified gastropods (probably periwinkles). One shell fragment of a larger snail was found and is tentatively identified as a small Waved Whelk (*Buccinium undatum*) a common intertidal scavenger, or Dogwinkle (*Thais lapillus)*, a predator of the blue mussel (Gosner 1978: 131-132).

While bones of fish and birds were also present in the Eskimo Island 3 collections, these fragile bones were highly fragmented and were not well preserved. Some fish bones were consistent in size and character with those of salmonids, such as Atlantic salmon and Arctic char, and with bones of gadids. No fish bones were identified to species. Similarly, some bird bones were consistent with those of geese, eider ducks and gulls but none of these were positively identified to species or genus. A variety of land mammal species were represented among the identified bones. Of these species, caribou, foxes, river otters and domestic dogs were the most common. Nevertheless, all of these species comprised less than 3% of the entire Eskimo Island 3 assemblage and only the caribou bones exceeded 50 total specimens. The river otter specimens include many bones that are most likely derived from a single individual. Single specimens or trace numbers of arctic hare, wolverine and bear bones (species indeterminate) were also identified in the Eskimo Island 3 assemblage.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Eskimo Island 3 Caribou Skeletal Element Frequency

The distribution of caribou skeletal elements in the Eskimo Island 3 assemblage are reported in detail in Appendix1, and are summarised in the form of MNE (the minimum number of elements represented by a collection of fragments identified to species and element) and MAU counts (minimum animal units, calculated as element MNE divided by element frequency in a complete skeleton) in Table 9.4. Food Utility Index (FUI) values and bone densities for each element are also presented in Table 9.4. The Food Utility Index used here was published by Metcalfe and Jones (1988) and is a revision of the Modified General Utility (MGUI) index originally devised by Binford (1978). Bone density values

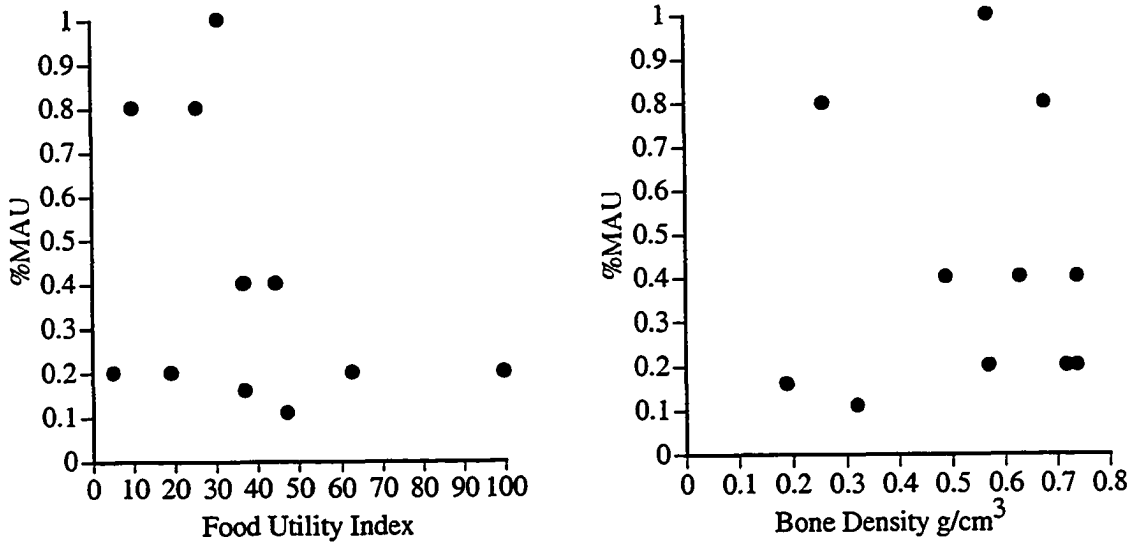
Table 9.4 Eskimo Island 3: Frequency of Caribou Skeletal Elements (MNE and MAU)

	MNE	MAU	%MAU	Food Utility Index (Metcalfe and Jones 1988)	Maximum Density of Element (Lyman 1994)
Skull				9.1	
Mandible/Hyoid	5	2.5	1.0	31.1	0.57
Atlas/Axis	2	2.0	0.8	10.2	0.26
Cervical vertebra	2	0.4	0.2	37.1	0.19
Thoracic vertebra	4	0.1	0.1	47.3	0.32
Lumbar vertebra				33.2	0.3
Rib				51.6	0.4
Sternum				66.6	0.22
Scapula	2	1.0	0.4	44.7	0.49
Humerus	1	1.0	0.4	36.8	0.63
Radius-Ulna	4	2.0	0.8	25.8	0.68
Metacarpal	1	0.5	0.2	5.2	0.72
Innominate				49.3	0.27
Femur	1	0.5	0.2	100	0.57
Tibia	1	0.5	0.2	62.8	0.74
Metatarsal	2	1.0	0.4	37.0	0.74
Phalange	4	0.5	0.2	19.4	0.57

Correlation coefficient of %MAU and FUI:	r =-0.297
Correlation coefficient of %MAU and bone density:	r = 0.405

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.6 Eskimo Island 3: Plots of Caribou %MAU vs. Food Utility Index and Bone Density



for White-tailed deer, as calculated by Lyman (1994) through photon densiometry, were used as proxies for the density of caribou elements. As can be seen in Table 9.4, relatively few elements are represented within this small assemblage, and significant portions of the skeleton were not represented. Accordingly, the assemblage is reviewed in this analysis at the relatively coarse level of whole elements, rather than portions of elements. No proximal ribs were identified or counted, though some rib fragments of large land mammals, counted in the Large Land Mammal TNF category, may have belonged to caribou.

Correlation coefficients of element frequency with the food utility and bone density indices are also presented in Table 9.4. The correlation of %MAU and FUI is negative for the Eskimo Island 3 assemblage, while the %MAU and the correlation with bone density is markedly positive. This suggests that the frequency of skeletal elements in the Eskimo Island 3 assemblage reflects the durability of those elements rather than their usefulness as

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

food. Attritional process had a shaped the caribou bone assemblage was shaped by attritional processes.

Table 9.5 Eskimo Island 1/Double Mer Point Caribou Skeletal Elements (MNE and MAU)

	MNE	MAU	%MAU	Food Utility Index (Metcalfe and Jones 1988)	Maximum Density of Element (Lyman 1994)
Skull				9.1	
Mandible/Hyoid				31.1	0.57
Atlas/Axis				10.2	0.26
Cervical vertebra				37.1	0.19
Thoracic vertebra				47.3	0.32
Lumbar vertebra				33.2	0.3
Rib				51.6	0.4
Sternum				66.6	0.22
Scapula	1	0.5	0.5	44.7	0.49
Humerus	1	0.5	0.5	36.8	0.63
Radius-Ulna	1	0.5	0.5	25.8	0.68
Metacarpal	1	0.5	0.5	5.2	0.72
Innominate	2	1.0	1.0	49.3	0.27
Femur	1	0.5	0.5	100	0.57
Tibia	1	0.5	0.5	62.8	0.74
Metatarsal	1	0.5	0.5	37.0	0.74
Phalange	3	0.5	0.5	19.4	0.57

Correlation coefficient of %MAU and FUI:	r =0.16
Correlation coefficient of %MAU and bone density:	r = 0.53

Percent MAU values are plotted against FUI and bone density values in Figure 9.6, in order to better examine the relationship between element frequency, economic anatomy and taphonomy. The %MAU/FUI plot has a loose curve with element frequency tending to decline while the FUI increases. This type of pattern is commonly termed a reverse utility or "bulk" strategy, and often reflects a processing site where high utility elements have

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

been removed for consumption elsewhere or a situation where, because of easy transport or proximity to residential sites, relatively whole carcasses are used. The %MAU/bone density plot shows a generally positive trend between element frequency and bone density and indicates the influence of destructive forces on less durable elements such as ribs, in this assemblage.

Eskimo Island 1/Double Mer Point NISP Counts

A somewhat more narrow range of species was identified in the amalgamated Eskimo Island 1/Double Mer Point assemblages than in the Eskimo Island 3 assemblage. By far the majority of specimens identified to more precise taxonomic levels were bones of seals, which numbered more than 93% of the assemblage. Specimens of other marine species present in the assemblage included small numbers of blue mussel shells and fragments of whalebones, including portions of six vertebrae. Both the whalebone and mussel shell represented less than one percent of the identified specimens in the total assemblage. A small number of poorly preserved fragments of fish and bird bones were also recovered. The fish bones were of suitable size to be salmonids and gadids, though none of these were confidently identified to species level and were reported in the TNF counts. Land mammals recovered in the Eskimo Island 1/Double Mer Point assemblages comprised caribou, foxes and dogs; each of these three species comprised between one and two percent of the amalgamated assemblage.

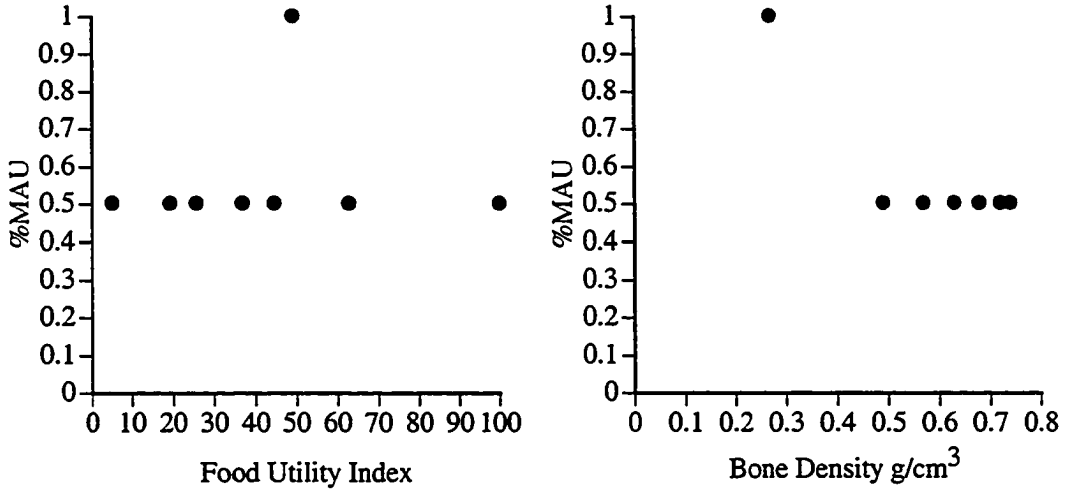
Eskimo Island 1/Double Mer Point Caribou Skeletal Element Frequency

The caribou bone assemblage is summarised through MNE and MAU counts, and compared with the Food Utility and bone density indices in Table 9.5. As in the Eskimo Island 3 collection, this assemblage is small and lacks elements from a large part of the skeleton, especially the axial skeleton. The Eskimo Island 1 caribou assemblage has a weak positive correlation with the Food Utility Index, and a much stronger positive correlation

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

with bone density, reflecting the absence of less durable elements such as ribs and vertebrae. Scatterplot comparisons of element frequency, the Food Utility Index and bone density are illustrated in Figure 9.7. Neither of these plots shows a clear trend between element frequency, economic anatomy or bone density. It is likely that the caribou bone assemblage is too small for effective application of the indices. The over-representation of limb bones in this collection may be due to the selective transportation of high-value elements to the site from caches or more distant hunting areas, or simply to the deletion of elements of the axial skeleton through attritional processes.

Figure 9.7 Eskimo Island 1/Double Mer Point: Plots of Caribou %MAU vs. Food Utility Index and Bone Density



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Eskimo Island 2 NISP Counts

The Eskimo Island 2 assemblage is also comprised, for most the most part (95%), of small to medium seal bones. Large seal bones were somewhat more common than in the other sites, but still only represented 1.5% of the Eskimo Island 2 assemblage. Fish and whalebone fragments were identified in trace amounts in the Eskimo Island 2 collections. Fish of the Gadidae and Salmonidae families were identified, probably representing Arctic Char or Atlantic Salmon, and Arctic cod or Tomcod. A larger number of bird bones were recovered as well, two of which were identified as belonging to either Willow Ptarmigan (*Lagopus lagopus albus*) or Rock Ptarmigan (*Lagopus mutus rupestris*). Many of the unidentified bird bones were of ptarmigan-sized birds and included a number of tarsometatarsi elements and phalanges, suggesting that bird legs were recovered. Jordan's field crew also recovered numbers of feathers from Eskimo Island 2, although these were not identified to species or counted.

The most frequently represented land mammal species in the assemblage were dogs, foxes and caribou, though all of these species represented less than 1.5% of total Eskimo Island 2 assemblage. Even smaller numbers of bones of bears and river otter were identified. Most of the River Otter specimens were cranial fragments recovered in a single context within House 6 and most of these bones were probably derived from a single individual.

Eskimo Island 2 Caribou Element Frequency

Caribou element frequencies are presented in MNE and MAU formats in Table 9.6. As in the other assemblages, MNE counts are low and many elements are not represented, though both axial and appendicular elements are represented. The %MAU values for this assemblage have a strong positive correlation with the Food Utility Index. They also have a less strong, positive correlation with bone density measures. Scatterplots of the %MAU

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

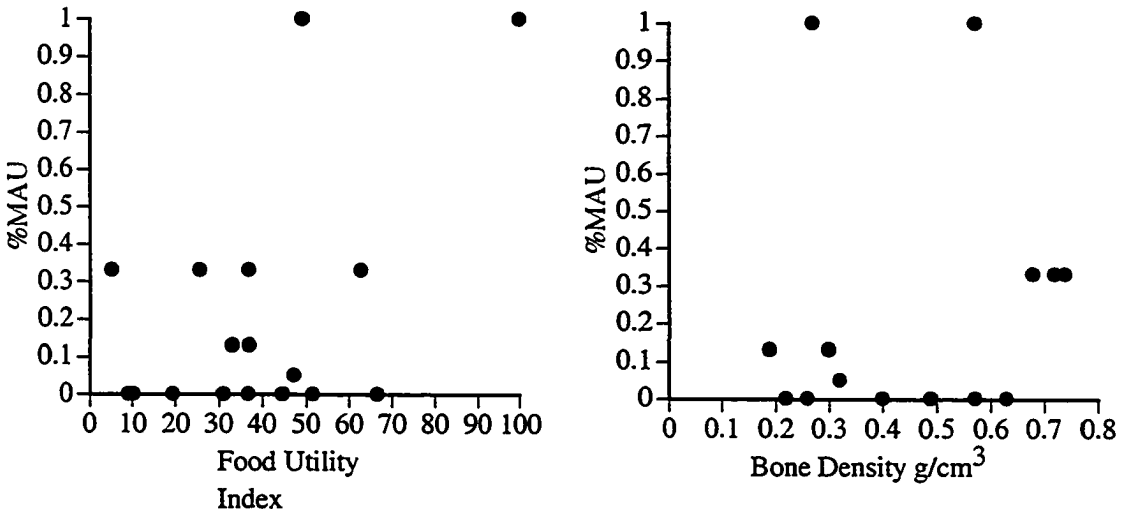
distributions versus FUI and bone density are presented in Figure 9.7. The %MAU/FUI plot shows a loose positive trend that approximates a "gourmet" strategy. Skeletal elements of low food utility are less common than elements with high food utility values. Such a pattern may be interpreted as an indication that primarily selected, high-value caribou elements were brought to the site from distant kill sites or from caches.

Table 9.6 Eskimo Island 2: Caribou Skeletal Element Distribution (MNE and MAU)

	MNE	MAU	%MAU	Food Utility Index (Metcalfe and Jones 1988)	Maximum Density of Element (Lyman 1994)
Skull				9.1	
Mandible/Hyoid				31.1	0.57
Atlas/Axis				10.2	0.26
Cervical vertebra	1	0.2	0.1	37.1	0.19
Thoracic vertebra	1	0.1	0.1	47.3	0.32
Lumbar vertebra	1	0.2	0.1	33.2	0.3
Rib				51.6	0.4
Sternum				66.6	0.22
Scapula				44.7	0.49
Humerus				36.8	0.63
Radius-Ulna	1	0.5	0.3	25.8	0.68
Metacarpal	1	0.5	0.3	5.2	0.72
Innominate	3	1.5	1.0	49.3	0.27
Femur	3	1.5	1.0	100	0.57
Tibia	1	0.5	0.3	62.8	0.74
Metatarsal	1	0.5	0.3	37.0	0.74
Phalange				19.4	0.57
Correlation coefficient of %MAU and FUI:				r =0.500	
Correlation coefficient of %MAU and bone density:				r = 0.201	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.8 Eskimo Island 2: Plots of Caribou %MAU vs. Food Utility Index and Bone Density



The %MAU vs. bone density graph also shows a loose distribution due to the very small size of the sample, and a modest positive relationship between density and element frequency. Because organic preservation conditions for hide, claws, feathers and even soft tissues in the Eskimo Island 2 houses were good, and the sites were not waterlogged, it may be that selective transport is a stronger influence on this assemblage than bone attrition.

Snook's Cove NISP Counts

Seal bones represent nearly 83% of bones identified to species in the small assemblage from Snook's Cove. A larger proportion of caribou bones (over 15% of the assemblage) were recovered from this site than from the others in Hamilton Inlet, though the very small size of the Snook's Cove sample serves as a caution against drawing firm conclusions from this difference. Whales, bears and dogs are also identified in trace quantities in the Snook's Cove assemblage. The caribou bone assemblage, reported in Table 9.7 and plotted in Figure 9.9, shows a weak positive correlation with the food utility

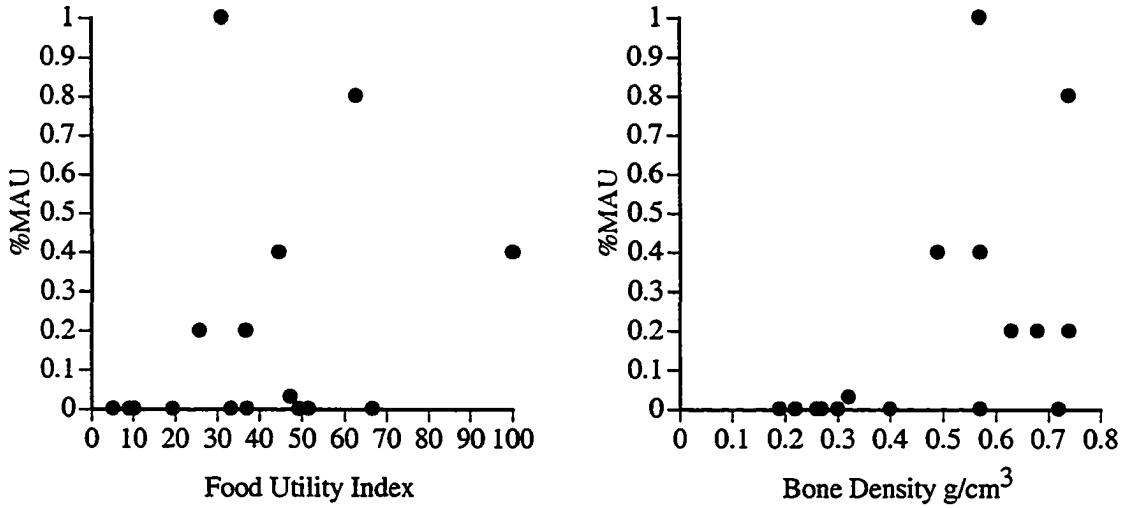
Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.7 Snook's Cove: Caribou Skeletal Element Distribution

	MNE	MAU	%MAU	Food Utility Index (Metcalfe and Jones 1988)	Maximum Density of Element (Lyman 1994)
Skull				9.1	
Mandible/Hyoid	5	2.5	1.0	31.1	0.57
Atlas/Axis				10.2	0.26
Cervical vertebra				37.1	0.19
Thoracic vertebra	1	0.1	0.03	47.3	0.32
Lumbar vertebra				33.2	0.3
Rib				51.6	0.4
Sternum				66.6	0.22
Scapula	2	1.0	0.4	44.7	0.49
Humerus	1	0.5	0.2	36.8	0.63
Radius-Ulna	2	0.5	0.2	25.8	0.68
Metacarpal				5.2	0.72
Innominate				49.3	0.27
Femur	2	1.0	0.4	100	0.57
Tibia	4	2.0	0.8	62.8	0.74
Metatarsal	2	0.5	0.2	37.0	0.74
Phalange				19.4	0.57
Correlation coefficient of %MAU and FUI:				r =0.295	
Correlation coefficient of %MAU and bone density:				r = 0.505	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.9 Snook's Cove: Plot of Caribou %MAU vs. FUI and Bone Density



index but no clearly defined exploitation strategy, as both high and low utility elements were abundant. The correlation between element frequency and bone density is much stronger, however, and suggests that attritional processes substantially shaped this assemblage.

Relative Frequency Counts (RF)

Relative Frequency (RF) counts are also employed to examine the species composition of the Hamilton Inlet assemblages from a complimentary perspective. RF counts are calculated by dividing by the NISP of each element by the frequency of each element in a complete skeleton, in much the same way as MAU counts are constructed. The resulting "corrected" element counts are then summed to create an abstract score expressing the frequency of the entire species in an assemblage. The RF count is considered an improvement upon simple the NISP count as a measure of taxonomic abundance because it compensates for the different skeletal anatomies of different species. Inter-species variability in skeletal anatomies may render comparisons based on NISP counts ambiguous.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.8 Relative Frequency Counts (RF) of Specimens Identified to Species in Amalgamated Assemblages in Hamilton Inlet

Species	Eskimo Island 3 late 16th to very early 18th century		Eskimo Is. 1/Double Mer 18th century	
	RF	% RF	RF	% RF
Blue mussel (*Mytilus edulis*)	3.5	0.3%	8.5	0.9%
Gastropoda sp. Indet	6	0.5%		
Waved Whelk/Dogwinkle (*Buccinium undatum/Thais lapillus*)	1	0.1%		
Caribou (*Rangifer tarandus*)	24.6	1.9%	17.4	1.8%
Arctic Hare (*Lepus arcticus*)	0.5	0.04%		
Bears (Ursidae sp. indet)	0.04	0.003%		
Foxes (*Vulpes vulpes, Alopex lagopus*)	8.39	0.6%	23.4	2.4%
River Otter (*Lutra canadensis*)	8.7	0.7%		
Wolverine (*Gulo gulo*)	3	0.2%		
Dogs (*Canis familiaris*)	16.9	1.3%	17.1	1.8%
Small Seals (Phocidae sp. indet.)	1220.9	93.6%	891.6	92.7%
Large Seals (*Erignathus barbatus*)	11.3	0.9%	3.6	0.4%
Walrus (*Odobenus rosmarus*)	0.1	0.004%		
Whales (Cetecea sp. Indet)			0.1	0.01%
Total RF	1304.8		961.8	

Species	Eskimo Island 2 1800-1850		Snooks Cove 1850-1900	
	RF	% RF	RF	% RF
Codfish (Gadidae sp. indet)	0.5	0.1%		
Salmonids (Salmonidae sp. indet)	1	0.1%		
Ptarmigan (*Lagopus* sp. indet.)	1.5	0.2%		
Caribou (*Rangifer tarandus*)	7.6	0.8%	14.3	11.8%
Bears (Ursidae sp. indet)	0.8	0.07%	0.5	0.4%
Foxes (*Vulpes vulpes, Alopex lagopus*)	10.3	1.0%		
River Otter (*Lutra canadensis*)	6.8	0.7%		
Dogs (*Canis familiaris*)	14.9	1.5%	0.9	0.7%
Small Seals (Phocidae sp. indet.)	951.9	93.7%	105.3	86.6%
Large Seals (*Erignathus barbatus*)	21.3	2.1%	0.5	0.4%
Whales (Cetecea sp.)	0.04	0.004%		
Total RF	1015.7		121.5	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The RF counts presented in Table 9.8 show that in all four assemblages, small seals are the dominant taxonomic category, ranging between 86% and nearly 94% of the total RF scores of each assemblage. Large seals, likely representing bearded seals, caribou, foxes and dogs, together, are the secondary species in the assemblages. Nevertheless, with the exception of caribou, which represent 11.79% of the small Snook's Cove assemblage RF, none of these species exceed 3% of assemblage RF. Molluscs, birds, fish, whales, bears, otters and wolverines were all rare taxa. Conspicuously, the RF counts provided a profile of taxonomic abundance in these assemblages that is almost identical to that described by the NISP counts, both in terms of the ranking of species and their absolute proportions within assemblages. The overwhelming proportion of seals and secondary important of caribou and the fur-bearers is therefore not an artifact of quantification methodology. Also noteworthy is that, examined with NISP or RF, all four assemblages had very similar profiles of species abundance, especially the Eskimo Island sites.

Table 9.9 Number of Seal Specimens Identified to Species in Amalgamated Assemblages in Hamilton Inlet

	Ringed Seal		Harbour Seal		Harp Seal		Bearded Seal		Total
	NISP	%NISP	NISP	%NISP	NISP	%NISP	NISP	%NISP	NISP
Eskimo Island 3 (17th century)	112	30.1%	39	10.5%	221	59.4%			372
Eskimo Island 1 – Double Mer Point (18th century)	43	22.5%	61	31.9%	86	45.0%	1	0.5%	191
Eskimo Island 2 (early to mid 19th century)	84.	45.9	31	16.9%	66	36.1%	2	1.1%	183
Snook's Cove (mid to late 19th century)	10	27.8%	15	41.6%	11	30.6%			36

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

NISP Counts of Seals Identified to Species

While the four amalgamated assemblages differed very little from each other at the raw NISP and RF levels of quantification presented in Table 9.3 and 9.8, they are much more distinct in terms of the proportions of counts of individual seal species. As outlined in Chapter 2, species attributions for seal bones were made only on the basis of crania, auditory bullae, maxillae, mandibles and humeri. Accordingly, NISP counts for the various seal species identified in these assemblages are presented separately in Table 9.9. They are not compared directly with the NISP counts of other species, which are based on a more complete range of elements. It should also be noted that bearded seal frequencies presented in Table 9.9 are also calculated in this manner for the sake of comparability, and so are different from the counts presented for this species in Table 9.3. As these NISP counts are calculated on the basis of the same elements in the different seal species, RF counts were not required. While the use of a restricted range of elements for seal species identifications inevitably results in a greatly reduced analytical sample, the larger assemblages all produced 180 or more identifiable specimens. Major taxa consistently number from 30 to over 200 specimens in this study, a sufficiently large sample size for a robust comparison of species abundance.

The Eskimo Island 3 seal bone assemblage is composed, in the majority, of harp seal bones (over 59%). Ringed seal bones are a sizeable secondary fraction of the assemblage (30.1%) and harbour seal specimens comprise just over 10.5%. In the combined assemblages of the Eskimo Island 1 and Double Mer Point, 45% of seal bones represent harp seals while harbour seals are the secondary species (31.9% of the seal bones) and ringed seals are the least frequent major species, with 22.5% of the assemblage). A single bearded seal specimen was identified in the assemblage.

Ringed seals are the most commonly identified specimens in the Eskimo Island 2 assemblages (over 45% of the total phocid NISP). Harp seals are the second most

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

commonly represented species with 36% of the assemblage, and harbour seals comprise about 17% of the assemblage. Only two bearded seal specimens were identified, and represent barely one percent of the Eskimo Island 2 assemblage.

The Snook's Cove assemblage, with only 36 specimens of seals identified to species, is too small to be considered more than an initial survey. Nevertheless, and uniquely amongst this group of sites, harbour seals are clearly the most common species of seal identified in that assemblage (41% of the identified seal bone collection), while harp seals and ringed seals are nearly equivalent secondary species each representing about 30% of the assemblage.

While the harp seals are, in general, the most frequently observed species of seal bone in these assemblages, the %NISP data given above are somewhat equivocal about the nature of variability in species representation between assemblages. Percentages are closed array comparative measures and it is often difficult to determine which variable is really changing and by how much within closed array comparisons (see Ringrose 1993). In order to better examine the statistical relationships between the various species represented in the faunal collections, the frequencies of seal taxa are reviewed in the form of ratios of NISP of species *X* vs. those of species *Y*, in Table 9.10.

Ratios may be presented in the form of NISP *X*: NISP *Y* or in the form of an integer which is obtained by dividing the numerator (in this case, NISP *X*) by the denominator (NISP *Y*). When the two variables compared in a ratio are equivalent, the ratio is written as 1:1, or 1.0. When the denominator (NISP *Y* in the present example), is larger than the numerator (NISP *X*), the integer will be a decimal value (for example, a ratio of 1:3 may be written as 0.33. When the numerator is a larger value than the denominator, the integer is greater than one (for example, a ratio of 4:1 equals a decimal value of 4.0). As a single number, the integer format is easily compared, manipulated and more readily graphed. However they are expressed, ratios have great utility as a simple comparative tool for defining patterns in the frequencies of taxa in archaeological assemblages.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The ringed seal to harp seal NISP ratio for the 17th century site of Eskimo Island 3 is 0.51 (or just over one ringed seal specimen identified for every two harp seal specimens). In the Eskimo Island 1 and Double Mer Point collections, grouped together as 18th century assemblages, the ratio of ringed seal specimens to those of harp seals is 0.5, also approximately one ringed seal specimen for every two harp seal specimens. The ringed seal to harp seal ratio for the Eskimo Island 2 (early to mid 19th century) is 1.27, indicating an approximate relationship of five ringed seals to four harp seals. In the faunal assemblage of the later 19th century Snook's Cove site, the ratio of ringed seals to harp seals is 0.91, indicating somewhat more harp seals than ringed seals in that assemblage. The long term trend in hunting in the Narrows indicated by this collection of closely-spaced sites is that the relative importance of the ringed seal and harp seal catches fluctuated over time, and that possibly the net economic importance of winter and fall/spring hunting also fluctuated. A general decline in the importance of harp seal hunting and of fall hunting, over time, is implied by this trend.

Ratios of ringed seal specimens to those of harbour seals in these assemblages are also presented in Table 9.10. The ringed seal to harbour seal ratio for the Eskimo Island 3 assemblage is 2.87, representing well over two and a half ringed seal specimens for every harbour seal specimen counted. In the Eskimo Island 1 and Double Mer Point assemblages, this ratio is much different, 0.7, with over three harbour seal specimens counted for every two ringed seal specimens. The ringed seal to harbour seal specimen ratio for the Eskimo Island 2 assemblage is 2.71, very close to that of Eskimo Island 3. Similarly, the ringed seal to harbour seal specimen ratio of the Snooks Cove assemblage, 0.67, is very close to that of Eskimo Island 1. A fluctuation in seal hunting patterns is also indicated by this trend, with modes of predominance of ringed seal alternating with predominant harbour seals. Harbour seals dominated the 18th and late 19th century assemblages. A strong shift to ringed seal hunting appears to be indicated in the early to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

mid 19th century Eskimo Island 2 assemblage, concurrent with the trend to decreased representation of harp seals described above.

Table 9.10 Ratios of Seal NISP counts for archaeological assemblages from Hamilton Inlet

	Eskimo Is. 3 (17th century)	Eskimo Is. 1/ Double Mer Pt. (18th century)	Eskimo Is. 2 (early to mid19th century)	Snook's Cove (mid to late 19th century)
Ringed Seal/ Harp Seal Ratio	0.51	0.5	1.27	0.91
Ringed Seal/ Harbour Seal Ratio	2.87	0.7	2.71	0.67

Estimating Seal Season and Age of Death from Incremental Structures

Thin sections of a total of sixty seal teeth (mostly canines) from jaws that could be identified to species were prepared and examined, representing ringed seals, harp seals and harbour seals. It was impossible to estimate age or season of death with confidence for many of these specimens, however, as dentine and cementum tended to be exfoliated, altered or otherwize poorly preserved; replicable attributions of season of death could only be made for a total of forty-one teeth. Because it is divided between five sites, this is a somewhat small collection from which to draw final conclusions about the seasonality of seal hunting and the demographics of the hunted population, especially when the sample is divided between five collections and three species. Nevertheless, studies of incremental growth structures have been applied to seal teeth in very few faunal assemblages from Labrador, of any size, and the tooth sections from this set of collections are sufficient to provide an initial examination of Inuit seal hunting in the Narrows region. Summary results of analyses of incremental structures in these teeth are presented in Table 9.11.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Discussion

The results of this analysis suggest that seal hunting in the Narrows took place throughout the fall, winter and spring without significant breaks. In so far as this set of small samples is a reasonably reliable indicator of the scale of seal hunting activities, consistent numbers of seals were taken in fall and spring, with a reduced but significant proportion of animals taken during the winter. The harp seals examined in this study were mostly killed during the fall months, the season in which they are typically most readily hunted and most healthy. The remaining harp seals were taken during the spring months, during their northward migration.

Season of death estimations indicate that Harbour seals were, in general, also hunted during the fall and spring in all periods, as one would expect for a species so strongly associated with open water. It seems likely that many were caught while hunters were seeking harp seals, which are the more common species during their massive migratory runs. Nevertheless, during the 18th century, harbour seals appear to have been hunted in the winter as well as the fall. Attributions of season of death could be made for only three harbour seal teeth from the 18th century assemblage, that from Eskimo Island 1 and Double Mer Point. Accordingly, the harbour seal assemblage reported here is too small to be taken at face value as a complete portrayal of the scheduling or scale of harbour seal hunting. Nevertheless, the study does provide evidence that, at least in the latter 18th century, harbour seals were hunted in the Narrows region during the winter and were therefore present in the Narrows during the sea ice season as well as that of open water.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.11 Estimations of Season and Age of Death of Seals in Hamilton Inlet assemblages, based on readings of incremental structures in teeth

Age of Death	0-1 Years	1-6 Years	7+ Years
Ringed Seal			
Eskimo Island 3, 17th century			5
Eskimo Island 1/Double Mer Pt., 18th century		1	6
Eskimo Island 2, early to mid 19th century	2	1	5
Season of Death	October-December	January-March	April-June
Harbour Seal			
Eskimo Island 3, 17th century	2		1
Eskimo Island 1/Double Mer Pt., 18th century	1	2	
Eskimo Island 2, early to mid 19th century	1		1
Snooks Cove, mid to late 19th century	1		4
Ringed Seal			
Eskimo Island 3, 17th century		2	2
Eskimo Island 1/Double Mer Pt., 18th century	1	3	3
Eskimo Island 2, early to mid 19th century		3	3
Harp Seal			
Eskimo Island 3, 17th century	3		1
Eskimo Island 1/Double Mer Pt., 18th century	3		2
Eskimo Island 2, early to mid 19th century	8		1

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Based upon this analysis, it appears that ringed seals were not hunted in numbers during the fall, in the Narrows region, during any period. Almost all of the ringed seal teeth that were successfully analysed represented winter or spring deaths; the catch of ringed seals represented in these assemblages is balanced between the winter and spring phases of the sea ice year. Harp seals and ringed seals, the two most important seal species in most of the assemblages from the Narrows, therefore appear to have been complimentary elements of Inuit subsistence in the Narrows. Harp seals contributed the bulk of animals obtained in the fall and ringed seals representing the bulk of animals landed in the winter and spring months. Harbour seals complimented the harp seal catch in these seasons.

While the faunal assemblages from the Narrows were not ideal in terms of sample size, recovery procedures or documentation, they are sufficient to point out important aspects about the changing nature of Inuit subsistence in the Narrows region through time. The faunal assemblages are also of interest as they provide a rare diachronic sample of subsistence data for a single region.

Overall, the faunal assemblages considered here demonstrate the use of a broad range of subsistence resources in the Narrows, or at least the capacity to do so. All of the most economically significant animals in the Hamilton Inlet region, including sea mammals, land mammals, fish and birds were represented in these assemblages, in at least minor quantities. Nevertheless, a degree of economic specialization may also be inferred on the basis of these collections, even after recognizing that these assemblages are likely biased in favour of the representation of larger vertebrates because their bones tend to be more durable and because they are more easily recognized and collected.

Seals were, by far, the most frequently represented group of species in all the sites, comprising between 84% and nearly 96% of the bones that could be identified at least to the level of genus, in the various assemblages, regardless of the quantitative method employed. Even after considering the likelihood that seal bones are over-represented in this analysis, the overwhelming dominance of seal bones in all of these assemblages strongly suggests

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

that seals were the economic mainstay of Inuit communities in the Narrows region from the 17th to the 19th century.

In clear contrast to the seals, all other animal taxa are of secondary importance in the archaeological assemblages. As a generic category, land mammal remains represent only about 10% to about 27% of the gross number of bone fragments (TNF), including those that could not be positively identified to species. Land mammal TNF counts were highest in the Eskimo Island 1 and Snooks Cove assemblages.

Caribou, foxes (including both arctic fox and red fox) and dogs are the most common land mammal species, although none of these species represented, individually, more than 2.5% of the total NISP or RF of the larger faunal assemblages. Caribou were most common in the Eskimo Island 3, Eskimo Island 1 and Snook's Cove collections. The differences between caribou %NISP and %RF counts for the larger faunal collections were slight and suggest that caribou were not, at any time, exploited in an intense manner in the Narrows, during the winter months. The absolute frequency of caribou bones in these assemblages may be limited by selective transport of high food-utility or by reduction for food processing, dog chewing, or other taphonomic weathering effects. Caribou element frequencies generally showed strong positive relationships with bone density, suggesting that the caribou bone assemblages were affected by taphonomic attrition. As well, all appendicular elements were extensively comminuted; many bore impact marks indicative of thorough processing for marrow and grease extraction, while many also bore traces of dog chewing. Nevertheless, the limited caribou bone assemblages were generally skewed in favour of limb bones, and the Eskimo Island 2 assemblage showed a strong correlation with the caribou food utility index. During this period at least, portions of caribou carcasses that were high in food value may have been brought to Eskimo Island, from caches or from more distant kill sites.

The Snook's Cove assemblage had a relatively large fraction of caribou bones (%NISP=13.6), as well as a large land mammal TNB count. Accordingly, caribou appear to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

have been of greater economic importance at Snook's Cove. The small size of this collection, which was derived from limited test excavations, limits this observation to a tentatively advanced conclusion. The correlation between caribou element frequency and the food utility index for Snook's Cove, though positive, was relatively weak and allows the possibility that caribou were hunted locally around this site, or were consumed in relatively whole units at it.

Specimens of other mammals, including bears, arctic hares, river otters, wolverines, walrus and whales were only recovered in trace numbers. Similarly, only very small numbers of molluscs, fish and birds were identified, implying that these animals were only of secondary economic importance. The simple number of bones in complete fish and bird skeletons, as well as the tremendous quantities of bivalve shells that accumulate as a result of intensive shellfishing activities lend support to this conclusion. Nevertheless, the use of hand-picking rather than sieving for recovery of these faunal assemblages, as well as the relative fragility of fish and bird bone, may also explain the scant representation of these useful food species in this analysis. The nature of taphonomic and recovery biases in these assemblages are impossible to determine without the recovery of new faunal assemblages from the sites in question.

While the initial impression of Inuit subsistence in the Narrows from the 17th to the 19th century provided by this analysis is one of a consistent emphasis of specialized seal hunting economies, the practice of seal hunting itself appears to have changed substantially through time. The harp seal is the dominant taxon in most of the assemblages from these sites. Analyses of dental annuli in harp seal teeth indicate that these animals were taken primarily during their southward fall migration (see Table 2). The fall migration would likely have been of critical economic importance since, during this season, harp seals are in prime condition, more readily accessible, more easily recovered when killed and would have provided a storable surplus of meat for use in the winter. In contrast, harp seals taken during their northward spring migration tend to be lean and less useful for food, and are

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

harder to recover because they sink when killed (Ames, 1977: 287). They may, as well, be inaccessible if rotten ice or pack ice keep them away from the shore.

