WALRUS, SEAL, AND SEABIRD FAUNAL REMAINS FROM SUMMIT ISLAND IN BRISTOL BAY, ALASKA: THE SUBSISTENCE PRACTICES OF NORTON PEOPLES IN AN ISLAND ENVIRONMENT (2740–980 CAL B.P.)

by

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DISSERTATION ABSTRACT

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Title: Walrus, Seal, and Seabird Faunal Remains from Summit Island in Bristol Bay, Alaska: The Subsistence Practices of Norton Peoples in an Island Environment (2740–980 cal B.P.)

The Norton Stage (2500-1000 cal B.P.) of the Norton Tradition is typically characterized as a caribou hunting and fishing culture, an idea developed by James Giddings through his formative work at the Iyatayet Site in Norton Sound. The concept of Norton fishers and caribou-hunters has been promoted by the long-term research of Don Dumond in the Naknek and Ugashik drainages on the Alaska Peninsula. While the northern Alaska Peninsula has historically productive salmon runs and abundant caribou populations, the concept that these taxa were essential to the Norton subsistence economy has not been critically evaluated. Giddings based his own assessment of Iyatayet subsistence practices on the animal harvest practices of contemporary Norton Sound Alaska Native communities, rather than directly from the faunal remains he identified during excavations.

Several faunal assemblages have been recovered from southwest Alaska, which provide the opportunity to test assumptions regarding Norton subsistence practices. Most of these assemblages come from the Bering Sea coast, a vastly different environment from more temperate coast of the Alaska Peninsula. In an effort to directly document Norton subsistence practices, I procured a sizeable faunal assemblage that Robert Shaw excavated in 1985 from 49-XHI-043 and 49-XHI-044. These sites are located on Summit Island, a nearshore island 6 km from the shoreline of northwest Bristol Bay.

Prior to my research, no analysis of the Summit Island collection had been conducted. As a result, an assessment of the faunal remains was not possible until I analyzed field notes to establish stratigraphic relationships and procured radiocarbon dates from the sites. I was able to confirm the presence of three discrete analytical components associated with Norton culture including Early Norton I (2740-2380 cal B.P.), Early Norton II (2400-2000 cal B.P.), and Late Norton (1390-980 cal B.P.). My analysis of 9,981 mammal and bird bone specimens resulted in the documentation of an intensive marine-focused subsistence economy. Over approximately 2,000 years, generations of Norton peoples harvested seals, walruses, murres, cormorants, and eiders from the Walrus Island chain. Terrestrial and riverine species were not well represented in the assemblage, despite the proximity of the mainland.

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CHAPTER I

INTRODUCTION

In Alaska, the Norton Stage of the Norton Tradition is largely understood as a caribou hunting and (salmon) river fishing culture with coastal adaptations that are more or less intensive depending on access to marine resources (Dumond 1984, 1987b, 2000b, 2016). This narrative developed from Giddings' 1948-1952 excavations at the Iyatayet Site in Norton Sound, which he used to first describe Norton culture (Giddings 1964). Dumond has supported and enhanced this interpretation through his decades-long research on the Alaska Peninsula (Dumond 1969, 1971, 1972, 1981, 1982, 1984, 1987a, 1987b, 1990, 1998, 2000a, 2000b, 2004, 2005a, 2011, 2016). Dumond (2016:403) recently asserted the importance of fishing by characterizing Norton peoples as "predominantly river fishing folk who also engaged actively in the terrestrial hunting of caribou as well in the coastal hunting of sea mammals...."

It was the orientation toward fishing that led Dumond (1982, 1987, 2000b, 2009:61, 2016) to surmise that Norton occupations were infrequent north of the Bering Strait, but widespread along it and to the south where salmon are abundant. Shaw (1982b, 1998) hypothesized that the intensive focus on mass netting of fish ultimately supported the expansion of Norton peoples away from the earliest coastal settlements into places like the Manokinak Site in the Yukon-Kuskokwim Delta, a later Norton occupation dating to approximately 1400 cal B.P. Bockstoce (1979) similarly asserted that people with Norton culture ultimately abandoned the Cape Nome region around 2000-1600 cal B.P. because of resource stress related to the decline of salmon and caribou.

The notched stones found in varying abundance in Norton components from the Naknek and Ugashik river drainages, Nunivak Island, Cape Nome, Hagemeister Island, and Iyatayet, which many researchers interpret as netsinkers used in fishing, support the narrative of Norton peoples as fishing-oriented (Bockstoce 1979:89; Dumond 1981, 1987, 2005b; Giddings 1964; Nowak 1982:86). Many Norton sites, whether on the coast or interior, are located along rivers with anadromous fish runs, but also in places with historic and extant caribou populations (Ackerman 1964, 1979, 1980; Bundy 2007; Burch 2012; Dumond 1981, 2005a, 2011; Henn 1978; Hoffman 2009; Saltonstall et al. 2012; Shaw 1983; VanStone 1988).

Materials from Iyatayet (the Norton type site), which Giddings (1964) used to infer Norton subsistence, included chipped stone endblades, sideblades, scrapers, and knives, scratched or polished slate tools, chipped adzes with polished bits, pumice abraders, pottery, labrets, and pecked stone bowls; and a small number of organic objects made from caribou, bird, and marine mammal by-products. Giddings also recovered a faunal assemblage (n=637) that came predominantly from small-bodied and bearded seals (86%), but also beluga (6%), walrus (6%), and caribou (2%). Giddings noted, but did not try to sample, degraded mussel shell lenses throughout the Norton components.

According to Giddings (1964), Late Holocene people with Norton culture lived on or near the coast, harvesting seals and other locally available marine mammals, but their major interests included mass netting anadromous fish and hunting caribou. People also harvested fur-bearing mammals, seabirds, waterfowl, bird eggs, and shellfish to an unknown extent. When on the coast, Norton peoples lived in large semi-subterranean houses that they occupied year after year, building up extensive trash middens at the edges of their homes. When away from the coast, Norton peoples traveled upstream and into the interior, living in less substantial dwellings, to follow migrating caribou and harvest other mammals, birds, and fresh-water fish as they became available. Giddings (1964) characterized Iyatayet as a winter settlement, based on his knowledge of historic and contemporary Inupiaq subsistence practices as well as the size and form of the houses, the depth and extent of the associated middens, the presence of pottery and pecked stone bowls he identified as marine mammal oil lamps. Yet he also recognized that the faunal remains indicated spring, summer, and fall activities.

Giddings equated a high abundance of notched netsinker stones with long-term intensive salmon netting, even though he did not note fish bones in the faunal assemblage. He suggested that Norton peoples relied on stores of preserved salmon for the winter months, a practice frequently documented in historic Alaska Native communities. Although caribou faunal remains were not abundant in the Iyatayet components, Giddings inferred that caribou were as important to Norton peoples as they were to historic Alaska Native communities, due to the small number of antler objects recovered from the site. From the abundance of projectile points, which he interpreted as indicative of caribou hunting, he believed that Norton peoples went to great lengths to procure caribou meat and by-products. Because of the limited evidence of caribou at the site, Giddings proffered that caribou hunting would have occurred mostly in the interior, away from Iyatayet, and less frequently on the coast.

While Giddings categorized Iyatayet as a winter settlement, with evidence of spring, summer and fall pursuits, he supposed that Norton people made regular seasonal rounds to the river and the interior, and conducted the most important subsistence practices away from Iyatayet. Despite the prevalence of marine animals represented in the faunal assemblage, Giddings directed his interpretations toward emphasizing the importance of terrestrial and riverine resources in Norton culture. This belief underscores his interpretation that site residents spent much of their time making tools at Iyatayet for activities that occurred away from the coast. The bias toward these resources is also apparent in his assessment that "a preponderance of small seals [represented in the Iyatayet faunal assemblage] may indicate intensive spring hunting at the ice edge to make up for a shortage of caribou" (Giddings 1964:185).

During and after the Iyatayet excavations, the concept of Norton culture continued to develop through formative work at several archaeological locales. On the west-southwest coast of Alaska, these places included Point Hope (Larsen and Rainey 1948), Norton Sound (Bockstoce 1979; Giddings 1949, 1960, 1964), Kuskokwim Bay (Ackerman 1964, 1982, 1986, 1998; Larsen 1950, 1982), Nunivak Island (Nowak 1973, 1982), and northwest Bristol Bay (Bailey 1991; Shaw 1979, 1986, 1998). In interior settings, archaeologists conducted Norton research in the Ahklun-Kilbuck Mountains vicinity (Ackerman 1964, 1979, 1980), Yukon-Kuskokwim Delta (Shaw 1982b, 1983, 1998) and the Naknek and Ugashik river drainages on the northern Alaska Peninsula (Dumond 1969, 1971, 1972, 1981, 1982, 1984, 1987a, 1987b, 1990, 1998, 2000a, 2000b, 2004, 2005a, 2011, 2016; Henn 1978). Much of this work focused on describing and comparing far flung, and seemingly dissimilar, tool assemblages to codify what made Norton culture a coherent archaeological tradition. With each archaeological study, researchers were able to understand better its extent, range, regional variation and relationship to other archaeological traditions in the Siberian and North American Arctic.

In the last 20 years, other researchers delved into previously uninvestigated archaeological places with Norton components, such as Round Island in northwest Bristol Bay (Schaaf 2015; Schaaf et al. 2007) and the Middle Togiak drainage, north of the Walrus Islands (Biddle 2001). Some archaeologists chose to reexamine sites previously studied by Giddings including the Difchahak Site (Harritt 2010) and the Iyatayet Site (Tremayne 2015), both in Norton Sound. Hoffman (2009) and Saltonstall et al. (2012) excavated previously unstudied Norton components in the Ugashik River drainage, Bundy (2007) along the Alagnak River, and MacMahan (2000) near Nushagak Bay, all within proximity to Dumond's core research area on the northern Alaska Peninsula.

Most Norton research has focused on artifact typology, house form, radiocarbon dating, and site location, which has greatly informed our understanding of the origins, extent, expansion, timing, settlement patterns, and material culture of the Norton Tradition. Our understanding of Norton subsistence practices, particularly through use of direct evidence from faunal analysis, has not experienced the same level of development. Norton components are often plagued by a lack of organic preservation, though some faunal assemblages and organic implements have preserved in permafrost coastal settings at Iyatayet (Giddings 1964; Tremayne 2015), Cape Nome (Bockstoce 1979), Nunivak Island (Nowak 1982), Hagemeister Island (Bailey 1991), Round Island (Schaaf 2015) and Summit Island (Shaw 1986). Shaw (1982b, 1983) also recovered numerous faunal remains from the interior Manokinak Site. For the most part, these assemblages are very small, not well described, or remain unanalyzed.

Many researchers have instead relied on indirect evidence, including site location, local ecology, and ethnographic analogy to portray Norton subsistence practices. The results generally support Giddings' interpretation of Norton peoples as coastally adapted salmon fishers and caribou hunters. When faunal assemblages do preserve, many times, researchers could not or did not undertake substantive faunal analysis to supply direct evidence of subsistence practices. Instead, they provided an anecdotal summation of the remains, which ultimately align with Giddings' original narrative. This is not a fault of the archaeologists, most of whose research interests have not centered on faunal analysis, but it leaves a valuable investigative tool unused. The continual offhand application of such narratives, however, codifies ideas that have never been systematically tested.

Faunal analysis has great potential to provide direct evidence of subsistence practices that can be used to evaluate long-held archaeological concepts, such as the idea that Norton people were coastally adapted caribou hunters and salmon fishers. Forty years ago, Dumond (1977: 110-113) noted the Norton peoples must have had a strong preference for open water marine mammal hunting, based on the location and ecology of sites throughout coastal Alaska, on par with their interests in salmon and caribou. It would seem that over time, however, the potential importance of marine mammals (and other marine animals) has been sidelined in the Norton narrative, while caribou and salmon have taken center stage. Several Norton-age sites have been located on islands in the Kuskokwim and Bristol bays, some with recovered organic objects and faunal remains. The limited descriptions of the organic assemblages from these sites suggest that throughout the Late Holocene some Norton peoples thrived in marine environments by intensively harvesting several kinds of locally available birds, fish, mammals and shellfish, rather than a dogged reliance on one or two major species. Given further systematic study, faunal assemblages would presumably provide an opportunity to test whether Norton peoples collectively preferred caribou and salmon or modified their strategies to local ecology.

Faunal analysis is useful, however, only with critical application. In Giddings' own faunal analysis at Iyatayet, 98% of the identified bones came from marine mammals and only 2% came from caribou, but he still focused his narrative on the importance of caribou and salmon. In reality, caribou faunal remains and antler/bone tools were minimally represented at Iyatayet, while fish bones were not even recovered. Giddings' interpretations of subsistence relied heavily on artifact typology and the blanket assertion common in ethnographic studies that because salmon was important to historic and contemporary Alaska Natives, it must have been equally important to pre-contact peoples as well. During recent excavations at Iyatayet, Tremayne (2015:215) recovered 12 unknown fish bone specimens, which he could have easily associated with salmon fishing. Instead, he applied the knowledge of a resident of the nearby community of Shaktoolik to infer that site residents more likely used netsinkers to fish for tomcod at the nearby Iyatayet Cove, rather than hauling the netsinkers away from the Iyatayet area to fish where salmon were available. Tremayne's critical application of local ecology and Shaktoolik fishing practices, combined with artifact typology and faunal analysis, makes apparent the more subjective nature of Giddings' take on Norton subsistence practices.

In 2012, I gained access to the Summit Island collection, with the intent to analyze the faunal remains to document Norton subsistence practices in an island environment. I was able to access this collection through the University of Alaska Museum of the North (UAMN) by loan to the University of Oregon Museum of Natural and Cultural History (UO MNCH) for my use. The collection that UAMN shipped to UO MNCH contained 30 bankers' and oversized boxes of animal bones, shellfish fragments, chipped and ground stone, pottery, wood, assorted other samples, and excavation documentation from Shaw's 1985 excavations of archaeological sites 49-XHI-043 and 49-XHI-044. To structure my faunal analyses, I attempted to answer research questions that would clarify the timing and nature of subsistence practices on Summit Island:

1. *When did people occupy Summit Island and how did the nature of the occupations change over time? How do the ranges of occupation differ between 49-XHI-043 and 49-XHI-044?*

2. *What kinds of animals did Summit Island residents harvest during the Late Holocene? Are certain taxa more significant than others? Do the harvested taxa change over time?*

3. *What time of year did site residents harvest primary taxa? Does season of harvest change over time? Is there evidence for year-round or winter habitation on Summit Island?*

4. *How do the timing of the Summit Island occupations and subsistence practices of the Summit Island residents compare with similar occupations in southwest Alaska?*

Although existing research indicated that the Summit Island components should be affiliated with the Norton Tradition, and possibly the Thule Tradition (Ackerman 1964, 1986, pers. comm., 2015; AHRS 2010; Bailey 1986, 1991; Dumond 1984, 1987b; Kowta 1963; Larsen 1950; Schaaf 2015; Shaw 1979, 1982a, 1985, 1986, 1998), there was, in fact, limited information to confirm this. Shaw (1986, 1998) characterized the

Summit Island components as Norton and Thule in nature, but did not provide any descriptive or analytical documentation of the material culture. The radiocarbon dates (2820-1120 RYBP) he obtained generally supported his assessment, but dates alone are not proof of archaeological or culture-historical affiliation. In general, the deep history of the northwest Bristol Bay region is not well understood. Research in the area is limited to a handful of minimally reported pedestrian surveys and small-scale test excavations (Ackerman 1964, Bailey 1986, 1991; Casperson 2011; Larsen 1950; Shaw 1979, 1982a, 1985, 1986). Notable exceptions include research at the Thule-age site of Old Togiak (Kowta 1963) and the multi-component Middle and Late Holocene site (49-XNB-043) on Round Island (Schaaf et al. 2007; Schaaf 2015). All of this work, however, has been relatively sporadic and short-lived, which is not conducive to defining local phases or periods. As a result, my dissertation is mostly a discussion of Summit Island subsistence practices by way of faunal analysis, but it also includes radiocarbon dating, analysis of stratigraphy, and minimal tool analysis to demonstrate the Norton affiliation of the Summit Island faunal assemblage.

Studying the Summit Island assemblage turned out to be a much more time consuming endeavor then I had initially anticipated. In the 30 years since the excavation, the collection has changed hands and venues multiple times before the Alaska Office of History and Archaeology (AOHA) sent it to UAMN for curation in 2011. In the 30 years since the excavation, portions of the collection went missing including the majority of excavation photographs and negatives, some field notes, part of the artifact inventory, other forms of miscellaneous documentation, several faunal lots, and artifacts. Shaw (pers. comm., 2013) told me that several organic toggling harpoon heads and artistic pieces had been stolen from the AOHA office. The condition of the collection and records made it difficult to establish the provenience of artifacts and faunal lots and to understand site stratigraphy. I spent several hundred hours interpreting and documenting the results of the excavation, which I discuss in this dissertation. Aside from these complications, the existing documentation shows evidence of a careful and methodical excavation, with detailed unit profiles, level plans, and field notes. The majority of the extant assemblage has provenience and research value to elucidate island-based Norton subsistence practices and local chronology, despite the incompleteness of the existing collection.

The dissertation is organized as follows: Chapter II is an overview of the setting and cultural and environmental background of northwest Bristol Bay. This chapter discusses the Walrus Islands State Game Sanctuary, of which Summit Island is a part, and the history and politics related to animal management in the sanctuary. The antiquity of subsistence practices discussed in this dissertation has implications for contemporary management of the sanctuary, particularly concerning the right of contemporary Yup'ik communities to engage in subsistence practices that have existed for 3,000 years or more (per Kowta 1963, Schaaf 2015, and this dissertation). Chapter III is an overview of the deep history of southwest Alaska including a summary of documented archaeological cultural traditions and the history of archaeological research, with a special focus on the timing of the Norton Tradition and subsistence practices. Chapter IV provides an overview of archaeological sites 49-XHI-043 and 49-XHI-044, including the history of previous investigations at the sites. This chapter presents my understanding of the 1985 excavation methods, which led to the recovery of the faunal assemblage that I analyzed for this dissertation. I describe site stratigraphy, radiocarbon dates, and the resulting analytical components derived for both sites. Chapter V presents my protocol for analyzing the Summit Island faunal assemblage from 49-XHI-043 and 49-XHI-044. In this chapter, I focus on the bird and mammal bones and present the results of my analysis, which includes a description of taxonomic abundance, consideration of age classes represented in the assemblage, and changes in taxonomic abundance over time. Fish and shellfish are present in the assemblage, however, excavation methods resulted in highly differential recovery of these two animal classes. Even though excavation methods did not necessarily recover adequate samples of fish and shellfish, they are described and interpreted to the extent possible. Chapter VI is a discussion of the life history and behavioral patterns of the important taxa represented in the faunal assemblage. I also include some information on pre-contact, historic, and contemporary subsistence practices related to these animals. My intent with this chapter is to provide context for where, when, and how Summit Island residents would have harvested these animals. In Chapter VII, I re-visit my original research questions and use the faunal data to address them. Chapter VIII summarizes my conclusions and outlines potential avenues for future research.

CHAPTER II

SETTING AND ENVIRONMENTAL BACKGROUND

Physical Setting

The Walrus Islands, a chain of seven individual islands, are located in southwest Alaska along the northwestern shoreline of Bristol Bay (Figures 1 and 2). The largest islands, from north to south, are Summit Island (2.5 km^2), High Island (9.0 km^2), Crooked Island (9.5 km^2), and Round Island (2 km^2) (Sinnott 1992). The remaining islets, Black Rock and the Twins (North and South Twin), are situated east and south, respectively, of Crooked Island.

The Ahklun Mountain Range is located in the interior on the mainland, north of the Walrus Islands and the Bristol Bay coastline. Partially located in the Togiak National Wildlife Refuge and Wood-Tikchik State Park, the Ahklun Mountains contain remnant glaciers from a Late Wisconsin ice cap that formed independently of the Cordilleran Ice Sheet (Kathan 2006:6; Manley 2001). These glaciers feed the Togiak River, which flows south to the coast and empties into Togiak Bay. The village of Togiak, positioned at the head of Togiak Bay, is located 25 km northwest of Summit Island. Togiak Bay extends some 30 km south from the community of Togiak to Bristol Bay and is 40 km at its widest point. On the western end, Tongue Point marks the mouth of the bay and Rocky Point the eastern end. Summit Island, the northernmost island in the chain, lies 4 km directly south of Rocky Point. The waters in Togiak Bay and around Summit Island are shallow measuring 28 m at the deepest points.

Figure 1. Bristol Bay, Alaska, with locations discussed in the text (created with ArcMap 10.3.1 ESRI Basemap).

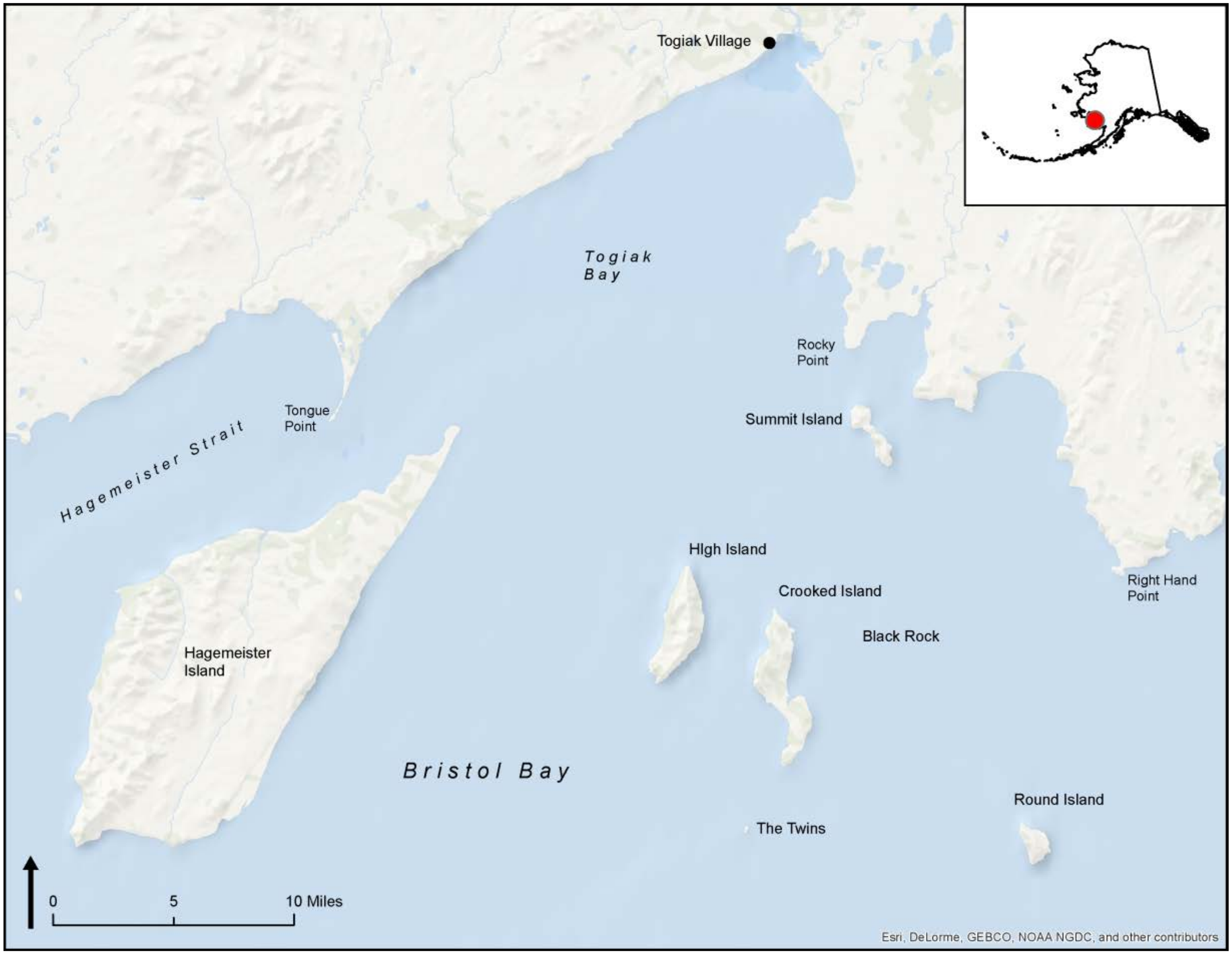

Figure 2. The Walrus Islands, Bristol Bay, Alaska (created with ArcMap 10.3.1 ESRI Basemap).

To the south, the open waters of Bristol Bay surround the Walrus Islands. To the east, Right Hand Point on the mainland most closely borders the Walrus Islands. Beyond Right Hand Point lie the Nushagak Peninsula and the community of Dillingham 100 km to the northeast. The eastern boundary of Bristol Bay terminates at the northern Alaska Peninsula. To the west of the Walrus Islands is Hagemeister Island (187 km^2), an island much larger than those in the Walrus Islands chain. The north tip of Hagemeister Island sits just south of Togiak Bay and east of Tongue Point on the mainland. Kuskokwim Bay borders Bristol Bay to the northwest. Both bays open into the Bering Sea, which separates Alaska and Asia.

Bristol Bay is located on the southeastern portion of the Bering Sea continental shelf, which extends 1200 km, north to south, by 500 km, east to west (CGER-NRC 1990:58). The Bering Sea continental shelf is relatively shallow, reaching a maximum depth of 170 m. At the deepest depth, the shelf break meets the Arctic Ocean by way of the Bering Strait (CGER-NRC 1990:58). The Bering Sea continental shelf is divided into three hydrographic domains: coastal, middle, and outer (CGER-NRC 1990:60). The Walrus Islands chain, due to its close proximity to the Alaska mainland, is located in the shallow coastal domain. The coastal domain starts at the coastline and terminates at the 50 m isobath. The horizontal extent of the 50 m isobath varies, but ends at least 50 km south of the Walrus Islands chain. The water in the coastal domain is “vertically homogenous” as opposed to the stratified water columns of the middle and outer domains (CGER-NRC 1990:60). The shallowness of the water closest to the coastline allows for both surface wind and bottom tidal movement to work in tandem to mix the water column (CGER-NRC 1990:59).

The ocean sediments in the Walrus Islands area consist of fine sands between Round Island and Cape Constantine and mud between Hagemeister and Round islands (Sinnott 1992:17). The extremely shallow bathymetry of the area, particularly surrounding the islands, combined with the dynamic nature of the water column, moves ocean sediments to form shifting shoals (sediment bars) that are hazardous to contemporary boaters. Shoaling is frequent and fast in waters that are 6 m or less. Several locations in the Walrus Islands region have shallow waters that form somewhat of an L-shaped path from Togiak Bay to Round Island (Casperson 2011; NOAA 2010). Shoal waters surround Summit Island and most of the mainland coastline of Bristol Bay, including Togiak Bay. Waters surrounding the Walrus Islands, with the exception of the shoal sections, generally have depths between 9 and 19 m, and do not exceed 28 m, except in Hagemeister Strait.

Climate

The current climate of the Walrus Islands is damp, cool, and breezy (Sinnott 1992:16). Summer temperatures range between 2 ^{o}C and 12 ^{o}C and winter temperatures range between -11 ^{o}C and -1.1 ^{o}C. Although calm, sunny days can occur during the summer months, annual precipitation is heavy with up to 94 cm of rainfall and up to 206 cm of snowfall. The typical wind speed in the Walrus Islands is 11 knots (21 km/h) reaching a maximum of 60 knots (113 km/h) (Sinnott 1992:6).

The climate of northwest Bristol Bay is capricious, and traveling around the Walrus Islands is heavily dependent on having optimum conditions and careful use of tides. Boat travel to the Walrus Islands is subject to diurnal tides, which have a range of 3 m (NOAA 2010). North of Anchor Point, Togiak Bay is not navigable during low tides and the Walrus Islands beaches are mostly rocky and high energy (NOAA 2010; Sinnott 1992:17). Wave climate (averaged wave height, frequency, and direction in a given location) around the islands and mainland coastline can be tempestuous and uneven, particularly when offshore wave climates generated by storms push into nearshore areas (Herbich and Walters 1982:855). In good conditions, boat travel between the community of Togiak and the Walrus Islands follows the eastern coastline of Togiak Bay to Summit Island. If traveling to one of the other islands, boaters will take a direct route from Summit Island to the island of choice. The route to Summit Island skirts the coastline and is relatively protected, whereas reaching any of the other islands in the Walrus Islands chain requires traveling over several kilometers of open water.

From the months of December through mid-April, at least 60% of Bristol Bay is covered with sea ice (Fay 1982; Live Science 2012; NASA 2012a, 2012b; Nghiem et al. 2012; NS&IDC 2012; Schumacher et al. 1979:80). Sea ice seasonally expands from a concentration of perennial sea ice in the high Arctic, through the Bering Sea, to its maximum extent in Bristol Bay, pushed south by cold temperatures and northerly winds (NASA 2012a, 2012b; Nghiem et al. 2012; NS&IDC 2012). Sea ice extends well into the coastal domain, which includes the Walrus Islands (NASA 2012a, 2012b; Schumacher et al. 1979: 83). Sea ice coverage in the Walrus Islands is typically 50% or greater and large open areas of water within the ice pack (or polynyas) are present around most of the islands. Shorefast ice forms on the mainland coast and periodically extends south of Summit Island (Sinnott 1992:18). See Figure 3 to show the maximum southern extent of sea ice in January 2012 (NASA 2012b).

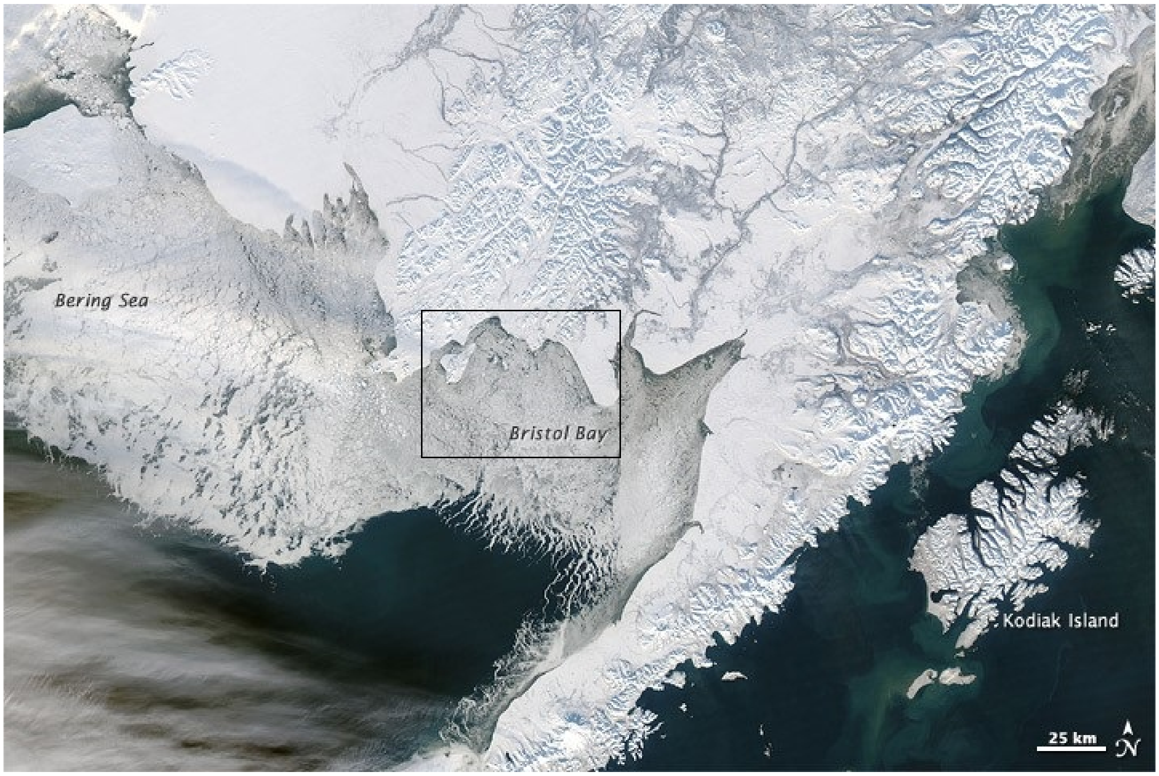

Figure 3. Maximum sea ice extent in the Bering Sea in January 2012. The Walrus Islands area is located in the box. Image taken via NASA satellite (NASA 2012b).

The interplay of water temperature, currents, and wind, with unique geographic features influences seasonal sea ice extent, which means that dependent on location, it can form in deep and shallow bathymetry (Nghiem et al. 2012:3). In the Bering Sea, where waters are relatively shallow, sea ice can extend as far as the break at the continental shelf (Nghiem et al. 2012). Sea ice does not expand beyond the shelf into the Bering Sea Basin because warm water currents that follow the break inhibit ice formation (Nghiem et al. 2012:6-7). Winds have a major impact on the expansion and retreat of sea ice in the Bering Sea. In the late fall, cold northerly winds “force” rapid sea ice expansion, by pushing ice floes south, which in turn limit dynamic wave movement that would mix the water column and stop ice from forming (Nghiem et al. 2012:6). In the spring, warmer southerly winds blow over large expanses of open water (that never froze, south of the sea ice extent), creating dynamic wave movement that effectively mixes water to facilitate break-up. The warm southerly winds also move over the surface of the ice, causing it to melt on the surface (Nghiem et al. 2012:6-7). The retreat of sea ice can happen quite rapidly, as evidenced by NASA satellite images of the Bering Sea and Bristol Bay region shown in Figures 4 and 5.

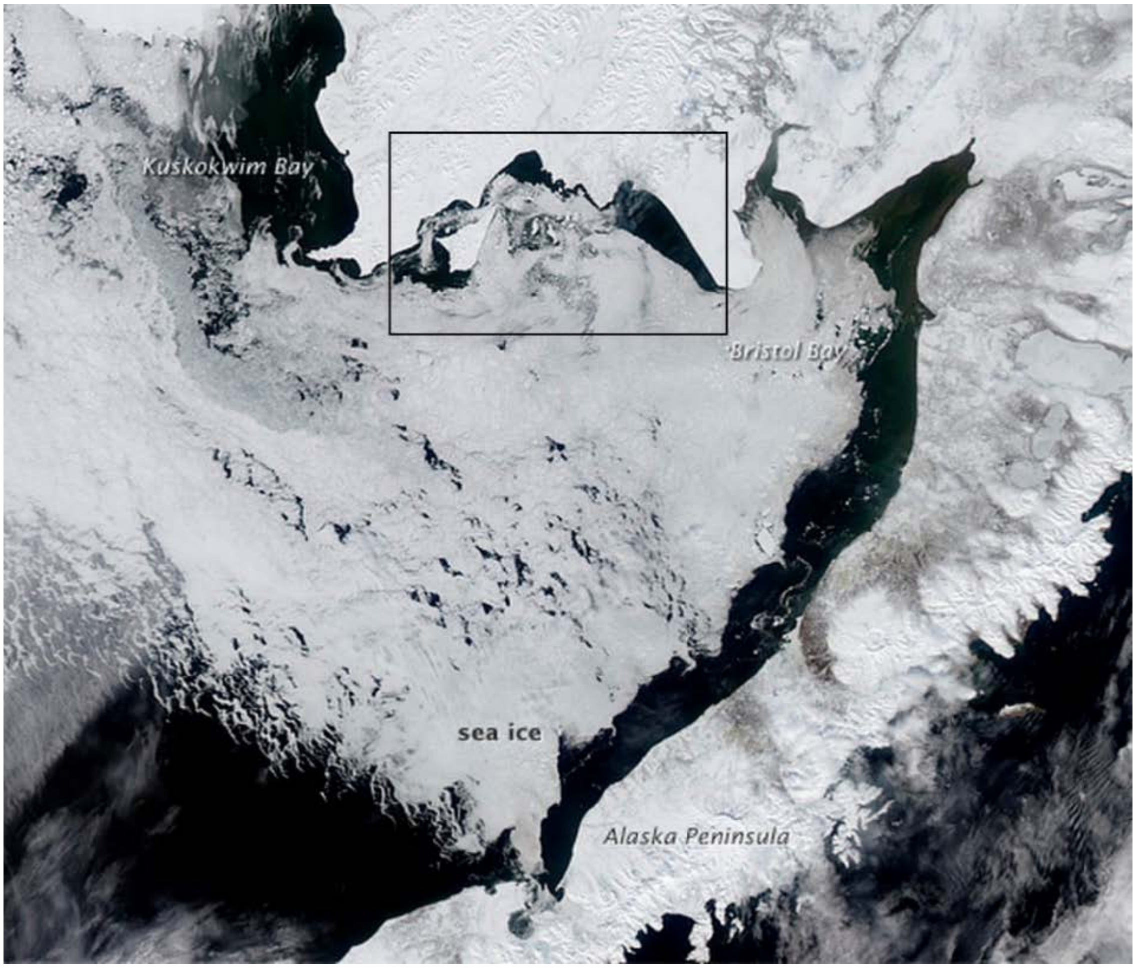

Figure 4. Sea ice extent in the Bering Sea on April 11, 2012. The Walrus Islands area is located in the box. Image taken via NASA satellite (NASA 2012a).

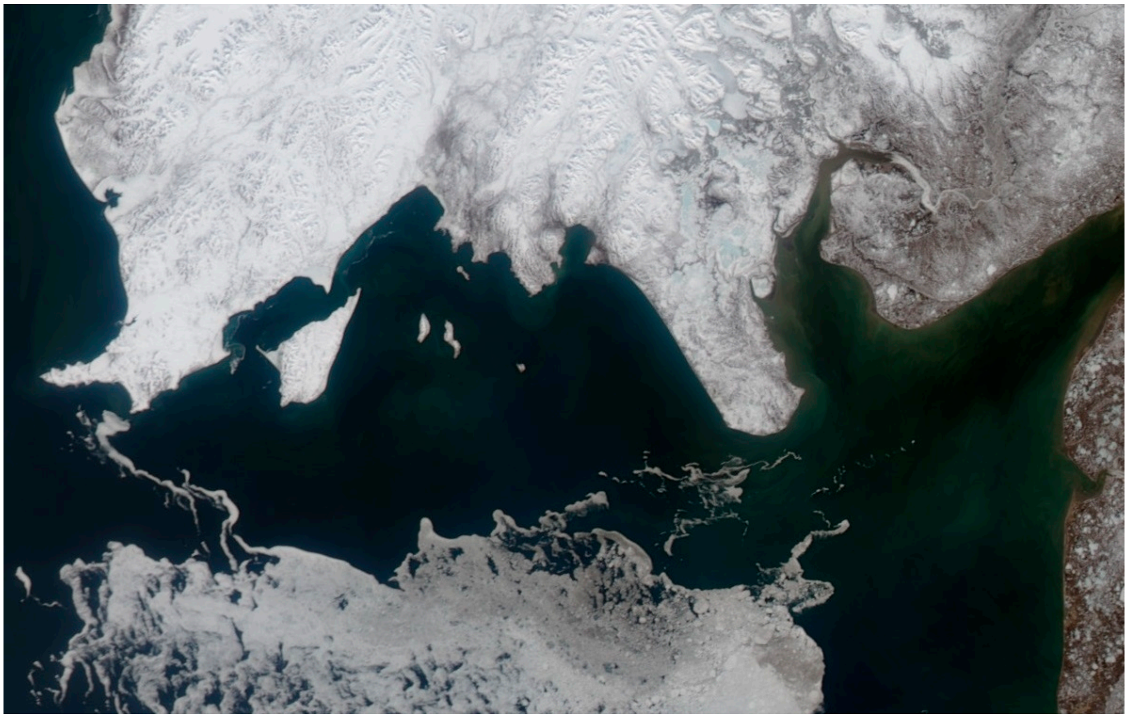

Figure 5. Sea ice extent in Bristol Bay on April 24, 2012. Image taken via NASA satellite (NASA 2012a).

Sea ice directly influences marine animal abundance, distribution, and migration patterns. Various species of Arctic adapted seabirds and ducks as well as ice-adapted seals, walrus, and whales that seasonally inhabit Bristol Bay do so in rhythm with sea ice expansion and retreat. These species, based on age and life history, have different habitat requirements within the sea ice expanse. For example, ringed seals will occupy shorefast ice that is close to the mainland, whereas bearded seals prefer deep waters, and they hang out at the edge of the sea ice (Georgette et al. 1998; Lowry et al. 1980; USFWS 2008). Walrus also prefer pack ice that is thinner, farther from the mainland, or ice floes (Fay 1982). Sea ducks, such as common eiders, flock by the thousands to polynyas or leads (temporarily open water in narrow linear cracks in sea ice when floes move) (SDJVP 2009). One thing that these marine species have in common is the need to access water, whether through self-constructed breathing holes or by staying in open water at the edge of the sea ice. Alaska Natives throughout coastal Alaska know the ecology of ice-adapted and Arctic-adapted animals and rely on these animals as important sources of meat and by-products, particularly during the months when sea ice is present (Fall et al. 1991; 2013; Gadamus and Raymond-Yakoubian 2015; Georgette et al. 1998; Huntington et al. 2013, 2015; ISC 2015; Lucier and VanStone 1991, 1995).

Late Holocene Paleoenvironment

Studies of the environmental history of Alaska have shown that glacial activity, tectonics, and climatic fluctuations significantly and continuously influenced eustatic and local sea levels. These long-term fluctuations in sea level have significantly altered the topography of coastal areas such as the Walrus Islands (Barclay et al. 2009; Briner and Kaufman 2008; Briner et al. 2002; Calkin et al. 2001; Garrett et al. 2015; Jordan 2001; Katsuki et al. 2009; Kaufman et al. 2003, 2012; Kaufman and Manley 2004; Manley et al. 2001; Mann et al. 1998, Mason and Jordan 2002). Understanding the impact of sea level rise on the geomorphology of the Walrus Islands is critical to interpreting the archaeology of the area. Over the past 25,000 years, global sea levels have risen approximately 120 m. Consequently, the Walrus Islands changed from high elevation landmasses on the exposed and dry Bering Sea continental shelf, into a chain of seven small islands off the Alaskan mainland by the Late Holocene (Manly 2002). In the span of time in which these changes occurred, generations of peoples moved across large swaths of the now underwater continental shelf. It is probable that rising sea levels and dynamic water movement have destroyed the majority of the evidence of Early and Middle Holocene human activity.

No sea level studies specific to the Walrus Islands currently exist. Coastal paleoenvironmental studies from the Seward Peninsula, Gulf of Alaska, and western Alaska Peninsula indicate that changes in local and regional sea levels vary significantly and it is problematic to apply data specific to other Alaskan locales to the Walrus Islands (Casperson 2011; Crowell and Mann 1996; Garrett et al. 2015; Jordan 2001; Mann et al. 1998; Mason and Jordan 2002). For the Walrus Islands, the most relevant study of sea level change is a large-scale GIS model developed for the Bering Sea continental shelf (Manly 2002). The model progresses on a millennial scale, starting during the Last Glacial Maximum (25,000 years ago), and progressing to the present, using the global sea level curve and bathymetry to estimate sea level rise. During the Norton-age occupation of Summit Island, between 3,000 and 1,000 years ago, Manley (2002) estimated that sea levels deviated less than 1.4 m from present levels. The modern topography of northwest Bristol Bay differs little from that of the late Holocene.

Analyses of radiocarbon-dated sediments from six distinct water sources in the Ahklun Mountains, located approximately 100 km northeast of the community of Togiak, provide proxy data for Late Holocene paleoclimate in southwest Alaska. These water sources include Cascade Lake, Grandfather Lake, Lone Spruce Pond, Ongivinuk Lake, Ongoke Lake, and Waskey Lake (Chipman et al. 2009; Hu et al. 1995, 2001; Kathan 2006; Kaufman et al. 2012 Levy et al. 2004). Many of the results from these studies are preliminary or provide multiple sets of proxy data that can be contradictory, and must be used with caution. That being said, the following discussion outlines the Middle and Late Holocene southwest Alaska paleoenvironment based on this research.

At 9000-8000 years ago, alder (*Alnus*) thickets expanded around the shores of Grandfather and Ongivinuk lakes and Lone Spruce Pond (Hu et al. 1995, 2001; Kaufman et al. 2012). Based on the long-term presence of high pollen counts throughout the sediment cores, Kaufman et al. (2012) suggested that alder remained the dominant vegetation around these water sources into the Late Holocene, overlapping with the Summit Island Norton occupations. By 4000 cal B.P., spruce (*Picea*) was present at Grandfather Lake, which Hu et al. (1995:388) suggested marked the shift to the contemporary forest-tundra vegetation community. The initial spread of spruce near Grandfather Lake generally corresponded with the advent of the Neoglacial, a major North American cooling event following the Hypsithermal (Kumar 2011). The start of the Neoglacial is documented between 4000 and 3500 cal B.P. at other Alaskan locales including the Brooks Range, Kenai Mountains, and Seward Peninsula (Kathan 2006:7; Levy et al. 2004:191). Hu et al. (1995:388-389) noted that the slow spread of spruce, indicated by consistent but low pollen counts, throughout the Late Holocene portions of the sediment cores, is likely explained by the cooler and wetter climate. The rate of expansion was slow because this climate does not facilitate the growth of the taxon.

Based on lake sediment cores and regression statistics of lichen diameters growing on moraine boulders from nearby Waskey Lake Valley, Levy et al. (2004:191) placed the advent of the Neoglacial in the Ahklun Mountains at 3100 cal B.P. This is at least a few centuries later than the other Alaskan locales previously mentioned. To ascertain temperatures during the climax of the Neoglacial in the Waskey Lake Valley

(750 cal B.P.), Levy et al. (2004:187) estimated equilibrium-line altitudes (ELA) for several reconstructed Neoglacial glaciers. The ELA is an average of altitudes of the zone on a glacier where accumulation and removal (ablation through melting or evaporation) of snow and ice are equal (Bakke and Nesje 2011). The past ELAs can be compared to present ELAs to determine potential differences in winter precipitation and summer air temperature (Bakke and Nesje 2011). Levy et al. (2004:187) estimated that the average Waskey Lake Valley Neoglacial ELA at 750 cal B.P. was 35±22 m below the modern ELA. In the Brooks Range, Kenai Mountains, and Seward Peninsula, Neoglacial ELAs ranged between 100 m and 200 m below present levels (Levy et al. 2004:187). According to Levy et al. (2004), the minor differences in 750 cal B.P. and contemporary ELAs suggests that the extreme Neoglacial temperatures in southwest Alaska may have been only 0.2 ± 0.2°C cooler than modern temperatures. Mann et al. (1998) suggested that Neoglacial temperatures in the Gulf of Alaska might have fluctuated as much as 2°C from modern temperatures. According to Levy et al. (2004) and Kathan (2006), the Ahklun Mountains may have experienced a warmer and wetter Neoglacial than elsewhere in Alaska.

The Neoglacial had multiple warm climatic fluctuations, one of the most pronounced being the Medieval Warm Period (MWP). Levy et al. (2004) did not document any proxy data at Waskey Lake, which would provide evidence of the MWP. Hu et al. (1995) documented spruce pollen in low abundances until approximately 2,000 cal B.P. when the spruce pollen count dramatically increased. Kathan (2006) found further evidence of a minor warm period in the Cascade Lake core dating around 1600-1400 cal B.P. This date range is consistent with the timing of the MWP at other Alaskan locales (Kathan 2006). Kaufman et al. (2012:23) identified increases in organic matter (OM) in the Lone Spruce Pond core between 1800 and 1200 cal B.P. that may also suggest warmer temperatures. OM is particulate detritus from decaying plants that ultimately ends up in water sources and becomes part of lake sediments. OM is rarely identifiable to plant taxon but can be quantified to identify changes in climate (Meyers and Lallier-Verges 1999).

Chipman et al. (2009) found potentially contradictory proxy data at Ongoke Lake. Analysis of sediment cores provided evidence of increased moisture between 2050 and 1650 cal B.P., but also a possible cold interval and increased ice cover by1600 cal B.P. This stands in contrast to Kathan (2006) who documented a warm period at the same time at Cascade Lake. Chipman further noted drier conditions between 1450 and 1250 cal B.P. with wetter conditions returning between 1250 and 550 cal B.P.

The several forms of proxy data and conflicting interpretations suggest that paleoclimate was highly variable on the local level, even between two nearby water sources in the same mountain range. Generally, we can infer that Summit Island residents lived during the Neoglacial, a major cooling event, and experienced periodic warm and cooling spells with varying levels of moisture. More evidence than not suggests that northwest Bristol Bay experienced some warming approximately 2000-1600 cal B.P. and possibly to as recently as 1200 cal B.P. Late Holocene people who occupied Summit Island ultimately experienced climatic conditions similar to contemporary climate. These conditions may have varied greatly from other locales in Alaska, which seem to have experienced much more severe climatic conditions during the Neoglacial.

Contemporary Flora and Fauna

Hasselbach and Neitlich (1996:3) documented 274 plant species and 18 plant communities on Round Island, which most likely occur on the other islands in the Walrus Islands chain. The most prominent communities identified include tundra (crowberry, bilberry, cloudberry, lichens, mosses, etc.), rock (lichens), graminoid-herbaceous (blue joint grass, sedges, and herbs), wet area riparian plants (horsetail, sedges, mosses, willow shrubs, herbs, etc.), and shrub (willow shrub). Shaw (1986) noted blue joint meadows and tundra communities on Summit Island (Shaw 1986). On the mainland, tundra with willow and shrub birch dominate the coasts, while boreal forests with white spruce, balsam poplar, and alder thickets are present in more interior areas along rivers and in the Ahklun Mountains (Chipman et al. 2009; Hu et al. 1995:383, 2001; Kaufman et al. 2012).

The Walrus Islands and surrounding area are biologically diverse and provide prime habitat to numerous species of fish, birds, and mammals. At least eight species of economically important fish inhabit the waters of the Walrus Islands (ADF&G 2015; Sinnott 1992; USFWS 2013d). Pacific herring (*Clupea pallasii*), which spawn in the waters between Nushagak Peninsula and Hagemeister Strait, have been commercially harvested since the late 19th century. Yellowfin sole (*Limanda aspera*) are also abundant in the eastern Bering Sea and capelin (*Mallotus villosus*) spawn off the western shore of Crooked Island (Sinnott 1992:20). King salmon (*Oncorhynchus tshawytscha*), silver salmon (*O. kisutch*), sockeye salmon (*O. nerka*), pink salmon (*O. gorbuscha)*, and chum salmon (*O. keta*) migrate through the waters surrounding the Walrus Islands (ADF&G 2015; Sinnott 1992:20; USFWS 2013d).

All seven islands support seabird colonies including common murres (*Uria aalge*), black-legged kittiwakes (*Rissa tridactyla*), pelagic cormorants (*Phalacrocorax pelagicus*), parakeet auklets (*Cyclorrhynchus psittacula*), horned puffins (*Fratercula corniculata*), tufted puffins (*F. cirrhata*), pigeon guillemots (*Cepphus columba*), and glaucous-winged gulls (*Larus glaucescens*). Over 400,000 seabirds nest on Round Island, 250,000 on South Twin, 100,000 on North Twin, 50,000 on High Island, and 25,000 on Black Rock (ADF&G 2010b; USFWS 2012). The Summit Island bird colony is home to approximately 1,000 birds, mostly pelagic cormorants and pigeon guillemots, but also glaucous-winged gulls, black-legged kittiwakes, horned puffins, and tufted puffins. On the mainland coast, at least nine seabird colonies are located between Tongue Point and Right Hand Point (USFWS 2012). Eight bird colonies are present on Hagemeister Island. A total of 26 bird families and 105 species including, but not limited to, passerines, raptors, alcids, anatids, and shorebirds inhabit the Walrus Island chain (ADF&G 2010b). Table 1 lists selected bird species (with the exception of most passerines), known to inhabit northwest Bristol Bay and their seasonal abundance (ADF&G 1996; Byrd et al. 1998; Dragoo et al. 2011; Denlinger 2006; Okonek et al. 2008; SDJVP 2009; Sibley 2006, 2009; USFWS 2013b, 2013b).

Table 1. Birds inhabiting the Northwest Bristol Bay Region (excluding most passerines)

Taxon	**Common Name**	**Spring Apr-May**	**Summer Jun-Jul**	**Fall Aug-Oct**	**Winter Nov-Mar**
Gaviidae (loons)					
Gavia stellata	red-throated loon*	C	C	C	
Gavia arctica	Arctic loon	U	U	U	
Gavia pacifica	Pacific loon*	C	U	U	

Table 1. (continued)

Taxon	Common Name	Spring Apr-May	Summer Jun-Jul	Fall Aug-Oct	Winter Nov-Mar
Gavia immer	common loon*	C	C	C	
Gavia adamsii	yellow-billed loon	R	R	R	
Podicipedidae (grebes)					
Podiceps auritus	horned grebe*	R	R	R	
Podiceps grisegena	red-necked grebe*	U	U	U	
Procellariidae (shearwaters, petrels)					
Fulmarus glacialis	northern fulmar		R		
Puffinus tenuirostris	short-tailed shearwater		R	R	
Hydrobatidae (storm-petrels)					
Oceanodroma furcata	fork-tailed storm-petrel		R	R	R
Oceanodroma leucorhoa	Leach's storm-petrel	R			
Phalacrocoracidae (cormorants)					
Phalacrocorax auritus	double-crested cormorant*	C	C	C	
Phalacrocorax urile	red-faced cormorant*	U	U	U	
Phalacrocorax pelagicus	pelagic cormorant*	C	C	C	
Fregatidae (frigatebirds)					
Fregata magnificens	magnificent frigatebird	R			
Anatidae, Anserinae, and Anserini (geese)					
Anser albifrons	greater white-fronted goose*	C	C	C	
Chen canagica	emperor goose*	C	U	C	
Chen caerulescens	snow goose	U	R	U	
Branta canadensis	Canada goose*	C	U	C	
Branta hutchinsii	cackling goose				
Branta bernicla	brant*	C	U	C	
Cygnus buccinator	trumpeter swan		U	U	
Cygnus columbianus	tundra swan*	C	C	C	R
Anatidae, Anatinae, and Anatini (dabbling ducks)					
Aix sponsa	wood duck	R			
Anas strepera	gadwall*	R	R	R	
Anas penelope	Eurasian wigeon	R			
Anas americana	American wigeon*	U	U	U	
Anas platyrhynchos	mallard*	C	C	C	U
Anas clypeata	northern shoveler*	C	C	C	
Anas acuta	northern pintail*	C	C	C	
Anas formosa	Baikal teal	R			
Anas crecca	green-winged teal*	C	C	C	

Table 1. (continued)

Taxon	Common Name	Spring Apr-May	Summer Jun-Jul	Fall Aug-Oct	Winter Nov-Mar
Anatidae, Anatinae, and Aythyini (bay ducks)					
Aythya valisineria	canvasback	R	R	R	
Aythya americana	redhead		R		
Aythya marila	greater scaup*	C	C	C	
Aythya affinis	lesser scaup	R	R	R	
Anatidae, Anatinae, and Mergini (sea ducks)					
Polysticta stelleri	Steller's eider	C	C	C	
Somateria fischeri	spectacled eider	R	R	R	
Somateria spectabilis	king eider	C	U	C	
Somateria mollissima	common eider*	C	C	C	U
Histrionicus histrionicus	harlequin duck*	C	C	C	
Melanitta perspicillata	surf scoter*	U	U	U	
Melanitta fusca	white-winged scoter *	C	C	C	
Melanitta nigra	black scoter*	C	C	C	
Clangula hyemalis	long-tailed duck*	U	U	U	R
Bucephala albeola	bufflehead*	U	U	U	
Bucephala clangula	common goldeneye *	U	U	U	U
Bucephala islandica	Barrow's goldeneye	U	U	U	U
Mergus merganser	common merganser*	U	U	U	C
Mergus serrator	red-breasted merganser*	C	C	C	
Accipitridae (osprey, hawks, eagles)					
Pandion haliaetus	osprey*	U	U	U	
Haliaeetus leucocephalus	bald eagle*	C	C	C	C
Haliaeetus pelagicus	Steller's sea eagle	R	R	R	
Circus cyaneus	northern harrier*	C	C	C	
Accipiter striatus	sharp-shinned hawk	U	U	U	U
Accipter gentilis	northern goshawk*	U	U	U	U
Buteo swainsoni	Swainson's hawk	R			
Buteo jamaicensis	red-tailed hawk*	R	R	R	
Buteo lagopus	rough-legged hawk*	C	C	C	
Aquila chrysaetos	golden eagle*	U	U	U	R
Falconidae (falcons)					
Falco sparverius	American kestrel		R	R	
Falco columbarius	merlin*	U	U	U	U
Falco rusticolus	gyrfalcon*	U	U	U	U
Falco peregrinus	peregrine falcon*	U	U	U	

Table 1. (continued)

Taxon	Common Name	Spring Apr-May	Summer Jun-Jul	Fall Aug-Oct	Winter Nov-Mar
Phasiandidae (grouse, ptarmigans)					
Falcipennis canadensis	spruce grouse*	C	C	C	C
Lagopus lagopus	willow ptarmigan*	C	C	C	C
Lagopus mutus	rock ptarmigan*	U	U	U	U
Lagopus leucurus	white-tailed ptarmigan*	R	R	R	R
Gruidae (cranes)					
Grus canadensis	sandhill crane*	C	C	C	
Charadriidae (plovers)					
Pluvialis squatarola	black-bellied plover*	U	U	C	
Pluvialis dominica	American golden-plover	U	U	U	
Pluvialis fulva	Pacific golden-plover*	U	U	C	
Charadrius mongolus	Mongolian plover*	R	R		
Charadrius semipalmatus	semipalmated plover*	C	C	C	
Haematopodidae (oystercatchers)					
Haematopus bachmani	black oystercatcher		R		
Scolopacidae (sandpipers, phalaropes)					
Tringa melanoleuca	greater yellowlegs*	C	C	C	
Tringa flavipes	lesser yellowlegs	U	U	U	
Tringa solitaria	solitary sandpiper	U	U	U	
Heteroscelus incanus	wandering tattler*	U	U	U	
Heteroscelus brevipes	gray-tailed tattler		R		
Actitis macularia	spotted sandpiper*	U	U	U	
Xenus cinereus	Terek sandpiper	R	R		
Numenius phaeopus	whimbrel*	U	C	C	
Numenius tahitiensis	bristle-thighed curlew	U	R	U	
Limosa haemastica	Hudsonian godwit		U	U	
Limosa lapponica	bar-tailed godwit	U	U	U	
Limosa fedoa	marbled godwit	U		U	
Arenaria interpres	ruddy turnstone	U	U	U	
Arenaria melanocephala	black turnstone*	U	U	U	
Aphriza virgata	surfbird*	U	U	U	
Calidris canutus	red knot		R	U	
Calidris alba	sanderling	U	U	C	
Calidris pusilla	semipalmated sandpiper	U	U	U	
Calidris mauri	western sandpiper*	C	C	C	
Calidris ruficollis	red-necked stint		R	R	

Table 1. (continued)

Taxon	Common Name	Spring Apr-May	Summer Jun-Jul	Fall Aug-Oct	Winter Nov-Mar
Calidris ruficollis	red-necked stint		R	R	
Calidris subminuta	long-toed stint		R		
Calidris minutilla	least sandpiper*	C	C	C	
Calidris bairdii	Baird's sandpiper	R	R	R	
Calidris melanotos	pectoral sandpiper*	U	U	U	
Calidris acuminata	sharp-tailed sandpiper		R	R	
Calidris ptilocnemis	rock sandpiper*	C	C	C	
Calidris alpina	dunlin*	C	C	C	
Philomachus pugnax	ruff			R	
Limnodromus griseus	short-billed dowitcher*	U	U	U	
Limnodromus scolopaceus	long-billed dowitcher	U	U	U	
Gallinago gallinago	Wilson's snipe*	C	C	C	
Phalaropus lobatus	red-necked phalarope*	C	C	C	
Phalaropus fulicaria	red phalarope	U	U	U	
Laridae (skuas, jaegers, gulls, terns)					
Catharacta maccormicki	south polar skua		R		
Stercorarius pomarinus	pomarine jaeger	U	U	U	
Stercorarius parasiticus	parasitic jaeger*	U	U	U	
Stercorarius longicaudus	long-tailed jaeger*	U	U	U	
Larus philadelphia	Bonaparte's gull*	U	C	U	
Larus canus	mew gull*	C	C	C	
Larus argentatus	herring gull	U	U	U	
Larus thayeri	Thayer's gull			R	
Larus schistisagus	slaty-backed gull		R	R	
Larus glaucescens	glaucous-winged gull*	C	C	C	R
Larus hyperboreus	glaucous gull*	U	U	U	
Xema sabini	Sabine's gull*	U	U	U	
Rissa tridactyla	black-legged kittiwake*	C	C	C	
Rissa brevirostris	red-legged kittiwake	R		R	
Sterna caspia	Caspian tern			R	
Sterna paradisaea	Arctic tern*	C	C	C	
Sterna aleutica	Aleutian tern*	C	C	C	
Alcidae (seabirds, auks)					
Uria aalge	common murre*	C	C	C	R
Uria lomvia	thick-billed murre		R		
Cepphus grylle	black guillemot	R			
Cepphus columba	pigeon guillemot*	C	C	C	

Table 1. (continued)

Taxon	Common Name	Spring Apr-May	Summer Jun-Jul	Fall Aug-Oct	Winter Nov-Mar
Brachyramphus marmoratus	marbled murrelet		U	U	
Brachyramphus brevirostris	Kittlitz's murrelet*		R	R	
Aethia psittacula	parakeet auklet*	C	C	C	
Aethia cristatella	crested auklet	N/A	N/A	N/A	N/A
Cerorhinca monocerata	rhinoceros auklet		R		
Fratercula corniculata	horned puffin*	C	C	C	
Fratercula cirrhata	tufted puffin*	C	C	C	
Columbidae (pigeons, doves)					
Columba livia	rock pigeon		R		R
Strigidae (non-barn owls)					
Bubo virginianus	great horned owl*	U	U	U	U
Nyctea scandiaca	snowy owl*	U	U	U	U
Surnia ulula	northern hawk owl*	U	U	U	U
Strix nebulosa	great gray owl*	U	U	U	U
Asio flammeus	short-eared owl*	C	C	C	
Aegolius funereus	boreal owl*	C	U	U	C
Aegolius acadicus	northern saw-whet owl	R	R	R	R
Corvidae (crows, jays, magpies)					
Perisoreus canadensis	gray jay*	U	U	U	U
Pica pica	black-billed magpie*	C	C	C	C
Corvus corax	common raven*	C	C	C	C

KEY for Seasonal Abundance
C = Common (certain to be seen in suitable habitat)
U = Uncommon (present, but not certain to be seen)
R = Rare (known to be present, but not every year)
* = Nests Locally, Known Breeder

The waters of northwest Bristol Bay teem with several species of marine mammals. Male Pacific walrus (*Odobenus rosmarus*) haul out on the beaches of Round, North Twin, High, Summit, and Crooked islands during the spring and into the fall (ADF&G 2010b; Sinnott 1992). Round Island is the most popular haul out in Bristol Bay; as many as 14,000 walrus have been counted on the beaches in a single day (ADF&G

2010b; Sinnott 1992). When walrus are not resting on the beaches, they hunt for bivalves and other mollusks in the shallow waters near the islands (Fay 1982; Bornhold et al. 2005; Jay et al. 2001; Sinnott 1992:25). Steller sea lions (*Eumetopias jubatus*) haul out on Round, High, Crooked, and the Twins islands. There are no established sea lion breeding areas in the Walrus Islands chain, though occasional breeding occurs (ADF&G 2010; Sinnott 1992). Up to 700 sea lions have been counted on the East Cape of Round Island (Sinnott 1992:27). Harbor seals (*Phoca vitulina*) are common in the Walrus Islands with as many as 300 individuals using Black Rock as a haul out (Sinnott 1992:28). Other smaller seal haul outs include Crooked, High, and Round islands (ADF&G 2010b). Spotted (*P. largha*) and northern fur seals (*Callorhinus ursinus*) infrequently inhabit the Walrus Islands as well. Gray whales (*Eschrichtius robustus*), humpback whales (*Megaptera novaeangliae*), minke whales (*Balaenoptera acutorostrata*), and orcas (*Orcinus orca*) are known to migrate through the area (ADF&G 2010b, 2015a, 2015b, 2016b).

Terrestrial mammals are rare on the islands (typically limited to rodents and foxes), but several kinds of large and small game including caribou (*Rangifer tarandus*), moose (*Alces alces*), black bears (*Ursus americanus*), brown bears (*U. arctos*), and beavers (*Castor canadensis*) are present on the mainland coast and in the interior. Table 2 lists mammal taxa known to inhabit the Walrus Islands chain, Togiak National Wildlife Refuge and northwest Bristol Bay (ADF&G 2008, 2015a, 2015b; USFWS 2013c).

Table 2. Mammal Species Present in the Northwest Bristol Bay Region

Family	Taxon	Common Name
Soricidae (shrews)	*Sorex cinereus*	common shrew
	Sorex hoyi	pygmy shrew
	Sorex monticolus	dusky shrew
	Sorex arcticus tundrensis	Arctic shrew
	Sorex yukonicus	Alaska tiny shrew
Vespertillionidae (bats)	*Myotis lucifugus*	little brown bat
Leporidae (hares, rabbits)	*Lepus americanus*	snowshoe hare
	Lepus othus	Arctic hare
Scuiridae (squirrels)	*Marmot caligata*	hoary marmot
	Spermophilus parryii	Arctic ground squirrel
	Tamiasciurus hudsonicus	red squirrel
Castoridae (beavers)	*Castor canadensis*	North American beaver
Muridae (mice, rats, voles)	*Clethrionomys rutilus*	northern red-backed vole
	Microtus oeconomus	tundra vole
	Microtus pennsylvanicus	meadow vole
	Ondatra zibethica	muskrat
	Lemmus trimucronatus	brown lemming
Zapodidae (jumping mice)	*Zapus hudsonius*	meadow jumping mouse
Erethizontidae (porcupines)	*Erethizon dorsatum*	porcupine
Canidae (dogs, foxes, wolves)	*Canis latrans*	coyote
	Canis lupus	gray fox
	Alopex lagopus	Arctic fox
	Vulpes vulpes	red fox
Ursidae (bears)	*Ursus americanus*	black bear
	Ursus arctos	brown bear
Otariidae (eared seals)	*Callorhinus ursinus*	northern fur seal
	Eumetopias jubatus	Steller sea lion
Odobenidae (walrus)	*Odobenus rosmarus*	Pacific walrus
Phocidae (hair seals)	*Phoca largha*	spotted seal
	Phoca vitulina	harbor seal
	Phoca hispida	ringed seal
	Phoca fasciata	ribbon seal
	Erignathus barbatus	bearded seal
Mustelidae (weasels, otters)	*Martes americana*	marten
	Mustela erminea	short-tailed weasel
	Mustela rixosa	least weasel
	Mustela vison	mink
	Gulo gulo	wolverine
	Lontra canadensis	river otter

Table 2. (continued)

Family	Taxon	Common Name
	Enhydra lutris	sea otter
Felidae (cats)	*Felis lynx*	lynx
Eschrichtiidae (gray whale)	*Eschrichtius robustus*	gray whale
Balaenopteridae (rorquals)	*Balaenoptera acutorostrata*	minke whale
	Megaptera novaeangliae	humpback whale
Monodontidae (beluga)	*Delphinapterus leucas*	beluga whale
Delphinidae (dolphins)	*Lagenorhynchus obliquidens*	Pacific white-sided dolphin
	Orcinus orca	killer whale
Phocoenidae (porpoises)	*Phocoena phocoena*	harbor porpoise
	Phocoenoides dalli	Dall’s porpoise
Ziphiidae (beaked whales)	*Ziphius cavirostris*	Cuvier’s beaked whale
Cervidae (caribou)	*Rangifer tarandus*	caribou
	Alces alces	moose

Walrus Islands State Game Sanctuary and Walrus Island National Natural Landmark

The Alaska Department of Fish and Game (ADF&G) currently manages the Walrus Islands chain and all waters within 5 km of the islands as the Walrus Islands State Game Sanctuary (WISGS). The State of Alaska established the sanctuary in 1960 in an effort to protect declining walrus populations and protect Round Island, which is an established and historically popular terrestrial haul out (ADF&G 2016b; Sinnott 1992; VanStone 1988). Since 1968, the Sanctuary is also registered as a National Natural Landmark, due to its significance as a walrus refuge (Brown 1968; Hall 1967; NPS 2009). Since 1976, ADF&G employees staff Round Island during the summer months to collect biological data on marine mammals and seabirds, protect against walrus poaching, and regulate pre-approved visitors (Sinnott 1992).

Historic and Contemporary Peoples of the Northwest Bristol Bay Region

Southwest Alaska is the ancestral territory of Central Yup'ik-speaking Alaska Natives (Funk 2010; Shaw 1990, 1998; VanStone 1984:224). In the late eighteenth century, at the advent of contact between western explorers and indigenous groups, the Tuyuryarmiut inhabited several villages along the shores of Togiak Bay and the Togiak River drainage. In Central Yup'ik, the islands are known by their historic use or relationship to oral traditions (Fall et al. 1991:4). Black Rock is known as *Ingricuar* or "small island," Crooked Island is known as *Nunalukaq* or "land big enough to live on awhile," High Island is known as *Ingriqvak* or "big island," Round Island is known as *Qayassiq* or "place to go in a kayak," Summit Island is known as *Qilkeq* named after a legendary folk hero associated with the island, and the Twins are known as *Nunevragak* or "temporary camping place."

Captain James Cook was the first European to see the Walrus Islands in 1778, and he may have provided the western name of Round Island for Qayassiq (Fall et al. 1991; Kowta 1963:11; Sinnott 1992). In 1818-1819, Russian Petr Korsakovskiy, visited and described some of the Walrus Islands and lands surrounding Togiak Bay (VanStone 1988). For one year, in 1821, the Russian-American Company established an outpost on the west coast of Hagemeister Island (Bailey 1991:14). The outpost was largely unsuccessful and in 1822, the Company moved the outpost to Nushagak Bay. Western explorers regularly passed through the area in the late 1800s, but according to several historic accounts, the Tuyuryarmiut remained isolated from European influence (Fall et al. 1991; Sinnott 1992).

In 1818, Petr Korsakovskiy noted the Tuyuryarmiut seasonally occupied the Walrus Islands, and harvested walrus, seals, belugas, seabirds, sea ducks, fish, and plants (and probably shellfish) from the islands and surrounding waters (VanStone 1988). Korsakovskiy's guides noted that numerous walrus and sea lions were regularly found on Round, Crooked, and the Twins islands. From his own observations, seals frequented the tidal flats of Summit Island (Sinnott 1992:5). In 1829, another Russian working for the Russian-American Company, Ivan Vasilev, wrote that the people of Togiak primarily fished and hunted bearded seals, belugas, and walrus (Fall et al. 1991:7; VanStone 1988).

Between 1830 and 1919, in three major catastrophic events, Euro-American diseases caused epidemics that spread throughout the region, killing large numbers of people and disrupting traditional lifeways (Sinnott 1992:8). Beginning in 1880, “Old Togiak” was gradually vacated for the current village of Togiak (Sinnott 1992). After the widespread influenza epidemic of 1918-1919, many Yukon-Kuskokwim residents also moved to Togiak (State of Alaska 2016). During this time of upheaval, the Yup’ik communities were influenced by continued interaction with the Russian-American Company and missionaries (Kowta 1963; Sinnott 1992:8).

Despite western influences, Togiak residents continued to use traditional hunting weaponry well after European technology became available (Fall et al. 1991:8). The people of Togiak used kayaks, spears, and harpoons for walrus and other marine mammal hunting until the late 1930s to early 1940s, although guns had been introduced to the area in the 1800s (Fall et al. 1991; Kowta 1963). Togiak residents have referred to this time of traditional hunting practices the “kayak era.”

According to Togiak residents, the preferred method of walrus hunting from the kayak era involved a highly organized hunting party of men, who were each responsible for a specific task (Fall et al. 1991:11). Only the best hunters were allowed to kill a walrus to minimize the possibility that a struck walrus would sink. Before the use of guns, the other members of the hunting party used spears to sort the desirable walrus (young and fat) from the not so desirable (old and sick). Other duties, including butchering and packing the meat, were typically relegated to young men who were not experienced enough to participate in the actual killing of walruses. According to Togiak residents, these hunts were important for young men because they learned the appropriate techniques for a successful hunt. Preferably, hunting occurred on land, where the likelihood of losing a walrus in the water is diminished, although hunting walrus from a kayak in open water also occurred. Ideally, walrus were killed on rocky beaches because sand hinders the butchering process and dirties the meat. The number of walrus killed was limited to the amount of meat the hunting party was able to carry home. The community of Togiak continues to hunt walrus in a similar fashion, with an organized group of men, working in tandem, to maintain the traditional values embodied in the hunt (BBNA n.d.a., n.d.b.). The process is now highly regulated by federal and state entities.

Walrus Hunting, Conservation Policy, and Alaska Native Subsistence

In the late nineteenth century, commercial whalers overharvested walrus populations for oil, hides, and ivory, causing their numbers to plummet repeatedly (Fall et al. 1991; Fay et al. 1994, 1997; Jay et al. 2011; NOAA 1978; Sinnott 1992). By the early to mid-1900s, the American, Canadian, and Russian governments began regulating walrus hunting, in an effort to preserve the species (Sinnott 1992). The Canadian and American governments ultimately banned commercial walrus hunting in the 1930-1940s, but allowed for the continuation of walrus harvest by Alaska Native and First Nation communities (Klein et al. 2005:627). The multinational legal movement to curtail the decimation of walrus populations led the State of Alaska to create the Walrus Islands State Game Sanctuary (WISGS) in 1960 (Sinnott 1992). Without consulting rural communities, the State determined that the walruses inhabiting the Walrus Islands were not an important subsistence resource to Alaska Natives. By 1961, the State prohibited all hunting in the sanctuary.

In an effort to protect marine mammals on a global level, the United States passed the Marine Mammal Protection Act in 1972 (16 U.S.C 1361). This law restricts the harvest, ownership, import, and export of marine mammals and marine mammal by-products, but has an exception for Alaska Native traditional practices. As explained in 50 C.F.R. Ch. II, Pt. 216.23(a)1-3, Alaska Natives may harvest marine mammals without a permit, in a way that is not wasteful, to continue traditional lifeways through harvesting animals for meat and using by-products to create and sell authentic crafts and artwork. The Marine Mammal Protection Act also directed states to impose regulations that would meet (or enforce) the spirit of the Act. Despite allowances for Alaska Natives, after the passage of the Marine Mammal Protection Act, the State imposed increasingly restrictive marine mammal hunting regulations and continued to manage the WISGS with a total ban on hunting (NOAA 1978:96-114; Robards and Lurman Joly 2007). These restrictions made it significantly harder for indigenous hunters across the state to procure walrus, which had unintended consequences on Togiak and nearby villages (Chythlook and Fall

1998; Fall et al. 1991; Sinnott 1992). Before the ban, hunters harvested walrus from the beaches of Round Island, where a large and stable population existed, and animals could be regularly and readily dispatched. After the ban, people hunted walrus in open water or salvaged carcasses that washed up on beaches (Fall et al. 1991). Hunting walrus in open water is not a preferred method because struck animals are often lost and wasted. Salvaging carcass meat from the shoreline is also not ideal because the meat is usually not fresh and may be spoiled. There is also a lack of regularity as to when a walrus swims by or a carcass washes up on the shore. The inability to access the population at Round Island made walrus an insecure and undependable resource, which had ramifications for regional Alaska Native sharing networks that had previously relied on a steady source of walrus meat and raw materials (Chythlook and Fall 1998; Fall et al. 1991).

In the 1970s, Alaska Native communities united to address increased state and federal regulation of marine mammal populations. In 1978, the Eskimo Walrus Commission formed to represent 19 rural communities throughout coastal Alaska, from Barrow to Bristol Bay, including Togiak (EWC 2016; Robards and Lurman Joly 2007). The formation of EWC was meant to protect the traditional practices associated with marine mammal harvests of Alaska Native communities, but also to create space for Alaska Native communities to actively participate in the management of the animal populations. In 1979, in the *People of Togiak v. United States*, the community of Togiak used the court system to protest overly restrictive State regulation and effectively argued that State policies of the 1970s ran counter to the original intent of the Alaska Native exception in Marine Mammal Protection Act (Justia 2016). The court ruled in favor of the community of Togiak, which led to a relaxation of statewide restrictions related to indigenous marine mammal harvests. The ban on walrus hunting in the WISGS, however, remained in effect.

In 1991, the Togiak Traditional Council submitted a proposal to the Alaska Board of Game to request that they open Round Island for limited walrus hunting (Fall et al. 1991; Chythlook and Fall 1998). In response, ADF&G launched a study on the historic and contemporary walrus harvest practices in Togiak, documented in Fall et al. (1991). Contrary to the 1960 determination of the State, Fall et al. (1991) noted that walrus is a highly valued animal to the people of Togiak and neighboring communities. Partaking in traditional methods of walrus hunting in the Walrus Islands, specifically Round Island was crucial to the continuation of the cultural values important to the Togiak community. According to Togiak elders, the walrus hunt is essential to the development of young men. During these hunts, young men learn through actions and discussion to "respect" the harvested animals by hunting in a specific manner and not wasting the meat (Fall et al. 1991:12). Once hunters return to Togiak, women control distribution of the kill, and play an integral role in sharing walrus (Fall et al. 1991:13). The families of highly ranked hunters are first in line for ivory and the choicest cuts of the walrus. Once all of the members of the hunting party receive their share of meat, they share the remaining walrus with other families and villages. Every part of the walrus, from the tusks to the internal organs, is used. Edible portions of the walrus are prepared and stored in *uqucilek* or tundra pits that stay cool until winter. The distribution of walrus promoted sharing and relationships within and between communities as well as providing essential food and by-products (Fall et al. 1991).

Later that year, the Council ultimately presented the results of Fall et al. (1991) to the Board of Game, who postponed making a decision until the following meeting to take place in 1993 (Chythlook and Fall 1998). In 1993, the Board of Game denied the request on the grounds that the state and federal governments did not have the right to regulate walrus hunting. Later that year, in what became known as the Arnariak Case, two Togiak residents killed a walrus on Round Island in protest. Though the killing of the walrus was committed without the support of the Council, the incident ultimately led to overturning the State's ruling (Chythlook and Fall 1998).

In 1995, the Board of Game approved the proposal and the Qayassiq Walrus Commission formed to oversee limited hunting on Round Island. In 2003, the Qayassiq Walrus Commission revised and signed the current cooperative agreement with the Eskimo Walrus Commission, Alaska Department of Fish and Game, and U.S. Fish and Wildlife Service. As of 2010, the commission represents the communities of Aleknagik, Clarks Point, Dillingham, Ekuk, Ekwok, Manokotak, New Stuyahok, Togiak, and Twin Hills. (BBNA n.d.a., n.d.b.:1). The Qayassiq Walrus Commission sets the season of harvest (September 10 – October 20), and the number of walrus that may be taken per hunt (BBNA n.d.b.). In 2017, up to 20 walruses may be harvested per year, and each village is annually allotted part of the total. Any walrus that is struck and lost is subtracted from the total. Hunters are required to obtain permits from the Qayassiq Walrus Commission and Alaska Department of Fish and Game before they can participate in the fall hunt (BBNA n.d.b.).

The Round Island walrus hunt occurs every fall, weather permitting, but Togiak residents noted that traditional walrus hunting on Round Island occurred in the spring and fall (BBNA n.d.b.; Fall et al. 2013). Togiak people continue to hunt walrus in the spring, outside of the Round Island hunt (September 10 to October 20), on ice around Hagemeister Island, or wherever walrus are present outside of the WISGS (Fall et al. 2013). Over several decades, local communities have modified their traditional subsistence strategies to stay in compliance with the regulations related to the WISGS, which restricts hunting on all of the islands and waters within one-half mile of them, with the exception of the Twins (ADF&G 2016c).

More recent subsistence studies (post Fall et al. 1991) reiterated that walrus hunting, and other traditional subsistence practices, including sealing, clamming, fishing, berry-picking, and bird and egg harvesting, are important to Togiak and other Alaska Native communities (Coiley-Kenner et al. 2003; Chythlook and Fall 1998; Chythlook 2006; Fall et al. 2012, 2013; Gadamus and Raymond-Yakoubian 2015; Huntington et al. 2015; ISC 2015; Krieg et al. 2007; Magdanz and Wolfe 1988). Togiak, being the closest community to Round Island, continues to play an important part in the trade and sharing network throughout western Alaska (Coiley-Kenner et al. 2003; Fall et al. 2013; Krieg et al. 2007). According to Togiak residents, the most shared items include walrus, seal oil, herring eggs, murre eggs, and clams (Krieg et al. 2007:47). All parts of the walrus continue to be highly valued resources.

The harvest of historically valued animals and plants continues to promote indigenous principles and provide food and materials essential for a satisfactory quality of life in Alaska Native communities (BBNA n.d.a., n.d.b., Chythlook 2006; Chythlook and Fall 1998; Fall et al. 2013; Hunn et al. 2003; ISC 2015; Krieg et al. 2007; Sherrod 1982). Traditional resources are widely shared within a community, including with elders and those with less access, which promotes the social well-being of the community (Krieg et al. 2007). Respecting the harvested animals, using proper techniques that minimize the loss of a struck animal, and taking only what you need are values espoused by Togiak hunters as well as other coastal villages that regularly hunt walrus and seals (EWC 2016; Fall et al. 2013; Gadamus and Raymond-Yakoubian 2015; Robards and Lurman Joly 2007). The “best practice” of the respectful hunt is often couched in a conservation ethic that attempts to convey to non-indigenes that Alaska Native communities understand how to manage animal populations for sustainability and have been doing so for millennia (Chythlook 2006; EWC 2016; Gadamus and Raymond-Yakoubian 2015; Hunn et al. 2003; Moss 2007a; Robards and Lurman Joly 2007).

This dissertation provides another source that documents the deep history of walrus hunting in northwest Bristol Bay (along with Fall et al. 1991; Kowta 1963; Schaaf 2015; Schaaf et al. 2007; VanStone 1988). I also document the long-term harvest of other animals that are heavily regulated by federal and state agencies. This dissertation notes that these practices extend into the Late Holocene, at least 2,700 years into the past. Based on Schaaf (2015) it is more likely that these animal harvest practices have existed for much longer, since at least 6,300 years ago. State and federal policies including those enacted for the Walrus Island State Game Sanctuary, the Marine Mammal Protection Act of 1972 and the Migratory Bird Act of 1918 (amended in 1997) heavily regulate Alaska Native subsistence practices that have been in existence for the better part of three millennia, at least in northwest Bristol Bay.

CHAPTER III

THE NORTON TRADITION IN SOUTHWEST ALASKA

The following discussion considers the archaeology of the Bering Sea coastline region of southwest Alaska, from Norton Sound in the north, to the northern coast of the Alaska Peninsula, where it meets Bristol Bay on the west and is bounded by the Aleutian Range on the east (Figure 6). In the Alaska interior, this area also includes the Yukon-Kuskokwim Delta and Ahklun-Kilbuck Mountains vicinity. I selected the area because it generally aligns with the ancestral territory of Central Yup'ik peoples, who are the direct descendants of Thule populations that were present in the area at the time of contact with westerners. Other researchers have used the boundaries of the Central Yup'ik ancestral territory to form a core research area known as southwest Alaska (Ackerman 1998, 2004; ANKC 2011; ANLC 2016; Dumond 1984, 1987b; Funk 2010; Shaw 1998; VanStone 1988; Woodburry 1984).

The research presented in this dissertation is focused on understanding the subsistence practices employed by the Late Holocene Summit Island residents through analysis of the 49-XHI-043 and 49-XHI-044 faunal assemblages, which Shaw excavated in 1985. An examination of the Summit Island artifact assemblage and the age range of 15 radiocarbon dates taken from major strata excavated at the two sites, generally supports the idea that the Summit Island collection is from mostly, if not all, Norton-affiliated components. My dissertation research resulted in the development of a tentative chronology for Summit Island that includes three components: Early Norton I (2740-

2380 cal B.P.), Early Norton II (2400-2000 cal B.P.) and Late Norton (1390-980 cal B.P.) As such, most of this chapter will be dedicated to discussing key archaeological research which has led to the current understanding of Norton subsistence practices and timing of Norton culture, rather than an in depth review of artifact or feature typology (instead see Dumond 1981, 1984, 1987b, 2005b, 2016; Giddings 1964; Larsen 1982; Shaw and Holmes 1982; Workman 1982). In an attempt to place Summit Island within the long-term regional culture history, I nested the lengthy Norton discussion within a brief review of the major archaeological cultural traditions found in southwest Alaska. Throughout the discussion, I use three types of dating conventions: uncalibrated radiocarbon years before present (RYBP), calibrated calendar years before present (cal B.P.), and generic age ranges (years ago).

Cultural Traditions in Southwest Alaska

Ackerman (1988, 1998) and Dumond (1984, 1987b, 2005a, 2011) have conducted long-term research in southwest Alaska and written overviews that connect the regional archaeology to several of the extensive cultural traditions present in Alaska, starting with the Paleoarctic Tradition (14,000-8,000 years ago) through the Thule Tradition, (1,000-200 years ago, Figure 7). Generally, Early and Middle Holocene peoples in southwest Alaska, with Paleoarctic and Northern Archaic (7000-4500 years ago) toolkits, have been interpreted as terrestrially oriented big game hunters, with incipient interests in small mammals, birds, and fish (Ackerman 1964, 1980; Dumond 1987b, 2005a; Holmes 2001).

Figure 6. Map of Alaska showing archaeological locales mentioned in the text.

Coastal adaptation was first attributed to the Arctic Small Tool Tradition (5500-3000 years ago), though it is typically understood as a terrestrial and riverine oriented culture (Dumond 1987b; Giddings 1964, but see Tremayne 2015). Only in the Late Holocene, with Norton (3000-1000 years ago) and Thule Traditions (1000-200 years ago), have researchers associated archaeological cultures in southwest Alaska with any developed coastal and marine adaptations. The Thule Tradition, however, is seen as the only culture with enough specialized technologies to thrive in any environment, including the ability to fully utilize the suite of resources available in marine environments (Dumond 1987b, 1990, 2000b, 2016; Giddings 1964; Nowak 1982). The trajectory of southwest Alaska subsistence practices, from Early Holocene terrestrial big game hunters to Late Holocene marine-oriented cultures, has been interpreted as dissimilar to that of the Early to Late Holocene marine-oriented cultures documented in the Aleutian Islands, Gulf of Alaska, and southeast Alaska (Clark 1979, 1984; Dumond 1977, 1987b, 1998; Dumond and Knecht 2001; Fedje et al. 2004; Fitzhugh 2003; Hausler-Knecht 1991, 1993; Holland 1992; Hrdlička 1944; Kopperl 2003; McCartney 1984; Moss 1998, 2004b).

What we know about the deep history of southwest Alaska is based on archaeological research concentrated in several widely dispersed locales including Norton Sound (Giddings 1949, 1960, 1964; Bockstoce 1979; Harritt 2010; Tremayne 2015), Nunivak Island (Nowak 1973, 1982; Griffin 1999, 2002), the Yukon-Kuskokwim Delta (Oswalt 1952a, 1952b; Shaw 1982, 1983, 1998), the Ahklun-Kilbuck Mountains vicinity (Ackerman 1979, 1980, 2004, 2008; Biddle 2001; Gallison 1983; Shaw 1979, Workman 1980), along the Kuskokwim Bay-northern Bristol Bay shoreline (Ackerman 1964, 1986, 2004, 2008; Bailey 1986, 1991; Kowta 1963; Larsen 1950; MacMahan 2000;

Ross 1971; Schaaf 2009, 2015; Schaaf et al. 2007; Shaw 1979, 1986, 1998; Staley 1990), and in the Naknek and Ugashik river drainages, on the northwest Alaska Peninsula (Dumond 1971, 1972, 1981, 1982, 1987a, 1990, 1998, 2000a, 2003, 2004, 2005a, 2005b, 2011; Henn 1978; Hoffman 2009; Saltonstall et al. 2012).

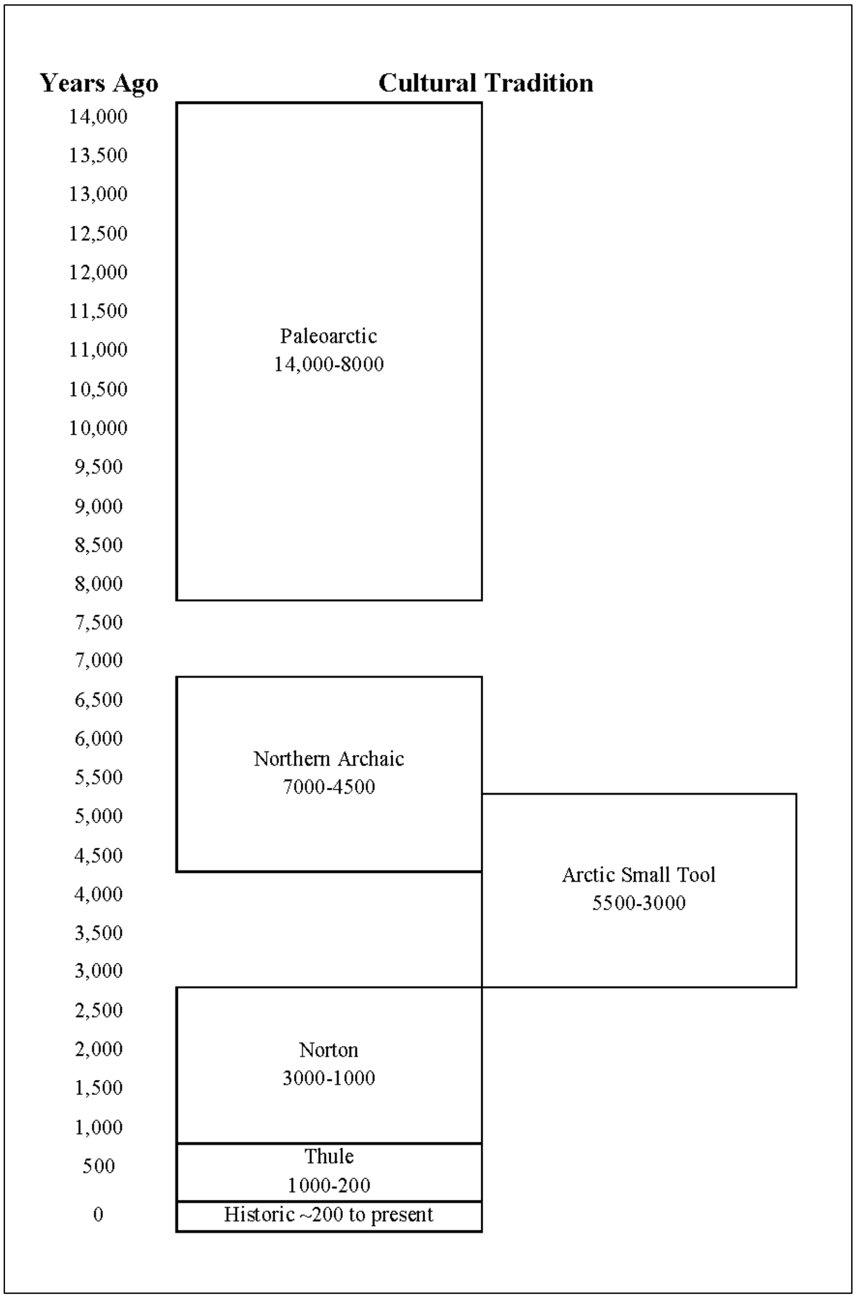

Figure 7. Archaeological cultural traditions in western Alaska.

Paleoarctic Tradition

The Paleoarctic Tradition (14,000-8,000 years ago) is represented in archaeological sites throughout interior and coastal mainland Alaska, the northwest Alaska Peninsula, the Aleutians, southeast Alaska, the Yukon Territory, and the coast of British Columbia (Giddings 1962; Dumond 1987b; Fedje et al. 2004; Holmes 2001; Moss 1998, 2004b). In southwest Alaska, Paleoarctic sites have been located on the Alaska Peninsula in the Ugashik River drainage and Graveyard Point, near the village of Koggiung, and in the Ahklun-Kilbuck Mountains vicinity, by Kagati Lake and the Kisaralik River drainage (Ackerman 1979, 1980; Dumond 1981, 1987b, 2005:15-16; Gallison 1983; Henn 1978).

In archaeological components, the Paleoarctic Tradition has been defined by the presence of chipped stone microblades (but not always), wedge-shaped cores, burins, and leaf-shaped biface technology (Ackerman 1979; Dumond 1984, 1987b:43-44, 2005a; Holmes 2001). The makers of these tools had close ties with Siberia, as evidenced by similarities in the Paleoarctic toolkit with earlier Diuktai and contemporaneous Sumnagin cultures of northeast Asia (Dumond 1987b).

Faunal remains and organic tools have not been found at any of the southwest Alaska Paleoarctic sites. Ackerman (1979) and Dumond (1984, 1987b, 2005, 2011:116) have used the placement of sites, in the interior uplands, near water sources and caribou migration routes, as evidence that peoples with Paleoarctic culture focused on hunting large terrestrial game such as bison, elk, and caribou. The recovery of thousands of faunal specimens from the Broken Mammoth site, in Tanana River Valley, east-central Alaska, has supported these inferences, but also indicated that interior Paleoarctic peoples harvested a diverse suite of animals including many kinds of ungulates, carnivores, small land mammals, migratory waterfowl, and fish (Yesner 2001). Not far from the Tanana River, Halffman et al. (2015) recently documented Paleoarctic people's harvest of anadromous fish with the recovery of 330 chum salmon specimens at the Upward Sun River Site, dated to 11,600-11,270 cal B.P. Early Holocene peoples who lived in southwest Alaska likely harvested many kinds of large and small animals, from various ecological niches, much like the Broken Mammoth and Upward Sun River site residents. Given the wide range of animals recorded at the two sites, seemingly taken from every available niche, it is likely that southwest Alaska Paleoarctic peoples who lived in proximity to the coast would have harvested marine animals as well.

Northern Archaic Tradition

By 7,000 years ago, until 4,500 years ago, the Northern Archaic Tradition replaced the Paleoarctic Tradition throughout interior and coastal mainland Alaska, the northwest Alaska Peninsula, and the Yukon Territory of Canada (Ackerman 2004, 2008; Dumond 1987b; Esdale 2008). The signature technology of the Northern Archaic toolkit included large chipped stone side-notched points, quite different from the toolkit of the preceding Paleoarctic Tradition. Several researchers have suggested that early peoples hafted the robust points onto dart shafts and projected them at caribou or other large game with an atlatl and throwing board (Ackerman 2004, 2008; Dumond 1984, 1987b, 2005b, 2011; Esdale 2008; Hare et al. 2004).

In southwest Alaska, at the Security Cove site, located on the south end of Kuskokwim Bay, the Northern Archaic toolkit also included scrapers, bifacially flaked knives, gravers, choppers, and notched pebbles. Ackerman (2004, 2008) suggested that the side-notched points facilitated striking large-bodied caribou, choppers aided in dismembering carcasses and breaking bone, while gravers and scrapers allowed for hide preparation. The location of the site near the coast and the presence of notched stones suggested to Ackerman an interest in harvesting anadromous fish. The site lacked any organic materials for dating, so Ackerman estimated the component dated between 6,000 and 5,000 years ago based on the typological similarities of the side-notched points with those from the Onion Portage site in Kobuk River Valley, northwest Alaska (Ackerman 2004, 2008; Staley 1990).

At the Pond site near Kagati Lake, Ackerman (1979, 1980, 2004, 2008) located Northern Archaic side-notched projectile points and a linear rock feature in association with a shallow pond that he interpreted as a drive line fence, used by Northern Archaic peoples to guide caribou into the water for easy dispatching. Other Northern Archaic artifacts of dubious context are present at the Mumtruk site, east of the modern village of Goodnews, Goodnews Lake, and at the edges of Kagati Lake (Ackerman 2004; Workman 1980). The location of Northern Archaic components at sites in the Naknek and Ugashik river drainages, near caribou migration routes and anadromous fish runs led Dumond (1984, 1987b, 2005a, 2011) to postulate that Northern Archaic peoples on the Alaska Peninsula also hunted caribou, but were more intensively focused on riverine resources (Henn 1978).

Throughout its distribution, researchers have typically defined the Northern Archaic Tradition as terrestrially oriented. Schaaf (2015), however, recently identified cultural components with a few walrus and murre bone fragments on Round Island, in northwest Bristol Bay, that are contemporaneous with the Northern Archaic Tradition (Ackerman 2004, 2008; Dumond 1987b; Esdale 2008; Potter 2008). Schaaf (2015:41) also found microblades similar to those recovered in a Northern Archaic component at Ugashik Narrows, but dissimilar to those at the nearby Security Cove and Pond sites. In the Middle Holocene, even with lower eustatic sea levels, Round Island would have been accessible only by boat or potentially ice (during the winter), which suggests some peoples with maritime adaptations or interests not typically associated with the Northern Archaic Tradition were present in northwest Bristol Bay.

The relationship between the Paleoarctic and Northern Archaic traditions is not well understood. Northern Archaic side-notched points share similarities with those from contemporaneous Archaic sites in Canada and the western United States, which may suggest a south to north migration of peoples (Ackerman 2008; Dumond 1984, 1987b). It is also possible that Northern Archaic culture evolved in situ from the earlier Paleoarctic Tradition (Esdale 2008). At the Ugashik Narrows Site, microblades are found in association with a Northern Archaic toolkit (Ackerman 2008; Dumond 1984, 1987b; Esdale 2008). Esdale (2008) noted that microblade and burin technology reminiscent of the Paleoarctic toolkit is present in approximately 30% of Northern Archaic stone tool assemblages throughout the tradition's geographic distribution.

Arctic Small Tool Tradition

The Arctic Small Tool Tradition (ASTt) is the subsequent archaeological culture in western Alaska and typified by small finely chipped stone tools including endblades, sideblades, microblades, burins, and knives, as well as burins and adzes with polished edges that show evidence of a “very delicate, narrow, and highly controlled flake removal [technique], often parallel and diagonal” (Dumond 2005b:67). Sites with ASTt material culture are found throughout coastal and interior mainland Alaska, the northern Alaska Peninsula, the High and Low Arctic of Canada (Pre-Dorset culture), and Greenland (Saqqaq and Independence I culture) (Anderson and Freeburg 2013; Anderson and Hodgetts 2007; Coltrain et al. 2004; Dumond 1984, 1987b, 2005a, 2005b; Fitzhugh 1984; Maxwell 1984; Mills 1994; Mobjerg 1999; Slaughter 2005; Tremayne 2011, 2015). ASTt culture appears to have some limited expression or intrusive distribution into distinctly maritime-based culture areas of Alaska, including the Takli Site on the Gulf of Alaska side of the upper Alaska Peninsula, the Hot Springs and Russell Creek sites on the lower Alaska Peninsula, Chugachik Island in Kachemak Bay off the Kenai Peninsula, the Kodiak Archipelago, and the Margaret Bay Site in the Aleutians (Clark 1977; Davis 2001; Davis and Knecht 2005; Dumond 1998, 2005a:72-73; Mills 1994; Steffian and Saltonstall 2005; Workman and Zollars 2002). In southwest Alaska, ASTt components and/or artifacts have been found at the Iyatayet Site on the coast of Norton Sound, Round Island in northwest Bristol Bay, near Eek Lake in the Ahklun-Kilbuck Mountains vicinity, the Wood River Lake and Lower Kvichak River in the Nushagak Bay vicinity and in the Naknek, Ugashik and Upper Kvichak river drainages on the northern Alaska Peninsula (Ackerman 1979; Dumond 1981, 2005a; Giddings 1962, 1964; Mills 1994; Schaaf 2015).

ASTt components generally range in age from 4,000 to 3,000 years ago (Dumond 1987b, 2005a, 2005b; Slaughter 2005). Slaughter (2005) noted, however, that out of 86 radiocarbon dates associated with ASTt components in Alaska, a very small percentage date between 4,000 and 5,500 years ago or more recent than 3,000 years ago (23%, n=20). Slaughter (2005:127-9) questioned the validity of several of these dates, and found that many of the outlier dates cannot be definitively associated with ASTt (Slaughter 2005:128-129).

Giddings (1964) was the first to identify ASTt components at the Iyatayet Site on Cape Denbigh (Dumond 1987b, 2004, 2005a; Giddings 1964:241-242; Irving 1962; Odess 2003; Slaughter 2005). The northern expression of ASTt, developed by William Irving, found on the Seward Peninsula and along Norton Sound (as well as interior northern Alaska), is coincidently named the Denbigh Flint Complex (Dumond 1987b; Irving 1962, 1964; Slaughter 2005). Until recently, the Denbigh Flint Complex components at Iyatayet had the earliest dates associated with the tradition, approximately 5000 years ago, based on Giddings (1964) radiocarbon dating of the site. The validity of the Iyatayet dates (ASTt and other components), however, has been called into question more than once, based on the material dated and the newness of radiocarbon dating procedures in the 1950s (Dumond 1984:99; Gerlach and Mason 1992; Slaughter 2005; Tremayne 2015). Tremayne (2015:165-171), recently re-dated Denbigh Flint Complex components at the Iyatayet Site and determined that the oldest components date to 3480±90 cal B.P., which is much younger than Giddings' dates.

Despite the late age of the ASTt components at Iyatayet, the earliest ASTt dates are still associated with coastal sites, notably Cape Espenberg on the Seward Peninsula (Tremayne 2015:139-152). The presence of early ASTt components on the west coast of Alaska, closest to Asia, continues to supports the long-standing theory that ASTt peoples had Asian origins, rather than representing an in situ development in North America

(Ackerman 1988, 1998; Dumond 1977, 1984, 1987, 2005; Tremayne 2015:152). This is also supported by noticeable similarities in the toolkits of ASTt and Siberian Neolithic cultures (Ackerman 1988; Dumond 1984, 1987b). Sites throughout interior Alaska and in the eastern Canadian Arctic also have slightly later dates, which many researchers believe indicates a rapid west to east expansion of ASTt culture (Dumond 1987b, 2005b; Fitzhugh 1984; Slaughter 2005; Tremayne 2015, but see Odess 2005).

Due to limited preservation of ASTt aged faunal assemblages, most researchers have relied on artifact typology, site location, and the knowledge of historical animal distributions to infer that peoples with ASTt culture, like their Northern Archaic predecessors, focused on terrestrial and riverine resources, with limited interests in coastal resources (Giddings 1964:241-242; Dumond 1984, 1987b, 2005a). Tremayne (2015:135) pointed out that this interpretation is partially supported by the fact that most ASTt research has been conducted on interior sites. It is also likely related to Giddings' (1964) original interpretation of Denbigh Flint Complex subsistence strategies at the Iyatayet Site, which he believed favored caribou hunting (based on the prevalence of sideblades interpreted as arrow points used for hunting herd animals), but also included the use of boats to harvest seals during the spring and fall (based on the presence of harpoon blades, a few charred seal remains, and the proximity of the site to the coast).

Results from the Matcharak Lake Site in the Brooks Range, north-central Alaska, generally support Giddings' interpretations of northern interior ASTt subsistence practices. Archaeologists recovered 81,000 faunal remains from ASTt components dated between 4030 and 3780 cal B.P. (Tremayne 2011). Three percent of specimens were identifiable (n=2,284), with the majority attributed to caribou (74%). The other identified animals were present in much smaller abundances including Dall’s sheep (4%), four fish taxa (14%), two bird taxa (4%), and seven terrestrial mammal taxa (4%). Based on the faunal analysis, Tremayne (2011:49) provided evidence that ASTt people camped at Matcharak Lake during the spring, summer, and fall to take advantage of migrating caribou. He did not find evidence of winter habitation at Matcharak Lake.

Faunal remains and organic implements from ASTt components are abundant in frozen sites throughout the Canadian Arctic, which provide ample evidence of a developed marine orientation in ASTt cultures in the eastern Arctic (Tremayne 2015:2-5). Faunal remains from Alaskan coastal sites are much more limited, but do provide some insight into marine adaptations in southwest Alaska during the Middle Holocene. Tremayne (2015) studied faunal remains from the Iyatayet Site (including those recovered by Giddings) and Cape Espenberg, which show evidence of ASTt seal hunting on the western Alaskan coast, with no direct evidence of caribou hunting. The Iyatayet assemblage that Tremayne analyzed, however, is quite small (n=38) and does not allow for a systematic assessment of coastal subsistence practices. Yet, the assemblages directly indicates that when living on the coast, Iyatayet residents harvested small seals (n=10), unidentified mammal (n=27), and small terrestrial mammal (n=1) to an unknown extent. Tremayne (2015:147) recovered fewer specimens at Cape Espenberg, three seal sesamoid bones, which complement the results from the Iyatayet Site. Farther south, in northwest Bristol Bay, Schaaf (2015) recovered a few seal and walrus bone fragments from Round Island. While all of these faunal assemblages are small, the direct evidence from organic remains, asserts the harvest of marine animals by ASTt peoples living on the coast (rather than caribou). Tremayne (2015) used several other lines of evidence in his dissertation to argue that marine adaptations developed much earlier in the Alaskan Arctic than previously accepted, particularly in ASTt groups who had access to marine resources.

Dumond (1984; 2005a:69-70) maintained that later ASTt peoples in the upper Alaska Peninsula were more sedentary than people of more northern locales, like Matcharak Lake and Iyatayet, because they had access to abundant salmon runs as well as caribou. He supported this inference by noting the presence of an unknown number of salmonid teeth in ASTt components and the placement of sites along "salmon-rich waterways" of Brook River and Ugashik River. There are several other sites in the Kvichak River and Wood River Lake System where ASTt people may have fished and hunted caribou, but these interpretations are not based on direct evidence from faunal remains (Shaw 1990, 1998; Dumond 2005b:71).

Norton Tradition

The Norton Tradition (3000-1000 years ago) replaced ASTt in western Alaska (Dumond 1987). Dorset culture (2500-1000 years ago), the high Arctic equivalent to Norton, replaced Pre-Dorset culture in eastern Canada and Greenland (Dumond 1987; Fitzhugh 1984). The Alaska Norton Tradition is made up of three cultural stages: Choris (3000-2500 cal B.P.), Norton (2500-1000 cal B.P.), and Ipiutak (2000-1400 cal B.P.) (Dumond 1977, 1987b, 2000b, 2016). The Norton Stage (2500-1000 cal B.P.) is the only Stage found in southwest Alaska, and therefore, has the most relevance to this study.

Abbreviated History of Norton Research

The archaeological concept of the Norton Tradition evolved out of mid-20th century research into three post-ASTt cultures including Choris (3000-2500 cal B.P.), Norton (2500-1000 cal B.P.), and Ipiutak (2000-1400 cal B.P.) (Dumond 1977, 1987b, 2000b, 2016). Between 1939 and 1941, Larsen and Rainey (1948) explored Ipiutak and “Near Ipiutak” culture through the excavation of burials, houses, and middens at Point Hope. Near Ipiutak was later recognized as the local expression of the Norton Stage at Point Hope and other locales in northern Alaska, distinct from the Ipiutak Stage (Dumond 2000b). In 1948-1952, Giddings (1949, 1964) excavated Norton components as well as later Nukleet (Thule), and earlier Denbigh Flint Complex (ASTt) components at the Iyatayet Site in Norton Sound. He excavated other Norton components at the nearby sites of Madjujuinuk, Gunguk, and Difchahak, to a more limited extent. This work resulted in Giddings (1964), a monograph in which the author first described Norton culture. Iyatayet is consequently the type site for Norton Culture.

In 1948, Larsen (1950) surveyed and documented 50 archaeological sites along the shores of Kuskokwim and Bristol bays. He excavated several sites in the smaller Chagvan, Nanvak, and Platinum bays that contained Norton, Thule, and Historic material culture. Larsen’s work at the Chagvan Bay, Nanvak Bay, and Platinum Village sites expanded the archaeological understanding of the geographic distribution of Norton culture to the southwest coast of Alaska, and confirmed typological differences in Ipiutak and Norton toolkits. Later, in 1956, on the Choris Peninsula in Kotzebue Sound, Giddings (1957) excavated an oval housepit without a noticeable entrance or corners, unlike the square and rectangular ones of Norton (or Near Ipiutak) and Ipiutak form, He ultimately assigned the material culture to Choris and recognized it as preceding Norton culture.

Dumond (1977, 1982, 1987b, 2000b) noted typological connections between Choris, Norton, and Ipiutak and suggested that the three should be considered stages or cultures of the Norton Tradition. Choris and Norton culture both have linear-stamped and check-stamped fiber-tempered pottery, scratched/polished slate, and oil lamps. They have different projectile technology, but both with flaking techniques reminiscent of ASTt. Norton and Ipiutak share the same finely chipped stone artifacts, but Ipiutak does not have pottery, slate, or oil lamps. At Point Hope, there were elaborate burials and carving of caribou antler and ivory not found in either Choris or Norton components. Dumond (2000b) noted that in more northern locales, there are many similarities and it can be difficult to differentiate between artifacts of the cultural stages.

Since Giddings' Iyatayet excavations, the concept of the Norton Tradition has continued to develop through Dumond's on-going research, which started in the 1960s in the Naknek and Ugashik River drainages located on the Bristol Bay side of the Alaska Peninsula (Dumond 1969, 1971, 1972, 1975, 1977, 1981, 1982, 1984, 1987a, 1987b, 1990, 1998, 200a, 2000b, 2004, 2005a, 2011, 2016, as well as Henn 1978). Dumond's work has focused on detailing the lengthy and developed cultural sequence of the Alaska Peninsula (Paleoarctic through Historic traditions). As a result, the Naknek cultural sequence has become the comparative standard for other research in southwest Alaska (Ackerman 1986; Bailey 1991; Biddle 2001; McMahan et al. 2000; Nowak 1982; Schaaf 2015). Dumond (1969, 1975, 1977, 1982, 1984, 1987b, 2000b, 2016) has also written extensively on Norton culture, based on this research.

From 1964 through 1979, Ackerman (1964, 1979, 1980, 1982, 1986, 1988, 1998) continued Larsen's work along the Kuskokwim-Bristol Bay shorelines, most notably excavating at the Chagvan Bay Site (49-XHI-001). He also expanded surveys into the Ahklun-Kilbuck Mountains vicinity to document interior sites with Norton (and much older) culture. In the 1970s and 1980s, several Norton researchers dispersed to other locales including Nowak (1973, 1982) on Nunivak Island, Bockstoce (1979) at Cape Nome, Shaw (1982b, 1983) in the Yukon-Kuskokwim Delta, and Shaw (1986, 1998) and Bailey (1991) on Hagemeister Island and the Walrus Islands off the northwest Bristol Bay coastline.

More recent Norton research, within the last 20 years, has included Biddle (2001) in the Middle Togiak drainage, McMahan et al (2000) at Clarks Point in Nushagak Bay, Bundy (2007) on the Alagnak River on the northwest Alaska Peninsula, Schaaf (2009, 2015) on Round Island (also Schaaf et al. 2007), Harritt (2010) at the Difchahak Site and Tremayne (2015) at the Iyatayet Site, both in Norton Sound, and Hoffman (2009) and Saltonstall et al (2012) in the Ugashik River drainage. Most notably, Tremayne (2015) recently reassessed the archaeological materials from Giddings' 1948-1952 work at the Norton type site of Iyatayet and recovered new faunal, radiocarbon, stratigraphic, and lithic data from excavations that he undertook in 2012-2013. Part of Tremayne's work directly addresses Giddings' interpretation of Norton (as well as ASTt) subsistence practices, within a larger framework of examining archaeological perspectives on the development and timing of Arctic marine adaptations.

Spatial Range of Norton Culture

Norton Stage material culture has been found on the Alaska coasts of the Arctic, Chukchi and Bering seas, throughout the Alaska interior, and as far east as the Firth River in Canada (Anderson 1984; Dumond 1982, 1984, 1987b, 2000b, 2016; Giddings 1964; Lutz 1972; MacNeish 1956). Coastal mainland sites are documented at Point Barrow, Point Hope, Kotzebue Sound, the Seward Peninsula, Norton Sound, and Kuskokwim Bay (Anderson 1984; Bockstoce 1979; Dumond 1987; Giddings 1964; Larsen 1950; Larsen and Rainey 1948; Lutz 1972). Norton culture has also been documented on nearshore islands including Nunivak Island, Hagemeister Island, and the Walrus Islands (Bailey 1991; Nowak 1973, 1982; Schaaf 2015; Shaw 1986, 1998).

Interior Norton sites are situated mostly along anadromous fish-bearing streams that feed into the ocean, including those of the Yukon-Kuskokwim Delta, the Ahklun-Kilbuck Mountains area, the Wood River and Tikchik Lake system, Nushagak River drainage, and in the Alagnak, Naknek and Ugashik river drainages of the Alaska Peninsula (Ackerman 1964, 1979, 1980, 1982, 1986, 1988, 1998, Bailey 1991; Biddle 2001; Bundy 2007; Hoffman 2009; McMahan et al. 2000; Saltonstall et al. 2012; Schaaf 2015; Shaw 1982, 1983, 1986, 1990, 1998; Dumond 1981, 2000b, 2011). Like the preceding ASTt, Norton material culture appears to have some limited expression in the Gulf of Alaska maritime-based culture areas including along the coast of the upper Alaska Peninsula, in the Kodiak Archipelago, and in Cook Inlet (G. Clark 1977; D. Clark 1982; Dumond 1971, 1981, 2005b, 2016; Reger and Townsend 1982).

Development and Expansion of Norton Culture

There is no documented cultural hiatus between ASTt (5500-3000 years ago) and the Norton Tradition (3000-1000 years ago) in the Bering Strait region (Dumond 2000b; Freeburg and Anderson 2012). In northwest Alaska, the Choris Stage (3000-2500 cal B.P.) was the typological and temporal link between ASTt (5500-3000 cal B.P.) and Norton culture (Dumond 2000b). Norton culture ultimately replaced Choris culture by 2500 cal B.P., and was quickly replaced by Ipiutak culture by 2000 cal B.P. (Dumond 1987b, 2000b).

Only the Norton Stage (2500-1000 cal B.P.) of the Norton Tradition has been found in southwest Alaska (Dumond 1984, 1987b, 200b, 2011, 2016). Dumond (1981, 2004, 2005b, 2011) documented a cultural hiatus between ASTt and Norton cultures, of approximately 800 years, possibly due to volcanism. Schaaf (2015) documented this hiatus between the Middle and Late Holocene cultures on Round Island in northwest Bristol Bay, as well (Schaaf 2015). South of Norton Sound, Dumond (1977, 1984, 1987, 2000b, 2016) noted that Norton culture continued much later, until 1000 cal B.P., before being replaced by the Thule Tradition (1000-200 years ago).

Dumond (2000b, 2016) observed that the earliest dates from northern Norton Stage sites tended to cluster around 2500 cal B.P., while the earliest Norton dates in the southern extent were slightly more recent, around 2400-2300 cal B.P. Dumond (1984, 1990, 2000a, 2000b, 2016) suggested that the ages of Norton components throughout Alaska provide evidence that Norton culture developed in the Bering Strait region around 2500 cal B.P., with a rapid expansion to the south on the Alaska Peninsula, by 2400-2300 cal B.P. According to Dumond (1982, 1990, 2000a, 2000b, 2016), the Norton Stage toolkit has markers of both northern influences, including finely chipped stone implements from the Denbigh Flint Complex and pottery from Choris culture, and southern influences including pecked stone bowls, labrets, and polished slate presumably from the Early and Middle Holocene Aleutians or Gulf of Alaska marine-oriented cultures. Dumond (2000a, 2016) hypothesized that Norton culture was fully developed before Norton peoples arrived on the Alaska Peninsula. He found no evidence of an in situ development, despite the Alaska Peninsula's proximity to the Gulf of Alaska and Aleutians (in comparison to the Bering Strait).

To explain this enigma, Dumond (2000a, 2000b, 2016) suggested that marine-oriented people from the south, possibly those evidenced at the Amaknak Bridge Site in the eastern Aleutians, must have migrated or traded northward and reached the Bering Strait area around 3000 years ago (as per Crockford and Frederick 2007; Knecht and Davis 2005). The nature of Choris, with its polished/scratched slate and oil lamps, supports his idea that the influence of the marine-oriented culture could have been in Bering Strait around 3,000 years ago (Dumond 2016:408). Dumond (2000b, 2016) also suggested that Old Whaling or Chukchi Archaic culture (2800-2670 RYBP) found only in Kotzebue Sound, with no obvious link to other archaeological cultures, might be crucial to understanding the southern influences that ultimately led to the development of Norton culture (Anderson and Freeburg 2013; Freeburg and Anderson 2012; Giddings and Anderson 1986; Mason and Gerlach 1995).

Timing and Extent of Norton Occupations in Southwest Alaska

To facilitate further discussion of the timing and extent of the Norton stage, I compiled calibrated (cal B.P.) date ranges for locales in southwest Alaska where major Norton research has occurred, including the Summit Island (49-XHI-043 and 49-XHI-044) components I present in this dissertation (Table 3). I included calibrated dates provided by other researchers, as well their designations for the various Norton components. If only uncalibrated dates were published, I calibrated them to 1-sigma using Calib7.1 (Reimer et al. 2013) to develop age ranges per site ("Age Range"). Sites with uncalibrated radiocarbon dates (listed in appendix) included Hagemeister Island (49-XHI-016), the Chagvan Bay Site (49-XHI-001), and the Anuska Tommy Site (49-GDN-233). How I developed the Summit Island age ranges will be discussed in Chapter IV.

My calibrations provide a general way to compare the various occupations, to get a sense of how Norton culture was temporally and spatially distributed across the southwest Alaska landscape. My calibrations are not meant to replace the uncalibrated dates presented by the various researchers or to serve as a critique of other researchers' radiocarbon dating reporting. When pertinent, I note uncalibrated dates along with my calibrations. The sites to be discussed in this section are listed in Table 3. The table is organized by location starting with Norton Sound, on the western coast of Alaska, just south of the Bering Strait, moving south through Kuskokwim Bay, and then east to Bristol Bay and the Alaska Peninsula. The last two sites listed in the table are located in the interior, in the Yukon-Kuskokwim Delta and Togiak River drainage. Table 4 provides summary information on faunal assemblages recovered from these sites.

Table 3. Calibrated Date Ranges for Norton Sites Discussed in the Text

Site	Age Range	Component	Reference
Norton Sound			
Iyatayet Site (Cape Denbigh)	2580-2020 cal B.P.	Norton	Giddings (1964:245)
Iyatayet Site (Cape Denbigh)	2560-1780 cal B.P.	Norton	Tremayne (2015:168)
Old Beach Site (Cape Nome)	2430-2180 cal B.P.	Early Norton	Bockstoce (1979:39, 88)
	2000-1600 cal B.P.	Late Norton	Bockstoce (1979:43, 88)
49-XNB-005 (Difchahak Site)	2520-2050 cal B.P.	Norton	Harritt (2010)
Kuskokwim Bay			
49-XNI-028 (Nunivak Is.)	2150-1700 cal B.P.	Early Duchikmiut	Nowak (1982)
	1700-1400 cal B.P.	Late Duchikmiut	Nowak (1982)
49-XHI-001 (Chagvan Bay)	2850-1630 cal B.P*	Phase I/II	Ackerman (1986)
	1600-910 cal B.P.*	Phase III	Ackerman (1986)
Northwest Bristol Bay			
49-XHI-043 (Summit Is.)	2740-2380 cal B.P.*	Early Norton I	This dissertation
49-XHI-044 (Summit Is.)	2400-2000 cal B.P.*	Early Norton II	This dissertation
49-XHI-043 (Summit Is.)	1390-980 cal B.P.*	Late Norton	This dissertation
49-XHI-016 (Hagemeister Is.)	1260-1060 cal B.P.*	Lower	Bailey (1991)
	900-670 cal B.P.*	Upper	Bailey (1991)
49-XNB-043 (Round Is.)	2365-1530 cal B.P.	Component III	Schaaf (2015)
	Post 1530 cal B.P.**	Component IV	Schaaf (2015)
Alaska Peninsula			
Naknek drainage	2400-2000 cal B.P.	Smelt Creek	Dumond (2005b, 2011)
	2000-1300 cal B.P.	Brooks River Weir	Dumond (2005b, 2011)
	1300-1000 cal B.P.	Brooks River Falls	Dumond (2005b, 2011)
Ugashik drainage	2200-1700 cal B.P	Inland	Henn (1978)
	1600-1000 cal B.P.	Tidewater	Henn (1978)
49-UGA-050	1990-1110 cal B.P.		Saltonstall et al. (2012)
49-UGA-052	1750-1150 cal B.P.		Hoffman (2009:44-45)
Yukon-Kuskokwim Delta			
Manokinak Site	1370-720 cal B.P.	Late Norton	Shaw (1983:114)
Togiak drainage			
Anuska Tommy Site	1290-930 cal B.P.*	Norton	Biddle (2001:27)

*Indicates date ranges calibrated herein

**Present, but undated

Table 4. Faunal Assemblages Recovered from Norton Components

Site	Description	Reference
Norton Sound		
Iyatayet Site	Giddings documented seals, whale, and caribou bone (n=637). Recovered worked antler, bone and ivory (n=52). Noted mussel shell lenses. Tremayne (2015) recovered faunal remains (n=1,053) and worked organics (n=10). Tremayne results mirror Giddings', but includes a few fish, bird, and canid bones.	Giddings (1964); Tremayne (2015)
Old Beach Site	Noted, but no systematic recovery of an unknown number of burned seal bone bits as well as caribou, walrus, seal and whale bone specimens. One ivory artifact.	Bockstoce (1979)
49-XNB-005	No faunal assemblage recovered.	Harritt (2010)
Kuskokwim Bay		
49-XNI-028	Large assemblage of marine mammal, caribou, and bird bones (n=900?). Faunal remains analyzed by Chatters (1972), but results problematic. Nowak (1982) analyzed antler, bone, and ivory implements (n=205).	Chatters (1972); Nowak (1982, 1988)
49-XHI-001	No faunal remains recovered.	Ackerman (1986)
Northwest Bristol Bay		
49-XHI-043, 49-XHI-044	Large assemblage of marine bird and mammal bone specimens, with limited terrestrial animal remains (n=9,981). Also contained limited fish (salmonid) and shellfish remains (dogwinkle and mussel). Results in Chapter V of this study.	This dissertation
49-XHI-016	Small assemblage that Bailey did not analyze (n=298). Anecdotal summary of shellfish, fish, birds, and seal. Antler, bone, and ivory implements present (n=30).	Bailey (1991)
49-XNB-043	Small assemblage including marine mammal and bird bone (n=107) and mussel/dogwinkle fragments (n=6).	Schaaf (2015)
Alaska Peninsula		
Naknek drainage	No faunal remains recovered during Dumond's work.	Dumond (2005b, 2011)
Ugashik drainage	No faunal remains recovered during Henn's work.	Henn (1978)
49-UGA-050	Recovery of possible walrus bone specimens (n=5).	Saltonstall et al. (2012)
49-UGA-052	No faunal remains recovered.	Hoffman (2009)
Yukon-Kuskokwim Delta		
49-MAR-007	Large assemblage, with birds, fish, mammals (marine and terrestrial), and shellfish. Anecdotal summary in Shaw (1983), but no faunal analysis.	Shaw (1983)
Togiak drainage		
49-GDN-233	Recovery of burned, unidentifiable specimens reported as large mammal, possibly caribou (n=28).	Biddle (2001)

The majority of components listed in Table 3 fall within the 2500-1000 cal B.P. Norton age range proposed by Dumond (2000b; 2016). Norton Sound sites including the Iyatayet Site (2580-1780 cal B.P.), the Old Beach Site (2430-1600 cal B.P.), and the Difchahak Site (2520-2050 cal B.P.) are appropriately early, based on Dumond's (1990, 2000a, 2000b, 2016) north to south Norton migration theory. Norton components on the Alaska Peninsula date later (per Dumond), between 2400 and 1000 cal B.P., in the Naknek River drainage, and between 2200 and 1000 cal B.P. in the more southern Ugashik River drainage (Dumond 1981, 2005b, 2011; Henn 1978). Recent work in the Ugashik drainage by Saltonstall et al. (2012) and Hoffman (2009) resulted in complementary dates at 49-UGA-050 (1990-1110 cal B.P.) and 49-UGA-052 (1750-1150 cal B.P.).

Dates that conflict with Dumond's assessment of Norton timing include the earliest components from Summit Island (49-XHI-043 and 49-XHI-044) and Chagvan Bay (49-XHI-0001), which have uncalibrated dates as old as 2710-2700 RYBP (Ackerman 1986; Shaw 1986, 1998). The Summit Island components that I dated extend the full range of the Norton Stage (2740-980 cal B.P.), with the earliest dates being at least 200 years older than what Dumond (2000b, 2016) currently accepts for Norton culture. The Norton components at Chagvan Bay range from 2850 to 910 cal B.P., some of which are possibly 300 years earlier than accepted Norton dates (Ackerman 1986).

Setting aside the early Summit Island and Chagvan Bay dates, Norton peoples seem to have settled much of the Alaskan coastline and several islands between Norton Sound and the Alaska Peninsula by approximately 2400-2000 cal B.P. These occupations were lengthy and extended for much of the Norton era. Researchers documented long-term Norton occupations of the Kuskokwim-Bristol Bay region on Nunivak Island, 2150-1400 cal B.P., Chagvan Bay, 2850-910 cal B.P., and Round Island, 2365-1530 cal B.P. (Ackerman 1986; Nowak 1973, 1982; Schaaf 2015). The Summit Island occupations presented in this dissertation were potentially also lengthy, ranging between 2740 and 980 cal B.P. One exception is Hagemeister Island, which seems to have been a late Norton occupation, 1260-670 cal B.P. (Bailey 1991). Interior sites including the Manokinak Site, 1370-720 cal B.P., in the Yukon-Kuskokwim Delta, and the Anuska Tommy Site, 1290-930 cal B.P., in the Middle Togiak drainage, were not occupied until the late Norton era (Biddle 2001; Shaw 1982, 1983). At first glance, the Chagvan Bay, Hagemeister Island, the Manokinak Site, and the Anuska Tommy Site have terminal dates that are too recent for the Norton era (2500-1000 cal B.P.).

Norton Sites in Southwest Alaska

Next, I will consider the sites listed in Tables 3 and 4: their age, material culture, but mostly the researchers' interpretations of subsistence practices from these sites. Current understandings of Norton subsistence are necessary to provide context for my analysis of the Summit Island faunal assemblage. The discussion is generally organized by region of study, and within each region, by history of research, starting with Giddings' work at the Iyatayet Site.

Iyatayet Site, Norton Sound

Giddings (1964:245) dated the Iyatayet Norton occupations between 2580 and 2070 cal B.P. Due to mixing between Nukleet, Norton, and Denbigh Flint Complex components, he was unable to document temporal changes in culture or subsistence practices. Giddings (1964:137) ultimately used "subtraction – a largely subjective process of removing the Nukleet and Flint complex artifacts and treating the remainder as Norton." He did not use screens to collect cultural material and focused mostly on diagnostic items. For the faunal remains, he selectively noted large or complete fragments, but did not collect them. He relied on local individuals to identify the animal bones. From this work, Giddings determined that the Norton toolkit included small chipped stone endblades and sideblades, stemmed projectile points, scrapers, and knives. He also recovered thick-walled check and linear-stamped pottery with fiber or hair-temper, ground, scratched, or polished slate tools, pecked or polished stone lamps used for burning marine mammal oil, shaft smoothers, whetstones, bi-notched stone weights (netsinkers), labrets, toggle harpoons, and heavy stone tools such as adzes with ground, polished, and/or flaked edges. Giddings (1964:176-184) recovered much smaller Norton-era stone assemblages from Madjujuinuk, Gungnuk, and Difchahak, which informed some of his assessment of Norton culture.

The majority of the Iyatayet artifacts were made from stone, with small numbers made of ivory, bone, and antler (n=52), and even fewer made from wood and bark. Almost half of the animal by-product objects were made of fragmented caribou antler and bone (n=24), with a lesser number identified as marine mammal ivory (n=16), bone (n=6), seal (n=2), walrus ivory (n=1), beaver incisor (n=1), bird bone (n=1), and mammoth ivory (n=1). Giddings also identified an assemblage of faunal remains (n=637) that were mostly from small-bodied seals and bearded seals (n=551, 86%) but also caribou (n=15, 2%), beluga (n=36, 6%), and walrus (n=34, 6%). Giddings (1964:185) did not find any bird or fish bones during excavations, which is not surprising given his focus on large and readily identifiable pieces. He noted, but did not try to collect abundant degraded mussel shell lenses throughout the Norton components.

Giddings' typology relied on comparisons with archaeological materials from St. Lawrence Island and the Punuk Islands (Collins 1937; Rainey 1941), Point Hope (Larsen and Rainey 1948), Kobuk River (Giddings 1952), and Cook Inlet (de Laguna 1937). Giddings (1964:139-144) used historic and contemporary ethnographic analogy to assign function to the Iyatayet hunting and fishing implements, and to conceptualize Norton-era subsistence practices. He referenced Larsen and Rainey's (1948) documentation of contemporary Utorqarmiut practices, Nelson's (1899) work in Norton Sound, Collins' (1937) work in the Bering Strait region, and Giddings' own discussions with Kobuk River and Norton Sound Alaska Native communities.

Giddings (1964) described Norton culture as terrestrial and riverine focused with coastal adaptations. For part of the year, Late Holocene people with Norton culture lived on or near the coast harvesting seals and other locally available marine mammals. Major pursuits included netting large quantities of anadromous fish and hunting caribou. People with Norton culture harvested fur-bearing mammals, seabirds, waterfowl, bird eggs, and shellfish to a lesser extent. When on the coast, Norton peoples lived in large semi-subterranean houses that they occupied year after year, building up extensive trash middens at the edges of their homes. When away from the coast, Norton peoples traveled upstream and into the interior, living in less substantial dwellings, to follow migrating caribou, but also harvest smaller-bodied animals as they became available.

Giddings (1964:185-190) believed that Norton people occupied Iyatayet throughout multiple seasons, but most notably identified it as a winter site, based on the size of one excavated house, the depth and extent of associated middens, and the presence of numerous pottery and stone bowls he identified as oil lamps. He mostly referred to subsistence practices that he believed took place in the spring through fall, however, including small seal hunting in the spring, hunting walrus and beluga between May and July, mussel gathering after storms in August and September, and salmon fishing in the summer. He attributed a dearth of bird bones as evidence that Iyatayet residents must have harvested birds and eggs off-site during the months of July and August, though he did identify one bird bone needle blank and other tool types potentially used for bird hunting (end prong for bird spear and gorge). He equated a high abundance of notched sinker stones (n=224) with long-term intensive salmon netting (though no fish bones were noted in the faunal assemblage), and suggested that Norton peoples relied on stores of preserved salmon for the winter months (as observed in the various ethnographic studies of coastal communities). Although caribou faunal remains (n=15) and worked objects (n=24, of which three came from scapulae) were not abundant in the Iyatayet Norton components, Giddings suggested that caribou were very important to Norton peoples due to the use of antler (n=21) as raw material for making hunting and other implements. From the abundance of projectile points, he believed that Norton peoples would have gone to great lengths to procure caribou by-products, as well as meat. Caribou hunting would have occurred mostly in the interior, and less frequently on the coast. Giddings assumed that Norton people made seasonal rounds to the river and the interior; much like contemporary and historic Inupiaq communities of northwest Alaska (see Lucier and VanStone 1991). Despite finding mostly marine mammal bones, Giddings (1964:185) posited “a predominance of small seal may indicate intensive spring hunting at the ice edge to make up for a shortage of caribou.”

In 2012-2013, Tremayne (2015:184-189) recovered another set of Norton faunal remains from the Iyatayet site (n=1,053) and some worked organic objects (n=10). The 2012-2013 faunal sub-assemblage is slightly larger than that recovered by Giddings between 1948 and 1952 (n=637), but Tremayne found less material to be identifiable (n=380, 36%). In a comparative analysis, Tremayne found similarities in the two assemblages. Like the 1948-1952 sub-assemblage, which contained 98% marine mammal specimens, the 2012-2013 one was dominated by marine mammal specimens (87%, n=331). The vast majority of the 2012-2013 marine mammal specimens were identified as small seal including ringed seal (n=280, 85%), with lesser numbers of specimens identified as bearded seal (n=2, <1%), walrus (n=1, <1%), beluga (n=1, <1%) and unidentified whale (n=4, 1%). The remaining marine mammal specimens were identified as pinniped, phocid, or large seal (n=43, 13%). Tremayne and Giddings also recovered similar abundances of caribou bone, with caribou representing 2% (n=15) of the 1948-1952 sub-assemblage, and representing 4% (n=17) of the 2012-2013 sub-assemblage.

While Giddings’ recovery of faunal remains was unsystematic, he chose to note only large and whole bones, Tremayne (2015) used systematic excavation methods and sorted excavated sediments through 1/8-in. mesh screen. Tremayne was able to recover smaller-bodied fish, bird, and land mammal bone fragments that could have been present (but missed) during Giddings’ excavation. These taxa make up a small portion of the 2012-2013 faunal sub-assemblage (n=32, 8%), but provide hints to some other Norton subsistence activities that took place at Iyatayet. None of the fish specimens could be identified beyond class (n=12), but site residents must have fished to some extent. Tremayne (2015:215) suggested that netsinkers recovered from the 1948-1952 and 2012-2013 excavations, as well as the unknown fish bones, provided evidence of fishing nearby at Iyatayet Cove, rather than the offsite harvest of salmon. Tremayne logically presumed that netsinkers would be used near Iyatayet, which is not near the mouth of a salmon-bearing river, rather than stored there and used elsewhere as Giddings hypothesized. This idea is supported by the historical ecology of Iyatayet Cove, which locals know to be a good place to fish for tomcod or polar cod, rather than salmon (Tremayne 2015:215). Some of the bird specimens (n=5) were identified as goose (n=1) and ptarmigan (n=2), which indicates an interest in local and migratory birds. Land mammals (n=15, minus caribou) included possible fox (n=1), possible dog (n=7), and rodent (n=2). The fox and rodent may have been non-cultural additions to the archaeological components (burrowers living in the archaeological components), but dogs would have been related to the human occupation of Iyatayet. The organic tools/worked items include six objects (including harpoon heads) made of unknown bone, but also two walrus ivory objects, and two seal rib objects. Based on the Giddings and Tremayne excavations, 62 organic worked objects are associated with Iyatayet Norton components. The combined worked bone and antler object assemblage is quite small, but suggests, as Giddings asserted, caribou antler and bone (n=24, 39%) was a common medium for the Iyatayet Norton toolkit. When considering proportions of recovered artifacts, however, marine mammal bone and ivory (n=23, 37%) likely had similar importance to caribou. The presence of bird and mammoth ivory in such a small assemblage further suggests that site residents valued other taxa, as well as rare fossil finds, for tool production.

Tremayne (2015:189) described the Norton artifact and faunal assemblages as indicative of the “intensification of marine resources between the Denbigh [ASTt] and Norton occupation of the site.” While he generally agreed that the 2012-2013 faunal assemblage showed the same subsistence patterns described by Giddings (1964), Tremayne characterized the Norton occupation as marine-oriented in nature, rather than concluding that the Iyatayet residents were primarily caribou hunters and salmon fishers. Tremayne (2015:186-189, 215) noted that Norton peoples (and later Nukleet peoples) “relied heavily on sea mammals, primarily small seals…Iyatayet, which is not located at the mouth of a river, was probably not a prime salmon fishing site.”

Naknek and Ugashik River drainages, Alaska Peninsula

For the Naknek River drainage, Dumond (1981:132-151, 1987b, 2005a, 2011, 2016) designated the local expression of Norton as the Brooks River Period. He defined the cultural sequence in the Naknek drainage from fieldwork at numerous sites between 1960 and 1975, but also from smaller projects throughout the 1980s and 1990s. There are three phases in the Brooks River Period including Smelt Creek (2400-2000 cal B.P.), Brooks River Weir (2000-1400 cal B.P.) and Brooks River Falls (1400-1000 cal B.P.). These phases were determined by radiocarbon dating, but also from changes in artifact morphology and frequency of tool types (Dumond 1981, 2005a, 2011).

The Smelt Creek (2400-2000 cal B.P.) artifact assemblage is quite similar to that of the Iyatayet Site, including small chipped stone endblades, sideblades, knives, and scrapers, edge polished chipped stone adzes, notched stone netsinkers, and check-stamped and plain pottery with fiber temper and cylindrical bodies that flare at the upper portion, and contract at the lip (Dumond 1981:132-152, 1984, 1987b, 2005b:31). In the Brooks River Weir Phase (2000-1400 cal B.P.), the toolkit stayed similar, with many of the small chipped stone implements still present, but with different morphology. Polished slate including ulus and lance blade knives were new additions, based on trade with Gulf of Alaska peoples, and pottery vessel shape changed to cylindrical or barrel-shaped, without contracting rims (Clark 1977; Dumond 1981, 2005b). People also did not decorate pottery as much as they had in the Smelt Creek Phase, but they still used check-stamp designs to some degree, though the stamps were larger than in the previous phase. In the Brooks River Falls Phase (1400-1000 cal B.P.), chipped stone projectile point morphology changed again (now with barbing), and the use of polished slate ulus and lance knives increased, chipped stone sideblades decreased significantly, and pottery was thicker, with more gravel temper, and less likely to have surface decorations. Check-stamp as a surface design was still used (Dumond 1981).

Dumond (2005b:33) indicated that faunal remains and organic implements did not preserve in Norton components in the Naknek River drainage. Instead, he looked to ethnographic analogy, site location, and local ecology to infer subsistence practices. He also used typological comparisons with other Norton sites throughout Alaska to draw parallels regarding Naknek subsistence. Dumond (1981, 1987b, 2000b:5, 2005b:34, 2016) noted that some sites along anadromous fish-bearing rivers in the Naknek drainage had extensive accumulated material culture (not necessarily related to number of houses or site size), giving the impression of populated semi-sedentary communities not associated with earlier Alaskan archaeological cultures (with proportionally less accumulated material culture in pre-Norton components). He noted that these sites appeared to be placed near major salmon runs (like the King Salmon River), where contemporary people fished. Dumond (1981) recovered small numbers of netsinkers in Smelt Creek, Brooks River Weir, and Brooks River Falls components, which he took to mean that Norton people used nets to mass harvest fish from the large salmon runs in the area. Dumond made a distinction between surficial sites with limited material culture and sites with extensive archaeological remains to infer that Naknek peoples with Norton culture had seasonal rounds of subsistence practices. Sites with more material culture, he associated with intensive fishing, winter habitation, and longer-term occupation. Those with less material culture and lacking pottery, he presumed were temporary and used to take advantage of mobile game, namely caribou.

Farther south, in the Ugashik drainage, in 1973-1975, Dumond and a University of Oregon field crew identified 30 archaeological sites (Henn 1978). Henn (1978) and Dumond defined a local Norton component, termed the Ugashik Lake Phase (2200-1000 cal B.P.), which contained pottery, labrets, chipped stone implements, and netsinkers similar to those in the Naknek River drainage. The Norton component included the Inland sub-phase (2200-1700 cal B.P.) found at Ugashik Narrows, which Henn (1978:82) likened to the Naknek Smelt Creek and Brooks River Weir phases, and the Tidewater sub-phase (1600-1000 cal B.P.), found farther west along Ugashik River and Ugashik Bay, reminiscent of the Brooks River Falls Phase. Henn noted that the temporal separation of the sub-phases was likely related to limited sampling. Dumond (1981) confirmed that the Ugashik cultural sequence was not well defined in comparison to the Naknek cultural sequence.

The Ugashik crew did not recover any faunal remains associated with Norton components, and Henn (1978:9) was most focused on interpreting the cultural sequence and toolkits rather than the subsistence practices of Ugashik River drainage inhabitants. He did note that the "Ugashik Narrows is a rather unique landform configuration which provides a crossing for game…" and recorded some extant fauna he saw during the field season including caribou, moose, and other large game animals, as well as marine mammals, salmon, other fish, birds, and small-bodied mammals. Henn (1978:9-10) also referred to the subsistence practices of historic Bristol Bay peoples including primarily salmon fishing, but also caribou hunting, seal hunting, harvesting waterfowl, and possibly targeting fur-bearing mammals. Henn (1978:10), like Giddings, felt it was "reasonable to believe that the…subsistence patterns of the Ugashik area differ little from that described for other peoples about Bristol Bay."

Like other Norton researchers, Henn (1978:53) noted netsinkers throughout the Norton components:

> There is a definite change in both size and weight of these sinkers throughout the Ugashik Lakes phase. The sinkers are initially large and heavy, then become progressively smaller and lighter. They occur as matched pairs in the Early Inland sub-phase and later are found more commonly as clusters or scatters. It is proposed that some change in fishing practices took place during the phase and culminated in the Tidewater sub-phase, where the sinkers are the lightest and smallest. It is

> presumed on the basis of historical accounts that salmon were the primary target of these fishing activities.

Henn (1978:54) hypothesized that the technological innovation evidenced by the change in netsinkers (on which he did not elaborate) resulted in people moving from the interior at Ugashik Narrows (Inland sub-phase) to Ugashik Bay and the lower reaches of the Ugashik River (Tidewater sub-phase). With this shift, Norton peoples moved from riverine and terrestrially oriented subsistence practices, to those that included coastal adaptations.

The more recent work of Hoffman (2009) and Saltonstall et al. (2012) showed that Henn (1978) and Dumond (1998) were correct to suggest that the Inland and Tidewater sub-phases were not based on a true occupational hiatus of the Ugashik River drainage, but rather the result of limited sampling. Saltonstall et al. (2012:64) identified repeated Norton occupations of the Penguq Site (49-UGA-050) that spanned most of the middle and late Norton era, from 1990-1110 cal B.P. Hoffman (2009:44-45) identified similarly aged Norton components at 49-UGA-052 that dated to 1750-1150 cal B.P.

Both sites are the remnants of large villages with dozens of house features, located on the middle King Salmon River, which ultimately feeds into the lower reaches of the Ugashik River drainage, at Ugashik Bay. Hoffman (2009) and Saltonstall et al. (2012) studied house form, material culture, stratigraphy, and chronology. They believed both sites showed evidence of long term, repeated, and multi-season occupations of mid-river settings, including potential winter habitation of the area. They also noted that site residents would have access to riverine, lake, terrestrial, and coastal resources at different places throughout the drainage, but 49-UGA-052 and the Penguq sites were placed to take advantage of the large salmon runs. The historical ecology of the King Salmon River as a major salmon run, as well as the presence of netsinkers in the cultural components supported their (and Dumond's) inferences. Faunal analysis could not be a factor in their research. Organic preservation at the Penguq Site was limited to some charred grass and wood, but also a few "highly degraded sea mammal bones" that zooarchaeologist Mike Etnier tentatively identified as five walrus specimens (Saltonstall et al. 2012:61). No bones or other organic materials of Norton age preserved at 49-UGA-052 (Hoffman 2009:67-68).

Mainland Coast of Kuskokwim-Bristol Bays

In 1948, Larsen (1950) documented 50 sites on the mainland coast of Kuskokwim and Bristol bays. He excavated seven sites, five of which he attributed to the Thule and Historic traditions, and two he described as also having components reminiscent of, but distinct from, the northern Ipiutak culture documented by Larsen and Rainey at Point Hope (1948). The oldest components at the village sites in Chagvan and Nanvak bays were ultimately assigned to Norton culture.

Larsen (1950:181) described the Chagvan Bay site (49-XHI-001) as a large village consisting of 50 houses with at least four distinct cultural periods. In the Norton components, he noted chipped stone endblades, sideblades, and scrapers, and "harder and finer" pottery different from the "brittle crude" pottery of the Thule Tradition. He also documented pumice abraders, notched sinker stones, ground stone adze blades, whetstones, and labrets. The Chagvan Bay assemblage was noticeably different from

Ipiutak culture based on the presence of pottery, which was plain, check-stamped, and cylindrical in form with grass, sand, and gravel temper.

At Nanvak Bay, north of Cape Pierce, Larsen (1950:183) found similar material culture, including chipped stone tools, netsinkers, pumice abraders, check-stamped and cord-impressed pottery, and at least one labret. Larsen did not note the recovery of any organic materials at either of these two sites, and he did not make any interpretations related to subsistence practices.

In the 1960s, Robert Ackerman (1964) revisited many of the sites Larsen (1950) surveyed on the Kuskokwim-Bristol Bay coasts including Platinum Spit, Security Cove, Nanvak Bay, and Chagvan Bay. He also surveyed east of Nanvak Bay to Asigyukpak Spit and Osviak Bay and located sites he believed spanned the most recent 2,000 years (the results of the survey are unpublished, but noted in Shaw 1998:238). Ackerman was primarily interested in investigating the cultural chronology at Chagvan Bay, which resulted in the documentation of the material culture of several local phases attributable to Norton, Thule, and Historic traditions. The results of this work did not include a discussion of Norton subsistence practices or the recovery of any faunal remains or organic items that could be associated with the Norton Tradition. Ackerman also excavated at Nanvak Bay, and found a small Norton component (Nanvak Bay Phase I) that he compared to the Norton components at Chagvan Bay.

Ackerman (1964) excavated at Chagvan Bay and he, Ross (1971) and Staley (1990) ultimately published on the archaeology of Chagvan Bay. These works focused on the stone tools, mapped features, and site stratigraphy, not the subsistence practices of the Late Holocene site residents. Ross (1971) developed a cultural sequence, which

Ackerman (1986) ultimately refined to include four phases: Chagvan I through IV. Ackerman (1986) compared the Chagvan Bay sequence to the well-established Naknek cultural sequence on the Alaska Peninsula (Dumond 1981, 2005b, 2011). According to Ackerman (1986), Phase I/II (2700-1600 RYBP or 2850-1630 cal B.P.) is comparable in time and typology to the Smelt Creek Phase (2400-2000 cal B.P.). Ackerman placed Phase III (1500-900 RYBP or 1600-910 cal B.P.) in the Brooks River Falls Phase (2000-1400 cal B.P.) despite temporal overlap with the earlier Brooks River Weir Phase (1400-1000 cal B.P.). Ackerman identified Phase IV (Post 800 RYBP) as a Thule to proto-historic component.