Ringed seals were the second-most common seal species in the majority of assemblages, and were most frequent in the assemblages that were dated to the 17th and early to mid 19th century. Age and season of death studies based on incremental structures in teeth indicate that ringed seals of all ages were hunted during the winter and spring, and that the majority of hunted seals were adults. Based on conventional ringed seal ranges and breeding behaviour in Hamilton Inlet and other regions, this age and season of death profile suggests that both open water and fast ice areas were important hunting areas within and around the Narrows. Fast ice appears to have been generally the most important hunting area, although ringed seal age distributions hint that open water hunting in the Narrows gained slightly in importance, in the 18th and 19th centuries.

Harbour seals fluctuated between being a common and uncommon seal species in the archaeological assemblages. They were most common in the 18th and late 19th century assemblages. Analyses of dental annuli in a small sample of teeth suggest that harbour seals were taken in all seasons at various times. Multiple specimens from the 17th century and 19th century assemblages represented fall and spring kills, two of the most likely seasons for hunting harbour seals, given their association with open water conditions. Two specimens from the 18th century assemblages represented winter season kills. While it is likely that the bulk of harbour seals hunted in the 18th century were indeed taken during spring and fall, the normal open water season, these specimens demonstrate the presence of at least some harbour seals in the Narrows in winter during the 18th century.

Ratios of ringed seal and harp seal bone indicated that the proportion of ringed seals to harp seal specimen is quite similar in the 17th and 18th-century assemblages with harp seals being about twice as common. Ringed seals were much more common in the 19th-century assemblages. The ringed seal/harbour seal ratios show a different chronological

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

trend. Very similar high ratios of ringed seal remains to those of harbour seals are noted for the 17th and 19th-century assemblages. Hunting in heavy winter and spring ice conditions would likely produce high proportions of ringed seals. However, a much different pattern is shown for the 18th-century collections and the middle to late 19th-century collection, with greater proportions of harbour seal remains represented.

Because harp seals were taken primarily in the fall and the ringed seals represent predominately winter and spring kills, the ringed seal/harp seal ratio represents a proxy measure of the scale of hunting on and around sea ice versus fall open water hunting in the generalized economies of whole site occupations. The ringed seal/harp seal ratios suggest that, in the 17th and 18th centuries, fall open water hunting was consistently of major importance and that relatively more effort was invested in winter hunting on and around sea ice in the early to middle 19th century. This may suggest that the harp seal hunting season was shorter during the early to middle 19th century or that fewer harp seals were available to coastal hunters; conditions which would agree with the heavy sea ice conditions indicated for this period. However, because the ringed seal and harp seal hunts were not synchronous, this ratio is likely of limited value as an indicator of environmental conditions during the winter and early spring.

Both harp and harbour seals are typically associated with open water and mixed, loose ice. If harbour seals were hunted primarily in the fall along with harp seals, it would be reasonable to expect that archaeological harp and harbour assemblages would co-vary in terms of NISP frequency and seasonality. However, the ringed seal/harbour seal NISP ratio trend is quite different from the ringed seal/harp seal NISP ratio. It increases dramatically in the 18th century-assemblages while the ringed seal/harp seal NISP ratio remains static at levels similar to those of the 17th century. Although it is likely that harbour seals were indeed hunted in the fall along with harp seals, harbour seals were also taken in the Narrows during the winter and spring in the 18th century. Therefore, the increased

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

fraction of harbour seals in the18th century assemblages is likely due, in part, to an extended hunting season encouraged by the presence of harbour seals in the Narrows well after migrating harp seals would have left the region. As discussed earlier, the modern extent of fast ice in the Narrows favours ringed seals during winter and spring (Ames, 1977: 287, 298). The presence of harbour seals in the locale is therefore suggestive of moderated winter and spring ice conditions.

If the archaeological ringed seal/harbour seal ratio reflects past sea ice conditions, relatively moderate ice conditions with open water in the Narrows and Groswater Bay may be indicated for the 18th and later 19th centuries. This pattern agrees with that demonstrated in Teillet's Labrador Sea ice severity index. In recent years, open water may at times stretch from the Narrows to the ice edge in Groswater Bay, opening the Narrows to species over-wintering at the ice-edge, including local harbour seal populations (Ames, 1977).

Similarly, the high ratios of ringed seals at the 17th and early 19th-century sites are consistent with the relatively heavy ice conditions indicated by the historic ice indices and the Penny Ice Cap proxy ice record. More severe ice conditions in the Narrows would have been manifest in more fast ice around Eskimo Island and pack ice enclosing or completely in-filling the Narrows. With sufficiently extensive ice, the Narrows waterway, and Eskimo Island itself, are sealed off from Groswater Bay. Harbour seals living at the ice edge are thereby excluded from entering the Narrows. As well, the presence of dense pack ice in the Narrows likely would have hindered the efforts of Inuit to hunt within the strait itself and encouraged the hunting of mature ringed seals and pups on the fast ice of Lake Melville.

Alternatively, the increased proportion of ringed seals in the 19th-century assemblages could reflect market demands for seal products and intensified hunting effort using new technologies such as firearms and seal nets. Both of these factors likely had significant roles in the economy of the 19th-century Labrador Inuit in general, but still require the presence of appropriate seal populations and the fast ice hunting platform. Nets,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

in themselves, are an especially non-selective hunting technology. The greatly reduced take of harbour seals in the early to middle 19th century makes a strong argument that harbour seals were comparatively less frequently found in the Narrows in winter during that time period.

Summary

In summary, the faunal assemblages considered here all suggest that Inuit subsistence in the Narrows has always focussed primarily on sea mammal hunting, to the relative exclusion of alternative resources. The study indicates that Inuit made effective use of all local seal species in their seasonal periods of availability or abundance and that Inuit living in the Narrows coped with the ecological impacts of climate change without changing the core of their subsistence economy. Hunting adult ringed seals on fast ice was always an economic mainstay but, as a general trend, fall and winter season open water hunting gained in importance relative to fast ice hunting during the 18th and mid to late 19th centuries.

Analyses of Faunal Collections from Oakes Bay 1

A faunal assemblage from the Oakes Bay 1 site, on Dog Island in the Nain district, is considered in this study. This assemblage is derived entirely from a 1.5m x 1.5m test excavation of one midden context, conducted in 2000. The midden was associated with House 3, a large communal house structure without impinging neighbouring houses, and was located in an area of flat ground with Sphagnum and dwarf birch vegetation immediately east of the eastern entrance passage wall of that house (see Figure 6.1). House 3 and the House 3 Midden were tentatively dated to the 18th century on the basis of a small artifact assemblage that includes trade goods. Using the accounts of the Moravian Missionaries, J. Garth Taylor (1974, 1977) reported that the Oakes Bay 1 site (called

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Parngnertokh) was occupied in the winter of 1771-1772. As this was the only site occupation reported by the Moravians, it is likely that 1772 was the last year that the site was home to a winter occupation. Accordingly, the House 3 Midden, probably dates to 1772 or earlier.

The midden was excavated in 5cm arbitrary levels following natural bedding angles to sterile beach gravel at a maximum depth of 45cm below surface. All excavated sediments were passed through a 4mm sieve to standardize recovery of small bones. The midden had three major layers of bone-rich deposit separated by thick layers and lenses of dense, partially carbonized organic material. While final identification of these organic layers awaits the conclusion of ongoing analyses, these layers are believed to be dense mats of partially burned sea mammal fat deposited over, and mixed with, heterogeneous midden detritus including animal bone and other butchery and food processing waste, feces, wood, twigs and grass. The organic layers appear to have encouraged organic preservation by protecting bones from trampling and root penetration, and insulating them from extreme variations in humidity and temperature. As described in Chapter 6, soil pH was moderately acid, and ranged from 6.0 to 6.8.

The 5cm arbitrary levels of the House 3 midden were grouped into Analytical Units (henceforth termed *A.U.*) on the basis of midden stratigraphy. A.U. 1 includes the upper 25cm of the profile, comprising the modern A soil horizon, leaf litter and root pack, and upper midden layers extending down to the upper contact of the first complete organic layer. A.U. 1 represents $0.56m^3$ of excavated deposit. A.U. 2 includes all arbitrary levels from 25cm to 45cm below surface and comprises several thin midden layers interspersed with lenses of hard organic matter. At the bottom of A.U. 2 was a moist humus layer containing matted grass and some animal bone (the original ground surface upon which the midden was deposited) overlying sterile sand, gravel and angular cobbles, the upper surface

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of an old raised beach deposit. Altogether, 0.45m³ of deposit representing four arbitrary levels were grouped within A.U. 2.

Table 9.12 Excavated Volume of Oakes Bay 1 House 3 Midden by Arbitrary Level

Oakes Bay 1 House 3 Midden	Arbitrary Levels Grouped within Analytical Unit	Total Excavated Volume (m^3)
Analytical Unit 1	0-25 cm below surface	0.5625 m^3
Analytical Unit 2	25-45 cm below surface	0.45 m^3
Total Excavated Volume of H3 Midden		1.0125 m^3

Total Numbers of Fragments Identified to Generic Taxonomic Levels

A summary of numbers of bone fragments from the House 3 midden that could be identified to general taxonomic categories is presented in Table 9.13. The total assemblage numbers 4170 specimens, which is a substantial bone sample for a small test excavation. When divided into analytical units, (A.U.1 includes 1923 specimens, while AU2 comprises 2247 specimens), the sample sizes of both sub–assemblages are large enough to be considered medium-sized faunal collections in their own right and are large enough to support a range of zooarchaeological analyses.

As demonstrated in Table 9.13, the largest single part (948 specimens or 49% of TNF) of the A.U. 1 assemblage was composed of mollusc specimens, including fragments of shell, chitinous periostracum and gastropod opercula. While molluscs are certainly an important component of this assemblage in terms of simple frequency of specimens, the real importance of molluscs in the subsistence of the site's inhabitants is more difficult to judge. It is problematic to directly compare mollusc frequencies with vertebrate bones, due to the very different anatomies of these animals and their different tendencies to fragment and to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

preserve in archaeological deposits. In sites where molluscs have been gathered and consumed on intensive scales for extended periods of time, vast shell deposits normally accumulate. These shell middens sometimes reaching depths of metres, far in excess of the scale of deposition indicated in this unit.

Table 9.13 Total Number of Fragments (TNF) Identified to Generic Taxonomic Level for Oakes Bay 1 House 3 Midden, Analytical Unit 1 and 2

	A.U. 1 (upper)	%TNB	A.U. 2 (lower)	%TNB
Molluscs	948	49.1%	306	13.6%
Fish	0	0.0%	1	0.04%
Birds			18	
Medium Birds	8	0.4%	17	0.8%
Large Birds			1	0.04%
Land Mammals (Total)	54	2.8%	49	2.2%
Small Land Mammals	1	0.1%	3	0.1%
Medium Land Mammals	46	2.4%	35	1.6%
Large Land Mammals	7	0.4%	11	0.5%
Sea Mammals (Total)	925	48.1%	1873	83.2%
Small to Medium Sea Mammals	911	47.4%	1857	82.5%
Large Sea Mammals	12	0.6%	13	0.6%
Very Large Sea Mammals	2	0.1%	3	0.1%
Total TNB:	1923		2247	

A more detailed list of frequencies of types of mollusc and crustacean shell fragments is presented in Table 9.14. The bulk of fragments were of the easily identified Blue Mussel, *Mytilus edulis*. Worthy of note in this table are indications of the highly fragmented state of these shells. Mussel shells are fragile and readily eroded by soil acids and moisture, and by mechanical forces such as trampling and soil mixing. Furthermore, mussel shells are coated with black chitinous periostracum that is durable and often outlasts the mineral component of the shell in wet conditions, but is prone to shredding due to

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

mechanical stress. Mussel shells, therefore, readily break up into multiple small pieces as they decompose and arguably are over-represented if each fragment is counted. Notably, most of the mussel specimens in these assemblages were small shell fragments or periostracum fragments. Very few whole or hinge fragments, which are directly indicative of the numbers of original whole shells, were counted. Because a substantial mass of easily preserved and fragmented shell may be produced from even a small meal of molluscs, and the meat associated with a single mollusc is quite small, it seems unlikely that molluscs were of primary economic importance at Oakes Bay 1.

Table 9.14 Oakes Bay 1 House 3 Midden: Total Numbers of Fragments of Molluscs and Crustaceans

Taxon	A.U. 1 (upper)	% of group	A.U. 2 (lower)	% of group
Blue Mussel, *Mytilus edulis* Total TNF	936		304	
Periostracum	785	83.9%	300	98.7%
Shell fragment	135	14.4%	4	1.3%
Complete shell/hinge	16	1.7%		
Cockle (Cardiidae)				
Shell fragment	2			
Deep Sea Scallop, *Placopecten magellanicus*				
Shell fragment	1			
Perwinkle, *Littorina* sp.				
Operculum	8		2	
Crenate Barnacle, *Balanuscrenatus*				
Shell	1			

Fish remains were entirely absent from A.U. 1, while only a very small number of highly fragmentary bird long bones were recovered; none were identified to species. Land mammal specimens too represent only a small part (less than three percent) of the bone assemblage. Most of the land mammal specimens were from medium sized animals, such

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

as foxes, hares, dogs and wolves. Sea mammals are, by far, the most commonly represented vertebrates in the faunal assemblage, comprising 48% of the total number of fragments. Almost all of these fragments were from small to medium sized animals.

The A.U. 2 assemblage was, in general, similar to that of A.U. 1. The proportion of molluscs in the assemblage was greatly reduced however, as mollusc fragments represented only 13.6% of the assemblage. Bones of fish and birds were both present in trace quantities, each representing less than 1% of the total assemblage. Most of the bird bones present were from medium sized birds, their long bones consistent in size with the long bones of ptarmigans and most alcids, but smaller than those of gulls, geese and ravens. The bulk of bird bone recovered in A.U. 2, and in the House 3 midden as a whole, was concentrated in a pocket of moist organic-rich humus formed beside a large flat rock in the 35-40 and 40-45 cm levels. This area had numbers of small bone fragments and better-preserved bones than the rest of the unit. Accordingly, the small proportion of birds in the House 3 midden assemblage as a whole likely is a partial reflection of bone preservation conditions. It is likely that birds were a more important part of the subsistence economy of Oakes Bay 1 than is indicated in this study.

Specimens of land mammal bones too were present in only small numbers. Collectively, all land mammal bones amounted to just over two percent of the total assemblage, with only a trace number of large land mammal bones recovered. Small to medium sized sea mammals represented the most abundant taxonomic category, contributing 83.2% of the fragments in the assemblage. On the basis of this initial examination, the House 3 midden assemblages are very much indicative of subsistence economies that were structured primarily (if not almost exclusively) around sea mammal hunting, with much smaller levels of productivity for the secondary activities of land mammal hunting, bird hunting and collecting shellfish. Very little evidence for fishing was discerned.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.15 Oakes Bay 1, House 3 Midden: Number of Specimens Identified to Species (NISP)

Species	A.U. 1	% NISP	A.U. 2	% NISP
Blue Mussel, *Mytilus edulis*	16	2.4%	1	0.1%
Cockle, Cardiidae sp.	2	0.3%		
Deep Sea Scallop, *Placopecten magellanicus*	1	0.2%		
Periwinkle, Littorina sp. Operculum	8	1.2%	2	0.2%
Barnacle, *Balanus crenatus*	1	0.2%		
Caribou, *Rangifer tarandus*			9	0.8%
Arctic Hare, *Lepus arcticus*	5	0.7%		
Bears, Ursidae sp.			1	0.1%
Foxes, *Vulpes vulpes, Alopex lagopus*	13	2.0%	24	2.1%
Dogs, *Canis familiaris*	15	2.2%	11	1.0%
Small Seals, Phocidae sp.	600	89.2%	1087	94.9%
Large Seals (*Erignathus barbatus*)	10	1.5%	7	0.6%
Whales, Cetecea sp.	2	0.3%	3	0.3
Total NISP:	673		1145	

Numbers of Identified Specimens Counts

Frequencies of specimens identified to more precise taxonomic categories are presented in Table 9.15. At this level of analysis, the A.U.1 and A.U. 2 assemblages are very similar and have comparable ranges of species. Fish and birds are conspicuous by their absence from Table 9.15. Because of their rarity and poor condition, no fish or bird specimens were identified to species. All of the shellfish species are of minor statistical importance in the total assemblage NISP count. The blue mussel NISP reported in Table 9.15 is based exclusively upon the number of whole shells and hinges identified. This count is used because it eliminates the inflating effect of highly fragmented shells and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

periostraca. It is worthy to note that when restricted to the number of shell fragments bearing hinges (there are two hinges for each bivalve mollusc), the number of mussels counted declines dramatically.

A variety of shellfish were identified and include species of the shallow intertidal zone (mussel, cockle, periwinkle and barnacle), as well as somewhat deeper water (deep sea scallop). Barnacles, periwinkles and mussels are species of the rocky intertidal zone, though both may be present on isolated rocks in soft-bottomed shallows (Gosner 1978: 148). Cockles generally are found in muddy intertidal or subtidal areas. All of these environments, and species, are present in the immediate vicinity of Oakes Bay 1. Blue mussels and periwinkles are particularly common, and barnacles are often attached to mussel shells. Inuit used to, and continue to, collect mussels when possible for dietary variety and their flavour is widely appreciated (Nain Resident 1997: personal communication; Williamson 1997). Deep sea scallops may be found in subtidal shallows and can be difficult to gather by hand, but are often cast up onto beaches by storms (Gosner 1978: 148). Seabirds presently scatter shellfish, including mussels and scallop shells, over the Oakes Bay 1 site area. The scallop shell may therefore be present in the assemblage as a penecontemporaneous or late intrusives.

Land mammal species were quite very poorly represented in the both A.U. 1 and A.U. 2 as no single species exceeded 2.5% of the total assemblage NISP. The most common species were foxes and dogs. Small numbers of arctic hare bone fragments were identified in AU1, while only a handful of caribou bones and a single bear bone were identified in A.U. 2. Sea mammals represent the clear majority of faunal remains that were identified to precise taxonomic categories. Bones of small seals constitute over 89% of the total assemblage NISP count for both A.U. 1 and A.U. 2., with bearded seals and whales present in small quantities (less than 2% and 0.5% of assemblage NISP, respectively).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.16 Oakes Bay 1, House 3 Midden: Relative Frequency (RF) Counts of Identified Specimens

Species	A.U.1 RF	%RF	AU 2 RF	%RF
Blue Mussel, *Mytilus edulis*	8	4.6%	0.5	0.2%
Cockle, Cardiidae sp.	1	0.6%		
Deep Sea Scallop, *Placopecten magellanicus*	0.5	0.3%		
Periwinkle Littorina sp.	8	4.6%	2	0.8%
Operculum				
Barnacle, *Balanus crenatus*	1	0.6%		
Caribou, *Rangifer tarandus*			2.9	1.2%
Arctic Hare, *Lepus arcticus*	2.0	1.2%		
Bears, Ursidae sp.			0.3	0.1%
Foxes, *Vulpes vulpes, Alopex lagopus*	5.2	3.0%	8.3	3.4%
Dogs, *Canis familiaris*	5.1	2.9%	3.8	1.5%
Small Seals, Phocidae sp.	140.5	80.5%	220.3	89.1%
Bearded Seals, *Erignathus barbatus*	3.28	1.9%	0.9	0.4%
Total NISP:	174.6		247.3	

Relative Frequency Counts

Relative frequency counts (RF) are used as a second measure of taxonomic abundance and are presented in Table 9.16. While the RF counts correct for distortions derived from anatomy and apparently add some more statistical weight to many of the minor taxa, this measure portrays a very similar pattern as that demonstrated by the NISP count. Bones of smaller seals are again the most abundant taxonomic category in both assemblages, and represent bout 80% to 89% of both the A.U.1 and A.U.2 assemblages total RF score. Molluscs, caribou, arctic hares, foxes, dogs and other fur-bearers all represent minor species, most with less that 3% of the total assemblage RF score. The mollusc species were somewhat more prominent in the RF comparison but, with less than 5% of the total assemblage RF score and considering the small amount of food associated

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

with individual shellfish, molluscs do not seem to have been of great economic significance at Oakes Bay 1.

Density of Deposition Counts

The Density of Deposition count (DD), is used in this study to verify the patterns of species abundance. DD counts are calculated by dividing the raw NISP counts of different species in an assemblage by the total excavated volume of their source context (Bigelow 1984). The resulting number is therefor an estimation of bone (and species) concentration, or species NISP per cubic metre. Because the DD count is standardized through reference to an external variable, they are not sensitive to the problems of statistical interdependence of taxa, which hampers closed array quantification methods such as the %NISP.

Table 9.17 Oakes Bay 1 House 3 Midden: Density of Deposition Counts (DD) for Specimens Identified to Species

Species	A.U. 1 DD (freq. per m^3)	A.U. 2 DD (freq. per m^3)
Blue Mussel, *Mytilus edulis*	28.4	2.2
Cockle, Cardiidae sp.	3.6	
Deep Sea Scallop, *Placopecten magellanicus*	1.8	
Periwinkle, Littorina sp. Operculum	14.2	4.4
Barnacle, *Balanus crenatus*	1.8	
Caribou, *Rangifer tarandus*		20.0
Arctic Hare, *Lepus arcticus*	8.9	
Bears, Ursidae sp.		2.2
Foxes (*Vulpes vulpes, Alopex lagopus)*	23.1	53.3
Dogs, *Canis familiaris*	26.7	24.4
Small Seals, Phocidae sp.	1066.7	2415.6
Large Seals (*Erignathus barbatus*)	17.8	15.6
Whales, Cetecea sp.	3.6	6.7
Total NISP:	1196.4	2544.4

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Notably, the patterns of species abundance demonstrated through this method are nearly identical to those described by the NISP and RF counts. Small seals are clearly the dominant taxa in both assemblages. Large seals, foxes, dogs and, to a lesser degree, caribou and molluscs are the more prominent secondary species. In general, the earlier A.U.2 deposits had a much great concentration of bone than did A.U.1, even though both were of approximately similar volume. Bones of small seals, caribou, foxes and whales (the few represented) were all more common in A.U. 2 than in A.U.1. Molluscs, hares and to a lesser degree, dogs and large seals were more common in A.U.1 than in A.U.2. None of these fluctuations in species abundance appear to represent substantial ordinal differences between A.U. 1 and A.U.2.

A tiny collection of only nine caribou bones was identified in the entire House 3 Midden, all of them in A.U.2. Caribou element frequencies are summarised in MNE format in Table 9.18. All these specimens were appendicular elements and many bore traces of fracturing for marrow extraction. The uniform representation of limb elements and reasonably strong positive correlation of this element distribution with the Food Utility Index, noted in Table 9.18, provides an initial indication that caribou were not hunted locally during the seasonal occupation of Oakes Bay 1. They may have been hunted at some distance and selected portions of their carcasses brought to the residence site, or hunted in other seasons and stored in caches for later use.

Counts of specimens of the different seal species, based on complete crania, maxillae, mandibles, auditory bullae and humeri, are presented in Table 9.19. There is relatively little species diversity among seals in either A.U.1 or A.U.2. Almost all the specimens identified to species in both assemblages belonged to ringed seals (82.9% in A.U.1 and 88.9% in A.U.2). Harbour seals and harp seals represent secondary seal species in A.U.1, and together comprised 17.3% of the total seal NISP. In A.U. 2, the only secondary species represented was the harp seal; harp seals constitute 11% of the AU2 seal NISP.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.18 Oakes Bay 1 House Midden A.U. 2 Caribou Skeletal Element Distribution

	MNE	MAU	%MAU	Food Utility Index (Metcalfe and Jones 1988)	Maximum Density of Element (Lyman 1994)
Skull				9.1	
Mandible/Hyoid				31.1	0.57
Atlas/Axis				10.2	0.26
Cervical vertebra				37.1	0.19
Thoracic vertebra				47.3	0.32
Lumbar vertebra				33.2	0.3
Rib				51.6	0.4
Sternum				66.6	0.22
Scapula				44.7	0.49
Humerus	1	0.5	1	36.8	0.63
Radius-Ulna				25.8	0.68
Metacarpal				5.2	0.72
Innominate				49.3	0.27
Femur	1	0.5	1	100	0.57
Tibia				62.8	0.74
Metatarsal				37.0	0.74
Phalange	3	0.38	0.8	19.4	0.57

Correlation coefficient of %MAU and FUI:	r =0.315
Correlation coefficient of %MAU and bone density:	r = 0.296

Table 9.19 Oakes Bay 1 House 3 Midden: Number of Seal Specimens Identified to Species (Phocid NISP based on counts of crania, maxillae, mandibles and humeri)

Context	Ringed Seals		Harbour Seals		Harp Seals		Total
	NISP	%NISP	NISP	%NISP	NISP	%NISP	NISP
House 3 Midden Analytical Unit 1	19	82.9%	3	13.0%	1	4.3%	23
House 3 Midden Analytical Unit 2	32	88.9%			4	11.1%	36

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

While bearded seal post-cranial elements were identified in the assemblages, no crania, mandibles or humeri were identified, and so bearded seals are not counted in this comparison

Analyses of Age and Season of Death of Seals based on Incremental Structures

A small collection of 24 seal teeth in jaws from the House 3 midden were available to provide an initial survey of the season of death of the hunted seal population. Results of analyses of incremental structures of these teeth are presented in Table 9.20. The majority of seals represented in this limited sample were ringed seals; nine sectioned ringed seal teeth were available from the A.U.1 assemblage and thirteen for the A.U. 2 assemblages. In both phases, ringed seals were killed in almost equal numbers during the winter months, when fast ice exists around Dog Island, and during the spring, when ringed seals commonly bask on the fast ice. A single harbour seal specimen in the A.U. 1 assemblage was a spring kill and single harp seal, also in the A.U. 1 assemblage, was a fall kill.

Age of death estimations for the ringed seal population represented in the House 3 midden are also presented in Table 9.20. The majority of ringed seals in the A.U. 1 assemblage were reproductively mature adult individuals seven years of age or older, with a smaller fraction of juveniles and subadult animals. This demographic pattern is suggestive of the use of both fast ice and ice edge hunting areas in both winter and spring, hunting mature ringed seals in their fast ice breeding territories, and non-breeding subadults at the ice edge. The A.U. 2 assemblage was somewhat different, as adults and juveniles/sub-adults were represented in almost equal proportions and a pup was identified as well. Like A.U. 1, the hunting pattern implied for the A.U. 2 assemblage is focused on ringed seals, with equal exploitation of subadults and adults and equal use of fast ice and the ice edge.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.20 Estimations of Season of Death of Seals in the Oakes Bay 1 House 3 Midden assemblages, based on analyses of dental annuli

Age of Death	0-1 Years	1-6 Years	7+ Years
Ringed Seal			
A.U. 1		3	5
A.U. 2	1	5	6
Season of Death	October-December	January-March	April-June
Harbour Seal			
A.U. 1			1
Ringed Seal			
A.U. 1		3	3
A.U. 2		4	5
Harp Seal			
A.U. 1	1		

Summary of Faunal Analyses of Oakes Bay 1 House 3 Midden

The faunal assemblage recovered from the Oakes Bay 1 House 3 midden is of sufficient size and quality of preservation to provide an initial examination of 18th century Inuit subsistence in the Nain district. In both the later and earlier and phases of occupation of House 3, represented by A.U. 1 and A.U. 2 respectively, subsistence was centered almost exclusively around specialized seal hunting, specifically of ringed seals. Harp seals, harbour seals and bearded seals were significant secondary resources, but these species contributed far fewer total numbers of animals to the household economy than did ringed seals. Birds and shellfish may have been among the resources of secondary importance, as well. Land mammals do not appear to have been of much economic importance as the most commonly represented species, foxes and dogs, together amounted to less than five percent of the total midden assemblage. As well, these are species that are not used directly food;

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

foxes are most useful for their pelts and dogs for traction. Very few specimens of the more typical terrestrial food species (such as caribou, arctic hares or bears were identified. Fish, as well, were not identified in any frequency.

Based on estimations of seasons of death for seal specimens, hunting seems to have been practiced around Dog Island in fall, winter and spring. House 3 may have been occupied during all of this time. Seals appear to have been the focus of hunting efforts and are today one of the most common animals in the Dog Island region today. Harp seals were hunted during the fall during their southward migration, though curiously few individuals appear to have been taken. Harbour seals may have been hunted in the fall as well, but were certainly hunted in the spring. The bulk of seal hunting appears to have occurred during the winter and spring. Ringed seals were the focus of most of the hunting efforts and were hunted in all parts of their local range, on fast ice and at the ice edge in winter, and while basking on fast ice in the spring. During both the earlier and later occupations of House 3, the hunting of mature adults and pups on fast ice in winter and spring appears to have been balanced with hunting at the ice edge.

The highly specialized ringed seal hunting economy with reduced emphasis of terrestrial species or seals that require mixed ice or open water conditions demonstrated at Oakes Bay 1 is one that should be effective in conditions with heavy ice or extensive fast ice. It is, as well, reminiscent of the kind of economy implied by Schledermann's environmental hypothesis for the communal house. Nevertheless, the initial dating of the House 4 Midden suggests that it was deposited during the middle to late 18th century, a period of relative moderation of ice conditions. It may be that fall harp seal hunts were staged from temporary camps documented in archaeological surveys on the eastern shores of Dog Island (Fitzhugh 1977), which were much closer to harp seal travel routes and boat landings. Further midden sampling at Oakes Bay 1 and survey of Dog Island would help to resolve this question.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Analyses of Faunal Collections from Uivak Point 1

The major faunal collection for this study was recovered from extensive midden excavations at the Uivak Point 1 site in northern Okak Bay. The faunal remains considered here were derived from excavations of middens associated with Houses 5/8, House 6 and House 7, as well as House 7 itself. Details of these excavations were outlined in chapter 7.

Test Pits 9, 10 and 11

Test Pits 10 and 11 were located between the entrances of Houses 5 and 8, and is provisionally attributed to the two houses collectively. The excavation included one one-metre test pit excavated to a depth of 30cm below surface and a second excavated to a depth of nearly one metre below surface. On the basis of stratigraphy, the excavation was subdivided into two Analytical Units; A.U. 1 consists of the upper 60cm while A.U. 2 is composed of levels deeper than 60cm. Only the upper 10cm of A.U. 2 included bone-bearing midden deposits. In Table 9.21, the arbitrary levels assigned to each A.U. are listed, along with the excavated volumes of each A.U.. A.U. 1 was provisionally dated to the later 18th century to early 19th century on the basis of trade goods. A.U. 2 could be dated but, for this study, is provisionally considered to be an 18th century deposit.

Table 9.21 Uivak 1 House 5/8 Midden (TP 10/11): Description of Analytical Units

	A.U. 1	A.U. 2
Levels:	0-30, 0-60cm	60-70cm
Number of Levels:	9	2
Excavated Volume (m^3)	$0.45m^3$	$0.1m^3$
Volume of one arbitrary level:	0.05 m^3	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 6 Midden

The House 6 Midden excavation was a 1.5m by 1.5 metre test placed adjacent to the entrance of House 6. It was excavated to sterile sand and gravels at an approximate depth of 45cm below surface. The midden is subdivided into two stratigraphically defined analytical units. The upper level (A.U. 1) is dated to the late 18th to early 19th century, tentatively from about 1770 to 1807. The lower layer (A.U. 2) may date from approximately 1730 to 1770. The manner in which arbitrary levels were assigned to Analytical Units is described in Table 9.22 along with the excavated volumes of A.U. 1 and A.U. 2.

Table 9.22 Uivak 1 House 6 Midden: Description of Analytical Units

	A.U. 1	A.U. 2
Levels:	0-25cm	25-45cm
Number of Levels:	5	4
Excavated Volume (m^3)	0.563 m^3	0.45 m^3
Volume of one arbitrary level:	0.1125 m^3	

House 7

Faunal remains from a large portion of the House 7 excavation were included in this analysis. These faunal remains can from portions of the entrance passage, floor and platforms in the eastern and northern ends of the house, and were restricted to specimens from intact floor deposits. As outlined in Table 9.23, this sample was derived from 6.65m^3 of excavated floor deposit from a total of 133 5cm arbitrary levels in 21 units. As a component of the latest house occupation, the floor deposit is dated to between ca.1785 and 1807.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.23 Uivak 1 House 7: Description of Analytical Units

	A.U. 2 (Floor Deposit)
Number of Levels:	133 m^3
Excavated Volume (m^3)	6.65m^3
Volume of one arbitrary level:	0.05 m^3

House 7 Midden

The House 7 Midden excavation was subdivided into seven analytical units; A.U. 1 post-dates the occupation of House 7. A.U. 2 includes detritus that had been part of the house walls or discarded during the house's occupation, and that came to rest on the midden surface through colluvial flow, as well as midden material (possibly disturbed) that likely contemporaneous with the very end of the occupation of House 7. A.U. 3 is composed of the uppermost intact midden layers and certainly dates to the late occupation of House 7. A.U. 2 and A.U. 3 therefore date from ca. 1785 to 1807. A.U. 4 is a set of sand layers without substantial cultural materials; it was used to define a clear stratigraphic separation between A.U. 3 from A.U. 5 and its faunal remains are included with A.U. 3 in this analysis. A.U. 5 is a thick, well-preserved set of midden deposits that represent the earlier phases of house occupation, tentatively dated to ca. 1740 at the earliest, to 1785 at the latest. A.U. 6 and A.U. 7 are grouped together in this analysis; they may be dated from the contact period before the construction of House 7, perhaps as early as 1740 or earlier. The grouping of 5cm arbitrary excavation levels within these Analytical Units is summarized in Table 9.24.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.24 Uivak 1 House 7 Midden: Description of Analytical Units

Unit	A.U. 1	A.U. 2	A.U. 3/4	A.U. 5	A.U. 6/7
1S/1W	0-15cm	15-20cm	30-45cm	45-60cm	
1S/2W	0-20cm	20-30cm	30-40cm	40-65cm	
1S/3W	0-20cm	20-30cm	30-45cm	45-80cm	80-85cm
1S/4W	0-20cm	20-35cm		35-75cm	75-90cm
1S/5W	0-20cm	20-30cm		30-60cm	60-65cm
1S/6W	0-15cm	15-25cm		25-40cm	
1S/7W	0-10cm	10-20cm			
2S/1W	0-20cm	20-25cm		25-35cm	
2S/2W	0-20cm		20-40cm	40-60cm	
2S/3W	0-15cm	15-20cm	20-35cm	35-80cm	80-85cm
2S/4W	0-20cm	20-40cm		40-60cm	60-70cm
2S/5W	0-20cm	20-30cm		30-60cm	
2S/6W	0-10cm	10-20cm		20-40cm	
2S/7W		0-10cm		10-20cm	
Total # Levels	45	26	13	63	8
Total Excavated Volume (m^3):	2.25	1.3	0.65	3.15	0.4

Test Pits 9, 10 and 11

Total Number of Fragments Identified to Generic Taxonomic Categories

Frequencies of fragments that were identified to generic taxonomic levels in the assemblages of Test Pits 9, 10 and 11 are presented in 9.25. With over 3000 and 1000 specimens respectively, A.U. 1 and A.U. 2 are relatively small collections, especially in comparison to the other assemblages from Uivak Point 1. Nevertheless, they are large enough to support useful analyses, accepting that the smaller sample size may limit species diversity. Both the A.U. 1 and A.U. 2 assemblages were clearly dominated by sea mammal remains. Molluscs represent the most important secondary taxonomic group with just

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

under one third of the total TNF counts of both assemblages. Birds and fish were very sparsely represented. Land mammals were a minor taxonomic group, but much more common in A.U. 1 than in A.U. 2. Aside from the land mammals, there is little evidence of diachronic changes in general economic practices in these assemblages.

The molluscs present in these assemblages are reported in Table 9.26. A.U. 1 was comprised almost entirely of blue mussel shell and periostracum fragments with a handful of gastropod opercula. A.U. 2, a very wet layer, consisted exclusively of periostracum. The small number of hinges suggests that the TNF mussel count in Table 9.25 is inflated through fragmentation.

Table 9.25 Uivak Point 1 Test Pits 9, 10, 11: Total Number of Fragments (TNF) Identified to Generic Taxonomic Level

	A.U. 1		A.U. 2	
Taxonomic Group	TNF	% TNF	TNF	% TNF
Molluscs	1002	30.8%	473	27.8%
Fish	13	0.4%		
Birds	25	0.8%		
Land Mammals (Total)	163	5.0%	33	1.9%
Small Land Mammals	10	0.3%	1	0.1%
Medium Land Mammals	135	4.2%	30	1.8%
Large Land Mammals	18	0.6%	2	0.1%
Sea Mammals (Total)	2053	63.1%	1195	70.3%
Small to Medium Sea Mammals	1950	59.9%	1190	70.0%
Large Sea Mammals	103	3.2%	5	0.3%
Total TNB:	3256		1701	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.26 Uivak Point 1 Test Pits 9, 10, 11: Total Numbers of Fragments of Molluscs

Taxon	A.U. 1 (upper) TNF	%of group	A.U. 2 (lower) TNF	%of group
Blue Mussel, *Mytilus edulis* Total TNF	996		473	
Periostracum	637	64.0%	473	100%
Shell fragment	325	32.6%		
Complete shell/hinge	34	3.4%		
Periwinkle, *Littorina* sp. Shell Operculum	6			

Numbers of Identified Specimens Counts

More detailed NISP counts of the Test Pit 9, 10 and 11 assemblages are presented in Table 9.27, and demonstrate a substantial degree of species diversity in A.U. 1 at least, though most species are represented by few specimens the smaller A.U. 2 assemblage is quite depopurate. Small seals are by far the most important taxon in A.U. 1 and A.U. 2 (which is almost entirely comprised of small seal specimens). The very high proportion of small seals argues strongly that seal hunting was of the utmost economic importance. All other species are of minor importance compared to the small seal counts. Ringed seals represent half or more of the seal specimens identified to species. Harp seals were very important s well, ranging from 30% to 45% of seal specimens and were more common in the earlier A.U. 2 assemblage. Harbour seals were a minor species, while no bearded seal crania, mandibles or humeri were counted, though other post-cranial remains were identified.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.27 Uivak Point 1 Test Pits 9, 10, 11: Numbers of Specimens Identified to Species (NISP)

Species	A.U. 1 NISP	A.U. 1 % NISP	A.U. 2 NISP	A.U. 2 % NISP
Blue mussel, *Mytilus edulis*	34	3.3%		
Gastropoda sp. indet., Operculum	6	0.6%		
Caribou, *Rangifer tarandus*	7	0.7%	1	0.3%
Arctic Hare, *Lepus arcticus*	1	0.1%		
Bears, Ursidae sp. indet	2	0.2%		
Foxes, *Vulpes vulpes, Alopex lagopus*	9	0.9%	2	0.5%
Dogs, *Canis familiaris*	52	5.0%	8	2.0%
Small Seals, Phocidae sp. indet.	834	80.4%	388	96.8%
Large Seals, *Erignathus barbatus*	44	4.2%		
Walrus, *Odobenus rosmarus*	1	0.1%		
Whales, Cetecea sp. indet	48	4.6%	2	0.5%
Total NISP:	1038		401	

Seal NISP	NISP	%	NISP	%
Harp seals, *Phoca groenlandica*	9	30.0%	9	45.0%
Harbour seals, *Phoca vitulina*	5	10.0%	1	5.0%
Ringed seals, *Phoca hispida*	20	60.0%	10	50.0%
Bearded seals, *Erignathus barbatus*				
Total	34		20	

The group of more important secondary taxa in A.U. 1 includes large seals, dogs, mussels and whale bones. Post-cranial remains of large seals were common in A.U. 1, in comparison to the other assemblages considered in this study, even if none of the countable diagnostic elements were identified. The count of whale specimens is inflated by the recovery of a substantial number of small fractured or trimmed whale bone fragments, rather than by the recovery of substantial fragments readily identified to element. When reduced

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

to counts of hinges, mussels are seen to be a minor species in terms of absolute numbers, and especially so when their small body masse is considered. Rather few fox specimens, which are common as secondary species in other collections were identified. Similarly, caribou were quite rare and too few specimens were recovered to warrant additional examination. No bird or fish specimens were identified to species. Poorer bone preservation in A.U. 2, resulting from quite wet conditions there, may have limited the identification of taxa other than sea mammals.