The Norton-age artifacts recovered from the three Norton phases included linear and check-stamped pottery, finely made chipped stone tools, ground slate ulus and adze blades, whetstones, pumice abraders, net weights, and labrets. Of note, Ackerman (1986:275) recovered ground slate ulus in Phase I components, which differs from Smelt Creek components that do not contain ground slate (Dumond 2005a, 2016). Ackerman (1986:294) noted “the limited amount of faunal material indicates that both caribou and walrus were utilized,” but did not specify which of the Chagvan Bay phases are associated with the faunal remains.

Cape Nome and Difchahak Sites, Norton Sound

Between 1969 and 1976, Bockstoce (1979) excavated at the Old Beach Site and Ayasayuk Midden near Cape Nome, on the north shore of Norton Sound. The Old Beach Site contained Denbigh Flint Complex (ASTt), Norton, Birnik, Thule, and Historic components, while the Ayasayuk Midden was a 500-year-old Thule site. At the time of the excavations, the Old Beach Site was considerably larger than the nearby Iyatayet Site, made up of two loci of Norton features with (respectively) at least 260 and 60 square to rectangular house features. Bockstoce noted active erosion of the site and estimated that a considerable amount would be lost to the sea.

At the Old Beach Site, Bockstoce (1979:37-43) documented two Norton phases, Early (2430-2180 cal B.P.) and Late (2000-1600 cal B.P.). Bockstoce compared the Old Beach site components to Iyatayet and noted considerable similarities in the two artifact assemblages, as well as temporal overlap. Artifacts at the Old Beach Site included chipped stone endblades, sideblades, knives, and scrapers, adze blades, burin-like implements, drill bits, shaft smoothers, whetstones, pumice abraders, netsinkers, labrets, ground slate blades, pecked stone lamps, and plain and check stamped pottery with fiber and sand temper. Artifact abundance remained very similar between the two phases, with the exception of netsinkers (Bockstoce 1979:57). Netsinkers were present in Early Norton components, but absent in Late Norton components.

Very few faunal remains were recovered, including what Bockstoce (1979:37-43) characterized as a few bone chips per house, one unidentifiable ivory artifact, and one seal phalanx from Early Norton components. An unknown number of small burned seal bone fragments, caribou bone fragments, walrus elements, seal elements and one large whale vertebra were recovered in the Late Norton components. To infer Cape Nome subsistence strategies, Bockstoce relied on local ecology, ethnographic data from historic Alaska Native communities, and Giddings’ inferences from the Iyatayet Site.

According to Bockstoce (1979:51), in the Early Norton Phase, the presence of seal bone suggested that site residents occupied the site during the winter (though

Giddings' thought Iyatayet sealing occurred in the spring), and netsinkers and line sinkers indicated summer salmon fishing. In the Late Norton Phase, Norton peoples hunted seal in the winter and walrus in the spring. Caribou are a resident species and could not be associated with a particular season. Two line sinkers (grooved stones) were found in Late Norton components, which Bockstoce suggested could have been used to fish for tomcod during the winter and spring. It is likely that the discrepancy in the inferred season of sealing was related to using different ethnographic and contemporary sources.

Bockstoce (1979) referred to Giddings's assessment of Norton subsistence practices and provided parallels for similar interests at Cape Nome. Sideblades suggested the harvest of caribou and marine mammals (despite limited caribou bone having been found at either site). Bockstoce agreed with Giddings that Norton peoples likely hunted caribou when away from the coast, but caribou must have been an important resource for meat and by-products on the coast (despite not being well-represented). He believed that salmon was very important due to the presence of netsinkers; Bockstoce hypothesized that the disappearance of netsinkers in the Late Norton components was related to a major decline in salmon populations.

In 2006, Harritt (2010) mapped and tested portions of the Difchahak Site (49-NOB-005), located south of the village of Shaktoolik on the east coast of Norton Sound (south of Iyatayet). Giddings (1964:3) originally tested the site in 1948, and he estimated that it contained 100 deep housepits. Harritt ascertained that Difchahak was a very large Norton occupation, stretching some 600 m across a beach ridge. As of 2006, the site contained 223 features, 155 of which were square to rectangular house depressions, and 68 were cache pits. Harritt also radiocarbon dated the site to 2520-2050 cal B.P. and noted that it overlapped in time with the Iyatayet Norton occupations. Harritt was not focused on interpreting subsistence practices, but instead, pointed out that Difchahak is one of the larger documented Norton sites in Norton Sound, much larger than the other nearby sites (including Iyatayet). Based on the size and length of occupation, Harritt (2010:87) hypothesized that Difchahak was central to the Norton “cultural sphere” in Norton Sound.

Nunivak Island, North of Kuskokwim Bay, Bering Sea

Norton peoples occupied Nunivak Island between 2150 and 1400 cal B.P., and were succeeded by Thule and then Cup’ig Yup’ik peoples (Nowak 1973, 1982). Norton is the oldest documented archaeological culture on Nunivak Island, and researchers working there have provided ample confirmation of a continuous human occupation of the island since around 2000 years ago (Griffin 1999, 2002; Nowak 1982; Souders 1997).

Between 1967 and 1973, Nowak (1982) excavated several sites on Nunivak Island. Much of this work remains unpublished, with the exception of excavations he conducted at 49-XHI-028, along the Mekoryuk River, on the north coast of the island. Based on this work, he separated the Norton occupations at 49-XNI-028 into Early Duchikmiut (2150-1700 cal B.P.) and Late Duchikmiut (1700-1400 cal B.P.) phases based on changes in artifacts, radiocarbon dates, and site stratigraphy. Pottery was very abundant in the 49-XNI-028 excavations, and Nowak used changes in temper to define the sub-phases. In the early phase, people made plain and check-stamped pottery with mostly hair temper, and in the late phase, shifted to mostly sand and fine gravel temper (Nowak 1982:77).

Nowak (1982:76-80) recovered lots of stone implements typical of the Norton toolkit including chipped stone endblades, scrapers, drills, gravers, bow drill shaft holders, burins, ground slate knives and adzes, and notched stones (netsinkers). Organic preservation was particularly good at the site, due to the presence of mussel shell midden (on which he did not elaborate). Nowak analyzed 205 organic implements including harpoon and dart heads and foreshafts, leister prongs, needles, awls, spoons, tubes, plugs, rings, bow ends, drill braces, picks, wedges, adzes, knife handle, and scrapers. He noted some were made of caribou antler and bone, as well as walrus, whale, and marine mammal bone, ribs, and ivory, and small bird bones (Nowak 1982:79-80). Nowak did not quantify the material used for the various organic objects, but all objects made from caribou antler/bone were attributed to the Late Duchikmiut phase, with the exception of one small group of awls without a specified phase (which may have been present in both phases). Weights were very abundant, made mostly of stone (n=1,438), with some of bone (n=5), and interpreted as notched stone netsinkers.

From analysis of the organic items, Nowak (1982:85, 1988) believed that most were associated with hunting and processing marine mammals. To substantiate this claim, Nowak (1982, 1988) briefly summarized the results of a faunal analysis of midden samples from 49-XNI-028 conducted by James Chatters (1972). According to Nowak (1988:44-46):

> Sea mammal harvesting has been a major subsistence undertaking for the past 2000 years on Nunivak Island (Nowak 1982a:87). Analyses of faunal samples obtained at XNI-028…indicate that the skeletal remains of walrus (*Odobenus rosmarius divergens*), Steller’s sea lion (*Eumetopias jubata*), bearded seal

> (*Erignathus barbatus*), common harbor seal (*Phoca vitulina*), ribbon seal (*Phoca faciate*), and possibly a beluga…are found at the site…It was occupied on a year-round basis, and the midden areas from which sea mammal bone samples were collected date before and after A.D. 490 (Nowak 1982a:85). Belugas are represented in a small enough proportion so that identification of this animal remains somewhat tentative in the Norton-aged archaeological deposits at XNI-028. Sea lions are more abundant, making up 13% of the bones of one sample and 7% of another (Chatters 1972:12, 17). Most common were the two Phoca species (representing 53% of the total sample). Bearded seals are also fairly common at 24% of the sample (Chatters 1972:17)…The fact that only three of nearly 700 bones are identified as beluga makes their place in prehistoric XNI-028 subsistence questionable.

In his Masters' paper, Paul Souders (1997) also summarized Chatters (1972) and noted that screens were not used to recover the faunal remains that Chatters analyzed. Souders (1997: Chapter I) described Chatters' work as such:

> Nowak (1982) apparently recovered a large faunal assemblage from the Mekoryuk sites, but this assemblage is poorly documented. He reported finding hair seal, bearded seal, sea lion, and beluga whale in large quantities at 49-XNI-028. Chatters (1972) described a preponderance of caribou remains in one level from a single house pit at the Mekoryuk Village sites; he also reported large numbers of marsh birds' remains. Chatters (1972), in a brief report to Nowak, outlined the recovery of mammal and bird remains from several units at the Mekoryuk Village

> sites. Many of Chatters' results were difficult to interpret, since Chatters referred to the sites with their field designations. Without Nowak's field notes or Chatter's laboratory notes, I could [not] ascertain to which sites and periods of occupation Chatters refers. Moreover, I had no information on conditions of excavation, such as screen size employed (if any)… [Most] of Chatters' analyses appear to refer to Norton-era occupations.

The summaries provided by Nowak and Souders seem to provide more context on the 49-XNI-028 faunal assemblage than reading Chatters (1972). As noted by Souders (1997), the field descriptions are confusing, but there are other problems with Chatters (1972) that call into question the results of the faunal analysis. Chatters (1972) noted that he did not have access to a good comparative collection and was missing many of the marine mammal taxa that he ultimately identified in the assemblage. He also chose to identify birds only to the level of family or subfamily (due to the lack of comparative bird specimens), and relied on a vague understanding of local animal behavior to assign an identity to bird bone specimens. Furthermore, once Chatters (1972:2-3) associated a bird specimen with a particular family, he would assign the specimen to subfamily based on the size of the specimen. An obvious issue with using size to identify an anatid specimen (ducks, geese, and swans) to subfamily, particularly in the Arctic, is that common eider bones have the same size and proportions of many medium-sized goose species. Given these issues, it is difficult to consider Chatters' identifications reliable beyond some generic groupings. In general, Chatters (1972) considered between 500 and 600 specimens identifiable for the final report (sample counts of identifiable and unidentified specimens do not add up to his total of 892 specimens). Of these, approximately 30% of the specimens came from birds, and approximately 70% came from mammals. The majority of mammal bones likely came from marine mammals (approximately 56%) and caribou (approximately 40%), though he noted that the minimum number of individual caribou that could potentially be represented in the faunal assemblage was much lower (approximately 20%) than marine mammal individuals. Very few of the specimens came from small land mammals (less than 5%). He also noted an unknown number of fish bones in at least one sample.

Based on the large number of netsinkers (n=1443), proximity of 49-XNI-028 to the Mekoryuk River, and contemporary use of the site as a fishing locale (but not the presence of archaeological fish remains), Nowak (1982) hypothesized that 49-XNI-028 site residents were also intensive fishers. Nowak's interpretation of the subsistence practices was also informed by local ecology. He noted the year-round availability of seals, walrus and caribou (at least pre-19th century), summer availability of nesting waterfowl, summer runs of salmon, and winter presence of tomcods (Nowak 1982:75).

Nowak (1982) identified the Duchikmiut phase as marine-adapted or marine-oriented, but acknowledged that Giddings and Dumond identified Norton as a coastally adapted culture of caribou hunters. He attributed the marine orientation evidenced on Nunivak Island to the fact that the 65 x 97 km island is large enough to sustain numerous species of migratory marine animals (as well as resident populations), but also isolated, being 50 km off the coast of mainland Alaska, which would require island residents to intensively harvest locally available species. Despite the remoteness of Nunivak Island, Nowak assumed that Norton peoples traveled by boat to the mainland if needed. They must have also interacted with other Norton peoples, based on the centrality of Nunivak

Island between Norton Sound and the Alaska Peninsula (when traveling along the coastline). According the Nowak, the entirety of the Duchikmiut Phase of Nunivak Island was well developed based on comparisons with the Norton components at Norton Sound and the Alaska Peninsula (i.e., no evidence of a proto-Norton phase). Due to the later age of the earliest components, Nowak believed that the Norton components on Nunivak Island could provide little toward understanding the origins of Norton.

Hagemeister Island and Walrus Islands, Northwest Bristol Bay

In the 1980s, as the State Archaeologist for the Alaska Office of History and Archaeology, Robert Shaw (1982a, 1982b, 1985) was the first to conduct archaeological work in the Walrus Islands State Game Sanctuary. He surveyed all seven islands in response to widespread illegal digging in the area and ultimately recorded eight sites on Crooked Island (49-XHI-036, 49-XHI-046 to -052), one on Round Island (49-XNB-043), and five on Summit Island (49-XHI-042 to -045 and 49-XHI-057). Several of these sites had sustained severe damage from illegal digging (AHRS 2010; Schaaf et al. 2007; Shaw 1982a, 1985, 1986; Sinnott 1992). He did not locate any sites on High Island or on the rocky islets of the Twins or Black Rock. The lack of sites on the islets is not surprising given the sheer rocky cliffs, bouldered beaches, and seasonal inundation of some of the beaches. Based on the Tuyuryarmiut Yup’ik name for the Twins, “temporary place to camp,” recorded in 1818 by Korsakovskiy, we know that some level of historic occupation occurred there (VanStone 1988).

In 1982, Shaw tested two of the sites on Crooked Island (49-XHI-046 and 49-XHI-051). He also visited Summit Island and tested 49-XHI-042, 49-XHI-043, and 49-

XHI-044 (AHRS 2010; Schaaf et al. 2007; Shaw 1998). In 1985, Shaw and crew returned to Summit Island for a six-week “salvage” excavation at 49-XHI-043 and 49-XHI-044 and minimally tested 49-XHI-045 and 49-XHI-057 (Shaw 1986, 1998). Shaw also conducted archaeological test excavations near 49-XHI-042 as part of a request for an Interagency Land Management Assignment (through the Alaska Department of Natural Resources, Division of Land and Water Management).

ADF&G intended to develop a 2.5-acre parcel to expand a herring management base camp, which law enforcement and researchers involved with the Togiak District Pacific herring fishery used during the field season (Shaw 1986:1). With a request for a Land Management Assignment, the state is required to protect archaeological sites and must comply with the Alaska Historic Preservation Act (Shaw 1985, 1986). With the test excavations, Shaw (1986) determined that the proposed development only marginally overlapped with 49-XHI-042 and would have limited impacts to the integrity of the archaeological site. He recovered very few non-diagnostic artifacts. In the final compliance report, (Shaw 1986) listed two radiocarbon dates from 49-XHI-042, one of possible Norton-age (2460±50 RYBP) and another of possible Thule age (610±50 RYBP). In 1986, Shaw and Berkeley Bailey visited 49-XNB-043 (on Round Island) and recorded Norton check-stamped and linear-stamped pottery (Bailey 1991:25).

In a later regional overview, Shaw (1998:239) described the 1980s Walrus Islands research as follows:

> There are numerous large villages on [Crooked and Summit] islands, and the tool inventory throughout occupation indicates a strong maritime adaptation. The oldest radiocarbon dates are 2820±70 and 2700±130

> [RYBP]. The remaining 21 dates cluster broadly at 1100-1750 and 2200-2500 radiocarbon years… No tests were made [on Round Island], but artifacts collected from the surface revealed Norton tradition occupations equivalent to those found at Crooked and Summit Islands and typologically dated to somewhat more than 2000 years BP.

No other descriptions of the excavations or artifacts have been published, with the exception of a photograph of an ivory figurine that is supposed to have come from Round Island published in Maschner (2008:176). Shaw reported site information to the Alaska Office of History and Archaeology (AOHA), however, and the site summaries provide some insight into the potentially extensive Late Holocene occupation of the Walrus Islands. Shaw's site information, as provided to AOHA, is listed in Table 5 (though I minimally edited this for clarity and removed some of the locational data). The exception is the Round Island (49-XNB-043) description, which is based on Jeanne Schaaf's fieldwork in 2004 (Schaaf et al. 2007).

Based on the site descriptions, it appears that Late Holocene peoples extensively and intensively occupied the Walrus Islands. The majority of the island settlements likely occurred during the Norton era, but may have lasted into the Thule era. Whether these occupations, which seem to be groups of several or more housepits and related middens and cache pits, were year-round or seasonal cannot be determined from the limited site descriptions. Nor can we infer the full range of Late Holocene subsistence practices with any certainty. It seems apparent, however, that the archaeological remains of several large island-based multi-component villages, placed specifically to take advantage of marine resources, were present throughout the Walrus Islands at the time of

Shaw’s fieldwork. Unfortunately, vandalism was rampant at the time, and may have irrevocably damaged several of the sites. This makes analysis of the faunal remains recovered from the 1985 excavations at 49-XHI-043 and 49-XHI-044 (the topic of this dissertation) a worthwhile undertaking.

Table 5. Walrus Islands Archaeological Sites Recorded by Robert Shaw in 1982-1985 (AHRS 2010)

Site	Description
Crooked Island	
49-XHI-036	Village site of as many as 50 features within a 200m x 38m site area. The dwelling features have no entrance tunnels, although one has an attached room. They vary in size from 4m x 3.5m to 6m x 11m. Vandalism is occurring at this site.
49-XHI-046	Village site of approximately 15 housepits…The features are round to oval in shape, with their maximum dimension 4-8m, and are up to 1.5m deep. The site measures approx. 240m x 150m. Shaw excavated a 2m x 1m test unit to a depth of approx. 80cm in 1982. Extensive vandalism.
49-XHI-047	The site is an example of rather extravagant vandalism. The 20m x 50m area…displays typical disturbed site vegetation. Burnt stubble indicates recent burning off the vegetation on the entire point. As many as 20 rectangular pits, having the appearance of pothunter’s excavations, measure less than 2m x 3m in size and are 20-80cm in depth. [Nearby] are two or three small, indistinct depressions.
49-XHI-048	Lithic scatter in blowouts, with no apparent surface features…in irregular 1-2m x 3-5m blowouts.
49-XHI-049	Village site consisting of perhaps 15-20 features, measuring from 4m x 4m to 11m x 5m, within a 130m x 58m area. No apparent vandalism.
49-XHI-050	Village site, with features measuring from 5m in diameter to 14m x 5m, within a 180m x 60m area. The numerous features... No apparent vandalism.
49-XHI-051	Village site extending for over 400m...The features vary from small round depressions to large, distinct rectangular house pits with entrance tunnels. The major features vary in size from 4m x 4m to 13m x 10.5m, and are up to 1.5m deep. Shaw excavated a 4m x 1m trench within a house pit and a 2m x 1m test in the bluff face. Cultural deposits found to a depth of 1.4m in the bluff test in 1982. In addition to natural erosion…the site has suffered vandalism.
49-XHI-052	Less than a dozen features, varying from 4.5-7m in diameter, and round to oval in shape, within a 60m x 58m area.

Table 5. (continued)

Site	Description
Round Island	
49-XNB-043	Village site… [with] over 100 prehistoric house pits, cache pits, and sod borrow areas from a series of occupations. Distinct house forms clustered together in later settlements appear to represent Norton and later Thule cultural traditions spanning the last 2500 years before contact in the late 18th cent. Two rock rings of unknown age are…nearby... Isolated artifacts… indicate a high probability of finding additional sites on the island.
Summit Island	
49-XHI-042	Village site [with]…numerous features, consisting of tent depressions and/or house pits and cache pits are dispersed over the entire site area, which measures 232m north-south x 227m east-west. The large depressions tend to be oval in outline. A single 1m test revealed cultural fill to a depth of 1.4m. [Part of the site]…suffers from erosion and slumpage, as well as continued vandalism.
49-XHI-043	Village site in three somewhat distinct loci atop 14-18m high bluffs. Features include house pits, tent depressions, and cache pits. The house pits tend to be rectangular in shape and the largest measured 12m x 9m. The three loci measured 82m x 63m, 60m x 90m, and 72m x 370m. Three tests revealed cultural fill up to 1.4m deep. The site is subject to heavy vandalism. Shaw further excavated in 1985 (not yet reported).
49-XHI-044	Village site in two loci...The north locus of the site consists of surface indications of approximately 25 dwelling features; a number of others are located in the southern locus. The largest feature, in the northern locus, measured about 19m x 5m, and partially excavated in 1985 (not yet reported). The two loci measure approx. 135m x 90m and 140m x 125m. A single shovel test at the front of the site revealed cultural fill to a depth of 70cm. The site has suffered from vandalism.
49-XHI-045	Six to eight oval house pits and a few scattered 1-2m cache pits...Two features, more distinct than the others, measured 6.5m x 5.5m and 4m x 4m. The relative distinctness between the features may indicate at least two periods of occupation. The vegetation has recovered more on this site than the others located on the island. The site measures 120m x 30m, shows no signs of vandalism, and was not tested.
49-XHI-057	This single feature…is an indistinct 3m x 3m depression, 40cm deep at one end, and 10cm deep at the other. The vegetation within the feature approaches climax tundra. Shaw tested the feature in 1985 (not yet reported).

In 1986, Bailey (1991) conducted his Master’s work at three sites located on the northern end of Hagemeister Island, just west of the Walrus Islands, including 49-XHI-016, 49-XHI-060, and 49-XHI-061. At the time, there were nine archaeological sites documented on the island; some large villages, others with single housepit features (Shaw 1979). Bailey identified Norton-era and Historic components at the three sites, but focused mostly on 49-XHI-016, a large village site with approximately 200 features. He estimated the site was over 200 m long containing at least 14 square to rectangular housepit features and 106 cache pits (Bailey 1991:57-58).

At 49-XHI-016, Bailey tested three house pits, with several living surfaces and midden, and identified two Norton components. He noted the earliest (lower), dated to 1210±80 RYBP (1260-1060 cal B.P.), was similar to Chagvan Bay Phase III in age (1600-910 cal B.P.) and material culture including comparable chipped stone drills, endblades, scrapers, pumice abraders, edge ground adze blades, and notched netsinkers. One difference is the lower component at 49-XHI-016 did not have any pottery, while Chagvan Bay Phase III did have linear impressed pottery (Bailey 1991:94, 97). Bailey described continuity in material culture between the 49-XHI-016 lower component and the more recent upper component (dated to 870-780 RYBP or 900-670 cal B.P.) including what he saw as a continued dependence on chipped and ground stone tools and the consistent lack of pottery. Two pecked stone lamps came from the upper component, including one with a nipple and raised lines reminiscent of those found in Kachemak culture in the Gulf of Alaska (Bailey 1991:99). Organic materials preserved at the site, including a small faunal assemblage and objects made of bone, antler, and ivory.

Bailey (1991:58) did not analyze the faunal assemblage. He characterized the assemblage as encased in “abundant blue mollusk shell…in addition to blue mussel shell, cockle shell and fish debris (salmon) were numerous. Seal and bird make up the majority of bone” (Bailey 1991:59). He further described anecdotal trends in the 49-XHI-016 faunal assemblage throughout his thesis. In the lower component, Bailey thought there was a lot of mussel shell and mammal bone, but mussel was sparse in the upper component. He believed there was continuity in the use of seal and birds but minimal fishing in the two components. With each feature or level, Bailey listed artifacts and number of faunal remains recovered, which provides some understanding of the faunal assemblage.

In the lower component, Bailey listed 246 faunal specimens he described as one fish bone and 245 mammal bones. In House 4 Floor Level, he noted fish “debris” but no mammal bone. Wood, antler, and sea urchin remains were also located in Level 5 of the midden, and fish “debris” as located in another midden level (Bailey 1991:84). In the upper component, four slate ulus were found in association with a “disarticulated [small] seal skeleton” (Bailey 1991:88). The listed faunal assemblage from the upper component consisted of 52 mammal bones and one walrus tooth. Bailey noted caribou was not present in the faunal assemblage, which suggests that most if not all of the specimens labeled as “mammal bones” may belong to marine mammals.

Bailey (1991:97-100) noted an increase in worked caribou antler and walrus items in the upper component, but confusingly also described the lower component as having numerous examples of broken and utilized caribou antler. My count of antler, bone, and ivory objects from both components, derived from his artifact list (n=30) is quite small and is unlikely to be useful in seeing an obvious change in use or abundance. On a whole, the faunal sample is too small and minimally described to make any reliable interpretations of subsistence strategies.

Ultimately, Bailey (1991) characterized the site as a late Norton-era seasonal camp where site residents focused on seal haul-outs, large bird colonies, and blue mussel beds. Site residents were minimally interested in fishing, evidenced by some fish bone present in the lower component and by six netsinkers in the upper component. He noted that walrus specimens were not represented in the faunal assemblage, but present only as worked items or tools, and believed that site residents were more interested in this species for by-products than as a food source (Bailey 1991:99).

Based partially on the lack of ceramics (and possibly the small size of the entire 49-XHI-016 assemblage), Bailey (1991:105) vaguely concluded that Hagemeister Island residents "remained only briefly during all periods of occupation, and that the site represents one stop along a total seasonal round cycle. Evidence of seasonal rounds on the mainland are indicated by caribou antler implements. The fact that midden debris shows little evidence of an economy centered on the acquisition of caribou further strengthens this argument." This assessment of the ephemeral nature of Norton occupations of Hagemeister Island apparently hinged on a lack of caribou faunal remains (and pottery), rather than a systematic analysis of the faunal remains represented – marine mammals, birds, fish, and shellfish. Giddings' conception of Norton subsistence as caribou-oriented (but surprisingly not salmon) appears to have factored heavily into Bailey's designation of a site with over 200 features (of which 14 appeared to be houses) as a brief stop between mainland activities.

Based on the most recent radiocarbon dates (870-780 RYBP or 900-670 cal B.P.), Bailey (1991:101) suggested that the upper component at 49-XHI-016 was contemporaneous with the earliest Thule occupations documented at Old Togiak, located on the nearby mainland coast of Togiak Bay (Kowta 1963). Bailey did not recover anything he considered to be Thule material culture at 49-XHI-016 such as antler weights like those found at Old Togiak (Bailey recovered Norton notched stone weights), ground slate projectile points, barbed harpoon points, or Thule-style ceramics. Bailey noted that the late-stage people who lived on Hagemeister Island also continued to use pecked stone lamps, a trait typical of the Norton tradition. He hypothesized that the shift from Norton to Thule culture may have happened later on Hagemeister Island than is generally accepted in the rest of southwest Alaska (1000 cal B.P.). Recent work by Anna Prentiss and Kirsten Barnett, which included radiocarbon dating Old Togiak between 1310 and 150 cal B.P. indicates that there most likely was some temporal overlap between the Old Togiak and Hagemeister Island occupations (Barnett pers. comm., 2017; Prentiss pers. comm., 2017).

In 2004 and 2008, Jeanne Schaaf conducted heritage law compliance work on Round Island (49-XNB-043) for the Alaska Department of Fish and Game. This included documenting archaeological sites present on the island and ascertaining if future ADF&G work would negatively affect any archaeological sites. Schaaf recorded a large multi-component village site with 105 features covering six acres (Casperson 2008, 2011; Okonek et al. 2008; Schaaf 2008, 2009, 2015; Schaaf et al. 2007). She tested several portions of the site, which resulted in the identification of the first pre-Norton components in the Walrus Islands, as well as the first island-based pre-Norton components west of the Alaska Peninsula (Schaaf et al. 2007). Until this finding, all pre-Norton archaeological sites located on islands had been restricted to the Aleutians, Gulf of Alaska, and southeast Alaska.

The pre-Norton components on Round Island were contemporaneous with the Northern Archaic (6310-4840 cal B.P.) and the Arctic Small Tool (3690-3210 cal B.P.) traditions represented at Security Cove and more interior locales. The earliest components, however, do not have diagnostic artifacts that can be readily associated with Northern Archaic and Arctic Small Tool traditions. Schaaf (2015) hypothesized that early Round Island residents likely had connections to the marine-adapted cultures of the Alaska Peninsula and the Aleutians. Schaaf also found Norton, possible Thule, and Historic era components on Round Island. She recovered a very small amount of walrus, seal, bird, and shellfish faunal remains from all of the cultural components. The presence of marine mammals in each component suggests that Round Island is a walrus and seal haul-out that may have existed for the past 6,000 years. It would also seem that generations of humans traveled to Round Island to procure walrus, seals, seabirds, and shellfish throughout the Middle and Late Holocene. The intensity of human use of the island is unknown, particularly in the earliest components.

The Norton components on Round Island (Component III and IV) are dated to 2365-1530 cal B.P. and post-1530 cal B.P. Associated with Component III, Schaaf (2015) noted a grouping of several square to rectangular house depressions, chipped stone endblades, sideblades, drills, knives, scrapers, a few ground slate tools, one toggling harpoon head, one fish spear prong, plain ware fiber tempered pottery, and a notched pebble. She also noted whale ribs associated with the corner of a partially excavated house feature that could be the structural members of a winter settlement (Schaaf 2015:60-61). Three ground slate lance blades and a large stemmed shoulder point were also recovered from the Norton components, which Schaaf noted have similarities to maritime cultures in the Gulf of Alaska (Ocean Bay II) and Kvichak River, respectively (Schaaf 2015:67-68).

Schaaf (2015:78) recovered a very small faunal assemblage of marine mammal and bird bone specimens (n=107) and mussel and dogwinkle fragments (n=6) from the Norton components. This assemblage is too small to infer seasonality or the nature of Norton subsistence practices on Round Island, but to an unknown level Norton people took an interest in seal (n=2), walrus (n=14), and common murre (n=1). The remaining specimens included marine mammal (n=66), bird (n=22), and the two whale ribs noted in a house feature. Schaaf (2015:61) identified a possible center prong of a fishing spear and a notched pebble in the Norton component, which may indicate some fishing on Round Island. Caribou antler and bone are not present in the Round Island assemblage, and it is possible that Round Island peoples were isolated from the other islands and mainland, similar to Nunivak Island. It is also likely that the faunal assemblage was too small to adequately represent taxa present in low abundances.

Schaaf (2015) recognized the limitations of the Round Island collection and did not over-interpret the direct evidence for subsistence practices. She noted, however, that walrus is represented throughout the length of the 6,300-year occupation and connected this fact to the historic and contemporary use of the island by local Yup’ik communities (Fall et al. 1991; VanStone 1988). She suggested that the presence of walrus in the 6,300-year-old component might indicate the antiquity of Round Island as a walrus haul-out that human populations relied on throughout the Middle and Late Holocene.

Interior Norton Occupations

Several archaeological surveys have resulted in the documentation of Norton components and artifacts throughout interior Alaska in the Yukon-Kuskokwim Delta (Shaw 1982b, 1983), the Ahklun-Kilbuck Mountains Vicinity (Ackerman 1979, 1980), the Wood-Tikchik Lakes area (Shaw 1990, 1998), and the Nushagak River drainage (McMahan et al. 2000; Shaw 1990, 1998). Much of this work is not readily accessible, but the results of some of this work have been noted in Shaw (1990, 1998). Generally, archaeologists documented Norton materials in these places, and based the cultural designation on artifact typology rather than radiocarbon dating. From these Norton sites, the archaeologists did not recover faunal remains. To provide some perspective of archaeological interpretations of interior Norton subsistence practices, I will discuss some of the more accessible research.

In 1978, Ackerman (1979) surveyed in the interior of southwest Alaska, in the Ahklun-Kilbuck Mountains vicinity, including areas around Goodnews Lake, the Goodnews River Valley, Kagati Lake, Eek Lake, the foothills near the Eek and Kwethluk rivers, and the Kanektok and Eek river drainages. Ackerman and crew located 167 surface sites, many of which were assigned to the Paleoarctic, Northern Archaic and Arctic Small Tool traditions (Ackerman 2004:161; Gallison 1983; Workman 1980:189). Norton artifacts, including chipped stone endblades and scrapers, but no faunal materials, were documented at Eek Lake, Goodnews Lake, Goodnews River Valley, and Kagati Lake. Ackerman (1979:15) talked with residents from nearby villages and considered local animal distributions to infer that generations of peoples living in the Ahklun-Kilbuck Mountains area would have been there to hunt caribou and harvest freshwater and anadromous fish. Ackerman assumed that the Norton occupations in the Ahklun-Kilbuck Mountains vicinity extended the full length of the Norton Tradition, but this was not based on radiocarbon dating or excavation.

In 1975, 1976-1981, Shaw (1983) conducted his Ph.D. research at the Manokinak Site (49-MAR-007), located on the shore of the Manokinak River, which feeds into Hazen Bay in the Yukon-Kuskokwim Delta. The site is 35 km from the head of Hazen Bay (Shaw 1983:40). The site contained Late Norton (Component I) and Thule (Component II) components, with well-preserved wood, bone, and antler. Shaw procured radiocarbon dates for the Norton components, which resulted in a 1370-720 cal B.P. date range (Shaw 1983:114). Given the large standard error of some of the dates, Shaw (1983:114) preferred to place the Norton component between 1200 and 1000 years B.P.

Shaw (1983:303-304) noted the recovery of a large faunal assemblage that spanned the entire occupation of the site, but he did not include a faunal analysis in the dissertation. He noted that caribou, goose, and duck bones were the most abundant in the Norton component, followed by fish, seal, and canids. Animals in very small abundances included swan, bald eagle, ptarmigan, puffin, mink, beaver, fox, unknown fish, blue mussel, and cockle. Shaw (1983:337) stated:

> though not clearly demonstrable on the analysis completed to date, it is my impression that salmon were more important as a food resource than were blackfish, cod, stickleback, and other resident winter fish….It is noteworthy that no fishing equipment such as net weights, nets, basket traps, or hook and line apparatus was recovered in Component I.

In his assessment of the material culture, Shaw had a difficult time associating implements with the harvest of specific animals; with the exception of endblades he believed fit into harpoon heads, a kayak paddle, and hunting helmet fragments that he inferred were used to hunt marine mammals in open waters.

In the 1990s, the Bureau of Indian Affairs, complying with the Alaska Native Claims Settlement Act, surveyed approximately 700 archaeological sites in southwest Alaska (Dumond 2016; Shaw 1998:236-237). As part of this work, Greg Biddle (2001) excavated the Anuska Tommy Site (49-GDN-233), located in the Middle Togiak River drainage. Biddle (2001) noted eight square to rectangular housepit depressions, and recovered chipped stone sideblades, endblades, scrapers, one knife, one adze bit, and one lance fragment he identified as Late Norton, based on several charcoal samples radiocarbon dated to 1290-1070 RYBP (1290-930 cal B.P.). Twenty-eight unidentifiable bone fragments were recovered from the site, which Biddle (2001:13) identified as large mammal, likely caribou.

From the site location and local ecology, Biddle (2001) described the site as a seasonal Norton caribou hunting camp. Based on the multiple house features, Biddle hypothesized that Norton people reused the locale over multiple seasons and years, but he believed the lack of pottery and lamps in the assemblage suggested only temporary and seasonal use (as per Dumond 1981). Biddle (2001) hypothesized that site residents harvested interior resources on the Togiak River in between longer bouts of habitation on the northwest Bristol Bay coastline.

Thule Tradition

According to Dumond (1977, 1987, 2009), the subsequent Northern Maritime Tradition or Thule Tradition (1,000-200 years ago) developed in the Bering Sea region out of four maritime cultures with Asian ties that temporally overlapped with the Norton and Ipiutak stages of the Norton Tradition including the Okvik, Old Bering Sea, Punuk, and Birnik cultures, approximately 1400-900 cal B.P. A fully developed stage of Thule culture quickly spread throughout Alaska including the interior and coasts of the Chukchi and Bering seas, the northwestern Gulf of Alaska, the Canadian Arctic and northwestern Greenland, completely merging with or replacing the in situ Norton culture within a few centuries (Ackerman 1980, 1986, 1988, 1998; Dumond 1984, 1987b, 2009; Giddings 1962; Shaw 1983, 1990, 1998, but see Bailey 1991). The expansion of Thule peoples generally corresponds with the traditional territories of the Inupiaq of north coastal Alaska, northern Canada and Greenland, Central Yup'ik in southwest Alaska, and Alutiiq of the northern Alaska Peninsula and eastern Gulf of Alaska (ANKC 2011; ANLC 2016).

Matthiassen (1927, 1935) was the first to suggest a 1000 cal B.P. date for this expansion, which appears to hold true in Alaskan Thule components, give or take a century. Early Thule harpoon heads from Point Barrow, in north-coastal Alaska, have dated to 1100-1000 cal B.P., while the earliest Thule components in the northern Alaska Peninsula dated to 900 cal B.P. (Dumond 1984, 1987, 2005b, 2009:63; Morrison 2001). McGhee (2000, 2009) asserted that Thule populations spread throughout the Canadian Arctic and northwestern Greenland slightly later than in Alaska, starting 800-700 cal B.P. Other eastern Arctic researchers have provided complementary dates that support a later movement of people into Canada and Greenland (Friesen and Arnold 2008; Morrison 2009).

In southwest Alaska, Thule Stage occupations have been documented throughout the mainland coast and in the interior (or Western Thule, as opposed to Eastern Thule in Canada and Greenland). These places include Norton Sound at Iyatayet and Cape Nome (Giddings 1964; Bockstoce 1979; Lutz 1972); on the Bering Sea coast, just south of Norton Sound, at Hooper Bay (Oswalt 1952a, 1952b); the Naknek and Ugashik River drainages (Dumond 1981; Henn 1978, Hoffman 2009; Saltonstall et al. 2012); along the coast of Kuskokwim and Bristol bays, particularly at Platinum and Old Togiak (Ackerman 1964; 1986; Kowta 1963; Larsen 1950), in the interior at the Manokinak Site in the Yukon-Kuskokwim Delta and throughout the Ahklun-Kilbuck Mountains (Ackerman 1979, 1980; Shaw 1983, 1990). Thule components have also been documented on Nunivak Island (Nowak 1973; Griffin 1999, 2002; Souders 1997). Schaaf (2015) and Shaw (1986, 1998) suggested that some Thule components may be present in the Walrus Islands as well, though definitively Thule artifacts and reliable radiocarbon dates have not been recovered.

In southwest Alaska, Dumond (1977, 1984, 1987b, 2005a, 2009) noted that the Thule Stage toolkit differed from the earlier Norton toolkit in that ground slate tools almost entirely replaced chipped stone tools, stone lamps replaced baked clay lamps, and gravel-tempered pottery increased in abundance over fiber-tempered pottery. At Thule sites, including Old Togiak, the Manokinak Site, and Iyatayet, there is evidence of heavy use of wood and bone to make an array of household and subsistence items as well as fine artistic carving and decoration on an array of organic objects (Dumond 1984, 1987b;

Kowta 1963; Shaw 1983). While the perception is that Thule peoples increased production of organic objects, and had a more developed interest in fine carving, Norton sites rarely have a similar level of organic preservation that allows for meaningful comparison.

Dumond (2005b, 2009:71) has suggested that the expansion of Thule peoples into southwest Alaska (particularly on the Alaska Peninsula) resulted in a cultural amalgamation of Thule peoples and resident Norton populations, rather than a total replacement of the preceding archaeological culture. This was based on no obvious cultural hiatus between Norton and Thule components, as well as continuity of artifacts types (in differing proportions) between the Norton and Thule eras. Shaw (1983) noted a similar merging of archaeological cultures in the Yukon-Kuskokwim Delta at the Manokinak Site, approximately 1000 cal B.P. In Bristol Bay, however, Bailey (1991) hypothesized that Norton culture may have continued into the more recent past, lasting longer than other typical Norton-age sites. On Hagemeister Island, Bailey identified late Norton components at 49-XHI-016 that he radiocarbon dated to 870-780 RYBP (900-670 cal B.P.). Based on this recent date, he suggested that Norton peoples living on Hagemeister Island could have potentially overlapped with the Thule occupation documented at Old Togiak (Kowta 1963). A temporal overlap seems likely given the suite of radiocarbon dates that Prentiss and Barnett (pers. comm., 2017) recently procured from Old Togiak, which range in age from 1310 to 150 cal B.P. These new dates, however, suggest overlap with both of the Hagemeister Island components that Bailey documented (1260-670 cal B.P.). Bailey procured only two radiocarbon dates for the

Norton components on Hagemeister Island, however, and more dates would be required to confirm the extent of any overlap.

Dumond (2016) recently stated that his reassessment of Norton and Thule components in the Naknek River drainage (at locality BR5), may point to some stratigraphic mixing between them, which no longer confirms continuity between the two cultures, at least on the Alaska Peninsula. Dumond (2016:410) noted

> when archaeologists are able to find any artifacts from which it is possible to interpret cultural continuity, they almost inevitably tend to do so….it now seems possible to say only that the change between late Norton culture and early Western Thule culture or the like was relatively sudden and essentially complete in terms of the bulk of the material toolkit.

Nelson (1899), Dumond (1977, 1984, 1987b. 2009), and Hill (2010) characterized Thule peoples as highly proficient maritime hunters, with advanced technological capabilities to hunt big whales (in northern locales) and other marine mammals in open waters. Thule peoples shared a similar interest in harvesting terrestrial and riverine resources as the preceding Norton culture, but with more intensity (mass harvest of salmon and other small-bodied animals). Dog-sled traction technology is also associated with later Thule components (Dumond 1984). The understanding is that the developed technologies of Thule populations, combined with their broad-based subsistence economy, allowed them to quickly colonize the Arctic and thrive in myriad environments in a way that exceeded the capabilities of peoples with a Norton toolkit (Dumond 1984, 1987b:133). Warmer temperatures and decreased sea ice during the Medieval Warm

Period are often cited as drivers of technological development in Thule culture (Dumond 1984, 1987b; Maschner et al. 2009).

Several Thule-age faunal assemblages have been recovered throughout southwest Alaska, including assemblages from Iyatayet, Cape Nome, the Manokinak Site, Nunivak Island, Old Togiak, and the northern Alaska Peninsula (Bockstoce 1979:84-85; Dumond 1981, 1998; Giddings 1964; Kowta 1963; Shaw 1983; Souders 1997; Tremayne 2015). Thule components tend to have excellent preservation in comparison to older archaeological cultures. All of the listed Thule assemblages have between 1,800 to 18,000 recovered specimens, whereas very few of the Norton faunal assemblages discussed in this study are as large (Summit Island as presented in later chapters herein is the single exception). Consequently, interpretations of Thule subsistence are supported by a preponderance of direct evidence. While it is not my intent to present an exhaustive discussion on Thule faunal assemblages, a few of the assemblages should be summarized to provide some perspective on the range of Thule subsistence practices throughout coastal southwest Alaska.

Giddings (1964:91-94, 115-116) noted that Nukleet populations living at Iyatayet 750-450 years ago had similar subsistence practices to those of earlier Norton peoples. Based partially on the analysis of a much larger faunal assemblage (n=17,795), in which only identifiable specimens were counted (but not collected), Giddings believed that Nukleet peoples used advances in technology to intensify the harvest of small seals, while decreasing the harvest of caribou over time. Nevertheless, Giddings noted that caribou was better represented in the Nukleet components, and suggested that Nukleet peoples harvested more caribou than Norton peoples did. The majority of the Nukleet specimens came from marine mammals including small seals (n=9,520, 54%), bearded seals (n=2,847, 16%), beluga (n=535, 3%), and walrus (n=267, 2%). The remaining 26% came from birds (n=2,669, 15%) and caribou (n=1,957, 11%). Recall that Giddings did not systematically recover Nukleet age faunal remains, nor did he radiocarbon date the Nukleet components. He did, however, compare the artifacts from the Nukleet components to those found in the Kobuk River area to ascertain relative age (Giddings 1964:115-116). Giddings also noted that fish and shellfish were present in the Nukleet components, but he chose to focus only on large bone specimens.

Tremayne's 2012-2013 excavations at Iyatayet recovered 347 faunal specimens and four antler/bone objects from Nukleet components that he dated between 710 ± 60 and 510± 70 cal BP (Tremayne 2015:165-172, 184). These absolute dates complement Giddings' relative dates. His analysis required re-calibrating dates from earlier studies including Gerlach and Mason (1992) and Murray et al. (2003), which were processed without considering the marine reservoir effect, and ultimately, were too old. Tremayne (2015:186) noted that his analysis of 125 identifiable remains supported Giddings' assessment that the Nukleet and Norton peoples who lived at Iyatayet shared similar subsistence strategies. Because Tremayne's assemblage was very small, he was not able to confirm Giddings' assessment that seal harvest intensified in Nukleet times, but he did note that caribou appeared to be proportionally more abundant in Nukleet components than in Norton components (23% versus 2% NISP or number of identified specimens). Marine mammals including seals, walrus, and beluga made up 60% (n=83) of the 2012-2013 faunal assemblage, while caribou represented 23% (n=29). Tremayne (2015:187-

188) also identified a very small number of tomcod/polar cod (n=1), duck (n=1), ptarmigan (n=2), fox (n=1), probable dog (n=2), and brown bear (n=1) remains.

Farther south, on Nunivak Island, Souders (1997: Chapter II) analyzed 3,739 faunal specimens from two discrete midden loci at the Ellikarrmiut Village Site (540-360 cal B.P.) on Nash Harbor. From this work, Souders (1997: Chapter IV) recovered 2,388 identifiable specimens that came from 45 taxa of bird, fish, mammal, and shellfish. Bird specimens included mostly cliff-dwelling colony birds (alcids and cormorants, 58% NISP), marsh birds (loons, grebes, and ducks, 21% NISP), and gulls (21% NISP). Fish were dominated by Pacific cod (90% NISP), with lesser amounts of salmonid, tomcod, and rockfish. Moss (2013) recently re-identified 142 specimens Souders believed to be herring as small gadid (cod family).

Mammal specimens from the Ellikarrmiut Village midden were represented by marine mammals (66% NISP). The most abundant marine mammals included seals (80% NISP) with smaller numbers of walrus (13% NISP), Steller sea lion (4% NISP) and whale (4% NISP). The less abundant terrestrial mammals (35% NISP) were represented by mostly canids (dogs, wolves, and foxes, 85% NISP) but also caribou (15% NISP). Souders also noted a very small amount of shellfish including mostly mussel, with minimal numbers of clam and acorn barnacle. From this work, Souders (1997) determined that Thule peoples living at Ellikarrmiut Village relied on seals and Pacific cod as food staples, but also regularly harvested walrus and cliff-dwelling birds. Souders (1997) suggested that the harvest of alcids and cormorants was an important component of trading bird skins with other villages on the island and mainland as described by Cup’ig elders in the 1980s (Hoffman 1990; Pratt 1990).

To the southeast of Nunivak Island, Old Togiak is located on the mainland shore at the mouth of the Togiak River, at the head of Togiak Bay, a mere 25 km from Summit Island. Because of Old Togiak's proximity to Summit Island, and because it is the only well-researched Thule site on the coast of northwest Bristol Bay, I will discuss it in more detail than I did for Iyatayet and Ellikarrmiut Village. The occupation of the site spans the entirety of the Thule era and potentially part of the Norton era, which has implications for understanding the deep history of northwest Bristol Bay (1310-150 cal B.P., Barnett pers. comm., 2017; Prentiss pers. comm., 2017).

In June-September 1960, Makoto Kowta (1963) excavated 150 m^3 of midden at Old Togiak recovering 4,070 objects of wood, bone, stone, and pottery, which provided a unique look into Thule material culture and economy. He applied ethnographic analogy, mostly from Nelson (1899), to identify the artifacts according to "cultural activity" including marine mammal hunting (n=239), land mammal/bird hunting (n=240), fishing (n=355), travel (n=90), tools/tool manufacture (n=735), household items/domestic work (n=217), personal adornment/clothing (n=46), social activities (n=64), pottery (storage, n=1,207), and unknown (n=877) (Kowta 1963:66-67, 378-379).

Marine mammal hunting artifacts included harpoons, throwing boards, floats, and related miscellaneous items to hunt whales, walrus, hair seals, sea lions, and fur seals from open waters, but also on the shore and ice (Kowta 1963:67-98). Kowta (1963:98) categorized fishing equipment as to whether it was for "angling, spearing, and netting," including line sinkers, fish hook shanks, leisters, salmon harpoon heads, fish arrows, and net weights/anchors. He also identified gear designed for seasonal activities, such as ice picks and ice scoop rims for making and keeping ice holes open in the early spring or winter, as well as net construction/repair (net gauges, net repair needles) and fish processing (scalers). Kowta (1963:150-177) grouped land mammal hunting and birding artifacts together including bows and arrows, items for making bow and arrows (shaft straighteners, feather setters), lances, bolas, bird spears, snares, and slate points. Kowta (1963:177-187) also recovered many items related to travel, which facilitated procuring resources at specific times of the year, but the author did not point to a specific kind of animal being hunted. These include fragments of snowshoes, sled runner supports and shoes, kayak parts (including a harpoon rest), and a boat hook.

Tools and items for making and maintaining tools included wedges, mauls, adzes, various handles, hammerstones, choppers, whetstones, anvils, knives, ulus, cutting boards, drill sockets/spindles, chisels, gouges, spatulas, awls/bodkins, needles, beamers/scrapers, sockets, etc. (Kowta 1963:187-262). Kowta further identified what he considered domestic items such as marine mammal oil lamps (made of pottery and stone), objects for starting and maintaining fires (trimmers, drill hearths/shafts), various food ware and utensils, containers/bag handles/basketry for carrying and storing things, shovel blades, mattock heads, picks, blubber hooks, water bag nozzles, and woven mat fragments. With regard to personal adornment, Kowta (1963:334-341) recovered some pieces of sewn skin he believed could be remnants of tailored clothing, as well as labrets, pendants, potential antler and wooden armor slats, and part of a helmet visor. Items denoting “social activities” included wooden dolls, tops, toy weapons, a toy boat, drum handles, masks, and possible figurines/effigies (Kowta 1963:341-349).

Pottery sherds were the most abundant type of artifact recovered from Old Togiak (n=1,207, 30%) and Kowta (1963:293-294) noted two unique types: Togiak Line-Dot and

Togiak Ridged. While the majority of recovered sherds were undecorated, the Togiak Line-Dot pottery was most abundant in the upper levels (levels 1-2), while Togiak Ridged sherds were most abundant in lower (older) levels (3-6). Only Togiak Ridged sherds were found in levels 7-11.

Kowta (1963:382-385) also recovered a well-preserved faunal assemblage (n=1,084) of mammal and bird bone "from a selected sample of the excavated midden." Kowta (1963:382) noted shellfish in the excavation matrix, mostly blue mussel, and minimally represented by two other unidentified species. Shell fragments were found "throughout the midden in circular deposits three to six feet in diameter and a few inches thick. In some instances they lay in shallow pits or depressions" (Kowta 1963:382). An unknown quantity of fish bone specimens were also present at Old Togiak, but Kowta (1963:383) merely stated that "aside from a limited quantity of vertebrae and fin skeletons, the bulk of the [fish] remains consists of small fragmentary parts found as layers in the bottom of cache pits." Kowta did not collect any of the fish or shellfish faunal specimens.

The faunal assemblage contained a nearly equal amount of mammal (n=622, 57%) and bird (n=462, 43%) bone specimens (Kowta 1963:386, 395). The most abundant mammal taxa included small seals (n=220), caribou (n=135), and canids (presumably dogs, n=102). Lower numbers of marine mammals included whale (n=34), walrus (n=17), bearded seal (n=13), Steller sea lion (n=3) and northern fur seal (n=1). Other terrestrial mammals included beaver (n=29), red fox (n=29), Arctic fox (n=21), bear (n=14), land otter (n=3), and porcupine (n=1). The most abundant bird remains included those of cliff-dwelling colony taxa such as cormorant (n=248), murre (n=117), and tufted puffin (n=29). Less abundant birds included eider (n=26), loon (n=23), goose (n=7), surf scoter (n=4), raven (n=3), and a few other unknown birds (n=5).

With much consideration of ethnographic data related to tool function and animal harvest practices, Kowta (1963:427-454) suggested the following yearly subsistence cycle. In the winter (November through February), Old Togiak residents relied mostly on stored foods, but they also fished with spears and hook and line through holes in the ice. Traps were also set in streams. Fox, wolf, bear, and bird trapping/snaring occurred in the winter months, and trapping fur-bearing animals increased in the months of February and May (while pelts are thick). Harvesting seals was important in the winter and early spring, by netting and clubbing through the ice, in open water by kayak with harpoon, throwing board, and float, or at the ice edge. Ice was a factor in Bristol Bay until May (Kowta 1963:429). By late spring Old Togiak residents harvested large numbers of migrating birds, did not harvest them in great numbers in the summer, and refocused on harvesting birds in the fall (during molting/migration). Egg collecting began in May. Salmon fishing was important in June through August; like Giddings, Kowta (1963:430) believed that Old Togiak residents capitalized on summer runs to take large numbers of salmon with nets, traps and spears. These summer runs would have been crucial to winter stores of food. Again like Giddings, Kowta did not use the faunal remains to corroborate that salmon (or any fish) was an integral taxon to the Old Togiak residents. Old Togiak residents hunted caribou in the later summer and fall, and preferred caribou hides for making clothing (Kowta 1963:431). The fall marine mammal hunt was also important for by-products, but also to build up meat and blubber stores for winter.

Kowta (1963:454) was able to directly associate migratory bird species with spring, summer, and fall activities, but the remaining seasonal activities he associated with Old Togiak relied heavily on knowledge of historic Alaska Native hunting practices, particularly those documented by Nelson (1899) in Norton Sound. He did associate two caribou skulls sans antlers as indicators of a later summer/fall caribou hunt, but young bull and cow caribou may keep their antlers until April (ADF&G 2010a). Some cows may never grow antlers (ADF&G 2010a). Many times, to determine the season of harvest, Kowta would use assigned function of an artifact to do so, rather than the life history of the animal. For example, Kowta (1963:455) believed that during the early part of the Thule era, Old Togiak was occupied during the summer months due to the identification of kayak parts and harpoon darts he associated with summer marine mammal hunting.

Kowta (1963:458-460) used what he saw as the decrease in marine mammal hunting harpoon darts (from Level 6 to Level 2) with the increase in toggle head harpoons (winter/spring seal hunting artifacts) as evidence that while all Old Togiak residents relied on seal harvests, the later occupants stopped summer sealing and shifted to intensive winter/spring sealing to adjust to plummeting seal populations in Bristol Bay. With the intensification of winter/spring sealing, Old Togiak residents also hunted more foxes and increased ice fishing. Small animals including birds and shellfish became more important in later times. Kowta (1963:61, 467) did not quantify the shellfish, but he suggested that the most recent site residents must have intensified use of the animals because they appear to be more abundant in the upper components at Old Togiak (he refers the site stratigraphy pictured in his Figure 3 as evidence). The increased insecurity associated with summer sealing also led Old Togiak residents to move interior to fish in riverine settings, rather than in Togiak Bay. Ultimately, Kowta believed that later Old Togiak residents shifted their summer activities to the interior and away from Togiak Bay, while harvesting myriad animals near Old Togiak in the winter/early spring became essential because they had less ability to store fish and seal meat and blubber harvested during the summer. This assessment was partially based on the prevalence of artifacts Kowta associated with spearing fish in the summer and winter (instead of netting salmon runs in the winter), rather than any faunal evidence from fish bones. Decreases in seal abundance is noticeable between levels 4-11 (from 57% to 51% NISP of mammal bones), Level 3 (34% NISP), and levels 1-2 (18-19% NISP), which seems to support Kowta's assessment that site residents gradually shifted from marine to interior subsistence practices over time. According to Kowta (1963:386), caribou abundance appears to have increased over time. Caribou was minimally represented in levels 3-11 (3-13% NISP), but became the most abundant mammal recovered at Old Togiak in levels 1-2 (31-41% NISP). Kowta (1963:455-464) further noted that majority of the caribou specimens (n=100, 74%) came from the most recent occupations (levels 1-2) of Old Togiak. In Bristol Bay, it is possible that the intensive interest in caribou noted in historic and contemporary Alaskan communities was a relatively recent development, around the end of the Thule era.

While Kowta was able to assign "cultural activity" to the suite of material culture he recovered from Old Togiak, as well as identify the bone specimens to bird and mammal taxa, there are some obvious problems with his attempt to track change in subsistence practices through time. Kowta (1963:49-65) originally attempted to excavate a much larger amount of the site than he was able to accomplish, and changes in methodology throughout the season resulted in a significantly reduced sampling of the lowest levels. While he excavated a considerable amount (150 m^3), at the start of the season, he opened up a much larger block of units than he ended with. Had he succeeded in fully excavating the original units, he would have moved approximately 18,200 m^3 of sediments. His original excavation started as a trench of 30 by 66 ft. (he measured everything in American Standard), which after sod removal, he reduced to 30 by 42 ft. After excavating the first level, Kowta decided to restrict the excavation to a 24 by 30 ft. trench. He did this because these units had the most archaeological materials. After a few months of excavation, Kowta realized that he would not be able to excavate into the lowest levels of Old Togiak by the end of his field season without further limiting the area of excavation. With Level 7, Kowta restricted excavations to a 6 by 24 ft. trench. From there, he was able to excavate the remaining levels (7-11) to sterile sands and excavate one more level (12) into the sterile sands. By the end of the excavation, Kowta was recovering artifacts in levels 7-11 from a space that was reduced by 75% from the 24 by 30 ft. trench. It would follow that any counts from levels 7-11 are severely diminished from materials recovered from the upper levels. A look at any of tables of abundance in Kowta (1963) shows an obvious drop in artifact and faunal sample size.

Kowta (1963:49-65) chose to excavate levels in 12 in. arbitrary levels, rather than follow natural stratigraphy. Though he noted changes in stratigraphy, he indicated that rain was a constant problem through the 1960 field season. The excavation was very muddy as a result, and he preferred flat levels in an attempt to keep water from pooling. It is probable that Kowta was not able to notice changes in stratigraphy given lack of visibility. He also did not screen excavated materials, but collected artifacts by hand. From the lack of discussion of debitage, it is apparent that Kowta only collected diagnostic materials, and recovery was likely impacted by the mud. The sample selection strategy that Kowta used to perceive change over time is also problematic. Kowta (1963:457) recognized that there were problems with the faunal remains from levels 7-11, as well as Level 1, so he only used faunal data from specimens collected in levels 2-6. This reduced the number of specimens available to analyze change through time by 30% (n=775 out of 1,084). Kowta appeared to use each excavation level as an analytical unit, though he noted that he dug them in arbitrary 12 in. increments, without regard to natural stratigraphy.

The largest hurdle to understanding Kowta's results is his use of relative dating methods to assign ages to the Old Togiak components. For the most recent occupation, Kowta (1963:12-14; 398-404) was able to rely on the lack of historic European items or trade wares to suggest that Old Togiak was not occupied during or after contact with Russians, which the earliest recorded interaction occurred sometime before 1826. Other parts of the spit where Old Togiak was located, however, were occupied throughout the historic era, until 1940-1950, when people moved across the bay to the current location of the village of Togiak (Kowta 1963:404). Kowta noted that several artifacts, including sled runners, harpoon foreshafts with slotted line holes, harpoon dart heads with a centrally placed line hole, etc., recovered at Old Togiak all had counterparts from other places in Alaska that came from pre-contact components dated 500-300 years ago (Kowta 1963:398-404). Based on the assumption of the southern migration of artifact traits, Kowta believed artifacts at Old Togiak would be slightly more recent than those found in the Bering Sea region; accordingly, he assigned Old Togiak a terminal date of 300-400 years ago (A.D. 1600-1700). The use of comparative artifact analysis to assign age was not uncommon, and has been used with success. Less reliable is the use of midden accumulation rates, which Kowta (1963:411) applied to derive at a date for the earliest Old Togiak components. Kowta (1963:411-415) applied Oswalt's rate of 45 years per one foot of accumulated midden, which Oswalt (1952b) came to through the use of dendrochronology and knowing the terminal date of the occupation at Hooper Bay. Kowta (1963:414-415) chose to round up to 50 years per one foot of midden accumulation and came up with a start date of A.D. 1050, which he then rounded down to A.D. 1000, presumably to coincide with the earliest known date for the Thule Tradition. This date must be based on 12 ft. of depth, though he noted that there was 11 ft. of cultural midden (levels 1-11) and one sterile sand level (Level 12).

Given Kowta's estimated Old Togiak timeline and sampling strategy of the faunal remains, it is difficult to know how, when, and why Thule subsistence practices changed throughout the occupation of Old Togiak. Kowta (1963), however, is an excellent descriptive analysis of organic Thule artifacts (and some non-organic), as well as a thoughtful consideration of how artifact function translates into human activities and the value of faunal analysis in archaeological research. His study does support the archaeological understanding that Old Togiak residents practiced a broad-based subsistence economy, and had lots of specialized technology to harvest marine and terrestrial animals, from sea ice, open water, coastal, interior upland and riverine environments. The subsistence practices evidenced at Old Togiak share many similarities with the other coastal Thule occupations of Ellikarrmiut Village on Nunivak Island and

Iyatayet in Norton Sound. At all three sites marine mammals (mostly seals) were a principal resource to Thule peoples living on the coast. Other animals including birds, caribou, smaller land mammals, fish, and shellfish also factored into Thule subsistence, from Norton Sound to Bristol Bay.

Sometime after site residents left Old Togiak, local Thule peoples, the Tuyurarmiuts (or Togiagamiuts), came into contact with Russian explorers, which occurred sometime between A.D. 1600 (by Kowta's reckoning) and 1820s (Dumond 1987b; Funk 2010; Kowta 1963; Shaw 1998; VanStone 1984, 1988). Because Thule populations are the ancestors of Inupiaq and Central Yup'ik populations, many researchers see an obvious continuity in subsistence practices between Thule and historic Alaska Native populations. Ethnographic accounts are routinely applied to describe Thule subsistence practices, such as the 1818-1819 diary of Russian Petr Korsakovskiy, and the 1829 account of Ivan Vasilev, both of whom traveled throughout southwest Alaska, and notably, the Walrus Islands (VanStone 1988). Both men describe early historic Alaska Native communities as focused on marine mammals (the biggest being beluga), caribou, and salmon, but also migratory birds, fur-bearing mammals, several species of fish, shellfish, and berries (VanStone 1988). Ethnographic accounts throughout coastal Alaska seem to confirm a broad-based subsistence economy for historic Alaska Natives, one that is focused the trifecta of salmon, caribou, and marine mammals, but also dynamic enough to intensively harvest birds, other fish, terrestrial mammals, shellfish, and plants (Collins 1937; Giddings 1964; Larsen and Rainey 1948; Lucier and VanStone 1991; Nelson 1899; VanStone 1988).

The temporal and ancestral link between Thule and historic Alaska Native populations lends credence to the use of ethnographic data to describe Thule subsistence practices. It is a strong descriptive tool that can flesh out the nuances of Thule subsistence, and provide a seemingly complete picture of Thule lifeways that appears complex in contrast to preceding archaeological cultures. As the preceding archaeological cultures go farther back in time, however, the application of ethnographic analogy becomes more tenuous, restricting a researcher's ability to confidently describe earlier subsistence practices to the same detail as that of Thule culture. It is also apparent from the limited discussion of Thule subsistence practices at Old Togiak, Ellikarrmiut Village, and Iyatayet that ethnographies detailing historic subsistence practices can only be used with critical application.

Norton Culture on Summit Island

As previously discussed, there have been no analyses, published or unpublished, to determine the cultural affiliation(s) of archaeological materials from Summit Island (49-XHI-043 and 49-XHI-044). My dissertation is focused on understanding the island-based subsistence practices of Late Holocene peoples through analysis of the faunal remains from Summit Island, which is not typically used to infer cultural affiliation. Archaeological traditions tend to be defined by material culture, or the toolkit, and faunal data are used to support assertions derived from artifactual studies. That being said, the previous discussion of the subsistence economies as they relate to archaeological cultures shows that archaeologists do see a link between specific subsistence practices and archaeological cultures. Given the location of a site, the age of a collection, and identifiable faunal remains, it should be possible to determine (archaeological) cultural affiliation by identifying the subsistence practices that occurred at a given site.

Shaw (1986, 1998), who oversaw excavation of the material culture from Summit Island, minimally described the collection as Norton (and Thule) in nature. Given the recent completion of his dissertation work at the Norton and Thule age Manokinak Site, as well as recent publications on Norton Culture (Shaw 1982b, 1983; Shaw and Holmes 1982), Shaw was primed to recognize associated material culture. Most archaeological research in southwest Alaska, discussed in this chapter, further suggests that the Summit Island components should be Late Holocene in age, and mostly if not all, Norton in affiliation. My own inventory (but not analysis) of the Summit Island material culture pointed to a Norton affiliation, rather than Thule or another archaeological culture previously documented in Alaska.

At first blush, Schaaf's identification of Middle Holocene components on Round Island does not factor into my understanding of the Summit Island materials as Norton. Her recent assessment that the Round Island material culture may show some previously undocumented connection to the archaeological cultures evidenced on the Alaska Peninsula and Aleutians, however, potentially adds a new twist to the culture history of northwest Bristol Bay (Dumond 2016; Schaaf 2015; Schaaf et al. 2007). The Summit Island data reveal some oddities that resist perfunctory assignment of cultural affiliation. The first issue is the early age of some of the Summit Island components (pre-2500 cal B.P.). Dumond (2016) has noted that the Norton Stage sites should have early dates ranging between 2500 and 2000 cal B.P. Sites pre-dating 2400 cal B.P. should be located in the Norton Sound region, while southerly Norton components should not be older than

2400 cal B.P. Most studied Norton sites adhere to Dumond's theory. Obvious exceptions include Component I at the Chagvan Bay Site (2850-2500 cal B.P., Ackerman 1986) and now the earliest Summit Island components (2740-2500 cal B.P.), which are approximately 250-350 years older than Dumond's timing. The second issue is that some of the earliest components at Summit Island also have slate implements, which Dumond (2016) no longer associates with the Smelt Creek Phase (2400-2000 cal B.P.), but with the later Brooks River Weir Phase (2000-1400 cal B.P.). This recent revelation differs from Dumond's earlier assessment that slate was present in low abundances in Smelt Creek components (Dumond 1981, 2005a, 2009).

Recent communications with Dr. Dumond (pers. comm., 2016, 2017) have resulted in discussions of the potential for a "proto-Norton" component on Summit Island that could be related to a northward movement of Aleutian or Gulf of Alaska maritime peoples (or ideas) during the Middle Holocene. Dumond (2016) has recently hypothesized that the ice seal-hunting Middle Holocene peoples evidenced at the Amaknak Bridge Site (in the eastern Aleutians) 3500-2500 RYBP may have some relation to the pre-Norton components found on Round Island (3690-3210 cal B.P.). He built off Crockford and Frederick (2007), who determined that Middle Holocene Amaknak Bridge residents had access to abundant pagophilic species because Neoglacial conditions allowed for the previously undocumented expansion of sea ice into the Aleutians. Dumond (2016) suggested that over time some of these populations followed the ice (and ringed seals) northward to Bristol Bay. The migrants could have left evidence of their occupation at Round Island, in the components dated to 3690-3210 cal B.P. Dumond (2016) further hypothesized that the Middle Holocene northward transmission of Aleutian or Gulf of Alaska ideas is related to the development of the Norton Tradition in the Bering Sea region. This is a continuation of Dumond's (1977, 1982, 1984, 1987b, 1990, 1998, 2000a, 2000b, 2005a, 2016) longstanding theory that Norton culture originated in the Bering Strait region and expanded into the rest of Alaska as a fully developed archaeological culture. The dating of Norton Stage components has mostly supported this idea. The Chagvan Bay Site is one exception, in that the earliest components are too old if a fully developed Norton culture expanded south from the Bering Strait region approximately 2500 cal B.P. As a stand-alone site, it is possible to discount the earliest dates from the Chagvan Bay Site as the result of imprecise dating techniques of the 1980s (2850-2500 cal B.P.). The Summit Island dates presented in this dissertation, which are "too old" for Norton culture (2740-2500 cal B.P.), are derived from modern radiocarbon dating techniques in 2015, which makes it harder to disregard the early dates from Chagvan Bay.

Recent conversations with Andrew Tremayne (pers. comm., 2017) identify another variable that may affect the cultural trajectory in this region. The cultural hiatus documented on the Norton Alaska Peninsula, between Arctic Small Tool (ASTt) and Norton traditions (2400-1000 cal B.P.); potentially due to volcanism that made the northern Alaska Peninsula uninhabitable (Dumond 2004) may explain the "early" or "pre-Norton" dates from Summit Island and Chagvan Bay. The northern Alaska Peninsula people with ASTt culture went somewhere between 3200 and 2400 cal B.P., and it is reasonable to think that some groups headed west to the Walrus Islands, out of the range of the most destructive ash fall. Dumond (2004:122) noted, however, that "Ash F" at Brooks River and "Ash 3" at Ugashik Knoll overlie the ASTt components, but do not appear to match well with dated Aniakchak eruptions. The length of the cultural hiatus between ASTt and Norton, which extends several centuries, also seems overly long, in that fauna and flora would have moved back into the area centuries before Norton culture is documented on the Alaska Peninsula (Dumond 2011:115). In his description of the aftermath from the historic eruption (and creation of) the Novarupta Volcano in 1912 A.D., on the northern Alaska Peninsula, Dumond (2005a) explained that salmon runs were not impacted by the eruption or extensive ash fall, and people returned to the area within a couple of decades. Schaaf (2015) and Bailey (1991) documented tephra on Round Island and Hagemeister Island, which suggests that Middle and Late Holocene peoples living in the northwest Bristol Bay area could have also been impacted by volcanism. Bailey (1991) did not date the tephra on Hagemeister Island that he found underneath the Norton components. Based on radiocarbon dating, Schaaf (2015:48) determined that the tephra layer found in the Round Island components developed between 3590 and 3405 cal B.P., which did not correlate to other documented Middle Holocene eruptions.

In light of these considerations, the next section provides some context for Norton occupations on Summit Island. I minimally review the ages of the Summit Island components and some material culture to point the reader toward my understanding of the Summit Island assemblages as Norton-affiliated. My methodology, which led to the Summit Island cultural chronology summarized in this section, is fully discussed in Chapter IV.

Temporal Range of Summit Island Occupations

Fifteen radiocarbon dates that I evaluated for this dissertation place the Summit Island occupations (at 49-XHI-043 and 49-XHI-044) between 2740 cal B.P. and 980 cal B.P. Based on my assessment of site stratigraphy and radiocarbon dates, there are three major ranges of occupation, which I have labeled Early Norton I (2740-2380 cal B.P.), Early Norton II (2400-2000 cal B.P.) and Late Norton (1390-980 cal B.P.). Table 6 lists the components, associated site, and age ranges.

Table 6. Cultural Components at 49-XHI-043 and 49-XHI-044

Site	Component	Age Range
49-XHI-043	Early Norton I	2740-2380 cal B.P.
49-XHI-044	Early Norton II	2400-2000 cal B.P.
49-XHI-043	Late Norton	1390-980 cal B.P.

I labeled the components in reference to Norton, because the radiocarbon dates are, for the most part, age appropriate to the Norton Tradition, given the location of Summit Island and the expected archaeological cultures that occurred in southwest Alaska. The ranges of dates for the components have some noticeable parallels to the phases in the Brooks River Period of the northern Alaska Peninsula: Smelt Creek Phase (2400-2000 cal B.P.), Brooks River Weir Phase (2000-1300 cal B.P.), and Brooks River Falls Phase (1300-1000 cal B.P.).

The age gap between Early Norton II and Late Norton (2000-1390 cal B.P.) should not be considered evidence for a break in human occupation of Summit Island. Shaw’s excavations centered on one housepit per site, which were limited explorations given the size of both sites (between seven and nine acres each). There are several more radiocarbon dates from Shaw's work at 49-XHI-042, 49-XHI-043 and 49-XHI-044, listed in Table 7, which I did not analyze for the dissertation, but hint at other occupations that may have taken place during the 600-year break. The unanalyzed dates suggest other components exist that may be as early as 3000-2550 cal B.P. to as recent as 650-550 cal B.P.

Table 7. Unverified Radiocarbon Dates from Summit Island (49-XHI-042, 49-XHI-043, 49XHI-044) not used in this Study

Site	Lab#	Field Sample#	RYBP	cal B.P. (1σ)
49-XHI-042	WSU-2969[a]	N/A	2460±50	2700 (2550) 2440*
	WSU-2976	N/A	610±50	650 (600) 550
49-XHI-043	WSU-4365	UA85-87-016	2335±80	2700 (2380) 2180
	WSU-3440	UA85-87-009	2290±90	2420 (2300) 2150
49-XHI-044	WSU-4295	UA85-88-019	2700±130	3000 (2830) 2550
	WSU-3445	UA85-88-003	1740±90	1780 (1660) 1550
	WSU-3449	UA85-88-015	1480±105	1520 (1400) 1300
	WSU-3448	UA85-88-010	1000±100	1050 (910) 790

*I calibrated the dates to 1-sigma with Calib7.1 per Reimer et al. (2013). Median dates are in parentheses.

[a] Washington State University processed these dates.

The unanalyzed 49-XHI-043 and 49-XHI-044 dates came from strata or units that I could not link to the site stratigraphy. These dates will require future critical assessment before they may be used to refine the Summit Island cultural chronology (described in Chapter IV). I did not analyze radiocarbon dates from 49-XHI-042 because the materials that Shaw (1986) excavated in 1985 did not contain any faunal remains.