Table 9.28 Uivak Point 1 Test Pits 9, 10, 11 Relative Frequency (RF) Counts of Numbers of Specimens Identified to Species

	A.U. 1		A.U. 2	
Species	RF	% RF	RF	% RF
Blue mussel Mytilus edulis	17.0	4.8%		
Gastropoda sp. indet. Operculum	6.0	1.7%		
Caribou, *Rangifer tarandus*	2.4	0.7%		
Arctic Hare, *Lepus arcticus*	0.5	0.1%		
Bears, Ursidae sp. indet.	0.3	0.1%		
Foxes, *Vulpes vulpes, Alopex lagopus*	48.5	13.8%		0.9%
Dogs, *Canis familiaris*	22.4	6.4%		2.5%
Small Seals, Phocidae sp. indet.	238.7	67.7%	104.8	96.5%
Large Seals (*Erignathus barbatus*)	16.3	4.6%		
Walrus, *Odobenus rosmarus*	0.5	0.1%		
Total NISP:				

Relative Frequency Counts

Relative Frequency counts are presented in Table 9.28 in order to compare with NISP counts. The RF counts again indicate that relative few species are present in greater than

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

trace amounts and that the remains of small seals predominate in these assemblages. Other species are present in proportions similar to those provided by NISP counts. With the RF count, however, foxes are seen to be the most important secondary species in A.U. 1, representing nearly 14% of the assemblage total RF. Even though few total fox bones were identified, a large proportion of the these were of crania and mandibles, pushing up their RF count. The frequency of these fox elements may indicate an emphasis of fox hunting in this limited context.

Table 9.29 Uivak Point 1 Test Pits 9, 10, 11 Density of Deposition (DD) Counts of Numbers of Specimens Identified to Species

	T.P. 9, 10, 11 AU 1 DD	T.P. 9, 10, 11 AU 2 DD
Blue mussel *Mytilus edulis*	3.28	
Gastropoda sp. indet. Operculum	0.58	
Caribou, *Rangifer tarandus*	15.6	10.0
Arctic Hare, *Lepus arcticus*	2.2	
Bears, Ursidae sp. indet.	4.4	
Foxes, *Vulpes vulpes, Alopex lagopus*	20.0	20.0
Dogs, *Canis familiaris*	115.6	80.0
Small Seals, Phocidae sp. indet.	1853.3	3880.0
Large Seals (*Erignathus barbatus*)	97.8	
Walrus, *Odobenus rosmarus*	2.2	
Whales, Cetecea sp. indet	106.7	20.0
	DD	DD
Harp seals, *Phoca groenlandica*	20.0	90.0
Harbour seals, *Phoca vitulina*	11.1	10.0
Ringed seals, *Phoca hispida*	44.4	100.0

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Density of Deposition Counts

Density of deposition counts, reported in Table 9.29 also emphasize the importance of small seals and relative unimportance of other taxa aside from dogs, foxes and whale bone. Worthy of note is the density of the A.U. 2 assemblage; despite its small size A.U. 2 appears to have included a dense midden deposit. A.U. 1, a much large assemblage drawn from a larger total excavated volume, was rather less densely packed with bone, likely due to a more gradual pattern of accumulation or to the intermixing of midden layers with relatively sterile peaty soils in this A.U. 2.

Table 9.30 Uivak Point 1 House 6 Midden: Total Number of Fragments (TNF) Identified to Generic Taxonomic Level

	A.U. 1		A.U. 2	
Taxonomic Group	TNF	% TNF	TNF	% TNF
Molluscs	21075	78.7%	337	16.4%
Fish	438	1.6%	2	0.1%
Birds	190	0.7%	19	0.9%
Land Mammals (Total)	324	1.2%	85	4.1%
Small Land Mammals	24	0.1%	1	0.1%
Medium Land Mammals	287	1.1%	72	3.5%
Large Land Mammals	13	0.1%	12	0.6%
Sea Mammals (Total)	4742	17.7%	1618	78.5%
Small to Medium Sea Mammals	4647	17.4%	1605	77.9%
Large Sea Mammals	95	0.4%	13	0.6%
Total TNB:	26769		2061	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

House 6 Midden Analysis

Total Numbers of Fragments Identified to Generic Taxonomic Categories

Frequencies of all specimens identified to general taxonomic categories for the House 6 midden are presented in Table 9.30. A total of 28830 such specimens were identified in the House 6 midden. Subdivision of this assemblage by analytical unit produced one large faunal collection with over 26000 total specimens (A.U. 1) and one medium sized faunal collection with over 2000 specimens (A.U. 2).

Molluscs are a conspicuous part of the House 6 midden assemblage, representing fully 78% of A.U. 1, and 16% of A.U. 2. It is initially tempting to conclude that molluscs were a central part of the diet of the inhabitants of House 6 on the basis of this impressive statistical proportion. Nevertheless, a deeper examination of the mollusc assemblage, as presented in Table 9.31, suggests otherwize. Almost the entire collection of mollusc specimens was composed of fragments of blue mussel, with a small number of periwinkle specimens (genus *Littorina*). In turn, almost all of the mussel specimens were fragments of the shell body or of periostracum, which are readily broken or shredded after deposition and after recovery, multiplying the number of countable fragments.

Table 9.31 Uivak Point 1 House 6 Midden: Total Numbers of Fragments of Molluscs

	A.U. 1 (upper)		A.U. 2 (lower)	
Taxon	TNF	%of group	TNF	%of group
Blue Mussel, *Mytilus edulis* Total TNF	21040		335	
Periostracum	5933	28.2%	193	57.6%
Shell fragment	13063	62.1%	130	38.8%
Complete shell/hinge	2044	9.7%	12	3.6%
Periwinkle, *Littorina* sp. Shell	13			
Operculum	22		2	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hinge fragments, in contrast, are essentially indivisible and are required to determine the minimum number of shells represented. Numbering 2044 specimens, hinge fragments compose less than 10% of the mussel fragments in the A.U. 1 assemblage. Only 12 hinge fragments were identified in the A.U. 2 assemblage, representing only 3.6% of the mussel fragments in that assemblage. Given the small mass of flesh associated with individual mussels, the food value of 1000-odd mussels represented by 2046 complete valves is insufficient to provide a staple subsistence resource. Nevertheless, the concentration of mussel shells in several discrete layers in the House 6 midden suggests that large numbers of mussels were consumed on multiple occasions during the occupation of the house.

Sea mammal bones represent the other major taxonomic category in the House 6 midden. Sea mammal bones were the most commonly identified category of specimens in A.U. 2, representing 78.5% of that assemblage. Sea mammals were the second most commonly identified category of specimens in A.U. 1 (17.7% of the whole assemblage, or 83% of the assemblage of vertebrate bones). Fish, birds and land mammals were identified in relatively small numbers in A.U. 1 and A.U. 2, representing less than a quarter of the number of sea mammal specimens. Of these groups, fish were particularly common in A.U. 1. While they still only represent a small proportion of the whole assemblage, more fish and bird bones were found in A.U. 1, in absolute numbers, than in any other context considered in this study. This may be due to the quantity of mussel shell present in A.U. 1, as much as to the localized influence of soil moisture or acidity on bone preservation. Mollusc shells are composed of basic carbonate minerals and can neutralize humic acid present in soil organic material. Notably, the shell-bearing midden layers of the House 6 midden had a perfectly neutral pH of 7.0, slightly less acid than many other midden sediments at Uivak Point and optimal for bone preservation.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.32 Uivak Point 1 House 6 Midden: Numbers of Specimens Identified to Species (NISP)

Species	A.U. 1 NISP	A.U. 1 % NISP	A.U. 2 NISP	A.U. 2 % NISP
Blue mussel, *Mytilus edulis*	2044	50.3%	12	2.1%
Gastropoda sp. indet., Operculum	22	0.5%	2	0.4%
Caribou, *Rangifer tarandus*	7	0.2%	5	0.9%
Arctic Hare, *Lepus arcticus*	2	0.1%		
Bears, Ursidae sp. indet			1	0.2%
Foxes, *Vulpes vulpes, Alopex lagopus*	37	0.9%	4	0.7%
Dogs, *Canis familiaris*	57	1.4%	11	1.9%
Small Seals, Phocidae sp. indet.	1813	44.6%	525	92.6%
Large Seals, *Erignathus barbatus*	15	0.4%	3	0.5%
Walrus, *Odobenus rosmarus*	6	0.2%	1	0.2%
Whales, Cetecea sp. indet	62	1.5%	3	0.5%
Total NISP:	4065		567	

Seal NISP		% NISP		% NISP
Harp seals, *Phoca groenlandica*	20	22.9%	11	37.9%
Harbour seals, *Phoca vitulina*	7	8.0%	3	10.3%
Ringed seals, *Phoca hispida*	58	66.7%	15	51.7%
Bearded seals, *Erignathus barbatus*	2	2.3%		
Total	87		29	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Numbers of Identified Specimens Counts

A summary of numbers of animal bones identified to species for the House 6 midden is presented in Table 9.32. Mussels, counting only hinge fragments, remain a statistically important component of A.U. 1, though much less so than in the TNF comparison. Given the overwhelming proportion of molluscs in true shell midden sites, the relative parity between absolute numbers of mollusc hinges and sea mammal bones in A.U. 1 suggests that molluscs were a secondary resource during the occupation of House 6. Mussels appear to have been gathered, consumed and their shells discarded in considerable quantity in a limited number of events. In contrast, mussels were only a minor species contributing to the A.U. 2 assemblage.

Of all the vertebrates, small seals are the most frequently represented category in the House 6 midden. Small seal bones represent 92% of the A.U. 2 assemblage and 44.6% of A.U. 1 (over 89% of the vertebrate specimens). All other species, including caribou, foxes, dogs, large seals (most of which are probably bearded seals), whale bones and walrus each represent less than two percent of total assemblage NISP, for both A.U. 1 and A.U. 2.

A sufficient number of whale bones were recovered in A.U. 1 to make whales one of the more common minor taxa. Most of these were small fragments of unidentifiable elements, likely the detrital splinters and shavings resulting from bone working activities, which inflate the proportion of whales in A.U. 1. A more modest total of 14 specimens were identifiable as fragments of ribs. The three fragments of whalebone in A.U. 2 were not identified to element.

Dogs and foxes, which are typically two of the more common terrestrial mammals in assemblages reviewed in this study, are remarkably rare in both A.U. 1 and A.U. 2. Caribou were even more rarely recovered; a total of only twelve specimens were identified in both assemblages combined. The frequency of caribou skeletal elements in A.U. 1 and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A.U. 2 are described in Tables 9.33 and 9.34, respectively, in terms of MNE and MAU. Correlation coefficients of element frequency with both the Food Utility Index and bone density, also presented in these tables, are both moderately positive. There are too few elements in both AU 1 and A.U. 2 for a statistically valid comparison of element frequency with these economic and taphonomic indicators. Nevertheless, the tables are sufficient to demonstrate that the caribou assemblages are composed primarily of limb elements and elements that are relatively durable and that have high food utility index values (or are riders on butchery units containing such elements). These assemblages are likely shaped both by selective transport and by density-mediated attrition.

NISP counts of seals, using crania, maxillae, mandibles and humeri, are also presented in Table 9.32. In general, these counts show that ringed seals are the most frequently identified species in A.U. 1 and A.U. 2, representing the outright majority of seal specimens. Harp seals are the second most common seal species, while harbour seals are uncommon and bearded seals relatively rare. A change in seal species frequency through time should be noted, however. Ringed seals were less common in the earlier A.U. 2 assemblage than in the later A.U. 1 assemblage, ranging from 51.7% to 66.7% of seal NISP. Harp seal specimens decreased in proportion though time, from 37.9% of seal NISP in A.U. 2 to 22.9% in A.U. 1. Harbour seals changed only slightly in their share of NISP, from 10.3% in A.U. 2 to 8% in A.U. 1. Bearded seals were found in trance numbers (2.3% of seal NISP) in A.U. 1.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.33 Uivak Point 1 House 6 Midden A.U. 1 Caribou Skeletal Element Distribution

	MNE	MAU	%MAU	FUI (Metcalfe and Jones 1988)	Bone Density (Lyman 1994)
Skull	0	0	0	9.1	
Mandible (w/tongue)	0	0	0	31.1	0.57
Atlas/Axis	0	0	0	10.2	0.26
Cervical vert.	0	0	0	37.1	0.19
Thoracic vert.	0	0	0	47.3	0.32
Lumbar	0	0	0	33.2	0.3
Rib	1	1	1	51.6	0.4
Sternum	0	0	0	66.6	0.22
Scapula	2	1	1	44.7	0.49
Humerus	0	1	1	36.8	0.63
Radius-ulna	1	0.5	0.5	25.8	0.68
Metacarpal	0	0	0	5.2	0.72
Innominate	0	0	0	49.3	0.27
Femur	1	0.5	0.5	100	0.57
Tibia-fibula	0	0	0	62.8	0.74
Metatarsal	0	0	0	37.0	0.74
Phalanges	0	0	0	19.4	0.57
r for %MAU/FUI:	0.258				
r for %MAU/dens:	0.237				

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.34 Uivak Point 1 House 6 Midden A.U. 2 Caribou Skeletal Element Distribution

	MNE	MAU	%MAU	FUI (Metcalfe and Jones 1988)	Bone Density (Lyman 1994)
Skull	0	0	0	9.1	
Mandible (w/tongue)	0	0	0	31.1	0.57
Atlas/Axis	0	0	0	10.2	0.26
Cervical vert.	0	0	0	37.1	0.19
Thoracic vert.	0	0	0	47.3	0.32
Lumbar	0	0	0	33.2	0.3
Rib	1	1	1	51.6	0.4
Sternum	0	0	0	66.6	0.22
Scapula	2	0	0	44.7	0.49
Humerus	0	0	0	36.8	0.63
Radius-ulna	1	0	0	25.8	0.68
Metacarpal	0	0	0	5.2	0.72
Innominate	0	0	0	49.3	0.27
Femur	1	0.5	0.5	100	0.57
Tibia-fibula	0	0	0	62.8	0.74
Metatarsal	1	0.5	0.5	37	0.74
Phalanges	1	0.1	0.1	19.4	0.57
r for %MAU/FUI	0.37				
r for %MAU/dens	0.167				

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.35 Uivak Point 1 House 6 Midden Relative Frequency (RF) Counts of Numbers of Specimens Identified to Species

Species	A.U. 1		A.U. 2	
	RF	% RF	RF	% RF
Blue mussel, *Mytilus edulis*	1022	67.20%	6	3.93%
Gastropoda sp. indet. Operculum	22	1.5%	2	1.3%
Caribou, *Rangifer tarandus*	2.2	0.1%	1.2	0.8%
Arctic Hare, *Lepus arcticus*	1	0.1%		
Bears, Ursidae sp. indet.			1	0.7%
Foxes, *Vulpes vulpes, Alopex lagopus*	10.4	0.7%	0.3	0.2%
Dogs, *Canis familiaris*	16.2	1.1%	4.4	2.9%
Small Seals, Phocidae sp. indet.	439.1	28.9%	135.8	88.9%
Large Seals (*Erignathus barbatus*)	6.0	0.4%	1.6	1.0%
Walrus, *Odobenus rosmarus*	1.8	0.1%	0.5	0.3%
Whales, Cetecea sp. indet	0.3	0.02%	0.04	0.03%
Total NISP:	1520.8		152.8	

As an alternative to NISP as a measure of species abundance, Relative Frequency (RF) counts are presented in Table 9.35. As discussed earlier, RF counts are, in essence, NISP counts that are corrected to account for inter-specific differences in skeletal structure. They are considered to provide a more reliable estimate of the proportions of species in an archaeological assemblage than the simple number of identified fragments. The RF count provides a very similar representation of species abundance as the NISP.

Molluscs comprised a large proportion of A.U. 1 but are a minor component of AU2. Large seals, foxes, dogs are the most common of the minor taxa in both assemblages, while the %RF of whales was much less than the NISP count, as the RF counts consider only the identified elements. RF counts for seal specimens are not presented here because, having been calculated from the same small set of (mostly paired) elements, their RF counts were entirely redundant with the NISP count.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

As a final measure of taxonomic abundance for this context, Density of Deposition counts of all species, including seal species, are presented in Table 9.36. The DD counts show, in general, the same pattern of species abundance as the NISP and RF counts. The major difference between the A.U. 1 and A.U. 2 assemblages is mostly one of scale; the later midden deposit (A.U. 1) was much more concentrated, with several times as many specimens per m^3 as were counted in A.U. 2.

Table 9.36 Uivak Point 1 House 6 Midden Density of Deposition (DD) Counts of Numbers of Specimens Identified to Species

	House 6 Midden AU 1 DD	House 6 Midden AU 2 DD
Blue mussel *Mytilus edulis*	3630.5	26.7
Gastropoda sp. indet. Operculum	39.1	4.4
Caribou, *Rangifer tarandus*	12.4	11.1
Arctic Hare, *Lepus arcticus*	3.6	
Bears, Ursidae sp. indet.		2.2
Foxes, *Vulpes vulpes, Alopex lagopus*	65.7	8.9
Dogs, *Canis familiaris*	101.3	24.4
Small Seals, Phocidae sp. indet.	3220.3	1166.7
Large Seals (*Erignathus barbatus*)	26.6	6.7
Walrus, *Odobenus rosmarus*	10.7	2.2
Whales, Cetecea sp. indet	110.2	6.7
Harp seals, *Phoca groenlandica*	35.5	24.4
Harbour seals, *Phoca vitulina*	12.4	6.7
Ringed seals, *Phoca hispida*	103.0	33.3
Bearded seals, *Erignathus barbatus*	3.6	

In A.U.2, seal bones are present in concentrations of over 1000 specimens per m^3, while the other non-phocine species are present in concentrations of less than thirty specimens per m^3. Of these, mussels, dogs and foxes were the most commonly identified.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The seal species were ranked, in order of greater to lower DD counts, as ringed seals, harp seals, harbour seals and finally bearded seals. In the A.U. 1 assemblage, mussel hinges were present in about the same concentration as the bones of seals. Bones of whales, dogs and foxes were the more common minor species. All the seal species were present in greater absolute numbers in A.U. 1 than in A.U. 2. The rank order of seal species in A.U. 1 was the same as that of A.U. 2 though the precise proportions of these species were different. The most striking difference was in the concentrations of ringed seals, which increased from 33.3 specimens per m3 in A.U. 2 to 103 specimens per m^3 in A.U. 1. The DD counts of harp seals and harbour seals increased as well, but to a much smaller degree. This relationship is investigated in ratios of seal species DD counts presented in Table 9.37. The ratios involving ringed seals consistently increased in A.U. 1 while the harp seal: harbour seal DD ratio remained essentially static. It is an increase in numbers of ringed seal specimens in excess of the general increase in bone concentration in AU1 that is driving the %NISP changes demonstrated in Table 9.32.

Table 9.37 Uivak Point 1 House 6 Midden: Ratios of Seal Species DD Counts

	A.U. 1	A.U. 2
Ratio of Ringed Seal to Harp Seal DD	2.9	1.4
Ratio of Ringed Seal to Harbour Seal DD	8.3	5.0
Ratio of Harp Seal to Harbour Seal DD	0.4	0.4

Faunal Analysis of the House 7 Assemblage

A large faunal collection with 7304 specimens, reviewed in Table 9.38, was recovered in the floor deposits of the sample of units considered in this study. Over 5000 over these, or 76.8%, were sea mammal specimens. Mollusc specimens represented the most substantial secondary taxonomic category with 15.5% of the assemblage, while land

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

mammal specimens comprised only 6.54%. Fish and bird bones, added together, represented just over one percent of the assemblage. Over 1100 mollusc specimens were recovered. As demonstrated in Table 9.39, the great majority of these were fragments of shell bodies or periostracum, both of which are readily fragmented in trampled areas. Only 6 mussel shell hinges were counted, suggesting that relatively few complete mussel shells were actually deposited on the house floor and are represented in the faunal assemblage. A total of 44 gastropod opercula were counted; these could not be identified to species but were of similar size and shape as the larger periwinkles (genus *Littorina*) currently found around at Uivak Point.

Table 9.38 Uivak Point 1 House 7 Floor Deposits (A.U. 2) Total Numbers of Fragments (TNF) by Taxonomic Group

Taxonomic Group	TNF	%TNF
Molluscs	1132	15.5%
Fish	25	0.3%
Birds	53	0.7%
Land Mammals (Total)	478	6.5%
Small Land Mammals	6	0.1%
Medium Land Mammals	416	5.7%
Large Land Mammals	56	0.8%
Sea Mammals (Total)	5616	76.9%
Small to Medium Sea Mammals	5487	75.1%
Large Sea Mammals	129	1.8%
Total TNB:	7304	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.39 Uivak Point 1 House 7 Floor Deposits Total Numbers of Mollusc Specimens

Category	A.U. 2	%of group
Blue Mussel, *Mytilus edulis* Total TNF	1088	
Periostracum	997	91.6%
Shell fragment	85	7.18%
Complete shell/hinge	6	0.055%
Gastropoda sp. indet. operculum	44	

Table 9.40 Uivak Point 1 House 7 Floor Deposits Measures of Taxonomic Abundance (NISP, RF, DD)

Species	NISP	% NISP	RF	%RF	DD
Blue mussel *Mytilus edulis*	6	0.2%	3	0.4%	0.9
Gastropoda sp. indet. Operculum	44	1.6%	44	5.2%	6.6
Caribou, *Rangifer tarandus*	27	1.0%	0.1	0.02%	4.1
Arctic Hare, *Lepus arcticus*	3	0.1%	0.7	0.1%	0.5
Foxes, *Vulpes vulpes, Alopex lagopus*	139	5.1%	47.5	5.6%	20.9
Dogs, *Canis familiaris*	121	4.5%	46.9	5.6%	18.2
Domestic Pig, *Sus domestica*	2	0.1%	1	0.2%	0.3
Small Seals, Phocidae sp. indet.	2285	84.1%	673.4	80.0%	343.6
Large Seals (*Erignathus barbatus*)	50	1.8%	22.1	2.6%	7.5
Walrus, *Odobenus rosmarus*	1	0.04%	1	0.1%	0.2
Whales, Cetecea sp. indet	40	1.5%	2.1	0.3%	6.02
Total NISP:	2716		841.8		
Harp seals, *Phoca groenlandica*	27	28.7%			4.1
Harbour seals, *Phoca vitulina*	15	16.0%			2.3
Ringed seals, *Phoca hispida*	47	50.0%			7.1
Bearded seals, *Erignathus barbatus*	5	5.3%			0.8
Total Seal NISP:	94				

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

NISP, RF and DD measures of the abundance of taxa in the floor deposits of House 7 are presented in Table 9.40. Just as in the other assemblages in this study, the House 7 assemblage is dominated by the bones of small seals, with foxes, dogs and to a lesser extent, large seals and whales are the more common minor taxa. The whale bones represented included mostly small splintered bone fragments but also fragments of a mandible, a rib, a scapula and a vertebra. In addition, a number of other large whale elements were excavated in the parts of the house, many of which were incorporated into the house structure, but were not part of this sample.

Most remarkable among the assemblage are two bones of domestic pig, including one maxilla fragment and one mandible fragment. Dental eruption and wear of the maxillary teeth were indicative of a young animal. Domestic pigs were a new introduction to Labrador in the 18th century. These particular specimens probably represent pigs shipped live to Labrador and killed soon upon arrival. Pigs would require considerable effort to overwinter in Labrador and it is unlikely that preserved pork would have been prepared or transported with the skull attached and therefore likely whole. The pigs must have been introduced by one of many European or American visitors to Labrador, or perhaps by the Moravian Missionaries at Okak Harbour for their Christmas meals. In the absence of bones indicating the consumption of more traditional cuts of pork, the presence of at least one pig crania in an Inuit house might be (speculatively) explained as evidence for the distribution of low-value food by the Moravians in trade or as gifts. Inuit might also have attempted to use large pig's teeth as a source of raw materials for craftwork.

Ringed seals are the most commonly identified seal in the house assemblage, comprising 50% of the total seal NISP. Harp seals comprised 28.9% of the identified seal, while harbour seals and bearded seals were 15.9% and 5.32% of the seal assemblage, respectively.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.41 Uivak Point 1 House 7 Floor Deposits (AU2) Distribution of Caribou Skeletal Elements

	MNE	MAU	%MAU	FUI (Metcalfe and Jones 1988)	Max Density (Lyman 1994)
Skull				9.1	
Mandible (w/tongue)				31.1	0.57
Atlas/Axis				10.2	0.26
Cervical vert.	2	0.4	0.4	37.1	0.19
Thoracic vert.	1	0.07	0.07	47.3	0.32
Lumbar	2	0.4	0.4	33.2	0.3
Rib				51.6	0.4
Sternum	1	0.1	0.1	66.6	0.22
Scapula	1	0.5	0.5	44.7	0.49
Humerus	1	0.5	0.5	36.8	0.63
Radius-ulna	1	0.5	0.5	25.8	0.68
Metacarpal				5.2	0.72
Innominate	1	0.5	0.5	49.3	0.27
Femur	2	1	1	100	0.57
Tibia-fibula				62.8	0.74
Metatarsal	1	0.5	0.5	37.0	0.74
Phalanges				19.4	0.57
r for %MAU/FUI:	0.542				
r for %MAU/dens:	0.178				

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The RF and DD counts described in Table 9.40 repeat the pattern of taxonomic abundance described by the NISP counts. The different measures do not produce significantly different rankings of species; small seals are the predominant category with all the counts and dogs, foxes and large seals are the more conspicuous minor taxa. Worthy of note is the more modest concentration of bones, in general, in the house floor deposits than the midden contexts analysed in this study. The ratios of DD counts of seal species in House 7 are listed in Table 9.42.

Table 9.42 Uivak Point 1 House 7 Floor Deposits (A.U. 2) Ratios of Seal Species DD Counts

Ratio	A.U. 2
Ratio of Ringed Seal to Harp Seal DD	1.74
Ratio of Ringed Seal to Harbour Seal DD	3.13
Ratio of Harp Seal to Harbour Seal DD	1.80

Faunal Analyses of the House 7 Midden

Frequencies of specimens identified to general taxonomic categories for all A.U.'s in the House 7 midden are presented in Table 9.43. A total of 52,543 specimens were recovered in the entire midden excavation. In the present analysis, this very large sample is divided into five sub-assemblages on the basis of stratigraphically defined analytical units. Three of the sub-assemblages comprise between 4000 and 35,000 specimens, and can be considered large to very large faunal assemblages in themselves. A.U. 3/4 and A.U. 5, which are derived from the most dense midden deposits contribute the largest faunal collections. A.U. 1 has a small to medium-sized assemblage and sub-assemblage, while the final assemblage (A.U. 6/7) is quite small.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.43 Uivak Point 1 House 7 Midden Total Numbers of Fragments (TNF) by Taxonomic Group

	A.U. 1		A.U. 2		A.U. 3/4		A.U. 5		A.U. 6/7	
	TNF	% TNF	TNF	% TNF	TNF	% TNF	TNF	% TNF	TNF	% TNF
Molluscs	253	13.2%	901	19.3%	6239	48.8%	20501	58.7%	47	46.08 %
Fish	1	0.05%	5	0.1%	53	0.4%	177	0.5%		
Birds	2	0.1%	33	0.7%	136	1.1%	216	0.6%		
Land Mammals (Total)	282	14.7%	337	7.2%	681	5.3%	1208	3.5%	4	3.9%
Small Land Mammals	5	0.3%	9	0.2%	20	0.2%	61	0.2%		
Medium Land Mammals	239	12.4%	295	6.3%	601	4.7%	1025	2.9%	4	3.9%
Large Land Mammals	38	2.0%	33	0.7%	60	0.5%	122	0.4%		
Sea Mammals (Total)	1385	72.0%	3402	72.7%	5678	44.4%	12855	36.8%	51	50.0%
Small to Medium Sea Mammals	1181	61.4%	2993	64.0%	5448	42.6%	12275	35.1%	48	47.1%
Large Sea Mammals	204	10.6%	409	8.7%	230	1.8%	580	1.7%	3	2.9%
Total TNB:	1923		4678		12787		34957		102	

As in the House 6 midden, mollusc fragments make up a large proportion of the House 7 midden assemblages. Molluscs range from a low proportion of 13.2% of TNF in A.U. 1 to 58.7% of A.U. 5; numbering over 20,000 specimens in that assemblage. Sea mammal specimens are the other major constituents of the midden assemblages while land mammals are a minor component. Fish and bird bones were present in trace numbers (less than 1.2% of assemblage TNF), even in contexts with neutral soil pH and excellent preservation conditions. Fish and bird remains apparently did not derive much advantage in preservation from the density of mollusc shell in A.U. 3/4 and A.U. 5. By contrast, sea

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

mammals, especially the small to medium sized seals, were especially common, comprising the bulk of the vertebrate specimens. Large sea mammal bones, including those of the largest seals, walrus and whales of all sizes are a small part of these assemblages, but tend to be more common in the House 7 midden than in the other sites examined in this study.

Table 9.44 Uivak Point 1 House 7 Midden Total Numbers of Mollusc Specimens

	A.U. 1		A.U. 2		A.U. 3/4		A.U. 5		A.U. 6/7	
	TNF	% of Group	TNF	% of Group	TNF	% of Group	TNF	% of Group	TNF	% of Group
Blue Mussel, *Mytilus edulis* Total TNF	241		888		6239		20403		44	
Periostracum	231	95.8%	871	98.1%	4971	79.7%	10943	53.6%	22	50.0%
Shell fragment	9	3.7%	16	1.8%	1205	19.3%	9108	44.6%	22	50.0%
Complete shell/hinge	1	0.4%	1	0.1%	63	1.0%	352	1.7%		
Gastropoda sp. indet., operculum	12		13		20		96			

Frequencies of the various components of the mollusc assemblage are presented in Table 9.44. Blue mussel specimens are found in great numbers in much of the midden and are the primary species of mussel represented; only small numbers of gastropod opercula, tentatively considered to be from periwinkles, are present. The simple numbers of mollusc specimens is somewhat misleading, as the bulk of mollusc specimens are highly fragmented shell body or periostracum fragments. The mussel assemblage is highly fragmented as almost all specimens are broken pieces of shell bodies or periostracum. Hinge fragments amount to 1.7% or less of the total number of mussel specimens, suggesting that relatively few mussels are actually represented in the House 7 midden. Mussel hinge fragments also comprise a smaller proportion of the House 7 midden assemblages than of A.U. 1 in the House 6 midden.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.45 Uivak Point 1 House 7 Midden Numbers of Specimens Identified to Species (NISP)

Species	A.U. 1		A.U. 2		A.U. 3/4		A.U. 5		A.U. 6/7	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Blue Mussel, *Mytilus edulis*	1	0.1%	1	0.1%	63	2.3%	352	5.2%		
Gastropoda sp. Operculum	12	1.0%	13	0.9%	20	0.7%	96	1.4%	3	9.1%
Caribou, *R. tarandus*	19	1.6%	15	1.0%	29	1.1%	64	0.6%		
Arctic Hare, *L. arcticus*	2	0.2%					2	0.03%		
Bears, Ursidae sp.	2	0.2%	1	0.1%	1	0.04%	6	0.1%		
Foxes *V. vulpes, A. lagopus*	10	0.8%	68	4.7%	85	3.2%	139	2.1%		
Dogs, *Canis familiaris*	137	11.3%	131	9.1%	208	7.7%	441	6.5%	3	9.1%
Small Seals, Phocidae sp.	942	77.4%	1137	78.5%	2175	80.7%	5312	78.6%	26	78.8%
Large Seals (*E. barbatus*)	40	3.3%	45	3.1%	53	2.0%	173	2.6%		
Walrus, *O.rosmarus*	6	0.5%	4	0.3%	2	0.1%	19	0.3%		
Whales, Cetecea sp.	46	3.8%	33	2.3%	56	2.1%	152	2.3%	1	3.0%
Total NISP:	1217		1448		2697		6756		33	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Harp seals, *P. groenlandica*	31	32.6%	20	27.0%	30	32.6%	79	28.6%		
Harbour seals, *Phoca vitulina*	9	9.5%	12	16.2%	3	3.3%	18	6.5%		
Ringed seals, *Phoca hispida*	44	46.3%	36	48.7%	48	52.2%	139	50.4%	1	100%
Bearded seals, *E. barbatus*	11	11.6%	5	6.8%	11	12.0%	40	14.5%		
Hooded seals, *C. cristata*			1	1.4%						
Total	95		74		92		276		1	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In Table 9.45, NISP counts for the House 7 midden assemblages are presented. The four large assemblages show very little difference between. Smaller seals clearly dominate all of the midden assemblages, and consistently represent between 77% and 81% of the total NISP each assemblage. Large seals represent between about 2% to 3.3% ofassemblage total NISP. Notably, mussels are clearly demonstrated to be secondary if not minor resources in all assemblages when only the numbers of hinges are counted.

Whale bones represent a minor fraction of all assemblages, ranging consistently between 2% and 3.8% of total NISP. Most of these specimens are small fragments that were not identifiable to species. The identifiable fragments are discussed at length later Ringed seals are the most common of the seal species and vary only slightly in frequency between assemblages; between 46% and 52% of the seal NISP. Harp seals were also common and too varied little in %NISP between assemblages, from 27% to 32.6%.

Harbour seals were much common and their share of %NISP varied more widely than the other species; from a low of 3.26% of seal NISP in A.U. 3/4 to a high of 16.2% in A.U. 2. Bearded seals, too, were represented in a relatively inconsistent manner, varying from 6.8% of the seal NISP in A.U. 2 to 14.5% in AU5; bearded seals were about 11% to 12% of NISP in both AU1 and A.U. 3/4. The frequencies of harbour seals and bearded seals appear to vary inversely as, in the only occasion when harbour seals represented more than 10% of the seal NISP (A.U. 2), bearded seals declined both in absolute frequency and in proportion. As well, one hooded seal specimen was identified in AU2, the only such specimen noted in this study.

A diversity of other secondary resources is noted in the tables including fish, birds, and a number of land mammal species. The most frequently identified of these are foxes and dogs, species which are most valuable a sources of raw material and for traction, rather than for food. Dogs in particular are identified in these assemblages in considerable numbers, between 137 to 441 specimens in each of A.U.'s 1 to 5. They are the only

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

secondary species to range in the vicinity of 7% and 11% of total NISP. Many of the dog bones show evidence of very robust muscle attachments, osteoarthritis and trauma-related pathologies, testifying to their strenuous lives pulling sleds as hunting animals.

Table 9.46 Uivak Point 1 House 7 Midden A.U. 3/4 Caribou Skeletal Element Distribution

	MNE	MAU	%MAU	FUI (Metcalfe and Jones 1988)	Max Density (Lyman 1994)
Skull				9.1	
Mandible (w/tongue)				31.1	0.57
Atlas/Axis				10.2	0.26
Cervical vert.	1	0.2	0.2	37.1	0.19
Thoracic vert.	2	0.1	0.1	47.3	0.32
Lumbar				33.2	0.3
Rib	4	0.1	0.1	51.6	0.4
Sternum				66.6	0.22
Scapula	2	1	1	44.7	0.49
Humerus	2	1	1	36.8	0.63
Radius-ulna				25.8	0.68
Metacarpal				5.2	0.72
Innominate	2	1	1	49.3	0.27
Femur	1	0.5	0.5	100	0.57
Tibia-fibula	1	0.5	0.5	62.8	0.74
Metatarsal	1	0.5	0.5	37.0	0.74
Phalanges				19.4	0.57
r for %MAU/FUI	0.389				
r for %MAU/dens	0.222				

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.44 Uivak Point 1 House 7 Midden A.U. 5 Caribou Skeletal Element Distribution

	MNE	MAU	%MAU	FUI (Metcalfe and Jones 1988)	Bone Density (Lyman 1994)
Skull	1	0.5	0.1	9.1	
Mandible (w/tongue)				31.1	0.57
Atlas/Axis	2	1	0.3	10.2	0.26
Cervical vertebra	3	0.6	0.2	37.1	0.19
Thoracic vertebra	4	0.3	0.1	47.3	0.32
Lumbar	2	0.4	0.1	33.2	0.3
Rib	1	0.04	0.01	51.6	0.4
Sternum	1	0.1	0.04	66.6	0.22
Scapula	6	3	0.8	44.7	0.49
Humerus	3	3	0.8	36.8	0.63
Radius-ulna				25.8	0.68
Metacarpal	1	0.5	0.1	5.2	0.72
Innominate	8	4	1	49.3	0.27
Femur	3	1.5	0.4	100	0.57
Tibia-fibula	2	1	0.3	62.8	0.74
Metatarsal	1	0.5	0.1	37.0	0.74
Phalanges	2	0.3	0.1	19.4	0.57
r for %MAU/FUI:	0.22				
r for %MAU/dens:	-0.0006				

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.10 Uivak Point 1 House 7 Midden AU3/4: Caribou Element Frequency (%MAU) vs. Food Utility Index and Bone Density

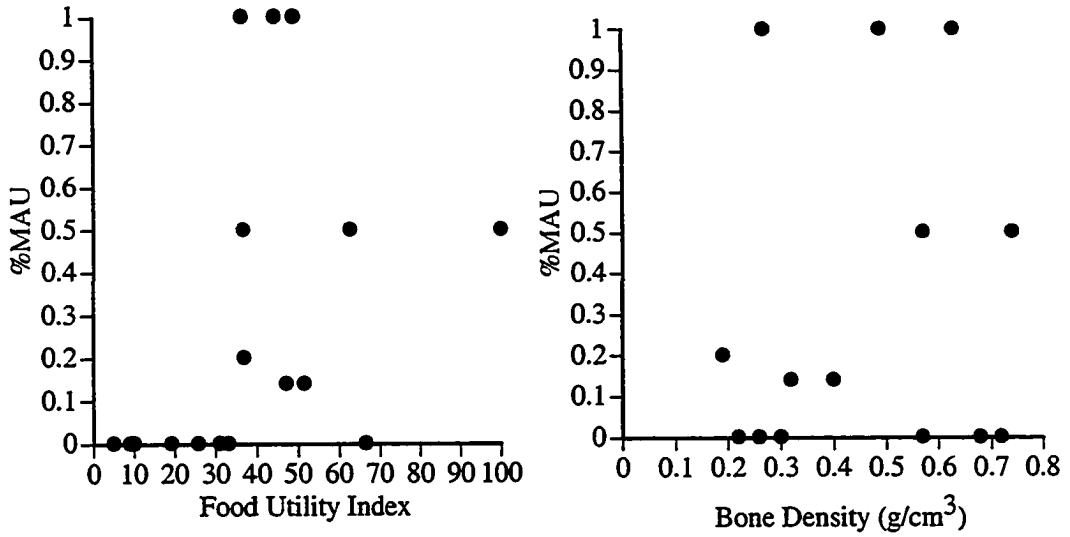
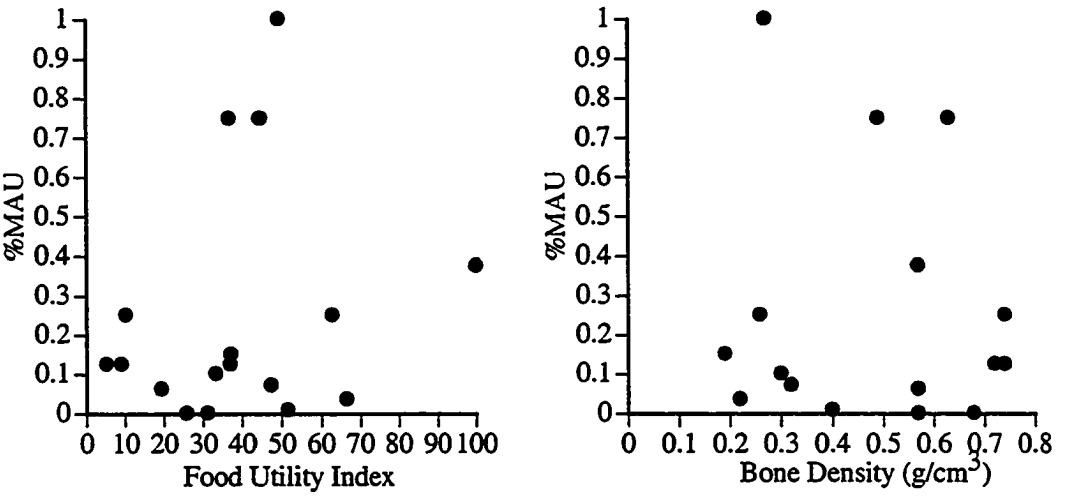


Figure 9.11 Uivak Point 1 House 7 Midden AU5: Caribou Element Frequency (%MAU) vs. Food Utility Index and Bone Density



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Caribou are quite uncommon and represent less than 2% of the total NISP of each assemblage. Element frequencies for A.U. 3/4 and A.U. 5 are presented in Table 9.46 and 9.47. The frequency of elements in the A.U. 3/4 assemblage shows a positive correlation with the Food Utility Index and a more moderate correlation with bone density. The relationships between element frequency, the FUI and bone density in A.U. 5 are further examined further in scatterplots in Figure 9.6 and Figure 9.7.