Artifact Sub-assemblages in the Summit Island Collection

The upper range of the Early Norton I component (2740-2380 cal B.P.) is at least 240 years too early for a traditional Norton occupation, given Dumond's (1987, 2000b, 2016) reckoning, and should range from 2500 to 1000 cal B.P. (but more likely around 2400 cal B.P.). The other two components, however, are well within accepted Norton age ranges. To provide some artifactual evidence that we are dealing with Norton-affiliated components, even with the earliest component, I photographed sub-assemblages of bone, stone, and pottery artifacts from Early Norton I, Early Norton II, and Late Norton. Figures 8, 9, and 10 show material culture from each component that when considered together are demonstrative of Norton culture, rather than ASTt or Thule (or a yet unknown proto-Norton culture). I chose artifacts that represented each component as a whole, rather than selecting items that I believed to be Norton and did not exclude non-Norton looking artifacts. The Summit Island sub-assemblages are comparable to the artifact assemblages at Iyatayet, Chagvan Bay, and the Naknek drainage.

Chipped stone objects including endblades, sideblades, stemmed points, and knives are present in each Summit Island component and are very similar to those found in Norton components at Iyatayet, Chagvan Bay, and Naknek drainage (Ackerman 1986; Dumond 1981, 2011; Giddings 1964). The pottery sherds from each Summit Island component are fiber-tempered and come from barrel or cylindrical-shaped pots that are reminiscent of Norton pottery, rather than gravel-tempered globular pottery of the Thule Tradition (Dumond 1984, 1987b:110-111; 2005a:32-36). Only one sherd, from Late Norton, exhibits the check-stamped design associated with Norton culture; the rest of the sherds are either plain or too degraded to make out any exterior surface design.

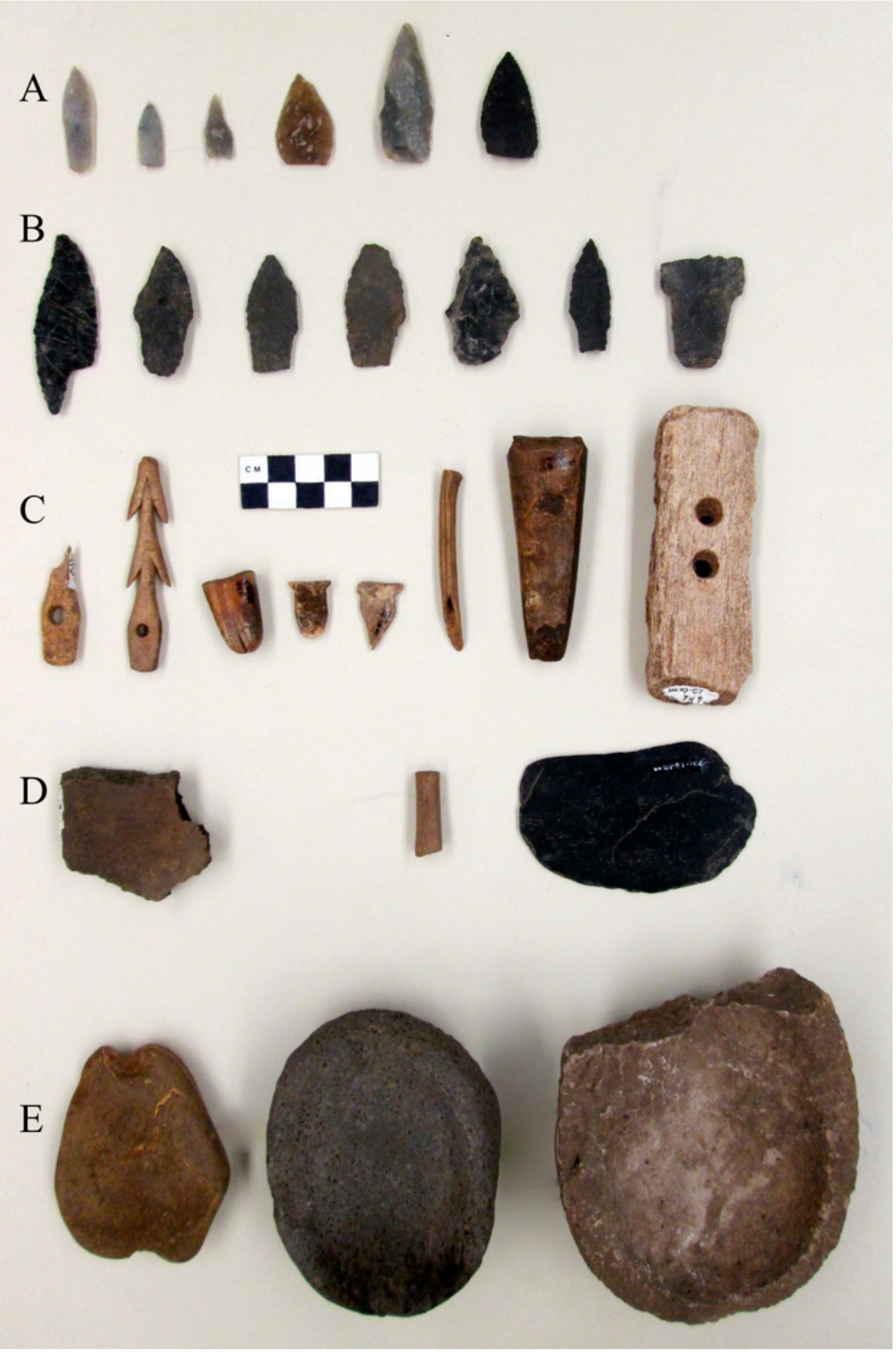

Figure 8. Stone and organic artifacts from Early Norton I. From left to right – Row A: (chipped stone endblades) UA85-87-674, -653, -730, -791, -722, -381; Row B (chipped stone knife) -654, (chipped stone stemmed points) -701, -678, -368, -700, -788, -702; Row C: (antler harpoons) -518, -504, (ivory labrets) 507, 526, 681, (bird bone needle blank) -513, (ivory wedge) -616, (ivory drill bearing/wedge?) -749; Row D: (plain fiber-tempered pottery sherd) -344, (whetstone) -950, (polished slate ulu fragment) -782; Row E: (bi-notched sinker stone) -607, (pecked stone bowl) -354, -1254.

Figure 9. Stone and organic artifacts from Early Norton II. From left to right – Row A: (chipped stone endblades) UA85-88-1232, -558, -739, -503, -944, -1183, -449, (chipped stone sideblade) -227; Row B: (engraved bone/ivory hairpin?) -981, (engraved bone/ivory bone harpoons) -258, -1217, -1204, (ivory labret) -891, (carved ivory figurine) -226; Row C: (ground slate fragment) -709, (drill bit) -991, (refit plain fiber-tempered wall/base pottery sherds) -333/922, (refit plain fiber-tempered and drilled rim/base pottery sherds, 2 pieces) -985; Row D: (bi-notched sinker stones) -396, -419, -170, 1052, (pecked stone bowl) -340.

Figure 10. Stone and organic artifacts from Late Norton. From left to right – Row A: (chipped stone endblades) UA85-87-877, -323, -238, -845, -843, -333, -251, -279, -284; Row B: (chipped stone biface fragments) -805, -298, (chipped stone scraper) -241, (chipped stone drill?) -864, (chipped stone flake knife) -874; Row C: (bone pin?) -248, (bone/ivory harpoon fragments) -455A&B, -444, -461, (bi-pointed bone rod) -604, (ivory labret) -438; Row D (plain fiber-tempered pottery rimsherd) -424, (check-stamped pottery sherd) -432, (plain fiber-tempered pottery sherd) -866; Row E: (ground slate fragment) -278, (pecked stone bowl) -462, (bi-notched sinker stone) -812.

The presence of any pottery in pre-1000 cal B.P. components, however, is suggestive of Norton culture. Bi-notched sinker stones are present in each Summit Island component as well, and are reminiscent of those found at Iyatayet, Hagemeister Island, Nunivak Island, Round Island, Naknek drainage, Ugashik drainage, and Cape Nome. Pecked stone bowls (or marine mammal oil lamps) were present in each component and are obviously not clay lamps typically associated with the Thule tradition. The trend of stone lamps in Norton components versus clay lamps in Thule components is documented on Nunivak Island and in the Naknek drainage (Nowak 1973, 1982; Dumond 1981, 2005b). Bailey (1991:99-100) also documented two pecked stone bowls in Norton components at 49-XHI-016 on Hagemeister Island. Interestingly, Bailey (1991:99-100) described one of the bowls as “identical” to an artifact that Giddings recovered from Norton components at the Gungnuk Site in Norton Sound, while the other bowl had a nipple in the center and raised lines on the outside perimeter. Bailey (1991:99) noted it bore “closer similarities with Kachemak examples from Cook Inlet.” The Summit Island pecked stone bowls also share similarities with some of the Norton bowls Giddings (1964) recovered from Iyatayet and Gungnuk (Pl. 58-59 and 63).

Dumond (2000b, 2016), Giddings (1964) and Workman (1982) have indicated that scratched or roughly polished slate is commonly found in Norton toolkits. Each Summit Island component contains roughly scratched or polished slate pieces. Notably, the Early Norton I sub-assemblage includes a polished slate ulu fragment (as well as other slate not included in the figures). All of the Norton components at Chagvan Bay, including Component I/II (2850-1630 cal B.P.) have associated slate as well. Ackerman (1986) indicated that material culture from the earliest Chagvan Bay component was comparable to that of the Smelt Creek Phase on the northern Alaska Peninsula. Dumond (2016) has discussed the rarity of polished slate in early Norton components (Smelt Creek Phase) on the Alaska Peninsula. Although he originally attributed small amounts of slate to Smelt Creek, he later determined that any slate recovered from Smelt Creek components was the result of mixing with later Brooks River Weir levels (2000-1400 cal B.P.). It is with the Brooks River Weir Phase that Dumond first documented evidence of trade between the maritime-adapted Pacific side of the Alaska Peninsula (Takli Cottonwood Phase) and those in the Naknek River drainage (Dumond 1981, 2005a, 2011).

Organic objects are uncommon in Norton components, due to limited preservation, but I included some dart and harpoon pieces that share similarities with the Iyatayet assemblage. Ivory labrets are also represented in each component, which Giddings (1964), Dumond (2000b, 2016), and Workman (1982) noted are present in Norton assemblages associated with large or more intensive (winter) settlements. Giddings (1964:Pl. 30) did recover ivory labrets from Iyatayet, but only from Nukleet (Thule) components. All recovered Norton-age labrets were made from stone. I included other organic pieces in the figures to show some of the range of implements present in the Summit Island collection.

Some Thoughts on Early Norton I on Summit Island

Given my examination of the Summit Island artifacts and Dumond’s first-hand assessment as well, I cannot readily dismiss the potential of a “proto-Norton” culture, one that has markers of Aleutian, Gulf of Alaska, or some unknown influences (Crockford and Frederick 2007; Dumond 2000, 2016; Maschner 2008; Schaaf et al. 2007; Schaaf 2015). It is also possible that Summit Island is evidence of a cultural and temporal link between ASTt and developed Norton in southwest Alaska (Tremayne, pers. comm., 2017). As Dumond (1982, 1990, 2000b, 2016) has noted, Norton culture is currently understood as a blend of northern and southern influences, which is a good descriptor for the Early Norton I artifacts (northerly: pottery and finely chipped stone tools and southerly: labrets, pecked stone bowls, and polished slate), despite the age range that might be considered “too early.” Clearly, the Norton-like quality of the Early Norton II and Late Norton components is obvious and since these are “age appropriate”, it is unlikely that another researcher would question their cultural affiliation as anything other than Norton. There is also an obvious continuity in artifact morphology between the Summit Island components, which points to grouping the artifacts as part of one cultural tradition, rather than isolating those from Early Norton I.

Given the nature of Early Norton I on Summit Island (and Component I from Chagvan Bay), it is possible that our understanding of Norton culture may need to be a bit more flexible to make room for regional variation, multiple waves of cultural influence, or cultural interactions that occurred earlier than previously documented. Research in the northwest Bristol Bay area is patchy at best, and for the most part, we have only hints of the deep history of the region through snapshots of Middle and Late Holocene occupations at Round Island (Schaaf 2015; Schaaf et al. 2007), Hagemeister Island (Bailey 1991) and Old Togiak (Kowta 1963). I submit that more research is needed to address fully the nature of pre-2500 cal B.P. Norton components evidenced at Summit Island, which is beyond the scope of this dissertation. For now, it is reasonable to state that the Summit Island components are Norton-affiliated, based on age, location, and typology, though it may date a bit earlier than advocated by Dumond (2000b, 2016).

CHAPTER IV

ARCHAEOLOGICAL RESEARCH OF 49-XHI-043 AND 49-XHI-044

This chapter reviews the 1982 and 1985 investigations of archaeological sites 49-XHI-043 (Summit Island #2) and 49-XHI-044 (Summit Island #3). Although Robert Shaw obtained 17 radiocarbon dates from the sites, I obtained nine additional dates in an attempt to better establish the chronology of deposits sampled during his excavations. My understanding of site chronology and stratigraphy is based on my study of fieldnotes and drawings produced by Shaw and his crew. Unfortunately, there is no descriptive overview of site stratigraphy available from this earlier work. From the site's stratigraphy and the now larger suite of radiocarbon ages, I defined analytical components (previously discussed in Chapter III). These components led me to select certain samples for faunal analysis. Much of this chapter describes the archaeological and analytical context for the faunal analyses to be presented in later chapters.

Setting of the Sites

The topography of Summit Island is shaped somewhat like a dumbbell with a low elevation saddle in the middle and two higher elevation areas that are encircled by cliffs on the north and south ends of the island. All five documented archeological sites are located in the low elevation saddle area (AHRS 2010; Casperson 2011; Shaw 1986). Sites 49-XHI-043 and 49-XHI-044 are located on the west-southwest coast of Summit Island, approximately 700 m apart, with a vista overlooking Bristol Bay and the more southerly Walrus Islands (Figure 11).

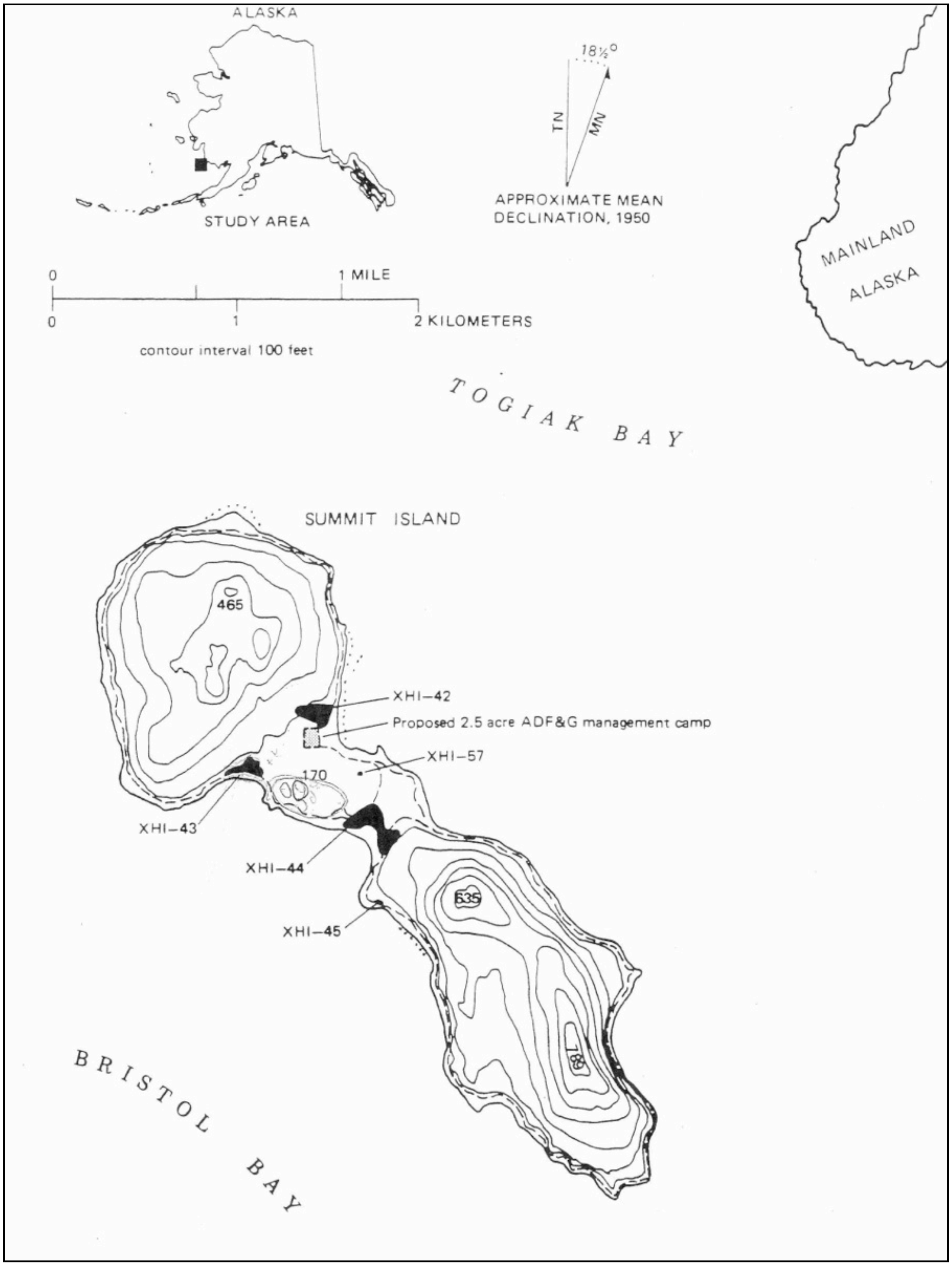

Figure 11. Summit Island archaeological sites (from Shaw 1986).

1982 Field Season

During the 1982 field survey, Shaw described 49-XHI-043 as a nine-acre prehistoric village with visible surface depressions of rectangular-shaped housepits, tents, and cache pits concentrated in three loci (AHRS 2010). The largest housepit measured 9 m x 12 m. The site had three major loci at the top of 14-18 m high bluffs overlooking the southwest coast of the island (AHRS 2010; Shaw 1985, 1986). Shaw (1986:5-7) excavated at least one 1 m x 1 m unit to a depth of 1.4 m into sterile sediments and noted stratified shell midden deposits with "excellent preservation of bone and antler in addition to stone and pottery items; only occasionally were traces of wood present…[which] indicate both Norton Tradition and Thule Tradition affiliations" (AHRS 2010). Shaw (1985:4) also hinted at the presence of many "elaborately carved ivory objects of high market value" including the ivory face represented in Figure 12.

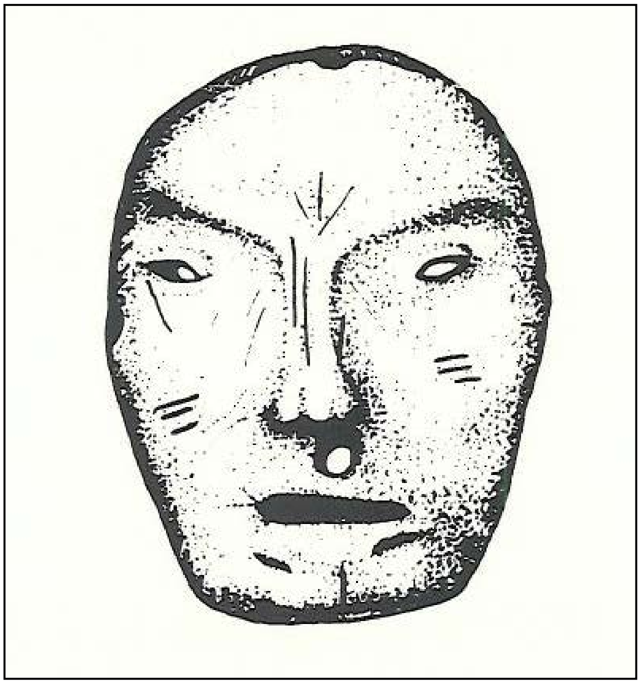

Figure 12. Ivory doll face recovered in 1982 at 49-XHI-043 (from Shaw 1986).

Shaw did not provide further details regarding the material culture or cultural matrix, but he did report some of the results of this work, including one drawing of a soil profile and two uncalibrated radiocarbon dates (1120 ±70 RYBP, 2230 ±60 RYBP), in grey literature (Shaw 1985, 1986). Shaw further noted that 49-XHI-043 was in poor condition, due to the erosion and undercutting of the slope on the south side of the site, where one or more housepits and related midden met the tall bluffs. Illegal digging had also heavily damaged the site (AHRS 2010; Shaw 1986).

Site 49-XHI-044 was located 700 m away from 49-XHI-043, along the same stretch of coast, to the southeast (AHRS 2010). Shaw described it as a prehistoric village, seven acres in size, with two distinct loci placed atop 10-12 m high bluffs. Shaw noted that one of the loci had at least 25 dwelling features, some as large as 5 m x 19 m. In 1982, Shaw dug one shovel probe in the site and found that cultural materials extended at least 70 cm in depth. He classified the artifacts from this site as Norton and Thule, but did not elaborate on his reasoning for doing so. Illegal digging had also severely affected 49-XHI-044 (AHRS 2010; Casperson 2011; Shaw 1986).

For this dissertation, I did not have access to the cultural materials Shaw excavated in 1982. They are considered lost or missing and have never been accessioned at the University of Alaska’s Museum of the North (UAMN), where the 1985 materials are curated. I discuss only the materials recovered during Shaw’s 1985 excavations at 49-XHI-043 and 49-XHI-044. I obtained the 1985 collection on loan from UAMN in 2012.

1985 Field Season and Excavation Methodology

In 1985, Shaw and a crew of eight archaeologists spent six weeks excavating sites 49-XHI-043 and 49-XHI-044, from late June to early August. The crew split into two excavation teams, one per site, with some people working at both sites. Shaw oversaw the excavations and was responsible for establishing the main stratigraphy for both sites. His interpretation of the 1985 stratigraphy relied heavily on the archaeological inventory and test excavations he conducted in 1982.

A partial site map for 49-XHI-043 with the 1982 and 1985 excavation units is depicted in Figure 13. This is my best attempt at a reconstruction using partial hand-drawn site maps and my understanding of some feature locations described in the crewmembers' field notes. Similarly, for 49-XHI-044, a partial site map with 1985 excavation units is portrayed in Figure 14. These maps cannot be considered comprehensive with relation to surface or subsurface features, but they do bring together information from various sources to provide a clearer picture of the excavations at these two sites.

Although there is no overarching narrative in the crews' fieldnotes or in Shaw's reports and publications that summarize the Summit Island excavations, I was able to extrapolate Shaw's methodology from soil profiles, level plans, field notes, and bag labels. The crew set up the excavations using cardinal directions and divided the excavation area into 1 m x 1 m square units. The site datum at 49-XHI-043 is located at N100/W100. The excavation area runs N38-46 and W109-122. The 49-XHI-044 site datum is unknown, but assumed to be located at S100/W100 based on the numbering of excavation units S32-51 and W96-104.

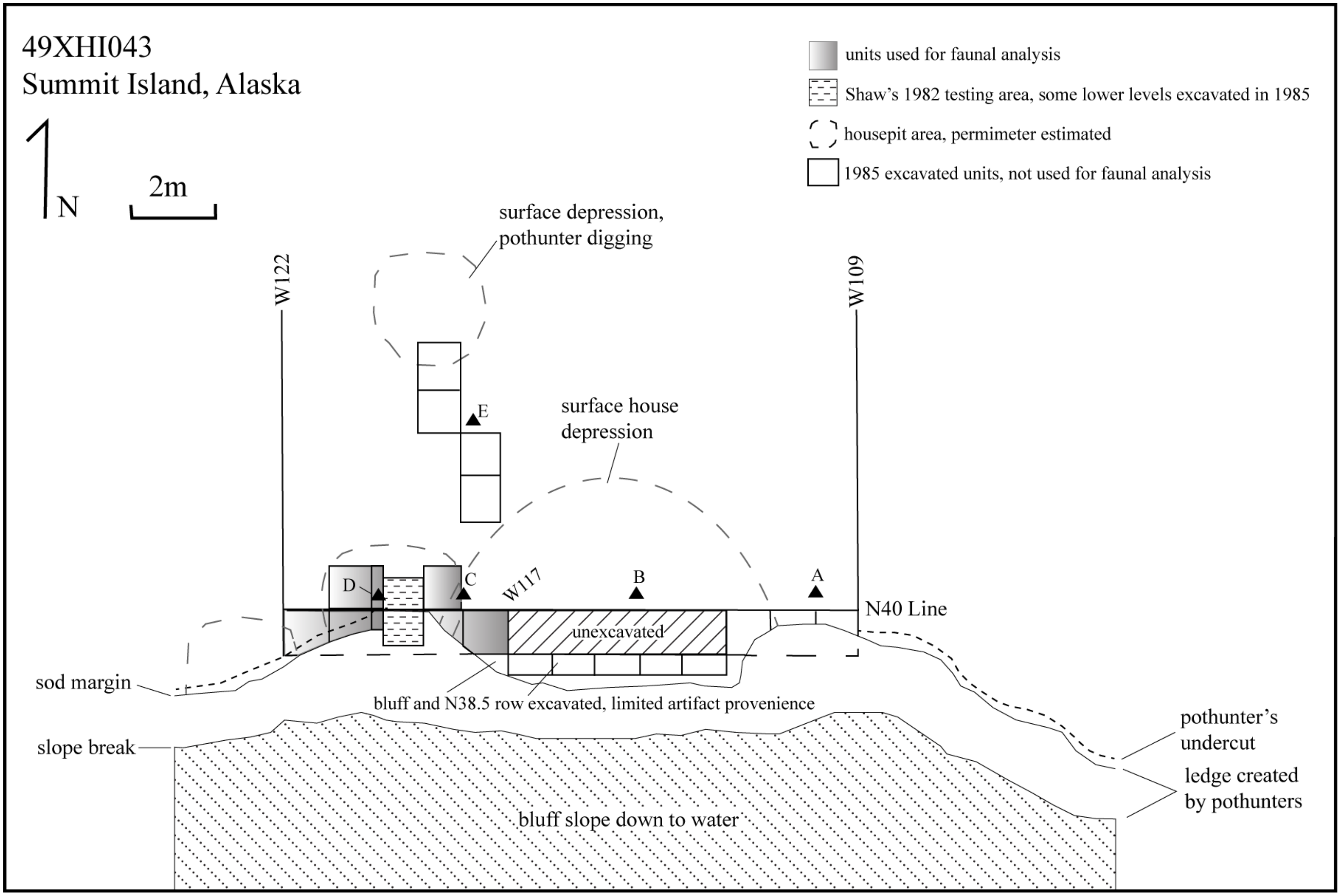

Figure 13. 49-XHI-043 site map with 1982 and 1985 excavation units.

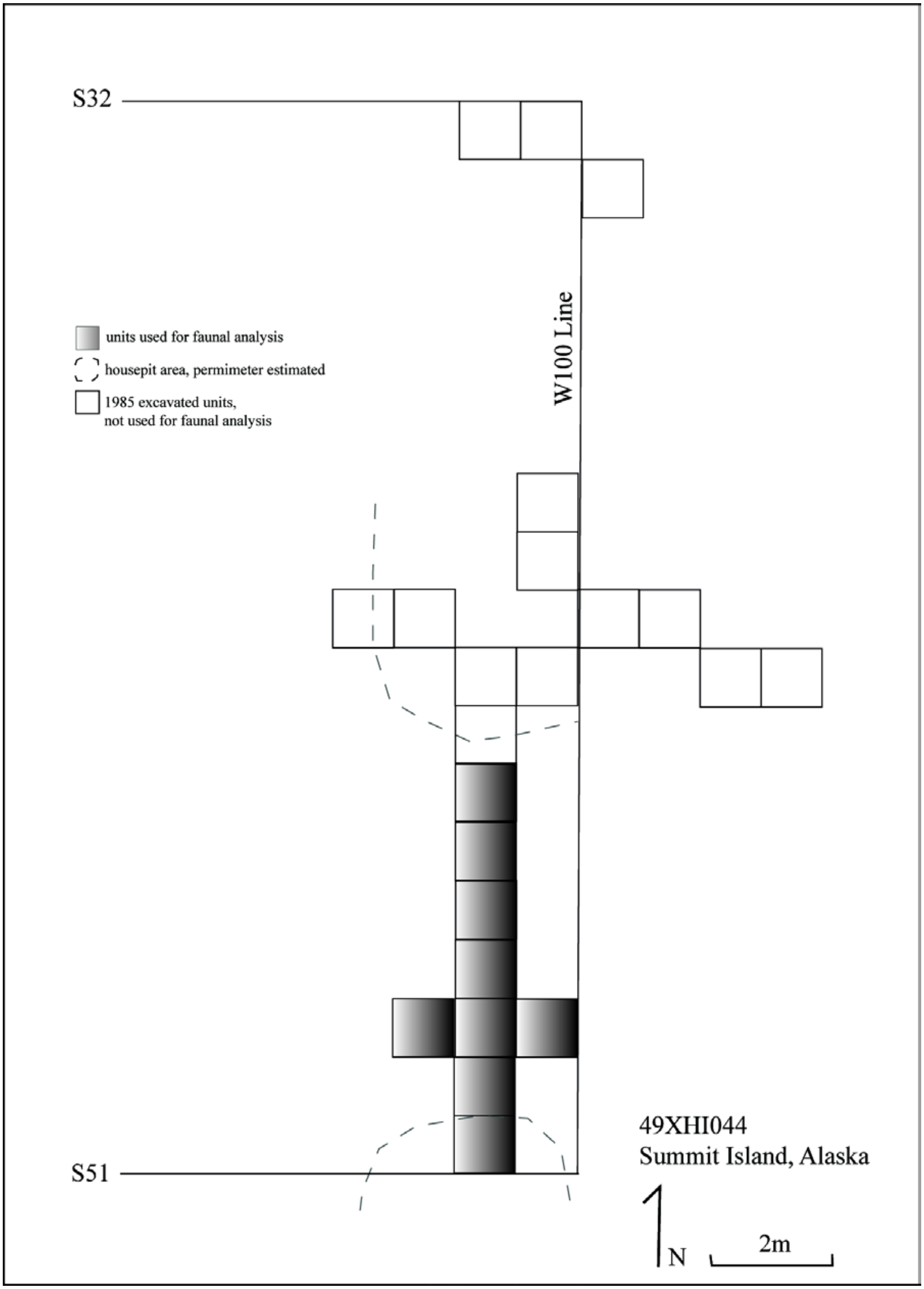

Figure 14. 49-XHI-044 site map with 1985 excavation units.

At both sites, the crew excavated with hand trowels and used 1/4-inch mesh screens. They excavated by stratigraphic levels when possible, but utilized 10 cm arbitrary levels with thick strata or when directed to do so by Shaw. Most of the field notes are detailed with regard to stratigraphy and artifact location, and Shaw provided the crew with a good understanding of site deposition. For the most part, the crew collected and bagged artifacts and faunal lots by unit, level, and stratum and created unit inventories. The crew did not collect any bulk samples of shell midden or sediment. The crew produced detailed level plans and point-plotted artifacts, collected some faunal remains and mineral samples, and noted changes in stratigraphy. The crew established a primary excavation datum (Datum A) as well as ancillary datums at each site. The crew used a local datum at each unit to record depths in centimeters. The unit datums can ultimately be tied back to each main site datum (49-XHI-043 – N100/W100 and 49-XHI-044 – S100/W100).

49-XHI-043: Site Stratigraphy

Shaw focused the 49-XHI-043 excavations around the large 9 m x 12 m housepit with a visible surface depression noted in the 1982 field survey. Excavations took place on the edges of the housepit in the midden zone and along the south bluff, where artifacts and faunal materials in a mussel shell matrix were actively eroding downslope. Figure 15 is a rendering of Shaw's hand drawn profile of the N40 wall between units W117 and W122. The profile depicts a small portion of the housepit evidenced in the surface depression in W117-118 unit and associated cultural midden in the W118-122 units. Table 8 lists Shaw's notes on excavated strata designations and descriptions, including some descriptive labels from Shaw's 1982 profile represented in Shaw (1986:6). I edited some of his notes for clarity and my comments are italicized in brackets. This table includes the uncalibrated radiocarbon dates Shaw procured in 1986 and 1991 from the Washington State University Radiocarbon Dating Laboratory in Pullman (WSU). The 1985 units generally lined up with Shaw's 1982 test unit, which was placed on the south face of the bluff. Shaw also placed some units north of the main housepit (N42-44/W117-118 and N44-46/W118-119) to investigate another surface depression.

My ability to interpret the depositional history of 49-XHI-043 was confounded by the site residents' intensive use and reuse of the housepit area. At least six vertical cuts into sediments, which Shaw interpreted as evidence of housepit use/reuse, are visible in the profile. Many of these can be associated with midden toss/berm building zones on the edges of the housepit cuts, living floor zones within housepits, and pit fills from later occupations. During the successive housepit re-use episodes, it is likely that people excavated into older cultural sediments and mixed them with their own material culture. Shaw dated key strata throughout the occupations, which provided a reasonable way to tentatively group strata into lower and upper components, dated to 2820-2230 RYBP and 1375-1120 RYBP, respectively. Shaw's dates, however, do not always align with the interpreted depositional history of 49-XHI-043. In many cases, lower stratigraphic layers, which appear to be older (based on the way soils lay in relation to each other), may have more recent ages than is appropriate given the ages of the surrounding strata.

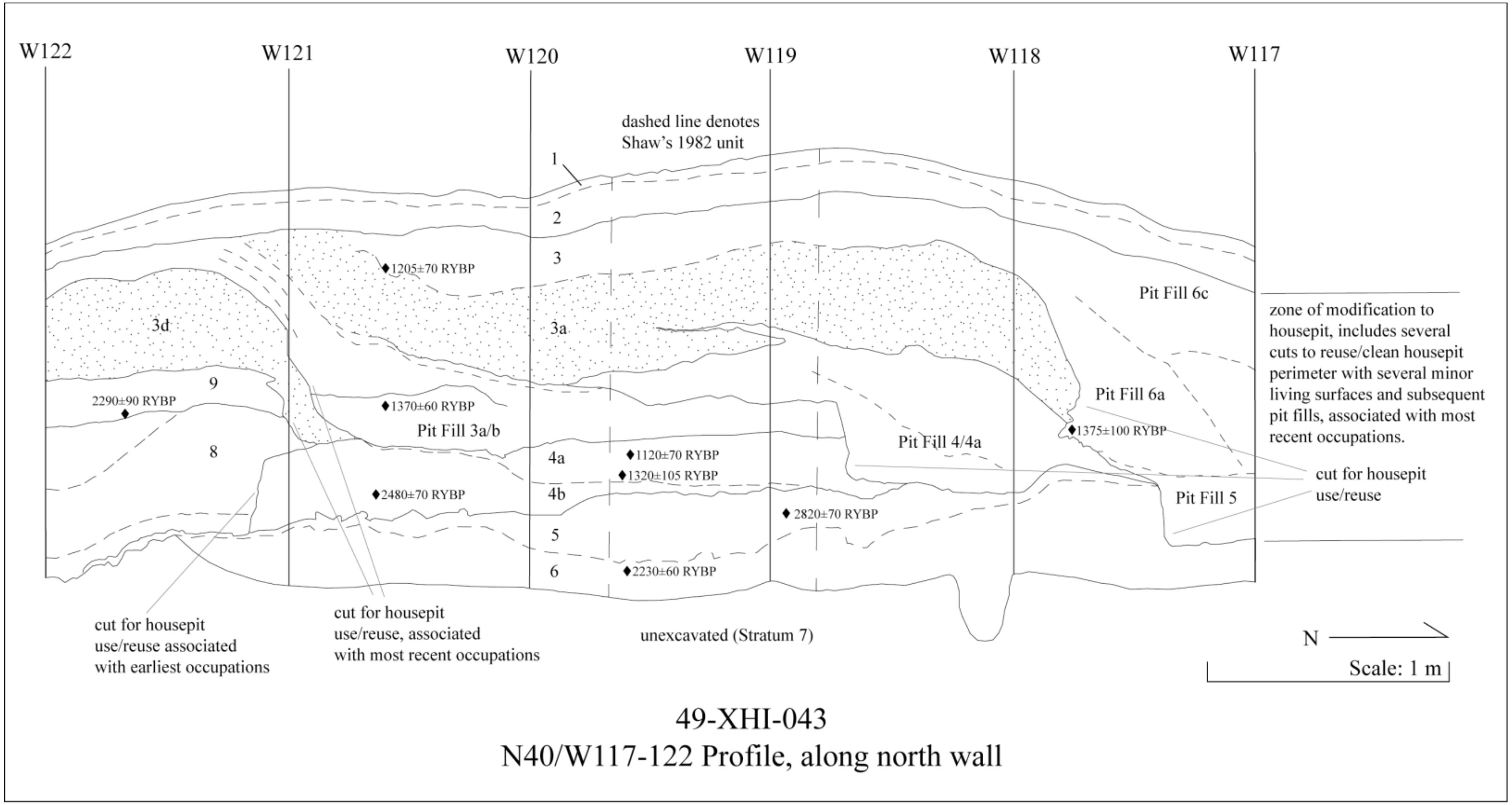

Figure 15. North wall stratigraphic profile of 49-XHI-043 at N40/W118-122. The figure includes Shaw's radiocarbon dates.

Table 8. Shaw 49-XHI-043 Strata Descriptions and Associated Radiocarbon Dates (RYBP)

Stratum	Description and Associated Dates (Lab#)	RYBP (Lab #)
1	This is contemporary surface vegetation/sod mat and root zone. (O-horizon).	
2	This is vegetation/sod mat and root zone intermixed with limited cultural fill. It has A1 characteristics [*large accumulation of organic layer in surface soil layer*].	
3	This is exterior midden created during the use of the housepit. It is a dark brown matrix with mottled charcoal stains. Pit Fill 6a is living floor zone. Pit Fill 6c is general surface midden fill into house pit and post abandonment fill.	1205±70 (WSU-3442) 1375±100 (WSU-3438)
3a	The stratum is homogenized backdirt from housepit. It has a slightly lighter color than the stratum above.	
3d	The stratum is homogenized midden that is backdirt from housepit cleaning/rebuilding. It is sandy tan loam, connected to Stratum 4a.	
Housepit Use/ Reuse Zone	[*This zone represents several cuts, living surface zones, midden toss/berm building zones, and subsequent pit fills from the cleaning/rebuilding of housepits throughout the course of the most recent occupations. Shaw labeled these various layers as zones, cuts, or pit fills as 2, 3a, 3b, 3c, 4, 4a, and 5. Not all of these features are labeled on the soil profile to facilitate easy reading.*] Pit Fill 4/4a: This material physically resembles Stratum 4a material. Perhaps it is pit excavation backdirt. Pit Fill 3a/3b are living floor zone and surface pit reuse zone, respectively. They are intermixed by trampling and use into one living floor zone in places. Pit Fill 5 has a probable living floor [*at the base*].	1370±60 (WSU-3443)
4a	The stratum is brown/yellow material under blue mussel layer and above the shell/bone layer [*Stratum 4b*].	1120±70 (WSU-2970) 1320±105 (WSU-3444)
4b	Shell/bone layer, with lots of crushed shell.	2480±70 (WSU-3441)
5	Red ochre zone, with lots of crushed shell.	2820±70 (WSU-3439)
6	Red ochre zone, with lots of crushed shell.	2230±60 (WSU-2975)
7	This stratum is sterile parent material, [*stratigraphically lower than Strata 8 and 9*].	

Table 8. (continued)

Stratum	Description and Associated Dates (Lab#)	RYBP (Lab #)
8	The stratum is pit fill with an underlying living floor zone, which is located at the base of stratum, [*and associated with a stratigraphically deeper housepit*].	
9	This is pit fill with a 2 cm thick black humic lens at the top of the stratum. There is a scattered charcoal surface at the base of the stratum. [*The stratum is associated with the stratigraphically deeper housepit, as with Stratum 8*].	2290±90 (WSU-3440)

Starting with the deepest layers and Shaw's radiocarbon dates, I assigned Strata 4b, 5, 6, 8, and 9 to the lower component (2820-2230 RYBP). Stratum 6 is the lowest depositional cultural layer and overlies Stratum 7 (sterile parent material), but does not have the earliest date associated with the lower component (2230±60 RYBP). This date is the youngest of any from the lower strata. In his field notes, Berkley Bailey characterized Stratum 6 as "mottled with large bones and fish remains, it constitutes a red layer that covers the entire floor just above the parent material [Stratum 7]".

Stratum 5 overlies Stratum 6, which Shaw dated to 2820±70 RYBP. This is the oldest date in the lower component and older than currently accepted Norton ages (2500-1000 cal B.P.). Two major lenses of mussel shell were recorded in Stratum 5. According to Berkley Bailey's fieldnotes, in Unit N40-41/W118-119, Stratum 5 was associated with "many whole fish skeletons and many bird skeletons." Shaw identified Strata 5 and 6 as a "red ochre zone." The majority of the faunal remains from these strata do exhibit ochre staining (based on my analysis). While the strata do not have obvious housepit cuts, Shaw noted a posthole (visible in the profile at the W118 line) dug into Stratum 7. Artifacts and charcoal were recovered from above and in the posthole, but not dated.

Stratum 4b was characterized as a mussel shell and bone layer and laid directly on top of Stratum 5. It was dated to 2480±70 RYBP, which is out of chronological order with the dates of the lower strata (5 and 6). Faunal remains from this stratum have some limited ochre staining, which suggests it was the subsequent depositional layer after Stratum 5. Stratum 4b truncated in the W121-122 wall by a housepit cut Shaw associated with Strata 8 and 9. These strata partially overlie Strata 4b, 5, and 6. Shaw noted that this housepit was located to the southwest of the profile and not associated with the main housepit area represented in W118-121. A scattered charcoal lens at the base of Stratum 9 dated to 2290±90 RYBP. A 2 cm thick humic lens capped the top of Stratum 9, suggesting it was once covered by surface vegetation. This is supported by the fact that the overlying stratum (Stratum 3d) was likely 700 years younger than Stratum 9. The date associated with Stratum 9 is acceptable based on my interpretation that it was deposited after Stratum 4b and should be younger.

The depositional history of the upper component is a bit more complicated (1375-1120 RYBP). There were five episodes of use and re-use of the main housepit area, represented by vertical cuts into lower (and supposedly older) sediments. Most of these cuts were associated with what Shaw termed “living floor zones,” midden toss/berm building zones, and subsequent pit fill when later groups started the housepit re-use/rebuilding process over again.

Housepit use/re-use should follow a sequence of events: people cut into lower sediments to create, expand, or clean an existing a housepit. This material is thrown into the toss zone. It forms a berm by the housepit cut (wall) and trails down slope over time. Some of it becomes intermixed with midden as people occupy the space and throw trash into the toss zone on the edges of the housepit. The living surface in the housepit is created during this time. The housepit fills in with “pit fill” after an occupation, and when people come back, and the process starts over again. Based on these assumptions, what follows is my best interpretation of the upper component’s depositional history (with Shaw’s help), from the earliest occupations to the most recent.

Stratum 4a developed first, and lay directly on top of Stratum 4b (of the lower component), without any noticeable development of non-cultural sediments between the two strata. This stratum consisted of a tan soil connected to Stratum 3d through a thin line of sediments visible in the W120-121 wall. Stratum 4a has two dates: 1320±105 RYBP and 1120±70 RYBP. The earliest date does not mesh well with the depositional history, since it is one of the youngest dates associated with the upper component. Shaw collected it from a charcoal concentration at the base of the stratum. The second and older date is acceptable given the dates of the strata above it, but it is slightly younger than dates from Pit Fill 3a/b and Pit Fill 6a (which should be younger or of similar age). Strata 4a and 3d overlaid (filled in) a housepit cut on the W121 line, but there is no obvious cultural stratum associated with the cut.

Pit Fill 3a/b was created next. It filled in a second housepit cut, parallel to the one in the W121 line and was cut into Strata 3d/4a. A thin blue mussel lens lined the base of the feature and separated it from Strata 4a and 3d. Shaw described the feature matrix as “scattered charcoal and mussel shell flecks”. A charcoal lens in the middle of Pit Fill 3a/b was dated to 1370±60 RYBP. There was a second charcoal lens at the top of Pit Fill 3a/b that was not dated.

Pit Fill 4/4a was excavated next and cut into Pit Fill 3a/b and Stratum 4a. It may have been associated with the housepit cut that formed one wall of Pit Fill 5, visible in the W117-118 wall. It had at least one thin mussel shell lens near the top of the feature. The cut by Pit Fill 5 was excavated into Strata 5 and 6, which suggests that Pit Fill 4/4a may have been mixed with lower component materials. Pit Fill 4/4a may have been the berm the people created when making the cut into Strata 5 and 6. The cut by Pit Fill 5 could also be associated with Stratum 3a, which according to Shaw was "homogenized backdirt from an episode of housepit building/rebuilding." Pit Fill 5 was created after Pit Fill 4/4a (note tail of Pit Fill 5 on top of Pit Fill 4/4a in Figure 15). There are no organic remains associated with Pit Fill 5 for potential dating.

Shaw identified Stratum 3a as "homogenized backdirt from housepit construction" and depositionally younger than Stratum 3d, Pit Fill 3a/b, Pit Fill 4/4a. It may be associated with the lowest housepit cut in W117-118 (by Pit Fill 5) or it may have been of similar depositional age to Pit Fill 5. The cut by Pit Fill 6a has obscured if there was a relationship between the two. Stratum 3a, however, appears depositionally older than Pit Fill 6a and Pit Fill 6c. Stratum 3a was not dated, but contained faunal remains, a few thin charcoal lenses, and lots of mussel and dogwinkle shell fragments.

Stratum 3 was "surface mussel shell and bone midden" and the last major occupation layer under the O and A horizons (organic vegetation surface in Stratum 1 and surface mineral layer with organic materials in Stratum 2, respectively). The stratum also contains Pit Fill 6a, 6b, and 6c. Shaw noted that Pit Fill 6c was partially post-abandonment fill as well as a continuation of the surface midden fill, which stretched across the length of the top of Stratum 3 from W117 to W121. Pit Fill 6a should be the oldest (lowest) depositional feature in Stratum 3. A charcoal sample from a mussel shell concentration in the fill was dated to 1375±100 RYBP. The material filled in a cut that was made into Stratum 3a and Pit Fill 4/4a. It appears to have rested directly on top of Pit Fill 5. Pit Fill 6a was described as "housepit fill with abundant blue mussel and charcoal dispersed flecks as compared to Strata 3 and 4 to the west." A tail of the Stratum 3 midden, in W120-121, was dated to 1205±70 RYBP. This is a plausible age for the upper reaches of the midden given the other dates associated with the upper component. Pit Fill 6c could be of similar or younger age than the "surface mussel shell and bone midden" noted in Stratum 3.

In summary, two major components are represented in Shaw's excavation at 49-XHI-043. Based on Shaw's work, the lowest and oldest strata are dated to 2820-2230 RYBP, while the most recent and shallow strata are dated to 1375-1120 RYBP. Each set of dates cluster together, separated by approximately 855 radiocarbon years, which suggests that the two components are temporally discrete. Both set of dates, however, are problematic in that the radiocarbon dates do not completely match the interpreted depositional history. Some dates are too old or young based on the associated strata, and it is impossible to determine change through time intra-component. Both components required further dating beyond what Shaw did.

The lower component has evidence of repeated human habitation of two distinct housepits, and the creation of shell and bone midden. Of note, was the red ochre zone, in the lowest strata, resting on sterile parent sediments. The upper component has five episodes of use and re-use of the main housepit area and several lenses of shell and bone midden and charcoal peppered throughout the occupations. The crew placed the excavation units mostly in the midden toss zones and, as such, both components were interspersed with abundant shell and bone midden and charcoal lenses. The placement resulted in the recovery of thousands of faunal remains and artifacts. The stratigraphy at 49-XHI-043 suggests intensive repeated occupation of Summit Island during the creation of the lower and upper components.

49-XHI-044: Site Stratigraphy

The 49-XHI-044 excavation centered on a large 5 m x 19 m housepit with a visible surface depression evidenced in the S41-43/W100-104 units (Figure 14). Figures 16 and 17 are renderings of Shaw's hand drawn profile of the S43-51/W102 west wall, which shows part of the main housepit cut in the S43-44 wall and associated cultural midden trailing south in the S44-51 units. The strata descriptions in Table 9 were taken either from Shaw's profile notes or from Steve Klingler's field notes. Most of the text is presented verbatim, although I re-worded some items for clarity. A few of my comments are italicized in brackets. Their descriptions of strata and deposition start in S43, move south, and downslope to S51. As the strata descriptions progress downslope, Shaw hyphenated the names of some of the strata to document their admixture. The table includes the uncalibrated radiocarbon dates Shaw procured in 1986 and 1991 from WSU. Shaw and crew also excavated three units on the north end of the main housepit (grouped around the S32 line). According to crewmember notes, those units were placed to test a possible cache pit.

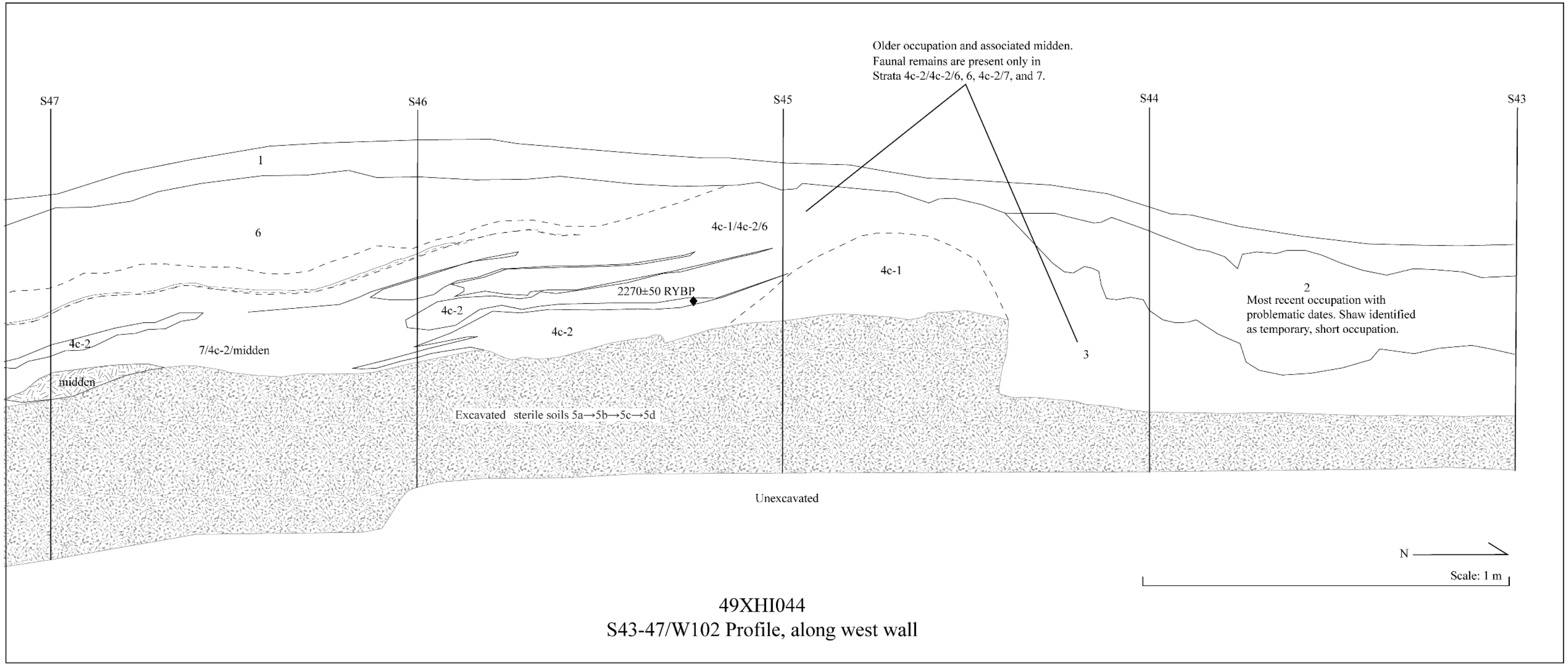

Figure 16. West wall stratigraphic profile of 49-XHI-044 at S43-47/W102. The figure includes Shaw's radiocarbon dates.

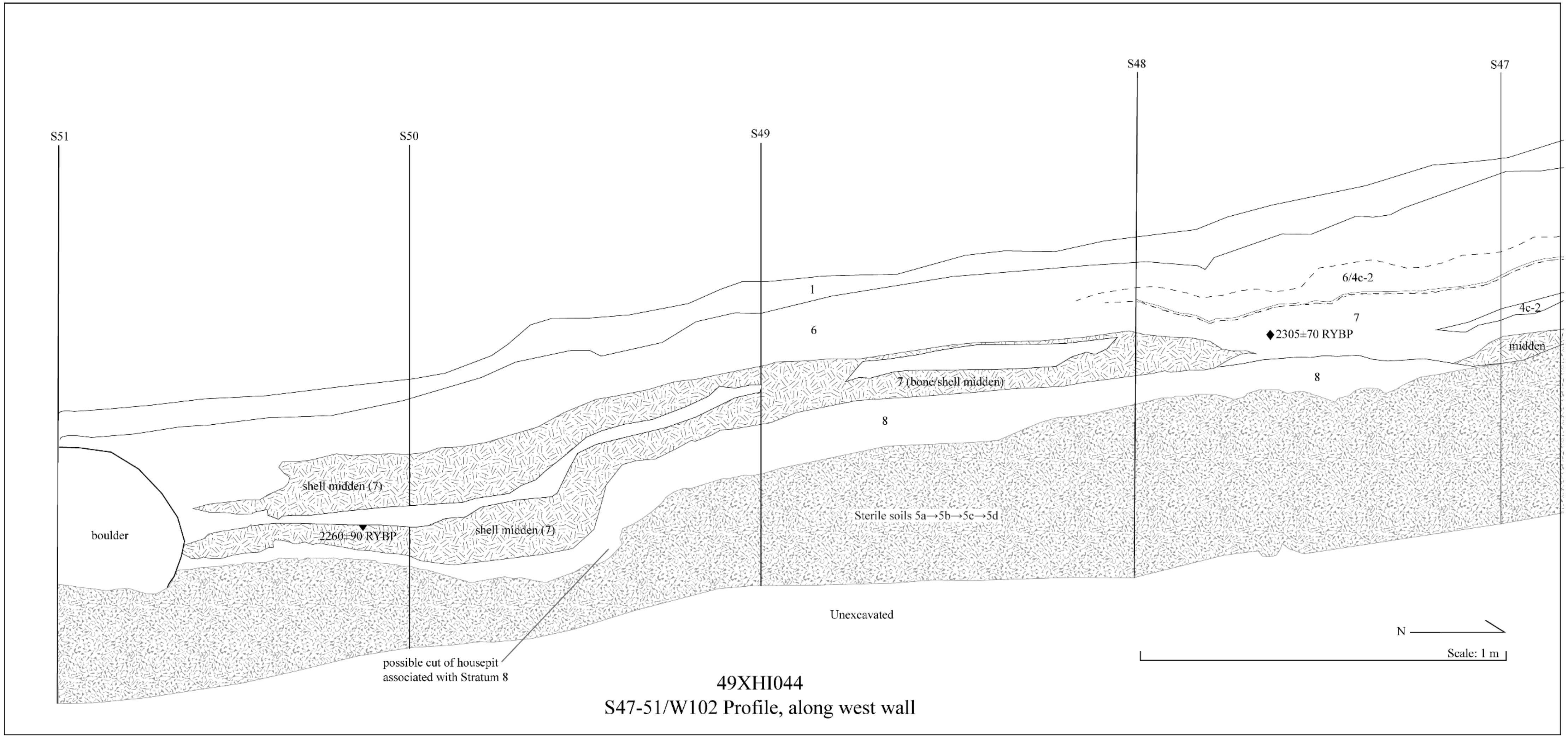

Figure 17. West wall stratigraphic profile of 49-XHI-044 S47-51/W102. The figure includes Shaw's radiocarbon dates.

Table 9. Shaw’s 49-XHI-044 Strata Descriptions and Associated Radiocarbon Dates (RYBP)

Stratum	Description	RYBP (Lab #)
1	Contemporary surface vegetation/sod mat and root zone. Brown soil with many rootlets and a few small pebbles. Rodent and fox disturbances. With depth, the soil becomes somewhat grittier, with increased number of pebbles (Steve Klingler’s field notes).	
2	Mottled brown soil is somewhat reddish brown with yellowish patches and charcoal stains. In addition to color, the top of the brown mottled soils appears to be marked by relatively numerous small pebbles and the tops of larger rocks. The brown mottled soil becomes a mottled yellowish brown, with charcoal and bone-stained soil. The stratum terminates in what appears to be a depression with charcoal-stained soils, possibly indicating a hearth or living surface. Shell and bone are present and charcoal samples collected (Klingler’s field notes).	1480±105 (WSU-3449) 1740±90 (WSU-3445)
3	Yellowish and reddish mottled sandy soil becomes sandy-clayey to the bottom of the pit. Three flakes recovered in this stratum (Klingler’s field notes).	
4c-1/4c-2	Non-sticky slightly plastic sandy loam, with medium to coarse sand from beach deposit origin. Pebbles are sub-rounded to rounded, scattered larger gravel. Soils have no internal structure. 10 YR 4/3, color is uniform in layers, looks to have been thoroughly mechanically mixed. Stratum 4c-2 material retains much of the physical character of 4a-4b parent materials, but is clearly mixed with some cultural material and occurs in distinct lenses, which inter-finger with heavily cultural midden (as one moves downslope and to the south toward S51). It is very similar to 4c-1. Note in perpendicular long profile [*W102 West Wall Profile*] through the front of the house locus that 4c-1 occurs as a pile of backdirt along the pit margin into increase effective depth of the pit. 4c-2 material appears to be 4c-1 material piled along the south end of the original house pit that was intermittently dispersed from that berm location as the midden in front of the house was created. In support of this, note that the 4c-2 lenses are thickest and greatest in number adjacent to the remnant 4c-1 berm [*in S44-45 unit*]. Note also that the lenses thin to south and have greater admixture of shell and bone heavy cultural midden. 4c-2 is 4c-1 berm is gradually being pushed southward away from house wall as people lived in the house and intensively used the front of house exterior location. The inter-fingering of 4c-2 with the shell/bone heavy cultural midden clearly suggests that the midden is associated with first house locus occupation (Shaw's profile notes).	
5a-5b-5c-5d-4a-4b	Sterile with natural soil development sequence [*from left to right, top to bottom soils*]. The original occupation is dug into these soils. In the large housepit, the people who excavated originally cut through the soft soils 5a-5b and suspended excavation when they hit compacted gravelly/cobbly parent material in 4a-4b. In W102 West Wall Profile, you can see that people excavated a short distance into 4a-4b (Shaw's profile notes).	

Table 9. (continued)

Stratum	Description	RYBP (Lab #)
6	Predominant color 5 YR 3/2 with gradual color shift in faint mottles of 5-10 cm patches with color rarely shifting as much as 10 YR 4/3. Sticky plastic humic silt loam. Weakly cultural. General exterior surface midden accumulation from non-intensive midden dispersal and surface vegetation accumulation (Shaw's profile notes).	
6/4c-2	Mottled material appears to be an incompletely homogenized (mechanically) mixture of two strata. Small patches retain predominant character of each (2-5 cm patches). Very faint black humic line at the top of Strata 6 and 7. Appears to be humic line created by disintegrating vegetation at a temporarily stable ground surface. Stabilization appears not to have lasted long enough for intensive soil process modification in immediately underlying material (Shaw's profile notes).	
7	Capped by black humic line originating from disintegrating vegetation at a temporarily stable ground surface. Predominantly 10 YR 3/2 with internal mottling appearing to have been masked by illuviation of humates immediately below surface of ground. Some very faint suggestions of mottled patches similar in size to 6/4c-2 mixture present. 6/4c-2 and 7 appear to be of similar origin (Shaw's profile notes).	2305±70 (WSU-3446)
7/4c-2 midden	Physical characteristics of both present but 4c-2 predominates. The darker material may be in place deposition of vegetation and other organic debris deposited at the time the midden was put in place during occupation of housepit. Pure clean crushed blue mussel and periwinkle almost exclusively where the shell has no soil admixture [*in S48-51 units*] (Shaw's profile notes).	2260±90 (WSU-3447) 2270±50 (WSU-4294)
8	10 YR 3/3 with some internal lensing/ patches to 10 YR 4/3. Mostly loam to silt loam, but some coarse sand of beach origin present. Slightly sticky, slightly plastic. Some lensing as if thrown out as backdirt, but otherwise has no structure. Stratum 8 appears to be a backdirt unit which retains the predominant character of 4a-4b parent material with a small percent of admixture of general exterior surface midden comparable to Stratum 6 and the somewhat earlier Stratum 7 material shown on the profile directly above. Stratum 8 seems to have no relationship to the house locus we have been excavating for the past six weeks. Stratum 8 seems to be a backdirt layer associated with a house pit locus lying southwest of the excavation grid. This is probably a chronologically older house pit (now exposed in wall cut along the W101 line [*between S49-50*]) that has shell midden associated with the main house locus [*in S43-45*] as garbage filled into it (Shaw's profile notes).	

Shaw identified one major component at 49-XHI-044, a large housepit and associated midden, which he dated to 2305-2260 RYBP. There is limited evidence of two other occupations in the excavation units as well; a possibly older, but undated housepit and an upper component with associated radiocarbon dates of 1480±105 RYBP and 1740±90 RYBP. These occupations had minimal physical overlap with the excavation units and are not well represented in the profile.

The possibly oldest (or at least stratigraphically lowest) housepit was associated with Stratum 8. In the lowest cultural levels in S47-51, the stratum sits on top of sterile sediments (5a-5b-5c-5d). Shaw described the stratum as backfill from another housepit, with a surface depression, located to the southwest of the excavation grid. A vertical cut at the S49.5 line marked the edge of the housepit. Shaw did not date this stratum.

The main occupation, which I term the lower component, consisted of one housepit cut and floor visible in the lower levels of the S43-44 wall and a several meters-long stretch of midden of mussel and dogwinkle shell and bone intermixed with sterile sediments visible in the S44-51 wall. Shaw noted that the earliest residents appear to have excavated the main housepit into sterile soils (5a-5b-5c-5d-4a-4b; evidenced by the vertical cut at the S44.5 line), which the residents then piled up at the edge of the housepit to increase the height of the wall (as Strata 4c-1 and 4c-2). Over time, the earliest residents tossed shell and bone midden downslope (marked as Stratum 7 and "midden"), where they had tossed the sterile soils (Strata 4c-1 and 4c-2). Over perhaps multiple episodes of cleaning/rebuilding the housepit and discarding trash, the materials ultimately eroded (or people moved them) downslope and they became intermixed (as Strata 7/4c-2/midden). At S47-51, what Shaw termed as thick "shell midden" and “dogwinkle” midden lenses accumulated (as opposed to the mixed sterile sediments and midden upslope). Lesser amounts of bone were present in the midden lenses as well. In the S49-51 units, where it is labeled “shell midden,” Shaw noted “pure cleaned crushed blue mussel and periwinkle almost exclusively where shell has no soil admixture” (though bone was present too).

Shaw dated Stratum 7/4c-2/midden in three locations, starting in Unit S45-46, just downslope of the housepit berm (2270±50 RYBP) and in Unit S47-48 (2305±70 RYBP), in the middle of the cultural midden. The final date came from the tail end of the midden, in the lowest levels associated with the main housepit, in Unit S50-51 (2260±90 RYBP). These dates are very close in age and do not have any noticeable issues with regard to depositional history, particularly because there is no obvious break in the main midden accumulation (i.e., no non-cultural sediment accumulation).

Shaw documented two faint humic lines; one that capped the upper reaches of Stratum 7 and another directly above that capped Stratum 6/4c-2 (in S45-48). He interpreted them as old ground surfaces, presumably when the housepit went through periods of abandonment. Shaw characterized Stratum 6 (and 6/4c-2) as “weakly cultural” from “non-intensive midden dispersal and surface vegetation accumulation.” Faunal remains were recovered from this stratum, mostly in the S48-51 units, at the break (mixing) between Strata 6 and 7. Shaw’s description of Stratum 6 suggests it was an A-horizon (with midden intermixed).

Stratum 3, visible in S41-44.5 units, appears to represent an occupational hiatus of the main housepit for several hundred years after the lower component occupations. According to Klingler, Stratum 3 was mostly sterile pit fill, with the exception of three flakes, recovered just below Stratum 2 that likely came from Stratum 2. In Shaw's profile notes, he described Stratum 2 as indication of "a temp[orary] camp in an existing housepit without [evidence of] recutting and rejuvenating the pit as a permanent structure." Shaw submitted two charcoal samples from Stratum 2 for radiocarbon dating, which returned dates of 1480±105 RYBP and 1740±90 RYBP. These dates suggest an occupation temporally distinct from the main housepit and an upper component for 49-XHI-044. The resulting dates, however, are problematic. The stratigraphically lower charcoal sample from Stratum 2 returned the most recent date of 1480±105 RYBP, while the shallower charcoal sample, in a distinct and upper sub-stratum, returned the older date of 1740±90 RYBP.

In summary, at 49-XHI-044, one lower component (2305-2260 RYBP) was highly visible in the excavation units; two occupations that were more ephemeral were minimally visible. The main excavation included one deep housepit and several meters of shell and bone midden. The ephemeral occupations included one wall cut and backdirt from a housepit that only minimally overlapped with the main 49-XHI-044 excavation. It is undated, but stratigraphically lower and potentially older than the lower component. The other ephemeral occupation appears to have been a temporary one, used several hundred years after the lower component. It has two associated radiocarbon dates of 1480±105RYBP and 1740±90 RYBP. The dates from this upper component are problematic in that the ages do not appear to match the depositional history. The lower component does not have obvious dating problems.

Radiocarbon Dating and Analytical Components

Shaw and crew provided a useful narrative in field and profile notes to help develop my interpretation of the depositional history of these two sites. Shaw's radiocarbon dates, for the most part, supported our combined assessments, which allowed me to group the strata into discrete cultural components. Most of his dates also fell within accepted Norton Stage age ranges (2500-1000 years ago), which supported the idea that the Summit Island occupations are affiliated with the Norton Tradition. With the exception of the lower component at 49-XHI-044, however, all of the components have dating problems, which needed to be resolved or excluded from further consideration before I could confidently establish the analytical components for faunal analysis. The presence of a suitable sample of identifiable faunal remains per stratum or component influenced my decision as to whether to pursue parsing out some of the dating issues.

At 49-XHI-043, all four of the dates from the lower component do not follow a chronological sequence or align with the interpreted depositional history, though they are close enough in age to justify creating a component that is distinct from the upper component. The lowest stratum, Stratum 6, had the most recent date for the component (2230±60 RYBP). The date from Stratum 5 is much too old for accepted Norton-age occupations (2820±70 RYBP), which raised questions about the validity of the date, especially given the fact that it should be younger than Stratum 6. The other two dates associated with Strata 4b and 9 (2480±70 RYBP and 2290±90 RYBP, respectively) are not problematic in themselves, but do not contribute to a better understanding of the age or development of the lower component given the problematic dates from Strata 5 and 6. The lower component, including Strata 4b, 5, 6, 8, and 9 contained thousands of associated faunal remains, a fact that supports re-dating the component. At first glance, Shaw's dates from this component suggest an early Norton (or pre-Norton?) occupation (2820-2230 RYBP).

In the upper component at 49-XHI-043, only one of five dates is out of sequence with the rest of the dates (1120±70 RYBP, 1205±70 RYBP, 1320±105 RYBP, 1370±60 RYBP, and 1375±100 RYBP). Stratum 4a, the lowest and presumably oldest strata in this component, had the youngest date (1120±70 RYBP). With the other dates, the most recent was located in the shallowest levels, and got older with each lower stratigraphic layer. I chose to re-date this component because of the high number of associated faunal remains and because of the one out-of-sequence date. The dates from this component suggest a late Norton occupation (1375-1120 RYBP).

At 49-XHI-044, the lower component has a set of three dates that do not have any noticeable inconsistencies (2260±90 RYBP, 2270±90 RYBP, and 2305±70 RYBP). They are close in age and came from one major midden zone (Strata 6/7/4c-1/4c-2/midden) interpreted to be from the intensive use of one housepit. Shaw's and my own assessment of stratigraphy suggests the midden and housepit can be combined to create a legitimate analytical component. There are numerous faunal remains from this component, which would significantly increase the sample size and benefit the faunal analysis. The dates from this component are suggestive of an early Norton occupation (2305-2260 RYBP).

There is an undated lower stratum (8), which hints at the possibility of an older component at 49-XHI-044. Determining the age of this stratum is not crucial to understanding the nature of the lower component because it is part of a separate housepit located to the southwest of the excavation units. There is minimal physical overlap between the two housepits according to Shaw's profile notes. The faunal sample recovered from this stratum is also quite small, with only one identifiable specimen present in the sample (out of 39 specimens total), and including it in my analysis will not substantially improve understanding the occupation of the main 49-XHI-044 housepit.

The upper component at 49-XHI-044 has two associated radiocarbon dates (1480±105 RYBP, 1740±90 RYBP), with the youngest date stratigraphically lower than the oldest date within Stratum 2. The dates are at least 400 radiocarbon years more recent than the lower component, which suggests that Stratum 2 should not be lumped in with the lower component. Based on the ephemeral nature of the occupations represented in Stratum 2, which Shaw interpreted as a temporary camp (and I agree), these dates hint at the possibility of a late Norton use of the site. Only nine identifiable faunal specimens (out of 18) were recovered from the stratum, which does not provide a lot in the way of quantitative analysis. I chose not to parse out the dating issues for this component. The presence of a temporary late Norton occupation(s) at 49-XHI-044, however, is worth noting. It is a settlement/subsistence strategy that differs from the intensive longer-term occupations evidenced in the lower and upper components at 49-XHI-043 and the lower component at 49-XHI-044. Future research into the changing nature of how and when Late Holocene peoples occupied Summit Island, including this upper component, is warranted.

Ultimately, I chose to date materials from the lower and upper components at 49-XHI-043 and the lower component at 49-XHI-044. I did not pursue dating Stratum 8 or the upper component (Stratum 2) at 49-XHI-044, due to the lack of a sizeable faunal sub-assemblage. I used caribou antler and bone specimens to avoid the marine reservoir effect and to obtain direct dates on the faunal remains I was studying (Nelson and Mohl 2003; Taylor and Bar-Yosef 2014). I avoided using the remaining charcoal samples (collected in the 1980s), because some of the issues with Shaw's dates may be the result of collection strategy.

The crew was cognizant of the "old wood problem" according to their fieldnotes. They avoided large diameter wood that could potentially make the component appear older if radiocarbon dated (Schiffer 1986; Taylor and Bar Yosef 2014). They also tried to collect "localized" samples from charcoal concentrations in features, but many times, they recovered samples from charcoal "scatters," which excavators described as "across the entire level" or from other dispersed areas. The crew focused on collecting large samples, several grams or more, which limited fine resolution or point specific dating.

This collection strategy was necessary, however, due to large sample size requirements for 1980s conventional radiocarbon dating. Collecting samples over a large area increases the chances of contamination from older or younger charcoal or the introduction of burned marine mammal bone fragments into the sample (which would also skew a date to appear much older than it is). Based on bag labels, all of the samples appear to have been processed in a laboratory and "fully collected by flotation," but I do not know if they sorted the processed samples to isolate small diameter wood like poplar or willow. A quick evaluation of the remaining charcoal samples, by paleoethnobotanist Jaime Kennedy, showed that they are unsorted (Kennedy, pers. comm., 2015).

For the 49-XHI-43 lower component, I submitted one caribou antler/bone sample per stratum for 4b, 5, 6, and 8. I did not date Stratum 9 because there were no associated caribou specimens or charcoal samples. The stratum has limited faunal remains, overall; I recovered three identifiable specimens, out of 37 total specimens. For the 49-XHI-043 upper component, I selected two features that had not been previously dated, one at the top of the component (Pit Fill 6c) and one at the bottom (Pit Fill 4/4a). Shaw's dates in this component are generally consistent in that the dates get older with depositionally older strata, with the exception of the 1120±70 RYBP date that is associated with the lowest stratum (4a). I did not have access to any caribou bone or charcoal samples from Stratum 4a, but I did not consider this a serious issue given that another date from this stratum, 1320±105 RYBP, complements the ages of the other strata. For the same reason, I did not think it was necessary to submit samples for any of the other previously dated strata, but I wanted to procure an early and late occupation date from the component and to check the validity of Shaw's dates.

While the dates from the 49-XHI-044 lower component seem reasonable (in that they are close in age and not out of chronological order), I opted to re-date the midden as a control for Shaw's dates. I also chose to date the midden because there have been advancements in radiocarbon dating over the last 30 years. In 2015, I was able to submit samples for accelerator mass spectrometry (AMS), a radiocarbon dating method that was not available in the 1980-1990s. AMS dating counts isotopes rather than measuring radioactive decay as with conventional dating, which allows for greater precision because the process does not take as long and can be replicated many more times (Taylor and Bar Yosef 2014). AMS requires much smaller samples, which many times, allowed me to focus on what strata I wanted to date, rather than if I had a sample large enough to date. Recent improvements in both conventional and AMS dating also typically result in a smaller standard error than dates obtained in the 1980-1990s (Taylor and Bar Yosef

2014). For the 49-XHI-044 lower component, I selected three caribou specimens from the upper, middle and lower portions of the midden (in S47-48, S48-49, and S50-51).

In 2015, I submitted nine caribou antler and bone samples for AMS dating to DirectAMS in Bothell, Washington (http://www.directams.net/index.html), in addition to the 17 wood charcoal samples Shaw submitted to the Washington State University, Radiocarbon Dating Laboratory, in Pullman (WSU) in 1986 and 1991. The 26 resulting radiocarbon dates from 49-XHI-043 and 49-XHI-044 are listed in Table 10. The table shows the lab and field numbers for each sample submitted for radiocarbon dating. It also lists the material dated and provenience of the sample. The dates are presented as uncalibrated (RYBP) and calibrated (cal B.P.) for 49-XHI-043 and 49-XHI-044, respectively. I used Calib 7.1 to derive calendar ages (cal B.P.) for all of the WSU and DirectAMS dates (Reimer et al. 2013). Calibrated date ranges are presented at one standard deviation (1-sigma), with median dates in parentheses.

Of the 26 radiocarbon dates listed in Table 10, I excluded five of them early in my analysis. Three of these, WSU-3448, WSU-4365, and WSU-4295, came from units that I did not use in my analysis (marked by a “c”). I excluded these dates because I could not tie them to the main site stratigraphy or the associated faunal remains lacked provenience. The other two dates (WSU-3444 and WSU-3449), marked by a “*”, came from the upper component at 49-XHI-044. As previously described, there were very few associated faunal remains, and correcting dating problems for this component was not crucial to my study.

Table 10. Radiocarbon Dates from 49-XHI-043 and 49-XHI-044

Lab#	Field Sample#	RYBP	cal B.P. (1σ)	Provenience	Material Dated
49-XHI-043					
D-AMS-014567[a]	UA85-87-414	1129±27	1060 (1030) 980	N40-41/W118-119, Feature Pit Fill 6C, 30-40 cmbd	Caribou phalange
WSU-2970[b]*	UA82-??-???	1120±70	1170 (1040) 960	N39-40/W119-119.7, Stratum 4A, ~90-105 cmbd, 1982 Test Unit, see Shaw (1986:5-6)	Wood charcoal, localized
WSU-3442	UA85-87-011	1205±70	1240 (1130) 1010	N40-41/ W119.75-121, Stratum 3, 41-43 cmbd	Wood charcoal, localized
WSU-3444	UA85-87-015	1320±105	1340 (1230) 1090	N40-41/ W119.75-121, Stratum 4A, 108-111 cmbd	Wood charcoal, localized
WSU-3438	UA85-87-002	1375±100	1380 (1290) 1180	N39-40/ W117-118.65, Feature Pit Fill 6A, Level 8	Wood charcoal, localized
WSU-3443	UA85-87-014	1370±60	1390 (1290) 1190	N40-41/ W119.75-121, Feature Pit Fill 3A, 70-73 cmbd	Wood charcoal, scatter
D-AMS-014566*	UA85-87-316	1996±27	1990 (1950) 1900	N39-40/W117-118.65, Feature Pit Fill 4A/4, 105-112 cmbd	Caribou antler, cut
WSU-2975*	UA82-??-???	2230±60	2330 (2230) 2160	N39-40/W119-119.7, Stratum 6, ~130-135 cmbd, 1982 Test Unit, see Shaw (1986:5-6)	Wood charcoal, localized
WSU-3440*	UA85-87-009	2290±90	2420 (2300) 2150	N39-40/ W120-122, Stratum 9, Level Plan 7, from dark layer under tan black layer, collected across entire level	Wood charcoal, scatter
WSU-4365[c]	UA85-87-016	2335±80	2700 (2380) 2180	N42-44/ W117-118	Wood charcoal, localized
D-AMS-014570	UA85-87-632	2437±29	2680 (2480) 2380	N39.3-40/ W119.8-120, Stratum 6, 109-116 cmbd in olive layered black variegated layer	Caribou antler, cut
WSU-3441	UA85-87-010	2480±70	2720 (2560) 2470	N39-40/ W120-122, Stratum 4B, 104-107 cmbd	Wood charcoal, localized
D-AMS-014569	UA85-87-609	2498±32	2720 (2590) 2500	N39.3-40/ W119.8-120, Stratum 4B, 89-100 cmbd, in shell/bone layer	Caribou metatarsal
D-AMS-014571	UA85-87-726	2532±28	2740 (2620) 2540	N39-40/ W120-122, Stratum 8, 100-110 cmbd, Strata 8, house pit fill	Caribou metatarsal, refit, n=2
D-AMS-014568	UA85-87-501	2538±30	2740 (2630) 2540	N40-41/W118-119, Stratum 5, 110-120 cmbd, ochre level	Caribou metatarsal, cut
WSU-3439*	UA85-87-005	2820±70	3060 (2940) 2850	N40-41/ W118-119, Stratum 5, Level 11	Wood charcoal, localized
49-XHI-044					
WSU-3448[c]	UA85-88-010	1000±100	1050 (910) 790	S39-41/W100-101	Wood charcoal
WSU-3449*	UA85-88-015	1480±105	1520 (1400) 1300	S42-43/W100-102, Stratum 2b, 33-39 cmbd	Wood charcoal, scatter

Table 10. (continued)

Lab#	Lab#	Lab#	Lab#	Lab#	Lab#
WSU-3445*	UA85-88-003	1740±90	1780 (1660) 1550	S41-42/ W102-104, Stratum 2c, 90-96 cmbd	Wood charcoal, scatter
D-AMS-014574	UA85-88-983	2080±32	2110 (2050) 2000	S50-51/ W101-102, Stratum 4c-2/midden, 40-60 cmbd shell/midden lens	Caribou antler, cut and shaped
D-AMS-014572	UA85-88-280	2102±29	2130 (2070) 2010	S46-48/ W101-102, Stratum 4c-2/7, 69 cmbd dark brown soil with shell and bone under mussel shell lens #1	Caribou antler, worked
WSU-3447	UA85-88-006	2270±50	2350 (2250) 2160	S45-46/W101-102, Stratum 4c-2/midden, 41-43 cmbd	Wood charcoal, localized
WSU-4294	UA85-88-012	2260±90	2350 (2250) 2150	S50-51/W101-102, Stratum 4c-2/midden, 48 cmbd	Wood charcoal, localized
WSU-3446	UA85-88-004	2305±70	2400 (2320) 2160	S46-48/W101-102, Stratum 7, 62-69 cmbd	Wood charcoal, scatter
WSU-4295[c]	UA85-88-019	2700±130	3000 (2830) 2550	S33-34/W99-100, 75-83 cmbd	Wood charcoal
D-AMS-014573*	UA85-88-462	2789±25	2930 (2890) 2850	S48-49/ W100-101, Stratum 4c-2/midden, 40-50 cmbd, brown mottled soil w/ shell	Caribou phalange

[a] DirectAMS dates were obtained in 2015.

[b] Shaw obtained the WSU dates in 1986 and 1991.

[c] Dates associated with excavation units that I did not include in my analysis. I did not validate the veracity of these dates.

*Dates that I excluded from analysis, despite being from excavation units I used in my analysis. My reasons are discussed in the text.

I evaluated the remaining 21 radiocarbon dates associated with the lower and upper component at 49-XHI-043 and the lower component at 49-XHI-044. Of these, I had to exclude six dates (D-AMS-014566, D-AMS-014573, WSU-2970, WSU-2975, WSU-3439, WSU-3440), because they were discordant with the rest of the component dates. I was able to confirm 15 radiocarbon dates, which I then used to develop the Summit Island analytical components. These dates ranged in age from 2740 to 980 cal B.P. and support the validity of three major analytical components including a lower and upper component at 49-XHI-043 and a lower component at 49-XHI-044. Seven of the DirectAMS dates and eight of Shaw's dates frame the age ranges of these components, which fall mostly within the Norton Stage (2500-1000 years ago). As described in Chapter III, I labeled the Summit Island components to reflect my belief that the materials are Norton-affiliated.

To facilitate comparison with Norton Stage sites, I have labeled each component as they relate to the timing of the Norton era. The lower component at 49-XHI-043 is Early Norton I (2740-2380 cal B.P.), the lower component at 49-XHI-044 is Early Norton II (2400-2000 cal B.P.), and the upper component at 49-XHI-043 is Late Norton (1390-980 cal B.P.). I do not consider the analytical components to be cultural "phases" because it is likely that further research into other parts of the sites would show extended occupations of the island. Such designations should only be made after a meaningful analysis of material culture. Figure 18 illustrates the temporal relationship between the Summit Island analytical components. The solid boxes represent Early Norton I, Early Norton II, and Late Norton, which I developed from the 15 verified radiocarbon dates. I also included dashed boxes to show the potential age ranges of the five unverified dates, which came from strata or units in the site that I did not analyze for the dissertation. The six (out of the 21) dates that I excluded were not used in this figure. Figures 19, 20, and 21 show the general provenience of the 21 caribou and wood charcoal samples that are associated with the excavation units I that used in my analysis. I included the six discarded dates in the figures to facilitate the following discussion on how I developed my analytical units.

Early Norton I (2740-2380 cal B.P.)

When calibrated to 1-sigma, five out of the eight dates associated with the lower component present a tightly grouped age bracket for Early Norton I. These include:

- 2680-2380 cal B.P. (2437±29 RYBP, D-AMS-014570) from Stratum 6;
- 2740-2540 cal B.P. (2538±30 RYBP, D-AMS-014568) from Stratum 5;
- 2740-2500 cal B.P. (2498±32 RYBP, D-AMS-014569) and 2720-2470 cal B.P. (2480±70 RYBP, WSU-3441) from Stratum 4b;
- 2740-2540 cal B.P. (2532±28 RYBP, D-AMS-14571) from Stratum 8.

These dates suggest that the lower component developed within a discrete span of time and reflects intensive use between 2740 and 2380 cal B.P. Because there is so much overlap in date ranges between the strata, it is not possible to document change through time in the lower component. The dates confirm that Early Norton I is a valid analytical component. The tight cluster of several dates makes clear that Shaw’s very early date from Stratum 5, 2820±70 RYBP (3060-2850 cal B.P., WSU-3439), is an outlier and should be excluded from Early Norton I.

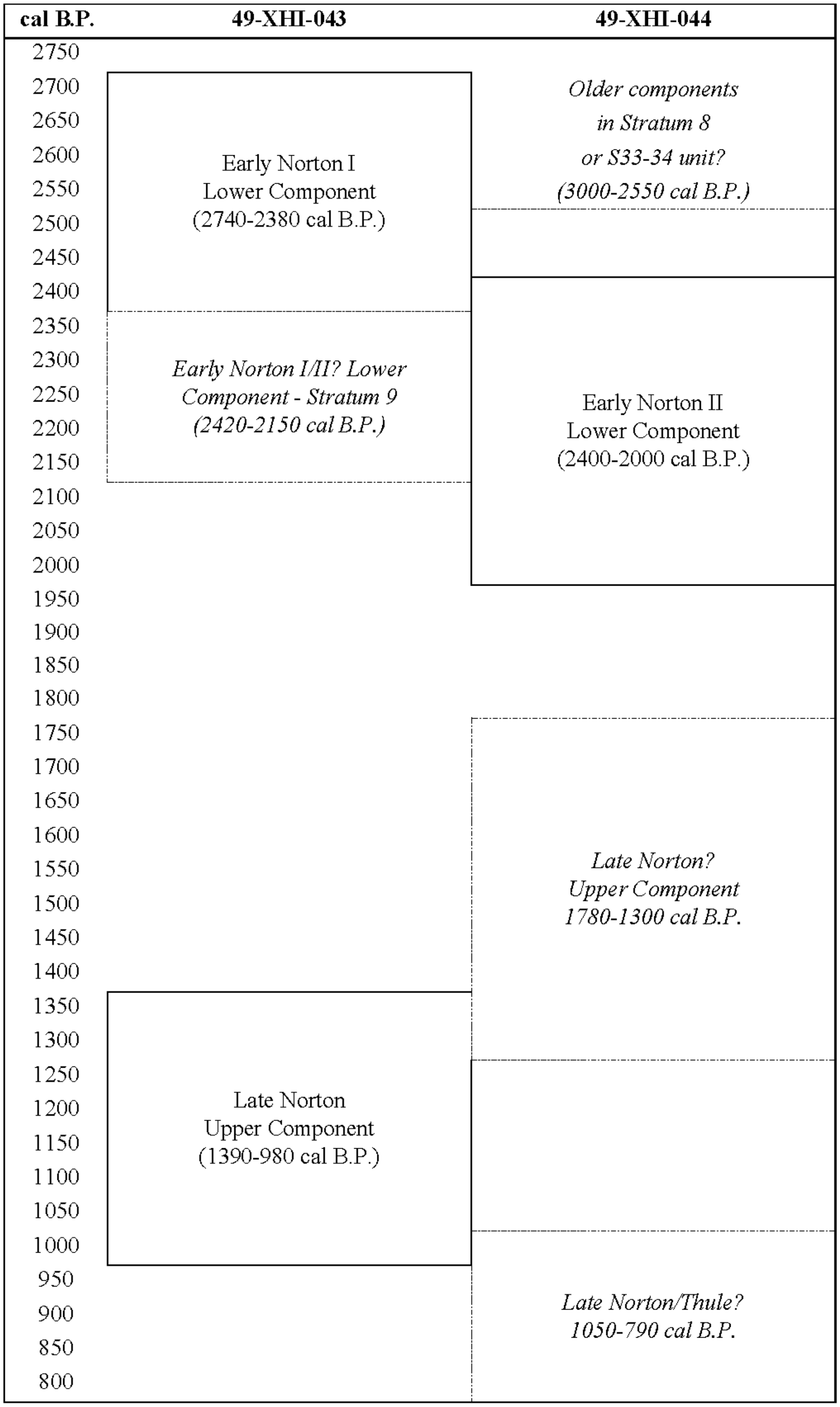

Figure 18. Age range of Summit Island analytical components based on verified (solid boxes), and unverified (dashed lines) radiocarbon dates.

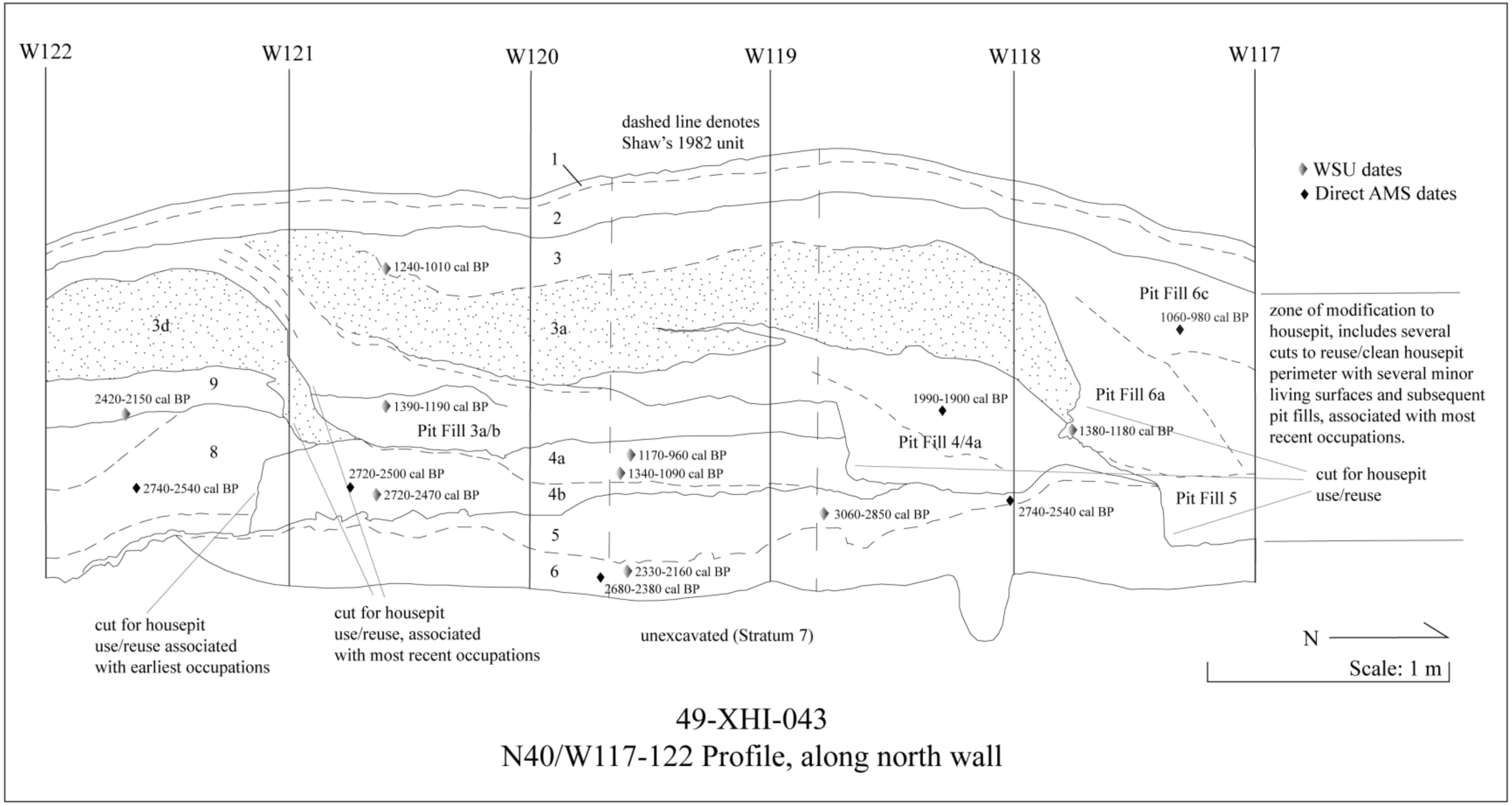

Figure 19. General provenience of radiocarbon-dated samples at 49-XHI-043. Includes Shaw and DirectAMS dates. Note that dates are calibrated to 1-sigma (cal B.P.).

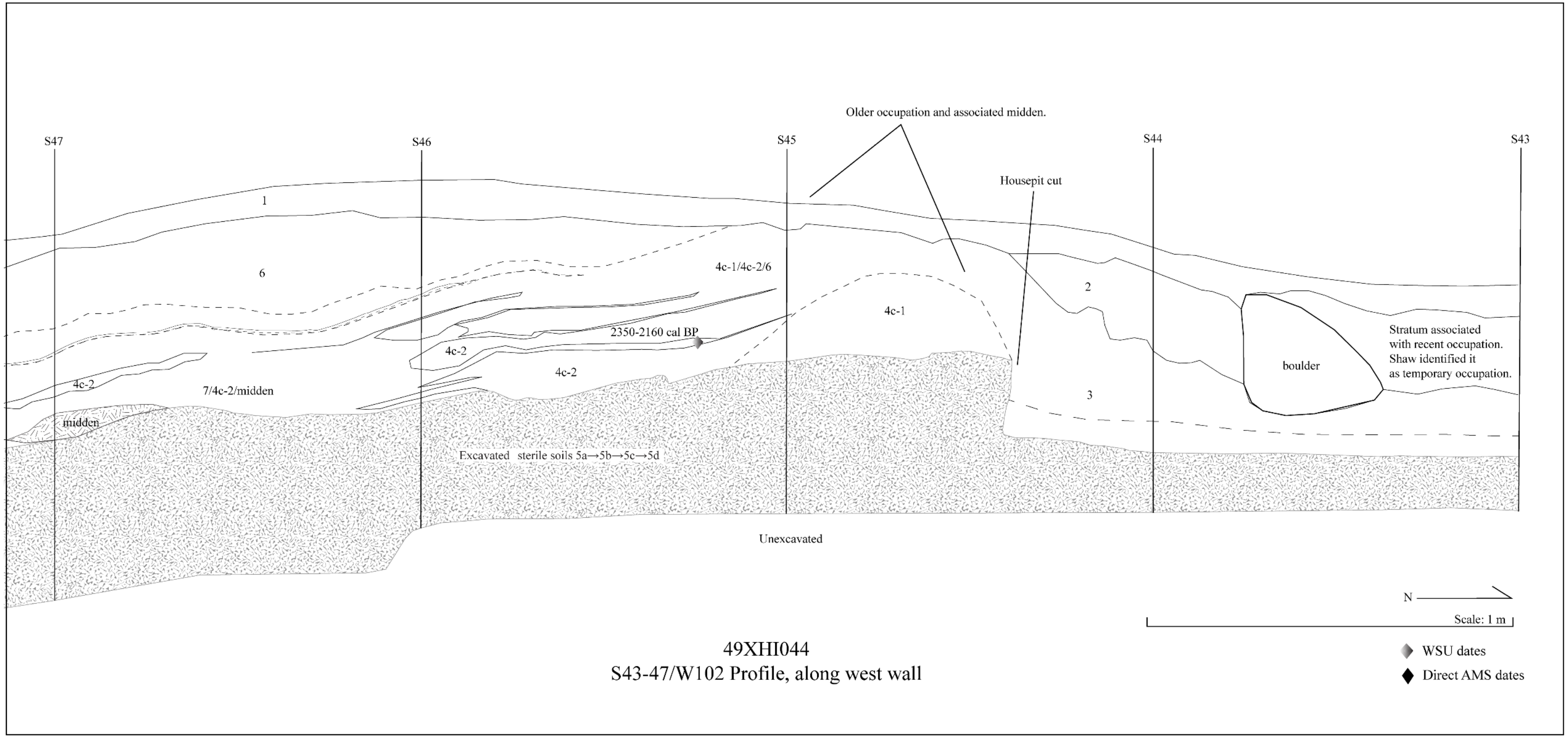

Figure 20. General provenience of radiocarbon-dated samples in S43-47 units at 49-XHI-044. Includes Shaw and DirectAMS dates. Note that dates are calibrated to 1-sigma (cal B.P.).

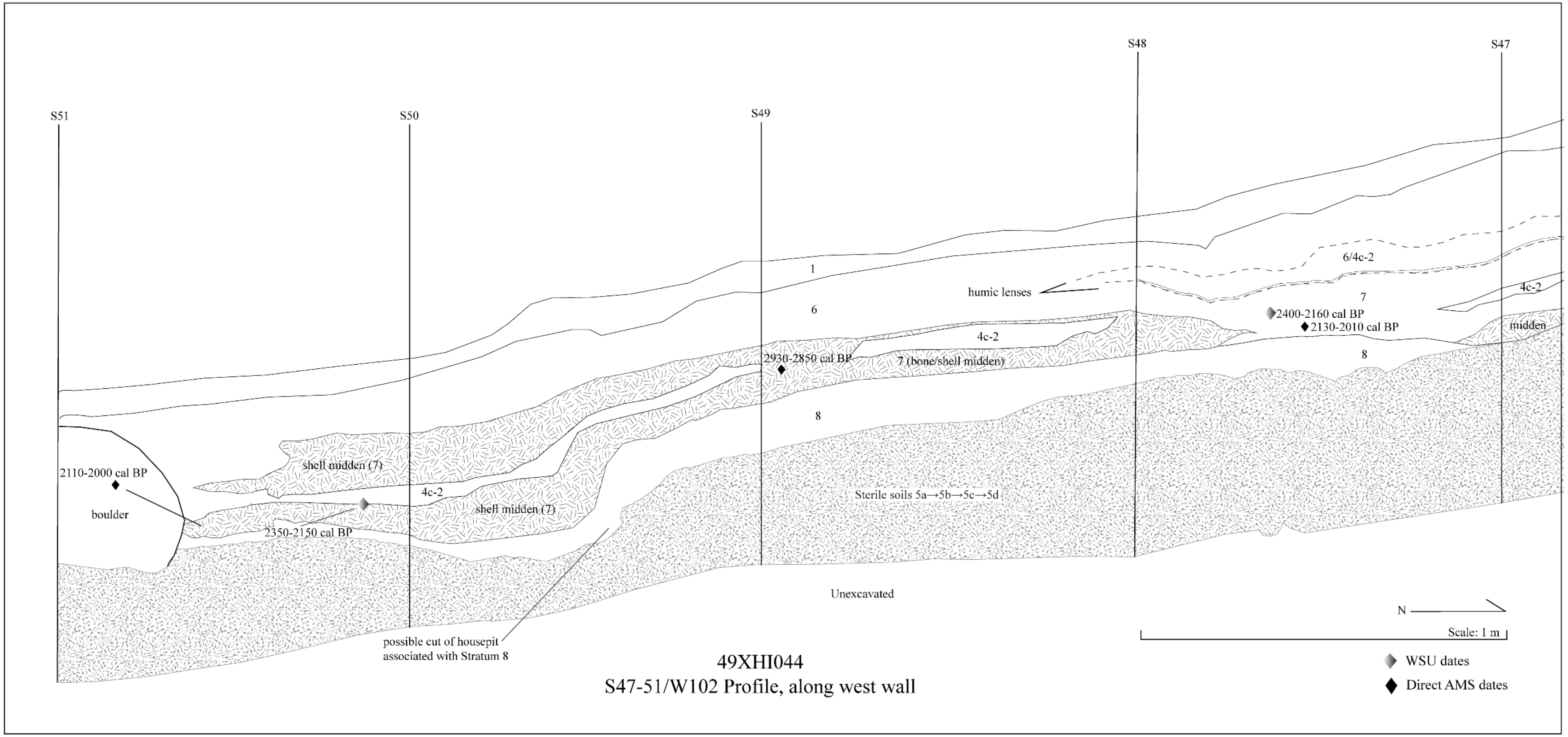

Figure 21. General provenience of radiocarbon-dated samples in S47-51 units at 49-XHI-044. Includes Shaw and DirectAMS dates. Note that dates are calibrated to 1-sigma (cal B.P.).

Shaw’s very recent date from the lowest cultural stratum (6), 2230±60 RYBP (2330-2160 cal B.P., WSU-2975), is also too young and should be omitted.

Early Norton I/II (2420-2150 cal B.P.)

The eighth date associated with the lower component, 2290±90 RYBP (WSU-3440) from Stratum 9, overlapped with Early Norton I by 40 years (2420-2150 cal B.P.). Stratum 9 is a stratigraphically later stratum, so the more recent age in relation to the rest of the strata in the lower component is plausible. Despite the overlap in age, I chose not to include Stratum 9 in Early Norton I. This one date has the potential to double the age range of Early Norton I, but I was unable to confirm the date’s validity by procuring another date for the stratum (no caribou or charcoal to date). Stratum 9 has only three associated identifiable faunal specimens (out of 37 faunal specimens), while the majority of the lower component faunal specimens (99%, n=3,849) come from the Strata 4b, 5, 6, and 8. Including Stratum 9 in Early Norton I masks the substantial concentration of faunal remains from the strata dated to 2740-2380 cal B.P. and creates a potentially false impression of the length of occupation in Early Norton I. Instead, I tentatively labeled it Early Norton I/II to make note that it exists, but did not factor any Stratum 9 specimens into my faunal analysis. This date for the purposes of this dissertation is unverified, and requires consideration in future research.

Early Norton II (2400-2000 cal B.P.)

Early Norton II (2400-2000 cal B.P.) overlapped in age with Early Norton I (2740-2380 cal B.P.) by approximately 20 years. When calibrated to 1-sigma, all of

Shaw's dates from the 49-XHI-044 midden are very similar: 2400-2160 cal B.P. (2305±70 RYBP, WSU-3446), 2350-2160 cal B.P. (2270±50 RYBP, WSU-3447), 2350-2150 cal B.P. (2260±90 RYBP, WSU-4294). Two of the DirectAMS dates are close in age to each other and to the most recent end of Shaw's date ranges, but there is no overlap between the two sets of radiocarbon dates: 2130-2010 cal B.P. (2102±29 RYBP, D-AMS-14572), 2110-2000 cal B.P. (2080±32 RYBP, D-AMS-014574). I purposely selected caribou specimens from two of the same units and similar depths and strata that Shaw dated (in S47-48 and S50-51) in an attempt to replicate Shaw's dates. Both sets of dates, 2400-2150 cal B.P. (Shaw) and 2130-2000 cal B.P. (DirectAMS), have internal consistency and are very close in age, which makes it impossible to throw out any of the dates. As such, I chose to keep all of them and consider Early Norton II a valid construct, but I recognize that more dating is needed in future research.

I excluded a sixth date, taken from the S48-49 unit, which was significantly older and out of place with the other five dates. This DirectAMS date, 2789±25 RYBP (2930-2850 cal B.P., D-AMS-014573), is at least 450 calendar years older than the other dates, despite being recovered from the same midden. It is possible that the sample was contaminated during the AMS analysis or it could not be fully cleaned of environmental contaminants (such as marine mammal oil). Another possibility is that the sample actually came from a different and older stratum. The midden stratum where the sample is supposed to be from (S48049/W100-101, Stratum 4c-2/midden, 40-50 cmbd, brown mottled soil with shell) laid directly above Stratum 8, which is undated, but a potentially older occupation than Early Norton II. This could be my error or attributable to one of the excavators. A third scenario is that I misidentified the sample as a caribou phalanx. Given

Figure 22, I consider this unlikely. In future research, this old date should be considered when analyzing materials recovered from Stratum 8. If Stratum 8 has a similar age, it is possible that this date is valid, with an incorrectly recorded provenience.

Figure 22. Caribou phalanx from 49-XHI-044 midden, with an anomalous radiocarbon date of 2789±25 RYBP (2930-2850 cal B.P., D-AMS-014573).

Other Pre/Early Norton I/II Components

There are two dates from Shaw's suite of 17 radiocarbon samples that I did not include in my analysis, though they overlapped with the Early Norton I/II age ranges. I did not attempt to verify them because I could not link the units they came from to the main site stratigraphy. The first date, 2335±80 RYBP (2700-2180 cal B.P., WSU-4365), was collected from the N42-44/W117-118 unit at 49-XHI-043. A slightly older radiocarbon date, 2700±130 RYBP (3000-2550 cal B.P., WSU-4295) came from S33-

34/W99-100 at 49-XHI-044. I have previously noted the possibility of an occupation at 49-XHI-044 that could be older than Early Norton II, associated with Stratum 8. For now, these dates are unverifiable and the possibility of occupations earlier than Early Norton I require more research.

Late Norton (1390-980 cal B.P.)

Late Norton is derived from five radiocarbon dates from the upper component at 49-XHI-043 that generally align with my interpretation of the depositional history. When the dates are calibrated to 1-sigma, there is significant overlap in the ages of three of the four lowest strata: Pit Fill 3/3a dated to 1390-1190 cal B.P. (1370±60 RYBP, WSU-3443), Pit Fill 6a dated to 1380-1180 cal B.P. (1375±100 RYBP, WSU-3438), and Stratum 4a dated to 1340-1090 cal B.P. (1320±105 RYBP, WSU-3444). Two of the upper strata including Strata 3 and Pit Fill 6a dated to 1240-1010 cal B.P. (1205±70 RYBP, WSU-2970), and 1060-980 cal B.P. (1129±27 RYBP, D-AMS-014567), respectively. Late Norton is the only analytical component that shows some definitive change in age intra-component. Unfortunately, I was unable to track any changes within the faunal assemblage due to mixing between the various Late Norton strata during excavation.

I excluded two other radiocarbon dates from the Late Norton component. The first is 1120±70 RYBP (1170-960 cal B.P., WSU-3442), which came from Stratum 4a, the lowest stratum in the component. While this date overlapped in age with the others from Late Norton, it was too young to be from the lowest component. It does not align with the other dates from Pit Fill 3/3a, Stratum 4a, and Pit Fill 6a. I also omitted the DirectAMS date from Pit Fill 4/4a. This date came back at least 500 calendar years older than the other Late Norton dates at 1990-1900 cal B.P. (1996±27 RYBP, D-AMS-014566).

Earlier in the chapter, I postulated that Pit Fill 4/4a could have been a mixture of upper and lower component sediments. If this were the case, the DirectAMS date of 1990-1900 cal B.P. should have resulted in a date at least 500 years older or younger than it is, mirroring the lower component dates of 2740-2380 cal B.P. or those in the upper component of 1390-980 cal B.P. There are a few possibilities as to why this date came back too young for Early Norton, but too old to Late Norton. It could have been contaminated during the lab prep for AMS dating, or it was too degraded for AMS dating (not enough carbon present for counting). The sample weighed 42.1 g and was dense, which I took as a good sign that it was a viable sample for AMS dating. It is also possible that I misidentified the sample as cut caribou antler, when it may be marine mammal bone. Again, I find this unlikely since I noted trabecular bone common in antler and the specimen retained part of the coronet/burr, the growth where the antler meets the skull. Based on the dates of the surrounding strata, it is unlikely that this date is correct. There is a small possibility that Pit Fill 5 (which is undated) or an unknown stratum/feature/living surface within the confines of the housepit (and not part of the excavation) dated to 1990-1900 cal B.P. and Pit Fill 4/4a is the related toss zone. In future research related to better understanding the Summit Island chronology, this avenue should be explored. For my study, I rejected the date, and considered Pit Fill 4/4a to be part of the Late Norton component.

Other Late Norton/Early Thule Components

There are two unverified radiocarbon dates from Shaw's suite of 17 samples, which overlapped in age with the Late Norton component that I did not include in my analysis, 1480±105 RYBP (1520-1300 cal B.P., WSU-3449) and 1740±90 RYBP (1780-1550 cal B.P., WSU-3445). These dates came from Stratum 2, which Shaw identified as a temporary occupation of 49-XHI-44. The excavation of this stratum resulted in a very small faunal assemblage (n=18), with only nine identifiable specimens. I ultimately omitted the dates because the oldest date came from a higher substratum, and I did not think it would substantially benefit my analysis to re-date a stratum with such a small faunal sub-assemblage.

A third date 1000±100 RYBP (1050-790 cal B.P., WSU-3448), hinting at a late Norton or possibly early Thule age occupation was collected from the S39-41/W100-101 unit at 49-XHI-044. I did not include this date in my analysis, because it came from a unit that I did not link to the main site stratigraphy. The potential of another late Norton or early Thule component on Summit Island, however, is worth exploring in future research.

Summary of Radiocarbon Dating of Summit Island Sites

We know that in much of Alaska, especially in the Arctic, which encompasses the ancestral homelands of the Yupik, Alutiiq, Aleut, and Inupiat, it is important to excavate houses sufficiently to establish their horizontal extent if we want to define meaningful occupational units. People in this part of the world often dug into the earth to build their houses and deposited cultural materials both inside and outside the house. Unfortunately, Shaw did not fully excavate any houses, so we don't fully understand the stratigraphy at the Summit Island sites he tested. I spent a great deal of effort trying to sort out the stratigraphy, but must rely on clusters of radiocarbon dates to set forth some cultural components. It may be better to think of these as imprecisely dated, as opposed to single houses that were occupied for centuries. Nonetheless, the material record of these people is very rich and the faunal remains can shed a lot of light on how people lived and supported themselves. So while I recognize that the components are not dated precisely, I believe we can still examine change through time and investigate what animals people were relying upon for subsistence during the Norton Stage.

Ultimately, I was able to develop three analytical components that are relevant to my dissertation research. Each has a suite of valid radiocarbon dates, which provide evidence of discrete temporal units, and they are associated with sub-assemblages of numerous faunal specimens. The analytical components are Early Norton I (2740-2380 cal B.P.), Early Norton II (2400-2000 cal B.P.), and Late Norton (1390-980 cal B.P.). There is unverified evidence of other early/pre-Norton age occupations (pre-2740 cal B.P.), as well as late Norton/early Thule-age occupations (1780-1300 cal B.P. and 1050-790 cal B.P.), including radiocarbon dates from unevaluated units, features, and strata. I did not include the unverified Summit Island radiocarbon dates because the associated units lacked useful faunal sub-assemblages or I could not link them to the main stratigraphy. The potential of other occupations should be considered during future research into the cultural chronology of Summit Island. These unverified dates suggest that people occupied Summit Island more intensively and for longer spans of time than I can confidently demonstrate in this study.

CHAPTER V

THE FAUNAL ANALYSIS: METHODS AND RESULTS

Summit Island Faunal Assemblage: Background and Units of Analysis

In 2012, I gained access to the 1985 Summit Island faunal assemblage by way of the Alaska Office of History and Archaeology (AOHA) and the University of Alaska's Museum of the North (UAMN). The entire 1985 Summit Island Collection, bones, stones, pottery, wood, miscellaneous samples, and excavation documentation from 49-XHI-043 and 49-XHI-044, has changed hands and locations many times before AOHA archaeologists shipped it to UAMN for curation in 2011. In 2012 and 2013, the UAMN staff shipped 30 banker and oversized boxes to the University of Oregon Museum of Natural and Cultural History for my use.

The collection has an interesting history. Over the past 30 years, multiple people have moved it to varying locations, and as a result, the integrity of the collection has suffered. Parts of the collection are missing including the majority of excavation photographs and negatives, some field notes, part of the artifact inventory, other forms of miscellaneous documentation, several faunal lots, and artifacts. There are reported instances of the theft of several bone toggling harpoon heads and artistic pieces including the carved ivory face depicted in Figure 12 (Shaw, pers. comm., 2013).

The condition of the collection presented many hurdles to establishing site stratigraphy and understanding the provenience of artifacts and faunal lots. What documentation is present, however, shows evidence of a careful and methodical excavation, with detailed unit profiles, level plans, and field notes. The majority of the extant assemblage has good archaeological context and holds research value to elucidate Late Holocene subsistence practices on Summit Island, despite its incompleteness.

Selecting Samples for Faunal Analysis

To select samples, I chose faunal lots that could be tied to specific 1 m x 1 m excavation units and the strata that I used to develop the Early Norton I, Early Norton II, and Late Norton analytical units. This resulted in 131 analyzable faunal lots with worked and unworked specimens some of which the excavators identified as tools or preforms. Table 11 lists all of the excavation units, the number of selected faunal lots per unit, my reasoning for excluding some units with faunal remains, and general notes. Some of the explanations are obvious, such as no faunal remains were present in a given unit, but were also excluded due to imprecise excavation methods that resulted in limited provenience or my inability to link some faunal remains to the main stratigraphy.

Table 11. Faunal Lot Provenience and Count of Selected Samples

Unit	Lots	Notes
49-XHI-043		
N38-39/ W111-118		Uncontrolled trowelling of sloughing south bluff edge, minimal provenience and selective collection, removed from faunal analysis.
N38.5-39/ W112-117		Excavated as 0.5 m x 5 m trench, limited provenience, removed from faunal analysis
N39-40/ W109-112		Some sloughing, limited provenience, removed from faunal analysis
N39-40/ W117-118.65	11	
N39-40/ W118.7-119.7		Unit south of Shaw's 1982 1x1 m excavation unit, top portions sloughed and no provenience, lowest levels excavated, no faunal remains recovered from the controlled excavation

Table 11. (continued)

Unit	Lots	Notes
N39-3-40/ W119.8-120	5	Controlled excavation of sloughing edge, good provenience
N39-40/ W120-122	21	Stratum 9 faunal remains removed from analysis, n=37. See Chapter IV.
N40-41/ W118-119	13	East of Shaw's 1982 1x1 m unit
N40-41/ W119.8-121	24	West of Shaw's 1982 1x1 m unit
N42-44/ W117-118		Stratum unidentified, removed from faunal analysis
N44-46/ W118-119		Stratum unidentified, removed from faunal analysis
49-XHI-044		
S32-33/ W100-102		No faunal remains
S33-34/ W99-100		No faunal remains
S39-41/ W100-101		No faunal remains
S41-42/ W98-100		No faunal remains
S41-42/ W102-104	2	
S42-43/ W96-98		No faunal remains
S42-43/ W100-102		Stratum 2 unidentified for upper component, which has minimal faunal remains (n=7).
S43-45/ W101-102		No faunal remains
S45-46/ W101-102	5	
S46-48/ W101-102	16	
S48-49/ W100-102	9	
S48-49/ W102-103	3	
S49-50/ W101-102	15	
S50-51/ W101-102	7	
Total	**131**	

For 49-XHI-043, I excluded the faunal samples from several units located on the south margin of the site because I could not tie them to specific strata (N38-39/W111-118 and N39-40/W109-112). The 1985 crew placed these southern units along the eroding, slumping bluff with the intent to expose the southern profile and recover diagnostic artifacts. The crew focused mostly on documenting artifact provenience, and as such, faunal remains from these units do not have consistently recorded provenience. I excluded two 1 m x 2 m units at the north end of the site (N42-44/W117-118 and N44-

46/W118-119) because I could not link the strata in these units to Shaw's main site stratigraphy and they were associated with a very small sub-assemblage of faunal remains. The three identifiable faunal specimens from Stratum 9 were not included because of the dating problems I explained in Chapter IV.

For 49-XHI-044, most of the excluded units did not contain faunal remains. I also excluded the nine identifiable faunal remains associated with the upper component related to Stratum 2 (S42-43/W100-102) and the one identifiable faunal specimen from Stratum 8 (S47-51/W101-103), due to the dating problems discussed in Chapter IV. Overall, the stratigraphy of 49-XHI-044 is more straightforward when compared to that of 49-XHI-043. At both sites, faunal remains are numerous in units excavated in midden areas along the margins of housepits or in midden fill re-deposited into older housepits (during later construction of more recent living surfaces).

Processing Summit Island Faunal Remains

I processed the Summit Island faunal remains with the assistance of Chelsea Buell, a recent University of Oregon (UO) graduate with considerable experience in faunal analysis. Former UO Anthropology undergraduate students Hannah Parrot and Jon Krier also assisted for a short duration. All identification work took place in labs located in the UO Department of Anthropology, Condon Hall.

Upon visual inspection, I noted that most of the bone specimens had been rinsed at least once, but needed further cleaning. We wet-sorted all samples through 1/2 in., 1/4 in., 1/8 in., and 1/16 in. mesh nested sieves. We used soft bristle toothbrushes and tap water to clean all materials resting on the 1/2 in. through 1/8 in. mesh screens. The materials in the 1/16 in. mesh were thoroughly rinsed, but not brushed. After washing, we placed all materials on trays to completely dry. Once dry, we sorted the specimens into the following animal classes: bird, fish, mammal, shell, and unidentifiable. No identifiable specimens were present in the 1/16 in. materials; however, we did recover some bone needle fragments.

The results of the wet screening and initial sort into animal classes indicated that the site was most likely excavated with 1/4 in. mesh screens. Small amounts of materials ended up in the 1/8 in. and 1/16 in. mesh sieves, but most of this was heavily fragmented pieces from larger specimens or bone and shell dust. This fragmentation likely occurred once the faunal lots had been bagged and subsequently moved to various locales over the 30 years since the excavations. Later readings of the field notes confirmed that most, if not all, of the excavators used 1/4 in. mesh during screening, but differentially recovered different kinds of animal specimens present at the site. This differential recovery is most notable with the fish and shellfish remains.

Fish and Shellfish in the Summit Island Faunal Assemblage

Although fish and shellfish specimens are present in several of the faunal lots from both sites, I chose not to include them in my analysis. I initially sorted and identified a large portion of the fish and shellfish, assuming that I could make meaningful interpretations despite the obvious differential recovery. From prolonged reading of the field notes and a consideration of the species that inhabit the waters around Summit Island, I concluded that small species of fish and shellfish as well as small parts of the taxa are too severely underrepresented to provide meaningful interpretations of subsistence practices related to these animal classes (James 1997; Partlow 2006; Shaffer et al. 1994; Zohar and Belmaker 2005). A prime example of this is the difference in abundance between *Nucella* (dogwinkle) and *Mytilus* (mussel) present in the Summit Island faunal assemblage.

The majority of recovered dogwinkle specimens, which I collected from 1/2 in. and 1/4 in. meshes during wet screening, are whole or nearly whole. Nearly all of these specimens could be counted as one individual. During wet screening, I recovered a very small amount of highly fragmented mussel, mostly from the 1/8 in. and 1/16 in. mesh sieves. I recovered some in the 1/4 in. mesh sieve too, but in smaller amounts. Very few of the fragments are mussel hinges that can be used to calculate the minimum number of individuals (MNI). The field notes made it apparent that the site contained enormous amounts of mussel shell and the crew believed it was the dominant shellfish present in the excavation units. Many of the midden matrices were described as mussel shell layers and according to various crewmembers' fieldnotes, there were several mussel lenses and features interspersed throughout the cultural strata.

Dogwinkle was also noted, but seem to have occurred less frequently based on the description of the shell midden and lenses in fieldnotes. Table 12 shows that dogwinkle recovered in the processed faunal samples vastly outnumbered mussel, which is a direct result of using 1/4 in. mesh during excavation and not collecting bulk or column midden samples.

Table 12. Shellfish Abundance (MNI) by Site

Site	Taxon	Common Name	MNI	Weight (g)
49-XHI-043	Mytilus	mussel	16	38.3
	Nucella	dogwinkle	731	2138.6
49-XHI-044	Mytilus	mussel	29	3.3
	Nucella	dogwinkle	820	2413.9

It is unfortunate that shellfish are not better represented in the 49-XHI-043 and 49-XHI-044 faunal lots. The ethnographic record on Yup'ik subsistence does not yield much information on these taxa, and we know little about their cultural use or significance. Shellfish, mostly mussels and clams, factor into some Yup'ik oral traditions, which provides some insight into their social and dietary roles (Fienup-Riordan 2005, 2007). Yup'ik elders have described shellfish in ways that characterize them as last resort foods, when people were starving and other resources were unavailable (Fienup-Riordan 2005:263). Turning to shellfish in times of great need, however, suggests that shellfish may have been a reliable food resource, as opposed to other more desirable animals, such as marine mammals.

Numerous archaeological studies on the Pacific Northwest Coast, southeast Alaska, Gulf of Alaska, Bristol Bay, and Aleutian Islands indicate that shellfish, mostly mussel, provided substantial dietary benefits to generations of humans despite how they were perceived socially (Broughton 2004; Clark 1970; Knecht and Davis 2005; Kowta 1963; Laughlin 1962; Losey and Power 2005; Moss 1989, 1993, 2004a, 2007b; Oswalt 1952a, 1952b, 1955, 1967, 1976; Workman et al. 1980). Moss (1993) has noted that Holocene-age shellfish middens are dense and prolific on the Pacific Northwest Coast, but their importance seems to be overwhelmingly undervalued in the ethnographic record. Gathering shellfish was associated with lower status people, women, children, and the elderly. Historically, male informants belittled the value of shellfish and androcentric researchers uncritically relied on this biased perspective to describe subsistence practices.

Losey and Power (2005) noted an abundance of dogwinkle shells in archaeological components at the Par-Tee Site near Seaside, Oregon, which they attributed to intentional collection by site residents, between 1800 and 1050 cal B.P. Due to the high proportion of large and whole dogwinkles recovered from the site (50% MNI of the shellfish assemblage and 14% of total shellfish weight), the authors ruled out many of the natural processes that can introduce shellfish into a cultural midden discussed by Bobrowsky (1984), Erlandson and Moss (2001), Moss (2004a), and Moss and Erlandson (2002). Because most of the dogwinkle specimens were whole (rather than fragmentary) and over 3 cm in size, the researchers believed that it was unlikely that gulls or other animals were ingesting the dogwinkles and depositing them into the midden. Losey and Power (2005) also rejected the idea that the dogwinkles were introduced into the midden as “riders” on the shells of intentionally collected mussels. There are similarities between the Par-Tee and Summit Island dogwinkle assemblages, which suggest that people occupying Summit Island may have purposely collected dogwinkle as well as mussel. If mussel were more abundant than dogwinkle, it is probable that Summit Island residents considered both species to be important food sources.

In the field notes, the Summit Island excavators also mention dense fish bone features as well as several wholly articulated large-bodied and small fish skeletons in Pit Fill 6a (upper component) and Strata 5 and 6 (lower component) at 49-XHI-043. Yet many of the resulting faunal lots for these locations contain very limited or no fish bones, suggesting that these materials were either not collected (as indicated by some of the excavators), slipped through 1/4 in. mesh screens, or were lost sometime after the excavation. My inspection of the fish specimens present in the faunal assemblage identified mainly salmonid vertebrae from Pit Fill 6a and Strata 5 and 6, suggesting that other elements and smaller taxa are underrepresented.

Ethnographies and contemporary subsistence data from rural Alaska confirm that fish have been a major resource for Alaska Natives for the last two centuries (Dumond and VanStone 1995; Fall et al. 2013; Giddings 1964; de Laguna 1937; Krieg et al. 2007), but direct evidence of Norton fishing practices is limited. As discussed in Chapter III, much of the evidence used to describe Norton fishing is indirect, and cannot be used to confirm the species harvested or the value of one species compared to another. Based on the potentially large number of fish remains that were present, but not recovered, during the Summit Island excavations, it is unfortunate that I was not able to use what fish remains are present in the faunal lots to test some of the assumptions about the importance of salmon in Norton subsistence. In future research, I hope to reconsider the fish bone specimens.

Other Sampling Considerations

It is possible that small elements from songbirds, voles, shrews, rabbits, marmots, etc., are underrepresented in the Summit Island faunal assemblage. The elements that I selected for analysis are some of the larger parts in the skeletal system, however, and I expected most identifiable portions to rest in the 1/4 in. mesh. For smaller animals, mandibles and long bones are usually large enough to be recovered in 1/4 in. mesh. Given the kinds of large-bodied mammals and birds present in the Summit Island faunal assemblage, I do not believe that an underrepresentation of small birds and mammals will prevent me from adequately interpreting the primary subsistence practices of Summit Island residents related to these animal classes. Based on my research into the animals that historically and currently inhabit the Walrus Islands, and the preferences of generations of Alaska Natives directly documented in contemporary subsistence reports, historic ethnographic reports, and archaeological studies, I feel confident that most birds and mammals valued by the Summit Island residents are represented in the assemblage (Ackerman 1998; ADF&G 1996, 2008, 2010a, 2010b, 2015a, 2015b, 2016a, 2016b; Brown 1968; Casperson 2011; Chythlook and Fall 1998; Coiley-Kenner et al. 2003; Collins 1940; Dumond 1984; Ellanna 1983; Fall et al. 1991; 1998, 2012, 2013; Gadamus and Yakoubian 2015; Garlich-Miller et al, 2006; Georgette et al. 1998; Holen et al. 2005; Krieg et al. 2007; Mangdaz and Wolfe 1988; Morgan et al. 2012; Naves 2015a; NPS 2009; Nelson et al. 1982; Okonek et al. 2007, 2008, 2009; Okonek and Snively 2005, 2006; Paige et a;. 2000; Russel and West 2003; Schaaf 2015; Sell and Weiss 2010, 2011; Sherrod 1982; Sinnott 1992; Stephanson and Mendenhall 1998; Taylor et al. 2015; USFWS 2012, 2013b, 2013c, 2013d, 2013e, 2013f; VanStone 1984, 1988; Weiss and Morrill 2014; Wolfe et al. 1990; Wolfe and Paige 2002). Some elements of large marine mammals, however, are underrepresented. For 49-XHI-043, there are several instances in the field notes where different excavators noted that large walrus bones were present in the unit/level, but not collected due to their size. Since the crew may have misidentified taxon or element, and there is no way to confirm identifications, I did not use them in the analysis.

Identification Protocol

I identified bone specimens from the Summit Island faunal assemblage through direct comparison with the University of Oregon Department of Anthropology North Pacific Comparative Collection (NPCC). To a lesser extent, I also used specimens from the Biology Department at Portland State University (PSU Biology), the National Oceanic and Atmospheric Administration's Marine Mammal Laboratory (NOAA MML), and the Ornithology and Mammalogy Laboratories at the University of Washington Burke Museum (UWBM). A list of the comparative specimens housed at NPCC can be found online (see Moss 2009). Bird specimens from the other collections are listed in Table 13. Comparative marine mammal specimens are listed in the following section.

Table 13. Burke Museum Comparative Bird Specimens

Common Name	Sex	Specimen ID
greater scaup	female	37017
greater scaup	male	42016
canvasback	female	31684
canvasback	male	32185
common goldeneye	male	28576
common goldeneye	female	32859
long-tailed duck	Female	51209
long-tailed duck	male	51216
red-breasted merganser	female	31821
red-breasted merganser	male	40038
Steller's eider	male	48273
Steller's eider	female	53817
common eider	female	35978
common eider	male	38168
king eider	female	42452
king eider	male	50720

I also utilized several osteology guides and peer-reviewed references including Bass (1995), Cohen and Serjeantson (1996), Crockford et al. (2004), Gilbert (1990), Gilbert et al. (1996), Ericson and Stora (1999) Fay (1982), Gilbert (1990), Hansen (n.d.), Hodgetts (1999), Kaspar (1980), Kastelein and Gerrits (1990), Post (2004, 2005a, 2005b, 2007, 2015), Smith (1979), Stora (2000), and VZAP (2015).

I considered specimens identifiable only if I could assign them to the level of family and identify the element where it originated. The few exceptions include whale specimens, which I identified to order (Cetacean). I was unable to identify whale specimens to a lower level due to limited access to comparative specimens. Whale is very minimally represented in the Summit Island faunal assemblage, reducing the need to put major effort into identifying the species. All other specimens were labeled as unidentified bird (UNI Bird), unidentified mammal (UNI Mammal) or unidentified bird/mammal (UNI). Based on the porousness of marine mammal bone, it was possible in many instances to identify UNI mammal as either terrestrial or marine. The majority of the UNI mammal specimens are from marine mammals, which is unsurprising given the high abundance of identifiable marine mammal versus the low abundance of identifiable terrestrial mammal specimens in the identifiable sub-assemblage.

I subsampled the assemblage by selecting specific elements for identification. I chose elements that are low in count per individual (one or two, typically paired elements), with the intent to represent the head, torso, and appendages. This strategy excludes many vertebrae, some carpals and tarsals, metapodials, ribs, and phalanges. For birds, I identified the following:

- cranial fragments, maxillae, premaxillae, and mandibles from the head

- coracoids, furcula, scapulae, sterna, and synsacra from the torso
- carpometacarpi, humeri, radii, and ulnae from the wings
- femora, tarsometatarsi, and tibiotarsi from the legs

For mammals, I identified the following:

- cranial fragments, maxillae, premaxillae and mandibles from the head
- atlas, axis, pelves, sacra, and scapulae from the torso
- humeri, radii, scapholunates, ulnae from the forelimb
- astragali, calcanei, femora, fibulae, and tibiae from the hind limb

I quantified specimens by the number of identified specimens (NISP) and the minimum number of individuals (MNI). NISP is simply the count of specimens that are used in an analysis, whereas MNI determines the minimum number of individuals that may be represented in a faunal assemblage by considering the taxon, element, element side, element portion, and age of the specimen in a given sample or analytical component (Grayson 1984; Reitz and Wing 2008; Serjeantson 2009). Comparing NISP and MNI for a given taxon is useful to expose the potential problems associated with simply counting specimens. NISP frequencies can exaggerate the importance of a taxon with more identified fragments over another with fewer NISP, but more complete elements (Casperson 2009; Reitz and Wing 2008; Serjeantson 2009). When ranking a taxon, NISP and MNI are expressed as %NISP and %MNI.

I noted and recorded cultural modifications (cut and burn marks, tool preparation), fragment portion, element side (left, right, or axial), age, and pathology (the presence of medullary bone or arthritic lipping) in an Excel spreadsheet. Portions of bird specimens were quantified using the numbering system described in Cohen and Serjeantson (1996). I recorded portion fragmentation to calculate the minimum number of elements (MNE) as per Lyman (1994) to estimate MNI. Scientific names and phylogenetic ordering of the birds are based on the Checklist of North American Birds produced by the American Ornithologists' Union (2012). Scientific names and phylogenetic ordering of the mammals are based on the Revised Checklist of North American Mammals (Baker et al. 2003).

Marine Mammal Age Determinations

Numerous immature seal and walrus specimens are present in the Summit Island faunal collection. To determine age and species, I used direct comparison with skeletal specimens from NPCC, UWBM, PSU Biology, and NOAA NMML as well as several osteology books, digital references, and articles (Crockford et al. 2004; Ericson and Stora 1999; Fay 1982; Gilbert 1990; Hansen n.d., Hodgetts 1999; Kaspar 1980; Kastelein and Gerrits 1990; Post 2007; Scheffer 1950; Smith 1979; Stora 2000; VZAP 2015). All relevant comparative seal and walrus specimens including those from NPCC are listed in Table 14.

Table 14. Marine Mammal Comparative Specimens

Institution #	Common Name	Sex	Portion	Age at Death	Age Category
NOAA NMML-219	bearded seal	M	skull	1+ year	juvenile
UWBM-34219	bearded seal	M	postcranial only	N/A	juvenile
NOAA NMML-217	bearded seal	M	skull	N/A	sub-adult/adult
UWBM-34220	bearded seal	F	complete skeleton	N/A	adult
UWBM-34597	ringed seal	F	complete skeleton	0-2 months	unweaned pup
NOAA NMML-203	ringed seal	M	complete skeleton	3-4 months	weaned pup
NOAA NMML-1849	ringed seal	M	complete skeleton	5-6 months	weaned pup
NOAA NMML-200	ringed seal	F	skull	8-9 months	yearling

Table 14. (continued)

Institution #	Common Name	Sex	Portion	Age at Death	Age Category
UWBM-34935	ringed seal	M	partial skeleton	N/A	sub-adult
NOAA NMML-199	ringed seal	M	skull	N/A	sub-adult/ adult
UWBM-34221	spotted seal	M	postcranial only	N/A	juvenile
UWBM-34222	spotted seal	F	postcranial only	N/A	juvenile
NOAA NMML-402	spotted seal	M	skull	N/A	sub-adult/adult
NPCC OIMB-0039	harbor seal	?	skull	0-2 months	unweaned pup
NPCC Ph vi 6	harbor seal	M	complete skeleton	0-2 months	unweaned pup
NPCC Ph vi 4	harbor seal	?	partial skeleton	1+ month	unweaned pup
NOAA NMML-1778	harbor seal	?	postcranial only	6-7 months	weaned pup
NOAA NMML-185	harbor seal	M	skull	10-11 months	yearling
UWBM-36044	harbor seal	F	complete skeleton	1+ year	yearling
UWBM-51211	harbor seal	?	postcranial only	1+ year	yearling/juvenile
NPCC Ph vi 2	harbor seal	M	complete skeleton	1-2 years	juvenile
NPCC Ph vi 3	harbor seal	?	partial skeleton	1-2 years	juvenile
NOAA NMML-188	harbor seal	F	skull	14 years	adult
NPCC OIMB-0010	harbor seal	F	complete skeleton	N/A	adult
UWBM-51216	harbor seal	M	complete skeleton	N/A	adult
NPCC Ph vi 1	harbor seal	?	partial skeleton	N/A	sub-adult
NPCC Ph vi 5	harbor seal	F	partial skeleton	N/A	sub-adult
NOAA NMML-309	Pacific walrus	M	skull	1-2 months	yearling
PSU Biology-N/A	Pacific walrus	?	complete skeleton	~6 months	yearling
NOAA NMML-307	Pacific walrus	M	skull	1 year	yearling
NOAA NMML-306	Atlantic walrus	M	skull	1 year	yearling
UWBM-35479	Pacific walrus	F	complete skeleton	~6 years	sub-adult
UWBM-35480	Pacific walrus	M	complete skeleton	18 years	adult
NPCC Od ro 1	Pacific walrus	?	partial skeleton	N/A	adult
NPCC Od ro 2	Pacific walrus	?	partial skeleton	N/A	adult
NPCC Od ro 3	Pacific walrus	?	partial skull	N/A	adult

To facilitate aging the seal specimens, I used “skeletal age” from Stora (2000) to check reference skeletons against their documented calendar age, which I then applied to the archaeological specimens. To develop skeletal age groups, Stora (2000:199) studied the “sequence of epiphyseal fusion” of 600 seal skeletons with known calendar ages. He found that several seal species share a similar history of skeletal development, which provides a good baseline for aging specimens from archaeological contexts. Stora conducted necropsies on most of these specimens and was able to document sexual maturity and body size of the seals. Stora linked skeletal age with life history, which resulted in four categories: Yearling, Juvenile, Young Adult, and Adult. Table 15 is a compilation of Stora’s research.

Table 15. Age Range of Element Fusion in Harbor and Ringed Seals (Stora 2000)

Element & Fusing Landmark	**Oldest age with no fusing**		**Youngest age of fusing**		**Oldest age of fusing**		**Earliest complete fusion**	
	ringed	harbor	ringed	harbor	ringed	harbor	ringed	harbor
Skeletal Age 1 to 3, Yearling								
Pelvis, acetabulum	8 mo.	7 mo.	3 mo.	3 mo.	8 mo.	7 mo.	5 mo.	11 mo.
Scapula, supraglenoid tuberosity	9 mo.	13 mo.	5 mo.	4 mo.	10 mo.	15 mo.	6 mo.	17 mo.
Humerus, head and greater tubercle fusing	9 mo.	11 mo.	4 mo.	5 mo.	9 mo.	13 mo.	5 mo.	14 mo.
Skeletal Age 4 to 5, Juvenile								
Crural bone, tibial-fibular proximal epiphysis	20 mo.	18 mo.	15 mo.	2 yrs.	2.5 yrs.	4 yrs.	17 mo.	2.75 yrs.
Femur proximal epiphysis	3.25 yrs.	3.75 yrs.	4.5 yrs.	2.25 yrs.	5 yrs.	4 yrs.	4 yrs.	4 yrs.
Humerus, distal epiphysis	3.25 yrs.	3.75 yrs.	3.25 yrs.	2.75 yrs.	5 yrs.	5 yrs.	4 yrs.	4 yrs.
Radius, proximal epiphysis	3.25 yrs.	4 yrs.	4.5 yrs.	2.75 yrs.	4.5 yrs.	5 yrs.	4 yrs.	4 yrs.
Sacrum	3.25 yrs.	3.75 yrs.	3.25 yrs.	2.75 yrs.	8 yrs.	6.25 yrs.	5 yrs.	4.75 yrs.
Calcaneal tuberosity	4 yrs.	3.75 yrs.	5 yrs.	3.75 yrs.	7.5 yrs.	5 yrs.	5 yrs.	4 yrs.
Skeletal Age 6, Young Adult								
Humerus, proximal epiphysis to diaphysis	5 yrs.	5 yrs.	5.75 yrs.	4 yrs.	10 yrs.	6 yrs.	4 yrs.	5 yrs.
Femur, distal epiphysis	5 yrs.	5 yrs.	5.75 yrs.	4 yrs.	10 yrs.	6 yrs.	4 yrs.	5 yrs.
Ulna, olecranon process	5 yrs.	4 yrs.	5.5 yrs.	4.75 yrs.	10 yrs.	6 yrs.	5 yrs.	5 yrs.
Crural bone, proximal epiphysis to diaphysis	7.25 yrs.	5 yrs.	6.25 yrs.	5 yrs.	12 yrs.	6 yrs.	5 yrs.	5 yrs.
Skeletal Age 7 to 8, Adult								
Ulna, distal epiphysis	12 yrs.	7 yrs.	6.25 yrs.	6 yrs.	15 yrs.	11 yrs.	7.25 yrs.	6.25 yrs.
Radius, distal epiphysis	12 yrs.	9 yrs.	8.5 yrs.	6 yrs.	15 yrs.	12 yrs.	7.25 yrs.	8 yrs.
Crural bone, distal epiphysis to diaphysis	12 yrs.	7 yrs.	7.25 yrs.	6 yrs.	15 yrs.	12 yrs.	7.25 yrs.	8 yrs.

Many of the reference skeletons, which fall within the Yearling group, had dates of mortality and could be aged to the month. This allowed me to further subdivide Yearling into the following categories: Fetal/Newborn/Nursing Pup (0-2 months), Weaned Pup (3-7 months) and Yearling/First Molt (8-12 months). These age categories are based on the life history of seals (ADF&G 2008). I recorded the subcategories of Yearling specimens in my main spreadsheet, and found the categories to be useful despite the fact that some elements from the same individual likely fit into more than one yearling subcategory. Element maturation is highly individualistic, as noted by Stora (2000); so two elements from the same individual may appear to have different levels of maturity. This has the potential to inflate MNI. To combat this, while exploring general trends in the Summit Island faunal assemblage, I calculated MNIs for Yearlings as a whole rather than by using the subcategories within the Yearling group. Later in the chapter, when I discuss the season of occupation as it relates to immature marine mammal specimens, however, I do calculate MNI for the Yearling sub-categories.

Despite having access to several yearling reference skeletons, I was unable to distinguish between small seal species (not including bearded seals). Direct comparison and measuring bones did not help (but see Crockford et al. 2004). This is partially a result of having limited access to complete comparative specimens. Even at very immature stages, bearded seal specimens are distinguishable from smaller-bodied seals due to their robusticity and large size.

To determine age, I considered the size of each specimen as well as lines of epiphyseal fusion, maturation, and texture. As noted by Stora (2000:207), newborn and unweaned pup specimens are identifiable by the rough texture, flaring at the ends of diaphyses, and amorphous features of the epiphyses. The bone is typically spongy and porous, and very different from the smooth and hard bone of more mature individuals. Bone features and landmarks are indistinct until seals enter the juvenile phase of life. As seals approach full maturity, the rate of bone growth slows significantly. At the sub-adult (Young Adult) phase, many elements will be close to or at full size growth, with articular ends almost completely fused. Lines of epiphyseal fusion, however, are typically present on the elements described by Stora (2000). Fully mature or elderly adult elements will be completely fused with no visible lines at the articular ends.

For analysis, I chose to combine the Young Adult and Adult elements into one category. This is based on the similarities in life history; the individuals in these two categories are usually sexually mature and have similar body proportions. The point of import with condensing the two categories is capturing the ratio of sexually mature, fully-grown (or close to) individuals, versus the juveniles (sexually immature, with much smaller body proportions), and yearlings (first of the year which are good indicators of seasonality).

The skeletal development of walrus differs from seals, and as such, I relied mostly on direct comparison with aged reference collections. For skull and tusk fragments, Kastelein and Gerrits (1990) was a valuable reference. Fay (1982) was particularly helpful for associating specimen size and maturity with chronological age and life history.

Summit Island Faunal Assemblage Trends

The Summit Island faunal assemblage consists of 9,981 specimens (NISP). Of these, 68% came from 49-XHI-043 (n=6,811) and 32% came from 49-XHI-044 (n=3,170). Only 22% of these specimens were identifiable for the purposes of this dissertation (n=2,212). Table 16 shows the number of identified and unidentified specimens by site and animal class.

Table 16. Abundance of Identified and Unidentified Bird and Mammal Bone Specimens (NISP and %NISP)

		ID Specimens		**UNI Specimens**		
Site	**Animal Class**	**NISP**	**%**	**NISP**	**%**	**Total**
49-XHI-043	Aves	912	48	988	52	1,900
	Mammalia	593	12	4,318	88	4,911
49-XHI-044	Aves	332	46	394	54	726
	Mammalia	375	15	2,069	85	2,444
	Total	**2,212**	**22**	**7,769**	**78**	**9,981**

Bird specimens compose 56% of the identified sub-assemblage (n=1,244), whereas mammals compose 44% (n=968). Eleven bird families (Tables 17) and eight mammal families (Table 18) are represented in the Summit Island faunal assemblage. Table 19 lists all 30 bird and 12 mammal taxa that I identified as well as the corresponding NISP by site and the total NISP.

Table 17. Abundance of Bird Families (NISP and %NISP)

	49-XHI-043		49-XHI-044		Total	
Families and Common Names	**NISP**	**%**	**NISP**	**%**	**NISP**	**%**
Gaviidae (loons)	3	<1	2	1	5	<1
Procellariidae (shearwaters, petrels)	2	<1	0	<1	2	<1
Phalacrocoracidae (cormorants)	138	15	54	16	192	15
Anatidae (ducks, geese, swans)	219	24	245	74	464	37
Accipitridae (eagle)	1	<1	0	<1	1	<1
Phasiandidae (grouse, ptarmigans)	8	1	0	<1	8	1
Scolopacidae (sandpiper or phalarope)	1	<1	0	<1	1	<1
Laridae (skuas, jaegers, gulls, terns)	8	1	5	2	13	1
Alcidae (seabirds, auks)	528	58	23	7	551	44
Strigidae (non-barn owls)	0	<1	2	<1	2	<1
Corvidae (crows, jays, magpies)	4	<1	1	<1	5	<1
Total	**912**	**100**	**332**	**100**	**1,244**	**100**

Table 18. Abundance of Mammal Families (NISP and %NISP)

	49-XHI-043		49-XHI-044		Total	
Families and Common Names	**NISP**	**%**	**NISP**	**%**	**NISP**	**%**
Sciuridae (squirrels, marmots)	0	<1	12	3	12	1
Castoridae (beaver)	1	<1	0	<1	1	<1
Canidae (dogs, foxes, wolves)	46	8	2	1	48	5
Odobenidae (walrus)	206	35	16	4	222	23
Phocidae (earless, true, or hair seals)	291	49	345	92	636	66
Mustelidae (otter)	1	<1	0	<1	1	<1
Cetacean (whale)	2	<1	0	<1	2	<1
Cervidae (caribou)	46	8	0	<1	46	5
Total	**593**	**100**	**375**	**100**	**968**	**100**

Table 19. Count of Bird and Mammal Bone Specimens by Site (NISP)

Taxon	**Common Name**	**49-XHI-043 (NISP)**	**49-XHI-043 (NISP)**	**Total**
Aves	bird, unidentified	988	394	1382
Gavia spp.	loon	3	2	5
Puffinus spp.	shearwater	2	0	2
Phalacrocorax spp.	cormorant	138	54	192
Anatidae	duck, goose, or swan	8	1	9
Anserinae	goose	1	4	5
Cygnus columbianus	tundra swan	3	0	3
Anatinae	duck	32	50	82
Aythya sp.	bay duck	0	1	1
Somateria spectabilis	king eider	6	3	9
Somateria mollissima	common eider	87	147	234
Melanitta sp.	scoter	1	0	1
Melanitta perspicillata	surf scoter	8	4	12
Melanitta fusca	white-winged scoter	49	20	69
Melanitta nigra	black scoter	0	1	1
Clangula hyemalis	long-tailed duck	24	12	36
Bucephala clangula	common goldeneye	0	2	2
Haliaeetus leucocephalus	bald eagle	1	0	1
Phasiandidae	grouse or ptarmigan	8	0	8
Scolopacidae	shore bird	1	0	1
Laridae	gull	1	4	5
Larus spp.	gull	1	1	2
Rissa spp.	kittiwake	6	0	6
Alcidae	seabird	3	1	4
Uria spp.	murre	514	18	532
Cepphus columba	pigeon guillemot	0	1	1
Brachyramphus sp.	murrelet	1	3	4
Cerorhinca monocerata	rhinoceros auklet	1	0	1
Fratercula spp.	puffin	9	0	9
Strigidae	owl	0	2	2
Corvus corax	common raven	4	1	5
	Subtotal	*1,900*	*726*	*2,626*
Mammalia	mammal, unidentified	2,451	1,017	3,468
Mammalia	mammal, marine	1,636	1,044	2,680
Mammalia	mammal, terrestrial	231	8	239
Marmot spp.	marmot	0	12	12
Castor canadensis	North American beaver	1	0	1
Vulpes vulpes	red fox	46	2	48
Odobenus rosmarus	Pacific walrus	206	16	222
Phocidae	earless, true, or hair seal	23	2	25
Phoca spp.	small seal	105	115	220
Phoca largha/vitulina	spotted seal, harbor seal	14	20	34
Phoca hispida	ringed seal	46	180	226
Erignathus barbatus	bearded seal	103	28	131
Lontra canadensis	river otter	1	0	1
Cetacean	whale	2	0	2
Rangifer tarandus	caribou	46	0	46
	Subtotal	*4,911*	*2,444*	*7,355*
	Total	**6,811**	**3,170**	**9,981**

Birds

Despite the taxonomic richness in the Summit Island faunal assemblage, the majority of bird specimens belong to the alcid (n=551, 44%), anatid (n=464, 37%), and cormorant (n=192, 15%) families (Table 20). All other bird specimens including loons, shearwaters, bald eagles, grouse or ptarmigans, shore birds, gulls, owls, and common ravens make up 4% of the assemblage (n=37).

Table 20. Bird Family Abundance (NISP and %NISP) by Site

	49-XHI-043		49-XHI-044		Total	
Bird Families	**NISP**	**%**	**NISP**	**%**	**NISP**	**%**
Phalacrocoracidae (cormorants)	138	15	54	16	192	15
Anatidae (ducks, geese, swans)	219	24	245	74	464	37
Alcidae (seabirds, auks)	528	58	23	7	551	44
All other bird families (8 others)	27	3	10	3	37	4
Total	**912**	**100**	**332**	**100**	**1,244**	**100**

The anatid group is comprised of 13 taxa (Table 21). The majority of these specimens are duck (n=447, 96%), with only 4% (n=17) identified as anatid, goose, or tundra swan. Mergini or sea ducks are the most abundant anatids (n=364, 78%). The three most abundant anatid taxa (also sea ducks) include common eider (n=234, 50%), white-winged scoter (n=69, 15%), and long-tailed duck (n=36, 8%). Of the remaining specimens, 18% (n=82) could not be identified beyond the sub-family of duck (Anatinae). Based on the high percentage of sea ducks present in the assemblage, it is likely that most of these are also sea duck specimens.