The FUI/element frequency plot for A.U. 3/4 shows that elements of low food value are absent from the assemblage, while the medium to high utility elements show a generally positive, though not unilinear, trend between utility and frequency. Because of the lack of low utility elements, assemblage most closely matches a "gourmet" strategy of carcass use, suggesting that the caribou represented in the A.U. 3/4 assemblage were transported from some distance or had been cached before being brought to the site.

A general positive but unfocussed trend between element frequency and bone density for A.U. 3/4 is demonstrated in Figure 9.10. The shape of the plot suggests that the A.U. 3/4 caribou assemblage has been shaped by attritional processes but has not been severely ravaged. The caribou assemblage of A.U. 5, described in Table 9.43, is the largest such assemblage in this study and includes a mix of axial and appendicular elements. The assemblage has a weak positive correlation with the Food Utility Index, and a weak negative correlation with bone density. A scatterplot of element frequency in A.U. 5 and the Food Utility Index (see Figure 9.11) shows a positive, but broadly cast relationship showing no clear trend. While low-utility elements had low frequencies or were absent altogether, the most frequent elements were predominately ones of moderate food value. The negative correlation of element frequency and bone density suggests that the assemblage has seen little taphonomic winnowing. With no preference for either high utility and little attrition, no clear picture of caribou carcass use is obtained, though it is possible that caribou elements were derived from relatively whole specimens processed, consumed and disposed on-site.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.48 Uivak Point 1 H7M Relative Frequency (RF) Counts of Numbers of Specimens Identified to Species

Species	A.U. 1		A.U. 2		A.U. 3/4		A.U. 5		A.U. 6/7	
	RF	%RF	RF	%RF	RF	%RF	RF	%RF	RF	%RF
Blue Mussel, *Mytilus edulis*	0.5	0.1%	0.5	0.1%	31.5	1.2%	176	8.6%		
Gastropoda sp. Operculum	12	2.6%	13	2.8%	20	0.8%	96	4.7%	3	18.9%
Caribou, *R. tarandus*	9.8	2.1%	4.8	1.0%	29	1.1%	24.7	1.2%		
Arctic Hare, *L. arcticus*	1	0.2%					0.6	0.03%		
Bears, Ursidae sp.	0.6	0.1%	0.3	0.05%	1	0.04%	2.8	0.1%		
Foxes, *V. vulpes, A. lagopus*	4.3	0.9%	15.2	3.3%	85	3.2%	48.5	2.4%		
Dogs, *Canis familiaris*	66.4	14.4%	45.8	9.9%	208	7.8%	145.9	7.1%	1.5	9.5%
Small Seals, Phocidae sp.	343.4	74.5%	363.9	78.9%	2175	81.8%	1467	71.5%	11.4	71.6%
Large Seals (*E. barbatus*)	19.9	4.3%	16.9	3.7%	53	2.0%	81.3	4.0%		
Walrus, *O. rosmarus*	3	0.7%	0.8	0.2%	2	0.1%	6.4	0.3%		
Whales, Cetecea sp.	0.2	0.04%	0.08	0.02%	56	2.1%	1.9	0.1%		
	461.0		461.2		2660.5		2051.2		15.9	

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Relative Frequency Counts

Relative Frequency counts for the House 7 midden are presented in Table 9.48. The RF count shows much the same pattern of taxonomic abundance as that illustrated with the NISP counts. Small seals are the dominant category and exceed 71% of RF in every assemblage. Dogs, foxes, large seals and, in A.U. 5, molluscs figure as the more important secondary species. In general, however, molluscs appear to be relatively unimportant parts of the assemblages.

Density of Deposition Counts

Patterns of taxonomic abundance are again examined with DD counts in Table 9.49. The concentrations of bones within the midden excavation is shown to be inconsistent; the DD counts of most species are highest in A.U. 3/4, and relatively low in AU6/7 and AU1, contexts which are considered to respectively to precede and to follow periods of active, intense midden deposition. The concentration of bones in the House 7 midden falls within the range of other middens reported in this study. Notably, bone concentrations in A.U. 1 are generally higher than for the floor deposits of House 7. The DD counts also show that small seals contributed the most bone remains of all the taxa and that dogs, followed by foxes, large seals, molluscs and whales represent the more common secondary taxa. While density of almost all species was increasing in AU3/4, that of blue mussels decreased from A.U. 5 to A.U. 3/4 while that of gastropods remained static. This points to a decline in the numbers, and likely use, of molluscs.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.49 Uivak Point 1 H7M: Density of Deposition (DD) Counts of Numbers of Specimens Identified to Species

	A.U. 1 DD	A.U. 2 DD	A.U. 3/4 DD	A.U. 5 DD	A.U. 6/7 DD
Blue Mussel, *Mytilus edulis*	3.3	2.3	96.9	355.2	0.4
Gastropoda sp. indet. operculum	5.3	10.0	30.8	30.5	7.5
Small Seals, Phocidae sp.	418.7	874.6	3346.2	1686.4	65.0
Large Seals (*Erignathus barbatus*)	17.8	34.6	81.5	54.9	
Walrus, *Odobenus rosmarus*	2.7	3.1	3.1	6.0	
Whales, Cetecea sp. indet	20.4	25.4	86.2	48.3	2.5
Caribou, *Rangifer tarandus*	8.4	11.5	44.6	20.3	
Arctic Hare, Lepus arcticus	0.9			0.6	
Bears, Ursidae sp. indet	0.9	0.8	1.5	1.9	
Foxes, *Vulpes vulpes, Alopex lagopus*	4.4	52.3	130.8	44.1	
Dogs, *Canis familiaris*	60.9	100.8	320.0	140.0	7.5
Harp seals, *Phoca groenlandica*	13.8	15.4	46.2	25.1	
Harbour seals, *Phoca vitulina*	4.0	9.2	4.6	5.7	
Ringed seals, *Phoca hispida*	19.6	27.7	73.9	44.1	2.5
Bearded seals, *Erignathus barbatus*	4.9	3.9	16.9	12.7	
Hooded seals, *Cystophora cristata*		0.8			

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.50 Uivak Point 1 House 7 Midden Ratios of DD counts for Seal Species

Ratios	A.U. 1	A.U. 2	A.U. 3/4	A.U. 5
Ringed Seal DD/Harp Seal DD	1.4	1.8	1.6	1.8
Ringed Seal DD/Harbour Seal DD	4.9	3.0	16.0	7.7
Ringed Seal DD/Bearded Seal DD	4.0	7.2	4.4	3.5
Harp Seal DD/Harbour Seal DD	3.4	1.7	10.0	4.4
Harbour Seal DD/Bearded Seal DD	0.8	2.4	0.3	0.5

Among the seals, the highest concentrations of identifiable bone for most species were deposited in AU3/4. DD counts also reproduce the same ranking of seal species, with ringed seals the most common, followed closely by harp seals, then bearded seals and finally harbour seals. The DD counts verify that harbour seals and bearded seal numbers do vary in an inverse fashion, as suggested by the NISP count. Harbour seals decreased in concentration while other species increased, in the A.U. 3/4 assemblage. The concentration of all seal species decreased in A.U. 2, except the harbour seal which actually increased in density, and as a result, in proportion.

Ratios of the seal species' DD counts, provided in Table 9.50, indicate that ringed seals and harp seals had a consistent relationship in the different assemblages, varying only within the range of 1.4 ringed seals per harp seal, to 1.8 ringed seals per harp seal. While these species had very consistent frequencies, harbour seals and bearded seals did not. The ratios of harbour seals to ringed seals and harp seals show a sharp decline in harbour seal frequency relative to other species in A.U. 3/4. Similarly, bearded seal counts have a fairly consistent proportional relationship with those other species in assemblages 1, 2 and 5, but their concentrations in A.U. 2 decreased more than those of ringed seals or harp seals.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.51 Uivak Point 1 Season of Death of Seals, Estimated through Analysis of Dental Annuli

	October-December	January-March	April-June
Harbour Seal			
House 6 Midden, A.U. 1			1 (100%)
House 7, A.U. 2			1 (100%)
House 7 Midden, A.U. 2	1 (100%)		
Ringed Seal			
House 6 Midden, A.U. 1		2 (13%)	13 (87%)
House 7, A.U.2		1 (14%)	6 (86%)
House 7 Midden, A.U. 2			2 (100%)
House 7 Midden, A.U. 3/4		2 (29%)	5 (71%)
House 7 Midden, A.U. 5	1 (5%)	7 (32%)	14 (63%)
Harp Seal			
House 6 Midden, A.U. 1	2 (50%)		2 (50%)
House 6 Midden, A.U. 2			1 (100%)
House 7, A.U.2	1 (100%)		
House 7 Midden, A.U. 2	3 (75%)		1 (25%)
House 7 Midden, A.U. 3/4	3 (75%)		1 (25%)
House 7 Midden, A.U. 5	10 (83%)		2 (17%)
TP 10/11, A.U. 1			1 (100%)
TP 10/11, A.U. 2	1 (100%)		
Bearded Seal			
House 7 Midden, A.U. 1			1 (100%)
House 7 Midden, A.U. 2			1 (100%)

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Estimations of Age and Season of Death of Seals Based on Incremental Structures

Season and ages of death of the seals represented in the Uivak Point 1 assemblages were estimated through analysis of dental annuli. Thin sections of a total of 121 seal teeth from species-identified jaws were prepared, mounted on slides and examined with a microscope. The teeth in this collection were, in general, well preserved and age and/or season of death estimates were obtained from a total of 108 of these samples. Season of death estimates based on this analysis are presented in Table 9.51, organized by provenience and species. As well, age of death estimates for ringed seals are listed in Table 9.52.

House 6 Midden

Thirty-two tooth sections were made from teeth recovered from the House 6 Midden. Almost all of these teeth were from A.U. 1, and most were ringed seals. Ringed seals in A.U. 1 were mostly (counting 87% of readable teeth) animals killed in spring. A small number of specimens (13%) were killed in winter. Sixty-one percent of the ringed seals in A.U. 1 are neo-natal or young-of-the-year pups, with sub-adults and adults represent 17% and 22% of the sample, respectively. The hunting pattern implied by the age and season of death profile is one dominated by spring hunting on fast ice and at the *sina*, with a minor fraction of winter season hunting on fast ice or at the *sina*. In winter, adult ringed seals may be found and hunted at their breathing holes amidst fast ice, while subadults (and some adults too) frequent the *sina*. The smaller winter catch likely reflects the difficulty of hunting these dispersed animals in winter conditions, and the effort required to do so. In spring, ringed seal birthing dens are easier to locate and seals are readily spotted while basking on the fast ice, around breathing holes, and along the *sina*. The most productive mode of ringed seal hunting represented in A.U. 1 was hunting pups at their birthing dens in spring, along with basking adults and subadults.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The harp seals from A.U. 1 were hunted in both fall and spring and, judging from the archaeological sample, the fall and spring hunts during the later occupation of House 6 were of approximately the same scale. The small size of the sample reviewed here hinders a more precise evaluation of the scale of the seasonal hunts. A single harbour seal specimen recovered in A.U. 2 was a fall kill. In addition, a reading of one harp seal tooth from the earlier A.U. 2 assemblage indicated a spring season of death.

Table 9.52 Uivak Point 1 Age of Death of Ringed Seals, estimated through Analysis of Dental Annuli

Ringed Seal Age of Death	0-1 Years	1-6 Years	7+ Years
House 6 Midden A.U. 1	11 (61%)	3 (17%)	4 (22%)
House 7 A.U.2	4 (57%)	2 (29%)	1 (14%)
House 7 Midden A.U. 1			1 (100%)
House 7 Midden A.U. 2	1 (50%)	1 (50%)	
House 7 Midden A.U. 3/4	1 (13%)	4 (50%)	3 (37%)
House 7 Midden A.U. 5	12 (46%)	5 (19%)	9 (35%)

House 7 Floor

The sample of ringed seals recovered from the floor deposits of House 7 included seven ringed seal specimens with legible annulations. Only one specimen in this assemblage (representing 14% of the group) was determined to have died during the winter, while the remainder (86% of the analysed ringed seal teeth) died during the spring. The majority of the individuals represented by these specimens (57%) were neonate pups or young of the year, while two specimens were subadults (29%) and one was an adult (14%). A focus on spring hunting, especially of pups and basking seals, appears to be indicated by this pattern. A single harp seal specimen from the house floor deposit represented an

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

individual killed in the fall. Readings of one harbour seal tooth indicated a spring season of death.

House 7 Midden

Only a small set of seal teeth from the upper portions of the House 7 midden (A.U. 1 and 2) were available for analysis. Three ringed seal teeth in these assemblages include one adult, a subadult and a pup; the pup and the subadult were killed in the spring. In A.U. 2, three of four harp seals represent animal killed in the fall, while one was killed in the spring. One harbour seal specimen and two bearded seal specimens were also spring kills. Bearded seals haul out to bask in the spring and so may be readily hunted on the fast ice as well as at the *sina* in that season.

Five of the seven analysed ringed seal specimens from A.U. 3/4 are identified as spring kills, while 29% were killed during the winter. Only one of these ringed seals is a pup killed in the spring. Of the rest, four are subadults and three are adults, both of which were hunted in winter and spring. Spring ringed seal hunting on fast ice and around the *sina* is again shown to have been the major mode ringed seal hunting. Nevertheless, a somewhat larger role of winter hunting of ringed seals, both at breathing holes and at the *sina*, may be indicated in this assemblage. Harp seal hunting during the late 18th century to very early 19th century occupation phase represented by A.U. 3/4 appears to have been centered around the fall hunt. Among the four harp seal specimens from A.U. 3/4 that were analysed, three are fall kills and one was killed in the spring.

A total of 26 ringed seal and harp seal teeth from A.U. 5 provided readable thin sections. Of 22 ringed seal specimens with estimated seasons of death, 5%are identified as fall kills (a single specimen), 32% are winter kills and 63% are spring kills. Ages of death were estimated on 26 sectioned teeth. Twelve of these, or 46%, were identified as neonate or young of the year pups, 5 (or 19%) represent subadult individuals, and 9 (or 35%) are

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

adults. These adults and subadults were hunted in the winter and spring, while the pups were hunted in the spring and fall. On the basis of these estimates, ringed seal hunting during the earlier phase of occupation of House 7 (estimated to be between ca. 1740 and 1785) appears to have been strongly oriented toward spring season hunting of pups and basking adults on fast ice and subadults around the *sina*. Nevertheless, there is more evidence for hunting ringed seals in winter, both of adults at breathing holes and subadults at the *sina*, than in the other assemblages at Uivak Point 1. Ringed seals were actively hunted through the winter.

Season of death estimates were determined for a total of twelve harp seal teeth from A.U. 5. The great majority of these (83%) are from individuals killed in the fall, while only 17% were killed in the spring. In this assemblage, which represents the bulk of the total House 7 midden deposit and possibly a long period of deposition, the fall harp seal hunt appears to balance the scale of spring season ringed seal hunting.

Studies of Dog Mortality

One significant aspect of the communal house models is the possibility of occurrence of nutritional shortfalls (or lack thereof) among winter communities. Food stress is a surprisingly difficult phenomenon to address solely through the zooarchaeological record. Often the best evidence for food scarcity is found in human skeletal pathologies. In order to indirectly assess the nature of food stress at Uivak Point 1, epiphyseal fusion patterns and incremental growth structures of dogs from that site were studied. Dogs are the only traditional domestic animal used by the Inuit; their capacity for pulling sledges in winter made them an essential part of Inuit subsistence throughout the arctic until snowmobiles were available. Dogs were certainly an important part of the economy of the 18th century Labrador Inuit; diaries of the Moravian Missionaries in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Labrador describe big sleds pulled by teams of up to 28 dogs and dog remains are prominent in the faunal assemblages of Inuit sites, especially those of Uivak Point 1.

Despite the economic importance of sled dogs, it is likely that Inuit sled owners were much the same position as farmers and pastoralists elsewhere, having to manage the size, reproductive capacity and health of their dog teams by making judicious and unsentimental decisions about which animals to keep. Once a healthy team was established, only a limited number of pups would be needed to provide future replacements and a large proportion of pups might be destroyed. Intractable animals that could not be trained to obey or that were prone to fighting or stealing food might also be destroyed. Prime age animals, from about 2 to 6 years of age, comprise the majority of most teams and are typically the healthiest and strongest animals. Finally, injuries, occupation-related pathologies, especially osteoarthritis, infections and disease afflict many mature individuals six years old or older (Bellars 1969; Nain Resident 1998: personal communication). These animals are culled once their performance is impeded, or die of natural causes.

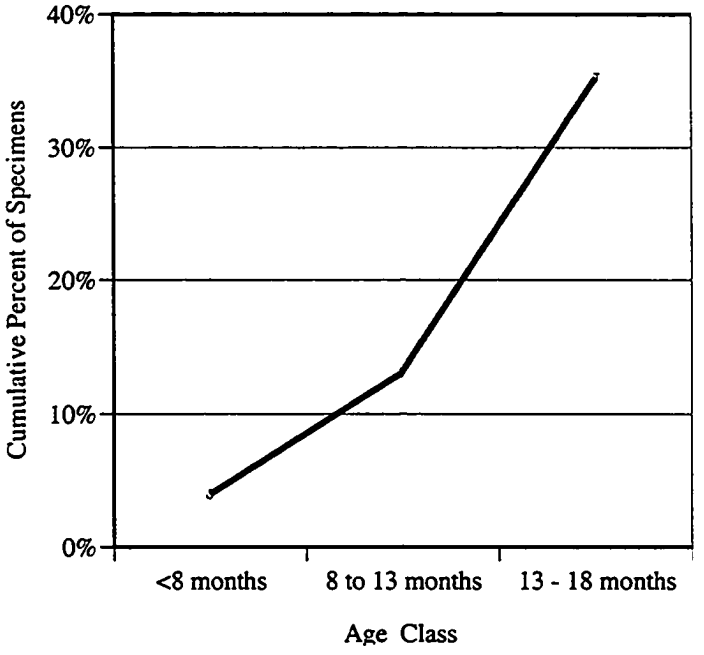
In conditions of adequate food supply, then, dog mortality patterns should reflect culling decisions to balance needs for pulling power with food demands and recruitment. A bimodal, attritional, mortality pattern may obtain. Pup mortality rates should be high and in proportion to the need for replacement dogs, while few prime age animals will be culled. Mortality would also be high for the older group of individuals, which are culled in increasing numbers at six years of age and older.

Dog teams have considerable food demands which, naturally, increase in proportion of the team. Much of the time, dogs are fed scraps or surplus which is not needed by people. In times of extreme shortfall however, dogs are competitors with people depending on cached resources and for alternative, back-up resources. Hungry dogs may break into food stores or consume animal skins used in clothing, lines or boat covers. In periods of food stress, or even of anticipated food shortfall (given the size of some of the Labrador dog teams described by the Moravians), dog team managers likely had to adopt a more drastic

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

culling pattern to maintain both food supplies and effective dog teams. This likely would involve more drastic culling of older individuals and, if acute shortfalls continue, progressive culling of pups and healthy, prime age animals. The mortality pattern produced by this practice would a catastrophic profile, reflecting culling of all age groups, and should be accompanied by sharp, episodic, fluctuations in overall proportions of dogs in faunal assemblages with decreased in density of deposition of primary food species. Evidence for consumption of dogs might also be present. Epidemic diseases, such as distemper might also cause catastrophic age profiles.

Figure 9.12 Age of Death of Dogs from House 7 and House 7 Midden Excavations based on Epiphyseal Fusion



An age of death profile for the Uivak Point 1 House 7 and House 7 Midden assemblages based epiphyseal fusion is graphed in Figure 9.12. Dogs grow quickly and most epiphyses in the skeletons fused by 18 months of age (Evans 1993; Habermehl 1961).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Epiphyseal fusion patterns are therefore not useful for aging the adult age class. Nevertheless, the analysis does show that pup mortality was high, approximately 35% of dog specimens analysed represent animals that died before they were fully-grown, at or before 18th months of age. Because of the reduced bone density of neonatal bones, it is likely that the remains of many very young pups were not preserved.

A more complete age of death profile for dogs from Uivak Point 1 is presented Table 9.53. These data are derived from counts of incremental growth structures in cementum of canine teeth. Of a total sample of 26 teeth drawn from the House 7 Midden and House 6 Midden, ages of death were estimated for a total of 18 specimens. Estimates of minimum age are used here is an 18 month possible range of attribution of the first complete pair of increments, due to the age of eruption of permanent dentition and the non-annual reproductive cycle of dogs. Thirty-five percent of these teeth had thin dentine deposits and lacked cementum deposits; these were all provisionally interpreted as being pups, although the cemental desposits of some may simply have weathered away. Notably, the epiphyseal fusion data also suggested that at least 35% of dogs died before 18 months of age. Only a small proportion of specimens came from individuals of at least two to five years of age. The majority of tooth specimens represented older adults of over five years of age, and none exceeded an estimate eight years of age. The age of death profile for Uivak Point 1, as characterized by this initial study, appear to be very much one of attritional mortality.

While no detailed mortality information for modern Labrador Inuit dog teams could be found, veterinary records of sled dog teams kept by the British Antarctic Survey (Bellars 1969, Bellars and Godsell 1969) and the Falkland Islands Antarctic Survey (Taylor 1957) provide useful comparisons for the Uivak Point data. These comparative data include age of death records of dogs periodically destroyed at B.A.S. bases at Stonington Island, Halley Bay and Graham Island. These dogs were killed over periods of years as excess pups, or due to injury, illness or old age; they represent the normal types of attritional deaths

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

associated with maintaining effective dog teams. Happily, these animals were descendants of Labrador Inuit sled dogs important to Antarctica by the BAS, and which were eventually bred with smaller cadres of huskies from Greenland (Bellars 1969). They were well cared-for animals with regular diets, veterinary care and isolated form disease; accordingly these data may be taken to represent "ideal" sled dog populations, in terms of longevity. Unfortunately, the report compilers note that they were unable to provide a complete record of pups born, or of pup mortality and accordingly, they under represented the number of pups in their research populations (Bellars 1969; Bellars and Godsell 1969).

Table 9.53 Age of Death Profile of Dogs in House 7, House 7 Midden and House 6 Midden Assemblages based on Cemental Annulations

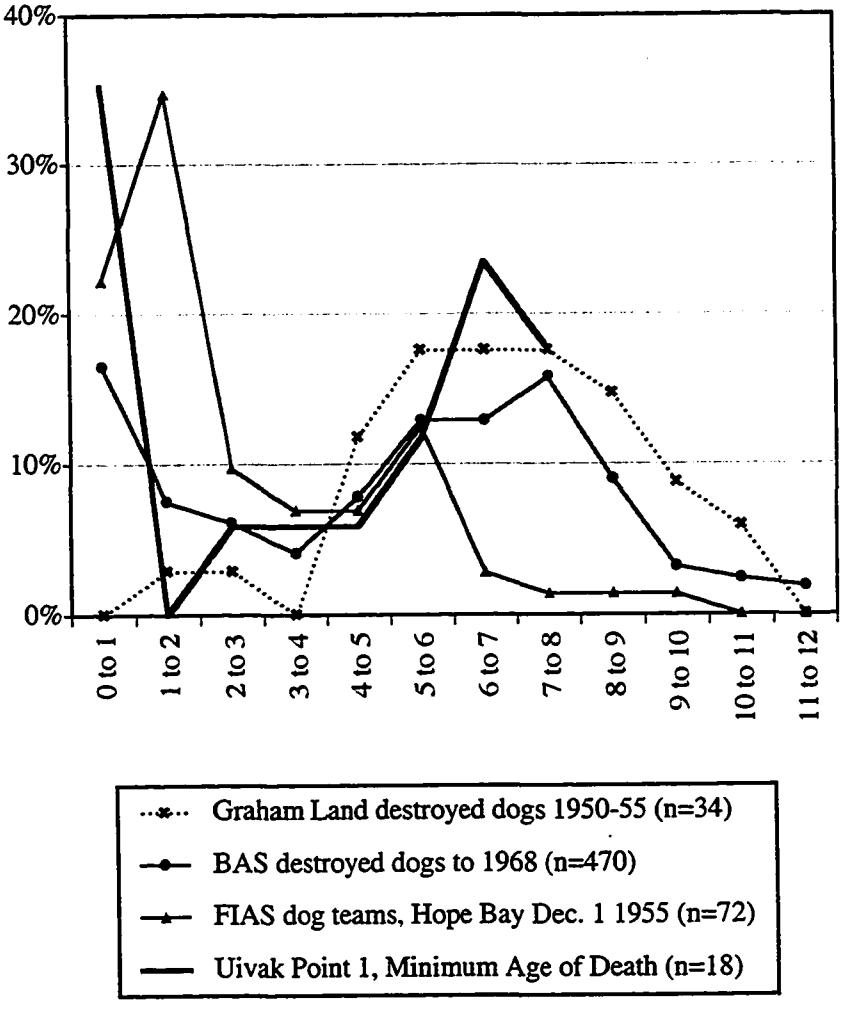
Age (yrs)	Frequency of Dogs' Canines in Minimum Estimated Age Group	% of Dogs in Category
0 to 1	6	35.3%
1 to 2	0	
2 to 3	1	5.9%
3 to 4	1	5.9%
4 to 5	1	5.9%
5 to 6	2	11.8%
6 to 7	4	23.5%
7 to 8	3	17.7%
8 to 9		
9 to 10		
10 to 11		
11 to 12		
Total:	18	

A demographic record of a complete, living, sled dog population is also available from a published veterinary survey of a large population of sled dogs at the FIAS based at

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hope Bay, Falkland Islands, on December 1 1957 (Taylor 1957). This survey provides a model of the age structure of living dog team and, hence, of a catastrophic death assemblage as well.

Figure 9.13 Comparisons of Age Profiles of Archaeological Dog Teams from Uivak Point and Modern Dog Teams



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The modern dog team demographic data are compared with that of the Uivak Point 1 sample in Figure 9.13. Of initial note are differences between the attritional assemblages of destroyed dogs from that of the live team census. The apparent extreme difference in frequency of pups is likely accentuated by the under-counting of this age class in the BAS veterinary records. Young prime age individuals are quite poorly represented in the attritional assemblages, as would be expected, and mortality rates rise quickly after five years of age. Even with veterinary care, few sled dogs survived beyond 8-9 years of age. The age profile of the living sled dog population can distinguished from those of the culled populations by higher proportions of young animals over two years of age and by very small numbers of animals over low representation of animals over seven years old.

The archaeological population does not entirely reflect either assemblage does, no doubt, to different aging methods and health of the original dog populations. The large proportion of pups resembles the age structure of the live dog team census, but this resemblance is inconclusive given the under-representation of this age class in the attritional death assemblages. More striking is the low representation of prime age animals and high proportion of individuals over 5 years of age. Mortality profile for Uivak Point 1 is clearly bimodal, with high mortality for pups and older individuals. The peak portion of the live dog team census age distribution, ca. 2 to 3 year of age, were very poorly represented in the archaeological sample. After about 5 years of age, the archaeological sample and live census populations tend to be out of phase with each other, the archaeological population (a death assemblage) increasing while the live population decreases. This pattern most closely resembles the attritional death assemblages. While this is a limited, preliminary analysis, it provides no evidence of the culling of large parts of effective dog teams in order to endure acute subsistence crises. On the contrary, this analysis suggests that dog mortality and culling patterns were governed by the everyday needs to maintain effective dog teams.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The Whale Bone Assemblage of Uivak Point

A number of whale bones, and fragments thereof, were identified in surveys and recovered in excavations at Uivak Point. The majority of these specimens came from excavations of House 7 and the House 7 midden. The elements from the house were incorporated into various parts of the house structure. Nevertheless, fragments were also identified in each of the other two midden excavations and others were observed in the boggy meadow between the modern shoreline and the sod house. The frequencies of fragments identified to species in the various excavations and observed as surface finds are presented in Table 9.54. A large number of relatively small whale bone fragments that could not be identified to element were also recovered. These specimens were mostly small, wedge-shaped splinters and shavings of cortical bone less than 10cm in length. Many bear impact or chop marks, and are, in all probability, debitage from bone-working activities.

The two most striking features of the whalebone assemblage are its small size and the element distribution. The combined assemblages include a total of 64 specimens that could be identified to element. Of these, over a third were fragments of skulls, maxillae/premaxillae and mandibles, with smaller proportions of vertebrae, ribs and limb bones. Few of these specimens were completely intact and most showed evidence of breakage, chopping or sawing, or dog chewing.

The whalebone assemblage is small in relation to the over size of the site assemblage, a situation which may be expected, given current understandings of behavioural and taphonomic factors that tend to limit the accumulation of whale bones on archaeological sites. Whale bones are typically reported in only small quantities in most Thule faunal assemblages and this deficit has long bedeviled attempts to assess the economic importance of Neoeskimo whale hunting (Rick 1980; Savelle and McCartney 1988: 26).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 9.54 Frequency Distributions of Whale Bones Recovered at Uivak Point 1

Element	House 6 Midden	TP 9/10/11	House 7	House 7 Midden	Uivak Locality	Total	% of Elements
Cranium		1	1	2	2	6	9.4%
Maxilla/Premaxilla			3	4		7	10.9%
Mandible			6	3		9	14.1%
Cervical Vertebra				1			
Thoracic Vertebra			2	1	1	4	6.3%
Thoracic Vertebra Fused			2				
Thoracic Vertebra Unfused					1		
Lumbar Vertebra			2	1		3	4.7%
Lumbar Vertebra Fused			1				
Lumbar Vertebra Unfused			1				
Caudal Vertebra Total				2		2	3.1%
Caudal Vertebra Fused				2			
Vertebra Fragment			3	4		7	10.9%
Pelvic Girdle				2		2	3.1%
Rib			5	6		11	17.2%
Humerus Total			1			1	1.6%
Humerus Unfused			1				
Radius/Ulna Total			2	1		3	4.7%
Radius/Ulna Fused			1				
Radius/Ulna Unfused			1	1			
Phalanges Total	1		1	2		4	6.3%
Phalanges Unfused	1		1	2			
Limb Bone Fragment	1					1	1.6%
Unidentified Small Fragment	49	50	39	264			
			Total of Identifiable Fragments:			64	

The potential causes of the apparent under-representation of whale bones are several. Whale are such large creatures that very few need to be caught in order to produce

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

substantial surpluses. Far fewer individual whale carcasses enter the archaeological record than those of smaller and more frequently captured species such as seals.

Selective transport represents a second important factor shaping whale bone assemblages. Once killed, bowhead whales had to be towed to shore with rowed skin boats. Their carcasses are very cumbersome and, accordingly, were sometimes taken to the nearest convenient shore for processing, rather than to settlements themselves (Taylor 1985: 127). Whales were also often flensed in shallow water in the intertidal zone and their meat, skin and blubber hauled ashore in large blocks (Savelle 1997: Taylor 1979, 1985). Other useful parts such as baleen sheets or bones might be retrieved (and returned to a settlement site) sometime after flensing and, accordingly, the remaining portions of the beached skeleton may remain in the intertidal zone and eventually be dispersed by waves or rafted ice. Finally, some carcass parts are far more useful than others as sources of food or a bone used as elements of houses and other structures. These multiple layers of transportation activities and selection choices influence the kinds of assemblages associated with particular kinds of sites.

The usefulness of certain whale bones as building materials is a great complication in interpreting the economic importance of whale hunting in Neoeskimo economies, as these bones might just as easily be collected stranded carcasses as from hunted whales. As well, the quantity of fat in whale bones provides an indication that older, weathered bones might have been preferable as building materials (Savelle 1997). Whalebone may have been recycled to build subsequent structures at Uivak Point 1, or to build houses at the neighbouring winter settlements of Kivalek and Okak. The Inuit settlement that grew up around the Moravian Mission post at Okak Harbour was occupied long after the abandonment of Uivak Point (Taylor and Taylor 1977: 61). Whalebone left in abandoned houses would have been useful resources for people building new houses at the Okak Mission, given the proximity of the two sites and that some of the Okak population may have lived previously at Uivak Point 1.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

In order to distinguish whale hunting from whale bone scavenging, Savelle (1997) developed a set of indices regarding economic uses of bowhead whale carcasses, which are presented in Table 9.55. The architectural utility index (termed "Combined Utility" in the table) is intended to approximate the usefulness of various elements as building materials. The index considers the bulk and shape of elements, with high index values attributed for dense, solid and substantial elements that are suitable as posts or braces in walls and other similar structures, and strong elongate elements that may be incorporated into frameworks, such as beams and rafters. The highest utility items, by this scale, are crania and most vertebrae, which are useful as braces, and maxillae, mandibles and ribs, most useful for frames. Of negligible architectural utility are small elements, such as the hyoid, sternum and phalanges. Mandibles were also widely accorded symbolic attributes that lent additional import to the architectural use of these elements (Rainey 1947: 261).

Savelle's Meat Utility Index (MUI) is a representation of the mass of edible meat, blubber and skin associated with individual skeletal portions (Savelle 1997: 872). The bowhead meat index was extrapolated from a parallel utility index devised for smaller toothed whales that have similar overall body compositions of fat, muscles, bone, and other tissues. It is a useful analytical tool until such time as a new utility index can be devised through dissection of a complete bowhead carcass. As illustrated in Table 9.50, the skeletal elements with the highest index values are those associated with the lumbar vertebra and tail, and the hyoid, which is part of the huge tongue. The elements of the thoracic region are of medium value, while the head, neck and flippers are associated with lesser masses of food. Savelle (1997: 873) noted that, in general, the architectural and meat utility indices were negatively correlated with each other, as high value architectural elements had lower meat utilities, and vice versa.

Savelle (1997: 873) also noted that his utility index generally reflects the pattern of apportioning body parts to historic era whale crews in the North Slope of Alaska, with high value thoracic, lumbar and tail sections reserved for feasts, for the captain (*umealik*) of the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

whale boat credited with the whale kill, and crew of that boat. Portions of lesser value were distributed to the crews of other boats involved in the kill. In north Alaska, the tail was of particular value for feasts held by the successful *umealik* (S. Kaplan 2002: personal communication), while tails were prized portions among 20th century Inuit whale hunters in Baffin Island (Stevenson 1997: xx). While it is unclear whether the pattern of butchery unit preference reported for North Alaska mirrors those of the Labrador Inuit, it appears, in general, to reflect the meat utility index.

An anomaly of the utility index might be the flipper portion, which has a low meat utility value but nevertheless was reported by Spencer (1954: 340, 346) to have been allocated as the "*umealik's* special share". Several writers report that the flipper was a choice portion among Inuit groups in various parts of the Arctic (Stevenson 1997: xx). Whorl (1980, cited in Savelle 1997: 873) also described the flippers as portions to be distributed to the oldest members of the whaling crew, an apparent gesture of respect due to elders. The low value (as defined in the utility index) of this particular portion, which includes little besides bone and flesh, may be due to its limited size in comparison to the huge whale abdomen, rather than inherent poor quality.

In Table 9.51, the frequencies of whale elements in the combined Uivak Point assemblages are applied to the utility indices in the form of Minimum Animal Units (MAU) counts. Cranial elements are very heavily represented in the MAU count, while vertebrae and limb elements appear to have been of secondary importance. The MAU count was difficult to obtain for some elements due to their fragmentation; cranial elements (including maxillae/premaxillae and mandibles) and ribs were especially fragmented. The maximum MAU for the various cranial elements was used as an estimate for the MAU count for the head, in order to compensate for the effects of fragmentation. Nevertheless, these elements are very large and readily recognizable, and therefore the MAU count likely over-represents the numbers of cranial elements.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 9.55 Whale Utility Indices and Element Frequency at Uivak Point 1 (Minimal Animal Units)

Anatomical Portion	Combined Architectural Utility*	%MUI Bowhead Whale*	MAU	%MAU
Head	9	18.9	4.5	100.0%
Cranium	9	3.8	4.5	100.0%
Maxillae/premaxillae	8	7.6	3.5	77.8%
Mandibles	9	7.6	4.5	100.0%
Hyoid	2	88.8		
Cervical Vertebrae	8	4.3	0.1	2.2%
Thoracic Vertebrae	6	49.2	0.3	6.7%
Lumbar Vertebrae	7	100	0.3	6.7%
Caudal Vertebrae	3	91.2	0.1	2.2%
Ribs	7	39.7	0.4	8.9%
Sternum	1	2.1		
Scapula	6	4.8		
Humerus	5	1.9	0.5	11.1%
Radius/ulna/phalanges	4	3.9	0.8	17.8%
Flipper	_	_	0.1	2.2%
Spearman's r correlations:				
Combined UI vs. %MAU:	r= 0.74 (p=0.0076)			
%MUI vs. %MAU:	r = -.0.174 (p=0.5315)			

*data from Savelle (1997)

The overall relationships between the utility indices and the MAU counts were evaluated with Spearman's *r* correlation tests. The combined architectural utility index had a reasonably strong positive relationship with %MAU counts (r=0.74, p=0.0076) while the meat utility index had a very weak negative correlation with %MAU (r=-0.174, p=0.5315). Whale element frequencies, as represented in MAU counts, therefore appear to reflect the deliberate selection of parts of carcasses most appropriate for whale carcass parts for building materials, more than for the food they carry. The immediate implications of these

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

correlations are that the assemblage of whale elements observed at Uivak Point could have been derived from the scavenging of beached carcasses for building materials as easily as from hunted animals. Some of the vertebral elements in particular represent large individuals that appear to be too large to be bowhead whales. The larger whale species that are common to Labrador, such as fin whales, are too large, active and fast to have been suitable prey for Inuit whalers using harpoons and open skin boats; the larger vertebrae would seem to represent bones scavenged from large stranded whale carcasses. Many of the elements considered here were, as well, recovered as *in situ* constituents of the house structure. Nevertheless, and laying aside the likelihood that the MAU counts of cranial elements used in this study are inflated, there are some additional zooarchaeological clues that whales were hunted from the site.