Table 21. Anatid Abundance (NISP and %NISP) by Site

Taxon	Common Name	49-XHI-043 NISP	49-XHI-044 NISP	Total NISP	%
Anatidae	duck, goose, or swan	8	1	9	2
Anserinae	goose	1	4	5	1
Cygnus columbianus	tundra swan	3	0	3	1
Anatinae	duck	32	50	82	18
Aythya sp.	bay duck	0	1	1	<1
Somateria spectabilis	king eider	6	3	9	2
Somateria mollissima	common eider	87	147	234	50
Melanitta sp.	scoter	1	0	1	<1
Melanitta perspicillata	surf scoter	8	4	12	3
Melanitta fusca	white-winged scoter	49	20	69	15
Melanitta nigra	black scoter	0	1	1	<1
Clangula hyemalis	long-tailed duck	24	12	36	8
Bucephala clangula	common goldeneye	0	2	2	<1
Total		**219**	**245**	**464**	**100**

The alcid group is much more homogenous than the anatid group. Murres make up 97% (n=532) of the alcids. The remaining 3% (n=19) of alcids are identified as alcid, pigeon guillemot, murrelet, rhinoceros auklet, and puffin. Murres, unlike the rest of the alcids, are represented in each dated component. As such, murre abundance is a useful tool to track long-term bird harvest practices on Summit Island. If only murres are taken into consideration, the relative abundance of major taxa shifts slightly. As shown in Figure 23, murres make up 43% (n=532) of the entire Summit Island bird bone assemblage, anatids are the second most abundant at 37% (n=464), and cormorants are the third most abundant at 15% (n=192). Other taxa, including the non-murre alcids, make up 5% (n=56) of the bird assemblage.

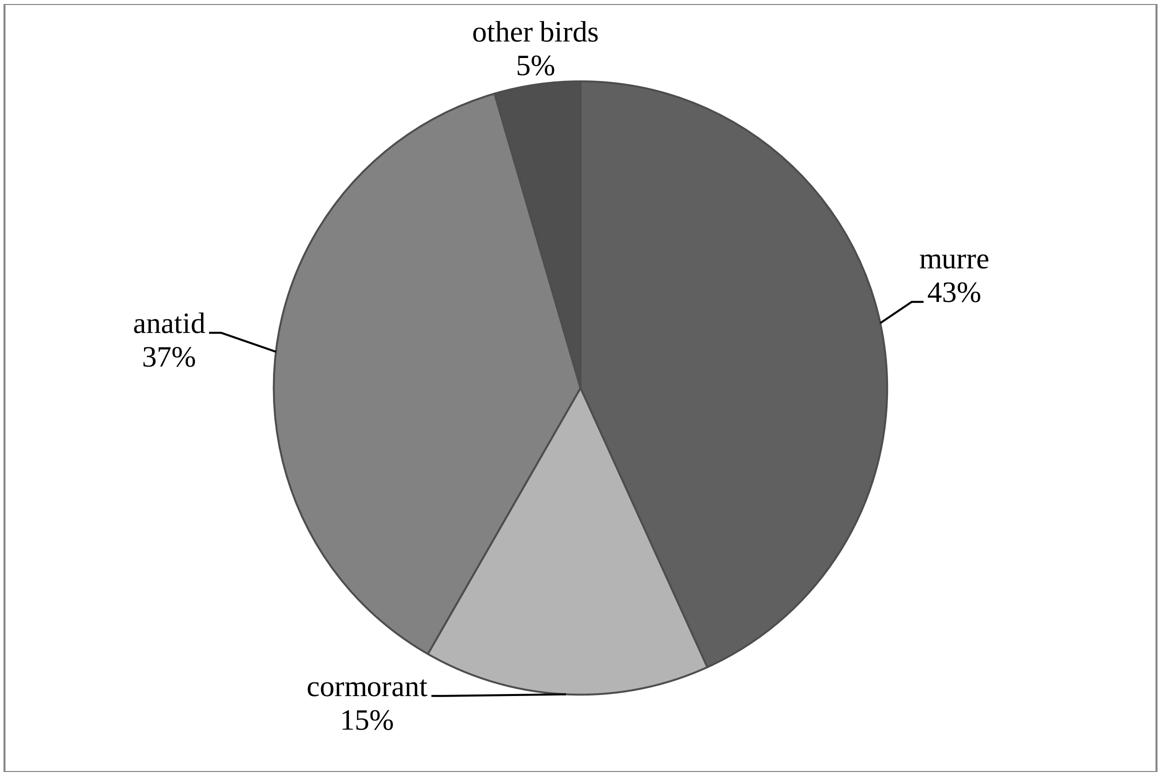

Figure 23. Relative abundance of murres, anatids, cormorants, and other birds (%NISP).

Mammals

Eighty-nine percent of the identified mammal specimens are marine mammals (n=860), with a much smaller number identified as terrestrial mammals (n=108, 11%). Major mammal taxa include phocids or hair seals (n=636, 66%) and Pacific walrus (n=222, 23%). Seals in the Summit Island assemblage include large-bodied bearded seals and small-bodied spotted/harbor seals and ringed seals. The phocid category also includes specimens identifiable only to family (Phocidae) or genus (*Phoca* sp.). In far smaller numbers, caribou (n=46, 5%) are present in the assemblage. The other terrestrial mammal taxa including marmot, beaver, river otter, and fox make up 7% (n=62) of the assemblage. Only two small whale specimens were identified (<1%). Table 22 shows major mammal groups and their corresponding NISP and %NISP by site and taxon.

Table 22. Mammal Family Abundance (NISP and %NISP) by Site

	49-XHI-043		49-XHI-044		Total	
Mammal Families	**NISP**	**%**	**NISP**	**%**	**NISP**	**%**
Odobenidae (Pacific walrus)	206	35	16	4	222	23
Phocidae (hair seals)	291	49	345	92	636	66
Cervidae (caribou)	46	8	0	<1	46	5
Other mammal families (6 others)	50	8	14	4	64	7
Total	**593**	**100**	**375**	**100**	**968**	**100**

Based on the NISP of specimens identified to the lowest taxonomic level (Table 19), the four most abundant mammal taxa include walrus (n=222), *Phoca* sp. or small seal (n=220), ringed seal (n=226), and bearded seal (n=131). A high number of *Phoca* sp. specimens are immature (n=152, 69%), but for reasons previously explained, I was unable to identify them to species despite the fact that many are in good condition.

When considering the abundance of ringed seal (n=226) versus spotted/harbor seal (n=34) specimens, it is probable that many of the *Phoca* sp. specimens are also ringed seal (Davis 2001:75). With this in mind, the relative abundance of Summit Island mammal specimens is better represented if all of the small seals (*Phoca* sp., spotted/harbor seal, ringed seal) are combined into one taxonomic group. With this combination, the main mammal taxa make up 87% of the mammal assemblage. Small seals are most abundant (*Phoca* sp., spotted/harbor seal, and ringed seal, n=480, 50%), followed by walrus (n=222, 23%), bearded seals (n=131, 14%), and caribou (n=46, 5%). The remaining six taxa (fox, marmot, beaver, river otter, whale, and phocid) make up 9% (n=89) of the Summit Island mammal assemblage (Figure 24).

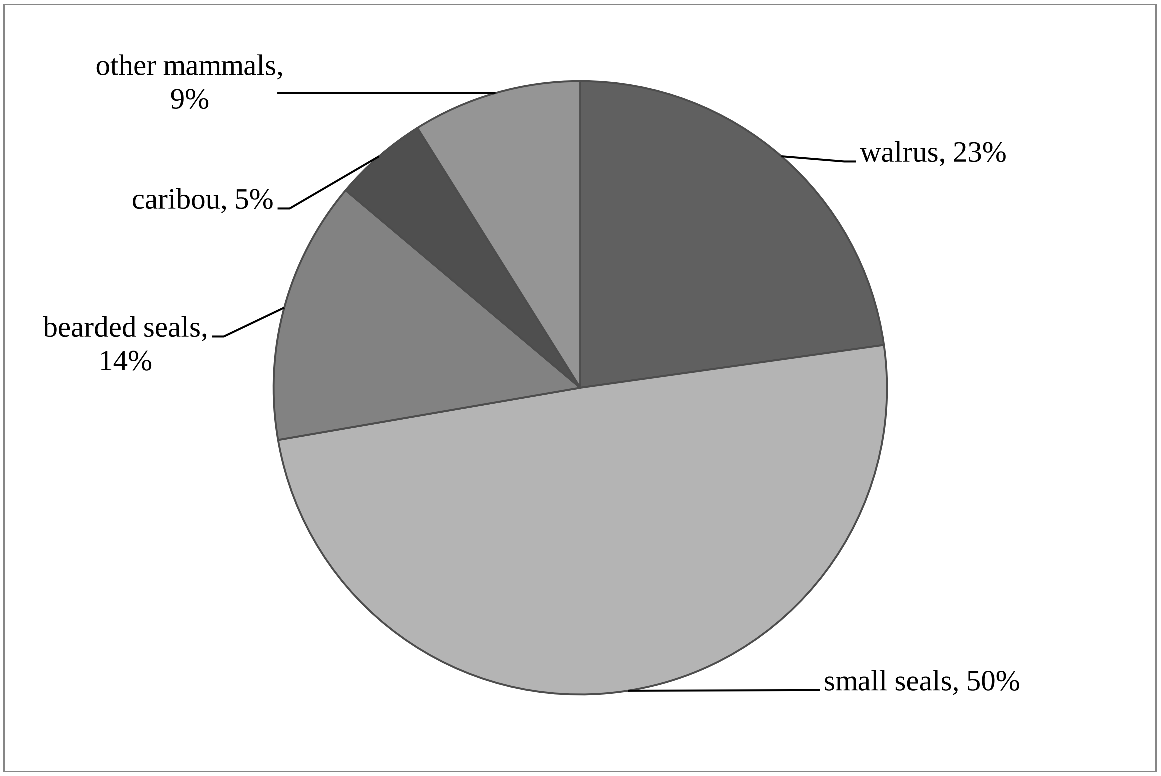

Figure 24. Relative abundance of small seals, walrus, bearded seals, caribou, and other mammals (%NISP).

Summit Island Components as Analytical Units

The Summit Island faunal specimens come from three analytical components including:

- Early Norton I (2740-2380 cal B.P.),
- Early Norton II (2400-2000 cal B.P.), and
- Late Norton (1390-980 cal B.P.).

Early Norton I and Early Norton II overlapped in age by 20 years, while Early Norton II and Late Norton were separated by 610 years. There is a 990-year break in occupation between the lower and upper components at 49-XHI-043 (Early Norton I and Late Norton). Unverified radiocarbon dates from different strata and features within 49-XHI-

043 and 49-XHI-044 hint at other occupations that could range from as early as 3000 cal B.P. to as recent as 790 cal B.P., potentially overlapping with the timing of my analytical components (see Chapter IV). The temporal breaks between my analytical components should not be considered tantamount to occupational hiatuses of Summit Island until more research is conducted. For the purposes of this study, however, there is enough data and evidence of discrete times of occupations to interpret changes in early and late Norton subsistence practices as they relate to birds and mammals.

Faunal specimens were distributed evenly between the three components with 38% (n=844) of the specimens associated with Early Norton I, 32% (n=707) with Early Norton II, and 30% (n=661) with Late Norton (Table 23).

Table 23. Abundance of Identified Specimens (NISP and %NISP) by Component

Animal Class	Early Norton I **NISP (%)**	Early Norton II **NISP (%)**	Late Norton **NISP (%)**	**Total NISP (%)**
Aves	422 (50%)	332 (47%)	490 (74%)	1,244 (56%)
Mammalia	422 (50%)	375 (53%)	171 (26%)	968 (44%)
Total (%NISP)	**844 (38%)**	**707 (32%)**	**661 (30%)**	**2,212 (100%)**

Birds and mammals had nearly equal representation in Early Norton I and Early Norton II, between 47-50% and 50-53%, respectively. In Late Norton, birds were much more abundant, representing 74% (n=490) of the sample with mammal specimens representing only 26% (n=171). Measures of relative abundance (MNI, %MNI, NISP, and %NISP) by component for all taxa identified in the Summit Island faunal assemblage are displayed in Tables 24 and 25.

Table 24. Bird Relative Abundance (MNI, %MNI, NISP, and %NISP) by Component

		Early Norton I				Early Norton II				Late Norton			
Taxon	**Common Name**	**MNI**	**%**	**NISP**	**%**	**MNI**	**%**	**NISP**	**%**	**MNI**	**%**	**NISP**	**%**
Gavia spp.	loon	1	2	2	<1	1	2	2	1	1	2	1	<1
Puffinus spp.	shearwater	1	2	1	<1					1	2	1	<1
Phalacrocorax spp.	cormorant	6	13	65	15	5	11	54	16	8	14	73	15
Anatidae	duck, goose, or swan			3	1			1	<1			5	1
Anserinae	goose	1	2	1	<1	1	2	4	1				
Cygnus columbianus	tundra swan	1	2	2	<1					1	2	1	<1
Anatinae	duck			16	4			50	15			16	3
Aythya sp.	bay duck					1	2	1	<1				
Somateria spectabilis	king eider	1	2	4	1	1	2	3	1	2	4	2	<1
S. mollissima	common eider	6	13	59	14	15	34	147	44	4	7	28	6
Melanitta sp.	scoter											1	<1
M. perspicillata	surf scoter	2	4	6	1	1	2	4	1	2	4	2	<1
M. fusca	white-winged scoter	3	7	18	4	3	7	20	6	4	7	31	6
M. nigra	black scoter					1	2	1	<1				
Clangula hyemalis	long-tailed duck	3	7	22	5	3	7	12	4	1	2	2	<1
Bucephala clangula	common goldeneye					2	5	2	1				
Haliaeetus leucocephalus	bald eagle	1	2	1	<1								
Phasiandidae	grouse/ptarmigan	2	4	7	2					1	2	1	<1
Scolopacidae	shore bird									1	2	1	<1
Laridae	gull	1	2	1	<1	1	2	4	1				
Larus spp.	gull	1	2	1	<1	1	2	1	<1				
Rissa spp.	kittiwake	1	2	2	<1					2	4	4	1
Alcidae	seabird			2	<1			1	<1	1	2	1	<1
Uria spp.	murre	11	24	196	46	3	7	18	5	26	46	318	65
Cepphus columba	pigeon guillemot					1	2	1	<1				
Brachyramphus sp.	murrelet					2	5	3	1	1	2	1	<1
Cerorhinca monocerata	rhinoceros auklet	1	2	1	<1								
Fratercula spp.	puffin	2	4	8	2					1	2	1	<1
Strigidae	owl					1	2	2	1				
Corvus corax	common raven	1	2	4	1	1	2	1	<1				
Total		**46**	**100**	**422**	**100**	**44**	**100**	**332**	**100**	**57**	**100**	**490**	**100**

Table 25. Mammal Relative Abundance (MNI, %MNI, NISP, and %NISP) by Component

		Early Norton I				Early Norton II				Late Norton			
Taxon	**Common Name**	**MNI**	**%**	**NISP**	**%**	**MNI**	**%**	**NISP**	**%**	**MNI**	**%**	**NISP**	**%**
Marmot spp.	marmot					1	3	12	3				
Castor canadensis	beaver	1	2	1	<1								
Vulpes vulpes	red fox	3	7	44	10	1	3	2	1	1	4	2	1
Odobenus rosmarus	Pacific walrus	10	25	181	43	5	12	16	4	6	25	25	15
Phocidae	hair seal			17	4			2	1			6	4
Phoca spp.	small hair seal			44	10			115	31			61	36
P. largha/vitulina	spotted/harbor seal	3	7	8	2	4	10	20	5	2	8	6	4
P. hispida	ringed seal	7	18	32	8	23	57	180	48	4	16	14	8
Erignathus barbatus	bearded seal	11	28	73	17	6	15	28	7	8	33	30	18
Lontra canadensis	river otter									1	4	1	1
Cetacean	whale	1	2	2	<1								
Rangifer tarandus	caribou	4	11	20	5					2	8	26	15
Total		**40**	**100**	**422**	**100**	**40**	**100**	**375**	**100**	**24**	**100**	**171**	**100**

Relative Abundance of Birds by Component

When considering NISP, in Early Norton I (2740-2380 cal B.P.), murres comprised 46% (n=196) of the birds, anatids comprised 31% (n=131), and cormorants comprised 15% (n=65). Other taxa made up 8% (n=30) of the sample. In Early Norton II (2400-2000 cal B.P.), bird abundances shifted greatly. Murre abundance dropped to 5% (n=18), anatid abundance increased to 74% (n=245), and cormorant abundance remained consistent at 16% (n=54). Other taxa decreased to 5% of the sample (n=15). In Late Norton (1390-980 cal B.P.), murres shifted back to being the most abundant at 65% (n=318), anatids decreased significantly to 18% (n=88), and cormorants remained consistent at 15% (n=73). Other taxa continued to decrease and made up 2% (n=11) of the sample. Figure 25 shows changes in abundance (%NISP) of the major bird groups between the three analytical components.

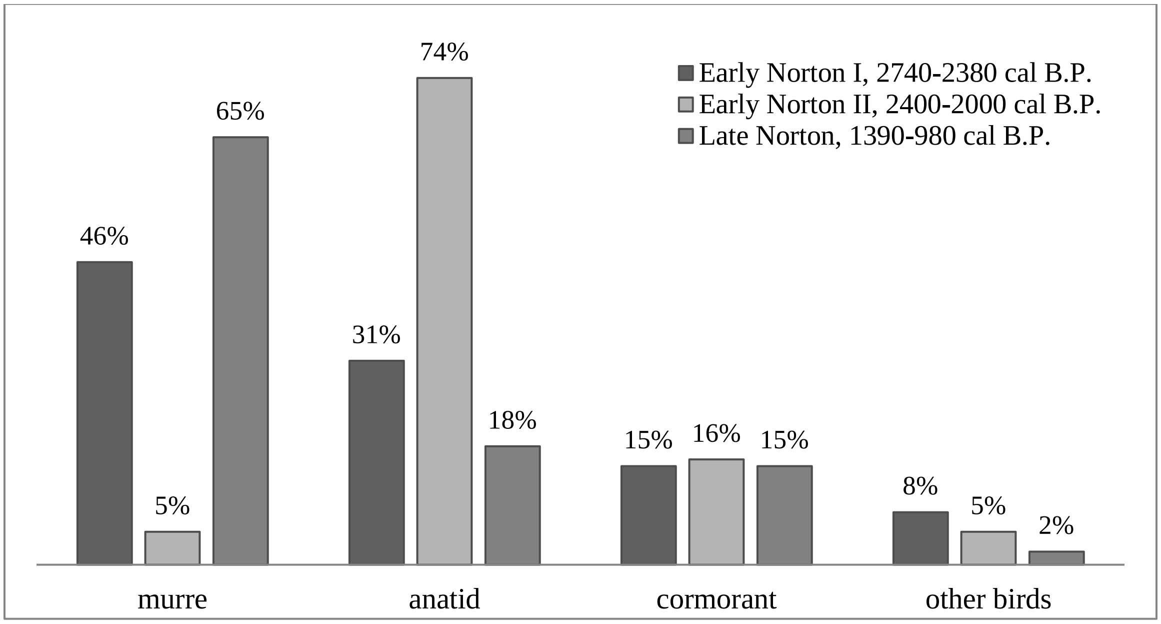

Figure 25. Relative abundance of murres, anatids, cormorants and other birds by component (%NISP). From left to right for each taxon, in the Early Norton I, Early Norton II, and Late Norton components**.**

MNI, which is useful to control for uneven representation between samples or taxa, shows a slightly different, but complementary, trend in bird abundances (Figure 26).

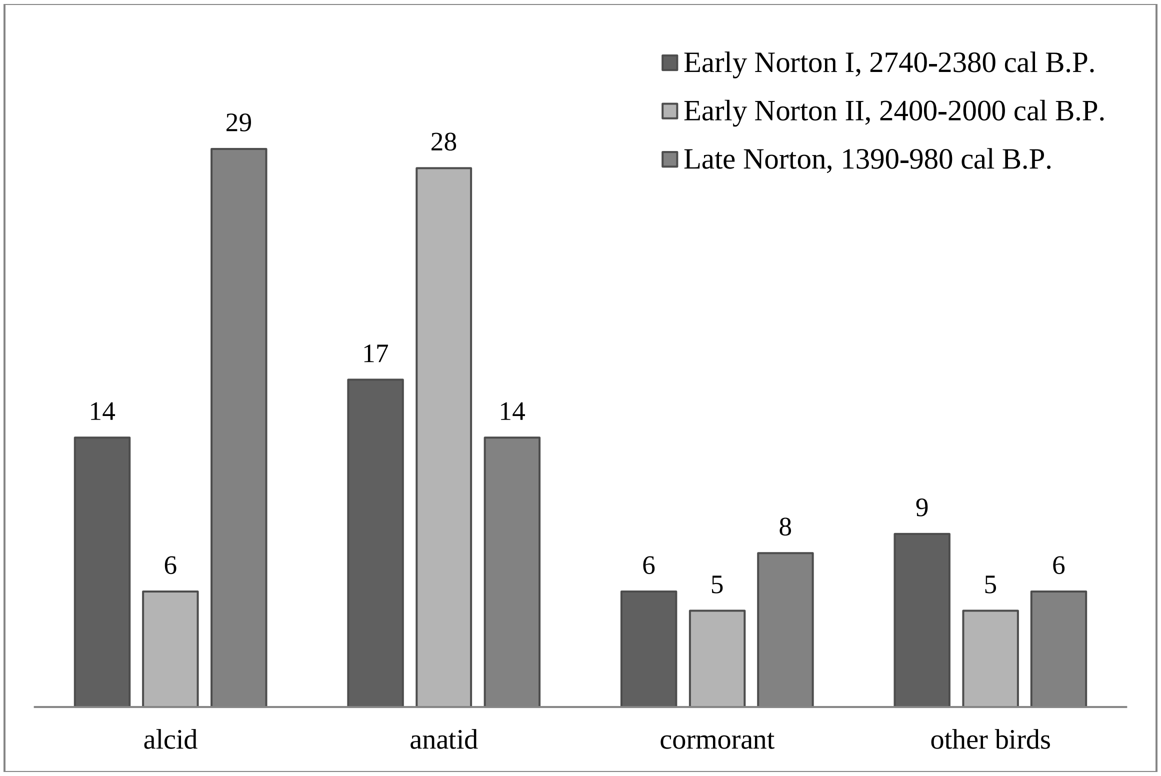

Figure 26. Abundance of alcids, anatids, cormorants and other birds by component (MNI). From left to right for each taxon, in the Early Norton I, Early Norton II, and Late Norton components.

One change is that individual anatids (17 MNI) were slightly more abundant in Early Norton I, than individual alcids (14 MNI, of which murres total 11 MNI). The remaining trends in proportions of MNI are similar to those noted with NISP. In Early Norton II, individual anatids increased to their most abundant (28 MNI), and in Late Norton decreased to their least abundant level (14 MNI). Individual alcids were least abundant in Early Norton II (6 MNI), decreasing by 16% from Early Norton I, but increased considerably in abundance in Late Norton (29 MNI). Proportions of individual cormorants remained low, but steady throughout the three components (5-8 MNI, 11-14% MNI). This was also true for other birds, which were minimally abundant in Early Norton I (9 MNI, 20% MNI), decreased in abundance in Early Norton II (5 MNI, 11% MNI), and Late Norton (6 MNI, 10% MNI).

In Early Norton I, the most abundant anatids were common eiders (45%, n=59 NISP), long-tailed ducks (17%, n=22), and white-winged scoters (14%, n=18). Other ducks made up 20% (n=26) of the sample. The remaining taxa made up 5% (n=6) and include anatid, goose, and tundra swan (Table 26).

Table 26. Anatid Abundance (NISP and %NISP) by Component

	Early Norton I		Early Norton II		Late Norton	
Common Name	**NISP**	**%**	**NISP**	**%**	**NISP**	**%**
duck, goose, or swan	3	2	1	<1	5	6
goose	1	1	4	2		
tundra swan	2	2			1	1
duck	16	12	50	20	16	18
bay duck			1	<1		
king eider	4	3	3	1	2	2
common eider	59	45	147	60	28	32
scoter					1	1
surf scoter	6	5	4	2	2	2
white-winged scoter	18	14	20	8	31	35
black scoter			1	<1		
long-tailed duck	22	17	12	5	2	2
common goldeneye			2	1		
Total	**131**	**100**	**245**	**100**	**88**	**100**

In Early Norton II, common eiders increased in abundance (60%, n=147), long-tailed ducks decreased in abundance (5%, n=12), and white-winged scoters decreased in abundance (8%, n=20). Other ducks increased in abundance to 25% (n=61). The remaining taxa decreased to 2% (n=5) and included anatid and goose.

In Late Norton, common eiders decreased in abundance (32%, n=28), long-tailed ducks continued to decrease in abundance (2%, n=2), and white-winged scoters increased in abundance (35%, n=31). Other ducks maintained a somewhat consistent abundance of 23% (n=21). The remaining taxa increased to 7% (n=6) and included anatid and tundra swan.

The change in anatid abundance (%NISP) between the three components is represented in Figure 27. In all three components, ducks, most of which are sea ducks, maintained a high abundance between 93% and 97%. Non-ducks (geese and swans) were minimally represented in all components (2-7%).

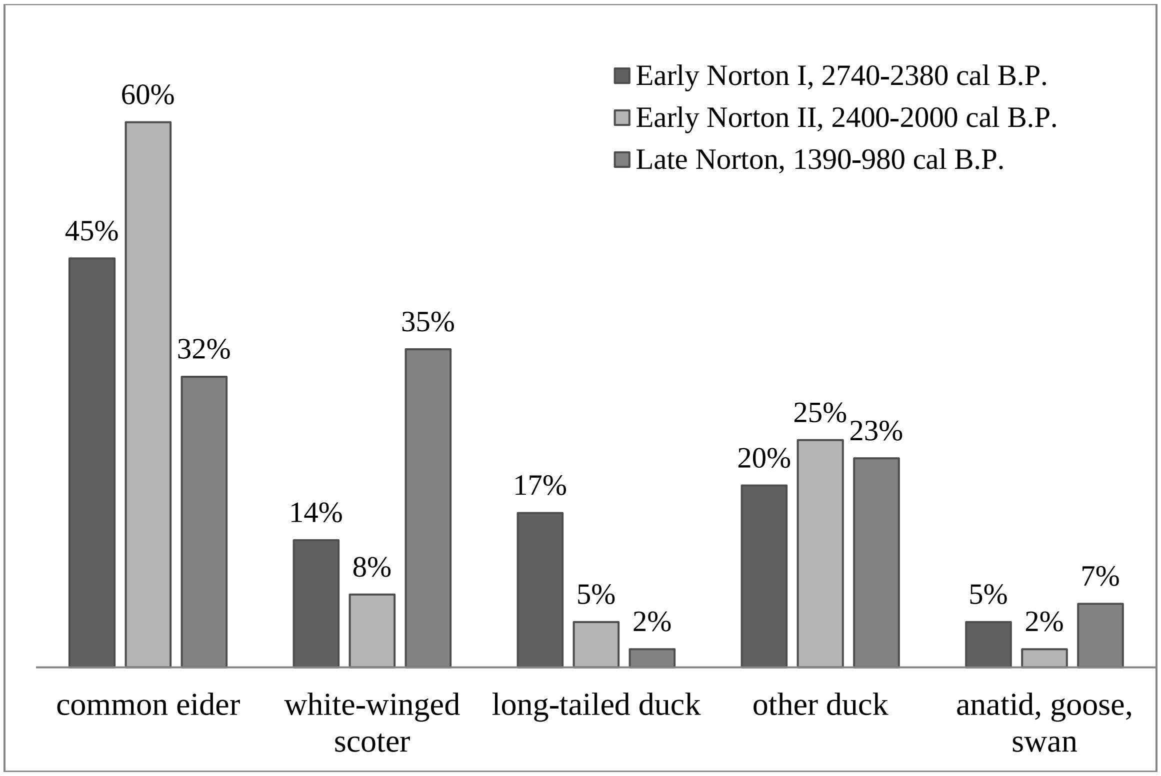

Figure 27. Relative abundance of common eiders, white-winged scoters, long-tailed ducks, other ducks, and non-ducks by component (%NISP). From left to right for each taxon, Early Norton I, Early Norton II, and Late Norton.

Within the anatid group, common eiders, white-winged scoters, and long-tailed ducks have the highest total MNIs, which shows similarities to anatid NISP proportions (Figure 28). In Early Norton I, individual common eiders (6 MNI) are twice as abundant as white-winged scoters (3 MNI) and long-tailed ducks (3 MNI). In Early Norton II, individual common eiders increased significantly in abundance (15 MNI), and were much more abundant than white-winged scoters (3 MNI) and long-tailed ducks (3 MNI). By Late Norton, common eiders and white-winged scoters were equally abundant (4 MNI), and were slightly more abundant than they had been in Early Norton II. They were also quite a bit more abundant than the long-tailed duck, which was represented by 1 MNI in Late Norton. Other ducks, made up of several taxa, had low abundances throughout the three components (3-6 MNI per component). Goose and swan had very low abundances, 1-2 MNI between components.

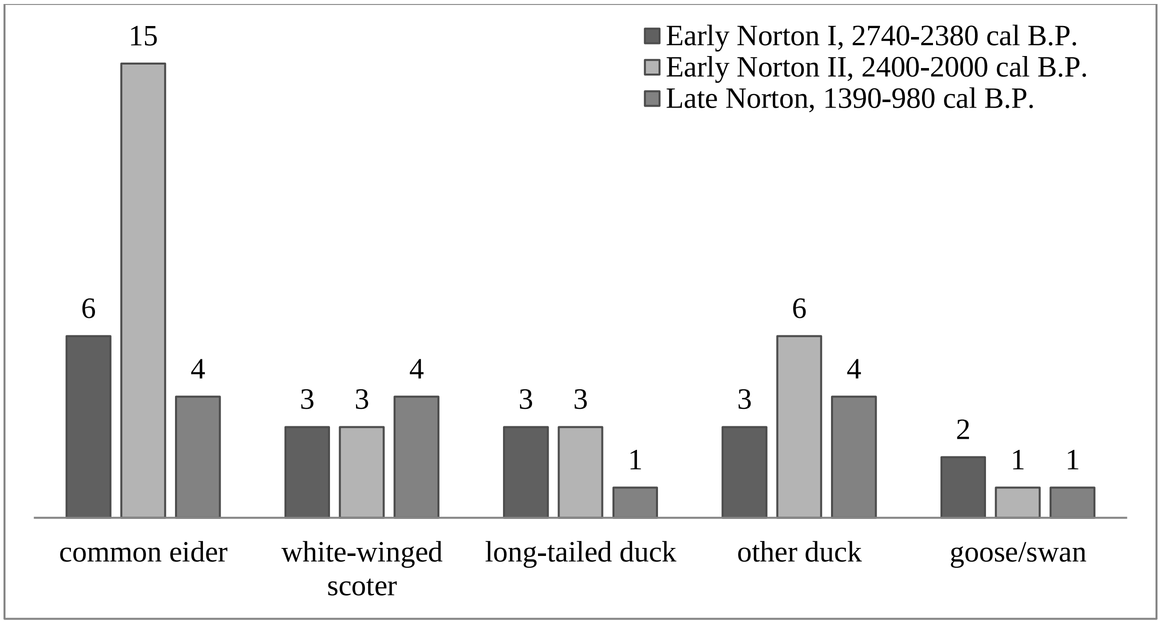

Figure 28. Abundance of common eiders, white-winger scoters, long-tailed ducks, other ducks, and geese/swans by component (MNI). From left to right for each taxon, Early Norton I, Early Norton II, and Late Norton components.

For the birds represented in the Summit Island faunal assemblage, NISP tended to portray more extreme differences in the abundance of the various taxa, than MNI. This is due to the number of species grouped into one bird taxon, such as murres (one taxon) and cormorants (one taxon), versus anatids (10 taxa), as well as the differential number of specimens representing one individual. With cormorants (192 NISP, 19 MNI), murres (532 NISP, 40 MNI), and common eiders (234 NISP, 25 MNI), and to a lesser extent white-winged scoters and long-tailed ducks, there were many more specimens per individual per component than there were for the other seven anatid taxa with calculable MNI. These seven other taxa including goose, tundra swan, bay duck, king eider, surf scoter, and common goldeneye were represented by 1-4 NISP and 1-2 MNI per component. I grouped the birds in such a manner in an attempt to make clear major trends in the bird assemblage (such as murres make up 97% of all alcids), to account for similar life history (colony birds versus sea ducks) and to consider the varying subsistence practices of Summit Island residents (to be discussed later).

The anatid group is generally more diverse than the other bird families. While common eiders are the most abundant, they only make up half of the anatid assemblage (n=234), with the other anatid taxa making up the same number of specimens (n=234). The alcid group includes six taxa with calculable MNI (small alcid, murre, pigeon guillemot, murrelet, rhinoceros auklet, and puffin), but murres are by far the most abundant (n=532 out of 551). The five remaining alcid taxa make up 3% NISP of the identified specimens for that bird group (n=19).

Indicators of Seasonality: Juvenile Bird Specimens and Medullary Bone

The presence of medullary bone in the endosteal cavities of female bird bones is a good indicator of what time of year site residents inhabited Summit Island. Medullary bone is a short-term build-up of calcium in the bones of breeding female birds to support the development of strong eggshells. It is present shortly before and after egg production (Dacke et al. 1993). Of course, the timing of laying eggs varies by species and latitude, but most often occurs in the spring and early summer (Serjeantson 2009).

Specimens containing medullary bone were present in extremely low abundances in Early Norton I and Early Norton II. In both components, these specimens made up between <1% and 1% of the identified bird specimens (Table 27). Medullary bone is present in common eider (n=4), murre (n=1), and puffin (n=2) bones. This means that minimally, based on murre, common eider, and puffin nesting habits, Early Norton I and Early Norton II peoples harvested the birds in May and June (Dragoo et al. 2011; Okonek et al. 2007, 2008, 2009; Okonek and Snively 2005, 2006; SDJVP 2009; Sell and Weiss 2010, 2011; Weiss and Sell 2013).

Table 27. Count of Specimens with Medullary Bone (NISP)

	Early Norton I		Early Norton II	
Taxon	**NISP**	**MNI**	**NISP**	**MNI**
common eider	2	1	2	1
murre	1	1		
puffin	2	1		
Total	**5**	**3**	**2**	**1**

Juvenile bird bones, which indicate when young birds are in their early life stages, are also reliable gauges of seasonality. Birds have a very short time frame when their bones display immaturity, ranging from two weeks to two or three months after hatching, which typically occurs in the summer until fall migration (Dacke et al. 1993; Denlinger 2006; Dragoo et al. 2011; Ehrlich et al. 1988; Casperson 2009, 2012; Serjeantson 2009). Juvenile bird bone specimens were present in low abundances in Early Norton II and Late Norton, between 1% (n=6)) and 8% (n=41), respectively. These juvenile specimens were identified as cormorant (n=43), duck (n=1), and common eider (n=3, Table 28).

Abundances are too low to have any significance with the exception of the cormorant specimens from Late Norton. The immature specimens identified in this component comprise more than half of the Late Norton cormorant sub-assemblage (55%, n=40), suggesting that the most recent site residents targeted young individuals. The specimens are large, near adult proportions, but with flared epiphyses, which suggests that site residents targeted large fledglings that were unable to fly. Based on cormorant behavior in the vicinity today, this suggests that site residents harvested young cormorants during in the months of August and October (Dragoo et al. 2011; Okonek et al. 2007, 2008, 2009; Okonek and Snively 2005, 2006; Sell and Weiss 2010, 2011; Weiss and Sell 2013).

Table 28. Count of Juvenile Bird Bone Specimens (NISP)

	Early Norton II		Late Norton	
Taxon	**NISP**	**MNI**	**NISP**	**MNI**
cormorant	3	1	40	
duck			1	1
common eider	3	1		
Total	**6**	**2**	**2**	**1**

Relative Abundance of Mammals by Component

For NISP, the most abundant mammals in Early Norton I include walrus (43%, n=181), small seals (20%, n=84), and bearded seals (17%, n=73). Terrestrial mammals including fox, beaver, and caribou make up 15% of the sample (n=65). The remaining marine mammal taxa make up 5% (n=19), and include specimens identified as Phocidae (large and small hair seals) and Cetacean (whale).

In Early Norton II, walrus abundance decreased drastically to 4% (n=16), while small seal abundance increased to 84% (n=315). Bearded seals decreased in abundance to 7% (n=28). Terrestrial mammals decreased in abundance to 4% (n=14) and included only marmot and fox (no caribou). Other marine mammals including Phocidae decreased to 1% of the sample (n=2).

In Late Norton, walrus abundance increased minimally to 15% (n=25), small seals still dominated the sample, but decreased in abundance to 48% (n=81), and bearded seals increased in abundance to 18% (n=30). Terrestrial mammals increased in abundance to 17% (n=29) and included caribou, river otter, and fox. Other marine mammals included Phocidae and increased in abundance to 4% (n=6). The change in abundance (%NISP) of the major mammal groups between the three components is represented in Figure 29.

A comparison of NISP and MNI for the mammals show somewhat different proportions and do not complement each other in the same way as the bird NISP and MNI abundances. When considering MNI, many of the marine mammal taxa are more evenly represented across the components than is expressed by counting specimens (Figure 30).

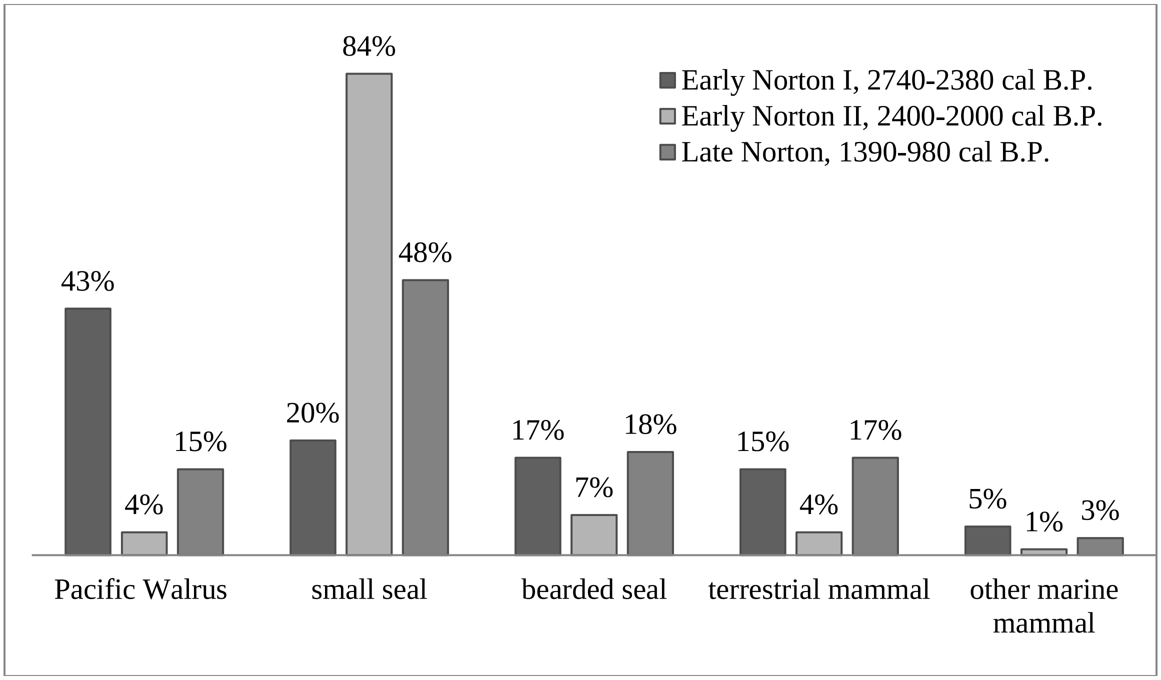

Figure 29. Relative abundance of walruses, small seals, bearded seals, terrestrial mammals and other marine mammals by component (%NISP). From left to right for each taxon, Early Norton I, Early Norton II, and Late Norton components.

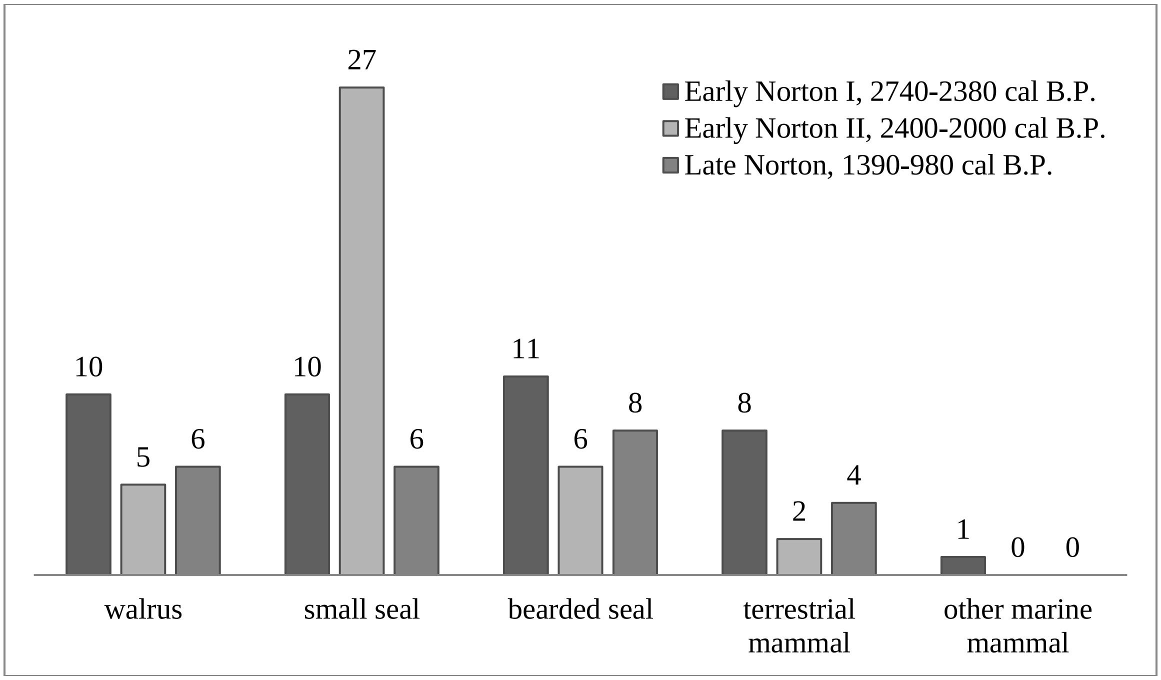

Figure 30. Abundance of walruses, small seals, bearded seals, terrestrial mammals, and other marine mammals by component, excluding *Phoca* spp. (MNI). From left to right for each taxon, Early Norton I, Early Norton II, and Late Norton components.

In Early Norton I, individual walrus (10 MNI) were abundant in equal amounts to small seals (10 MNI) and bearded seals (11 MNI). This is markedly different from the NISP that shows walrus to be significantly more abundant than any of the seals (43% versus 20% and 17% NISP). In Early Norton II, walrus abundance decreased by half (5 MNI) as did that of bearded seals (6 MNI). Small seals, on the other hand, increased almost three times (27 MNI) to that of small seal abundance in Early Norton I. The NISP in Early Norton II showed a similar substantial increase in small seal abundance (84%), but indicated that walrus abundance decreased significantly to a mere 4%, while bearded seals abundance decreased to 7%. By late Norton, small seal significance decreased to the lowest abundance (for any component) to 6 MNI. Walrus and bearded seals maintained similar abundances to those in Early Norton II, to 6 MNI and 8 MNI, respectively. In Late Norton, walrus, small seals, and bearded seals had equal representation. This is, again, different from the Late Norton NISP, which showed small seals as significantly more abundant (48%) than walrus (15%) and bearded seals (18%).

The NISP and MNI of terrestrial mammals (fox, marmot, beaver, river otter, and caribou) and other marine mammals (whale) shows similarly low abundances across the components, however, the proportions have shifted slightly. In Early Norton I, caribou had the highest number of individuals (4 MNI) with the lowest NISP (n=20), but in Late Norton had the highest NISP (n=26) and lowest number of individuals (2 MNI). There are no caribou faunal remains in Early Norton II, which stayed constant between NISP and MNI. Fox and beaver were minimally represented in Early Norton I as 3 MNI and 1 MNI, respectively. Marmot was present in very low abundances in Early Norton II (1 MNI), and river otter in Late Norton (1 MNI). Whale was present only in Early Norton I

(1 MNI), while Phocidae remains present in Early Norton II and Late Norton, while noticeable in NISP, do not have calculable MNIs.

Overall, MNI presents what seems to be a much more balanced interest in walrus, small seals, and bearded seals in Early Norton I (a 1:1:1 ratio), with a very noticeable spike in small seal hunting in Early Norton II (1:5:1 ratio), and Late Norton harvest levels (1:1:1 ratio) returning to the levels evidenced in Early Norton I. This assessment of MNI, however, is potentially misleading, given that only half of the specimens identified as small seal were used to calculate MNI.

Small Seal Abundance and Estimating MNI

Small seals compose half of the Summit Island mammal sub-assemblage (50%, n=480) and include specimens identified as *Phoca* sp., *Phoca largha/vitulina* (spotted/harbor seal), and *Phoca hispida* (ringed seal). Ringed seals (47%, n=226) and *Phoca* spp. (46%, n=220) are equally represented per NISP, while spotted/harbor seals are present in a much smaller abundance (7%, n=34, Figure 31).

As noted earlier in the chapter, I was unable to identify most of the *Phoca* sp. specimens to a lower taxonomic level based on their maturity, but given the abundance of specimens identified as ringed seals, it is likely that most of the *Phoca* sp. specimens are ringed seals (and fewer are spotted/harbor seals). If this were the case, ringed seals could make up to 93% of the small seal specimens, and proportions of ringed seal abundance (NISP and MNI) would be quite a bit higher than what is currently calculated. In general, MNI vastly underrepresents small seals in each component. Combining *Phoca* sp., spotted/harbor seal, and ringed seal into one taxonomic group increased small seal NISP by almost 50%, and adjusting the MNI to account for the 220 NISP of *Phoca* sp. should provide a more accurate depiction of marine mammal abundance in the Summit Island faunal assemblage.

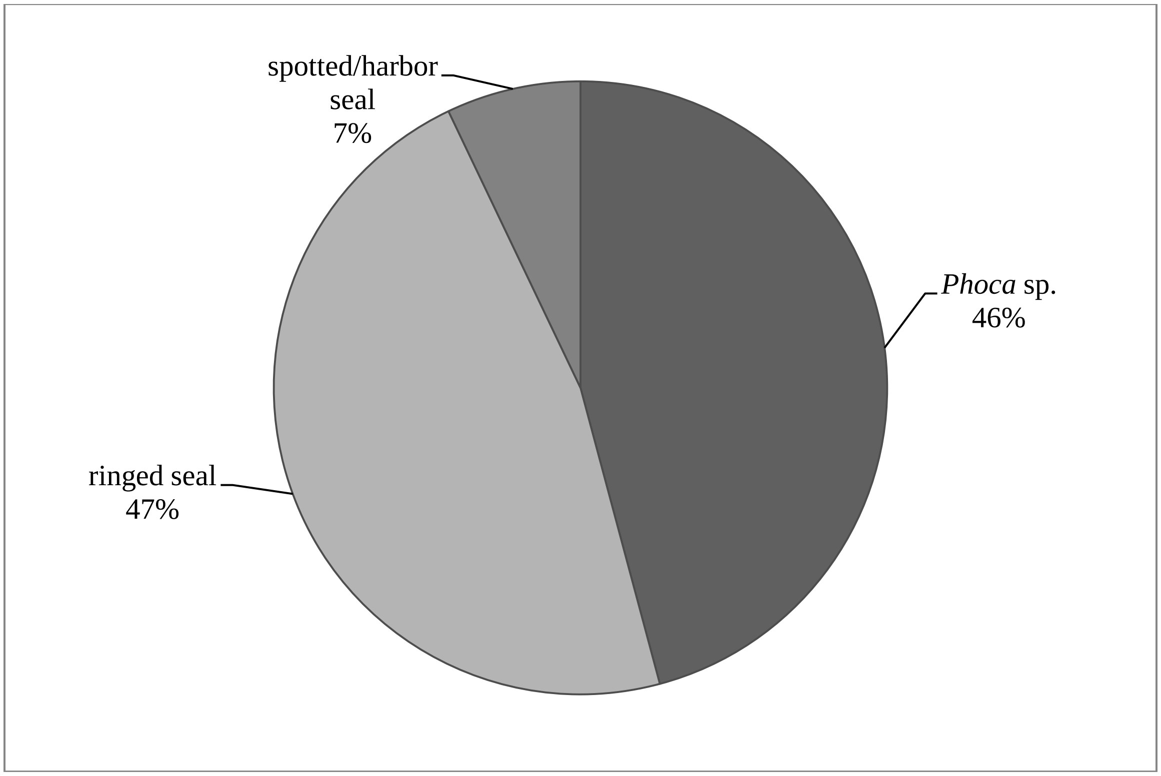

Figure 31. Relative abundance of small seals (n=480) including *Phoca* spp., ringed seals, and spotted/harbor seals (%NISP).

A logical way to estimate MNI for the small seal group that includes the *Phoca* sp. specimens would be to calculate the ratio of NISP to MNI for spotted/harbor seals and ringed seals per component, and then apply this ratio to the *Phoca* sp. specimens (Table 29). In each component, the NISP to MNI ratio for spotted/harbor seals and ringed seals range between 0.14 and 0.3. Applying this ratio to the *Phoca* sp. specimens resulted in estimates of 11 to 18 MNI of additional small seals per component. This method used a much lower ratio to calculate small seal MNI than that for NISP (~50%), and can be cautiously applied to adjust small seal MNI. Calculating MNI in this way is not without problems, because I did not analyze whether elements are evenly represented in the *Phoca* sp., spotted/harbor seal, and ringed seal sub-assemblages. Even with this caveat, this estimate is conservative, but provides a better assessment of small seal abundance given the very high number of specimens identified as *Phoca* sp. (n=220) in comparison to those identified as spotted/harbor seal and ringed seal (n=260).

Table 29. MNI Estimates with and without *Phoca* spp.

Current MNI	Early Norton I			Early Norton II			Late Norton		
Taxon	**MNI**	**NISP**	**Ratio**	**MNI**	**NISP**	**Ratio**	**MNI**	**NISP**	**Ratio**
Phoca spp.		44			115			61	
spotted/harbor seal	3	8	0.4	4	20	0.2	2	6	0.3
ringed seal	7	32	0.2	23	180	0.1	4	14	0.3
	10	**40**	**0.3**	**27**	**200**	**0.14**	**6**	**20**	**0.3**
Revised MNI									
Phoca spp.	*11*	44	0.3	*16*	115	0.14	*18*	61	0.3
spotted/harbor seal	3	8		4	20		2	6	
ringed seal	7	32		23	180		4	14	
	21	**84**	**0.3**	**43**	**315**	**0.14**	**24**	**81**	**0.3**

With the revised MNI for small seals, proportions of mammal abundance by component shift considerably and show a consistent trend of harvesting mostly small seals with lesser, but regular numbers of walrus and bearded seals throughout the Late Holocene (Figure 32). Small seals were by far the most abundant mammal represented in Early Norton I (21 MNI), Early Norton II (43 MNI), and Late Norton (24 MNI). Summit Island residents harvested the greatest proportion of walrus and bearded seals in Early Norton I (10 MNI and 11 MNI, respectively), decreased the proportion of these species by half in Early Norton II (5 MNI and 6 MNI, respectively) and continued this trend into Late Norton (6 MNI and 8 MNI, respectively). In Early Norton I, site residents harvested twice as many small seals as walrus and bearded seals, as represented in these samples. The Early Norton II sample shows twice the proportion of small seals, and fewer walrus and bearded seals. In Early Norton II, site residents were harvesting small seals seven times more often than walrus and bearded seals. That being said, however, the harvest of walrus and bearded seals persisted in Early Norton II and this trend continued through Late Norton. Walrus and bearded seal abundances remained consistent between Early Norton II and Late Norton, while small seal abundance decreased to Early Norton I levels. Late Norton site residents still harvested small seals at a rate of three to four times more than bearded seals and walrus.

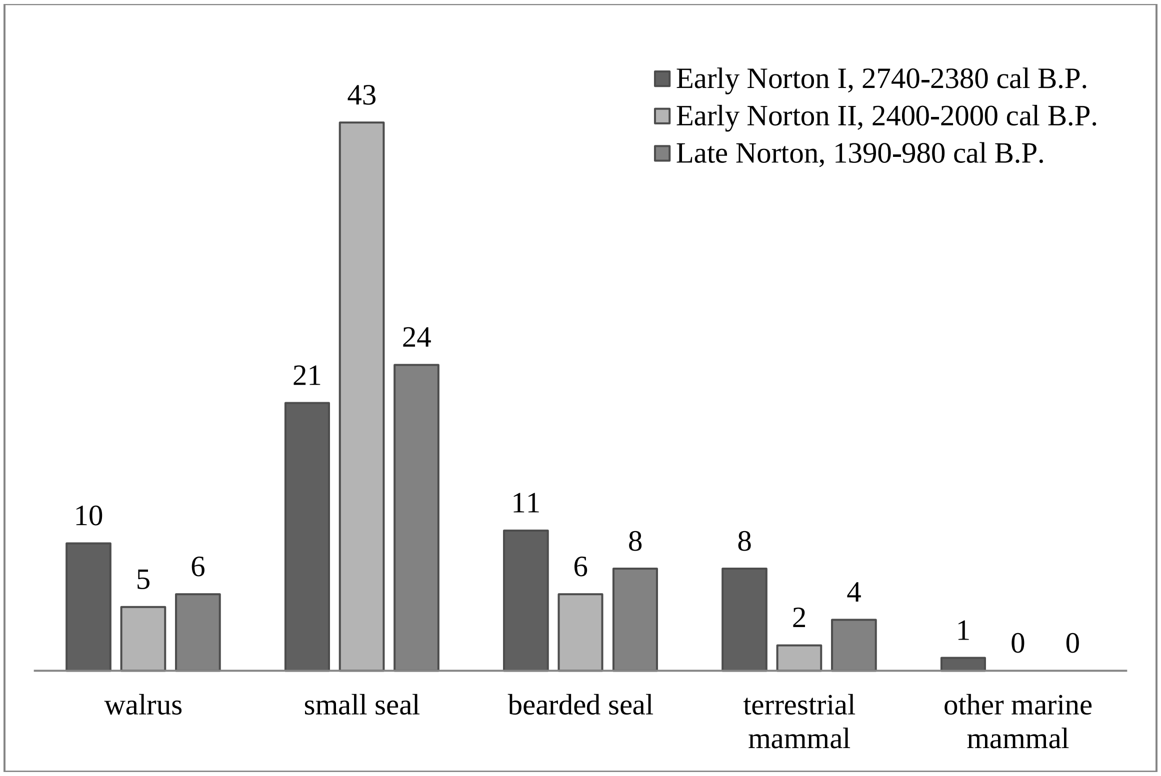

Figure 32. Abundance of walruses, small seals (including *Phoca* spp.), bearded seals, terrestrial mammals, and other marine mammals by component (MNI). From left to right for each taxon, Early Norton I, Early Norton II, and Late Norton components.

Age Classes of Marine Mammals

Ninety percent (545 out of 603) of walrus and spotted/harbor, ringed, and bearded seal specimens could be assigned to one of the following age groups: Yearling, Juvenile, and Young Adult/Adult. The NISP and MNI by age class, taxon, and component are presented for each taxon in Tables 30, 31, and 32. These tables show the number of specimens that have been assigned to an age category and were used to calculate MNI (Aged NISP) and the total NISP for each taxon including aged and un-aged specimens (Taxon NISP). I did not include *Phoca* sp. specimens in this exercise, which means I did not consider the estimated increase in small seal MNI when looking at the distribution of individuals across the age categories. It did not make sense to apply the ratios evenly across the age classes. Given the immaturity of the majority of the *Phoca* sp. specimens, however, it is very likely that Yearling ringed and spotted/harbor seals are underrepresented.

Table 30. Abundance of Yearling, Juvenile, and Young Adult/Adult Marine Mammals in Early Norton I (NISP and MNI)

	Yearling		**Juvenile**		**Young Adult/Adult**		**Aged**	**Taxon**
Taxon	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**NISP**	**NISP**
Pacific walrus	4	24	3	90	3	48	162	181
spotted/harbor seal	1	2	1	4	1	1	7	8
ringed seal	3	4	2	10	2	4	18	32
bearded seal	6	30	3	22	2	9	61	73
Total	**14**	**60**	**9**	**126**	**8**	**62**	**248**	**284**

Table 31. Abundance of Yearling, Juvenile, and Young Adult/Adult Marine Mammals in Early Norton II (NISP and MNI)

	Yearling		Juvenile		Young Adult/Adult		Aged	Taxon
Taxon	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**NISP**	**NISP**
Pacific walrus	2	4	1	1	2	9	14	16
spotted/harbor seal	1	12	2	5	1	3	20	20
ringed seal	5	16	12	116	6	43	175	180
bearded seal	2	6	2	6	2	11	23	28
Total	**10**	**38**	**17**	**128**	**11**	**66**	**232**	**244**

Table 32. Abundance of Yearling, Juvenile, and Young Adult/Adult Marine Mammals in Late Norton (NISP and MNI)

	Yearling		Juvenile		Young Adult/Adult		Aged	Taxon
Taxon	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**NISP**	**NISP**
Pacific walrus	2	7	2	3	2	13	23	25
spotted/harbor seal			1	3	1	3	6	6
ringed seal	2	2	1	5	1	2	9	14
bearded seal	5	14	1	6	2	7	27	30
Total	**9**	**23**	**5**	**17**	**6**	**25**	**65**	**75**

I used %MNI to compare changes in walrus and seal age class abundance between components and to control for uneven fragmentation among samples (Grayson 1984). One example of this includes the walrus specimens from Early Norton I, which ranges between 3-4 MNI and 24-90 NISP per age class. If %NISP were used, some of the walrus age classes would appear to have a much higher proportion of individuals than other classes. The use of %MNI, however, is not without problems. With MNI, many age categories have only 1 or 2 MNI per taxon. Calculating proportions (%MNI) with such low MNIs may suggest that one age class is more important than another, and changes between components are more apparent than real. For example, the Summit Island spotted/harbor seal NISP abundance of aged specimens is very low (n=33).

Spotted/harbor seals are present in all components, though not represented in every age class (0-2 MNI per age class). When looking at proportions (%MNI), a small sample can skew the importance (or presence) of one age group over another, when it is the presence or absence of a rare taxon (like the spotted/harbor seal) that is important to note. With these cautions in mind, Figures 33, 34, 35, and 36 provide visual comparisons of the relative abundance of Yearling, Juvenile, and Young Adult/Adult age classes of walrus, spotted/harbor seal, ringed seal, and bearded seal for the three components.

The low MNI of walrus in all three components does not support an obvious interpretation that Summit Island residents targeted individuals in a specific age class or that walrus hunting strategies changed over time (Figure 33). For the Yearling group, between two and four individuals are represented in all of the components, for the Juvenile group, there are between one and three individuals, and for the Young Adult/Adult group between two and three individuals are represented.

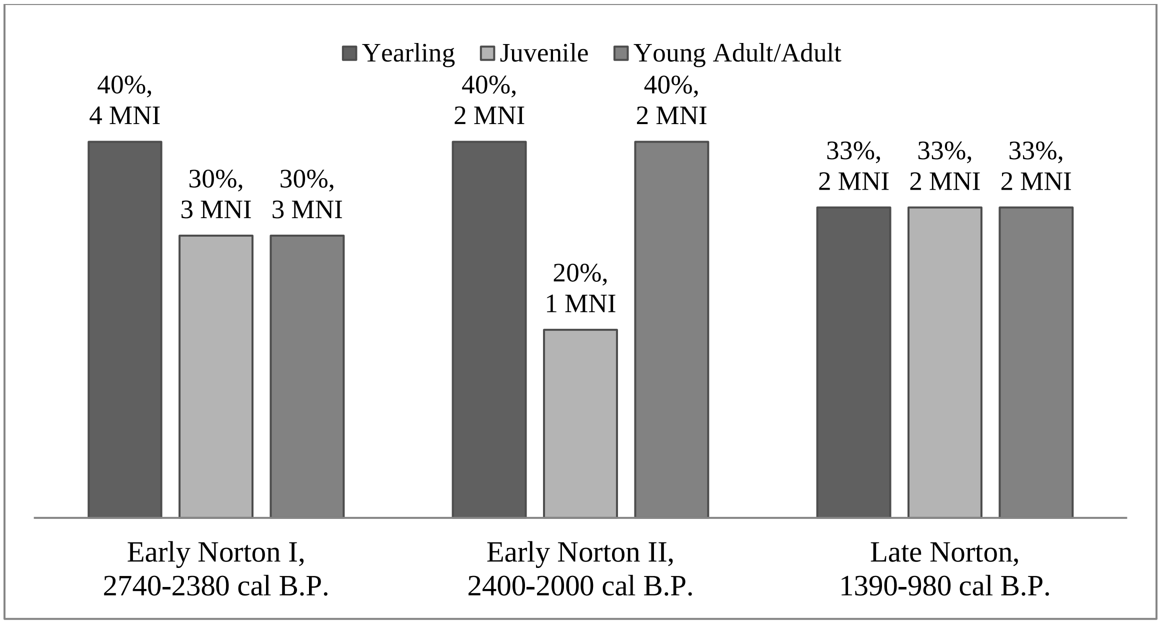

Figure 33. Relative abundance of walrus by age class and component (MNI and %MNI).

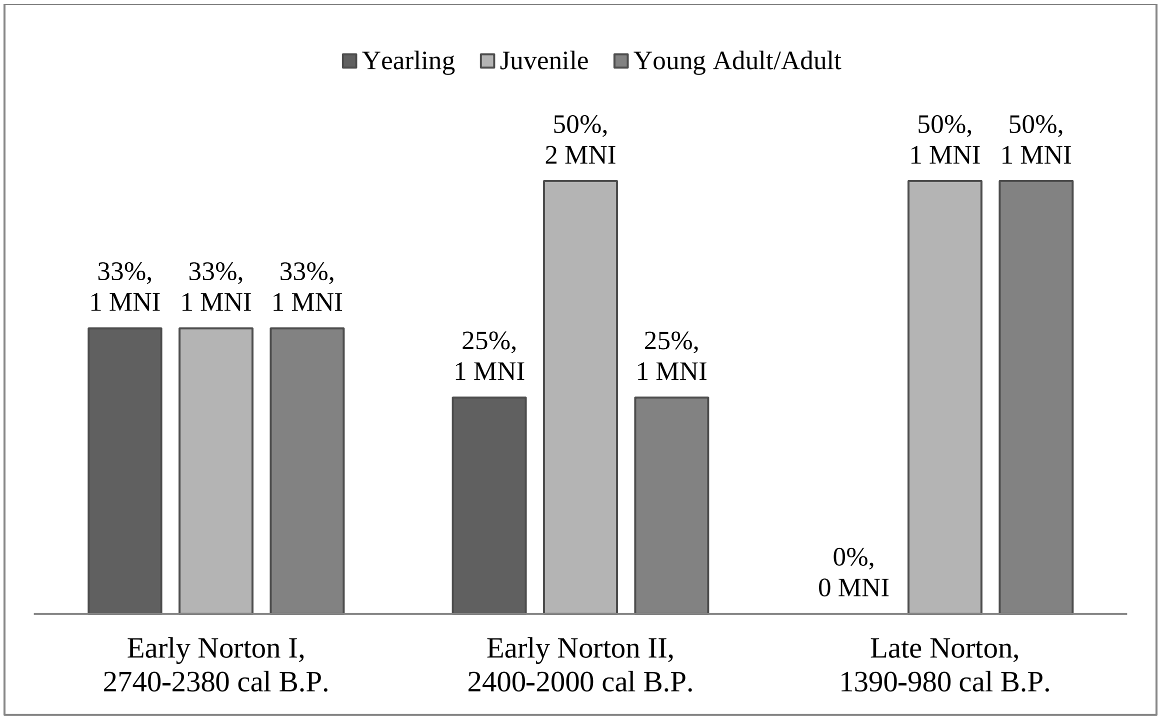

Figure 34. Relative abundance of spotted/harbor seal by age class and component (MNI and %MNI).

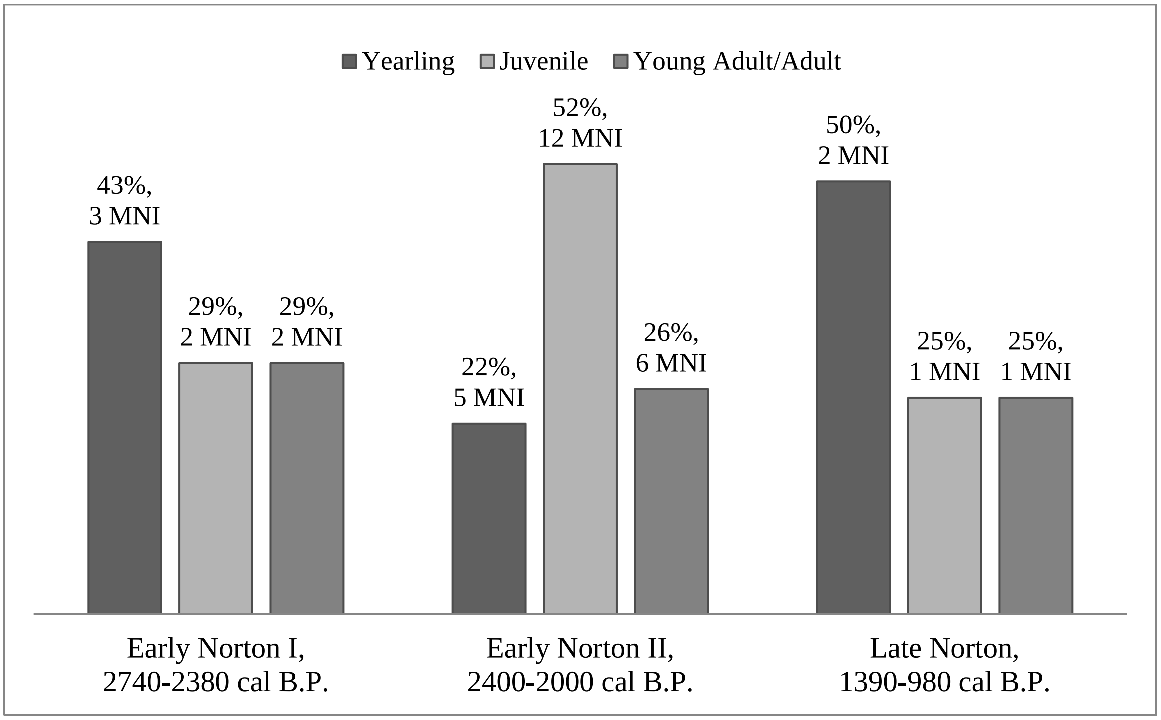

Figure 35. Relative abundance of ringed seal by age class and component (MNI and %MNI).

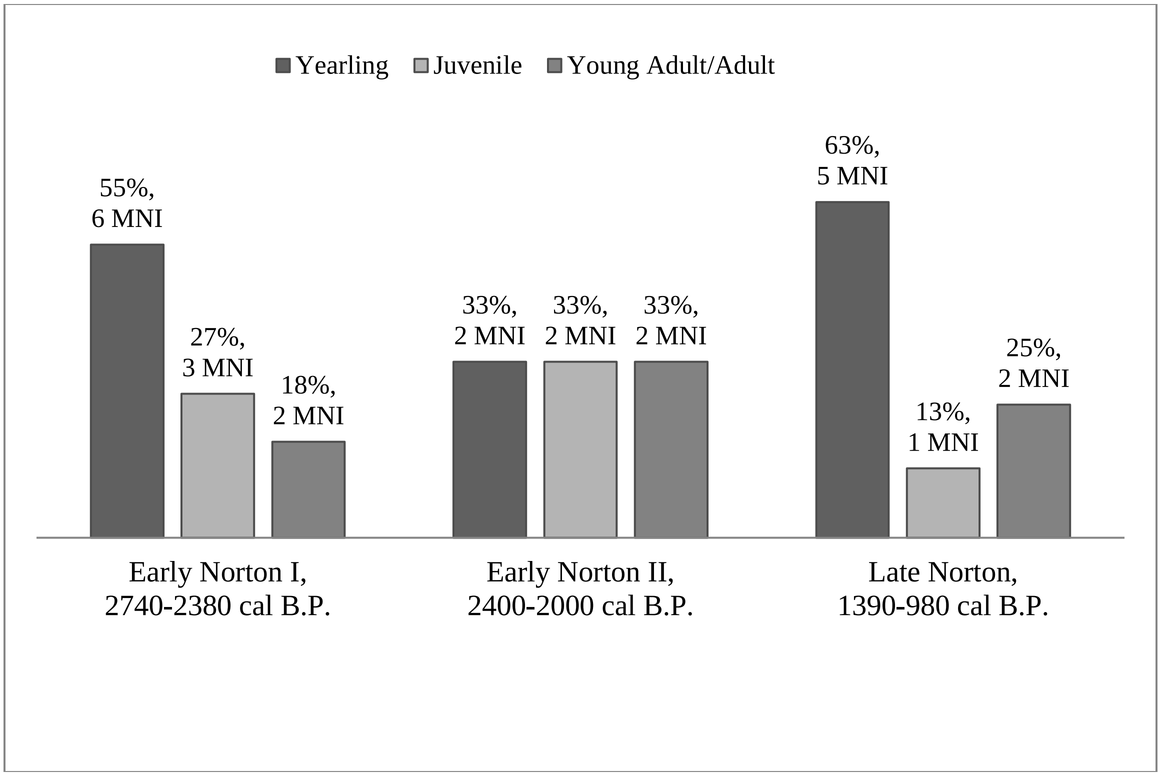

Figure 36. Relative abundance of bearded seal by age class and component (MNI and %MNI).

This trend suggests that Summit Island residents regularly procured low numbers of walrus, regardless of age, as a long-term subsistence strategy. Most, if not all of the specimens in the Young Adult/Adult age group, retained some epiphyseal fusion lines, however, suggesting that site residents may have targeted healthy breeding age individuals over elderly individuals.

Similar to walrus, spotted/harbor seals are present in each component in very low MNIs (between two and four individuals) and it is difficult to make any interpretations regarding changes in harvesting methods or interest in specific ages of spotted/harbor seals (Figure 34). For the Yearling group, between zero and one individuals are present, for the Juvenile group, between one and two individuals are present, and for the Young

Adult/Adult group one individual is present in each component. Similar to walrus, it seems likely that the residents of both sites regularly procured low numbers of spotted/harbor seal as a long-term subsistence strategy.

The low MNI of ringed seal in Early Norton I (7 MNI) and Late Norton (4 MNI), and the fairly even distribution between the age groups, again, do not indicate that site residents targeted one age class over another (Figure 35). Aged ringed seals in Early Norton II, however, total 23 MNI, which suggests that between 2400 and 2000 cal B.P., Summit Island residents intensively focused on harvesting ringed seals. Fifty-two percent of these individuals are included in the Juvenile age class (12 MNI), while 26% (6 MNI) are included in the Young Adult/Adult age class and 22% (5 MNI) are part of the Yearling age class. Site residents may have focused on procuring larger-bodied juvenile ringed seals due to availability (whether seasonal or local access). Juveniles may have been more accessible to Summit Island residents because they are not as ice dependent as mature seals and can be found in the shallows of Togiak Bay (Fall et al. 2013; USFWS 2008). As previously stated, immature seals are likely underrepresented in this exercise.

Bearded seals are present in low abundances in each component (Figure 36). There is, however, a noticeable trend in slightly higher MNIs in the Yearling age class in Early Norton I and Late Norton. In both components, yearling bearded seals represent between 55% and 63% of the total individuals. While the number of bearded seal individuals per component is low enough that this trend is not statistically significant (between 6 MNI and 11 MNI), it is possible that site residents focused on harvesting young bearded seals. This could be because immature bearded seals were more accessible than adults near Summit Island. Yearlings are independent within a month of birth, and known to frequent nearshore waters like Togiak Bay, rather than the edge of the sea ice like adults (Fall et al. 2013; USFWS 2008).

Indicators of Seasonality: Yearling Marine Mammal Specimens

Immature seal bones, particularly those that came from an individual that was one-year-old or younger at the time of death, are good indicators of seasonality. Seals have consistent mating and birthing patterns as outlined in Table 33 (ADF&G 2008; Fall et al. 2013; Fay 1982).

Table 33. Birth Month of Marine Mammals Represented in the Summit Island Faunal Assemblage

Taxon	Birth Month and Location	Reference
walrus	Late April-early May, on the ice	ADFG (2008); Fay (1982)
bearded seal	Late April-early May, on the ice	ADFG (2008)
harbor seal	May-mid-July, on land or glacier	ADFG (2008)
spotted seal	April-May, on sea ice	ADFG (2008)
ringed seal	March-April, in subnivean	ADFG (2008)

Ringed seals are born the earliest every year, in the months of March and April (ADF&G 2008). Spotted and bearded seals are born slightly later, at the end of April through May. All three of these species give birth on the ice and unweaned young (0-2 months) will be found on the ice for one to two months after birth (ADF&G 2008). The pups nurse for one to two months and typically double in weight before the mother leaves to breed. Bearded seals can weigh up to 190 lbs. in one month of nursing (and are on their own), while the smallest of the seals, the ringed seal, will weigh 20 lbs. within two months of birth. Harbor seals are born later, between the months of May and July, typically on land, but also on glacial ice (rather than sea ice). Harbor seal pups are not as helpless as the ice seals, and can swim with their mothers within a few hours of birth. Walrus give birth during spring migration, in late April to early May, when they head north with receding sea ice (ADF&G 2008; Fay 1982). Females and young are the most ice dependent, and will move with the ice pack. Immature walrus stay with their mothers for approximately two years after birth (Fay 1982; ADF&G 2008).

I had access to several comparative seal and walrus specimens that were aged one year or younger, with their date of death recorded. This allowed me to attain a fine level of aging for the Yearling specimens (n=121). The NISP and MNI for the Summit Island yearling marine mammals are listed by component in Tables 34, 35, and 36. I grouped Yearlings into three categories: 0-2 months (Fetal/Newborn/Nursing Pup), 3-7 months (Weaned Pup), and 8-12 months (Yearling/First Molt). The first age bracket, 0-2 months is based on life history, in that the young are typically unweaned, and dependent on their mothers (ADF&G 2008). The bones of such young individuals also display extreme immaturity, in that the epiphyses and the articular ends of the diaphyses are amorphous, without noticeably distinct articular surfaces. Specimens in the second category, 3-7 months, and third category, 8-12 months, are similar in size and degree of element maturity, based on my consideration of the comparative specimens and application of Stora’s (2000) methodology. These age categories also loosely match spring, summer/fall, and winter deaths, respectively.

Table 34. Yearling Marine Mammal Abundance (NISP and MNI) in Early Norton I

Common Name	0-2 months		3-7 months		8-12 months		Total NISP	
	NISP	MNI	NISP	MNI	NISP	MNI		Notes
walrus	1	1	23	3			24	2 MNI is 3 mo., 1 is 6+mo.; 1 is 0-2 mo.
seal (phocid)								
small seal (*Phoca* spp.)	6		5		3		14	
spotted/harbor seal			2	1			2	
ringed seal			4	3			4	
bearded seal	11	2	19	2			30	All animals are 3 mo. or younger

Table 35. Yearling Marine Mammal Abundance (NISP and MNI) in Early Norton II

Common Name	0-2 months		3-7 months		8-12 months		Total NISP	
	NISP	MNI	NISP	MNI	NISP	MNI		Notes
walrus	1	1	3	1			4	1 MNI in second category is 6 mo.
seal (phocid)	2						2	
small seal (*Phoca* spp.)	15		11		3		29	
spotted/harbor seal					12	1	12	
ringed seal	1	1	5	1	10	3	16	
bearded seal	4	1	2	1			6	All animals are 3 mo. or younger

Table 36. Yearling Marine Mammal Abundance (NISP and MNI) in Late Norton

Common Name	0-2 months		3-7 months		8-12 months		Total NISP	
	NISP	MNI	NISP	MNI	NISP	MNI		Notes
walrus	4	1	3	1			7	1 MNI in second category is 6 months
seal (phocid)	1						1	
small seal (*Phoca* spp.)	14		4		2		20	
spotted/harbor seal								
ringed seal			1	1	1	1	2	
bearded seal	6	2	8	3			14	All 0-3 months, except a 6 month old

In all three components, walrus yearlings between the ages of 0-2 months and 3-7 months are represented in low abundances. Each component has 1 MNI in the 0-2 months age category and 1-3 MNI in the 3-7 months age category. The individuals in the 3-7 months age category are either three months of age or six months of age. These individuals would have been harvested throughout the months of April through June and then from September through October. There are no individuals aged in the 8-12 months category, which suggests that people were not hunting young walrus during the winter months, between October and March. This indicates that throughout each component, Summit Island residents regularly harvested very young walrus in the spring through the early summer and again in the fall.

Yearling spotted/harbor seals are represented in very low abundances in Early Norton I and Early Norton II. Each component has 1 MNI. In Early Norton I, one individual is included the 3-7 months age category, which indicates a summer to fall harvest between July and October. In Early Norton II, the one individual is placed in the 8-12 months age category, which suggests a fall or winter harvest, between November and February. Yearling ringed seals are present in each component in low abundances.

In Early Norton I, one individual is placed in the 3-7 months age category, suggesting a May to August harvest. In Early Norton II, one ringed seal is included in the 0-2 months age category, one in the 3-7 months age category, and three in the 8-12 months age category. This low but consistent abundance across the age categories suggest that Early Norton II site residents depended on yearling ringed seals from the time of their birth in March-April throughout the summer, fall, and into the winter months. In Late Norton, one individual is included in the 3-7 months age category and one in the 8-12 months age category, indicating summer, fall, and winter harvests of ringed seals.

Yearling bearded seals are present in all three components in the 0-2 months and 3-7 months categories. All but one of the bearded seals were aged three months or less. In Early Norton I and Early Norton II people likely harvested yearling bearded seals in low numbers throughout the late spring and early summer. In the Late Norton era, one individual is aged to six months, and the other four are three months or less. Site residents likely harvested the yearlings in late spring to early summer and again, in fall.

Yearling Phocids and Phoca *spp*.

I also included phocid (n=3) and *Phoca* sp. (n=63) specimens in Tables 34, 35, and 36 to show that there are many more immature seal specimens that could be aged within the Yearling sub-categories than those that I could identify to species. These specimens are more abundant than Yearling walrus (n=35), spotted/harbor seal (n=14), ringed seal (n=22), and bearded seal (n=50) specimens, which suggests that Yearling seals are underrepresented when applying MNI. As discussed previously, based on the high abundance of ringed seal specimens in the Summit Island faunal assemblage, it is probable that most *Phoca* sp. specimens came from ringed seals. If the small seal (*Phoca* sp.) specimens are combined with the ringed seal specimens, small seal abundance increases across the three components and within age categories (Table 37).

Table 37. Ringed Seal Abundance versus Combined *Phoca* sp. and Ringed Seal Abundance by Component

	0-2 months		**3-7 months**		**8-12 months**	
Component	**ringed seal MNI**	**combined MNI**	**ringed seal MNI**	**combined MNI**	**ringed seal MNI**	**combined MNI**
Early Norton I		2	3	4		2
Early Norton II	1	4	1	3	3	3
Late Norton		3	1	2	1	1
Total	**1**	**9**	**5**	**9**	**4**	**6**

While *Phoca* sp. specimens cannot be used to calculate higher MNIs for ringed seals (or spotted/harbor seals), the "combined MNI" in Table 37, provides some evidence that Yearling small seals may be underrepresented quite a bit due to my inability to identify more *Phoca* sp. specimens to species. Given these numbers, it is also probable that Summit Island residents harvested more Yearling small seals than is evident in Figures 33-36 and Tables 34-36.

What the Yearling *Phoca* sp. specimens can provide, however, is a bit more data that can be used to infer seasonality. The majority of the *Phoca* sp. specimens (n=35) fall within the 0-2 months category, which shows more evidence of spring sealing in all three components (as do the three phocid specimens). Twenty specimens belong in the 3-7 months categories, and provide secondary data that suggests summer-fall sealing occurred in all three components as well. A much smaller number (n=8) of the *Phoca* sp. specimens are included in the 8-12 months category. All three components have 8-12 month *Phoca* sp. specimens, which indicate fall and winter sealing.

Caribou in the Summit Island Faunal Assemblage

Several researchers have promoted the idea that caribou was central to Norton subsistence practices, for food and by-products, even in coastal settings where numerous species of marine animals were available (Bailey 1991; Bockstoce 1979; Giddings 1964; Dumond 2000b, 2016; Nowak 1982; Shaw 1982b, 1983). While researchers have presented many lines of indirect evidence to support this assessment, in reality, worked and unworked caribou remains are not well represented in Norton components, particularly in comparison to marine mammal bone and ivory from the same assemblages (see Chapter III). The presence of caribou in archaeological assemblages from Iyatayet, the Manokinak Site, Nunivak Island, and Hagemeister Island indicates Norton peoples had some interest in the terrestrial species, but provides only limited support that Norton peoples focused on caribou to the exclusion of other taxa.

To assess the importance of caribou to Summit Island residents, I took note of all caribou specimens, even those that I considered unidentifiable (UNI) given my identification protocol. Table 38 presents the number of caribou specimens I located in the Summit Island faunal assemblage. It includes caribou specimens that I considered identifiable (Caribou ID) and unidentifiable (Caribou UNI, i.e., not identifiable to element), which I compared to the total identifiable mammal specimens (Mammal ID) and unidentified mammal specimens (Mammal UNI). These counts are grouped by component to examine whether caribou abundances change over time.

Table 38. Identified and "Unidentified" Caribou Abundance (NISP and %NISP) by Component

	Caribou ID	Mammal ID	Caribou UNI	Mammal UNI	Total Caribou		Total Mammal
Component	**NISP**	**NISP**	**NISP**	**NISP**	**NISP**	**%NISP**	**NISP**
Early Norton I	20	422	93	2,957	113	3	3,379
Early Norton II		375	7	2,069	7	<1	2,444
Late Norton	26	171	105	1,361	131	9	1,532
Total	**46**	**968**	**205**	**6,387**	**251**	**3**	**7,355**

Caribou specimens make up 3% (n=251) of the Summit Island faunal assemblage (including UNI and ID specimens). In the identifiable category, caribou make up 5% (n=46) of the sub-assemblage, and 3% (n=205) of the unidentified sub-assemblage. In Early Norton I, caribou represented 3-5% of the identifiable and unidentified specimens (n=20 and 93, respectively). They were almost non-existent in Early Norton II, with only seven unidentified specimens recovered (<1% NISP). Caribou was better represented in Late Norton, with specimens making up 8-15% (n=105 and 26, respectively) of the unidentified and identifiable specimens.

To assess the importance of caribou as a material for making hunting implements, tools or other objects, I counted the total number of organic artifacts that could reasonably be labeled as a tool, preform, blank, or had signs of being prepared or used for potential tool-making (needle blanks removal marks on a bone or groove and snap scoring present). In Table 39, the counts are listed for caribou, marine mammal, bird, and UNI mammal by site. UNI mammals include unidentifiable mammal specimens that I could not assign to caribou, another taxon, or generic marine mammal. Non-caribou terrestrial mammal bones are present in negligible amounts and do not appear to have been used in any significant quantity for making objects at Summit Island (though some may be identified with further analysis of the worked organic objects).

Table 39. Count of Organic Objects by Component (NISP)

Site	Caribou	Marine Mammal	Bird	UNI Mammal	Total
Early Norton I	8	35	6	52	101
Early Norton II	5	12	5	36	58
Late Norton	5	16	2	38	61
Total	**18**	**63**	**13**	**126**	**220**

Worked caribou objects are represented in extremely low, but consistent abundances, between 5 and 8 NISP per component. Of the worked objects, caribou specimens represent 8% (5 to 8 NISP) of the sub-assemblage in each component, while bird specimens represent 3-9% (2 to 6 NISP). Marine mammal specimens appear to have much more importance as a raw material for constructing organic artifacts at both sites, between 21 and 35% (12 to 55 NISP). Many of the worked objects are considered UNI mammal, 51-63% (38 to 52 NISP). It is possible that more caribou specimens are present in the worked object assemblage, mislabeled as UNI Mammal. See Figure 37 for a visual representation of worked antler, bone, and ivory object by animal class.

Overall, caribou is very minimally represented in the Summit Island faunal assemblage, as faunal remains or as worked objects. It is probable that Summit Island residents did not consider caribou a primary resource when they lived on the island, likely due to the accessibility of and preference for marine mammals and birds from this location.

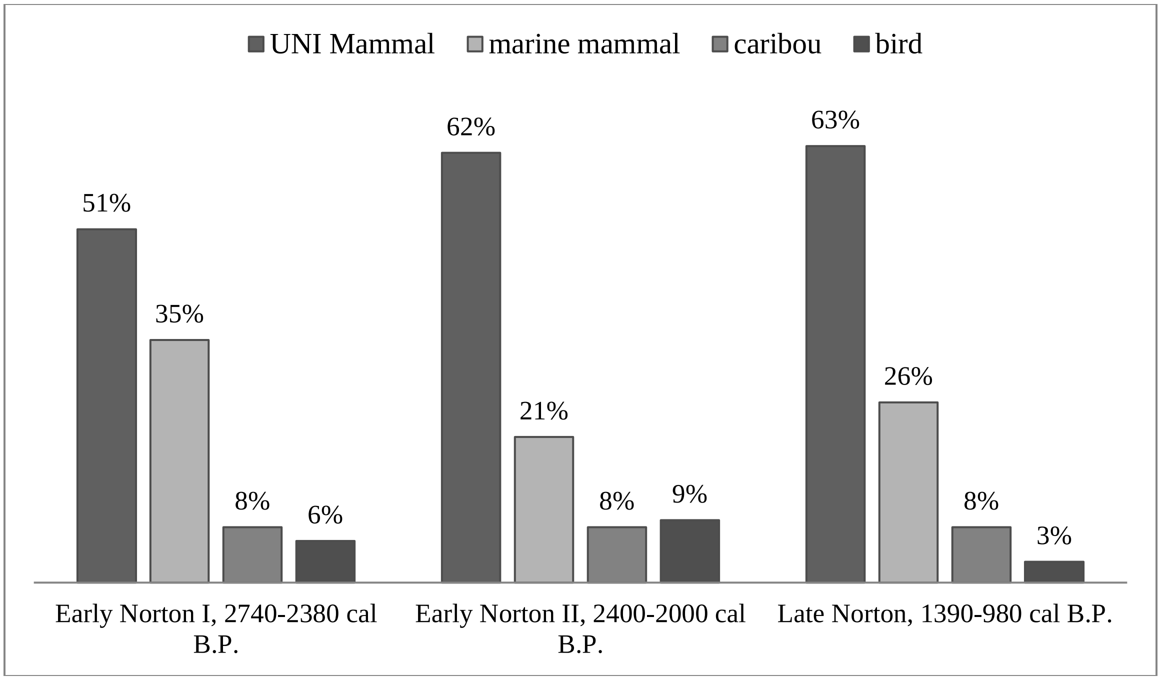

Figure 37. Worked animal bone, antler, and ivory relative abundance for Early Norton I, Early Norton II, and Late Norton (%NISP).

CHAPTER VI

SEABIRDS, SEALS, AND WALRUS: THE MAINSTAYS OF SUMMIT ISLAND LIFE

This chapter explores the life history and behavioral patterns of the most abundant taxa represented in the Summit Island faunal assemblage. I also include some information on pre-contact, historic, and contemporary subsistence practices related to these animals. My intent here is to provide context for where, when, and how Summit Island residents would have harvested these animals.

Government agencies responsible for managing animal populations regularly collect biological data and provide the most accurate information on historic and extant animal behavior. Such data can cautiously be applied to understanding Late Holocene animal populations, even though pre-contact, historic, and extant animal populations have different circumstances affecting their behavior, population, and distribution (Casperson 2009; Crowell et al. 2003; Denlinger 2006). The same agencies, notably the Alaska Department of Fish and Game (ADF&G) and U.S. Fish and Wildlife Service (USFWS), also gather subsistence harvest data from rural Alaska Native communities, typically published in technical reports. The information collected provides much data on when and where certain animals are available, but more importantly, these reports provide information on the long-term and historic subsistence practices of rural Alaskans, most of whom trace their ancestry to pre-contact Thule populations.

Many of these reports provide data on contemporary subsistence practices shaped by the recent industrialization, politicization, and bureaucratization of rural subsistence practices, in addition to information on long-standing traditional practices employed by historic Alaska Native communities before widespread implementation of regulatory policy and the migration of non-indigenous people to Alaska by the mid-19th century. The impact that wildlife management policies have had on contemporary Alaska Native subsistence practices cannot be overstated. An obvious example includes the nearly 40-year restriction on hunting walrus within the Walrus Islands State Game Sanctuary, and the adjustments local communities have made to legally procure walrus (Fall et al. 1991). Agency technical reports tend to highlight the obvious changes in rural subsistence practices between "what is" and "what was," which provide narratives on long-term human behavior that can be critically applied to interpret patterns derived from the study of archaeological materials.

For the purposes of discussing animal behavior in the project area, spring takes place in April and May, summer in June and July, fall in August through October, and winter in November through March (USFWS 2013b). In northwest Bristol Bay, seasons are defined by the extent of sea ice. Spring break-up typically occurs in April, but can occur as late as May, while the forming of sea ice, typically in December, indicates winter (USFWS 1986, 2008). In recent years, Togiak hunters have noted that sea ice distribution has changed since the 1980s (Fall et al. 2013:284). In the 1980s and before, spring break-up did not start until the end of May, but now sea ice is gone by April (Kowta 1963; Fall et al. 2013; Fay 1982; Schumacher et al. 1979; Sinnott 1992). Changes in sea ice extent have impacts on the seasonal distribution and availability of marine animals, particularly those represented in the Summit Island faunal assemblage.

Murres

Alcids, or seabirds, are the most abundant bird family represented in the Summit Island faunal assemblage (n=551). Of these, murres make up the majority (97%, n=532). There are two species of murres potentially represented in the faunal assemblage, the common murre (*Uria aalge*) and thick-billed murre (*U. lomvia*). Both these species are plentiful in Arctic and Subarctic waters, with global population estimates in the millions (Denlinger 2006). Common and thick-billed murres are morphologically similar, have overlapping distribution, and nest together in mixed species colonies (Denlinger 2006; Ehrlich et al. 1988). Given the similarity in behavior and distribution, it is adequate to identify the specimens as "murre" rather than attempt to assign them to a species. I did not have access to any thick-billed murre comparative specimens, which influenced my decision to be conservative with identifications.

Murres are present in large, stable numbers, of up to 500,000 individuals in the Walrus Islands during the spring and summer (Denlinger 2006; Sibley 2006, 2009; USFWS 2012, 2013b). They are by far the most numerous birds to inhabit the Walrus Islands. In April, murres flock by the thousands to one of several bird colonies in Bristol Bay to prepare for breeding and nesting on cliff faces and rocky outcrops (Figure 38). Between 20,000 and 200,000 are estimated per colony on all of the islands in the Walrus Islands chain, with the exception of Summit Island (USFWS 2012). The Summit Island bird colony is home to cormorants and pigeon guillemots, but not murres (USFWS 2012).

Murres have strong fidelity to nesting colonies and will reuse the same one throughout their lives (Ehrlich et al. 1988:197).

At two established bird colonies, Cape Pierce (95 km west of Summit Island) and Round Island (26 km south), murres lay their first eggs in mid-June. The first chicks of the season hatch in mid-July, and both adults protect and feed the hatchling at the nesting site for approximately 20 days (Olsson et al. 1999). By the end of July to early August, immature murres hop off the nesting ledge and many head out to sea to forage (Dragoo et al. 2011; Okonek et al. 2007, 2008, 2009; Okonek and Snively 2005, 2006; Sell and Weiss 2010, 2011; Weiss and Sell 2013). Immature murres are one-quarter of their full weight when they leave the nest and adult males tend them for several weeks throughout the fall (and molting) until they fledge (Denlinger 2006; Ehrlich et al. 1988; Olsson et al. 1999).

Frederiksen et al. (2016) determined that male murres and immature chicks sometimes remain in waters close to the colonies for several weeks after the chicks have left the nest before they migrate to open sea. Other males and dependent young stay close to the colonies until the immature murres can fly by the end of fall migration. Female murres, which do not care for young in open water, are more likely to migrate out of the area quickly, and molt out at sea. Based on this behavior, murres are less abundant in coastal areas after chicks leave the nest (mid-July/August), and will not be found in large numbers at the colonies. Adult and chick murres, however, will still be common in coastal waters throughout the Walrus Islands through fall migration.

Figure 38. Extant bird colonies in northwest Bristol Bay. White dots represent colony locations (USWS 2012).

In the winter, murres congregate in large rafts of hundreds of thousands of birds, just beyond the extent of sea ice (Denlinger 2006:57). Because of their raft-forming behavior, murres are susceptible to high mortality rates in catastrophic events such as oil spills or extreme storms (Ehrlich et al. 1988; USDOI & ADF&G 1970). Murres are also extremely sensitive to changes in the ocean ecosystem (Frederiksen et al. 2016; Olsson et al. 1999). Contemporary Alaska Native communities have characterized changes in seabird populations as “cyclical,” noting that murres “die-off” in significant numbers on an infrequent basis, with the most recent in Bristol Bay occurring in the late 1990s (Huntington et al. 2013:326).

Several instances of “wrecks” of murres, or large numbers of dead and dying murres blown onto beaches or far inland, have been documented throughout the murre range (USDOI & ADF&G 1970). In some instances, eyewitness accounts described beaches “black with dead birds” (USDOI & ADF&G 1970:2). In April 1970, at least 86,000 murres, still weak from wintering in the Bering Sea, were found dead and dying on the beaches of Bristol Bay (USDOI & ADF&G 1970:1). Scientists who documented the event, noted multiple signs of starvation, and hypothesized that the birds perished because a severe three-day storm had prevented the birds from eating when caloric intake was critical for them to recuperate from the winter. Such an extreme mortality event could decimate up to 20% of Bristol Bay’s extant murre population. While murres are quite prolific, such catastrophic events could presumably wipe out an existing colony if all of the birds that showed fidelity to the location were part of a mass mortality event. Such an event could potentially explain changes in murre abundance between components.

In Early Norton I, murre specimens were well represented in the Summit Island bird sub-assemblage (n=196, 46%). At least 11 individual murres (MNI) were represented. One specimen exhibited medullary bone, suggesting a late May to early June harvest of that individual. Two puffin specimens in the same component also exhibited medullary bone. Puffins inhabit mixed-species colonies and are found in much smaller numbers throughout the Walrus Islands (USFWS 2012). It is likely that site residents took murres and puffins from the same colony. Murres in general would have been most accessible during the spring and early summer months when they congregated in large colonies to breed and nest. The lack of juvenile specimens indicates that site residents must have harvested most of the murres before and during egg production, but not in significant numbers after hatching.

In the 1980s, Cup'ig elders explained historic cliff-hanging and netting techniques used to capture cliff-dwelling colony birds and their eggs (Hoffman 1990). In this method, a man would pound a stake in the ground at the edge of a cliff, tie a walrus skin rope around his waist, and then slowly lower onto different ledges, by using a second anchor rope until he located birds. This technique was very dangerous, requiring physical strength and prowess, and had to be limited to dry and sunny days to avoid slipping on guano-encrusted rocks. Nunivak Island men gathered eggs in the spring and summer before hatching and carried two woven baskets strapped to their waist to fill with eggs. The men typically captured cormorants and murres in groups by throwing a collapsing net that pinned 30-40 individuals per throw. They would hoist the net full of birds back up the cliff to the ledge where family members collected the catch and sent the net back down to the cliffhanger to procure more birds (Hoffman 1990:70). In this way, hunters could gather large numbers of birds in a relatively short time, but this technique would have a high personal cost if the cliffhanger were to lose control and hurtle hundreds of feet to the beach.

Murres have been important to Arctic and Subarctic peoples since at least 7,000 years ago (Casperson 2009, 2012; Causey et al. 2005; Hausler-Knecht 1991, 1993; Hoffman 1990; Moss and Bowers 2007; Naves 2015a; Paige et al. 2002; Pratt 1990; Serjeantson 2009; Schaaf 2015; Sloan 2014). Schaaf (2015) noted murre in the earliest components on Round Island (6310-4840 cal B.P.), while Casperson (2009, 2012) documented long-term extensive use of murres (cormorants and anatids as well) off the coast of Shelikof Strait in the Gulf of Alaska between 7500 and 4100 cal B.P. Ethnographic and subsistence data from Nunivak Island, Saint Lawrence Island, the Aleutians, and southeast Alaska shows that murre and other seabird eggs (as well as meat and skins) have been an important long-term resource to coastal Alaska Native communities (ADF&G 2016a; Hoffman 1990; Hunn et al. 2003; Moss 2007a; Naves and Zeller 2013; Pratt 1990). Murres are gregarious and can be captured in mass numbers, yet they are small with high fat content, and can be carried home with relative ease. They are easy to process because of their size, and can be smoked and stored as mostly whole birds (Russell and West 2003). Murre feathers and skins have also been sought after for making parkas (Pratt 1990). In contemporary Togiak, murre eggs continue to be a major resource that people share and trade within and between communities (Krieg et al. 2007). In recent decades, communities in northern Bristol Bay and the Yukon-Kuskokwim Delta harvested tens of thousands of murre and other seabird eggs on an annual basis (Naves

2015b; Paige and Wolf 1997; Wentworth 2007; Wolf and Paige 1998). It is likely that Early Norton I site residents targeted murres when both eggs and birds were available.

In Early Norton II, murres represented 5% of the bird sub-assemblage (n=18), which suggests that site residents either did not visit large murre colonies or did not have access to murres. Only three individuals (MNI) were represented in this component. This is quite different from the subsistence strategies of Early Norton I as well as Late Norton residents, in which murres represented 65% of the bird specimens (n=318). At least 26 individual murres (MNI) were represented in the Late Norton component. The high abundance of murre specimens in the most recent component suggests that site residents targeted murres and their eggs during the spring and summer months, much like people in Early Norton I. The significant decrease in murre harvest in Early Norton II may be related to multiple factors.

One possibility is that severe spring storms decimated Early Norton II murre populations that resulted in a series of mass mortality events. If 20% or more of Bristol Bay's murre populations were wiped out by severe weather events, Early Norton II site residents may not have been able to rely on nearby murre colonies. They would have had to shift their subsistence strategies to rely on other bird populations (as they did with sea ducks). The spike in murre abundance in Late Norton could be evidence of a rebound in the Bristol Bay murre population.

Sea Ducks

Anatids are the second most abundant bird family in the Summit Island faunal assemblage (37%, n=464). Of these, most are identified as sea ducks (78%, n=364).

While 13 taxa compose the anatid group, the common eider is most abundant sea duck represented in the Summit Island faunal assemblage (n=234, 25 MNI), followed by the white-winged scoter (n=69, 10 MNI), and long-tailed duck (n=36, 7 MNI). Sea ducks are typically marine-oriented for most of their lives and share similarities in behavior.

Common eiders, white-winged scoters, and long-tailed ducks prefer to nest and raise young in marine settings along the mainland shore and on nearshore islands like the Walrus Islands (Baldassarre 2014; SDJVP 2009). Common eiders nest in dense colonies on beaches in May and June, and at least one small extant colony is present on the shores of Round Island (USFWS 2012). White-winged scoters do not start nesting until mid-June, and move inland to densely vegetated areas during the breeding season. They are not known to nest and breed in Bristol Bay in significant numbers (SDJVP 2009). Long-tailed ducks will nest on nearshore tundra ponds, and breed in loose colonies along the Bristol Bay coast (Ehrlich et al. 1988; Sibley 2006, 2009; SDJVP 2009). Male ducks typically head for open waters after breeding and do not assist in incubation or raising the young. Within weeks of hatching, the young of all three species leave the nest for open water, and fledge between one and two months after hatching (Munro and Bedard 1977; SDJVP 2009). All three species form crèches, or large floating rafts of a few guardian females and numerous ducklings, after the hatchlings leave the nest. By fall migration, these young are ready to fly (Baldassarre 2014; Ehrlich et al. 1988; Munro and Bedard 1977).

Outside of breeding and nesting, the three species prefer water environments. Long-tailed ducks and white-winged scoters move to inland waters during fall molting, while common eiders move to open waters. All three species are known to inhabit Bristol

Bay in large numbers during the spring migration (and molt), some migrating to more northern locales, others preparing to nest and breed in the area (Baldassarre 2014). During winter, common eiders form large flocks in polynyas within pack ice or in open waters at the edges of sea ice in Bristol Bay (SDJVP 2009). They will mix with other eider species. White-winged scoters and long-tailed ducks form similar rafts in polynyas or at the edge of sea ice during the winter, but they tend to winter in the Aleutians, rather than northwest Bristol Bay (Baldassarre 2014; SDJVP 2009). All three species typically show fidelity to breeding grounds (Ehrlich et al. 1988).

In Early Norton I, common eiders (n=59), white-winged scoters (n=18), and long-tailed ducks (n=22) represented 23% of the avifaunal sub-assemblage (all anatids represented 31%, n=131). At least six individual common eiders, three white-winged scoters, and three long-tailed ducks were represented in the Early Norton I sub-assemblage (MNI). In Early Norton II, sea ducks were very abundant (as were all anatids 74%, n=245). Common eiders represented 44% (n=147) of all bird taxa, with at least 15 individual (MNI) birds accounted for, a considerable increase from Early Norton I. White-white winged scoters (6%, n=20) and long-tailed ducks (4%, n=12), however, decreased in abundance. Each species had only 3 MNI for Early Norton II. By Late Norton, common eider abundance fell to 6% (n=28) of the bird sub-assemblage, while white-winged scoter abundance rose to an equal level (6%, n=31). Both species had four individuals represented in Late Norton. Long-tailed ducks were even less abundant (<1%, n=2), with only 2 MNI. Overall, anatids were least abundant in Late Norton (18%, n=88).

In Early Norton I, the presence of two common eider specimens exhibiting medullary bone suggest a spring to early summer harvest (April-June). In Early Norton

II, two common eider specimens exhibiting medullary bone and three juvenile common eider specimens suggest spring to fall occupations of Summit Island (April-September). In Late Norton, one large juvenile duck specimen suggests a late summer to fall harvest (August-September). Contemporary communities living along the northwest Bristol Bay-Kuskokwim coastline (and throughout Alaska) continue to take advantage of sea duck migration patterns and intensively harvest waterfowl in the spring and fall (USFWS 2008, 2013a). The harvest of migratory ducks in the spring/early summer and fall is well documented throughout pre-contact, historic, and contemporary Arctic and Subarctic peoples (Casperson 2012; Gelvin-Reymiller and Reuther 2010; Georgette 2000; Hunn et al. 2003; Monchot et al. 2016; Moss 2004a, 2007a, 2008; Moss and Bowers 2007; Nelson et al. 1982; Russell and West 2003; Serjeantson 2009; VanStone 1988; Wentworth 2007; Wolfe et al. 1990). It is during this time that sea ducks congregate in large flocks to coastal settings like the Walrus Islands and hunters can dispatch numerous individuals from open waters or nesting grounds. Molting occurs in the spring (before breeding) and in the fall, which restricts flight from two weeks to one month, rendering sea ducks highly vulnerable to hunters (Ehrlich et al. 1988).

In the subsistence practices of contemporary Alaska Native coastal communities, common eider harvest is linked to, and secondary to, marine mammal hunting that occurs when sea ice is present (Paige 2000; Wolfe and Paige 2002). Hunters from Barrow and Wainwright noted that they intensified their spring harvest of common eiders when whale hunting was unsuccessful (Wolfe and Paige 2002:70). When ice conditions were “poor,” hunters would stay out on the ice to look for common eiders (Wolfe and Paige 2002:70). Paige (2000) and Wolfe and Paige (2002) noted that common eider harvest was a "supplemental activity" to whaling. Eiders and whale both frequent open leads, "closer to the pack ice," and hunters would always choose harvesting whales over common eiders (Wolfe and Paige 2002:70). Barrow and Wainwright hunters also took higher numbers of common eiders during spring break-up, when they hunted walrus, because they inhabit similar niches. In the eastern Aleutians and Yukon-Kuskokwim Delta, eiders were hunted in the late winter and during spring break-up when hunters were out on the ice looking for seals either resting on ice floes or at the edge of shorefast ice (Wolfe and Paige 2002:80).

Cormorants

Cormorants are the third most abundant bird in the Summit Island faunal assemblage (15%, n=192). Today, cormorants inhabit the region during spring, summer, and fall, in low, but consistent numbers (USFWS 2013b). Resident populations likely inhabit the region year round, but there is a dearth of information regarding cormorant wintering in Bristol Bay (Ehrlich et al. 1988; Denlinger 2006). Subsistence harvest data from contemporary rural Alaskan communities indicate that people harvest cormorants at any time of the year, depending on local interests and needs (ADF&G 2016a; Coiley-Kenner et al. 2003; Fall et al. 2012; Naves 2015a; Paige et al. 2000). Several coastal communities in the Aleutians, Saint Lawrence Island, and the Alaskan coast of the Bering Sea, however, prefer to harvest young cormorants during the fall and winter. Newly fledged cormorants (as well as other birds) are favored because they are young and tender, not tough like adults, providing fresh meat over the winter (ADF&G 2016a; Georgette 2000; Naves and Zeller 2013).

One small cormorant and pigeon guillemot colony is documented on Summit Island (n=1,000), on the rocky cliffs that exist on the north side of the island. Between 200 and 2,000 estimated cormorants nest at Black Rock, the Twins, High Island, and Round Island (USFWS 2012). At Round Island and Cape Pierce, cormorants return to the tall cliffs in early May and begin building nests immediately (Dragoo et al. 2011; Weiss and Morrill 2014). Cormorants lay the first eggs of the season in mid-May, the first chicks of the season hatch in mid-June, and the height of chick population (maximum number of chicks counted) peaks in mid-July (Dragoo et al. 2011; Okonek et al. 2007, 2008, 2009; Okonek and Snively 2005, 2006; Sell and Weiss 2010, 2011; Weiss and Sell 2013). After hatching in July, cormorants fledge for almost two months, through September and October (Denlinger 2006).

In the Summit Island assemblage, cormorants were present in all three components in consistent abundances, between 15% and 16% NISP (n=54 to 73 depending on component). Between five and eight individual cormorants were represented in each component (MNI). These abundances suggest that site residents had regular and local access to a stable, but small cormorant population that was independent of the murre population. In Early Norton I, site residents likely harvested cormorants from a colony on Summit Island between the months of May and June or possibly in the winter. This is supported by the lack of juvenile specimens in the earliest component. Juvenile specimens, depending on the level of maturity, would indicate a mid-June through September or October harvest. Chick bones would be small and amorphous, and indicate a summer harvest, whereas older, but still immature birds (juveniles/subadults) would have bones that are closer in proportion and maturity to adult birds and would indicate a late summer to fall harvest (Bovy 2005; Broughton 2004; Casperson 2009).

In Early Norton II, people continued to harvest cormorants in May and June, but they also harvested cormorants into the months of September and October. Three large juvenile cormorant specimens were recovered from this component. In Late Norton, evidence suggests that site residents also occupied Summit Island during the fall, in September and October. More than half of the cormorant specimens identified in the Late Norton component (n=40) are juveniles close in proportion to mature individuals, but they display spongy and amorphous epiphyses. These specimens came from individuals that are more than one month old, but not fully fledged (three or more months old), which places the harvest in September to October (Bovy 2005; Casperson 2009:42).

Adult cormorants will abandon their young when faced with a disturbance or predators (Bovy 2005; Broughton 2004; Denlinger 2006; Ehrlich et al. 1988), which may have influenced what time of year some Summit Island residents chose to harvest cormorants. The Early Norton II and Late Norton site residents who harvested fledgling cormorants may have preferred to target the species when fledglings were close in size to mature individuals, but easier to catch because they could not fly. In this way, people would have focused on seasonally available larger-bodied, but still young and tender, cormorants. Cormorants that cannot fly would still be able to swim, however, so it is possible that site residents targeted the taxon while they were sleeping. The practice of noosing sleeping cormorants or positioning snares above cormorants to fly into once waking have been documented in the Aleutians, Nunivak Island, Cook Inlet, and Greenland (Corbett 2016; Gotfredsen 1997; Oswalt 1967; Pratt 1990).

Small-bodied Ice Seals

Small-bodied ice seals (ringed seal, spotted seal, and *Phoca* sp.) are the most abundant mammal group recovered in the Summit Island faunal assemblage (n=480, 88 MNI). Of these, ringed seals make up the majority (n=226). They are a prolific species, with global estimates in the millions (ADF&G 2008). Hunters in the Norton Sound-Bering Strat region call them "winter seals" or "regular seals" because they are most abundant near the coast (Georgette et al. 1998:32). They are the smallest and most ice-adapted of the hair seals. They rely on sea ice to haul-out, find food, give birth, and nurse and wean pups (ADF&G 2008). The largest ringed seals can be 5 ft. long and weigh 110-150 lbs. Males tend to be slightly larger than females. Males are sexually mature at 4-5 years, while females can reproduce at 3-4 years. Based on contemporary harvests, Ashley (2002) placed meat weight at approximately 30% of a ringed seals' live weight, while Olanna Conger and Magdanz (1990) estimated that 50% of the live weight could be harvested for edible meat weight. Given these estimates, a large full-grown ringed seal could provide up to 45-70 lbs. of edible meat, blubber, organs, and other parts.

Ringed seals give birth in April to May in subniveans (snow burrows). Newborn ringed seals weigh approximately 10 lbs. They wean within two months of birth, during ice break-up, and typically have doubled in weight by this time. Ringed seals breed one month after they give birth, while females are still nursing pups. Males are known to produce an unpleasant smell during the breeding season and are aptly called kerosene seals; humans and polar bears alike avoid hunting them during the mating season (ADF&G 2008). Molting occurs in May through June, and the seals spend a lot of time hauling out on sea ice. They are wary when hauling out and maintain breathing holes and lairs to avoid capture. Ringed seals migrate with sea advance and retreat, but there are also resident juvenile populations throughout the Bering Sea area. Ringed seals show a high degree of fidelity to birthing and breeding grounds. During the winter, this species inhabits shorefast ice and is the most abundant seal closest to the coastline. Like all ice seals, this is when the ringed seal will have the highest blubber content. In recent years, Togiak hunters noted that changes in shorefast ice and sea ice impact ringed seal availability in Togiak Bay (Fall et al. 2013; Huntington et al. 2013). In winters with less ice, ringed seals, tend not venture into Togiak Bay, but can still be found in the Walrus Islands area, particularly around Summit Island.

Despite their abundance, ringed seals are underrepresented in all of the Summit Island components due to the high number of immature specimens that I could only identify as *Phoca* spp. (n=220). With this in mind, I chose to consider small seals as a taxonomic group for the purposes of calculating NISP abundances. Ringed seals make up 87% of the seal specimens that I was able to identify to species, so it is more than likely that most of the *Phoca* sp. specimens came from ringed seals. The small seal group included some specimens identified as spotted/harbor seals (n=34). Spotted seals are pagophilic, have life histories similar to that of ringed seals, and are known to haul out together (ADF&G 2008; Georgette et al. 1998). Harbor seals are much less reliant on ice, and generally not good indicators of ice environment, though the movements of the Bering Sea stock of harbor seals is influenced by sea ice extent. O’Corry-Crowe et al. (2003) noted that Bering Sea harbor seals tend not to leave the coastal areas of Bristol Bay until shorefast sea ice drives them away, and return shortly after spring break-up. For short periods, it would seem that harbor seals can be found in the sea ice environment.

Spotted seals and harbor seals have very similar bone morphology, making it difficult to separate the species during faunal analysis. Moss et al. (2006) noted that even between physiologically distinct pinnipeds, there can be multiple factors that lead to the misidentifications of archaeological specimens. In an ancient DNA study related to the distribution of northern fur seals, Moss et al. (2006:179) ascertained that five out of 37 specimens visually identified as northern fur seals were in fact Steller sea lion (n=4) and Guadalupe fur seal (*Arctophalus townsendi*, n=1). The authors indicated that it can be difficult to accurately identify pinniped specimens when some display juvenile morphology or are highly fragmentary. Mistakes can also be made when a researcher does not have access to “comparative specimens representing the full range of morphological variation among pinniped species” (Moss et al. 2006:179). Recall that I noted similar issues with the Summit Island small seal specimens in Chapter V. My decision to lump some specimens as spotted/harbor seals rather than trying to identify them to species is a conservative approach. Based on the low abundance of this taxon in comparison to the high number of pagophilic pinnipeds represented in the Summit Island faunal assemblage, I do not consider this detrimental to my analysis.

Observational data on spotted and harbor seals is also problematic, given that the two species overlap in habitat and have similar physiology and coats (Allen and Angliss 2014; O’Corry-Crowe et al. 2003). The Ice Sea Committee (2016:61) noted problems with subsistence data collected for Bristol Bay seal harvests between the early 1990s and 2012, which based the identification of spotted seals and harbor seals on the month of harvest. Any seal harvested between October and May was assumed to be a spotted seal, while any seals harvested in June through September were categorized as harbor seals.

The association of spotted seals with ice and harbor seals with summer is misleading, steering researchers to pursue genetic testing (ISC 2016). Norton Sound-Bering Strait hunters noted that “spotted seals are the only seals found in large numbers in the northern Bering Sea during the ice-free months…they typically show up in the region during break-up and stay through freeze-up in the fall” (Georgette et al. 1998:35).

As a group, small seal specimens (ringed seals, spotted/harbor seals, and *Phoca* spp.) made up 20% (n=84) of the Early Norton I, 84% (n=315) of the Early Norton II, and 48% (n=81) of the Late Norton mammal sub-assemblages. Calculating the minimum number of individuals for only the spotted/harbor seals and ringed seals, resulted in low MNIs that did not account for the high number of *Phoca* sp. specimens (n=220) included in NISP abundances. To allow for a more balanced picture of overall small seal abundance using MNI, I calculated a NISP to MNI ratio of seals identified to species for Early Norton I (0.3), Early Norton II (0.14), and Late Norton (0.3) to estimate MNIs that took into account *Phoca* sp. specimens. With this method, individual small seals were represented by 21 MNI in Early Norton I, 43 MNI in Early Norton II, and 24 MNI in Late Norton. Even with such conservative estimates of MNI, it is apparent that Summit Island residents intensively harvested small seals throughout the Late Holocene, in greater numbers than any other mammal. The NISP to MNI ratios were used only to get an estimate for overall seal abundance, not to develop abundances within age groups.

In Early Norton I and Late Norton, Yearling, Juvenile, and Young Adult/Adult ringed seals were represented in low, but stable numbers (1-3 MNI). This suggests that site residents were most focused on harvesting ringed seals as a species, more so than targeting a specific age class. In Early Norton I, three 3-7 month old ringed seal pups are represented, indicating a June to September harvest of these individuals. In Late Norton, one 3-7 month old pup and one 8-12 month old pup are represented. This suggests site residents harvested some ringed seals in June through February. In Early Norton II, site residents harvested twice as many Juvenile ringed seals (12 MNI) than Yearlings (5 MNI) and Young Adult/Adults (6 MNI). The high number of juvenile ringed seals may be a product of more intensive, year-round, ringed seal harvest, than a specific interest in juveniles. The age (in months) of yearlings identified in the sub-assemblage supports this idea. In Early Norton II, one 0-2 month old pup is represented, as well as one 3-7 month old pup, and three 8-12 month old pups (MNI). These specimens demonstrate harvest of ringed seals throughout the year.

Spotted/harbor seals were also present in low abundances with 2 to 4 MNI per component in the Summit Island sub-assemblage. Within the Yearling, Juvenile, and Young Adult/Adult age groups, between 0 and 2 MNI were represented, suggesting that site residents did not target a specific age group. These low, but stable abundances suggest that Summit Island residents valued the taxon as a consistent, but uncommon, food source. Yearling spotted/harbor seals were represented in the two earliest components by 1 MNI. In Early Norton I, site residents harvested one 3-7 month old seal between July and September. In Early Norton II, site residents harvested one 8-12 month old seal between October and February.

Considering all small seal specimens together (ringed seal, spotted/harbor seal, and *Phoca* sp.), it is apparent that site residents targeted small seals on a year-round basis resource throughout the Late Holocene. When taken together, 8-12 month old specimens from the three seal taxa are associated with Early Norton I (n=3), Early Norton II (n=25), and Late Norton (n=3). In all three components, site residents harvested some small seals during the fall and winter. All Summit Island residents also harvested Yearling small seals during the spring and summer in Early Norton I (n=17), Early Norton II (n=37), and Late Norton (n=20).

Contemporary Togiak hunters noted that late winter and spring, from February through April, are the best times to hunt ringed seals. As ice dependent seals, they are more abundant and often come into the smaller embayments in Bristol Bay with the expansion of shorefast ice. These seals also tend to return to their birthing location and give birth to pups in places like Togiak Bay and around Summit Island (Fall et al. 2013:284). Togiak residents use the term *iluraqs* or "cousin" to refer to ringed and bearded seals, because they tend to be found together, though bearded seals prefer deeper waters, whereas ringed seals will hang out in the shallows of Togiak Bay (Fall et al. 2013:284).

Bearded Seals

Bearded seals were another highly abundant mammal represented in the Summit Island faunal assemblage (n=131, 25 MNI). Their rank in the faunal assemblage varies between second and third depending on the measure of abundance (second with MNI, third with NISP). They are the largest of the hair seals, with fully mature seals weighing 575-800 lbs. and extending 8 ft. long (ADF&G 2008). Females tend to be larger than males. Females are sexually mature at 5-6 years, and males at 6-7 years. The species is pagophilic or "ice loving" and rely on sea ice to haul-out, find food, give birth and nurse and wean pups.

Bearded seals give birth in late April to early May and pups wean within one month of birth (ADF&G 2008). Pups grow extremely fast. They are approximately 4 ft. long and weigh 75 lbs. at birth, but grow to 190 lbs. within one month of birth (ADF&G 2008). Mature seals breed shortly thereafter in late May to early June, and regularly haul-out during the breeding season. Bearded seals vocalize during the breeding season, which leads hunters to them. Contemporary Togiak hunters noted that changes in shorefast ice and sea ice reduced bearded seal availability in Bristol Bay, and the species tends to congregate in the deeper waters around Summit Island and Hagemeister Island, rather than in Togiak Bay, when there is less ice (Fall et al. 2013; Huntington et al. 2013). Mature bearded seals tend to migrate through the Bering Strait during late spring and early summer, following sea ice extent. Juvenile seals, however, are not as ice dependent and can be found in bays and estuaries in Bristol Bay during the spring and summer (Huntington et al. 2013). In the fall, some juveniles swim up the Togiak River (Huntington et al. 2013). In general, bearded seals show a high degree of fidelity to birthing and breeding grounds (ADF&G 2008).

Bearded seals have the highest blubber content in the winter and spring, and as a result, Norton Sound and Bering Sea communities consider them a very desirable food source during these seasons (Gadamus and Raymond-Yakoubian 2015). Alaska Natives also value bearded seals for their skins and sinew, which is useful for making rope, water-resistant boot soles and other winter gear, watercraft covers, and canvasses (Lucier and VanStone 1991:35; Gadamus and Raymond-Yakoubian 2015). Togiak hunters have similarly noted that the best time to hunt bearded seals (and ringed seals) is between the months of February and April (Fall et al. 2013:284). They tend to be wary and solitary, however, and stay near cracks and polynyas when hauling-out (ADF&G 2008). Contemporary hunters estimate bearded seal meat weight is approximately 40-50% of an individual's live weight (Ashley 2002).

Contemporary Togiak hunters noted that bearded seals have been abundant in northwest Bristol Bay in their lifetimes, but they are no longer as abundant (Huntington et al. 2013). In the recent past, bearded seals hauled out on the northwestern tip of Hagemeister Island in the "thousands," so many that they would "muddy" the waters (Huntington et al. 2013:326). "Long ago there used to be big groups of bearded seals that would line up and space out for feeding, but you never see that anymore" (Huntington et al. 2013:326). One Togiak hunter remembered sea ice that did not melt until May providing access to many bearded seals between February and April in the 1970s (Fall et al. 2013:284). Other Togiak respondents from another subsistence report indicated that they hunted bearded (and ringed) seals from December until April in 1983 (Wolfe et al. 1984:327). Many Togiak hunters noticed decreases in bearded (and ringed) seal availability in the 1980s, which they attribute to climate change and commercial fishing (Fall et al. 2013; Huntington et al. 2013). The description of numerous bearded seals from recent decades sounds similar to the scene described by Petr Korsakovskiy in 1818, when he visited Summit Island and documented "small tide flats on which many seals lie" (VanStone 1988:38). Korsakovskiy similarly noted seals at the mouth of Togiak River and swimming up the river. These may have been juvenile bearded seals, but alternatively, may have included some of the smaller hair seals.

In the Summit Island assemblage, bearded seal abundance was highest in Early Norton I (17%, n=73), with decreased abundances in Early Norton II (7%, n=28) and

Late Norton (18%, n=29). Estimated individual bearded seals were also most abundant in Early Norton I, with 11 MNI, but decreased by approximately 30-40% in Early Norton II (6 MNI) and Late Norton (8 MNI). The decrease in bearded seal abundance in Early Norton II and Late Norton, in comparison to Early Norton I, mirrors that of changes in walrus abundance. Yearling, Juvenile and Young Adult/Adult bearded seals were present in low abundances throughout the three components (between 1 and 6 MNI). While not statistically significant, it appears that Early Norton I and Late Norton site residents may have targeted yearling bearded seals. In both components, yearlings made up 55-63% MNI of the aged individuals. It is possible that site residents focused on harvesting bearded seals in the spring because they preferred yearlings as delicacies (Gadamus and Raymond-Yakoubian 2015) and because bearded seals are easier to track and harvest when they are on the ice (Fall et al. 2013). Within the Yearling group all but one of the bearded seals came from individuals that were aged 0-3 months. Four individuals were represented in Early Norton I, and two individuals in Early Norton II. Site residents would have harvested these bearded seals in early spring to early summer (May to June). In Late Norton four individuals were aged 0-3 months, while one was aged at six months, suggesting harvests in May to June and September to October. All of the 3-6 month old individuals would have weighed over 190 lbs. and provided more edible meat than an adult ringed seal.

Pacific Walrus

The Pacific walrus is the second and third most abundant mammal represented in the Summit Island faunal assemblage (n=222, 21 MNI). Walrus are pagophilic or “ice loving," and rely on sea ice to haul-out, find food, give birth and nurse and wean calves. Walrus inhabit the various seas and passages in the High Canadian Arctic as well as the Arctic Ocean, and migrate through the Bering Strait to as far south as Bristol Bay (Fay 1982:7). Both male and female walruses can be found throughout the species' range, but movement of each sex is influenced by the expansion and recession of sea ice (ADF&G 2008). Females with calves tend to be the most migratory, in that they are most dependent on sea ice, whereas subpopulations of males remain in southerly ice-free places during the summer (Jay and Fischbach 2008; Jay and Hills 2005; Jay et al. 2008; Jay et al. 2010). Generally, walrus inhabit the Bering Sea (and Bristol Bay) during the winter months, and stay in the Chukchi Sea during the summer (Fay 1982; Jay et al. 2008, 2010, 2012, 2014).

Walrus are the largest pinniped in Arctic and Subarctic waters (ADF&G 2008; Fay 1982, 1985; Fay et al. 1984). Adult males can measure 10 ft. in length and weigh up to 4,000 lbs. Females are smaller and can weigh up to 2,000 lbs. Walrus become sexually mature around 5-7 years of age, but do not attain their full weight until 10-12 years for females, and 12-14 years for males (Fay 1982). A sexually mature six-year-old walrus, of either sex, may weigh 1100-1300 lbs. (Fay 1982:35). Walrus can live up to 40 years (Fay 1982). Walrus calves require much more care than seal pups; they depend on their mothers for approximately two years (ADF&G 2008). As such, females breed every other year. Walruses breed in January and February and give birth over one year later, on ice in late April to early May, during spring migration. At birth, a walrus will weigh 140 lbs. At six months, a walrus calf will weigh 275 lbs., and double in weight by 18 months to 570 lbs. (Fay 1982). By the end of the two years, the young walrus can weigh up to 750 lbs.

Much of this is blubber weight. Mothers are very protective and do not abandon calves in the face of a disturbance or predator. Hunters and researchers commonly note the gregarious and protective nature of male and female walruses (Fay 1982; Gadamus and Raymond-Yakoubian 2015).

Based on observations of several researchers in the 1930s through the 1970s, Fay (1982) was able to document the seasonal movement of walrus south of the Bering Strait. Female walruses and calves that occupy Bristol Bay are most abundant in the Walrus Islands area during the months of March and April, when sea ice is prevalent and during spring break-up (Fay 1982:10-27). Fay (1982:27) documented herds of over 600 walrus including mostly adult females (56%) and young (38%), but also some adult males (6%), inhabiting the bay in March and April. Walrus in ice environs prefer to be near the edges of the ice pack or by polynyas within the ice pack, where there is thinner dark ice, open water, and they can easily establish breathing holes (Fay 1982:21, Figure 39).

At spring break-up, when females and dependent young migrate north with the retreating sea ice, many males stay in more southern locales, including the Walrus Islands, hauling out in large numbers on beaches (Fay 1982; Jay and Hills 2005). Round Island is the largest most southerly summer male walrus haul-out; researchers have estimated that as many as 14,000 walruses have hauled out there in one summer (ADF&G 2015a; Sinnott 1992). Historically and today, walrus have been documented hauling out on Summit Island, North Twin, High Island, and Crooked Island, in much smaller numbers, and can be found swimming in the waters within the bounds of the Sanctuary (Fall et al. 1991; VanStone 1988).

Figure 39. Prime sea ice habitat for female walrus and their young in March 1978. Note the numerous sets of twin holes, from walrus tusks (from Fay 1982:25).

They do not typically approach the mainland shores (Fay 1982; Sinnott 1992; VanStone 1988). In the fall, male walruses of breeding age leave these haul-outs and head north to the Saint Lawrence Island area where they rejoin a large walrus herd that is migrating south with the advancement of sea ice (ADF&G 2008). In a multi-year radio-tag study, Jay and Hills (2005) documented many male walruses remaining in the Walrus Islands year round, though migrating males tended to leave the area in November and

December. Walruses ultimately inhabit the Walrus Islands year round, but numbers and sex of the animals change throughout the year (Fay 1982). The distribution of walrus in the Walrus Islands, throughout the year, is dictated by the availability of shellfish in shallow waters that tend to be less than 60-70 m deep (Fay 1982; Jay and Hills 2005).

Ashley (2002), Fall et al. (1991), and Olanna Conger and Magdanz (1990:6-8) noted that contemporary meat weight estimates for walrus vary greatly from hunter to hunter and throughout rural Alaska, from 2% to 100%. How much of the walrus is harvested is very dependent on time of year, the scarcity of walrus, and the specifics of the hunt. For example, hunters tend to harvest more of a walrus when it is taken on the ice or beach, rather than in open water, because they are easier to butcher (Olanna Conger and Magdanz 1990). Hunters also harvest more of an individual walrus early in the season, when there is more uncertainty as to how many walrus will be taken in a given year. The sex and age of walrus also affect how much of an individual will be harvested as well. Young healthy sexually mature individuals tend to be processed more fully than old and leathery individuals, because the edible portions of the younger animal are considered tender and more desirable (Fall et al. 1991). The bones of walrus are quite dense and heavy, which must be considered when estimating edible meat weight. It is unlikely that the Summit Island residents harvested 100% of the live weight of walrus for food because they did not eat bone (as evidenced by the recovery of walrus bone in the faunal assemblage). That being said, it is probable that site residents harvested a large majority of the walrus. According to Togiak hunters interviewed by Fall et al. (1991:13), walrus hide, fat, muscle tissues, flippers, head, brain, and several internal organs (heart, liver, kidney, lungs) are edible. Fall et al. (1991) estimated that all of these portions would result in between 25% and 50% of the live weight of a walrus.

For the Summit Island faunal assemblage, walrus specimens were most abundant in Early Norton I (43%, n=181) and lowest in Early Norton II (4%, n=14). Walrus specimen abundance increased somewhat in Late Norton (15%, n=25). Based on MNI abundance, site residents harvested proportionately more walrus in Early Norton I, with 10 MNI. In Early Norton II and Late Norton, estimated walrus take decreased to 5 MNI and 6 MNI, respectively. Walrus were important to Summit Island residents throughout the Late Holocene, though people harvested walrus at lower abundances in Early Norton II and Late Norton than in Early Norton I.

Yearling, Juvenile, and Young Adult/Adult walrus were represented in low, but even numbers throughout all of the components (between 1 and 4 MNI per age group). This trend suggests that Summit Island residents regularly procured low numbers of walrus, regardless of age, as a long-term subsistence strategy. Most, if not all of the specimens in the Young Adult/Adult age group, retained some epiphyseal fusion lines, and were most like the UWBM 6-year-old comparative walrus specimen in maturity. This suggests that site residents may have targeted smaller individuals of breeding age over larger, but older, individuals. Togiak residents who currently hunt walrus in the Walrus Islands vicinity prefer visibly healthy individuals (Fall et al. 1991). Togiak elders Tom Chythlook and David Gusok noted that it is customary for hunters to bypass old or sick walruses with “lumpy hide surface” that congregate close to the water, and focus on the younger, but still large, “plump” animals with smooth skin that gather farther away from the shoreline, up on higher rocks and cliffs (Fall et al. 1991:11-15).

In Early Norton I, four yearling walrus were represented in the faunal assemblage. One was 0-2 months old at the time of death, while two others were 3 months old and one was at least 6 months of age. The three youngest would have been harvested in the spring or early summer, in April-June, while the older yearling would have been harvested in the fall (September-October). In Early Norton II, one 0-2 month old and one 6-month-old yearling were represented, suggesting an April-May harvest, and then a September-October harvest. In Late Norton, one 0-2 month old and one 6-month-old were identified in the sub-assemblage. These animals were also taken in April-June and then later in September-October. It appears that Summit Island residents from all three components targeted walrus in the spring (April-June) and fall (September-October). Togiak elders noted that spring and fall are the best time to harvest walrus, when they are still on ice in the spring, and when they are fat in the fall and hauling out on shore (Fall et al. 1991, 2013:284). Hunters prefer not to take walrus in open waters where they are likely to sink if killed or dive if wounded, and be lost to the hunter (Fall et al. 1991).

The presence of 0-3 month old walrus specimens in the faunal assemblage suggests that sea ice was present at the time of death, and hunters would have harvested the yearlings with their mothers. Yearling and Young Adult/Adult individuals (mothers?) are represented in similar MNIs, which support the suggestion of mother-calf pairs. If a mother accompanied these yearlings, it is probable that Bristol Bay in the Late Holocene was icy enough to facilitate the hunting of female-calf pairs from April through June. Hunters may have targeted females with calves, because the mothers would be more likely to stay to protect their young. Taking the calf with a large adult female would be an added bonus, given the amount of edible meat and by-products that could be obtained from the two individuals. The presence of 6-month-old walrus calf specimens in each Summit Island component suggests that the fall expansion of sea ice would have reached Bristol Bay somewhat earlier then what is typical for the 20th century. It is likely that sea ice was abundant in Bristol Bay in October or November, facilitating the fall harvest of calves and their mothers during the Late Holocene.

If sea ice conditions in the Late Holocene were similar to contemporary ones (and sea ice expansion in Bristol Bay did not start until December), it is possible that the 6-month-old yearlings were on their own, without their mothers, and hunters harvested them during the fall hunt. They may have been targeted because calves are less agile than adults and can be easily captured. Since 1976, the Alaska Department of Fish and Game has employed one or two individuals to manage Round Island between the months of May and August. During this time, the staff collects biological data on the large numbers of walrus that haul out on Round Island as well as other marine mammals, seabirds, and any unique biological phenomena that occur. Reports compiled over the last four decades indicate that one or two yearlings are sighted infrequently at Round Island during the summer months, sans mother (Fay 1982:140; Okonek et al. 2007). The assumption is that the young walrus have somehow become separated from their mothers and they attach themselves to the older males that haul-out on Round Island, rather than migrating north with female herds. In some instances, older walrus have been documented caring for them and allowing the young to ride on their backs (Okonek et al. 2007). Fay (1982:204) also reported several instances where unrelated females and male walruses tried to protect and carry away calves after hunters shot their mothers. Some of the Yearlings represented in the Summit Island assemblage could have been taken to Round Island by other walruses after the loss of their mother.

Caribou

Identifiable caribou specimens are present in low abundances in the Summit Island faunal assemblage (n=46), represented by a minimal number of individuals in Early Norton I (4 MNI) and Late Norton (2 MNI). They do not appear to have significantly contributed to Summit Island residents' subsistence practices, with marine mammals and birds being overwhelmingly more abundant in each component. I have included caribou in the species accounts, however, because researchers have hypothesized that caribou were one of the primary animal resources to Norton peoples throughout Alaska, including those who lived on the coast (Bockstoce 1979; Dumond 1984, 1987b, 2000b, 2016; Giddings 1964; Shaw 1982b, 1983). Caribou very well may have been important to Late Holocene Norton populations, but their primacy to the Summit Island residents is not evident in the faunal assemblage.

Adult bull caribou weigh 350-400 lbs., while females weigh 175-225 lbs. (ADF&G 2017). Based on contemporary harvests, meat weight is approximately 25-30% of the full weight of a living animal (ADF&G 2017; Ashley 2002). Caribou are migratory, and large herds can travel up to 640 km between summer and winter ranges (ADF&G 2008). Caribou herds have distinct territories and calving areas, though they mix with other herds during the winter (ADF&G 2008). When herds get sufficiently large, they can move into the territory of other herds and may inter-mix or absorb smaller herds (Harper 2007; Holen et al. 2005). In southwest Alaska, caribou give birth in early

June and tend to reuse calving grounds (ADF&G 2008). After calving, herds will migrate to the coasts or into the mountains, where temperatures are more moderate and winds can disperse insects. Caribou will congregate on snow patches at high elevations to stay cool (ADF&G 2008). Caribou have regular migration routes, influenced by weather, food sources, and population dynamics. Small or dwindling herds use much smaller areas than large herds, and may not migrate (ADF&G 2008; Harper 2007; Holen et al. 2005).

Historical accounts indicate that caribou have been plentiful periodically in the Togiak area and in southwest Alaska in general, but populations can fluctuate greatly in the span of a decade (Coiley-Kenner et al. 2003; Harper 2007; VanStone 1988). The Mulchatna herd, which is the dominant herd in southwest Alaska, has experienced several episodes of growth and decline since 1818. At its maximum range, this herd mixed with others and inhabited most of southwest Alaska, from Norton Sound to the Alaska Peninsula (Holen et al. 2005). In 1818, Petr Korsakovskiy and, in 1829, Ivan Vasilev noted abundant caribou herds in the Nushagak and Togiak River drainages, which extended to Norton Sound (VanStone 1988). Both of these observers noted that local peoples regularly harvested caribou and the Russian teams were able to hunt caribou as well. Caribou was the second most abundant animal represented in the Old Togiak components, which suggests that local Thule populations harvested caribou with some regularity prior to contact with the Russians (Kowta 1963).

Historic caribou numbers peaked in the 1860s, only to decline significantly until the 1930s (Harper 2007). Population counts are generally unavailable from the 1930s until the 1950s, when ADF&G started aerial surveys (Harper 2007:15). By 1965, the herd had 5,000 estimated individuals, and the population slowly recovered over the 1970s. By

1981, the Mulchatna herd had 20,000 individuals (Coiley-Kenner et al. 2003; Harper 2007). By 1996, the Mulchatna herd grew to 200,000 individuals and absorbed the smaller Nushagak Peninsula herd (Coley-Kenner 2003). As of 2008, the herd has declined to 30,000 individuals, and the population has remained constant into 2016 (Coiley-Kenner et al. 2003:10; Dischner 2016; Harper 2007).

Caribou is currently a very important animal for Bristol Bay communities, including Togiak (Coiley-Kenner et al. 2003; Holen et al. 2007). People in the northern Bristol Bay area hunt caribou during August until mid-September, and again in February through April (Holen et al. 2005:32-34). Locals do not hunt caribou in late September and October during rutting season because they do not prefer the meat of testosterone-laden bulls (ADF&G 2008; Holen et al. 2005:34). Outside of these months, locals opportunistically hunt caribou, as they are available. The preferred seasons of contemporary caribou harvest are influenced by the use of snow machines and motorboats (Holen et al. 2005), which limits the applicability of applying these hunting seasons to Late Holocene populations. Kowta (1963:428), however, noted that historic communities followed similar seasonal cycles for caribou hunting, obviously without the use of mechanized transportation. Ultimately, the low number of caribou in the Summit Island faunal assemblage does not point to specific seasons of harvest. There is no obvious indication of the season of hunt in the Old Togiak faunal assemblages either.

As previously discussed, there is little direct evidence in the Summit Island faunal assemblage to suggest that caribou was an important or stable resource in the northwest Bristol Bay area during the Norton stage. This stands in contrast to data from Old Togiak, which indicates that caribou were important to Thule peoples, second only to small seals

(Kowta 1963). Kowta (1963:455-464) noted that the majority of caribou specimens (n=100, 74%) came from the most recent occupations (levels 1-2) of Old Togiak, circa 300-400 years ago. In lower and presumably older levels (3-11), caribou was minimally represented (3-13% NISP), while small seal specimen proportions stayed relatively consistent and highly abundant between levels 4 and 11 (51-57% NISP). In the Bristol Bay area, it is possible that the intensive interest in caribou noted in historic and contemporary Alaskan communities was a relatively recent development, around the end of the Thule era, approximately 300-400 years ago.

Caribou specimens account for only 5% of the identified Summit Island faunal assemblage (n=46), and are unevenly distributed between the components. In Early Norton I, caribou abundance was highest at 4 MNI (n=20), non-existent in Early Norton II (n=0), and minimally represented in Late Norton (2 MNI, n=26). The majority of identified caribou specimens display heavy cutting and hacking marks, related to butchering meat, rather than controlled shaping to create tool blanks. It is evident that Early Norton I and Late Norton site residents brought caribou meat to Summit Island, and heavily processed it, much like they did the marine mammals.

All caribou specimens, including identified and unidentified, account for 3% of the entire mammal sub-assemblage (n=251 out of 7,355). Caribou antler and bone also accounts for 8% of the worked organics recovered from Summit Island (n=18 out of 205). Out of worked specimens that could be assigned to an animal class (caribou, marine mammal, bird, n=94), caribou accounts for 19% (n=18), whereas marine mammal accounts for 67% (n=63). This provides evidence that site residents considered caribou a valuable enough resource to transfer small amounts of workable materials to Summit

Island, but it does not appear to have been a major resource when people lived on the island. Summit Island residents chose to use more accessible and abundant marine mammal by-products instead of those from caribou. This is logical given the high value that contemporary and historic coastal communities have placed on seal and walrus meat, skin, blubber, oil, bones, and ivory.

CHAPTER VII

DISCUSSION

In this chapter, I interpret larger patterns in the Summit Island faunal assemblage based on assessment of site stratigraphy, radiocarbon dating, and faunal analysis. I organized the discussion with a restatement of, and answers to, the research questions posed in Chapter I. To facilitate the narrative, my analytical components are as follows:

- Early Norton I (2740-2380 cal B.P.) is the lower component at 49-XHI-043,
- Early Norton II (2400-2000 cal B.P.) is the lower component at 49-XHI-044,
- Late Norton (1390-980 cal B.P.) is the upper component at 49-XHI-043.

1. *When did people occupy Summit Island and how did the nature of the occupations change over time? How do the ranges of occupation differ between 49-XHI-043 and 49-XHI-044?*

Late Holocene peoples occupied Summit Island between 2740 and 980 cal B.P. The timing of the occupations and my review of the Summit Island material culture indicate that the site residents had Norton culture. The age ranges of Early Norton I (2740-2380 cal B.P.) and Early Norton II (2400-2000 cal B.P.) indicate that generations of people consistently occupied Summit Island for approximately 740 years in the earliest stages of the Norton era. There is no obvious break in occupation of the island between

2740 and 2000 cal B.P., but residents appear to have stopped using the large housepit at 49-XHI-043 around the same time that people moved into the housepit at 49-XHI-044, sometime around 2400-2380 cal B.P. The two sites are located 700 m away on the same shoreline, which suggests that groups of Norton peoples may have alternated between occupation of the two housepits for any given reason, but had a preference for occupying the west-southwest coast of Summit Island. This part of the coast has a vista of Bristol Bay and the other Walrus Islands, and it is likely that site residents preferred it to the view of the mainland. This could have been partly for aesthetic reasons, but likely involved the need to spot animals that inhabited the Walrus Islands. The marine animals represented in the Summit Island faunal assemblage prefer the deeper waters surrounding the island chain, rather than the shallow coastal waters of Togiak Bay, which support this interpretation.

The earliest occupations of Summit Island, Early Norton I and Early Norton II, appear to have each lasted 300-400 years, and in that time, some of the site residents intensively used two housepit locations (one per site). There are, however, hints of human use of other earlier and contemporaneous housepits from the minimal exposure of other strata that run counter to the main stratigraphy in the excavations, as well as the earliest age ranges of Shaw’s unverified dates (3000-2550 cal B.P. and 2420-2150 cal B.P.). Early Norton I and Early Norton II components have several layers of living floors and midden nested together with no obvious breaks in occupation (i.e., sterile strata between cultural strata). The five radiocarbon dates associated with Early Norton I overlap in age between several strata so that there is no noticeable change in time within the component (2740-2540, 2740-2540, 2720-2500, 2720-2470, and 2680-2380 cal B.P.). This is also true for the five radiocarbon dates from Early Norton II (2400-2160, 2350-2150, 2350-2160, 2130-2010, and 2110-2000 cal B.P.). In both of these components, dense cultural layers accumulated relatively quickly (more than 1 m deep), which suggests intensive use of the two sites. At both sites, the living surfaces evidenced in Early Norton I and Early Norton II appear to have developed in quick succession after the development of the potentially earlier cultural strata in the other uninvestigated housepits. There is little to no build-up of sterile strata between the investigated and unstudied housepits at 49-XHI-043 and 49-XHI-044.

The next major occupation of Summit Island occurred 610 years after Early Norton II, at the tail end of the Norton era, between 1390 and 980 cal B.P. During Late Norton, site residents reoccupied the housepit at 49-XHI-043 for some time within a 400-year span. There is an approximately 1,000-year separation between the occupations of the housepit, the first in Early Norton I and the second in Late Norton. The Late Norton occupation is quite similar to the Early Norton I and II occupations in that the most recent site residents appear to have intensively used the excavated housepit, with no discernable break in occupation throughout the component and a seemingly rapid accumulation of dense cultural layers. The Late Norton site residents continued to accumulate extensive shell and bone midden in the toss zone, on the edges of the housepit, much like their predecessors. Again, the five dates from Late Norton overlap enough between strata that it is not possible to identify significant change through time within the component (1390-1190, 1380-1180, 1340-1090, 1240-1010, and 1060-980 cal B.P.).

The temporal break between Early Norton II and Late Norton (2000-1390 cal B.P.) is not definitive evidence for an occupational hiatus of Summit Island. A few of

Shaw's dates from 49-XHI-044 (see Chapter IV) suggest continued occupation between Early Norton II and Late Norton sometime around 1780-1550, 1520-1300 cal B.P. and after Later Norton, 1050-790 cal B.P. At least one brief occupation is evident in Stratum 2 at 49-XHI-044, associated with the 1780-1550 and 1520-1300 cal B.P. date ranges. Unverified dates from 49-XHI-042 also range in age from 2700-2440 cal B.P. and 650-550 cal B.P. (Shaw 1986), which suggest other occupations of Summit Island during the Norton and possibly the Thule eras.

Recall that Shaw and crew focused excavations on one housepit (and associated midden and cache features) per site. Shaw estimated both sites to be seven and nine acres in area, with two to three loci per site. Shaw estimated that one locus at 49-XHI-044 contained at least 25 dwelling features (AHRS 2010). Shaw documented other sites on Summit Island as well, which points to a much more extensive Late Holocene occupation of the island than is evident from the materials studied in this dissertation. In the site forms filed with the Alaska Office of History and Archaeology, Shaw noted that 49-XHI-042 was 13 acres in size with "numerous features, consisting of tent depressions, and/or housepits and cache pits dispersed over the entire site area," and 49-XHI-045 consisted of up to eight housepits (AHRS 2010). Future investigation of any of these archaeological sites will likely lead to evidence of extensive and unbroken Late Holocene occupations of Summit Island.