First, these assemblages were almost entirely collected from excavations in and around sod houses and thus we should anticipate the presence of elements used as building materials as well as positive correlations between MAU counts and the architectural utility index. Savelle (1997: 875; Savelle and McCartney 1990: 717) reported similar positive correlations between architectural utility and %MAU counts, driven primarily by high frequencies of cranial elements, in Thule sod houses from several sites in the Central Arctic. A wider field of survey concentrating on areas where whales might have been processed is probably required to locate a less ambiguous "hunted whale" assemblage.

As well, the whale element profile includes elements such as thoracic and lumbar vertebrae that are associated with relatively high meat utility values, as well as high architectural utility values. Other noteworthy specimens included caudal vertebrae, phalanges and vestigial pelvises, small elements that together comprised over 12% of the identified assemblage. Caudal vertebrae have minimal architectural utility but are part of the tail butchery unit, which is highly valued for its meat and often is considered a prize share elsewhere in the Arctic. Similarly, the phalanges have no value as building materials, but are parts of the flipper, which is a valued food portion. The vestigial pelvis is a small relic

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

element that is not attached to the axial skeleton. It is encased in the flesh of the abdomen and so is part of the lumbar region butchery unit. These elements are all "riders" on highly valued butchery units and are indicative of the use of whale carcasses for meat. As well, these elements were small enough to have been from individuals amenable to Inuit whale hunting techniques.

The presence of elements representing high MUI-value butchery units (but of low architectural utility) at the site supports an argument that choice butchery units were consumed at Uivak Point and were brought there from a processing area in another location. Alternatively, whole whale carcasses may have been processed in the immediate vicinity of Uivak Point. Similarly, butchery units such as the tail and flippers were, in the well-known ethnographic examples of north Alaskan whale hunting (Spencer 1954) often apportioned on the basis of prestige. These units were given to or claimed by respected senior hunters, to successful whaleboat crews, to harpooners, whale boat owners or captains, or which are reserved for feasts. Assuming that similar sharing rules obtained for the Labrador Inuit, the presence of these elements in the assemblages associated with House 7 suggests that whale hunting was practiced by the inhabitants of House 7 and that one or more successful whaling leaders and boat crews appear to have resided there.

A third line of archaeological evidence for the practice of whaling lies in the age structure of the whale assemblage. Ethnographic and historical accounts suggest that Inuit bowhead whaling efforts were focused in whole or in part on small calves, yearlings and immature whales that were easier to hunt and recover (Savelle and McCartney 1990; Taylor 1979). Savelle and McCartney (1990, 1994) provided ample osteometrical archaeological evidence that Thule whale hunting in the Central Arctic was also focused almost entirely on young individuals.

While most of the pertinent whale elements at Uivak Point 1 were too fragmented to conduct osteometrics, preliminary indications of age structure may be drawn from epiphyseal fusion data presented in Table 9.54. The majority of the large vertebrae

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

observed at Uivak Point had fused epiphyses and thus represent adult individuals. It is most likely that these specimens represent elements collected from the stranded carcasses of large, adult whales for use as building materials. The clear majority of limb elements, however, which are constituents of the flipper, lacked fused epiphyses. The pattern of fusion of these elements, which are among those most likely to be representative of hunted whales, is consistent with selective hunting of immature individuals.

A final, but very important, line of evidence for Inuit whale hunting at Uivak Point 1 comes from J. Garth Taylor's ethnohistorical analysis of 18th century Labrador Inuit subsistence. Taylor (1974, 1988) reviewed Moravian Missionaries' descriptions of whale hunting activities and compiled a record of all the whales known by the Moravians to have been hunted, landed or scavenged by Inuit between Killinek and Hopedale, from 1771 to 1784. Taylor noted that all of the hunted whales were captured between July and December, while the majority of whales were landed in November (Taylor 1988: 125). He also concluded that these whales were bowhead whales, on the basis of their size and their presence on the Labrador coast in late autumn (Taylor 1988: 126).

Table 9.56 Whales Captured and Landed by Inuit in the Okak Bay Region 1771-1790 (data from Taylor 1974: Table 10; 1988: Table 1).

Year	Number
1774	1
1775	1
1778	3
1779	2
1781	1
1784	2
1790	2

Taylor (1988: 124) documented a total of 63 whales landed by Inuit in the Hebron, Nachvak, Saglek, Okak and Hopedale regions between 1771 and 1784, an average of 4.5

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

landings per year (see Table 9.56). The majority of these (49 whales) were captured in the regions north of Okak Bay, where Taylor concludes whale hunting was a regular fall practice. A summary of the whales landed in the Okak Bay region from 1771 to 1790 is presented in Table 9.56 using data from Taylor (1974: Table 10; 1988: Table 1).

In the 19-year span covered by Taylor's data, a total of at least 12 whales were landed in the Okak Bay region, an average of one whale per 1.6 years, though whales were only landed in an average of 37% of years (one year in 2.7 years). Whale hunting seems to have been a highly risky activity in Okak Bay. Whale hunting crews from all of the three major winter settlements in northern Okak Bay (Okak, Kivalek and Uivak Point 1) cooperated in capturing and landing these animals. Several of whales were captured near Uivak Point 1, and Taylor reports occasions when whales were towed to Uivak Point 1 to be butchered (1974: 33, 88). Nevertheless, people from Uivak Point were also able to share in the meat, fat and baleen of whales butchered at the other winter settlements of the region, though conflicts were known to arise over the distribution of shares (Taylor 1974: 89).

Taylor (1988: 128) reported that a further 7 dead, stranded whales were scavenged in the Okak region between 1771 and 1784, while 12 whales were scavenged in the Nain region and one was salvaged in Napartok Bay, which border Okak Bay to the north and south. The average rate of recovery of stranded whales for these regions combined was 1.05 whales per year. While not all of these were bowheads, most yielded baleen and several were fresh enough to have provided meat and skin for dog food and blubber for lamps as well as for food on occasion (Taylor 1988: Table 2).

The ethnohistorical data provided by Taylor appears to provide a stronger argument than the zooarchaeological data for the importance of whale hunting at Uivak Point and in the Okak Bay region. It shows that whales were indeed regularly hunted in the later 18th century in all regions of northern Labrador except the Nain region, and were captured with great regularity and frequency in northernmost Labrador. In Okak Bay, whales were hunted successfully during the years in which House 7 at Uivak Point was occupied although, with

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

successful landings one year in 2.7 years, whale hunting seems to have been too unpredictable to have been a source staple subsistence resources in every year. The much more reliable whale hunt of the Hebron region might have allowed Okak Bay people to travel north to partake in more regular winter feasts, however. While each landed whale certainly provided a tremendous quantity of valued food, the motivation for pursuing high-risk whale hunting in Okak Bay may have been the trade goods (baleen and oil) provided by a whale carcass, as much as the food itself. When the number of stranded whales salvaged in the Okak and Nain regions are also considered, just over one per year on average (Taylor 1988: Table 2), it is clear that whales could have provided a regular supply of trade goods.

Summary of Uivak Point 1 Faunal Analyses

Collectively, the faunal assemblages from Uivak Point 1 that were analysed in this study comprised over 95,500 total specimens from ten different, well-dated contexts including multiple contemporaneous middens, stratigraphically linked midden layers and a house floor. These assemblages provide an excellent database to support a detailed faunal analysis, as sample sizes of most individual collections were very large, even when subdivided into stratigraphically defined sub-assemblages. Multiple middens, a house floor linked with a midden and large proportions of a midden were sampled, increasing the likelihood of sampling a range of different activity areas, households and time periods within the period of the middle18th century to 1807. Furthermore, bones in these assemblages were, in general, well preserved and all collections were recovered with complete sieving strategies. In sharing this set of characteristics, the Uivak Point 1 faunal assemblages are a unique resource in Labrador archaeology.

All of the Uivak Point assemblages showed substantial similarities in species representation and taxonomic abundance, suggesting corresponding similarities in the underlying subsistence economies. In general, greater species diversity was noted in these

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

assemblages, in comparison to those of Oakes Bay 1 and Hamilton Inlet, though the range of fur-bearers noted at Uivak Point 1 was not so broad as that demonstrated in the Hamilton Inlet sites. More remains of birds, fish and different species of sea mammals were recovered than in the other sites involved in this study. Part of this greater apparent diversity likely results from the effective combination of preservation, stringent recovery methods, sample size and diversity of sample characteristic of the Uivak Point 1 collection. Nevertheless, the subsistence opportunities offered by the rich and diverse marine and terrestrial biological communities of the Okak Bay region and the inner coast are also likely reflected in the diversity of the faunal assemblages.

The most frequently represented animals in the faunal assemblages were, by far, seals, and a fuller range of seal species was represented in the Uivak Point assemblages than in the Oakes Bay 1 and Hamilton Inlet assemblages. Ringed seals were the most commonly represented species in all assemblages, usually representing about half or more of the identified seal remains. Seasonality studies indicate that, in most assemblages, between 14% and 32% of ringed seals were hunted in the winter, while the spring hunt accounted for between 63% and 100% of ringed seals. Approximately equal proportions of adult and subadult ringed seals were hunted, while pups usually represented half or more of the seal assemblage. This suggests that Inuit at Uivak practiced a diversified pattern of ringed sea hunting, taking ringed seals in appropriate habitats from fall to spring. The bulk of ringed seal hunting was oriented around taking pups and basking adults and subadults on fast ice in the spring. Nevertheless, adults were also hunted at breathing holes in fast ice through the winter, and subadults were likely hunted at the *sina* in all seasons.

Harp seals were also quite common, comprising between about 20% and 45% (and usually about 30%) of the seal assemblages. Most harp seals were hunted in the fall, though harps were also hunted during their spring migration. Given the limited duration of the fall harp seal migration, the fall hunt appears to have been an intensive and usually a very productive enterprise. Bearded seals were represented inconsistently, between 2% and 15%

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of identified seals when present, but were most frequent in the largest assemblages from the House 7 midden. The relative commonness of these very large animals suggests that they were a more important economic resource at Uivak Point than at the other sites. A small number of bearded seal tooth section suggest that they were hunted for the most part during the spring, at the *sina* or while basking nearby. Harbour seals also usually represented about 10% or less of identified seal bone assemblages and were generally less common than bearded seals. Tooth sections also indicated that these animals were hunted in the spring, though it seems reasonable that some might also have been in the fall prior to freeze-up. In addition to seals, zooarchaeology provided some evidence for the hunting of walrus, likely in the spring.

The sheer proportion of seal bones in the archaeological assemblages suggests that seals were taken in considerable numbers. The seasonality studies demonstrated that seal hunting activities continued from fall to spring, as hunters exploited all local species when and where they were available. More than one species or age group of seals was available in each season. The rush of intensive harp seal hunting in the fall, with perhaps some harbour seals hunted as well, likely produced a surplus of food and other resources that were used immediately or cached. Breathing hole hunting augmented stored harp seals with a slow but apparently steady supply of adult ringed seals through the winter, with perhaps some subadult ringed seals and bearded seals from the sina. The spring was a second season of very active seal hunting, beginning with basking ringed seals and, at the *sina*, bearded seals and other species and continuing with harp seals and harbour seals as the ice broke up.

Conspicuously, consistent patterns of sea mammal species abundance and seasonality is demonstrated by comparisons of the House 7 floor assemblage and of A.U. 2, A.U. 3 and A.U. 5 in the House 7 midden. These are the most well dated assemblages at Uivak Point 1, representing the earliest 19th century (H7 A.U. 2, H7M A.U. 2), 1785 to 1807 (H7M A.U. 3) and about 1745 to 1785 (H7M A.U. 5) respectively. These assemblages have very similar seal species NISP counts, almost identical ratios of ringed

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

seal to harp seal DD counts, and season and age of death profiles. All these assemblages have seal faunas that are suggestive of effective hunting of all local species in their seasons of abundance. The faunas of A.U. 3 and A.U. 5 in the House 7 midden are particularly similar.

Judging by the various proxy records of sea ice conditions discussed earlier in this chapter, the time spans represented by these assemblages were dominated by moderated ice conditions. Just as this moderating trend saw a diversification of local ice conditions in Hamilton Inlet and a broadened pattern of seal hunting, it is reasonable to conclude that the broad and apparently prosperous seal hunting economy suggested at Uivak Point is also related to a consistent and mixed local sea ice environment. For the Uivak Point/Okak Bay region, this "mixed" sea ice environment would have included a long fall open water season, or at least no trend to very early ice formation. There would likely have been, as well, ample areas of stable fast ice in sheltered bays and coasts adequate for ringed seal denning and human travel. The location of the *sina* would have been within reasonable reach of the coast, and a mix of loose pack ice and formation of flaw lead polynyas associated with westerly winds, may have prevailed at the *sina*. Rattles too might develop, though there are presently rather few rattles in the northern Okak Bay region. The variety and balance of such a sea ice regime would lend itself to a diversification of sea mammal faunas and a range of economic options from fall to spring.

The only notable variations between the assemblages compared above involve a decrease in the frequency of bearded seals and an accompanying increase in the frequency of harbour seals in the House 7 floor and House 7 midden A.U. 2 assemblages, relative to the other earlier assemblages. The House 7 floor and House 7 midden assemblages were dated to after 1785, up to about 1807, and more likely tending to the latter half of this range. These were years that, according to the ice records illustrated in Figure 9.4, had light ice conditions, with some of lightest ice conditions noted after AD 1000 in the PIC sea salt sodium record. In this context, the decrease in the bearded seal catch and increased harbour

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

seal catch may suggest a more frequent presence of a flaw lead polynya at the *sina* in the spring.

The faunal analysis provided some evidence for whale hunting in the late 18th century to the opening of the 19th century, in the presence of skeletal elements that are associated with whole carcasses or meat packages but that were not useful as building materials. Some of these elements were associated with prize whale portions that are conventionally considered the shares of the whaling captain or other senior elders in other parts of the Arctic. There was also ample evidence for the use of whale bone for building materials, and for use of bones scavenged from very large baleen whales.

The best evidence for Labrador Inuit whale hunting remains that provided by ethnohistorical sources, especially those reviewed by Taylor (1974, 1988). According to Taylor, bowheads were pursued in the fall by hunters from Uivak Point, in cooperation with hunters at neighbouring settlements, though not with a great probability of success in individual years. These whales were prized for their baleen, meat, skin and fat; the baleen was used in trade, the fat provided food, fuel and perhaps tradable oil, and the meat and skin were used for food. In some years, the inhabitants of Uivak Point hosted guests from other settlements for feasts held after their whaling crews had successful hunts. In other years, the inhabitants of Uivak Point were themselves guests as feasts held in the settlements of other successful whale hunting crews. During the late 18th century, more dead stranded whales were scavenged per year in the Okak and Nain regions than were hunted, suggesting that, in those areas, the most regularly available whale products were those useful for trade, fuel and raw material, rather than food products. It seems likely that, in regions with only moderate whale hunting success, it was the importance of fuel and the trading economy that provided the incentive for expending labour, time and resources on risky whale hunts.

An ample stored surplus of seal meat, such as the fall-hunted harp seals identified in the Uivak Point archaeological assemblages, would likely have been a necessary precondition of planned whale hunting. Food and skins would have been needed for boat

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

crews, their families and their boats while they prepared themselves and actively pursued whales to the exclusion of other hunting activities. The fall harp seal hunt was the only opportunity to obtain such a surplus at the sod house sites, as people generally moved to them only in the fall, shortly before the short whale hunting season. With low demonstrated success rates for whale hunting, a secured food store or predictable food supply lasting into the winter, independent of whale meat, would have been necessary in most years to supply the boat crews, their families and dogs until winter hunting could begin in earnest.

After the seals and other sea mammals, the more prominent secondary taxa were fish, birds, blue mussels, caribou, foxes and dogs. Fish were present in small quantities in all contexts everywhere except in the House 6 midden; both salmonids and gadids were represented. Birds too were represented in small quantities. The small numbers of fish and birds may be the result of attritional processes rather than underutilization.

Mussels contributed a great quantity of shell and periostracum fragments to most assemblages, and were the most frequently represented taxon in terms of simple numbers of fragments in the House 6 midden A.U. 1 and House 7 midden A.U. 3/4 and A.U. 5 assemblages, the three largest assemblages of the site. When only hinges were counted however, mussels were of much less importance and, considering their frequency and small meat weight, appear to have been a secondary species in almost all cases. Mussels were a statistically important part of the NISP count of only one context, the House 6.midden A.U. 1 assemblage, which included a fairly dense shell deposit. Nevertheless, even this example can be accounted for by large scale shellfish collecting for limited periods of time, rather than long term reliance on this secondary species.

Foxes and dogs were relatively common secondary species; dogs were more common and comprised between 1.4% and 11.6% of total assemblage NISP. Neither of these species were likely consumed regularly for food, except in conditions of hardship. Foxes were killed as pests and for their fur, while dogs were used for traction, hunting, and their fur was useful as well. It is likely that the presence of these species in the assemblages

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

is primarily due to these non-nutritional factors. Because fox furs were desired by traders, foxes may have gained additional economic importance by the late 18th century. Despite this, the numbers of fox bones seems too low to make a strong case for a trapping industry at that time, especially given the usefulness of fox pelts in traditional material culture. Further research and intersite comparisons are needed to resolve this question.

Despite being used primarily as a traction animal, dogs were present in the Uivak Point assemblages in greater numbers than many species taken regularly for food. The significant number of dog specimens suggests that the inhabitants of Uivak Point 1 did keep large dog teams, as argued by Taylor (1974), and that large numbers of dogs died at the site, contributing their skeletons to the midden. Epiphyseal fusion patterns and counts of cemental annulations indicate a bimodal mortality pattern for the dog populations, dominated by animals less than 2 years of age and those over 6 years of age.

Through comparisons with mortality profiles and census data from modern sled dog populations, it is evident that the Uivak Point dog mortality profile is most similar to an attritional death profile resulting from culling of excess pups and aging, injured or infirm individuals while sparing prime age dogs. Accordingly, the substantial Uivak Point dog assemblage appears to reflect the regular maintenance of an effective dog team rather than catastrophic mortality resulting from disease or radical dog team culling in the face of severe nutritional shortfalls.

Only small numbers of caribou specimens were identified in each of the Uivak Point 1 assemblages. The paucity of caribou remains is somewhat surprising given the presence of these animals in the Okak region, which were found in coastal areas through the winter in the late 20th century, and the long-standing importance of their meat and hides in the Inuit economy. Both Kaplan (1983: 380) and Richling (1993) have argued that caribou herds were one of the diverse subsistence resources that drew Inuit settlement into the inner island regions in the 18th century, and both anticipated that caribou would have been an important part of a broadened subsistence economy in the inner island region.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The small numbers of caribou specimens present in the Uivak Point 1 assemblages, as well as those of Oakes Bay 1 and the Hamilton Inlet sites, suggests, however, that caribou were of minor economic importance or, more likely, that the pattern of their use and preservation was complex. In general, weak but positive correlations were demonstrated between archaeological caribou element frequency and the Food Utility Index, suggesting that the caribou assemblages were shaped by selective transport of high-value elements.

The available evidence for defining the fashion of caribou hunting is, as yet, equivocal. In some assemblages, caribou appear to have been hunted elsewhere and only selected portions were returned with food packages to the residence site. The strength of the caribou %MAU and FUI correlations were ambiguous enough, however, to allow for the possibility that caribou might also have been hunted locally on occasion, as in House 7 midden AU5, for example. Caribou bones are somewhat more vulnerable to attritional effects than seal bones, especially through marrow and grease processing and dog chewing. Nevertheless, correlations between caribou element frequency and bone density were generally weaker than those with the Food Utility Index, and sometimes weak negative correlations were obtained, lending little support for the contention that this is simply a preservation issue.

If caribou were present around the coast in winter, one might expect the assemblages to reflect "bulk" strategies, with more complete patterns of carcass use and element representation. In this situation, caribou would have been available locally and dog sleds could have been used to transport whole or nearly whole carcasses to residence sites. The lack of such a "bulk" pattern of element representation in most assemblages suggests that caribou were not frequently hunted locally.

Caribou might then have been hunted around the coast in the summer or fall, cached and then retrieved in the winter. Caribou might also have been hunted in special trips taken deep into the interior in the fall and winter, with some skeletal elements brought to Uivak Point 1 as riders on limited numbers of dressed-out carcasses, along with hides need for

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

winter clothing. Inuit undertook such trips in the 18th century as well as in recent years (Brice-Bennett 1977; Taylor 1969; Williamson 1997). Some caribou elements may also have been brought to sod house settlements in the fall when Inuit moved to occupy their sod house settlements in time for the harp seal and whale hunting season. All of these latter scenarios would have resulted in the sort of "gourmet" caribou element distributions.

The real economic importance of caribou in terms of food, and certainly in terms of hides, was likely greater than directly indicated by the simple numbers of caribou bone specimens. It is also possible that Labrador caribou herds were experiencing one of their periodic population crashes in the later 18th century and so were unavailable to the residents of Uivak Point 1 except through extended trips into the interior.

Considered as a whole, the faunal assemblages of Uivak Point 1 are indicative of subsistence economies with flexibility and a relative degree of security. A wide range of species were available and exploited, though the bulk of hunting efforts appear to have been directed at the most useful and plentiful species, especially the seals. Secondary resources such as mussels, fish, birds and terrestrial mammals were also used but in supplementation rather than in replacement of primary resources, suggesting that preferred prey species were sufficient for subsistence requirements. Moderated sea ice conditions, and general climatic conditions as well, appear to be contributing factors to this economic security.

As demonstrated by seasonality studies, the residents of the site were able to maintain subsistence production consistently from fall until spring. In each season, Inuit were able to exploit the most plentiful, profitable and readily available species. The fall and spring were the most productive seal hunting seasons, but ringed seals were also hunted on the fast ice and at the ice edge throughout the winter. It appears that the residents of Uivak Point 1 were also able to accumulate food surpluses in the fall and probably in the spring as well. The fall harp seal hunt was a consistently important activity at the site, and would have provided food for supplementing the winter's diet. Subsistence in the spring was secured by exploiting pulses of different seal species that become available as the ice broke up.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Additional evidence of economic security comes from the attritional mortality pattern of sled dogs, consistent with the regular culling of surplus and aging individuals rather than catastrophic culling in times of stress.

Archaeological data from Uivak Point 1 provided some material evidence to supplement ethnohistorical evidence for whale hunting by the inhabitants of the site. Neither of these lines of evidence suggest that whale hunting at Uivak Point 1 or in the Okak Bay region was successful enough to be a dependable activity every year. Nevertheless, successful hunts provided great surpluses of food, fuel and trade goods in the Okak Bay region on average one in every 2.7 years in the late 18th century. People living at Uivak Point 1 would have shared in these resources even when their own crews were not themselves successful. Stranded whales were available more frequently than hunted whales, greatly increasing the pool of trade goods and fuel. Thus, whales provided a more regular supply of raw materials and trade goods than foodstuffs and, in most years, it was these material goods that were circulating in sharing and exchange networks.

The employment of a broad range of hunting methods, by Inuit living at Uivak Point, may be inferred from the zooarchaeological species abundance, age and season of death data. The smaller terrestrial animals, birds, fish and certainly mussels and berries identified in zooarchaeological and archaeobotanical studies were all resources readily amenable to hunting or collection by individuals working alone, male or female. Individualized hunting methods were also likely used to hunt ringed seals at winter breathing holes on fast ice and would also have been practical for hunting basking seals in spring (Taylor 1974: 44-46), although group efforts often improved the effectiveness of these hunting methods.

Taylor (1974) also noted that many other subsistence activities were likely conducted with cooperative efforts. Hunting trips requiring much travel by dog team or kayak likely involved small cooperative groups for safety and mutual aid. Ice edge hunting involving kayak also benefits from cooperation. In more recent years in Labrador,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

elder/junior pairs of hunters shared the responsibilities of tending dog teams, handling kayaks, hunting and processing carcasses in ice edge hunting, and often pairs of such groups might join together (Nain Resident 1997: personal communication). The effectiveness of open water hunting with kayaks when gregarious species, such harp seals, or particularly large or dangerous animals, belugas or walrus, were pursued (Taylor 1974: 46-47). Similarly, *umiak* crews of about a dozen people were needed to hunt whales (Taylor 1974: 43). Polar bears were also hunted by groups of hunters. Finally, cooperative drive hunting and ambush techniques were used to hunt herds of caribou (Taylor 1969; 1974: 48).

Summary of Archaeobotanical Analyses of Uivak Point 1 Samples

Cynthia Zutter conducted an analysis of plant macrofossils including leaves, stems, seeds and other vegetative matter recovered from sediment samples collected in House 7, the House 7 midden and an off-site control sampling site. She identified the species represented by these macrofossils and presented her results in a report (Zutter n.d.), which is partially summarized here.

Preservation conditions for plant remains proved to be excellent in the excavated contexts at Uivak Point 1. A total of over 15,500 macrofossils were counted and identified in 44 one-litre soil samples of about one litre each. These samples were drawn from a sampling column in the House 7 midden, another in a boggy meadow just north of House 7 and from multiple sampling sites in the floor, entrance passage and sleeping platform of House 7. Complete information regarding sample location are presented in Zutter (n.d.).

The off-site sample reflects current local tundra vegetation. The sample contains the seeds of blueberry, crowberry and bearberry, the leaves, stems and catkins of woody plants such as dwarf birch, weedy apophytes, sedges and moss.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Floor samples, in contrast, included concentrations of woody plants, very common crowberry, blue berry and bearberry seeds, and seeds of weedy plant species that grow in disturbed contexts. While the latter may be colonist species that invaded the abandoned house floor, the berry seeds were likely food waste, lost or discarded on the house floor. The volume of berry seeds in the floor deposits is substantial; berry seeds comprised up to 50% or more of macrofossils in these samples.

The samples from sleeping platform areas were composed in large part of the remains of conifer stems and needles and birch leaves and catkins. The concentration of these materials in sleeping and sitting areas is very likely due to the use of boughs and brush as bedding material. These boughs may have some from outside the immediate locality of the site as conifers were missing from the off-site control sample. Berry seeds were also common in some platform samples. Finally, human fecal matter was also found in association with the platform. In particular, a coprolite was recovered from a deposit of spruce and juniper boughs in unit 5S/6E, located in the south end of the house. This coprolite, human in origin, consisted of a total of 10,100 crowberry and blueberry seeds, representing an approximate total of 1222 individual berries along with probable animal fat residues. Zutter (n. d.) notes ethnohistorical descriptions of Inuit mixing berries and animal fat to make a storable foodstuff and it is reasonable to conclude that this coprolite is the residuum of a meal composed of just such a food.

The samples from the entrance passage resembled those of the floor, having numerous weedy plant seeds, berry seeds and parts of edible plants, as well as many conifer needles and twigs. Much of this material may have collected accidentally in sediment trap provided by the depressed passage floor, though boughs may have helped insulate this area of the house as well.

Macrofossils in the midden samples were mostly represented by berry seeds (about 80% of macrofossils), with the remaining macrofossils being conifers and seeds of apophytic weed species. Concentrations of as many as 100 to over 600 berry seeds per litre

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

were identified in midden deposits. This quantity of berry seeds is reminiscent of the coprolite sample and strongly suggests that the berry seeds were contributed to the midden as part of disposed human waste; indeed the midden sediment likely consists of considerable quantities of decayed fecal matter. The conifer specimens are most likely discarded bedding materials removed from the house during occasional cleaning episodes. The weedy species are probably plants that colonized the continually disturbed and fertile midden surface.

For the purposes of this dissertation, the most important aspects of the archaeobotanical study are that it makes a provocative and important statement about the importance of plant resources in Labrador Inuit subsistence and material life. While the importance of wood as a raw material for house building and artifact construction has long been apparent, this archaeobotanical study demonstrates the use of particular species for dressing and insulating the house interior. More importantly, the study demonstrates that plant foods, specifically berries, were an important food stuff, and that traces of berries, lost, discarded or digested, permeate the house and surrounding activity areas. The density of berries apparent in human wastes and in contexts where these wastes accumulate, such as the midden, provide strong evidence that berries were consumed in considerable quantities and that they were an important dietary element. Because berries are storable, surplus fall berry crops might well have been collected for use in winter. In this case, berry collecting would have been an integral part of the subsistence security of winter settlements. The uses of berries for food and other plant materials to prepare house interiors are, in general, poorly documented in ethnohistorical and ethnohistorical sources concerning the Labrador Inuit. Until now, they have remained almost entirely unconsidered in the archaeological literature of Labrador as well. Similarly, the plant food and plant raw materials provide an indication of the economic importance of gathering in the Labrador Inuit economy, and of the valuable contributions made by those who may not be directly or primarily involved in hunting.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Summary of Palaeoentomological Analyses of Uivak Point 1 Samples

At the time of writing, an analysis of insect remains in sediment samples from House 7, from the House 7 midden excavation and from an off-site location at Uivak Point 1, by Allison Bain was underway. Initial results of this study have been presented in an interim report, which is summarised below (Bain n.d.).

Bain reported excellent preservation of insect remains, with over 1400 individual beetles recovered in seventeen samples of two or four litre samples. From the floor of House 7, Bain identified several different groups of beetle species that are indicative of particular environments. Moist leaf little lying on the floor of the house, likely brush used as floor coverings, was indicated by numbers of Staphylinid rove beetles, the most commonly represented beetle taxon in the house. Similarly, the presence of the species *Stereocerus haematopus,* a ground beetle that lives in dry tundra environments with crowberry vegetation, may indicate the additional use of crowberry brush to prepare the floor. Arctic-adapted water scavenger beetles (*Helophorus arcticus*) and moss-feeding beetles (*Simplocaria metallica*) also indicate the placement of moss onto the house floor or wet conditions within the house. Cut or broken conifer wood in the house was suggested by the presence of specialist bark beetles (*Polygraphus rufipennis*). Finally, northern adapted dung beetles (and carrion beetles (*Aphodius borealis, Catops sp., Thanatophilus lapponicus)* were also identified in samples from the house floor, suggesting the presence of caribou dung or human feces and decaying animal tissue in the floor deposit.

Staphylinid rove beetles were also very common in a sample from the sleeping platform, along with some bark beetles and water scavenger beetles. These species were likely associated with quantities of moss, spruce needles, twigs and boughs identified on the sleeping platform surface. As well, the presence of feces on the sleeping platform was again demonstrated by dung beetles (including *Aphodius borealis)* in the sample.

The entrance passage area included many Staphylinid rove beetles indicative of moist leaf litter and bark beetles that forage on conifers. Much wood was present in the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

entrance passage excavation and in A.U. 2 in the adjacent midden, while twigs and spruce needles were identified in the entrance passage floor deposit, providing ample habitat for bark beetles. Dung beetles (including *Catops* and *A. borealis)* were also present in the entrance passage floor deposit, suggesting the present of feces there.

As might be expected, the insect assemblage of a sample from the House 7 midden included numbers of dung beetles, as well as rove beetles, water scavengers and *S. haematopus*, linked respectively with feces, wet leaf litter, moss and *Empetrum.* While dung beetles would have been living in the midden, some of the other species may have been introduced to the midden with the occasional cleaning of vegetation used to prepare living surfaces in the house.

This preliminary palaeoentomological analysis indicates that House 7 was a suitable environment for a range of niche-specific beetle species. Many of these species were living on grass, moss or brush that was brought into the house to prepare living surfaces. Some others foraged on this vegetative material as it decayed, or on the wood incorporated into the house construction itself. The presence of specialist foragers of the bark and wood of white pine and spruce indicate the use of these tree species in the house construction. Dung beetles and carrion beetles found in household deposits provide additional proof that refuses accumulated in portions of the house interior, if not all of it. Occasional cleaning episodes may have added some of this refuse, and the insect fauna to the midden. Away from the site, a much different beetle fauna was found, including those that live in leaf litter and moss, and insectivorous beetles. This difference in beetle faunas illustrates the anthropogenic development of specialized microenvironments in and around human habitations, nourished by the introduction and concentration of building materials, plant matter and the fertilizers of carrion refuse and human waste. In demonstrating the presence of dung, carrion, boughs and brush, and mosses within the house and midden, the palaeoentomological study reinforces the observations of the archaeobotanical study discussed above.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Chapter Summary

In this chapter, a range of data detailing the palaeoenvironmental contexts of Neoeskimo culture change in Labrador and the subsistence economies associated with those changes was presented. Several reconstructions of palaeoclimatic changes and sea ice conditions pertinent to Labrador through the last 400 years were reviewed. Then, the results of faunal analyses of several archaeological sites dating within this period were presented, and their significance for Inuit subsistence practices was discussed. In addition, studies of ecofact data from one of these sites were summarised.

A diverse set of palaeoclimatic reconstructions was used to define the nature of climatic trends in the North Atlantic and Arctic regions during the LIA. Most significant for this study, several different lines of evidence showed that the general cooling associated with the LIA was interrupted by a significant warming trend that began by the early 18th century and that persisted as late as the early 19th century. Records of historical sea ice suggest that indicate that sea ice conditions in the Labrador Sea also moderated during this period.

Zooarchaeological analyses of several sites in Hamilton Inlet, and from the sites of Oakes Bay 1 and Uivak Point 1 demonstrated the employment of broadly similar maritime-oriented economies through time by Inuit in Labrador. Nevertheless, significant economic differences were noted in these assemblages, revolving around seal hunting practices, use of terrestrial species and involvement in whale hunting. These analyses also served to demonstrate a degree of resiliency and success for Inuit subsistence during the18th century, especially in their capacity to generate seasonal resource surpluses. Archaeobotanical and palaeoentomological analyses complimented the zooarchaeological subsistence study by illustrating the substantial scale of use of plant foods and raw materials.

The different sets of data laid out in this chapter provide means for answering key questions regarding the environmental context and economic function of the communal

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

house in Labrador. These questions were posed in Chapter 2, and will be revisited in the following, and concluding, chapter, using the data presented here as lines of argument.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER 10

CONCLUSION

This dissertation is intended as a multidisciplinary examination of Labrador Inuit subsistence economy from the 17th to the 19th century, and of the roles of environmental and social factors in particular culture changes of that period. Subsistence is a convenient venue for assessing these changes as its is a central part of the reproduction of social relations, of fulfilling material needs and of strategic social action underlying the reproduction of social units. Accordingly, this study was conducted in the expectation that significant social changes among the Labrador Inuit ought to be reflected in their subsistence practices.

The research conducted for this dissertation follows and builds upon a substantial body of work by earlier researchers regarding the (pre)history of Neoeskimos in Labrador. Much of this previous work was concerned with documenting the settlement of Labrador by Thule migrants and their development into a distinctive and successful cultural tradition, the Labrador Inuit. Through archaeological surveys, excavations and examinations of ethnohistorical sources conducted by several researchers (Auger 1991; Brice-Bennett 1981; Cox 1977; Fitzhugh 1972, 1994; Jordan 1977, 1978; Jordan and Kaplan 1980; Kaplan 1983, 1985; Loring 1992; Martijn 1980; Richling 1978; Schledermann 1971, 1976a, 1976b; Taylor 1974; 1980), much has been learned about the Thule culture and their Inuit descendants in Labrador. A framework for Neoeskimo culture history has been developed indicating a 13th century date for the initial migration of Thule people, the pace of the subsequent Thule and Inuit expansions, and the extent of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

relationships with other cultures in Labrador. Several studies, archaeological and ethnohistorical, have examined the entry of Europeans into Labrador and their influence upon Inuit society. Likewise, settlement patterns for the Thule and Inuit periods were defined and differentiated. The natures of subsistence economies were examined at regional scales and related to processes of adaptation to changing ecological conditions. Finally, these researchers have identified periods of particularly complex cultural phenomena in which historical, social and ecological factors are apparently deeply intermeshed.

One of these, the communal house phase, has been the subject of particular anthropological attention due to the implications it holds for understanding the roles of history and environment in the development of Inuit society and for generalizations about Inuit social organization. Despite different approaches by several researchers, questions of the origin and function communal houses in Labrador have eluded definitive resolution. Part of the reason for this situation is that theoretical and methodological developments in palaeoenvironmental sciences and archaeology, and improved understandings of the historical record, have repeatedly allowed the exploration of new ideas and facets of the communal house problem. As the debate has been refined, researchers have developed new demands for types of data that previous researchers were not able to accumulate.

Peter Schledermann (1971; 1976a, 1976b) made a major development by linking his own archaeological culture history and architectural data with Robert Petersen's theoretical perspectives on the communal houses in Greenland, Vibe's (1967) theory of arctic ecological change and the palaeoenvironmental data of the day, including early ice

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

core temperature reconstructions (Dansgaard, et al. 1970). Schledermann's conclusions that the communal house was an adaptive reinforcement of sharing practices, and the environmental archaeology approach initiated by him and his contemporaries (see, for example, Cox 1980; Fitzhugh 1972; McGhee 1974/75) have been of lasting influence.

While Schledermann's work was decidedly oriented around ecological adaptation, a growing body of research drew out a new range of cultural and historical data. Drawing upon artifactual evidence of increasingly profound Inuit-European interactions in his own excavations in Hamilton Inlet, Richard Jordan (1977 took a contrary view. He emphasized social and economic processes related to trade mediated by Inuit middlemen, membership in whale hunting crews and leadership as factors leading to the formation of large, hierarchically organized households. Jordan placed importance upon subsistence data and so recovered faunal collections, but he was not able to make full use of these data as initial analyses of these collections were completed after the bulk of his conclusions were published and these were without parallel examples.

Many of Jordan's conclusions were anticipated in J. Garth Taylor's (1974) ethnohistorical study of Labrador Inuit culture change in the 18th century. Taylor provided detailed ethnohistorical descriptions of the kinship organization of polygynous multifamily Labrador Inuit households living in communal houses, gave the names of men identified as social leaders and leaders of whale hunting and trading activities, described the practice of whale hunting and the workings of long distance exchange networks. Taylor's study was limited in its time frame, however, and to the places and activities known to the Moravian Missionaries who recorded the bulk of his data. While

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

very detailed and careful, it was also difficult to place Taylor's study into the context of longer-term environmental change.

Susan Kaplan (1983) followed upon Jordan's and Taylor's approaches, amalgamating ethnohistorical data of social organization and contact history with archaeological data drawn from a very extensive archaeological survey program and a limited number of more detailed site excavations. Kaplan's work added a body of new subsistence data to the communal house debate, through use of models of land use derived from ethnohistorical data and geographical studies of the physical landscape, ecology and archaeological settlement patterns. This analysis enabled Kaplan to come to define regional and temporal variation in Neoeskimo subsistence in Labrador, and to infer how subsistence was related to settlement pattern changes and such practices as inter-regional exchange networks. While Kaplan was able to make use of the limited zooarchaeological data available to her, the bulk of her economic study depends on a locational analysis approach more sensitive to regional than site-level patterning.

While Kaplan (1985), Taylor (1985, 1988, 1990) and Richling (1993) have published refinements of this body of work, researchers have not come much closer to unraveling or effectively knitting together the environmental, social and historical threads that run through the communal house debate. There is a rich and growing body of evidence for the importance of leadership roles, trade and whale hunting as factors motivating the use of communal houses. At the same time, the history of the use of communal houses, centered on the 18th century, lies within the span of the Little Ice Age as it is conventionally defined and historical sources do note examples of environmental hardships during the period (Elton and Ashburner n.d.). Ethnohistorical and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

archaeological data sources were mostly mute concerning 17th century Labrador Inuit culture and, without such data, it was difficult to determine if the cultural situation so well described in the ethnohistorical data pertaining to the 18th century was novel. Accordingly, it was also difficult to judge between the elements of environmentally-induced stress and the opportunism of aggrandizers that run through the different theories.

There are avenues for further work on the communal house, however, in studies of subsistence economies and in applying developments in palaeoenvironmental studies in the past few years. Because the major theories that explained the use of the communal house in terms of environmental stress or the social action of aggrandizers assumed particular economic activities and conditions, subsistence represents a useful pathway for shedding further light on this debate. At the same time, recent methodological developments have greatly increased the resolution, reliability and scope of palaeoenvironmental reconstructions, in comparison to those available in the early 1970's.

The reconstruction of subsistence economies has been a central concern for the previous studies of Labrador Inuit culture. For the most part, these economic reconstructions are based on settlement patterns documented by very extensive archaeological survey projects. Fitzhugh (1972), Cox (1977) and Kaplan (1983) mapped the distribution of archaeological sites onto detailed surveys of modern landscape features and resource distributions to model regional modes of subsistence that likely obtained in the past. Ethnohistorical studies provided an additional level of detail in

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

economic reconstructions by documenting Inuit hunting methods, land use patterns and, in some cases, limited catch data (Taylor 1974).

Kaplan (1983) merged these methods to provide data for reconstructions of seasonal rounds that summarizing regional-scale Neoeskimo economic organization, to associate particular economic activities with particular sites and to generating hypotheses concerning culture change. Nevertheless, because of their scale of analysis, locational analyses are not particularly sensitive to spatial or temporal variability in economies within regions. They do not specify, in a systematic manner, the kinds of species and individuals actually taken, their relative numbers, or the life history details of prey or managed animal populations. As well, they are difficult to apply to individual sites. Accordingly, regional locational analyses and ethnohistorical approaches, while informative,

Site-oriented zooarchaeological studies can, however, provide both quantitative and qualitative proxy data concerning the composition of hunted and managed animal populations, their demographic characteristics, the season in which animals were captured, and how they were used. Zooarchaeology addresses, therefore, basic aspects of economic decision-making that are related to coping with environmental change and to the realization of social goals through production.

Very few analyses of Neoeskimo faunal collections had been attempted prior to this study. Thus, there was a significant opportunity to refine reconstructions of Labrador Inuit subsistence, and to help resolve questions regarding the function of communal houses, through a comparative analysis of faunal collections from multiple Labrador Inuit sites. The initial objectives of this dissertation were, therefore, to conduct just such an

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

intensive, multi-site comparative study, reinforced by archaeobotanical and palaeoentomological studies of land use, palaeoecology and site formation. The further objectives of the dissertation were to relate particular subsistence practices to pertinent environmental changes demonstrated in high-resolution palaeoenvironmental records, to social practices described in ethnohistorical accounts and, if possible, to conditions of economic scarcity or prosperity. Fieldwork, archaeological analyses conducted in this dissertation and palaeoenvironmental data evaluated here are summarized in the following section. Then, these data are used to evaluate the economic implications of the major theories explaining the function of the communal house in Labrador.

Summary of Results

Fieldwork

As part of this project, new fieldwork projects were undertaken at two Labrador Inuit archaeological sites, Uivak Point 1 in Okak Bay, and Oakes Bay 1, in the Nain Bay region. Previous survey projects had identified these sites as excellent locations for excavations because of the presence of intact communal house ruins and because of excellent preservation of organic remains in middens. At Uivak Point 1, large excavations were undertaken in a house and its associated midden, and two other midden areas were tested. At Oakes Bay 1, a further midden was tested.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Review of Palaeoenvironmental Studies

Several lines of palaeoenvironmental evidence were reviewed including high-resolution palaeoclimatic records from ice cores and tree ring studies, and proxy sea ice records relying on ice cores and historical records. These records are relevant both to specific aspects of palaeoecology and to general climate trends and provide evidence for ongoing climate change over the last millennium. An abrupt, deep and variable cooling phase, beginning around the mid-16th century (depending on the record considered) is noted in ice core and tree ring palaeoclimate records, consistent with the Little Ice Age. This cooling phase moderated greatly however, through the 18th century, with spans of decades exceeding mean temperatures for the last 1000 years. Climatic conditions grew more severely cold and variable again in the 19th century. Sea ice conditions in the eastern Arctic and northwest Atlantic, as inferred through aerosol proxies in ice core records and archival sources, generally followed the course of the climate record. Sea ice was severe in the later 16th and 17th centuries, much more moderate and consistent through the 18th century, and during the later 18th century. Ice conditions then grew more severe and variable again in the 19th century. These data do not indicate that the Little Ice Age was a period of consistently cold climate, but rather was one of considerable temporal and spatial variability comprising, in the eastern Arctic/northwest Atlantic region, both very severe cooling and extended periods of moderation.

Faunal Analyses

Substantial faunal assemblages were recovered during these excavations, and were analyzed in this project, along with several previously excavated faunal

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

assemblages from sites in The Narrows region of Hamilton Inlet. The Uivak Point assemblages were dated by a variety of means, including dendrochronology, to the later 18th and very early 19th century. The Oakes Bay 1 assemblages were dated to the later 18th century, while the Hamilton Inlet assemblages represented four periods; the 17th century, the later 18th century, the late 18th to mid 19th century, and the mid to later 19th century. Because of the dating of these sites, the analyses undertaken here lent themselves to the examination of the subsistence-related functions of communal houses as they were used into the late 18th century, rather than to the question of their earliest origins in the late 17th century. In addition to zooarchaeology, this study referred to archaeobotanical and palaeoentomological analyses in order to broaden subsistence, palaeoecology and site formation studies. High-resolution palaeoenvironmental studies were also used to link subsistence changes to particular environmental variables, specifically sea ice.

In the faunal analyses, various measures of taxonomic abundance were used as proxies of the frequency of species in the hunted assemblage. Element frequency studies were used to consider the manners in which caribou and whale carcasses were transported and utilized. Studies of age and season of death based on incremental structures in the teeth of seals provided qualitative data regarding the demographic structure of the hunted assemblage. These data were used to define hunting methods and schedules, and also to infer ecological characteristics of the seascape. Age of death studies of dogs based on cemental annuli were used in a similar manner, to provide a gauge of dog team management and culling practices which are, in turn, indications of economic stress or security in the Inuit site population.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hamilton Inlet

The faunal analyses of the Hamilton Inlet sites showed a remarkable degree of consistency in overall economic orientations, from the 17th to the late 19th century. Sea mammals, specifically seals, were the primary economic resource in all periods, and suggest that the rich fjord and polynya environment of The Narrows was a key factor drawing ongoing Inuit settlement to that locality. Despite the immediate proximity of interior terrestrial hunting areas, caribou and foxes and other fur-bearers figure as minor secondary species with much less importance than seals. Only in the later 19th century assemblages were caribou of notable significance. In general, caribou element profiles were indicative of attritional processes but also give tentative indications of non-local caribou hunting in the 19th century. Very scant evidence of the use of fish, birds and molluscs was noted, though sampling and recovery procedures may account for this situation.

Harp seals were common in all assemblages and were hunted in considerable numbers in the fall. Comparisons of the ringed seal and harbour seal assemblages showed considerable temporal variability that coincided with sea ice conditions in the Labrador Sea. Ringed seals, associated with sea ice habitats, were most common in the 17th and early to mid 19th century assemblages. Proxy palaeoenvironmental records indicate that the Labrador Sea had heavy sea ice conditions during these periods. Harbour seals, associated with open water conditions, were most common in the 18th communal house assemblages and in the late 19th centuries. These were periods of reduced sea ice conditions on the Labrador coast. Seasonality studies showed that both

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

of these species were hunted in The Narrows in the winter during the 18th century. This situation offers a strong argument that, in The Narrows, communal houses were used during a period of moderated winter climatic and ice conditions, and were associated with the practice of local open water hunting in winter.

Oakes Bay 1

The Oakes Bay 1 faunal assemblages also show a highly specialized maritime orientation. Seals are clearly the most important species in the assemblage and consist in the majority of ringed seals with a secondary component of harp seals. Molluscs, caribou and other terrestrial mammals were of minor secondary importance, while birds and fish were almost entirely unremarked. Ringed seal hunting, plainly the dominant element of subsistence at Oakes Bay 1, was conducted through the winter and spring on fast ice and at the *sina*. There is no evidence of a substantial fall harp seal hunt, or of a spring hunt. Without the significant use of readily available secondary backup resources such as fish or caribou, or quantities of mussels, the faunal assemblage of Oakes Bay 1 likely represents a winter and spring occupation with a fall camp located somewhere else, rather than an ongoing failure of the fall harp seal hunt.

Uivak Point 1

A diverse range of faunal assemblages from a house floor and three middens at Uivak Point 1 were analysed. While precise chronological relationships between all of these contexts are unclear, they are all dated to between the mid-18th century and the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

opening years of the 19th century. The different contexts showed very similar patterns of species representation, with more species diversity in relation to the other assemblages in this study. Seals were the most important components of these assemblages. Ringed seals and harp seals were represented in great numbers, while bearded seals and harbour seals were secondary species. Bearded seals generally comprised more than 10% in many of the seal assemblages, a very high proportion of these large animals in comparison to other sites. Small numbers of hooded seals and walrus were also indicated.

The majority of harp seals were hunted in the fall, while about 25% were hunted in the spring. The large numbers of harp seals represented in almost all of the assemblages suggests that the fall hunt regularly produced a sizeable surplus of seal meat that could be used to fund other activities such as whale hunting, or stored for winter use. In general, up to one third of ringed seals were hunted in the winter and two thirds or more in the spring. This suggests that ringed seals were hunted at breathing holes or at the *sina* on a consistent if slow-paced basis, throughout the winter. Spring hunting appears to have been very productive, as great numbers of both adult ringed seals and pups were hunted during the basking season, along with numbers of large bearded seals. In addition, harp seals, harbour seals and walrus augmented the spring hunt. Seal hunting appears, therefore, to have been practiced on a continual basis from fall to spring; the fall harp seal hunt and the diverse spring hunts were clearly the most productive seal hunting seasons, but no discernable break in seal hunting was noted in the winter. Seals contributed a steady flow of staple resources for immediate consumption and storage throughout most of the seasonal occupations of Uivak Point 1.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

A wide range of secondary species were represented at Uivak Point, including mussels, fish (salmonids and gadids), birds, caribou, foxes, bears and arctic hares. With the exception of mussels, all of these species were present in uniformly small to tiny quantities. Mussels were very common in many contexts but not sufficiently common to represent a resource of primary economic importance. They were an important secondary prey species in only one context, the upper layers of the House 6 midden. In this case, the high frequency of mussels was accompanied by somewhat reduced proportions of harp and harbour seals, suggesting that mussels may have been collected to cope with unpredictable fall seal hunts. Nevertheless, the importance of this deviation in the frequencies of harp and harbour seals is ambiguous as other secondary species were not of increased importance.

The presence of choice portions of whale carcasses, as well as bones of immature whales in excavated contexts at Uivak Point 1 the site suggests that baleen whales were hunted by the residents of Uivak Point during the later 18th century. Ethnohistorical evidence confirms the conclusion that whales were hunted at Uivak Point 1, in Okak Bay and in northern Labrador generally (Taylor 1974; 1988). The available evidence suggests that in simple terms of subsistence, whale hunting was a high-risk activity at Uivak Point 1 and in Okak Bay, with averaged catches of less than one whale per year and most years without a successful landing. When the numbers of scavenged, stranded whales are considered along with hunted whales however, whales appear to have provided a reliable and steady supply of trade goods, fuel and dog food, along with occasional huge surpluses of food.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Dogs were represented in greater proportions at Uivak Point 1 than any other vertebrate species, other than seals. Furthermore, dog remains were more common at Uivak Point than in many other documented assemblages in the Arctic (Savelle and McCartney 1988). The size of the assemblage is consistent with ethnohistorical descriptions of the maintenance of very large dogs teams by Labrador Inuit in the 18th century (Taylor 1974). The ages of death profiles of the dogs were indicative of attritional mortality of aging adults and culling of excess pups. These culling patterns are consistent with economic priorities placed upon normal management of effective and healthy dog teams rather than aggressive culling of dog teams in conditions of food shortages.

Major Research Questions Concerning the Function of the Communal House

Four general questions that lie at the heart of a subsistence approach to the communal house problem were set out in Chapters 1 and 2. After having presented the rationale this research project and having presented a synthesis of palaeoenvironmental analyses and the results of new archaeological analyses in previous portions of the dissertation, it is time apply these data to the research questions and to consider their implications for theories of the function of the communal house.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Question 1: *Is the time period associated with the communal house (the late 17th to early 19th century) a period of environmental degradation, unpredictability or stability?*

Current archaeological evidence is that communal houses were used in Labrador from the late 17th century to the early to mid-19th century. The array of palaeoenvironmental studies reviewed in this project indicate that this was a period of significant environmental changes, both in terms of climate and of various environmental factors related to or derived from climate. Certainly, the period lies within the span of the LIA as traditionally defined (beginning in the 14th to 16th century and ending in the 19th century). Nevertheless, much recent research suggests that climatic conditions during the LIA (and the preceding MWP) were variable in time and in space, to the degree that the term LIA loses coherent definition.

The GRIP $\partial^{18}O$ record places the deepest part of a 17th cooling trend between 1670 and 1700, followed by moderating conditions reaching or exceeding the 700 year mean through most of the 18th and early 19th centuries, followed again by a cooling period after about 1815. Borehole temperatures also suggest that a cooling trend reached its deepest point prior to the 18th century. Temperatures moderated through the 18th century, with a maximum in the late 18th century, followed by cooling in the mid 19th century. Hemispherical scale dendroclimatological records suggest that there was a variable cold phase through the 17th century, warming through the 18th century until about 1815 and a sharp and deep new cooling phase from about 1815 to the later 19th century.

The proxy sea ice records repeat much this same trend. The PIC sea salt sodium record indicates severe ice conditions through the 17th century, a period of moderated ice

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

conditions in the middle to late 18th century and a resumption of heavy ice condition by 1800. The historical sea ice records specific to the Labrador Sea suggest light to moderate, and consistent, sea ice conditions from 1750 to 1815, then much more severe and unpredictable ice conditions afterwards.

By the terms of the studies reviewed here, the communal house in Labrador appears to have coincided with this period of moderated climate and sea ice conditions. Its development follows some of the most severe climatic conditions of the LIA and, according to some of these records, its early history may have overlapped these severe conditions. Similarly, the dates given for the abandonment of the communal house follow or roughly coincide with the resumption of cold climates with heavier and more variable ice conditions. The degree of climatic variability is more difficult to assess, given the differences between these various records, but the Labrador Sea ice severity records suggest that the communal house form was used during a period of consistently mild sea ice conditions, which became highly variable and much more severe about the time it fell out of use. While it may be premature to argue specifically that the demise of the communal house form was caused by environmental deterioration, it seems apparent that its use coincided with moderated climatic and sea ice conditions, not with more severely cold and icy conditions.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Question 2: *Do the subsistence economies associated with communal houses reflect specialized hunting of ice-adapted sea mammal species or other species associated with cold conditions?*

Comparisons of the three sets of assemblages from communal house contexts involved in this study (Eskimo Island 1, Oakes Bay 1 and Uivak Point 1) suggest that communal houses were associated with a surprising range of subsistence activities, rather than any particular kind of hunting economy. Sea mammal hunting was clearly the paramount activity at all of these sites, but different modes of hunting were demonstrated at each. Terrestrial mammal hunting was universally of minor importance.

As demonstrated in their faunal assemblages, fall harp seal hunting was of tremendous economic importance at the Eskimo Island 1 and Double Mer Point sites. Winter season hunting practices were focused on a mix of ringed seals caught on fast ice and open water hunting of ringed seals and harbour seals, with harbour seals being a more important species overall than ringed seals. Open water hunting in expanded local ice-free areas, and the cooperative hunting methods suitable for kayak hunting, appear to have been distinctive of communal house assemblages in Hamilton Inlet. The diachronic trend in hunting methods from the 17th to the 19th century provided by the full range of faunal collections from The Narrows indicates a fluctuation in the importance of the winter open water seal hunting component that is synchronized with historically documented sea ice conditions. Winter open water hunting was of increased importance in periods with moderated ice conditions in the 18th and later 19th centuries, while the reverse was true of the more severe 17th and early to middle 19th century.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The Oakes Bay 1 assemblage reflected an overwhelming importance of ringed seal hunting during the winter and spring. Both adults and subadults were commonly taken, suggesting that hunting efforts were directed at breathing hole hunting on fast ice as well as ice edge hunting. Only sparse evidence of harp seal hunting in fall or spring was obtained, while other species were even more rare or absent. This pattern is highly reminiscent of the ice-oriented ringed seal hunting pattern implied by Schledermann's environmental theory and would have been amenable to use of individual and group hunting techniques. It may also be that the present state of knowledge of the Oakes Bay 1 site is too limited to tell if the site is purely a winter settlement that was paired with a fall harp seal hunting camp in the vicinity, or if the small midden sample analysed to date is simply idiosyncratic.

The set of assemblages from Uivak Point 1 were all indicative of a third, more generalized, sea mammal hunting pattern that involved a substantial fall harp seal hunt, fall baleen whale hunting, winter ringed seal hunting on fast ice, a productive hunt of ringed seal pups and adults during the spring basking season, and the pursuit of bearded seals and subadult ringed seals at the *sina* through winter and spring, as well as hunting harp seals, harbour seals, walrus and belugas later in spring. This economic pattern indicates the application of intensive hunting efforts to seal species when and where they were most plentiful and most readily available. All manner of sea mammal hunting methods would likely have been employed at Uivak Point, though cooperative hunting methods would have been very important in the fall open water season and for hunting at the *sina*.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Faunal analyses indicated that different types of seal hunting economies were employed in the Okak Bay, Nain, and Hamilton Inlet regions in the later 18th century. It seems reasonable to conclude that the differences between these three data sets reflect regional ecological differences and local economic priorities. This variability implies that the communal house was an institution that allowed considerable economic flexibility.

Question 3: *Is there evidence for a maintained or increased role of whale hunting at communal house sites?*

Archaeological evidence for whale hunting remains somewhat ambiguous, perhaps in part because no project has yet devised and employed survey and collection strategies that are geared specifically to the particular problems inherent in whale bone assemblages. Ethnohistory remains the source of the most informative data concerning Inuit whale hunting in Labrador. Nevertheless, it is possible to offer some basic conclusions on the basis of zooarchaeological data presented in this dissertation.

No particular evidence of whale hunting was apparent in the faunal assemblages from sites in The Narrows, though whale bones were recovered, including bone used as raw materials and as structural components of houses. The inner fjord environment of much of The Narrows may be inimical to local whale hunting or, if whales were indeed present, the economic objectives of the sites' inhabitants may have been to exchange whale products already obtained from further north, rather than to obtain more whale products (Kaplan 1985).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Similarly, little osteological evidence of whales was identified in the Oakes Bay 1 assemblages except for whale bone used in house construction and for raw materials. Baleen fragments were recovered, and substantial indurated fatty layers of were also observed in midden excavations at the site. These deposits are of unknown origin but may be related to large-scale blubber processing activities or disposal of unwanted meat and fat. Ethnohistorical sources indicate that whale carcass scavenging was a fairly regular practice in the Nain region. Scavenging appears to have provided a fairly regular supply of fuel and raw materials rather than a consistent supply of human food.

Faunal assemblages from Uivak Point 1 provided evidence of whale elements scavenged for use as building and raw materials and for butchery units obtained from hunted whales. Ethnohistorical studies also provide specific anecdotal evidence of whale hunting conducted by residents of Uivak Point and of feasts related to successful whale hunts. Whale hunting in Okak Bay seems to have been of limited success, however, as whales were successfully landed in 37% of years within the entire region, in the late 18th century. Accordingly, the economic surplus provided by intensive fall harp seal hunts would have been of critical importance as a means of financing whale hunting activities, both in terms of outfitting and feeding whale hunting crews and their families while they pursued whales, and for providing a dependable supply of stored foods for winter use in the majority of years when no whales were obtained.

Whale hunting provided ambitious Inuit with unequalled opportunities to generate and amass social capital and material goods for trade. Scavenging also regularly supplemented the supply of material whale products. The riskiness of whale hunting and importance of fuel and baleen suggests that, while a successful hunt yielded an immense

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

supply of food, the most important economic payoff of whale hunting and the chief incentive to continue the practice, was provided by non-food whale products.

Question 4: *Is there evidence for food shortages or economic hardship in the archeological record?*

Potential lines of archaeological evidence for economic stress lie in diet breadth, scheduling of hunting activities, residential mobility, and in direct evidence for economic decision-making in the management of animal populations. The faunal assemblages considered in this study show a diversified pattern of resource use by the Labrador Inuit during the 18th century, but also that sea mammals were the overwhelming focus of subsistence. The major faunal collections of Uivak Point 1 and from sites in The Narrows show no seasonal break in seal hunting, while the Oakes Bay collection shows that ringed seals were also hunted there steadily through winter and spring. With the exception provided by the relative lack of harp seals at Oakes Bay 1, these collections showed extensive use of all major seal species during their seasonal pulses of availability, with significant catches of harp seals made in the fall. The Uivak Point 1 assemblages were especially robust in terms of the diversity of seal hunting practices they demonstrate. A capacity to generate seasonal surpluses, especially through the fall harp seal hunt, was also apparent in the Uivak Point 1 site and those in The Narrows. As well, land mammals (specifically caribou), birds and fish were of minor significance in almost all the faunal assemblages considered here. The lack of utilization of these species

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

implies that seal hunting was sufficiently productive to meet the bulk of subsistence needs from fall to spring.

Some secondary faunal resources were of variable importance in the different assemblages considered here. However, with only one minor exception, notable increases in the frequency of particular secondary species, such as mussels, were not matched by accompanying increases in other secondary species or dramatic shortfalls of primary species. By far the largest proportion of mussel shell in any assemblage considered here was reported in the Uivak Point 1 House 6 midden A.U. 1 assemblage, were mussel hinges represented 50% of assemblage NISP). Yet even this remarkable diversion from the normal pattern of species representation for that site was accompanied by only relatively minor changes in the seal hunting pattern. It is therefore hard to link these fluctuations with subsistence stress.

Residential mobility may also be a remedy for economic shortfalls but little evidence of a temporary hiatus, within the span of a season, can be noted in the occupation of Uivak Point House 7. Resources collected from fall to spring were consistently represented at the site, including species brought from the sina, where temporary seasonal camps were likely to have been established.

Dog team management practices provide another practical scale for assessing economic stress. A sample of the sled dog assemblage from Uivak Point 1 showed a bimodal mortality pattern indicative of high mortality among young dogs less than two years old, and among aging adults five years and of age and older. This mortality profile closely resembles those of healthy, well-maintained sled dog populations studied elsewhere where excess pups and aged individuals too infirm to pull sleds were

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

selectively culled. Notably, a catastrophic death assemblage with prime age individuals, suggestive of economic shortfalls, was not indicated in the archaeological sample.

None of the diet breadth, secondary resource use, seasonality, residential mobility or dog team management data appear to indicate conditions of economic stress. The dates of the three communal house samples considered here all clustered between the middle of the 18th century to the opening years of the 19th century. As judged from palaeoclimatic and sea ice records, this period was for the most part one marked by moderated climate and sea ice conditions. The diversified sea mammal assemblages of the sites considered in this study, especially those of Uivak Point 1 and Eskimo Island 1, appear to represent the utilization of a wider range of economic opportunities accompanying this period of relative amelioration. During this period, significant seasonal surpluses were accumulated through seal hunting, through collection of plant foods, and occasional windfalls of whale meat. At the same time, the winter economy was not wholly dependent on stored food, as seal hunting continued in to the spring. The economies associated with the communal house phase in 18th century Labrador therefor appear to indicate a degree of prosperity, success and security. This is not to say that short-term economic hardships did not occur. Rather, the conclusion of this study is that subsistence economy of the later 18th century was, on average, sufficiently flexible and productive to warrant decisions based on assumptions of security, such as concentrating winter populations, maintaining expensive investments in large dog teams and risky whale hunting, raiding and trading ventures.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Implications of the Study

Arctic Anthropology

The most immediate significance of this study and its conclusions for archaeology in Labrador and the Arctic lie in its implications for research concerning the economic function of Labrador Inuit communal houses and the social relations they entail. Uivak Point 1, Oakes Bay 1, Eskimo Island and Double Mer Point are the only communal house sites in Labrador that have. as yet furnished substantial faunal assemblages useful for detailed zooarchaeological analysis. This study makes a useful contribution to the communal house debate by providing the first detailed study of their economic functions and a review of current research concerning the palaeoenvironmental context of their use. Studies of subsistence economy have the potential to expose the strengths and weaknesses in the various theories proposed to explain the function of communal houses. Accordingly, this research project provided an original opportunity to test some of the economic implications of these theories.

The data presented in this dissertation provide a set of evidence that contradicts several of the major elements of the environmental explanations for the function of the communal house. Some authors (Richling 199 3; Schledermann 1971, 1976a, 1976b; also Petersen 1974-75) associated the communal house with environmental cooling, increased sea ice, a less diverse ice-adapted marine fauna, the cessation of whale hunting and a manifest degree of economic hardship. A much different economic picture was portrayed by the sample of communal house sites (representing the middle 18th century to early 19th century) presented in this study.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The faunal assemblage examined here provided ample evidence that the communal house may be associated with a reasonably secure and productive subsistence economy that had the capacity to generate seasonal surpluses and to maintain production of staple resources through the lean weeks of mid-winter. Seal hunting efforts were diversified and usually made intense use of species that would be deterred or excluded by heavy sea ice, as well as ones that seek out sea ice. Open water, fast ice and ice edge hunting techniques were all used and seasonally important. Most notably, in areas with local polynyas, open water techniques were used to catch harbour seals in the winter in the 18th century. Similarly, the scale of spring ice edge hunting and the species obtained thereby suggest frequent open water conditions at the sina as well, encouraged perhaps by frequent or reliable flaw lead polynyas. Seal hunting appears to have provided frequent seasonal surpluses useful for funding other social or economic activities and for supplementing winter food stores. Seal hunting in winter, though not dramatically productive, was practiced. Despite access to terrestrial animals in the inner bay/coastal environments of many of the communal house sites, little use was made of them. This suggests that marine resources were adequate for the needs of inhabitants of these sites. Berries were however collected on a substantial scale and would likely have contributed to surplus food stores.

Whale hunting too was possible and to a degree practical, accepting a high degree of risk and having alternative food resources available. No obvious evidence of economic stress was apparent in subsistence patterns or in dog team management practices. Finally, the communal house economies described in this zooarchaeological study were all practiced within the context of generally moderated climatic and sea ice

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

conditions during the middle of the 18th century to the early 19th century. As demonstrated in a number of independent but concurrent palaeoenvironmental records, this period was the most consistently moderate period in terms of climate and sea ice conditions between the 15th century and the modern period. More severe sea ice conditions are indicated for the 17th century and both more severe and much more variable sea ice conditions were demonstrated for the Labrador Sea after 1815, prior to and following the major time span in which the communal house appears to have been used.

Because the communal house sites considered here had broadly coeval occupational histories, this study was focussed on subsistence economies and environment of the middle to later 18th century. As a result, no direct statement about the origins of the communal house in Labrador, conventionally dated to the late 17th century can be made here. Few Inuit archaeological sites of the late 17h century have been identified in Labrador. Given that some palaeoenvironmental records also place the end of the initial phase of LIA-era cooling in the late 17th century, the dating of any early communal house structure will be critical for resolving how the communal house relates to climate history.

In general, this study supports several implications of the various social arguments regarding the function of the communal house. The models imply that the Labrador Inuit enjoyed a degree of general economic success and security. Arguably, this study has demonstrated such conditions in the diversity and effectiveness of the seal hunting economy, through the minor degree in which readily accessible back up resources were used, by the practice of whale hunting and trade and the presence of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

sufficient wealth to do so, and by the presence of environmental conditions fostering a diverse range of economic options. The modes of hunting that likely to have been practical in these economies include several modes of cooperative hunting, which are amenable to the application of a measure of control by task group leaders and property owners. The zooarchaeological indicators of economic stress available here, including diet breadth, seasonality and dog team management practices to no indicate that economic decisions were not made in terms of coping with stress. Rather, in the 18th century at least, the Labrador Inuit show a capacities for flexibility and surplus production coupled with economic risk-taking driven by socially defined values.

Labrador Inuit as Complex Hunter-Gatherers

The Labrador Inuit displayed many characteristics normally shared by societies classed as complex hunter-gatherers. They employed an economic strategy of logistical mobility that encouraged a delayed return economic system, food storage, sedentism and a measure of economic specialization and leadership in task groups. Hayden (1990, 1995) envisioned competitive social and economic relations between individuals in such societies and linked the capacity for these accumulators and aggrandisers to pursue strategic action to a preexisting condition of economic prosperity.

While various Inuit groups have often been portrayed as exemplary egalitarians, and reciprocity seems to be the central social value underlying Peter Schledermann' s theory of commensalism as an adaptive response to environmental stress (Schledermann 1976a), it seems reasonable to conclude that accumulators played a role in Labrador Inuit culture as well. Whale hunting, feasting, trading and raiding were all activities loaded

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

with social meanings and inherent possibilities for individuals to build social personae and to realize strategic and social and political ends as well as Inuit social groups to build cohesion. That the Inuit diverted surplus production, time and labour to these goals argues for the presence of a political and competitive social dynamic in Labrador Inuit social life.

In the example provided by Labrador, a variety of leadership roles overlapped in particular individuals, facilitated by kinship, complex marital alliances and household organization, controls over corporate household resources and transportation infrastructure, hunting skills and attributed spiritual skills. Ethnohistorical sources document social rivalries, conflicts and feuds that sometimes erupted from stresses generated by the pursuit of surplus-producing activities, over the distribution of surplus goods and the oftentimes antisocial activities of would-be accumulators (Taylor 1974, 1979a, 1990). The arguable economic success of the Labrador Inuit in subsistence also provided more opportunities for individuals to exercise leadership roles in cooperative hunting practices, feasts and performances, and in mediated relations with non-Inuit neighbours, activities that may clothe motivated self-interest with those of the community at large. This success also sets up Hayden's necessary precondition of surplus to enable competition.

Zooarchaeology as Part of Integrated Historical Ecology Approach

This central methodological orientation of this dissertation was that of historical ecology. I have intended to conduct a broad study that was capable of examining

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

landscape history in fine scale, the involvement of social actors and the patterns in which Inuit made use of their environment. In order to meet these goals, this project employed a multidisciplinary approach derived from those recently applied in other parts of the Arctic and North Atlantic.

Zooarchaeology was the central component of this project and provided a means of addressing, with primary independent data, questions about Inuit subsistence and its relation to environmental change. A detailed multisite zooarchaeological study was conducted with the intention of obtaining quantitative and quantitative data about Inuit hunting patterns, economic stress and the biological insights about ecotones provided by indicator species, life history and seasonality studies. Very large faunal assemblages and an experimental analysis of sled dog mortality were important parts of this analysis. New archaeobotanical and palaeoentomological studies were used to broaden the subsistence and palaeoecological components of the study as well. Ethnohistorical records provided details about historical context, land use and social actors.

An essential part of this project was the use of a range of high resolution palaeoenvironmental records were used to draw out the operation of environmental variables that are relevant to subsistence economies, within the short time scales corresponding to human actors and to rapid climate change processes. Newly applied dendrochronological dating methods, in addition to multiple conventional dating methods, were essential for establishing chronological relationships between archaeological subsistence data and these fine-grained environmental records, as well as to ethnohistorical records.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Though the use of all these methods and perspectives, this project has intended to aid understandings of interrelationships between Labrador Inuit culture change during the Contact Period, historical contingency and environmental change. To this end, the major contribution of this project has been to build a fine-scaled landscape history of the Labrador Inuit in particular ecotone environments. The significant logical step is to apply this landscape history to an equally detailed history of social agents and their economic decision-making.

Future Research

Any project as open-ended as this one inevitably finds that its inquiry leads to new questions and potential approaches. A set of potential avenues for further research is indeed apparent at the conclusion of this dissertation.

The conclusions of this study would be reinforced by zooarchaeological analyses of further 18th century communal house sites, by improving the depth of comparison and representation of regional economies. In particular, new archaeological projects should concentrate on recovery of wood for dendrochronological dating if substantial and well preserved faunal collections may be recovered. Furthermore, a survey of coastal areas for evidence of whale bone scatters resulting from butchery away from residence sites, and bottom surveys of the subtidal shore zones of whale hunting sites such as Uivak Point may be necessary to obtain a more reliable archaeological understanding of whale hunting. In addition, recovery of faunal assemblages from midden contexts at sites from prior to and after the 18th century would be highly informative, especially if they could be drawn from regions with existing 18th century archaeological faunas. Sites from the late

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

17h century must be examined to gain an understanding of when and why communal houses were originally adopted in Labrador.

Further work should continue to explore qualitative economic and ecological data inherent in archaeological faunal assemblages. Incremental structures in teeth and bone are suitable targets for this research especially as they are readily applied to fine scale palaeoenvironmental records. As well, it is possible that other species or tissues may be investigated than those considered in this study. Further research should concentrate on refining the use of incremental structures in dog's teeth to reconstruct age and season of death as an analytical tool in subsistence studies.

Finally, further research should pursue fine-scale studies of Labrador Inuit social actors. The live and careers of many such individuals might be traced in ethnohistorical sources. Merged with present advances in palaeoenvironmental records, in the dating of archaeologial contexts in Labrador, and in zooarchaeological methods, such data provide a tremendous, perhaps unmatched, opportunity for historical ecology research.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

APPENDIX 1

Uivak Point 1 House 7 Artifact Summary

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 1: Uivak Point 1 House 7 Artifact Summary

Category	Frequency
General Hunting	
Gun Flint	28
Lead Shot	8
Sea Mammal Hunting - Open Water	
Harpoon Foreshaft Socket (moveable)	1
Seal Bladder Nozzle	4
Sea Mammal Hunting - Ice	
Harpoon Finger Rest	2
Harpoon Ice pick	1
Drag Handle	1
Wound Plug	3
Terrestrial Hunting	
Archer's Wrist Guard	1
Seal Mammal Hunting - General	
Harpoon Head	2
Iron Harpoon Endblade	6
Harpoon Foreshaft	1
Fishing Equipment	
Wood Float	2
Iron Fish Hook	4
Bone and Iron Fish Hook	1

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 1 (con't). Uivak Point House 7 Artifact Summary

Category	Frequency
Transportation - Dog Sled	
Paddle Edge	3
Transportation - Dog Sled	
Dog Trace Buckle	3
Dog Trace Toggle	3
Sled Runner	9
Household Utensils and Tools	
Men's Knife Handle, bone	8
Iron Knife Blade	4
Whetstone	10
Ulu handle	1
Ground Slate Ulu Blade	1
Ground Stone Ulu Blade Preform	2
Bone Scapula Scraper	1
Household Utensils and Tools	
Thimble, Copper/Brass	6
Ivory Bodkin	1
Iron Awl	1
Boot Creaser	1
Bow Drill Socket	1
Bow Drill Bow End?	1
Soapstone Lamp	5
Soapstone Lamp Preform	1
Wick Trimmer	1
Soapstone Vessel Fragment	24
Soapstone Vessel Handle	3
Wood bowl	1

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 1 (con't). Uivak Point House 7 Artifact Summary

Category	Frequency
Household Utensils and Tools	
Wood Disc - Cup Base?	2
Flat Glass Fragment	20
Glass Vessel Fragment	29
Misc. Glass Fragment	72
Glass Goblet	2
Ceramic Vessel Sherd	577
Iron Vessel Fragment	10
Iron Handle	66
Clay Brick/Tile Fragment	6
Mattock Blade	1
Copper Disc	4
Copper strip	1
Copper Rod	2
Iron Hinge Plate	1
Iron Tube	1
Iron Hoop	278
Iron Nail	55
Iron Spike	11
Iron Rod	3
Iron Peg	1
Iron Wedge	1
Iron Gear	4
Iron Hook	1
Iron Ring	1
Iron Sleeve	3
Iron File	2

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 1 (con't). Uivak Point House 7 Artifact Summary

Category	Frequency
Household Utensils and Tools (con't)	
Iron Strip	28
Iron Sheet	2
Iron Wire	1
Iron Loop	2
Bone Wedge	1
Wood Shaft	1
Clothing	
Textile	3
Clothing Fastening Hook	3
Button, Leather	1
Button, Metal	9
Ornaments, Personal Items	
Comb, Wood or Ivory	2
Copper Pendant	3
Ivory Pendant	1
Perforated Tooth Pendant	5
Globular Bone Pendant	2
Lead Drop	3
Purple Glass Rhinestone	1
Glass Beads	276
Kaolin Pipe Stem	73
Kaolin Pipe Bowl	40
Carvings, Amulets	
Carved Ivory Object	2
Incised Whale Bone Disc	1
Wood Bear Figurine	1

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 1 (con't). Uivak Point House 7 Artifact Summary

Category	Frequency
Toys, Games	
Ajagaq	1
Toy lamp	3
Mouth Harp	1
Unidentified Items	
Unidentified Organic Matter	6
Unidentified. Bark	3
Unidentified Hair	7
Unidentified Leather/Hide	35
Unidentified. Baleen	18
Worked Antler	17
Worked Ivory	12
Worked Bone	152
Utilized Bone	2
Whalebone Preform	1
Worked Wood	48
Painted Wood	2
Cork	7
Coal	1
Unidentified Metal	28
Iron Object	167
Lead object	13
Lead strip	4

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 1 (con't). Uivak Point House 7 Artifact Summary

Category	Frequency
Lithics	
Worked Soapstone	40
Ground Slate Fragment	5
Flaked Projectile Point	1
Flaked Biface	23
Flaked Scraper	3
Punch	1
Utilized Flake/Piece	198
Retouched Flake	9
Core	29
Microblade	6
Blade	2
Burin	1
Burin Spall	2
Burinated Flake	1
Flake	98
Chunk	9
Hammerstone	3
Abrader	3
Polished/Polishing Stone	29

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

APPENDIX 2

Uivak Point 1 House 7 Midden Artifact Summary

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 2: Uivak Point 1 House 7 Midden Artifact Summary

Category	Frequency
General Hunting	
Gun Flint	2
Lead Shot	1
Musket Ball	1
Sea Mammal Hunting - Open Water	
Seal Bladder Nozzle	2
Harpoon Foreshaft Socket	2
Float Mending Plugs	2
Sea Mammal Hunting – Ice	
Harpoon Finger Rest	1
Drag Handle	1
Seal Mammal Hunting – General	
Harpoon Head	3
Harpoon Preform	1
Harpoon endblade, slate	2
Iron Harpoon Head	1
Terrestrial Hunting	
Wood Bow, Nock End	1
Iron Arrowpoint	1
Wood Arrowpoint	1
Antler Arrowpoint Base	1
Transportation – Boats	
Paddle Edge	7
Paddle Tip	8

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 2 (con't): Uivak Point 1 House 7 Midden Artifact Summary

Category	Frequency
Transportation – Dog Sled	
Dog Trace Buckle	4
Dog Trace Toggle	3
Sled Runner	8
Komatik Slat	1
Household Utensils and Tools	
Iron Axe Head	1
Men's Knife Handle, bone	13
Knife blade, Iron	6
Whetstone	4
Ulu handle	1
Bone Scapula Scraper	9
Iron Awl	1
Bow Drill Socket	1
Soapstone Lamp	2
Soapstone Lamp Preform	1
Wick Trimmer	4
Soapstone Vessel Fragment	16
Soapstone Disc	1
Wood Bowl/Ladle/Cup Base	4
Flat Glass Fragment	2
Glass Vessel Fragment	6
Misc. Glass Fragment	4
Ceramic Vessel Sherd	38
Iron Vessel Frag.	1
Iron Vessel Handle	1
Clay Brick/Tile Fragment	14

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 2 (con't): Uivak Point 1 House 7 Midden Artifact Summary

Category	
Household Utensils and Tools (con't)	**Frequency**
Mattock Handle	1
Antler Pick	1
Iron Chisel	1
Iron File	1
Copper strip	6
Iron Tube	1
Iron Nail	108
Iron Spike	18
Iron Rod	4
Iron Peg	1
Iron Tube	1
Iron Hook	1
Iron Strip	3
Iron Sheet	2
Bone Peg	1
Bone Wedge	2
Bird Bone Tube	1
Clothing	
Clothing Fastening Hook	1
Copper/Copper Alloy Button	1
Ornaments, Personal	
Comb, Wood or Ivory	2
Perforated Tooth Pendant	8
Globular Bone Pendant	4
Carved Ivory	2

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 2 (con't): Uivak Point 1 House 7 Midden Artifact Summary

Category	Frequency
Ornaments, Personal	
Glass Beads	37
Kaolin Pipestem	8
Kaolin Pipebowl	9
Carvings, Amulets	
Carved Ivory Object	2
Toys, Games	
Ajagaq	1
Toy Lamp	1
Toy Pot	1
Wood Doll	1
Unidentifiedentified Items	
Unidentified. Organic Matter	2
Unidentified Hair	1
Unidentified Leather/Hide	3
Unidentified. Baleen	5
Worked Antler	20
Worked Ivory	7
Worked Bone	156
Worked Wood	103
Sawn Wood	1
Cork	3
Antler Preform	2
Bone Preform	2

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Appendix 2 (con't): Uivak Point 1 House 7 Midden Artifact Summary

Category	Frequency
Unidentifiedentified Items	
Iron Object	55
Lead object	3
Lead strip	3
Copper Object	2
Lithics	
Worked Soapstone	10
Ground Slate Fragment	3
Flaked Projectile Point	1
Flaked Biface	4
Flaked Scraper	1
Utilized Flake/Piece	9
Retouched Flake	8
Core	9
Microblade	5
Burin Spall	1
Flake	17
Hammerstone	1
Polished/Polishing Stone	2
Ochre	1

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

BIBLIOGRAPHY

Adams, R. L.

1974 Anthropological perspectives on ancient trade. *Current Anthropology* 15 (3):239-258.

Albright, D.

1993 Precision of seasonality determination in ringed seals. *Archaeozoologia* VI (11):7-18.

Alley, R. B.

2000 *The two-mile time machine: Ice cores, abrupt climate change and our future.* Princeton University Press, Princeton.

Ames, R.

1977a Land Use in the Rigolet region. In *Our Footprints Are Everywhere: Inuit Land Use and Occupancy in Labrador*, edited by C. Brice-Bennett, pp. 279-308. Labrador Inuit Association, Nain, Newfoundland and Labrador.

—

1977b Land Use in the Postville region. In *Our Footprints Are Everywhere: Inuit Land Use and Occupancy in Labrador*, edited by C. Brice-Bennett, pp. 205-237. Labrador Inuit Association, Nain, Newfoundland and Labrador.

Amorosi, T.

1989 *A post-cranial guide to domestic neo-natal and juvenile mammals.* BAR Archaeological Reports International Series No. 533, Oxford.

—

1992 Climate impact and human response in northeast Iceland: archeological investigations at Svalbard, 1986-1988. In *Norse and Later Subsistence in the North Atlantic*, edited by C. D. Morris and D. J. Rackham, pp. 103-138. Department of Archaeology, University of Glasgow Occasional Paper Series No. 1. The Department of Archaeology, University of Glasgow, Glasgow.

Amorosi, T., J. M. Woollett, S. Perdikaris and T. McGovern

1996 Regional zooarchaeology and global change: problems and potentials. *World Archaeology* 28 (1):126-157.

Arundale, W.

1981 Radiocarbon dating in eastern Arctic anthropology: A flexible approach. *American Antiquity* 46 (2):244-271.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Atmospheric Environment Service, A. E. S.
1992 *Ice Thickness Climatology, 1961-1990 Normals.* Ice Centre, Cat. No. En57-28. Environment Canada, Ottawa.

Auger, R.
1991 *Labrador Inuit and Europeans in the Strait of Belle Isle: From the written sources to the archaeological evidence.* Collection Nordicana. Centre d'Études Nordiques, Université Laval, Québec.

Austin, O. L. J.
1932 *The birds of Newfoundland Labrador.* Memoirs of the Nuttall Ornithological Club No. VII. 2 vols. The Nuttall Ornithological Club, Cambridge.

Baillie, M. G. L.
1982 *Tree-ring dating and archaeology.* Croom Helm, London.

Bain, A.
1999 *Archaeoentomological and archaeoparasitological reconstructions at Îlot Hunt (CeEt-110): New perspectives in historical archaeology (1850-1900).* Unpublished Doctoral Dissertation, Université Laval.

—
n.d. *Uivak Archaeoentomological Analysis- 2.* Unpublished report in the possession of the author.

Bakker, P.
1989 "The language of the coast tribes is half Basque": A Basque-American Indian pidgin in use between Europeans and Native Americans in North America ca. 1540-ca. 1640. *Anthropological Linguistics* 31 (3-4):117-147.

Balée, W.
1999 Introduction. In *Advances in Historical Ecology*, edited by W. Balée, pp. 1-10. Columbia University Press, New York.

Banfield, A. W. F.
1974 *The mammals of Canada.* University of Toronto Press, Toronto.

Banfield, C. E.
1981 The Climatic Environment of Newfoundland. In *The Natural Environment of Newfoundland Past and Present*, edited by A. G. Macpherson and J. B. Macpherson, pp. 83-153. Dept. of Geography, Memorial University of Newfoundland, St. John's.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1993 The climate of Newfoundland. In *Climate and Weather of Newfoundland and Labrador*, edited by A. Robertson, S. Porter and G. Brodie, pp. 13-31. Creative Publishers, St. John's.

Barkham, S.

1978 The Basques: Filling a gap in our history between Jacques Cartier and Champlain. *Canadian Geographical Journal* 49 (1):8-19.

—

1980 A note on the Strait of Belle Isle during the period of Basque contact with Indians and Inuit. *Études/Inuit/Studies* 4(1-2):51-58.

Barlow, L. K.

2001 The time period A.D. 1400-1980 in central Greenland ice cores in relation to the North Atlantic sector. *Climatic Change* 48:101-119.

Bellars, A. R. M.

1969 Veterinary studies of the British Antarctic Survey's Sledge Dogs: I. Survey of diseases and accidents. *British Antarctic Survey Bulletin* 21:1-18.

Bellars, A. R. M. and M. F. Godsal

1969 Veterinary studies on the British Antarctic Survey's Sledge Dogs: II. Occupational Osteoarthritis. *British Antarctic Survey Bulletin* 22:15-38.

Bigelow, G. F.

1984 *Subsistence in Late Norse Shetland: An investigation into a northern island economy.* Unpublished Ph.D. Thesis, Cambridge University.

Bigg, M. A.

1981 Harbour Seal: *Phoca vitulina* Linnaeus, 1758 and *Phoca largha* Pallas, 1811. In *Handbook of Marine Mammals Volume 2: Seals*, edited by S. H. Ridgway and R. J. Harrison. Academic Press, New York.

Binford, L. R.

1978 *Nunamuit Ethnoarchaeology.* Academic Press, New York.

—

1980 Willow smoke and dog's tails: hunter-gatherer settlement systems and archaeological site formation. *American Antiquity* 45 (1):1-17.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

1991 When the going gets tough, the tough get going: Nunamuit local groups, camping patterns and economic organization. In *Ethnoarchaeological Approaches to Mobile Campsites: Hunter-Gatherer and Pastorialist Case Studies*, edited by C. S. Gamble and W. A. Boismier. vol. 1. International Monographs in Prehistory, Ethnoarchaeological Series, Ann Arbour.

Binford, L. R.
2001 *Constructing frames of reference: an analytical method for archaeological theory building using hunter-gatherer and environmental data sets.* University of California Press, Berkeley.

Bintliff, J.
1991 The contribution of an *Annaliste*/Structural History approach to Archaeology. In *The Annales School and Archaeology*, edited by J. Bintliff, pp. 1-33. New York University Press, New York.

Bird, J.
1945 Archaeology of the Hopedale area, Labrador. *Anthropological Papers of the American Museum of Natural History* 39 (2).

Birket-Smith, K.
1928 The Greenlanders of the present day. In *Greenland*, edited by M. Vahl, G. C. Amdrup, L. Bobé and A. S. Jensen, pp. 1-208. vol. II: The Past and Present Population of Greenland. C. A. Reitzel, Copenhagen.

Boas, F.
1964 The Central Eskimo. In *Sixth Annual Report of the Bureau of Ethnology.* Bison Books Edition ed. University of Nebraska Press, Lincoln.

Böcher, J. and B. Fredskild
1993 Plant and arthropod remains from the Palaeo-Eskimo site on Qeqertasussuk, West Greenland. *Meddelelser om Grønland Geoscience* 30.

Boles, B. K., G. J. Chaput and F. R. Phillips
1980 *Offshore Labrador Biological Studies, 1979: Seals. A study and review of the distribution of pinnipeds in Labrador.* Atlantic Biological Services Ltd., for Total Eastcan Explorations.

Bowen, W. D., D. E. Sergeant and T. Ørtisland
1983 Validation of age estimation in the Harp Seal, *Phoca groenlandica*, using dental annuli. *Canadian Journal of Fisheries and Aquatic Sciences* 40:1430-1441.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Brain, J. A.
1979 *Tunica Treasure*. Papers of the Peabody Museum of Archaeology and Ethnology 71, Harvard University, Cambridge.

Braudel, F.
1972 *The Mediterranean in the Age of Phillip II*. Translated by S. Matthews. 2 Vols. Harper and Row, New York.

Brice-Bennett, C.
1977 Land use in the Nain and Hopedale Regions. In *Our Footprints are Everywhere: Inuit Land Use and Occupancy in Labrador*, edited by C. Brice-Bennett, pp. 97-203. Labrador Inuit Association, Nain, Newfoundland and Labrador.

—
1978 *Offshore Labrador Biological Studies, 1978: An overview of the occurrence of Cetaceans along the Labrador Coast*. Atlantic Biological Services Ltd., for Total Eastcan Explorations. M79-252.

—
1981 *Two Opinions: Inuit and Moravian Missionaries in Labrador, 1804-1860* Unpublished M.A. Thesis. Department of Anthropology, Memorial University of Newfoundland.

—
1990 Missionaries as Traders: Moravians and the Inuit, 1771-1860. In *Merchant Credit and Labour Strategies in Historical Perspective*, edited by R. E. Ommer, pp. 223-246. Acadiensis Press, Fredericton.

Briffa, K. R., T. J. Osborn, F. H. Schweingruber, I. C. Harris, P. D. Jones, S. G. Shiyatov and E. A. Vaganov
2001 Low-frequency temperature variations from a northern tree ring density network. *Journal of Geophysical Research* 106(D3):2929-2941.

Brumfiel, E. M.
1992 Distinguished lecture in Archaeology: Breaking and entering the ecosystem - gender, class, and faction steal the show. *American Anthropologist* 94:551-567.

—
1994 Factional competition and political development in the New World: an introduction. In *Factional Competition and Political Development in the New World*, edited by E. M. Brumfiel and J. W. Fox, pp. 3-13. New Directions in Archaeology. Cambridge University Press, Cambridge.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Buckland, P., T. Amorosi, L. K. Barlow, A. J. Dugmore, P. A. Mayewski, T. McGovern, A. E. J. Ogilvie, J. P. Sadler and J. M. Skidmore
1996 Bioarchaeological and climatological evidence for the fate of Norse farmers in medieval Greenland. *Antiquity* 70:88-96.

Buckland, P. C., G. Sveinbjarnardottir, D. Savory, T. H. McGovern, J. M. Skidmore and C. Andreasen
1983 Norsemen at Nipaitsoq, Greenland: a palaeoecological review. *Norwegian Archaeological Review* 16 (2):86-98.

Bunn, H. T. and E. Kroll
1986 Patterns of skeletal representation and hominid subsistence activities at Olduvai Gorge, Tanzania, and Koobi Fora, Kenya. *Journal of Human Evolution* 15:673-690.

Burns, J. J.
1981 Bearded Seal: *Erignathus barbatus* Erxleben, 1777. In *Handbook of Marine Mammals Volume 2: Seals*, edited by S. Ridgway, H. and R. J. Harrison, pp. 145-170. Academic Press, New York.

Bursey, B. and B. R. LeDrew
1977 *Seabird observations from fall and winter cruises in the Labrador Sea.* C-CORE Technical Report No. 77-29. Centre for Cold Ocean Resources Engineering, Memorial University of Newfoundland, St. John's.

Busch, B. C.
1985 *The war against the seals: A history of the North American seal fishery.* McGill-Queen's University Press, Kingston and Montreal.

Cabak, M.
1991 *Inuit women as catalysts of change: An archaeological study of 19th century northern Labrador.* Unpublished M.A. Thesis, University of South Carolina.

Calvert, W.
n.d. *Histological techniques for age determination of tooth cementum.* Canadian Wildlife Service. Submitted to Report in possession of the author.

Canadian Hydrographic Service (C.H.S.)
1988 *Sailing directions: Labrador and Hudson Bay.* Sixth Edition ed. Department of Fisheries and Oceans, Ottawa.

Canadian Ice Service (C.I.S.)
2001 *Sea ice climatic atlas, east coast of Canada, 1971-2000.* Minister of Public Works and Government Services of Canada, Ottawa.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

2002 *Sea ice climatic atlas: northern Canadian waters 1971-2000.* Minister of Public Works and Government Services of Canada, Ottawa.

Canadian Soil Survey Committee (C.S.S.C)
1978 *The Canadian system of soil classification* Publication 1674. Research Branch Canada Department of Agriculture, Ottawa.

Cartwright, G.
1792 *A Journal of Transactions and Events during a residence of nearly sixteen years on the coast of Labrador; containing many interesting particular, both of the country and its Inhabitants not hitherto known.* 3 vols. Allin and Ridge, Newark.

Chambers, A. L.
1992 *Seal bone mineral density: Its effect on specimen survival in archaeological sites.* Unpublished B.A. Honors Thesis, University of Missouri.

Clermont, N.
1980 Les Inuit du Labrador méridional avant Cartwright. *Études/Inuit/Studies* 4 (1-2):148-166.

Cote, P. W.
1992 *Ice Thickness Climatology, 1961-1990 Normals* En57-28. Ice Climatology Services, Environment Canada, Ottawa.

Cox, S.
1977 *Prehistoric settlement and culture change at Okak, Labrador.* Unpublished Ph.D. Dissertation, Harvard University.

Cox, S. and A. Spiess
1980 Dorset settlement and subsistence in northern Labrador. *Arctic* 33 (3):659-699.

Crabtree, P.
1990 Zooarchaeology and complex societies: some uses of faunal analysis for the study of trade, social status and ethnicity. In *Archaeological Method and Theory, Vol. 2.*, edited by M. B. Schiffer. vol. Vol. 2. University of Arizona Press, Tucson, Arizona.

Crane, R. G.
1978 Seasonal variations of sea ice extent in the Davis Strait-Labrador sea area and relationships with synoptic-level atmospheric circulation. *Arctic* 31 (4):434-447.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Crantz, D.
1820 *The History of Greenland; Including a history of the mission carried on by the United Brethren in that country.* 2 vols. Longman, Hurst, Rees, Orme and Brown, London.

Crumley, C. L.
1994 Historical Ecology: A multidimensional ecological orientation. In *Historical Ecology: Cultural Knowledge and Changing Landscapes*, edited by C. Crumley, pp. 1-16. School of American Research Press, Santa Fe.

—
1999 Foreword. In *Advances in Historical Ecology*, edited by W. Balée, pp. ix-xiv. Columbia University Press, New York.

Cuffey, K. M., R. B. Alley, P. M. Grootes, J. F. Bolzan and S. Ananskrishnan
1994 Calibration of the $\partial^{18}O$ isotopic paleothemometer for central Greenland, using borehole temperatures. *Journal of Glaciology* 40:341-349.

D'Arrigo, R. D., E. R. Cook and G. C. Jacoby
1996 Annual to decadal-scale variations in northwest Atlantic sector temperatures inferred from Labrador tree rings. *Canadian Journal of Forestry Research* 26:143-148.

D'Arrigo, R. D. and G. C. Jacoby (editors)
1992 *Dendroclimatic evidence from northern North America.* Routledge, London.

—
1993 Secular trends in high northern-latitude temperature reconstructions based on tree rings. *Climatic Change* 25:163-177.

Dahl-Jensen, D., K. Mosegaard, N. Gundestrup, G. D. Clow, S. J. Johnsen, A. W. Hansen and N. Balling
1998 Past temperatures directly from the Greenland Ice Sheet. *Science* 282:268-271.

Damas, D.
1968 The diversity of Eskimo societies. In *Man the Hunter*, edited by R. B. Lee and I. Devore, pp. 111-117. Aldine, Chicago.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Dansgaard, W., S. J. Johnsen, H. Clausen, D. Dahl-Jensen, N. Gundestrup, C. U. Hammer, C. S. Hvidberg, J. P. Steffensen, A. E. Sveinbjörnsdóttir, J. Jouzel and G. C. Bond
1993 Evidence for general instability of past climate from a 250 yr ice-core record. *Nature* 264:218-220.

Dansgaard, W., S. J. Johnsen, J. Moller and C. Langway, Jr.
1969 One Thousand Years of a climate record from Camp Century on the Greenland Ice Sheet. *Science* 166:377-381.

Dansgaard, W., S. J. Johnsen, N. Reeh, N. Gundestrup, H. Clausen and C. U. Hammer
1975 Climatic changes, Norsemen and modern man. *Nature* 255:24-28.

Dansgaard, W., S. J. Johnson and H. Clausen
1970 Grønlands Klima - Før, Nu og 50 aar Frem. *Grønland* 6(161-172).

Dansgaard, W., J. White and S. J. Johnsen
1989 The abrupt termination of the Younger Dryas climate event.

Davis, D. S.
1976 *Periwinkles*. The Nova Scotia Museum, Halifax, N.S.

Deitz, R., M.-P. Heide-Jørgensen, T. Härkönen, J. Teilmann and N. Valentin
1978 Age Determination of European Harbour Seal, *Phoca vitulina L. Sarsia* 76:17-21.

Department of Forest Resources and Agrifoods (D.F.R.A.)
2002 *Ecoregions of Labrador*. Government of Newfoundland and Labrador. http://www.gov.nf.ca/forestry/maps/eco_lab_regions.asp#5;

Dunbar, M. J.
1981 Physical causes and biological significance of polynyas and other open water areas in sea ice. In *Polynyas in the Canadian Arctic*, edited by I. Stirling and H. Cleator, pp. 29-40. Occasional Paper No. 45 Canadian Wildlife Service. Environment Canada, Ottawa.

Dyke, A. S., J. Hooper and J. M. Savelle
1996 A history of sea ice in the Canadian Arctic Archipelago based on postglacial remains of the bowhead whale (*Balaena mysticetus*). *Arctic* 49 (3):235-255.

Egede, H.
1818 *A Description of Greenland*. T. and J. Allman, London.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1926 Det gamle Grønlands nye perlustration. *Norge og Grønland* No. 1. A. W. Broggers Boktrykkeris Forlag, Oslo.

Ellen, R.

1982 *Environment, Subsistence and System: The ecology of small-scale social formations*. Cambridge University Press, Cambridge.

Elton, C. S. and P. Ashburner

n.d. Extracts from the Periodical Accounts of the Moravian Missions 1791 onwards. Manuscript on file with the New York Zooarchaeological Society, pp. 174, New York.

Ericson, P. G. P. and J. Storå

1999 *A manual to the skeletal measurements of the seal genera Halichoerus and Phoca (Mammalia: Pinnipedia)*. Department of Vertebrate Zoology, Swedish Museum of Natural History.

Evans, H. E.

1993 Chapter 4: The Skeleton. In *Anatomy of the Dog*, edited by H. E. Evans, pp. 122-218. vol. 3rd. W.B. Saunders, Philadelphia.

Fallou, L.

1997 *Le Bouton Uniforme Français (De l'Ancien-Regime à Fin Juillet 1914)*. Éditions du Canonnier, Talmont-Saint-Hilaire.

Farmer, G.

1981 The Cold Ocean Environment of Newfoundland. In *The Natural Environment of Newfoundland Past and Present*, edited by A. G. Macpherson and J. B. Macpherson, pp. 56-82. Dept. of Geography, Memorial University of Newfoundland, St. John's.

Finley, K. J., G. W. Miller, R. A. Davis and W. R. Koski

1983 A distinctive large breeding population of Ringed Seals (*Phoca hispida*) Inhabiting the Baffin Bay pack ice. *Arctic* 36(2):162-173.

Fisher, D. A. and R. M. Koerner

1994 Signal and noise in four ice core records form the Aggasiz Ice Cap, Ellesmere Island, Canada: Details of the last millennium for stable isotopes, let and solid conductivity. *The Holocene* 4(2):113-120.

Fisher, H. D.

1954 *Studies on reproduction in the harp seal Phoca groenlandica Erxleben in the Northwest Atlantic*. Fisheries Research Board of Canada MS Report No. 588, Ottawa.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Fitzhugh, W. W.

1972 *Environmental Archaeology and Cultural Systems in Hamilton Inlet, Labrador: A survey of the central Labrador coast from 3000 B.C. to the present.* Smithsonian Contributions to Archaeology No. 16. Smithsonian Institution Press, Washington, D.C.

—

1977 Indian and Eskimo/Inuit settlement history in Labrador: An archaeological view. In *Our Footprints are Everywhere: Inuit Land Use and Occupancy in Labrador*, edited by C. Brice-Bennett, pp. 1-41. Labrador Inuit Association, Nain, Newfoundland and Labrador.

—

1978 Maritime Archaic cultures of the central and northern Labrador Coast. *Arctic Anthropology* 15 (2):61-95.

—

1980 Preliminary report on the Torngat Archaeology Project. *Arctic* 33 (3):585-606.

—

1984 Subsistence pattern development in the Labrador Maritime Archaic: Longhouse models and 1983 surveys. In *Archaeology in Newfoundland and Labrador - 1983, Annual Report No. 4.*, edited by J. S. Thomson and C. Thomson. Historic Resources Division, Department of Culture, Recreation and Youth, Government of Newfoundland and Labrador, St. John's.

—

1985 Commentary. In *Cultures in Contact: The European impact on native cultural institutions in eastern North America, A.D. 1000-1800*, edited by W. W. Fitzhugh. Anthropological Society of Washington Series. Smithsonian Institution Press., Washington D.C.

—

1994 Staffe Island I and the northern Labrador Dorset-Thule succession. In *Threads of Arctic Prehistory: Papers in honour of William E. Taylor, Jr.*, edited by D. Morrison and J.-L. Pilon, pp. 239-268. Archaeological Survey of Canada Mercury Series Paper No. 149. Canadian Museum of Civilization, Ottawa.

Fontaine, P.-H.

1998 Whales of the North Atlantic: Biology and Ecology. Éditions MultiMondes, Sainte-Foy, Québec.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Francis, P. J.
1994 *Beads of the world: a collector's guide with price reference.* Schiffer Publishing, Atglen, Pennsylvania.

—
2002 *The Bead Site.* Center for Bead Research. http://www.thebeadsite.com.

Freeman, M. R.
1984 Arctic Ecosystems. In *Handbook of North American Indians Volume 5: Arctic*, edited by D. Damas, pp. 36-48. Smithsonian Institution, Washington, D.C.

Freuchen, P. (editor)
1935 *Mammals: Part II. Field notes and biological observations.* Report of the Fifth Thule Expedition, 1921-1924. Vol. II No. 5.Copenhagen.

Frost, K. J. and L. F. Lowry
1981 Ringed, Baikal and Caspian Seals: *Phoca hispida* Schreber, 1775; *Phoca sibirica* Gmelin, 1788 and *Phoca caspica Gmelin, 1788.* In *Handbook of Marine Mammals Volume 2: Seals*, edited by S. Ridgway and R. J. Harrison, pp. 29-53. Academic Press, New York.

Gautier, A.
1984 How do I count you, let me count the ways? Problems of archaeozoological quantification. In *Animals in Archaeology Vol. 4: Husbandry in Europe*, edited by C. Grigson and J. Clutton-Brock, pp. 237-251. vol. No. 227. British Archaeological Reports International Series, Oxford.

Gesner, P.
2000 *HMS Pandora project-a report on Stage 1: Five seasons of excavation.* Memoirs of the Queensland Museum, Cultural Heritage Series Vol. 2 Part 1. Queensland Museum, Brisbane.

Gilbert, A., A. Aitken and B. McLaughlin
1982 *Offshore Labrador Biological Studies, 1979: A biophysical survey of coastal environments in the vicinity of Nain, Labrador.* Queen's University, for Petro-Canada Exploration, Inc.

Gilbert, A. and B. Singer
1982 Reassessing zooarchaeological quantification. *World Archaeology* 14(1):21-40.

Gilbert, B. M.
1993 *Mammalian Osteology.* Missouri Archaeology Society, Columbia, Mo.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Gilchrist, H. G. and G. J. Robertson
2000 Observations of marine birds and mammals wintering at polynyas and ice edges in the Belcher Islands, Nunavut, Canada. *Arctic* 53 (1):61-68.

Godden, G. A.
1966 *British pottery and porcelain, An illustrated encyclopedia of marked specimens*. Crown Publishers, New York.

Goodwin, E. A. and W. B. Ballard
1985 Use of tooth cementum for age estimation of gray wolves. *Journal of Wildlife Management* 49 (2):313-316.

Gordon, B. C.
1984 Selected bibliography of dental annular studies on various mammals. *Zooarchaeological Research News Supplement No. 2*:1-24.

Gosling, W. G.
1910 *Labrador: It's discovery, exploration, and development*. The Musson Book Company Limited, Toronto.

Gosner, K.
1978 *A field guide to the Atlantic seashore*. Peterson Field Guides 24. Houghton Miflin Company, Boston.

Grayson, D. K.
1981 A critical view of the use of archaeological vertebrates in palaeoenvironmental reconstruction. *Journal of Ethnobiology* 1 (1):28-38.

—
1984 *Quantitative Zooarchaeology: Topics in the analysis of archaeological faunas*. Studies in Archaeological Science. Academic Press, New York.

Grenfell, W.
1913 *Labrador, The country and the people*. MacMillan Company., New York.

GRIP Members
1993 Climate instability during the last interglacial period recorded in the GRIP Ice core. *Nature* 364:203-207.

Grønnow, B.
1994 Qeqertasussuk - The archaeology of a frozen Saqqaq site in Disko Bugt, West Greenland. In *Threads of Arctic Prehistory: Papers in honour of William E. Taylor, Jr. Mercury Series Paper 149*, edited by D. Morrison and J. Pilon. Archaeological Survey of Canada, Museum of Civilization, Ottawa.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Grønnow, B., M. Meldgaard and J. B. Nielsen
1983 Aasivissuit - The Great Summer Camp. Archaeological, ethnographical and zoo-archaeological studies of a caribou-hunting site in West Greenland. *Meddelelser om Grønland Man and Society No. 5.*

Grønnow, B. a. M. M. e.
1991 Qeqertasussuk. De første mennesker i Vestgrønland. *Tidsskriftet Grønland* 39:4-7.

Grootes, P. M., M. Stuiver, J. White, S. J. Johnsen and J. Jouzel
1993 Comparison of oxygen isotope records from the GISP2 and GRIP Greenland ice cores. *Nature* 366:552-554.

Grove, J.
1988 *The Little Ice Age.* Methuen, London.

Grove, J.
2001 The initiation of the "Little Ice Age" in regions round the North Altantic. *Climatic Change* 48:5382.

Grue, H.
1976 Non-seasonal incremental lines in tooth cementum of domestic dogs (*Canis familiaris* L.). *Danish Review of Game Biology* 10(2):2-8.

Grue, H. and B. Jensen
1973 Annular structures in canine tooth cementum in Red Foxes (Vulpes vulpes L.) of known age. *Danish Review of Game Biology* 8(7):3-12.

—
1976 Annual cementum structures in canine teeth in Arctic Foxes (*Alopex lagopus* L.) from Greenland and Denmark. *Danish Review of Game Biology* 10(3):3-11.

—
1979 Review of the formation of incremental lines in tooth cementum of terrestrial mammals. *Danish Review of Game Biology* 11(3):3-44.

Grumet, N.
1997 *Glaciochemical investigations of the last 1,000 years from the Penny Ice Cap, Baffin Island.* Unpublished M. Sc. Thesis, University of New Hampshire.

Grumet, N. S., C. P. Wake, P. A. Mayewski, G. A. Zielinski, S. I. Whitlow, R. M. Koerner, D. A. Fisher and J. M. Woollett
2001 Variability of sea-ice extent in Baffin Bay over the last millennium. *Climatic Change* 49:129-145.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Gullason, L.
1999 *Engendering Interaction: Inuit-European contact in Frobisher Bay, Baffin Island.* Unpublished Ph.D. Dissertation, McGill University.

Gulløv, H. C.
1982 Migration et diffusion – Le peuplement Inuit de l'ouest du Groënland à l'époque post-médievale. Études/Inuit/Studies 6(2): 3-20).

—
1985 Whalers, Whales and Eskimos: The impact of European whaling on the demography and economy of Eskimo society in West Greenland. In *Cultures in Contact: The European Impact on Native Cultural Institutions in Eastern North America, A.D. 1000-1800*, edited by W. W. Fitzhugh, pp. 46-71. Smithsonian Insititution Press, Washington, D.C.

—
1995 "Olden Times" in southeast Greenland: New archaeological investigations and oral traditions. *Études/Inuit/Studies* 19(1):3-36.

—
1997 *From Middle Ages to Colonial Times: Archaeological and ethnohistorical studies of the Thule culture in South West Greenland 1300-1800 AD.* Meddelelser om Grønland Man and Society 23.

Gustajtis, K. A.
1979 Oceanography and climatology of the Labrador Sea. In *Oil Spill Scenario for the Labrador Sea*, edited by B. R. LeDrew and K. A. Gustajtis, pp. 81-148. Research and Development Division, Environmental Emergency Branch, Environmental Impact Control Directorate, Environmental Protection Service Department of the Environment, Government of Canada, Ottawa.

Habermehl, K.-H.
1961 *Die Altersbestimmung bei Haustieren, Pelztieren und beim jagdbaren Wild.* Paul Parey in Berlin und Hamburg, Berlin.

Hall, E. R. and K. R. Kelson
1959 *The mammals of North America* Vols. 1 and 2. The Ronald Press Co., New York.

Hallock, C.
1861 Three months in Labrador. *Harper's New Monthly Magazine* 22(81):577-579, 743-765.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Hantzsch, B.
1931 Contributions to the knowledge of extreme north-eastern Labrador. *The Canadian Field-Naturalist* XLV(49-224).

—
1932 Contributions to the knowledge of extreme north-eastern Labrador. *The Canadian Field-Naturalist* XLVI:7-162.

Harington, C. R.
1968 *Denning habits of the Polar Bear (Ursus maritimus Phipps).* Canadian Wildlife Service Report Series No. 5. Environment Canada, Ottawa.

Harper, F.
1961 *Land and fresh-water mammals of the Ungava peninsula.* Miscellaneous Publication No. 27. University of Kansas Museum of Natural History, Lawrenceville.

Harwood, L. A., T. G. Smith and H. Melling
2000 Variation in reproduction and body condition of the Ringed Seal (*Phoca hispida*) in western Prince Albert Sound, NT, Canada, as assessed through a harvest-based sampling program. *Arctic* 53 (4):422-431.

Hawkes, E. W.
1916 *The Labrador Eskimo.* Geological Survey Memoir No. 91. Government Printing Bureau, Ottawa.

Hayden, B.
1990 Nimrods, Piscators, Pluckers and Planters: The emergence of food production. *Journal of Anthropological Archaeology* 9 (1):31-69.

—
1995 Pathways to power: Principles for creating socioeconomic inequalities. In *Foundations of Social Inequality*, edited by T. D. Price and G. M. Feinman, pp. 15-85. Plenum, New York.

Heitzmann, R.
1980 *The Cochrane Ranche site.* Archaeological Survey of Alberta Occasional Paper No. 16. Archaeological Survey of Alberta, Edmonton.

Hennet, P.
1995 Dental anatomy and physiology of small carnivores. In *Manual of Small Mammal Dentistry*, edited by D. A. Crossley and S. Penman, pp. 93-104. Second ed. British Small Animal Veterinary Association, Shurdington, Cheltenham.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Henshaw, A. S.
1995 *Central Inuit household economies: Zooarchaeological, environmental, and historical evidence from outer Frobisher Bay, Baffin Island, Canada.* Unpublished Ph.D. Dissertation, Harvard University.

Hesse, B. and D. Perkins
1974 Faunal remains from Karatas-Semayük in Southwest Anatolia: An interim report. *Journal of Field Archaeology* 1:149-160.

Hickey, C. G.
1984 An examination of processes of cultural change among Nineteenth Century Copper Inuit. *Études/Inuit/Studies* 8 (1):13-35.

Hiller, J. K.
1968 *The Foundation and Early Years of the Moravian Mission of Labrador, 1752-1805.* Unpublished Ph.D. Thesis, Memorial University of Newfoundland.

Hillson, S.
1986 *Teeth.* Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

—
1996 *Dental Anthropology.* Cambridge University Press, Cambridge.

Hodder, I.
1982 *Symbols in Action: Ethnoarchaeological Studies of Material Culture.* Cambridge University Press, Cambridge.

Holm, G.
1914 Ethnological Sketch of the Angmagsalik Eskimo. *Meddelelser om Grønland* 39 (1):4-147.

Hood, B.
1993 The Maritime Archaic Indians of Labrador: Investigating Prehistoric Social Organization. *Newfoundland Studies* 9 (2):163-184.

Hume, I. N.
1984 *A Guide to Artifacts of Colonial America.* First Vintage Books Edition, New York.

Hurrell, J. W.
2002 *Winter NAO Index, 1963-1993.* University Corporation for Atmospheric Research, Climate and Global Dynamics Division. www.cgd.ucar.edu/~hurrell/nao.html2

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1995 Decadal Trends in the North Atlantic Oscillation: Regional Trends and Precipitation. *Science* 269(4):676-679.

Hurrell, J. W. and H. Van Loon

1997 Decadal Variation in Climate Associated with the North Atlantic Oscillation. *Climatic Change* 36:301-326.

Hutton, S. K.

1912 *Among the Eskimos of Labrador: A record of five years close intercourse with the Eskimo tribes of Labrador.* Seeley, Service & Co., London.

Jacobs, J. D., R. G. Barry and R. L. Weaver

1975 Fast Ice characteristics, with special reference to the eastern Canadian Arctic. *Polar Record* 17 (110):521-536.

Jacoby, G. C. and R. D. D'Arrigo

n.d. *Unpublished analysis of tree ring records from Salt Water Pond and Nutak, Okak Island, Labrador.* 2002. I.G.B.P. PAGES/World Data Center for Paleoclimatology Data Contribution Series. N.O.A.A./N.G.D.C. Paleoclimatology Program, Boulder Colorado, U.S.A. www.ngdc.noaa.gov/paleo/sciencepub/front.htm

Johnsen, S. J., H. Clausen, W. Dansgaard, N. Gundestrup, C. U. Hammer, K. K. Andersen, C. S. Hvidberg, D. Dahl-Jensen, J. P. Steffensen, H. Shoji, A. E. Sveinbjörnsdóttir, J. White, J. Jouzel and D. A. Fisher

1997 The $\partial^{18}0$ record along the Greenland Ice Core Project deep ice core and the problem of possible Eemian climatic instability. *Journal of Geophysical Research* 102:26397-26410.

Johnson, M.

1999 *Archaeological Theory: An Introduction.* Blackwell Publishing Ltd., Oxford.

Jones, A. K. G.

1982 Bulk-sieving and the recovery of fish remains from urban archaeological sites. In *Environmental Archaeology in the Urban Context*, edited by A. R. Hall and H. K. Kenward, pp. 79-85. CBA Research Report No. 43, London.

Jordan, R. H.

1974 Preliminary report on investigations of the Labrador Eskimo in Hamilton Inlet in 1973. *Man in the Northeast* 8 (1):77-89.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1975 Pollen diagrams from Hamilton Inlet, central Labrador and their environmental implications for the northern Maritime Archaic. *Arctic Anthropology* XII(2):92-116.

—

1977 Inuit occupation of the central Labrador coast since 1600 AD. In *Our Footprints are Everywhere: Inuit Land Use and Occupancy in Labrador*, edited by C. Brice-Bennet, pp. 43-48. Labrador Inuit Association, Nain, Newfoundland and Labrador.

1978 Archaeological investigations of the Hamilton Inlet Labrador Eskimo: Social and economic responses to contact. *Arctic Anthropology* 15 (2):175-185.

—

n.d. *Field notes of excavations at Eskimo Island, Double Mer and Snooks Cove, Labrador. 1973-1975.* Unpublished report on file at the Peary-MacMillan Arctic Museum and Arctic Studies Center, Bowdoin College., Brunswick, Maine.

Jordan, R. H. and S. A. Kaplan

1980 An archaeological view of the Inuit/European contact period in central Labrador. *Études/Inuit/Studies* 4 (1-2):35-45.

Jouzel, J., R. B. Alley, K. M. Cuffey, W. Dansgaard, P. M. Grootes, G. Hoffmann, S. J. Johnsen, R. D. Koster, D. Peel, C. A. Shuman, M. Stievenard, M. Stuiver and J. White

1997 Validity of temperature reconstructions from water isotopes in ice cores. *Journal of Geophysical Research* 102 (C12):26471-26487.

Julien, M.

1979 *Analyse preliminaire du materiel osseaux provenant du site Nunainguq 1 (KIL.3-A) saison 1978. Annex III.* Report of the Nunainguq Misison 78 (KIL.3) - JcDe-1, Henry Stewart, ed. Report on File, Laboratoire d'Archaeologie de l'Université Québec à Montréal.

Kaplan, S. A.

1980 Neo-Eskimo occupations of the northern Labrador Coast. *Arctic* 33 (3):646-658.

—

1983 *Economic and social change in Labrador Neo-Eskimo culture.* Unpublished Ph.D. Dissertation, Bryn Mawr College.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1985a European goods and socio-economic change in early Labrador Inuit society. In *Cultures in contact: The European impact on native cultural institutions in eastern North America, A.D. 1000-1800*, edited by W. W. Fitzhugh, pp. 45-70. Smithsonian Institution Press, Washington D.C.

—

1985b Early Neoeskimo sites in central Labrador. In *Archaeology in Newfoundland and Labrador 1984, Annual Report No. 5*, edited by J. Sproull Thomson and C. Thomson, pp. 15-47. Historical Resources Division, Department of Culture, Recreation and Youth, St. John's.

Kaplan, S. A. and K. J. Barsness

1986 *Raven's Journey: The world of Alaska's native people.* The University Museum, University of Pennsylvania, Philadelphia.

Kaplan, S. A. and J. M. Woollett

2000 Challenges and choices: Exploring the interplay of climate, history, and culture on Canada's Labrador Coast. *Arctic, Antarctic and Alpine Research* 32 (3):351-359.

Karklins, K.

1975 Seventeenth-century Dutch beads. *Historical Archaeology* 8:64-82.

—

1992 *Trade ornament usage among the native peoples of Canada: a source book.* Studies in Archaeology, Architecture and History. National Historic Sites, Parks Service. Environment Canada, Ottawa.

Kasper, J. C.

1980 *Skeletal identification of California sea lions and Harbor Seals for archaeologists.* Ethnic Technology Notes No. 17. San Diego Museum of Man, San Diego.

Katona, S., K., V. Rough and D. Richardson

1993 *A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland.* Fourth Edition ed. Smithsonian Institution Press, Washington, D.C.

Kelly, R. L.

1995 *The foraging spectrum: Diversity in hunter-gatherer lifeways.* Smithsonian Institution Press, Washington, D.C.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Kidd, K. E. and M. A. Kidd
1970 A classification system for glass beads for the use of field archaeologists. In *Canadian Historical Sites: Occasional Papers in Archaeology and History*, pp. 45-89. vol. 1. Parks Canada, Ottawa.

Kindle, E. M.
1924 *Geography and geology of the Lake Melville district, Labrador peninsula.* Geological Survey Memoir No. 141; No. 120, Geological Series. Canada Department of Mines, Ottawa.

King, J.
1964 *Seals of the world.* British Museum of Natural History, London.

Klein, R. G. and K. Cruz-Uribe
1984 *The analysis of animal bones from archaeological sites.* University of Chicago Press, Chicago.

Kleivan, H.
1966 The Eskimos of northeast Labrador. *Norske Polarinstitutt Skrifter* 139.

Klevezal, G. A.
1996 *Recording structures of mammals.* Translated by M. V. Minna and A. V. Oreshkin. A. A. Balkema, Rotterdam.

Klevezal, G. A. and S. E. Kleinenberg
1967 *Age determination of mammals by layered structures in teeth and bone.* Fisheries Research Board of Canada Translation Series No. 1024, 1969. Available from Canada Institute for Scientific and Technical Information, National Research Council, Ottawa, Ontario, Canada, KIA 0S2.

Klevezal, G. A. and L. I. Sukhovskaya
1988 *The causes of differences in the optical density of dentine layers in mammalian teeth.* Fisheries Research Board of Canada Translation Series No. 5357, 1988. Available from Canada Institute for Scientific and Technical Information, National Research Council, Ottawa, Ontario, Canada, KIA 0S2.

Kmoch, G.
1858 *Memoir of Br. George Kmoch, Missionary in Labrador; who departed this life at Ockbrook, December 21, 1857 in the 88th year of his age.* W. Mallalieu and Co., London.

Knapp, A. B.
1992 Archaeology and *Annales*: time, space and change. In *Archaeology, Annales and Ethnohistory*, edited by A. B. Knapp, pp. 1-21. Cambridge University Press, Cambridge.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Koerner, R. M.
1997 Devon Island Ice Cap: core stratigraphy and paleoclimate. *Science* 196:15-18.

Kolhmeister, B. and G. Kmoch
1814 *Journal of a voyage from Okkak on the coast of Labrador to Ungava Bay, westward of Cape Chudleigh.* W. M. McDowell, London.

Kupferschmidt, T.
n.d. *Preliminary analysis of animal remains from Skull Island 6, Structure 1, Labrador.* Unpublished Report on File, Peary-MacMillan Arctic Museum and Arctic Studies Center, Brunswick.

Lamb, H. F.
1980 Late Quaternary vegetational history of southeastern Labrador. *Arctic and Alpine Research* 12 (2):117-135.

—
1984 Modern pollen spectra from Labrador and their use in reconstructing Holocene vegetational history. *Journal of Ecology* 72:37-59.

—
1985 Palynological evidence for postglacial change in the position of the tree limit in Labrador. *Ecological Monographs* 55 (2):241-258.

Laws, R. M.
1962 Age determination of pinnipeds with special reference to growth layers in teeth. *Zeitschrift für Säugetierkunde* 27:129-146.

Lawson, J. W., G. D. Harrison and W. D. Bowen
1992 Factors affecting accuracy of age determinations in the harp seal, *Phoca groenlandica. Marine Mammal Science* 8 (2):169-171.

Leacock, E. and R. B. Lee
1982 Introduction. In *Politics and history in band societies*, edited by E. Leacock and R. B. Lee, pp. 1-19. Cambridge University Press, Cambridge.

Lee, R. B.
1988 Reflections on primitive communism. In *Hunters and Gatherers Vol I: History, evolution and social change*, edited by T. Ingold, D. Riches and J. Woodburn, pp. 252-268. Berg, Oxford.

Lein, J.
1985 *Wet and fat: Whales and seals of Newfoundland and Labrador.* Breakwater Books, St. John's.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Lentfer, J. W.
1982 Polar bear: *Ursus maritimus.* In *Wild Mammals of North America: Biology, Management, Economics*, edited by J. A. Chapman and G. A. Feldhammer, pp. 557-566. Johns Hopkins University Press, Baltimore.

Lieberman, D. E.
1994 The biological basis for seasonal increments in dental cementum and their application to archaeological research. *Journal of Archaeological Science* 21:525-539.

Loring, S. G.
1992 *Princes and princesses of ragged fame: Innu archaeology and ethnohistory in Labrador.* Ph.D. Thesis, University of Massachusetts.

—
1998 The Archaeology of Eskimo Hütte (IkDb-2): Inuit sovereignty in the Torngat. *Études/Inuit/Studies* 22 (2):53-76.

Low, A. P.
1896 *Report on explorations in the Labrador peninsula along the East Main, Koksoak, Hamilton and Manicuagan Rivers and portions of other rivers in 1892-93-94-95.* Geological Survey of Canada, Ottawa.

Lyman, R. L.
1994 *Vertebrate Taphonomy.* Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

Lyman, R. L., J. Savelle and P. Whitridge
1992 Derivation and application of a meat utility index for phocid seals. *Journal of Archaeological Science* 19:531-555.

MacRury, I. K.
1991 *The Inuit dog: Its provenance, environment and history.* Unpublished M. Phil. Thesis, Cambridge University.

Maggo, P.
1999 *Remembering the years of my life: Journeys of a Labrador Inuit hunter.* Social and Economic Studies No. 63. Memorial University of Newfoundland, St. John's.

Manning, T. H.
1974 *Variations in the skull of the Bearded Seal, Erignathus barbatus (Erxleben).* Biological Papers of the University of Alaska, Vol. 16, Fairbanks.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Mansfield, A. W.
1967 *The seals of Arctic and eastern Canada.* Fisheries Research Board of Canada Bulletin No. 137. Ottawa.

Marquardt, W. H. and C. Crumley
1987 Theoretical issues in the analysis of spatial patterning. In *Burgundian Landscapes in Historical Perspective*, edited by C. Crumley and W. Marquardt. Academic Press, San Diego.

Martijn, C. A.
1980 La présence Inuit sur la côte-nord du Golfe St-Laurent à l'époque historique. *Études/Inuit/Studies* 4((1-2)):105-125.

Mathiassen, T.
1927 *Archaeology of the Central Eskimo, the Thule Culture and its position within the Eskimo culture.* Report of the Fifth Thule Expedition, 1921-1924. No. 4. Glydendalske Boghandel, Nordisk Forlag, Copenhagen.

Maxwell, M. S.
1985 *Prehistory of the eastern Arctic.* Academic Press, New York.

Mayewski, P. A.
2002 *The Ice Chronicles: The quest to understand climate change.* University Press of New England, Hanover.

Mayewski, P. A., L. D. Meeker, M. S. Twickler, S. Whitlow, Q. Yang, W. B. Lyons and M. Prentice
1997 Major features and forcing of high latitude northern hemisphere atmospheric circulation using a 110,000 year long glaciochemical series. *Journal of Geophysical Research* 102(C12):26345-26366.

Mayewski, P. A., L. D. Meeker, S. Whitlow, M. S. Twickler, M. C. Morrison, P. Bloomfield, G. C. Bond, R. B. Alley, A. J. Gow, P. M. Grootes, D. A. Meese, M. Ram, K. C. Taylor and W. Wumkes
1994 Changes in atmospheric circulation and ocean ice cover over the North Atlantic during the last 41,000 years. *Science* 263:1747-1751.

McCann, T. S.
1993 Age determination. In *Antarctic Seals: Research Methods and Techniques*, edited by R. S. Laws, pp. 199-227. Cambridge University Press, Cambridge.

McCartney, A. P.
1977 *Thule Eskimo prehistory along northwestern Hudson Bay.* Archaeological Survey of Canada Mercury Series Paper No. 70. National Museum of Man, Ottawa.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

McCullough, K. M.
1989 *The Ruin Islanders: Early Thule pioneers in the eastern high Arctic.* Archaeological Survey of Canada, Mercury Series Paper 141. Canadian Museum of Civilization, Ottawa.

McGhee, R.
1969/70 Speculations on Climate Change and Thule Culture development. *Folk* 11/12:173-184.

—
1985 The Thule Village at Brooman Point, High Arctic Canada. *Archaeological Survey of Canada Mercury Series* No. 125. National Museum of Man, Ottawa.

McGovern, T.
1979 *Report of the faunal analysis of the Eskimo Island collections.* Unpublished Report in Possession of the Author.

—
1985 Contributions to the paleoeconomy of Norse Greenland. *Acta Archaeologica* 54:73-122.

McGovern, T. H.
1991 Climate, correlation and causation in Norse Greenland. *Arctic Anthropology* 12 (2):77-100.

McGovern, T. H., P. C. Buckland, D. Savory, G. Sveinbjarnardottir, C. Andreasen and J. M. Skidmore
1983 A study of the faunal and floral remains from two Norse farms in the Western Settlement, Greenland. *Arctic Anthropology* 20:93-120.

McLaren, I. A.
1958 *The biology of the ringed seal, Phoca hispida, in the eastern Canadian Arctic.* Fisheries Research Board of Canada Bulletin No. 118, Ottawa.

McLaren, P. L. and R. A. Davis
1982 *Offshore Labrador Biological Studies, 1982: Winter distribution of Arctic marine mammals in ice-covered waters of eastern North America.* LGL Limited, for Petro-Canada Exploration, Inc.

McManus, G. E. and C. H. Wood
1991 *Atlas of Newfoundland and Labrador.* Breakwater Books, St. John's.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Meldgaard, M.
1986 *The Greenland Caribou - Zoogeography, Taxonomy, and Population Dynamics*. Meddelelser om Grønland BioScience 20. Copenhagen.

Mertz, G., S. Narayanan and J. Helbig
1993 The freshwater transport of the Labrador Current. *Atmosphere-Ocean* 31(2):281-295.

Metcalfe, D. and K. T. Jones
1988 A reconsideration of animal body part utility indices. *American Antiquity* 53:486-504.

Meteorological Service of Canada (M.S.C.)
2002 Canadian Climate Normals. Environment Canada. http://www.msc-smc.ec.gc.ca/climate/climate_normals/show_normals_e.cfm

Miles, A. E. W. and C. Grigson
1991 *Colyer's variations and diseases of the teeth of animals*. Cambridge University Press, Cambridge.

Miller, F. L.
1982 Caribou: *Rangifer tarandus*. In *Wild animals of North America: Biology, management and economics*, edited by J. A. Chapman and G. A. Feldhammer, pp. 923-959. Johns Hopkins University Press, Baltimore.

Miquelon, D.
1979 Fornel, Louis. In *Dictionary of Canadian Biography*, edited by F. G. Halpenny, pp. 224-225. vol. III: 1741-1770. University of Toronto Press, Toronto.

Møhl, J.
1986 Dog remains from a paleoeskimo settlement in West Greenland. *Arctic Anthropology* 23(1-2):81-90.

Moore, S. E. and R. R. Reeves
1993 Distribution and Movement. In *The Bowhead Whale. Special Publication No. 2, The Society for Marine Mammology*, edited by J. J. Burns, J. J. Montague and C. J. Cowles, pp. 313-378.

Morrison, D.
1989 Radiocarbon Dating Thule Culture. *Arctic Anthropology* 26 (2):48-77.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Mysak, L. A., R. G. Ingram, J. Wang and A. van der Baaren
1996 The anomalous sea-ice extent in Hudson Bay, Baffin Bay and the Labrador Sea during three Simulataneous NAO and ENSO episodes. *Atmosphere-Ocean* 34(2):313-343.

Mysak, L. A., D. K. Manak and R. F. Marsden
1990 Sea-ice anomalies in the Greenland and Labrador Seas during 1901-1984 and their relation to an interdecadal Arctic climate cycle. *Climate Dynamics* 5:111-133.

Newell, J. P.
1983 Preliminary analysis of sea-ice conditions in the Labrador Sea during the nineteenth century. In *Climatic Change in Canada 3*, edited by C. R. Harrington, pp. 108-129. National Museums of Canada Syllogeus 49, Ottawa.

Newell, J. P.
1990 *Spring and summer sea ice and climate conditions in the Labrador Sea, 1800-present.* Unpublished Ph.D. Dissertation, University of Colorado.

—
1996 Sea-ice and atmospheric circulation anomalies in the Labrador Sea region associated with extremes of the Southern Oscillation. *Journal of Climatology* 16:63-71.

North Atlantic Bioarchaeology Organization (NABO)
2001 NABONE Zooarchaeological archive. Northern Science & Education Center, CUNY, New York.

Northland Associates Limited
1979 *Resource utilization and potential impact.* Research and Development Division, Environmental Emergency Branch, Environmental Impact Control Directorate, Environmental Protection Service Department of the Environment, Government of Canada. Ottawa.

O'Brien, S. R., P. A. Mayewski, L. D. Meeker, D. A. Meese, M. S. Twickler and S. I. Whitlow
1995 Complexity of Holocene climate as reconstructed from a Greenland ice core. *Science* 270:1962-1964.

O'Connor, T.
2000 *The archaeology of animal bones.* Texas A&M University Anthropology Series. Texas A&M University Press, College Station.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Ogilvie, A. E. J. and T. Jónsson
2001 "Little Ice Age" research: A perspective from Iceland. *Climatic Change* 48:9-52.

Oosten, J. G.
1986 "Big-Man" and Ihumatar: Personal power and leadership in Melanesia and the Canadian Arctic. In *Private Politics: A Multidisciplinary Approach to "Big-Man" Systems*, edited by M. van Bakel, R. Hagesteijn and P. van de Velde, pp. 67-75. Studies in Human Society Vol. 1. E.J. Brill, Leiden.

Overpeck, J., K. Hughen, D. Hardy, R. Bradley, R. Case, M. Douglas, B. Finney, K. Gajewski, G. C. Jacoby, A. Jennings, S. Lamoureux, A. Lasca, G. MacDonald, J. Moore, M. Retelle, S. Smith, A. Wolfe and G. A. Zielinski
1997 Arctic environmental change of the last four centuries. *Science*:1251-1256.

Packard, A. S.
1891 *The Labrador Coast: A journal of two summer cruises to that region.* N.D.C. Hodges, New York.

Paine, R.
1971 A theory of patronage and brokerage. In *Patrons and Brokers of the Eastern Arctic*, edited by R. Paine, pp. 8-21. Social and Economic Papers 2. Institute for Social and Economic Research. Memorial University of Newfoundland, St. John's.

Palmer, N.
1993 Bones and Joints. In *Pathology of Domestic Animals*, edited by K. V. F. Jubb, P. Kennedy and N. Palmer, pp. 1-181. Forth Edition ed. vol. 1. Academic Press, San Diego.

Paradiso, J. L. and R. M. Nowak
1982 Wolves: *Canis lupus* and allies. In *Wild animals of North America: Biology, management, economics*, edited by J. A. Chapman and G. A. Feldhammer, pp. 460-474. Johns Hopkins University Press, Baltimore.

Park, R. W.
1987 Dog remains from Devon Island, N.W.T.: Archaeological and osteological evidence for domestic dog use in the Thule culture. *Arctic* 40(3):184-190.

—
1988 "Winter Houses" and Qarmat in Thule and Historic settlement patterns: Some implications for Thule studies. *Canadian Journal of Archaeology* 12:163-175.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Petersen, R.
1974-75 Some considerations concerning the Greenland longhouse. *Folk* 16-17:171-188.

Peterson, I. K., S. J. Prinsenberg and P. Langille
2000 Sea ice fluctuations in the western Labrador Sea (1963-1998). *Canadian Technical Report of Hydrography and Ocean Sciences* 208:1-56.

Pope, P.
1997 The 16th-century fishing voyage. In *How Deep Is The Ocean? Historical Essays on Canada's Atlantic Fishery*, edited by J. E. Candow and C. Corbin, pp. 15-30. University College of Cape Breton Press, Sydney, Nova Scotia.

Power, S., B. and L. A. Mysak
1992 On the interannual variability of Arctic sea-level pressure and sea ice. *Atmosphere-Ocean* 30(4):551-577.

Price, T. D. and J. A. Brown
1985 Aspects of hunter-gatherer complexity. In *Prehistoric Hunter-Gatherers: The emergence of cultural complexity*, edited by T. D. Price and J. A. Brown. Academic Press, New York.

Prinsenberg, S. J. and I. K. Peterson
1992 Sea-ice properties off Labrador and Newfoundland during LIMEX '89. *Atmosphere-Ocean* 30(2):207-222.

Prinsenberg, S. J., I. K. Peterson, S. Narayanan and J. U. Umoh
1997 Interaction between atmosphere, ice cover and ocean off Labrador and Newfoundland from 1962 to 1992. *Canadian Journal Fisheries and Aquatic Science* 54(1):30-39.

Prowse, D. W.
1895 *A History of Newfoundland from the English, colonial and foreign Records*. MacMillan and Co., London.

Quimby, G. I.
1966 *Indian culture and European trade goods: The archaeology of the Historic period in the western Great Lakes region.* University of Wisconsin Press, Madison.

Rainey, F. G.
1947 The whale hunters of Tigara. In *Anthropological Papers of the American Museum of Natural History*, pp. 231-283. vol. 41(2), New York.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reeves, R. and R. L. Brownell, Jr.
1982 Baleen whales *Eubalaena glacialis* and allies. In *Wild animals of North America: Biology, management, economics*, edited by J. A. Chapman and G. Feldhammer, A., pp. 415-446. Johns Hopkins University Press, Baltimore.

Reeves, R. R. and J. K. Ling
1981 Hooded Seal *Cystophora cristata* Erxleben, 1777. In *Handbook of Marine Mammals Volume 2: Seals*, edited by S. Ridgway and R. J. Harrison, pp. 171-194. Academic Press, New York.

Reidman, M.
1993 *The pinnipeds: Seals, sea lions, and walruses.* University of California Press, Berkeley.

Reitz, E. J. and E. S. Wing
1999 *Zooarchaeology.* Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

Remmert, H.
1980 *Arctic animal ecology.* Springer-Verlag, Berlin.

Richling, B.
1978 *Hard Times, Them Times: An interpretive ethnohistory of Inuit and setters in the Hopedale district of northern Labrador, 1752-1977.* Unpublished Ph.D. Dissertation, McGill University.

—
1993 Labrador's "Communal House Phase" reconsidered. *Arctic Anthropology* 30(1):67-78.

Rick, A. M.
1980 Non-cetacean vertebrate remains from two Thule winter houses on Somerset Island, N.W.T. *Canadian Journal of Archaeology* 4:99-117.

Ridgway, S. H. and R. J. Harrison (editors)
1981 *Handbook of marine mammals Vol. 2: Seals.* Academic Press, New York.

Ringrose, T. J.
1993 Bone Counts and Statistics: A critique. *Journal of Archaeological Science* 20:121-157.

Rink, H.
1974 *Danish Greenland; Its people and products.* McGill-Queen's University Press, Montreal.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Roche, C., S. K. Pashar and R. D. Worsfold
1978 *Preliminary radar analysis, Lake Melville and offshore ice - February, 1977 - Field data report #13.* Centre for Cold Ocean Resources Engineering, Memorial University of Newfoundland. Copies available from C-CORE Publication 78 - 15.

Rogers, J. C.
1984 The association between the North Atlantic Oscillation and the Southern Oscillation in the Northern Hemisphere. *Monthly Weather Review* 112:1999-2015.

Rogers, J. C. and H. van Loon
1979 The seesaw in winter temperatures between Greenland and northern Europe. Part II: Some oceanic and atmospheric effects in middle and high latitudes. *Monthly Weather Review* 107:509-519.

Rollmann, H.
1985 Inuit shamanism and the Moravian Missionaries of Labrador: a textual agenda for the study of native Inuit religion. *Études/Inuit/Studies* 8 (2):131-138.

Ross, L. A.
1990 Trade beads from Hudson's Bay Company Fort Vancouver (1829-1860), Vancouver, Washington. *Beads* 2:29-67.

Saunders, D. e.
1989 The Spanish Flu. *Them Days* 14 (2):5-9.

Savelle, J. M.
1997 The role of architectural utility in the formation of zooarchaeological whale bone assemblages. *Journal of Archaeological Science* 24:869-885.

Savelle, J. M. and T. M. Friesen
1996 An Odonodete (Cetacea) meat utility index. *Journal of Archaeological Science* 23:713-721.

Savelle, J. M. and A. P. McCartney
1988 Geographical and temporal variation in Thule Eskimo subsistence economies. *Research in Economic Anthropology* 10:21-72.

—
1990 Prehistoric Thule Eskimo whaling in the Canadian Arctic islands: Current knowledge and future research directions. In *Canada's Missing Dimension: Science and History in the Canadian Arctic Islands*, edited by C. R. Harington. vol. II. Canadian Museum of Nature, Ottawa.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1994 Thule Inuit Bowhead whaling: A biometrical analysis. In *Threads of Arctic Prehistory: Papers in Honour of William E. Taylor Jr.*, edited by D. Morrison and J.-L. Pilon, pp. 281-310. Archaeological Survey of Canada Mercury Series No. 149. Canadian Museum of Civilization, Ottawa.

Schledermann, P.

1971 *The Thule tradition in northern Labrador.* Unpublished M.A. Thesis, Memorial University of Newfoundland.

—

1975 *Thule prehistory of Cumberland Sound, Baffin Island, Canada.* Archaeological Survey of Canada Mercury Series Paper No. 38. National Museum of Man, Ottawa.

—

1976a Thule culture communal houses in Labrador. *Arctic* 29 (1):27-37.

—

1976b The effect of climatic/ecological changes on the style of Thule culture winter dwellings. *Arctic and Alpine Research* 8 (1):37-47.

—

1996 *Voices in stone: A personal journey into the Arctic past.* Komatik Series No. 5. Arctic Institute of North America of the University of Calgary, Calgary.

Schmid, E. S.

1972 *Atlas of animal bones.* Elsevier, Amsterdam.

Scoresby, W.

1969 *An account of the Arctic regions with a history and description of the whale-fishery. Volume 1: The Arctic.* 2 vols. David and Charles Reprints, Newton Abbot, Devon.

Sergeant, D. E.

1991 *Harp seals, Man and ice.* Canadian Special Publication of Fisheries and Aquatic Sciences No. 114. Department of Fisheries and Oceans, Ottawa.

Service, E. R.

1979 *The Hunters.* Second ed. Prentice-Hall, Inc., Englewood Cliffs, N.J.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Skidmore, J. M.
1979 *Labrador sea synoptic ice description.* Research and Development Division, Environmental Emergency Branch, Environmental Impact Control Directorate, Environmental Protection Service Department of the Environment, Government of Canada. Copies available from EPS 3-EC-79-4.

Smith, M. and B. Rigby
1981 Distribution of polynyas in the Canadian Arctic. In *Polynyas in the Canadian Arctic*, edited by I. Stirling and H. Cleator, pp. 7-28. Occasional Paper No. 45 Canadian Wildlife Service. Environment Canada, Ottawa.

Smith, M. E.
1992 Braudel's historical rhythms and chronological theory in Archaeology. In *Archaeology, Annales and Ethnohistory*, edited by A. B. Knapp, pp. 23-34. Cambridge University Press, Cambridge.

Smith, S. D., R. Muench, D. and C. H. Pease
1990 Polynyas and leads: An overview of physical processes and environment. *Journal of Geophysical Research* 95 (C6):9461-9479.

Smith, T. G.
1973 *Population dynamics of the Ringed Seal in the Canadian eastern Arctic.* Fisheries Research Board of Canada Bulletin No. 181. Fisheries Research Board of Canada, Department of the Environment, Ottawa.

—
1987 *The Ringed Seal, Phoca hispida, of the Canadian western Arctic.* Canadian Bulletin of Fisheries and Aquatic Sciences No. 216. Department of Fisheries and Oceans, Ottawa.

Smith, T. G., M. O. Hammill and G. Taugbøl
1991 A Review of the developmental, behavioural and physiological adaptations of the Ringed Seal, *Phoca hispida*, to life in the Arctic. *Arctic* 44 (2):124-131.

Smith, T. G. and I. Stirling
1975 The breeding habitat of the ringed seal (*Phoca hispida*). The birth lair and associated structures. *Canadian Journal of Zoology* 53:1297-1305.

Spencer, R. F.
1959 *The North Alaskan Eskimo: A study in ecology and society.* Smithsonian Institution Bureau of American Ethnology Bulletin 171. Smithsonian Institution, Washington, D.C.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Spiess, A.
1976 *Genus Phoca: Metrical analysis for osteoarchaeology.* Unpublished report in the possession of the author.

—
1978 Zooarchaeological evidence bearing on the Nain area Middle Dorset subsistence-settlement cycle. *Arctic Anthropology* 15:48-60.

Spiess, A. and M. H. Hedden
1983 *Kidder Point and Sears Island in prehistory.* Occasional Papers in Maine Archaeology No. 3. The Maine Historic Preservation Commission, Augusta, ME.

Stanford, D.
1976 *The Walakpa site, Alaska.* Smithsonian Contributions to Anthropology No. 20. Smithsonian Institution, Washington, D.C.

Stenton, D. R.
1983 *An analysis of faunal remains from the Peale Point site, (KkDo-1), Baffin Island, N.W.T.* Unpublished M. A. Thesis, Trent University.

—
1989 *Terrestrial adaptations of Neo-Eskimo coastal-marine hunters on Southern Baffin Island, N.W.T.* Unpublished Ph.D. Thesis, University of Alberta.

Stenton, D. R. and R. W. Park
1994 Formation processes and Thule archaeofaunas. In *Threads of Arctic Prehistory: Papers in Honour of William E. Taylor Jr. Archaeological Survey of Canada Mercury Series No. 149*, edited by D. Morrison and J.-L. Pilon, pp. 409-422. Canadian Museum of Civilization, Ottawa.

Stevenson, M. G.
1997 *Inuit, whalers and cultural persistence: Structure in Cumberland Sound and Central Inuit social organization.* Oxford University Press, Oxford.

Steward, J. H.
1955 *Theory of culture change: The methodology of multilinear evolution.* University of Illinois Press, Urbana.

Stewart, R. E. A., B. E. Stewart, I. Stirling and E. Street
1996 Counts of growth layer groups in cementum and dentine in Ringed Seals (*Phoca hispida*). *Marine Mammal Science* 12(3):383-401.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Stirling, I.
1981 Introduction. In *Polynyas in the Canadian Arctic*, edited by I. Stirling and H. Cleator, pp. 5-6. Occasional Paper Number 45 Canadian Wildlife Service. Environment Canada, Ottawa.

Stirling, I., W. R. Archibald and D. DeMaster
1977 Distribution and abundance of seals in the eastern Beaufort Sea. *Journal of the Fisheries Research Board of Canada* 34:976-988.

Stirling, I. and H. Cleator (editors)
1981 *Polynyas in the Canadian Arctic*. Canadian Wildlife Service, Ottawa.

Stirling, I., H. Cleator and T. G. Smith
1981 Marine Mammals. In *Polynyas in the Canadian Arctic*, edited by I. Stirling and H. Cleator, pp. 5-49. Occasional Paper no. 454. Canadian Wildlife Service, Ottawa.

Stirling, I., N. J. Lunn and J. Iacozza
1999 Long-term trends in the population ecology of the Polar Bears in western Hudson Bay in relation to climatic change. *Arctic* 52(3):294-306.

Stoker, S. W. and I. I. Krupnik
1993 Subsistence whaling. In *The Bowhead Whale. Special Publication No. 2, The Society for Marine Mammology*, edited by J. J. Burns, J. J. Montague and C. J. Cowles, pp. 579-629.

Stone, L. M.
1974 *Fort Michilimackinac 1715-1781: An archaeological perspective on the Revolutionary frontier*. Publications of the Museum, Michigan State University. Anthropological Series Vol. 2. Mackinac Island State Park Commission.

Tanner, V.
1944 *Outlines of the geography, life and customs of Newfoundland-Labrador*. Vols. 1 and 2. Cambridge University Press, Cambridge.

Taylor, J. F.
1957 The breeding and maintenance of sledge dogs. *Polar Record* 8 (56):429-440.

Taylor, J. G.
1969 William Turner's journeys to the caribou country with the Labrador Eskimos in 1780. *Ethnohistory* 16(2):141-164.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1974 *Labrador Eskimo settlements of the early contact period.* Publications in Ethnology No. 9. National Museum of Man, National Museums of Canada, Ottawa.

—

1977 Traditional Inuit land use and occupancy by the Labrador Inuit. In *Our Footprints are Everywhere: Inuit land Use and Occupancy in Labrador*, edited by C. Brice-Bennett. Labrador Inuit Association, Nain, Newfoundland and Labrador.

—

1979a Tuglavina. In *Dictionary of Canadian Biography*, edited by F. G. Halpenny, pp. 740. vol. IV 1771-1800. University of Toronto Press, Toronto.

—

1979b Mikak. In *Dictionary of Canadian Biography*, edited by F. G. Halpenny, pp. 536-537. vol. IV 1771-1800. University of Toronto Press, Toronto.

—

1979c Inuit whaling technology in eastern Canada and Greenland. In *Thule Eskimo Culture: An Anthropological Retrospective*, edited by A. P. McCartney, pp. 292-300. Archaeological Survey of Canada Mercury Series Paper No 88. National Museums of Man, Ottawa.

—

1980 The Inuit of southern Québec-Labrador. *Études/Inuit/Studies* 4(1-2):185-193.

—

1985 The Arctic whale cult in Labrador. *Études/Inuit/Studies* 9(2):121-132.

—

1988 Labrador Inuit whale use in the early contact period. *Arctic Anthropology* 25(1):120-130.

—

1990 The Labrador Inuit Kashim (ceremonial house) complex. *Arctic Anthropology* 27(2):51-67.

Taylor, J. G. and H. Taylor

1977 Inuit land use and occupancy in the Okak region, 1776-1830. In *Our Footprints are Everywhere: Inuit land Use and Occupancy in Labrador*, edited by C. Brice-Bennett, pp. 59-81. Labrador Inuit Association, Nain, Newfoundland and Labrador.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Taylor, R. E.
1987 *Radiocarbon dating: an archaeological perspective.* Academic Press, New York.

Teillet, J. V.
1988 *A reconstruction of summer sea ice conditions in the Labrador Sea using Hudson's Bay Company ship's log-books, 1751 to 1870.* M.A., University of Manitoba.

Templeman, W., H. J. Squires and A. M. Fleming
1957 Nematodes in the fillets of cod and other fishes in Newfoundland and neighbouring areas. *Journal of the Fisheries Research Board of Canada* 14(6):831-897.

Thalbitzer, W.
1914 The Ammasalik Eskimo: Contributions to the ethnology of the East Greenland natives. *Meddelelser om Grønland* 39:1-755.

Thistle, P.
1986 *Indian-European trade relations in the lower Saskatchewan River region to 1840.* Manitoba Studies in Native History II. University of Manitoba Press, Winnipeg.

Todd, W. E. C.
1980 *Birds of the Labrador peninsula and adjacent areas: A distributional list.* Buteo Books, Vermillion, South Dakota.

Trigger, B. D.
1989 *A history of archaeological thought.* Cambridge University Press, Cambridge.

Trigger, B. G.
1985 *Natives and newcomers: Canada's "heroic age" reconsidered.* McGill-Queen's University Press, Montreal.

True, F., W.
1904 *The whalebone whales of the western North Atlantic, compared with those occurring in European waters; with some observations on the species of the North Pacific.* Smithsonian Contributions to Knowledge Vol. XXXIII. Smithsonian Institution, Washington, D.C.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Turgeon, L.
1998 French fishers, fur traders, and Amerindians during the sixteenth century: History and archaeology. *William and Mary Quarterly, 3rd Series* LV(4):583-610.

Turner, L.
1979 *Ethnology of the Ungava district, Hudson Bay territory.* Presses Coméditex, Québec.

Tynan, C. T. and D. P. DeMaster
1997 Observations and predictions of Arctic climate change: Potential effects on marine mammals. *Arctic* 50(4):308-322.

United States Naval Hydrographic Office (U.S.N.H.O.)
1941 *Sailing directions for Labrador, Greenland and Iceland: Including the western shores of Davis Strait and Baffin Bay (Emergency Edition).* Hydrographic Office No. 74. United States Naval Hydrographic Office, Washington, D.C.

United States Naval Oceanographic Office (U.S.N.O.O.)
1965 *Sailing Directions for Labrador and Hudson Bay: Labrador Northward of St. Lewis Sound, Hudson Strait and Hudson Bay.* First Edition ed. Hydrographic Office No. 15. United States Naval Oceanographic Office, Washington, D.C.

van Loon, H. and J. C. Rogers
1978 The seesaw in winter temperatures between Greenland and northern Europe. Part 1: General Description. *Monthly Weather Review* 106:296-310.

Vibe, C.
1967 Arctic animals in relation to climate fluctuations. *Meddelelser om Grønland* 170(5). Copenhagen.

Wadhams, P.
2000 *Ice in the ocean.* Gordon and Breach Science Publishers, Amsterdam.

Walker, I. C.
1983 Nineteenth-century clay tobacco-pipes in Canada. In *The Archaeology of the Clay Tobacco Pipe: VIII. America*, edited by P. Davey, pp. 1-87. BAR International Series No. 175, Oxford.

Walsh, J. E.
1983 The role of sea ice in climatic variability: Theories and evidence. *Atmosphere-Ocean* 21:229-242.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Walsh, J. E. and C. M. Johnson
1979 Interannual atmospheric variability and associated Arctic sea ice extent. *Journal of Geophysical Research* 84:6915-6928.

Wang, J., L. A. Mysak and R. G. Ingram
1994 Interannual variability of sea-ice cover in Hudson Bay, Baffin Bay and the Labrador Sea. *Atmosphere-Ocean* 32(2):421-447.

Weyer, E.
1962 *The Eskimos, their environment and folkways*. Archon Books, New Haven.

Wheeler, E. P.
1953 *List of Labrador Eskimo place names*. National Museum of Canada Bulletin No. 131. Canada Department of Resources and Development, Ottawa.

White, J., L. K. Barlow, D. A. Fisher, P. M. Grootes, J. Jouzel, S. J. Johnsen, M. Stuiver and H. Clausen
1997 The climate signal in the stable istopes of snow from Summit, Greenland: Results of comparisons with modern climate observations. *Journal of Geophysical Research* 102(C12):26425-26439.

Whitehead, N. L.
1999 Ecological history and historical ecology: Diachronic modeling versus historical explanation. In *Advances in Historical Ecology*, edited by W. Balée, pp. 30-41. Columbia University Press, New York.

Whitridge, P. J.
1999 *The construction of social difference in a prehistoric Inuit whaling community*. Unpublished Ph.D. Dissertation, Arizona State University.

Williamson, A. H.
1964 *Population movement and the food gathering economy of northern Labrador*. Ph.D. Thesis, McGill University.

—
1997 *From Sina to Sikujâluk: Our Footprint. Mapping Inuit environmental knowledge in the Nain district of northern Labrador*. Labrador Inuit Association. Nain.

Woodburn, J.
1980 Hunters and gatherers today and the reconstruction of the past. In *Soviet and Western Anthropology*, edited by E. Gellner, pp. 95-117. Duckworth, London.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

—

1982 Egalitarian societies. *Man (N.S.)* 17:431-51.

Woodward-Clyde Consultants

1980 *Offshore Labrador Biological Studies, Physical shore-zone analysis of the Labrador coast.* Petro-Canada.

Woollett, J. M.

1999 Living in the Narrows: Subsistence economy and culture change in Labrador Inuit society during the contact period. *World Archaeology* 30(3):7.

—

n.d. *The archaeofauna of Nunaingok: Analysis of faunal remains from 1987 and 1988 excavations.* Report on file with Hunter College Bioarchaeology Facility, Department of Anthropology, Hunter College CUNY.

Woollett, J. M., A. S. Henshaw and C. P. Wake

2000 Palaeoecological implications of archaeological seal bone assemblages: Case studies from Labrador and Baffin Island. *Arctic* 53(4):395-413.

Yasui, C.

1987 Subsistence on the southern Labrador Coast before 1800: a faunal analysis of the Seal Islands site (FaAw-5) in the Strait of Belle Isle. In *Manuscript on file, Department of Archaeology, University of Calgary*, Calgary.

Zimmerly, D. W.

1991 *Cain's land revisited.* Fourth Printing ed. Social and Economic Studies No. 16. Institute of Social and Economic Research, Memorial University of Newfoundland, St. John's.

Zutter, C. M.

n.d. *Archaeobotanical investigation of the Uivak archaeological site, Labrador, Canada.* Unpublished report in possession of the author, pp. 6.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.