2. *What kinds of animals did Summit Island residents harvest during the Late Holocene? Are certain taxa more significant than others? Do the harvested taxa change over time?*

Based on the analysis of 9,981 bird and mammal bone specimens, of which 2,212 were identifiable to the level of family (22%), it was possible to document noticeable trends in the subsistence practices of Summit Island residents during the Late Holocene. Site residents intensively and systematically harvested birds, which represent over half of the identified specimens (56%, n=1,244), as well as mammals (44%, n=968). Throughout the numerous occupations of the island, from 2740 to 980 cal B.P., generations of peoples harvested birds from 11 families including loons, tubenoses, cormorants, anatids, raptors, game birds, shore birds, gulls, sea birds, and ravens. They also harvested mammals from eight families including marmots, beavers, foxes, walruses, seals, otters, whales, and caribou. Thirty bird and mammal taxa are represented in the assemblage, with the majority taken from marine environments (94%. n=2,081). Taxa harvested from terrestrial environments, including caribou, fox, marmot, beaver, and ptarmigan/grouse, make up a very minimal part of the assemblage (6%, n=131). Site residents could have harvested most of the terrestrial taxa from Summit Island, rather than from the mainland, with the exception of caribou. Caribou were minimally represented, making up 5% of the identified mammal specimens (n=46) and 2% of all identified animal specimens. Despite the diversity of animals represented in the faunal assemblage, site residents focused on a five key marine bird and mammal taxa. These taxa represent 91% of the identified faunal assemblage (n=2,021).

For the birds, site residents were most focused on murres (n=532, 43%), anatids (n=464, 37%), and cormorants (n=192, 15%). All other bird taxa make up 5% (n=56) of the sample. The most abundant anatids were sea ducks, including common eiders (n=234, 52%), white-winged scoters (n=69, 15%), and long-tailed ducks (n=36, 8%). For mammals, site residents focused mostly on seals (n=636, 66%) and walruses (n=222, 23%). All other mammal taxa make up 11% (n=110) of the faunal assemblage. Two small whale scapulae specimens are present in the assemblage (5 cm at maximum dimension), but the subsistence significance of these is unknown; they may be scavenged bones used as raw material for making tools. The seals include small-bodied hair seals (n=480, 75%), large-bodied hair seals (bearded seals, n=131, 21%), and a small number that could only be identified as phocid (n=25, 4%). The majority of the small-bodied seal specimens that could be identified to species came from ringed seal (n=226, 45%). The remaining specimens were identified as spotted/harbor seal (n=34, 7%) and *Phoca* sp. (n=220, 44%). Based on the large number of identified ringed seal specimens, it is reasonable to infer that many of the *Phoca* sp. specimens came from ringed seals too.

Terrestrial mammals make up a very small amount of the Summit Island faunal assemblage (n=108, 11%) and many of the specimens may be non-cultural additions to the sample. For example, fox and marmots live year-round in the Walrus Islands where they burrow extensively (ADF&G 2015a). It is very possible that the fox specimens identified in the assemblage, most without any noticeable cultural markings on them, came from individuals that lived and died within the matrices of 49-XHI-043 and 49-

XHI-044. Caribou, however, do not live on Summit Island, and are most assuredly cultural additions to the site materials, and are represented in the identifiable assemblage in low numbers. Throughout the approximately 1,800-year span that Late Holocene peoples occupied Summit Island, they were very consistent in their focus on harvesting birds and mammals from marine environments. While living on the island, between 2740 and 980 cal B.P., the site residents appear to have had rather limited interest in procuring terrestrial species, either on any of the Walrus Islands or from the mainland. Interest in the most abundant taxa, however, changed over time, and between cultural components.

Temporal Variation in Summit Island Animal Harvest Practices

Early Norton I, 2740-2380 cal B.P.

Seabirds and sea ducks were the two most important bird groups to Summit Island residents during Early Norton I, 2740-2380 cal B.P., with MNIs of 14 and 17, respectively. The most sought after bird was the murre (11 MNI), followed by sea ducks including common eiders (6 MNI), white-winged scoters (3 MNI), and long-tailed ducks (3 MNI). Site residents also harvested cormorants (6 MNI). When harvesting mammals, Early Norton I site residents focused on marine mammals, putting equal effort into harvesting walrus (10 MNI) and bearded seals (11 MNI), but harvesting twice as many small seals (21 MNI). Small seals included mostly ringed seals, but also spotted/harbor seals. Limited remains from caribou (4 MNI), fox (3 MNI), beaver (1), and grouse/ptarmigan (2 MNI) recovered in the Early Norton I faunal sub-assemblage suggest that site residents had less interest in terrestrial animals.

Caribou do not live on Summit Island, meaning Early Norton I peoples must have transported rations of caribou meat (and by-products) from the mainland. Site residents used caribou antler and bone to make objects (n=8), but much more frequently relied on marine mammal bone and ivory (n=35). Bird bone (n=6) was also infrequently used to make objects. Beaver (1 MNI) and ptarmigan/grouse (2 MNI) could have also come from the mainland. Site residents likely harvested fox on the island, if the fox remains are in fact a cultural addition to the faunal assemblage (3 MNI). Two whale specimens without any cut marks or other modification have unknown importance to Early Norton I subsistence strategies.

Early Norton II, 2400-2000 cal B.P.

In Early Norton II, 2400-2000 cal B.P., site residents modified their bird harvest practices to focus on anatids (28 MNI), rather than alcids (6 MNI). People harvested proportionately more common eiders (15 MNI) than residents had in Early Norton I, but continued to harvest white-winged scoters (3 MNI) and long-tailed ducks (3 MNI). Murre harvest decreased (3 MNI) compared to the previous component. People continued to harvest cormorants in similar abundances (5 MNI) as the previous generations of site residents who lived during Early Norton I. For mammals, Early Norton II site residents focused more on small seals (43 MNI) than did those during Early Norton I. Conversely, bearded seals (6 MNI) and walrus (5 MNI) harvest decreased. I did not identify unworked caribou bone in the Early Norton II sub-assemblage, suggesting that site residents did not rely on caribou as a food source. The recovery of limited antler blanks and worked objects indicates that Early Norton site residents did value caribou antler and bone as a toolmaking medium (n=5), but not to the same extent as marine mammal bone and ivory (n=12). Bird bone (n=6) was used for making objects as well. Marmot (1 MNI) and fox (1 MNI) may have been natural additions to the Early Norton II assemblage, but site residents could have opportunistically harvested them on Summit Island too.

Late Norton, 1390-980 cal B.P.

By Late Norton, 1390-980 cal B.P., Summit Island residents again focused on alcids (29 MNI), more so than any of the peoples preceding them. Murre harvest increased significantly (26 MNI) in comparison to Early Norton II murre harvests. The most recent site residents continued to harvest anatids (14 MNI), but at a decreased level, similar to that of peoples living in Early Norton I. Common eider harvests decreased (4 MNI), equal to that of white-winged scoter harvest (4 MNI). Site residents seemed to have limited interest in long-tailed ducks (1 MNI), but continued to harvest cormorants in abundances (8 MNI) similar to that of previous occupants in Early Norton I and Early Norton II. More than half of the cormorant specimens recovered in Late Norton components came from juvenile individuals, aged one to two months, suggesting that the most recent site residents targeted young birds that were large-bodied, but unable to fly.

Late Norton site residents continued to harvest walrus (6 MNI) and bearded seals (8 MNI) at a rate consistent with that in Early Norton II. Small seal harvest (24 MNI) decreased proportionately in Early Norton II, but to a level similar to that in Early Norton I. Small seals continued to be the most sought after marine mammal, and site residents harvested them more often than the larger pinnipeds. Unworked caribou bone, presumably from meat-laden portions, came from a couple of individuals (2 MNI), and these low numbers suggest Late Norton site residents opportunistically harvested caribou from the mainland. Site residents continued to work caribou antler and bone (n=5) as did peoples in Early Norton I and Early Norton II. Marine mammal bone and ivory (n=16) were more frequently used than caribou products and bird bone (n=2) for making objects. Fox (1 MNI) and river otter (1 MNI) may have been taken opportunistically from, or in the waters near Summit Island.

3. *What time of year did site residents harvest primary taxa? Does season of harvest change over time? Is there evidence for year-round or winter habitation on Summit Island?*

Murres

Summit Island residents intensively harvested murres in the spring and early summer. This process started as early as April, when murres, by far the most abundant bird represented in the faunal assemblage, flocked to the sheer rocky cliffs of Black Rock, The Twins, Crooked Island, and High Island in excess of 20,000 to 200,000 individuals per colony (USFWS 2012). The birds nested and laid eggs by mid-June and incubated their eggs until mid-July to early August (Dragoo et al. 2011; Okonek et al. 2007, 2008, 2009; Okonek and Snively 2005, 2006; Sell and Weiss 2010, 2011; Weiss and Sell 2013). Between these months, site residents harvested many birds and eggs from the colonies, possibly using techniques similar to those of the Nunivak Island cliffhangers (Hoffman 1990; Pratt 1990). For safety reasons, any cliffhanging would have occurred on dry, sunny days, to avoid slipping on wet guano-covered rocks (Hoffman 1990). A few puffin (n=2, 1 MNI) and murre (n=1, 1 MNI) specimens exhibit medullary bone providing direct evidence of the spring/early summer harvest of alcids (at least in Early Norton I).

Due to the lack of chick or juvenile specimens in the assemblage, it is unlikely that site residents harvested many murres in the late summer, after mid-July/early August. Murres leave the colonies within a few weeks of hatching, and while some birds remain within waters near the colonies, many murres would have migrated out to sea to forage and molt (Frederiksen et al. 2016; Olsson et al. 1999). After hatching through fall migration, murres as a species would have been less abundant in the Walrus Islands. Murres would also be less vulnerable when floating in open water, rather than bunched together against the rock face in colonies, making it more difficult for people to mass harvest them (Denlinger 2006; Ehrlich et al. 1988). It is possible that site residents avoided intensive bird hunting during the summer in an effort to promote sustainable populations. Huna Tlingit living in the community of Hoonah have explained that they do not harvest gull eggs once females have started incubating eggs, because at this point, they are no longer capable of laying more eggs for the year (Hunn et al. 2003). To collect eggs after females have started incubating will ensure that the bird will not have any viable offspring in that year, which respondents believed would adversely affect gull populations.

By winter, most murres would have migrated beyond the sea ice extent, and only low numbers of a resident population would inhabit the Walrus Islands (Denlinger 2006). Studies on extant murre populations indicate that the birds prefer the outer islands, with more exposed cliff faces, and they do not congregate close to the mainland shore or

Summit Island (Fall et al. 2013; USFWS 2012, 2013b). Outside of the nesting season, Summit Island residents would have had a harder time harvesting murres because they are more dispersed and mobile, but less abundant, in nearshore environments. Based on the faunal data, there is no evidence to indicate that Summit Island peoples harvested murres in any significant capacity in the fall and winter. This mirrors historic and contemporary subsistence data, which documents the intensive harvest of alcids and eggs from nests during the spring and early summer months, and opportunistic harvest throughout the rest of the year (Naves 2015b; Paige et al. 2000; Wentworth 2007).

Sea Ducks

Summit Island residents harvested sea ducks primarily during spring and fall migrations, when hundreds of thousands of waterfowl pass through Bristol Bay (SDJVP 2009; USFWS 2008, 2013b). Ducks that nest and breed in Bristol Bay would have been available into the summer as well. The harvest of sea ducks started in April, when spring break-up provided numerous leads of open water where birds could rest and molt. White-winged scoters, which do not currently breed in Bristol Bay, would have been most abundant during spring and fall migrations and available infrequently at other times of the year (Baldassarre 2014; SDJVP 2009). Common eiders would have been the most abundant duck to occupy Bristol Bay during the spring/early summer because they nest in large colonies on the beaches of the Walrus Islands in May and June (USFWS 2012). I recovered four common eider specimens containing medullary bone, from Early Norton I and Early Norton II (1 MNI each), providing direct evidence of spring/early summer harvests. I recovered three large juvenile common eider specimens from one individual that also indicate some fall harvest of this species (in Early Norton II). Long-tailed ducks would have been less abundant than common eiders, but still available in the summer, nesting on the islands, but inland, away from the shoreline (SDJVP 2009).

The presence of medullary bone and large juvenile anatid specimens indicates harvests in the spring/early summer and the late summer/fall. There is no direct evidence (the recovery of chick specimens) that site residents harvested sea ducks in the middle of the summer, after young had recently hatched. Like the Huna Tlingit, site residents may have avoided intensively harvesting sea ducks during the summer, once birds started incubating eggs, to not adversely affect sea duck populations. On the other hand, it is possible that Summit Island residents did not have the same level of access to sea ducks during the summer as during the spring and fall migrations, because sea ducks take to open water within weeks of birth and are generally less inaccessible. A much smaller population of ducks inhabit the region in the summer (than during the spring and fall), because many of the birds migrate to other locales for breeding and nesting. In Greenland, Gotfredsen (1997) found that Nipisat residents targeted nesting females (with medullary bone), hatchlings, and juvenile common eiders during the Middle Holocene, from 4400-2800 cal B.P., which indicates that some pre-contact groups were not adverse to harvesting incubating females and chicks. Site residents may have also had a different focus during the summer months. Historically and today, the people of Togiak harvest berries and salmon during the summer months (Coiley-Kenner et al. 2003; Fall et al. 1991; Krieg et al. 2007; VanStone 1988). The salmonid remains recovered from the Summit Island excavations (though not analyzed for this study) could be remnants from Late Holocene summer fishing.

Site residents would have had access to common eiders during the winter, because they frequent polynyas and leads that exist in the sea ice expanse (Ehrlich et al. 1998; SDJVP 2009; Wolfe and Paige 2002). Hunters in the Yukon-Kuskokwim and eastern Aleutians have noted that eiders can be found just beyond shorefast ice, and they will take common eiders opportunistically when hunting seals (Wolfe and Paige 2002:79-82). Summit Island is located within the margin of shorefast ice expanse, with researchers having documented shorefast ice extending beyond the island in some years (Schumacher et al. 1979; Sinnott 1992). Because of Summit Island's location within the shorefast ice zone, it is probable that Summit Island residents had local, ready access to common eiders populations wintering in the Walrus Islands. Subsistence data from the 1990s A.D. indicates that people from coastal Alaska Native communities from the North Slope to the northern Alaska Peninsula have hunted common eiders on a year-round basis, though intensity of harvest varied by season (Wolfe and Paige 2002:28 and 70). Based on the annual eider harvest, the majority of recent common eider harvest occurred in the spring (59%). Lesser numbers of common eiders were taken in the fall (23%), summer (15%), and winter (3%). Subsistence data from coastal Alaska Native communities generally links common eider harvest with spring break-up and as supplementary to marine mammal hunting (Paige 2000; Wolfe and Paige 2002).

Cormorants

Summit Island residents harvested cormorants in the spring and fall, much as they did with sea ducks. Migrating cormorants return to Bristol Bay in May, and begin nesting and breeding almost immediately. By mid-May, cormorants would have been incubating eggs, with hatching occurring between mid-June and July. Cormorants would have been most abundant and available in a colony setting, and site residents harvested cormorants from a small colony on Summit Island. They may have also harvested cormorants from murre-dominated colonies on other islands. Cormorants will abandon the nest when disturbed, so site residents would have likely harvested them by noosing individual birds or dropping nets over multiple birds, by surprise or when sleeping (Gotfredsen 1997; Oswalt 1967; Pratt 1990).

The presence of large juvenile specimens (aged 1-2 months old) in the Early Norton II (n=3) and Late Norton sub-assemblages (n=40), indicates that site residents targeted this taxon during the fall (September and October), when cormorants were at or near adult proportions, but still unable to fly. The lack of chicks suggests that site residents did not target cormorants in the summer, within the first month after hatching. Cormorants are a resident species in northern Bristol Bay (Denlinger 2006). Site residents would have had year-round access to the taxon, though in much smaller numbers during the winter. Winter harvest of cormorants is not evident in the Summit Island faunal assemblage, but may have occurred opportunistically when site residents were hunting marine mammals in the sea ice environment. Contemporary subsistence data from the Aleutians, Saint Lawrence Island, and the Alaskan coast of the Bering Sea indicate that some hunters will opportunistically harvest young cormorants in the fall and winter (ADF&G 2016a; Georgette 2000; Naves and Zeller 2013). The faunal data, however, only provide direct evidence of spring/early summer and fall harvest of cormorants.

Small Seals

Summit Island residents harvested small seals on a year-round basis. This idea is supported by the recovery of yearling bone specimens aged 0-2 months, 3-7 months, and 8-12 months in each component. MNI abundances associated with each of these yearling age groups is very low (1-4 MNI), and it is not possible to ascertain whether site residents intensified harvest of seals on a seasonal basis. Low abundances of adult small seals are also associated with each component (2-7 MNI). Given the life history of small seals, it is likely that site residents had more access to the adult seals during the months of November through April, when sea ice was present. Juvenile seals are slightly better represented in the Summit Island faunal assemblage, than yearlings and adults (19 MNI versus 12 MNI), but these specimens do not provide much in the way of seasonal data. Juveniles do not have the same habitat restrictions as breeding seals and site residents could have harvested them from myriad environments (shorefast ice, ice floes, open water, anadromous rivers, island beaches, mud flats, etc.) throughout the year.

Subsistence data from several contemporary coastal Alaska Native communities show a similar pattern of year-round harvest, but with noticeable increase in take related to season (Fall et al. 2012, 2013; Georgette et al. 1998). People stated that they typically did not prefer to harvest seals in mid-summer, due to thin skins and low blubber content (July-August) or in mid-winter due to limited daylight and extreme temperatures and weather (Fall et al. 2013; Georgette et al 1998). Based on counts, intensive contemporary seal harvest typically occurs during spring break-up, in the months of May and June, and again in the late fall, in September and October. Lower seal takes occur throughout the remaining months, but respondents harvested seals in every month of the year (Georgette et al. 1998). Hunters from Togiak have noted a preference for hunting seals on ice between February and April (Fall et al. 2012, 2013; Wolfe et al. 1984).

Bearded Seals

The identification of 0-3-month-old bearded seal remains, in each component, indicates that Summit Island residents harvested the taxon during spring break-up and through the summer, from late April to mid-July. Yearling bearded seals were slightly more abundant than any other age group of bearded seal (juvenile and adult), which suggests that site residents may have targeted bearded seals during spring break-up. I identified one 6-month-old bearded seal in Late Norton as well, providing some evidence of a fall harvest (September-October) of the species. Adult bearded seals were present in low abundances in each component. Based on the life history of the species, site residents would have had access to them from the months of November to April, when sea ice is present in Bristol Bay. Site residents harvested similarly low abundances of juvenile beaded seals, but given that they do not have restrictive habitat requirements and inhabit Bristol Bay on a year-round basis, the presence of these individuals does not specify season of harvest. As with small seals, contemporary hunters have the most success taking bearded seals during breeding and pupping season (at spring break-up), when they are most abundant in coastal zones (Fall et al. 2012, 2013; Wolfe et al. 1984). Coastal Alaska Native communities link bearded seal availability with the presence of sea ice, preferring to hunt them on ice because they are easier to dispatch, less likely to be lost when struck or spoil, and are easier to process (Fall et al. 2013; Gadamus and Raymond-Yakoubian 2015; Georgette et al. 1998; Huntington et al. 2013, 2016). In Togiak, hunters typically harvest bearded seals February through April, but as late as May, depending on the presence of sea ice (Fall et al. 2012:221).

Pacific Walrus

Summit Island residents harvested walrus during the spring (April-June) and fall months (September-October), most likely in the sea ice environment. Late Holocene hunters targeted herds composed mostly of adult females and calves. I suggest this based on the identification of low abundances of 0-3-month-old and 6-month-old calves (2-4 MNI), as well as similar abundances of breeding age walrus, in each component (1-3 MNI). While I did not determine the sex of the breeding age walrus specimens, they all come from small individuals, similar in proportion to a 6-year-old female walrus comparative specimen from UWBM (#35479). Walruses display sexual dimorphism, and similarly aged male would be larger and have proportionally bigger bones (Fay 1982). The mother-calf bond is very strong in walrus, and it is unlikely that all of the calves represented in the faunal assemblage were abandoned or orphaned. It is possible, however, that some of the calves were abandoned/orphaned, and site residents may have harvested them when there was no sea ice in Bristol Bay. If this is the case, the calves, particularly the 6-month-old walruses were likely harvested from male haul-outs like the major one that currently exists at Round Island, or from other islands with smaller haul-outs. Researchers have documented small numbers of walrus hauling out on Summit Island in the summer months, historically and today (ADF&G 2015a; Sinnott 1992; VanStone 1988). It is conceivable that Summit Island residents were able to take some walrus near their settlements as well. There is no documented occupation of Summit

Island after the Norton era, however, and it is possible that recent and historical observations of walrus hauled out on Summit Island coincided with people no longer intensively inhabiting the island. Given the wary and skittish nature of walruses, the Late Holocene human use of Summit Island may have been enough to keep walrus from hauling out there (Fay 1982; Jay et al. 1998). Older adults with fully fused bones and juvenile walruses are also represented in the faunal assemblage, which could have come from female-dominated herds or from male haul-outs. These animals do not provide any obvious seasonal data.

In various subsistence reports, Alaska Native hunters have noted that the best way to hunt walrus is on the ice (Fall et al. 2013; Fay 1982; Gadamus and Raymond-Yakoubian 2015; Olanna Conger and Magdanz 1990). Hunting on ice results in more successful takes (rather than losing a struck animal that swims away or sinks), cleaner processing, and easier transport. In recent decades, Togiak hunters targeted walrus in the spring and fall, though the specifics of the contemporary hunt are very much influenced by the creation of the Walrus Island State Game Sanctuary in 1960 and pursuant animal conservation policy (Fall et al. 1991; 2013). Contemporary spring hunts occur throughout northwest Bristol Bay, wherever there is ice, including in the waters around Hagemeister Island, Summit Island, High Island, and Crooked Island (Fall et al. 2012, 2013; Huntington et al. 2013). It is plausible that Summit Island residents found walrus in similar places in the spring during the Late Holocene. The contemporary northwest Bristol Bay fall hunt is centered on harvesting walrus from the beaches of Round Island, which is heavily regulated in the timing and annual take of walruses (BBNA n.d.a, n.d.b.; Chythlook and Fall 1998; Fall et al. 1991). Based on the data presented in Fall et al.

(1991) and VanStone (1988), Round Island was also an important place for hunting walrus in the historic era, due the abundance and regularity of walruses that hauled out there. Schaaf et al. (2007) and Schaaf (2015) have also provided evidence that humans hunted walrus on Round Island in the Middle and Late Holocene, starting as far back as 6310 cal B.P. It is probable that Summit Island residents hunted walrus on Round Island throughout the Late Holocene, but the season of use is unknown. Given the behavior of male walruses, if Summit Island residents hunted walruses on Round Island, they would have had the most regular access to abundant walrus populations during the summer and fall, much like contemporary hunters do.

Seasonal Variation in Summit Island Subsistence Practices

Immature animal bones recovered from the Summit Island faunal assemblage, some of which can be aged to the approximate month of death, directly indicate the time of year that site residents harvested certain taxa. Medullary bone, which is present in the endosteal cavities of female birds shortly before and after egg production, also provides direct evidence of the season of harvest (notably spring and early summer). Less direct evidence includes the seasonal movements and habitat requirements of marine birds and mammals, which can vary based on maturity, latitude, or climatic fluctuations. Figure 40 provides a visual representation of when Summit Island residents occupied Summit Island based on my assessment of the direct and indirect evidence related to key taxa identified in the faunal assemblage. In the figure, greyed sections show confident assessments of seasonal animal harvest based on the direct indicators and a consideration of when animals would have been most abundant and accessible in the Walrus Islands.

Boxes with question marks indicate seasons that site residents could have reasonably harvested animals, but with more uncertainty.

Figure 40 shows that there is remarkable consistency in the seasonal subsistence practices of the Late Holocene Summit Island residents, from 2740 to 980 cal B.P. Based on the recovery of 0-2 month old, 3-7 month old and 8-12 month old small seal specimens from each component, it is possible to say that Summit Island residents harvested small seals on a year-round basis, throughout the Late Holocene. Bird bone specimens containing medullary bone also came from Early Norton I and Early Norton II components, directly indicating that some site residents harvested birds during the spring and early summer. Juvenile bird bone specimens recovered from Early Norton II and Late Norton also provide direct evidence that some site residents harvested birds in the fall. Although I did not identify bird bone specimens containing medullary bone or those identified as juvenile from every component, it is reasonable to infer that based on the consistency of taxa recovered from each component, all Summit Island residents harvested marine birds during the spring/early summer and fall. This is when sea ducks and seabirds would be most abundant in the Bristol Bay area, and site residents would have had the most reliable access to birds and eggs.

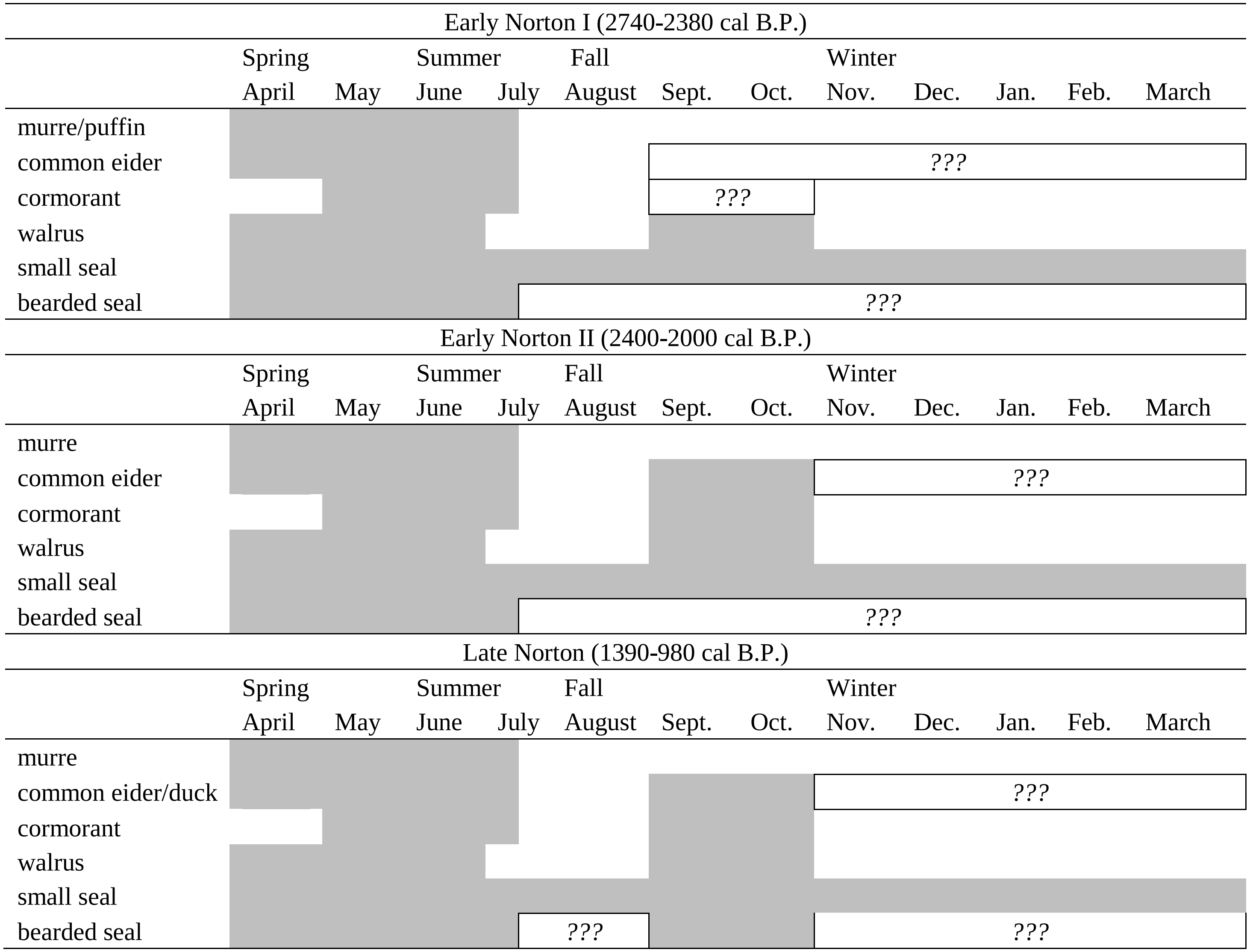

Figure 40. Summit Island seasonal animal harvest inferred from faunal analysis.

A similar argument is applicable to inferring season of harvest of some marine animals, where no direct evidence is available. There is direct evidence that site residents from each occupational component harvested immature small seals throughout the year, including the winter months. Based on the migration patterns and pagophilic nature of breeding age ringed and spotted seals, if site residents harvested yearling small seals in the winter, they also harvested adult small seals at the same time (and juveniles too). The life history and habitat requirements of the bearded seal mirrors those of the small ice seals, which also suggests that site residents would have harvested bearded seals at the same time that they harvested small seals. Therefore, I suggest that Summit Island residents harvested large-bodied and small-bodied seals (ringed, spotted/harbor, and bearded seals) on a year-round basis, as part of a general practice of intensively harvesting seals, though site residents obviously had more success catching (or access to) small seals over bearded seals. Late Holocene site residents also consistently targeted walruses in the spring from April through June, and again, in the fall during the months of September and October. I based this assessment on the recovery of pairs of 0-3-month-old and 6-month-old calf specimens in each component.

There are two possible differences in seasonal activities over time. While I stated that all Late Holocene site residents may have opportunistically harvested common eiders as a supplemental activity to hunting seals on the ice (from November through April), it is possible that Early Norton II site residents made a focused effort to harvest common eiders throughout the year, with a particular emphasis on winter harvest. I propose this because of the significant increase in common eider abundance that contrasts to the very low abundance of murres in Early Norton II. Murres were very abundant in the other two components, which indicates some shift in bird harvesting practices. Site residents also harvested many more small seals in Early Norton II as well, while walrus harvest and bearded seal harvest decreased. It is possible that as Early Norton II site residents intensified their harvest of small seals, throughout the ice bound months, they also directed more efforts to harvesting common eiders as well. Fluctuation in the extent of shorefast ice may have favorably positioned Early Norton II site residents to have better access to small seal and common eider populations close to Summit Island.

The second difference involves the targeted fall harvest of 1-2 month old cormorants during the Late Norton component. More than half of the Late Norton cormorant specimens came from large-bodied fledglings, which shows that Late Norton site residents actively targeted these individuals. This contrasts with the cormorant specimens recovered in Early Norton I, of which none were identified as juvenile, and with Early Norton II, of which only three were identified as juvenile. Cormorant abundance stayed relatively consistent between the three components (15-16% NISP, 5-8 MNI), which suggests that the high representation of juvenile cormorants in Late Norton is not the result of intensifying the harvest of cormorants, but rather a specific seasonal focus on fledgling cormorants in the months of August through October.

Overall, site residents maintained consistent seasonal animal harvest practices. Throughout the year, all Late Holocene Summit Island residents harvested ringed, spotted/harbor, and bearded seals. Seal harvest may have intensified during spring break-up and in the fall, as has been noted with contemporary seal harvests (Fall et al. 2012, 2013; Georgette et al. 1998). Intensified harvest in the spring is directly related to increased animal abundance close to the coastline and vulnerability during pupping and breeding. Hunters also prefer to harvest seals in the fall, because they are fat with thick skins (Georgette et al. 1998; USFWS 2008). Walrus harvest occurred in the spring and fall throughout the Summit Island occupations, which is similar to contemporary patterns in northwest Bristol Bay (Fall et al. 1991, 2013). Summit Island residents harvested seabirds and sea ducks in the spring migration and early summer during the nesting and breeding season, and again in the fall, during fall migration. Site residents likely harvested low numbers of birds during the summer months as well, but the lack of chick remains suggests that site residents focused on other interests during the summer. Historic and contemporary subsistence data points to the potential harvest of salmon and berries during the summer (Fall et al. 1991; Krieg et al. 2007). Sealing occurred in the winter, and it is likely that site residents harvested other available animals that live in the sea ice environment on an opportunistic basis. Common eiders would have been the most abundant bird in the winter, but site residents could have accessed some murres and cormorants as well. Site residents would have also harvested walrus in the winter, if available, but their distribution closer to the edge of the sea ice may have made it more difficult and dangerous for site residents to risk winter walrus hunting, particularly when ice seals are more locally abundant close to Summit Island.

Winter Habitation of Summit Island

Many of the key taxa identified in the Summit Island faunal assemblage are dependent on sea ice, which provides ample evidence that site residents inhabited Summit Island when sea ice was present in Bristol Bay. The recovery of 0-2 month old, 3-7 month old, and 8-12 month old small seal specimens shows that site residents harvested them throughout the year, including winter. The MNIs associated with these yearlings are too low to suggest a major season of harvest (1-4 MNI per group), and I do not suggest that site residents intensively harvested small seals over the winter. The intensity of winter occupations is unknown, based on the faunal data.

Contemporary subsistence data from coastal Alaska demonstrates that Alaska Native hunters take small seals in every season, with a noticeable increase in seal harvest during spring break-up and in the fall (Fall et al. 2012, 2013; Gadamus and Raymond-Yakoubian 2015; Georgette et al. 1998; Huntington et al. 2013, 2016). In one study, researchers documented the actual number of seals harvested in the Norton Sound-Bering Strait region from February 1996 to January 1997 (Georgette et al. 1998). Despite increases in seal harvest (both bearded and small-bodied seals) during the months of May (n=534), June (n=682), September (691), and October (889), hunters harvested seals in every month, taking between 68 and 327 individuals in the other months (Georgette et al. 1998:18). Even in the summer, when contemporary hunters from communities in Norton Sound, Bering Sea, and Bristol Bay, noted that they do not prefer to hunt seals (due to thin skins and low blubber) seal harvest in the Norton Sound-Bering Strait region ranged from 154 animals in July, to 230 in August (Fall et al. 1991, 2013; Georgette et al. 1998:18-19). It is very possible that Summit Island residents targeted small seal populations in a similar way. Ultimately, there is direct evidence that Early Norton I, Early Norton II, and Late Norton site residents harvested small seals in the winter. Winter harvest would not have been restricted to yearlings, and site residents would have harvested adult and juvenile ice seals (including bearded seals) during the winter as well.

Ethnographic and subsistence data throughout coastal Alaska indicates that many hunters from indigenous communities prefer to hunt marine mammals on the ice (Coiley-Kenner et al. 2003; Crowell 2016; Fall et al. 2012, 2013; Fay 1982; Gadamus and Raymond-Yakoubian 2015; Georgette et al. 1998; Huntington et al. 2013, 2016; ICS 2015, 2016; Krieg et al. 2007; Lucier and VanStone 1991; Magdanz and Wolfe 1988; Nelson 1899; VanStone 1988). Generally, seals and walrus are easier to kill, process, and transport when on the ice. They are also fatter and have thick skins when sea ice is present (as opposed to the summer when they are leanest and molting). Historic and contemporary Alaska Native communities in the Pribilof Islands, St. Lawrence Island, Diomede Islands, Nunivak Island, and the Aleutians opportunistically harvested cormorants and common eiders in the ice environment, when they hunted marine mammals. Although not the focus of the forays into the sea ice, Alaska Natives valued birds as a source of fresh meat in the winter, particularly recently fledged birds that they considered more desirable because they are tender and fat (ADF&G 2016a; Georgette et al. 1998; Naves and Zeller 2013:42, Paige et al. 2000; Pratt 1990; Wolfe and Paige 2002).

The majority of the important taxa represented in the faunal assemblage inhabit northern Bristol Bay year round, though they have varied availability and abundance depending on the season. Murres, common eiders, and cormorants are resident species, which site residents could have harvested during the winter, though in much lower abundances than would be possible in the spring and fall. Adult ringed seals, bearded seals, spotted seals, female walruses and calves are for the most part dependent on sea ice, and it would follow that the adults harvested during the Late Holocene (and represented in the faunal assemblage) were taken from ice environments. Obviously, direct evidence points to walrus harvest in the spring and fall, but site residents may have been able to harvest some walrus over the winter.

The likelihood of site residents living on Summit Island during the winter is not particularly controversial when one considers its location and proximity to the mainland. While site residents would have been able to take advantage of animals that frequent the deeper waters surrounding Summit Island, the island is relatively close to the mainland shore (6 km). During the winter, site residents would have had much more temperate winter weather, like that experienced on the mainland coast, in comparison to the less protected, more southern location of the other Walrus Islands. The offshore placement of the island, however, would have positioned site residents just a bit closer to marine animals on a year-round basis. Many of the animals represented in the faunal assemblage live within the Walrus Islands, rather than on the mainland coast. Togiak hunters have noted that the deeper waters near Summit Island is prime habitat for bearded and ringed seals even in years of less expansive sea ice, particularly in comparison to the shallow waters on the coast and in Togiak Bay (Fall et al. 2013; Huntington et al. 2013). The periodic expansion of shorefast sea ice south of Summit Island also connects the island to the mainland coast during the winter. In some years, it is likely that Late Holocene site residents were able to walk or boat through open leads from Summit Island to the mainland coast. The proximity of the mainland as well as the ice expansion provided ready access to the mainland coast.

Despite the close access of the mainland coast (regardless of seasonal access), it is obvious that whatever mainland activities Summit Island residents engaged in are not well represented in the Summit Island faunal assemblage. Site residents obviously hunted low numbers of caribou for meat, skin, and tool-making raw materials. This is evidenced by unworked caribou elements with cuts and deep gouges resulting from butchering carcasses in Early Norton I and Late Norton. In Early Norton II, it appears that site residents were not eating much caribou on the island (no unworked elements), but they used antler and bone blanks to make objects and tools. They may have harvested some of the salmon identified in the faunal assemblage from anadromous rivers on the mainland, but they could have also fished for salmon in the waters surrounding the Walrus Islands or in Togiak Bay. Given the underrepresentation of fish (and shellfish) in the faunal assemblage, it is difficult to know how important fish (or shellfish) were to site residents.

Caribou and other terrestrial fauna represented in the faunal assemblage (fox, ptarmigan/grouse, river otter, etc.), swim or walk over ice to islands (Griffin 2014; Leblond et al. 2016; USFWS 2013a). Sometimes these movements result in resident populations, or are part of a migratory/foraging pattern. Nearby examples from the archaeological record include Late Holocene resident caribou populations on Nunivak Island and polar bears on St. Matthew and Hall islands (Griffin 1999, 2014; Lantis 1984; Souders 1997; VanStone 1984). Griffin (2014) noted that though polar bears lived on St. Matthew and Hall islands year round (until their extirpation in the 1890s), the number of polar bears would change as individuals left the island during spring break-up to hunt ice seals on the pack ice. It is within the realm of possibility that site residents procured low numbers of transient caribou on the ice, off the mainland coast, or on Summit Island. I make this point not to argue that site residents lived only on Summit Island and never visited or stayed on the mainland, but rather to note that conceivably all of the animals represented in the faunal assemblage could have been harvested away from the mainland.

Throughout the Late Holocene, Summit Island residents displayed a heavy reliance on marine animals and could reasonably access meat and by-products from birds and pinnipeds that lived in the Walrus Islands chain, on a year-round basis. There is limited evidence to suggest that site residents required or focused on mainland resources.

Some of the artifacts recovered from Summit Island provide further proof that site residents lived on the island during the winter. Artifacts recovered from all three Summit Island components, which are associated with winter occupations (at least at mainland sites) include pecked stone bowls (used as marine mammal oil lamps to provide light during short winter days) and pottery for long-term food storage (Bockstoce 1979; Bundy 2007; Dumond 1981; Giddings 1964). Dumond (1981, 2016), Giddings (1964), Harritt (2010), Hoffman (2009), and Saltonstall et al. (2012) noted that extensive and long-term Norton occupations, those that have been interpreted as winter settlements, tend to be associated with extensive middens, high artifact counts, and deeply dug housepits, with several living surfaces and episodes of reuse. These sites also tend to cover several acres consisting of multiple house features and associated cache pits to keep food stores for winter use. Shaw (AHRS 2010) characterized 49-XHI-043 and 49-XHI-044 as extensive sites with several large housepit features and cache pits. The discussion of site stratigraphy in Chapter IV shows that the housepits were deeply excavated and had extensive associated midden. The radiocarbon dates from each component also suggest that each component developed in a relatively short period (centuries versus millennia). Although the artifacts have not been quantified, Shaw and crew recovered several thousand bone, stone, wood, and pottery artifacts. Schaaf (2015) suggested that Norton winter occupations may be present on Round Island, based on the recovery of Norton pottery sherds and pecked stone bowls (oil lamps?), and a house feature with whalebone structural members that she interpreted as a more sturdy winter structure. Shaw also documented several other large village sites, possibly from the Norton era, on other parts of Summit Island, Crooked Island, and Hagemeister Island that may have been intensively occupied (AHRS 2010; Shaw 1998).

Given the long-term harvest of marine birds and mammals represented in the faunal assemblage, the islands in northwest Bristol Bay probably provided Late Holocene peoples with better access to animal populations than the mainland coast. The Late Holocene coincided with the Neoglacial, a major cooling event that would have supported extensive sea ice cover in Bristol Bay making the Walrus Islands a prime place for all of the ice-adapted species represented in the faunal assemblage. Proxy data on the local paleoenvironment suggests that northwest Bristol Bay experienced similar, but slightly cooler climatic conditions compared to the 20th century, with variable cooling and warming spells (Chipman et al. 2009; Hu et al. 1995; Kathan 2006; Levy et al. 2004). Almost 40 years ago, Schumacher et al. (1979) estimated average sea ice coverage in Bristol Bay was 50% or greater of the bay’s total area, at the height of winter, and documented the presence of polynyas around most of the Walrus Islands. Recent NASA satellite data from 2012 shows that, in some years, sea ice can cover most of northern Bristol Bay as late as April, with many open leads and polynyas present around the Walrus Islands (NASA 2012a, 2012b). If we speculate that sea ice coverage was greater and lasted longer in the Late Holocene during the Summit Island occupations, it is possible that Arctic species inhabited northern Bristol Bay (and the area around Summit Island) in greater numbers and for longer stretches of time, than with extant populations.

With increased sea ice present in northern Bristol Bay, ice-adapted species would have had plenty of habitat to stay near Summit Island potentially as late as June and return as early as October with expanding sea ice (as evidenced by the 3-month-old and 6-month-old walrus calf bones in the faunal assemblage).

With such conditions, Summit Island would have been an appealing place for Norton people to take advantage of large populations of animals living within the sea ice environment from October through June. Summit Island residents would have been able to access the mainland as needed, with Right Hand Point being a mere 6 km to the north, either by boating through open leads in the sea ice or walking across the ice. The placement of homes on the west-southwest shore of Summit Island, which overlooks Bristol Bay, would have provided these people with better opportunities to locate and harvest animals living on the ice or flocking to open waters with the ice pack. The position of the island at the break between more dynamic pack ice and shorefast ice margins would have provided site residents with an excellent opportunity to access species that inhabit both niches.

If sea ice (and pagophilic animals) attracted site residents to the island, warmer conditions, which did not favor sea ice, may have influenced Norton peoples to move away from Summit Island. All of the major occupations of Summit Island evidenced in Shaw's excavations show that peoples intensively used large housepits at 49-XHI-043 and 49-XHI-044 from 2740-2000 cal B.P. and again in 1390-980 cal B.P. Between Early Norton II and Late Norton, it appears that people stopped occupying these housepits and only made use of the 49-XHI-044 housepit as a temporary camp around 1780-1550 cal B.P. (or as late as 1520-1300 cal B.P.). Shaw documented this temporary use in Stratum 2 at 49-XHI-044, evidenced as a shallow living surface with limited associated artifacts and faunal remains. This ephemeral living surface was quite different from the thick cultural strata with numerous artifacts and faunal remains associated with Early Norton I, Early Norton II, and Late Norton components. While I noted in Chapter IV the dating inconsistencies with Stratum 2, these dates overlap with the Medieval Warm Period, which researchers documented in northwest Bristol Bay anywhere between 2000 and 1400 cal B.P., but possibly as late as 1200 cal B.P. (Hu et al. 1995; Kathan 2006; Kaufman et al. 2012; Levy et al. 2004).

Faunal remains from Stratum 2 include nine identifiable specimens (out of 18) from one Young Adult/Adult walrus (n=7, 1 MNI), one Young Adult/Adult bearded seal (n=1, 1 MNI), and one long-tailed duck (n=2, 1 MNI). The walrus specimens were covered with heavy cut marks and butchery hacks, while the bones from the other animals did not have any noticeable modifications. Given the small number of animal remains recovered from the stratum, it is possible that one or a few hunters camped on Summit Island in the spring or fall, when migrating long-tailed ducks stopped over in Bristol Bay, with the intent to harvest a walrus hauled out on the island, but also take advantage of any other available animals. Once hunters dispatched and butchered the walrus, they returned to their main settlement, with meat in tow. During this warm period, there may have been less ice by Summit Island, which decreased ringed seal habitat. The people who typically occupied Summit Island over centuries shifted their main settlement to another locale, where more shorefast ice and ringed seals were available. They continued to scout Summit Island, however, for the larger walrus and bearded seals that tend not to venture into Togiak Bay. When climatic conditions cooled again, bringing back more sea ice, people took up residence back at the housepit at 49-XHI-043 during Late Norton.

4. *How do the timing of the Summit Island occupations and subsistence practices of the Summit Island residents compare with similar occupations in southwest Alaska?*

Summit Island and Timing of the Norton Stage in Southwest Alaska

With the exception of the Chagvan Bay Site (2850-910 cal B.P.), Summit Island appears to have the longest span of Norton Stage occupations documented in Alaska. These include components from 49-XHI-043 and 49-XHI-044 radiocarbon dated between 2740 and 980 cal B.P. Early Norton I (2740-2380 cal B.P.) on Summit Island as well as Phase I/II (2850-1630 cal B.P.) of the Chagvan Bay Site have some of the oldest Norton components in Alaska, though they fall outside the traditionally accepted Norton date range (2500-1000 cal B.P.). As discussed by Dumond (1977, 1982, 1984, 1987a, 1987b, 1990, 2000a, 2000b, 2011, 2016), all other Norton Stage sites follow a distinct pattern of age: sites in the Norton Sound region have the oldest dates, with the earliest hovering around 2500 cal B.P., while those to the south are more recent by at least 100 years (2400-2300 cal B.P.). In Norton Sound, the oldest radiocarbon-dated sites include Iyatayet (2580-1780 cal B.P.; Giddings 1964; Tremayne 2015), Old Beach Site (2430-2180 cal B.P.; Bockstoce 1979), and Difchahak (2520-2050 cal B.P.; Harritt 2010). The next oldest Norton Stage radiocarbon dates came from Smelt Creek Phase components on the northern Alaska Peninsula (2400-2000 cal B.P.; Dumond 1981, 2011), Component III on Round Island (2365-2120 cal B.P.; Schaaf 2015), and Early Norton II on Summit Island (2400-2000 cal B.P., this study). At least one radiocarbon date from the Chagvan Bay Site demonstrates that humans also lived in Kuskokwim Bay around the same time (2310-2120 cal B.P, see appendix). The temporal overlap in the 19 radiocarbon dates that Ackerman (1988) recovered from Settlement Clusters I and II, however, make it difficult to ascertain if there was a discrete occupation at Chagvan Bay that co-occurred with the Smelt Creek Phase, Component III, and Early Norton II (see appendix).

Dates from the Naknek Region, Round Island, Summit Island, and Chagvan Bay make it apparent that Norton peoples occupied the length of the southern coast of mainland Alaska by 2400-2300 cal B.P. The dates from Early Norton I on Summit Island (2740-2380 cal B.P.) and Component I/II at Chagvan Bay (2850-1630 cal B.P.) indicate that this occupation started earlier than previously recognized. The age of the Bristol-Kuskokwim Bay sites, 2850-2500 cal B.P., are older than the Norton Sound sites by 200-300 years (2580-2430 cal B.P.), which suggests that the development of the Norton Stage occurred a few centuries earlier than previously documented.

The identification of pre-2500 cal B.P. Norton Stage components in the Bristol-Kuskokwim Bay area, and not in Norton Sound, is as much about chance as it may be about the dynamic nature of the paleoenvironment. Research in southwest Alaska is relatively sporadic, and very few intensive studies have been conducted in the region. As described in Chapter III, core research areas with long-term or extensive archaeological investigations include Norton Sound and the Naknek-Ugashik drainages with sporadic or limited research scattered along the coastline between these two areas. It is very likely that archaeological sites with pre-2500 cal B.P. Norton Stage components remain undisturbed along the vast coastline stretching from Norton Sound to the northern Alaska Peninsula. It is also possible that some have been excavated, like the Summit Island collection, but remain unanalyzed. Thus far, the earliest Norton Stage components have been located on islands or in protected bays and sounds, rather than on the more exposed coastline between Norton Sound and Bristol-Kuskokwim Bay, which may play a factor in the distribution of early Norton sites. Researchers working on Arctic and Subarctic coasts have documented noticeable erosion of coastal sites, due to storms and sea level change, within the span of a few decades or from one field season to the next (Anderson n.d.; Anderson and Freeburg 2013; Blankholm 2009; Bockstoce 1979; Dawson 2015; Freeburg and Anderson 2012; Hald 2009). Due to the dynamic nature of climate change and sea level fluctuation, it is very likely that some early Norton sites (presumably on the coast) have been submerged or destroyed by wave erosion. Manley (2002) estimated that eustatic sea levels rose a mere 1.4 m during the last 3,000 years, but changes on the local level can be unique, and cause considerable modifications to the coastline (Crowell and Mann 1996).

Components that could be categorized as Middle-age Norton (2000-1300 cal B.P.) are not well documented on Summit Island. I noted, however, that unverified dates from 49-XHI-044 components (1780-1300 cal B.P.) are likely the key to finding a temporal connection between Early Norton II (2400-2000 cal B.P.) and Late Norton (1390-980 cal B.P.). I also pointed out that Shaw’s 1985 excavations centered on two housepits and related features; the site information he provided on the Alaska Office of History and Archaeology site forms described much larger and extensive archaeological components that may cover the range of Middle Norton. Middle Norton components are represented in Bristol-Kuskokwim Bay by some radiocarbon dates from Component III on Round Island (2055-1530 cal B.P.; Schaaf 2015), Chagvan Bay (2040-1630 cal B.P.; Ackerman 1986), and Nunivak Island (2150-1400 cal B.P.; Nowak 1982). In Norton Sound, Bockstoce (1979) noted a Norton component he termed Late Norton, dated to 1800-1600 cal B.P. On the Alaska Peninsula, the Brooks River Weir Phase (2000-1300 cal B.P) and the Inland sub-phase of the Ugashik Lake Phase (2200-1700 cal B.P.) represent Middle Norton components (Dumond 2005b, 2011; Henn 1978). More recent excavations at 49-UGA-050 and 49-UGA-051 in Ugashik drainage, have resulted in the identification of other Middle (and Late) Norton components as well (1990-1110 cal B.P. and 1750-1150 cal B.P., respectively; Saltonstall et al. 2012; Hoffman 2009).

Late Norton on Summit Island dated to 1390-980 cal B.P. This overlapped with other Bristol-Kuskokwim Bay components including Phase III at Chagvan Bay (1600-910 cal B.P.), and the Lower Component on Hagemeister Island (1260-1060 cal B.P.) (Ackerman 1986; Bailey 1991). Schaaf (2015) noted a post-1530 cal B.P. Norton component on Round Island, but it is currently undated. Late Norton components have not been located in Norton Sound, despite Bockstoce (1979) calling the most recent Old Beach Site component Late Norton. In reality, it is contemporaneous with mid-range Norton components throughout southwest Alaska. Late Norton components were present on the northern Alaska Peninsula in the Brooks River Falls Phase (1300-1000 cal B.P.) of the Naknek drainage and the Tidewater sub-phase of the Ugashik Lake Phase (1600-1000 cal B.P.) from the Ugashik drainage (Dumond 2005b, 2011; Henn 1978; Hoffman 2009; Saltonstall et al. 2012). Interior sites in the Yukon-Kuskokwim Delta (49-MAR-007) and Togiak drainage (49-GDN-233) had Late Norton components dated to 1370-720 cal B.P.

and 1290-930 cal B.P., respectively (Shaw 1982b, 1983; Biddle 2001). Some of the terminal dates in these Late Norton sites are too recent to fit within the current conception of the Norton Stage (2500-1000 cal B.P.; Dumond 2000b, 2016). This is in part related to the large standard errors of 1980s conventional radiocarbon dates, which Shaw (1983:114) addressed in his analysis of the Manokinak Site. He suggested that the most recent Norton components were more appropriately dated to 1200-900 cal B.P.

The Upper Component on Hagemeister Island (900-670 cal B.P.) is the youngest component identified as stylistically Norton (Bailey 1991). Bailey (1991) noted that the 900-670 cal B.P. age was too recent for Norton, but hypothesized that it was a late Norton occupation that overlapped with a nearby Thule occupation at Old Togiak (Kowta 1963). While the material culture from the Upper Component does appear to be Norton, it is possible that this is an erroneous date. Bailey (1991) only procured two dates for the Upper Component, and it should be re-dated to confirm this recent age.

Given the review of radiocarbon-dated Norton Stage sites in southwest Alaska, it is possible to develop five general time periods represented in different sub-regions. I grouped these based on date ranges, but the designations do take into account Dumond’s conception of Norton phases, which he based on dating and artifact typology:

- *Early Norton I, 2850-2500 cal B.P.*, thus far limited to Bristol-Kuskokwim Bay;
- *Early Norton II, 2500-2000 cal B.P.*, found throughout coastal southwest Alaska, from Norton Sound to the northern Alaska Peninsula;
- *Middle Norton, 2000-1300 cal B.P.*, found throughout coastal southwest Alaska, from Norton Sound to the northern Alaska Peninsula;

- *Late Norton, 1300-900 cal B.P.*, found in Kuskokwim Bay to the northern Alaska Peninsula and in the interior;
- *Post-Norton/Late Norton, 900-670 cal B.P.*, found on Hagemeister Island and in the interior.

Shaw's excavations at Summit Island recovered cultural materials that extended the full range of the Norton era. Some of the components may pre-date and postdate Norton, which has implications for understanding the origins of Norton culture, as well as the transition from Norton to Thule culture in southwest Alaska. Dumond's work on the Alaska Peninsula provides a valuable baseline against which to measure trends in the Summit Island assemblage. Future work will require an investigation of the material culture and more radiocarbon dating of the Summit Island components. For now, the earliest Norton components have been documented on the shores of northwest Bristol Bay and southern Kuskokwim Bay, evidenced at Chagvan Bay and on Summit Island (2850-2500 cal B.P.). By early Norton II, the occupation of Summit Island aligns with the widespread coastal expansion of Norton culture evidenced in Norton Sound, Nunivak Island, the Walrus Islands, and the northern Alaska Peninsula. Occupation of Summit Island during Middle Norton is ambiguous, but evidenced in Stratum 2 at 49-XHI-044. This may be a sampling issue. By Late Norton, Norton peoples continued to occupy Summit Island, but there is limited evidence to suggest the island was occupied during the Thule era (Post-Norton/Late Norton).

Norton Stage Subsistence Practices in Coastal Southwest Alaska

It is difficult to compare the subsistence practices that I documented for the Summit Island residents with those evidenced in other Norton Stage components (as described in Chapter III). Much of the published information related to faunal remains recovered from Norton sites is anecdotal, or the assemblages are too small, to allow for a nuanced comparative analysis. Based on researcher descriptions, the faunal assemblages from Nunivak Island (49-XHI-028, n=900?) and the Manokinak Site (49-MAR-007, n=?) are sizeable, with a diversity of species represented (Chatters 1972; Nowak 1982, 1988; Shaw 1983; Souders 1997). If further analyzed, these assemblages could potentially provide meaningful data to understand the variability of Norton subsistence practices in remote offshore island and interior settings, which differs from the near-coastal island setting of Summit Island. To a lesser extent, the small assemblage from Hagemeister Island (49-XHI-016, n=298) and Round Island (49-XNB-043, n=107) should be able to provide an inventory of some of the kinds of animals site residents targeted, but not much in the way of identifying changes in harvest practices through time. Very small, poorly preserved assemblages include 49-UGS-050 (in the Ugashik drainage, n=5), Cape Nome (Old Beach Site, n=?), and the Anuska Tommy Site (49-GDN-233, n=28). These small assemblages can be useful to indicate the presence of one of more taxa harvested by site residents. The Iyatayet faunal assemblage has been analyzed and is the only assemblage large enough to compare to the Summit Island collection. Though excavated approximately 50 years apart, when combined, Giddings (1964) and Tremayne (2015) analyzed 1,690 faunal specimens and 62 organic implements from Iyatayet. This is now the second largest analyzed Norton faunal assemblage (the Summit Island faunal assemblage is the largest).

Iyatayet and Summit Island share some similarities in that they are located in coastal settings along relatively protected Arctic waters. Summit Island is located on a nearshore island, 6 km away from the mainland, in northwest Bristol Bay, while Iyatayet is situated “in a small, sheltered cove” on Cape Denbigh on the mainland coast in Norton Sound (Tremayne 2015:155). Marine, freshwater, and terrestrial resources are readily accessible from both locations. Due to the migration patterns of the birds and marine mammals discussed in this study, both places are inhabited by many of the same species, if not the same individuals, in a given season. Sea ice also factors greatly into the winter environments of both locales.

Differences in excavation methods and researchers’ interests limit a full comparison of the two assemblages. Giddings (1964) did not screen any of the materials he collected from Iyatayet, nor did he attempt to recover all cultural materials. Giddings noted only large faunal specimens, though he had the good sense to ask local people to identify the animal bones. The lack of systematic recovery, and disinterest in non-diagnostic items, may have influenced his assessment that Norton people did not harvest birds while living at Iyatayet. It may have also influenced the lack of recovered fish and small land mammal specimens. Several decades later, Tremayne (2015) systematically excavated at Iyatayet, working sediments through 1/8 in. mesh, recovering large and small bone specimens including some fish, bird, and small land mammals. On Summit Island, Shaw and crew screened materials through 1/4 in. mesh and attempted to recover all materials that stayed in the screen. Unfortunately, an untold amount of small fish and shellfish parts did not catch in the screen, and did not make it into the faunal lots. The crew also deemed some bone specimens too large for collection. They documented these specimens in field notes, but did not recover them, which makes confirming their field identifications impossible.

Despite the differences in the assemblages, a look at the relative abundance (NISP and %NISP) of faunal specimens recovered from Iyatayet and Summit Island shows some obvious similarities in subsistence practices, particularly in regards to the harvest of mammals (Table 40). The Iyatayet specimen counts are compiled from Giddings (1964:186) and Tremayne (2015:187-188).

Table 40. Summit Island and Iyatayet Animal Abundance (NISP and %NISP)

	Summit Island		**Iyatayet**	
Taxon	**NISP**	**%NISP**	**NISP**	**%NISP**
terrestrial mammal, identifiable	62	6	10	1
walrus	222	23	35	4
small seal	480	50	717	72
bearded seal	131	14	116	12
pinniped, phocid, large seal	25	3	43	4
beluga/whale	2	<1	41	4
caribou	46	5	32	3
Subtotal (mammal)	968	100	994	100
bird, identified	1,244		3	
Subtotal (identified)	2,212		997	
bird, unidentifiable	1,382		2	
terrestrial mammal, unidentifiable	239		5	
marine mammal, unidentifiable	2,680		5	
mammal, unidentifiable	3,468		672	
fish, unidentifiable	present		12	
shellfish, unidentifiable	present		present	
Subtotal (unidentified)	7,769		696	
Total	**9,981**		**1,690**	

Both sets of site residents primarily harvested seals, though Iyatayet residents appear to have more intensively focused on the taxon in comparison to Summit Island residents (88% versus 67% NISP). Small seals are by far the most abundant in each assemblage (72% for Iyatayet versus 50% for Summit Island); with bearded seals represented by much lower abundances (12% for Iyatayet versus 14% for Summit Island). It is probable the Iyatayet and Summit Island residents harvested bearded seals at the same time that they harvested small seals, but took more small seals because they tend to be more abundant in nearshore areas. Site residents would have had less access to bearded seals, because they are generally uncommon close to shore, except during pupping and breeding seasons (ADF&G 2008; Georgette et al. 1998). It is probable that Iyatayet residents harvested seals on a year-round basis, much like the Summit Island residents did, though no age data exists for the Iyatayet assemblage to confirm this.

Summit Island residents relied on seasonal access to walrus, and purposefully hunted them in the spring and fall. The species is the second most abundant animal represented in the Summit Island mammal sub-assemblage (23% NISP). Walrus have frequented the Walrus Islands since the Middle and Late Holocene, and other pre-contact peoples living on Round Island and at Old Togiak hunted them (Schaaf 2015; Kowta 1963). VanStone (1988) noted that they were historically abundant in the region, and walrus continue to be an important and abundant resource to contemporary northwest Bristol Bay Alaska Native communities (Fall et al. 1991, 2013). Iyatayet residents seemed to have less interest in walrus (4% NISP), which may be related to access. Beluga are represented in the Iyatayet faunal assemblage in a low, but equal, abundance to walrus (4% NISP). The high abundance of seals versus the low abundance of walrus and beluga represented in the Iyatayet assemblage could be related to many factors including seasonal access, abundance, level of effort required, or a general preference. Today beluga migrate into Norton Sound and Bristol Bay during ice-free months, and they have been historically abundant in Norton Sound (Lowry et al. 1999; Lucier and VanStone 1995). Local communities targeted high numbers of beluga in July, because they were consistently abundant (Giddings 1964; Lowry et al. 1999; Lucier and VanStone 1995). In Bristol Bay, Citta et al. (2016) tagged and tracked belugas from 2002 to 2011 and noted that beluga frequent the waters west of the Nushagak Peninsula, but do not appear to regularly inhabit the waters around the Walrus Islands. Belugas swim upriver in April as soon as rivers containing rainbow smelt are accessible, and stay throughout August to take advantage of the abundant salmon runs in northeast Bristol Bay. By September, belugas are not present in rivers or close to the coastline, and head out to open waters in Bristol Bay. Belugas tracked in the study moved in and out of the more dynamic pack ice (with lots of open water) during the later fall and winter, but none moved into the Walrus Islands area. It is possible that beluga have never been a common animal in northwest Bristol Bay, due to the highly productive spring and summer salmon runs in northeast Bristol Bay, and the more restrictive sea ice present in the Walrus Islands area. This could account for the lack of beluga remains in the Summit Island faunal assemblage (though the two cetacean specimens could belong to beluga), whereas walrus, which have inhabited the Walrus Islands since at least the Middle Holocene, are well represented. According to Fay (1982), walrus are most abundant in the Norton Sound region during April and May, during spring migration, but they are not a particularly common species near the coast of inner Norton Sound. Throughout the rest of the year, walrus concentrate in the Bering Sea on the pack ice. Iyatayet residents may have had less access to walrus than the Summit Island residents, which could account for the differences in abundance. The Iyatayet and Summit Island residents valued large marine mammals, but harvested them to a lesser degree than the more locally abundant seals. This seems logical given that the harvest of one walrus or beluga would equate to the harvest of several small seals in edible meat and by-products.

Caribou are present in both faunal assemblages in low abundances (3% NISP for Iyatayet and 5% for Summit Island), which suggests that Iyatayet and Summit Island residents valued the species, but did not rely on them. This contrasts with Giddings' (1964:185 and 242) assessment that Iyatayet was a caribou-hunting camp (as noted by Tremayne 2015:192), and site residents turned to seal hunting only when caribou were scarce. It is very possible that both sets of site residents actively targeted caribou when away from the coast, but these activities are not well represented in the two faunal assemblages. A consideration of organic implements recovered from Iyatayet and Summit Island, however, indicates that Iyatayet residents may have preferred caribou antler and bone as a tool medium to a greater degree than Summit Island residents (Table 41).

At Iyatayet, nearly equal amounts of recovered organic objects derived from caribou (39% NISP) and marine mammal (37% NISP). For the Summit Island organic objects, most were made from marine mammal by-product (29% NISP) with a much smaller percentage coming from caribou (8% NISP) and bird bone (6% NISP). It is possible that the differences in the abundances of material type for organic objects is because Summit Island residents had better access to walrus ivory than Iyatayet residents.

Table 41. Summit Island and Iyatayet Organic Object Abundance (NISP and %NISP)

	Summit Island		Iyatayet	
Object Material	**NISP**	**%NISP**	**NISP**	**%NISP**
caribou antler and bone	18	8	24	39
marine mammal bone	63	29	23	37
bird bone	13	6	1	2
terrestrial mammal bone			1	2
mammoth ivory			1	2
unknown	126	57	12	19
Total	**220**	**100**	**62**	**100**

Caribou have been historically abundant in southwest Alaska and accounts by Russian explorers noted abundant caribou herds that extended from the Nushagak and Togiak River drainages to Norton Sound (ADF&G 2017; Burch 2012; Giddings 1964; Harper 2017; Holen et al. 2005; Tremayne 2015; VanStone 1988). Kowta (1963) further noted a high abundance of caribou remains in the upper levels of Old Togiak, which suggests that late Thule peoples had regular access to caribou in the proto-historic period. The limited representation of caribou in both the Iyatayet and Summit Island faunal assemblages, however, suggests that caribou were not abundant on the coast during the Late Holocene. If site residents harvested them, they did so away from Iyatayet and the mainland coast near Summit Island, likely in the interior.

Small terrestrial mammals are minimally represented in both assemblages, though there is more diversity of animals represented in the Summit Island faunal assemblage, as well as a greater abundance. At Iyatayet, Tremayne (2015) recovered some rodent and possible dog and fox specimens (n=10, 1% NISP). Very low numbers of marmot, beaver, fox, and river otter specimens were recovered from Summit Island (n=62, 6% NISP). At both sites, rodents and fox bones were probably non-cultural additions to the archaeological deposits. Overall, site residents from both sites appear to have had limited interest in land mammals while living at Iyatayet and on Summit Island.

An obvious difference between the two faunal assemblages includes the high abundance of bird bone specimens recovered from Summit Island (n=2,626) versus the very small number recovered at Iyatayet (n=5). Nearly equal numbers of identifiable mammal specimens came from Iyatayet (n=994) and Summit Island (n=968), which is coincidental, but allowed for easy comparison of mammals. This cannot be accomplished for the birds. Giddings (1964:185) reasoned that birds were absent from the Norton faunal assemblage, though present in Nukleet components, because site residents must have harvested birds and eggs offsite during the spring and summer. He noted, however, that other spring and summer activities were represented at Iyatayet, such as hunting walrus and beluga in May through July, while shellfish gathering was a later summer activity. Giddings (1964:140-141) also noted some organic objects recovered from Iyatayet that may have been used to harvest birds including the end prong for a bird spear and a gorge. At least one needle blank was also made from bird bone (Plate 37). Tremayne (2015) had slightly more luck recovering identifiable bird bone specimens, including one goose and two ptarmigan specimens. Iyatayet residents had some interest in birds, but to what extent is unknown. This stands in contrast to the obvious importance that Summit Island residents placed on birds and eggs as food sources and for by-products including skin, feathers, and bones. I identified 30 bird taxa from 11 families in the Summit Island faunal assemblage, and noted that the site residents had a strong interest in harvesting seabirds and sea ducks, most notably murres, common eiders, white-winged scoters, long-tailed ducks, and cormorants. The importance of birds to pre-contact, historic, and contemporary coastal peoples has been documented throughout Alaska, and it is possible that they were equally important to Norton-era Iyatayet residents (Casperson 2012; Causey et al. 2005; Corbett 2016; Crockford et al. 1997; Fall et al. 1998; Georgette 2000; Moss 2007a; Naves 2015b; Naves and Zeller 2013; Paige et al 2000; Sloan 2014; Wolfe et al. 1990; Young et al. 2014). Birds may be underrepresented in the Iyatayet faunal assemblage due to excavation sampling, or as posited by Giddings, bird and egg harvest took place away from Iyatayet.

Fish and shellfish played some role in the Norton subsistence economies at Iyatayet and Summit Island, but to what extent is unknown. I recovered large dogwinkle (1,551 MNI) and mussel specimens (45 MNI) from the Summit Island faunal assemblage (but none that would fall through 1/4 in. mesh). Shaw and his crew described extensive shellfish layers and lenses in the 49-XHI-043 matrices that are not well represented by the minimal amount of shell I encountered in the faunal lots. Giddings (1964:185) also noted "abundant traces of mussel shell throughout Norton culture deposits," which local helpers typically harvested in August and September. Shaw and his crew also described numerous fish bones from large and small-bodied individuals, some wholly articulated, in some features and levels at 49-XHI-043, but very little of this made it into the faunal lots that I analyzed. I noted mostly salmonid vertebrae, but any smaller parts that would fall through 1/4 in. mesh are missing. At Iyatayet, Giddings (1964) noted netsinkers, a leister spear, a barb for a fish spear prong, etc., for taking fish, which he assumed would be used mostly for catching salmon. Neither Giddings nor Tremayne recovered salmon remains, though Tremayne recovered 12 fish specimens. While Giddings suggested that the fishing gear at Iyatayet was likely used off-site to procure salmon, Tremayne (2015) posited that Iyatayet residents probably fished for tomcod at the nearby cove.

The comparison of the Iyatayet and Summit Island faunal assemblages shows that Norton peoples in Norton Sound and the Walrus Islands employed similar subsistence strategies, even though the two sites are over 600 km apart, as the crow flies, and over 1,000 km apart, when following the shoreline. This is not surprising given the similar ecology of Iyatayet and the Walrus Islands, as two well-protected locales on the west and southwest coast of Alaska. People from both sites were able to take advantage of pagophilic species that inhabit the Bering Sea. Small ice seals and bearded seals provided the staple food source, though site residents took advantage of the migration patterns of larger marine mammals including beluga and walrus in Norton Sound, and only walrus in the Walrus Islands. Given a recent tracking study, it is possible that beluga have never been a common resource close to Summit Island (Citta et al. 2016). Seals were more consistently abundant, with fewer seasonal restrictions, but Iyatayet and Summit Island residents valued larger marine mammals as well and would actively target them when available. Marine mammals provided the primary source of food and by-products for Iyatayet and Summit Island residents. Caribou and other land mammals provided a much smaller portion of the Norton diet and fewer by-products. Caribou antler and bone, however, had obvious importance in the Norton subsistence economy for making organic objects. It appears to have been more important at Iyatayet, where people had less access to walrus ivory than the people living on Summit Island. Seasonally available seabirds and sea ducks were extremely important to Summit Island residents. Though Iyatayet residents probably harvested birds, they are not well represented in the faunal assemblage. Fish and shellfish played roles in Iyatayet and Summit Island subsistence economies, but how, when, and to what degree are not clear.

The published data regarding the Norton faunal assemblages from the Old Beach Site (Bockstoce 1979), Nunivak Island (Nowak 1982, 1988), Hagemeister Island (Bailey 1991), and Round Island (Schaaf 2015) generally support the results from Iyatayet and Summit Island, but much of it is anecdotal and ultimately unreliable (with the exception of Schaaf 2015). Bockstoce (1979) identified an unknown number of seal, walrus, whale, and caribou bone specimens at the Old Beach Site in Norton Sound. Chatters (1972) and Nowak (1982, 1988) described the Nunivak Island (49-XHI-028) faunal assemblage as containing mostly small seals, but also bearded seals, beluga, Steller sea lion, and walrus. Caribou and birds were prevalent in some levels and features. Nowak also noted a mussel shell matrix at 49-XHI-028, which allowed for excellent organic preservation. Chatters (1972) located some fish bones in at least one Norton age sample. On Hagemeister Island, Bailey (1991:58) noted a mussel shell matrix with mostly seal and bird bones and lower numbers of fish remains. How these animal classes tally with the list of 298 animal bone specimens he recorded in Bailey (1991) is unknown (or if they are one in the same). On Round Island, Schaaf (2015) recovered 107 bone specimens belonging to walrus (n=14), seal (n=2), common murre (n=1), marine mammal (n=66), and bird (n=22). Schaaf also noted two whale ribs as part of a Norton house feature. Mussel and dogwinkle were represented by six fragments.

Researchers also recovered organic objects from the Old Beach Site, Nunivak Island, Hagemeister Island, and Round Island. At the Old Beach Site, Bockstoce (1979) only recovered on ivory object of unknown function. Nowak (1982) analyzed 205 organic objects from Nunivak Island made of caribou, walrus, whale, marine mammal, and bird bone, which he associated with hunting and processing marine mammals. He did not provide counts by material type, but most of the caribou implements are associated with the terminal phase of the Norton occupation evidenced at 49-XHI-028. On Hagemeister Island, Bailey (1991) noted 30 organic objects made of antler, bone, and ivory. He noted that caribou and walrus were not represented in the faunal remains, but only in the worked object assemblage. On Round Island, Schaaf (2015) did not recover any caribou faunal remains or worked objects (though this could be related to the small sample size). Schaaf did recover one center prong of a fishing spear (and a notched pebble), which she associated with possible fishing.

When taken together, all of the Norton faunal data from Norton Sound to the Walrus Islands point to a subsistence economy heavily focused on the harvest of marine mammals. Caribou does not appear to have been a primary food source for Norton peoples living on the western and southwest coast of Alaska. Caribou antler and bone, however, were valuable raw materials for making organic artifacts, as were marine mammal bone and ivory. Norton peoples on the coast infrequently used small terrestrial mammal and bird bones for making objects, but to a much lesser extent than they used marine mammal and caribou by-products. In larger assemblages (Nunivak Island and Summit Island), birds appear to be better represented, which may be a result of sampling and organic preservation, or it may be related to the local value and accessibility of birds. Millions of migratory birds pass through the Walrus Islands in the spring and fall, and a subset of these form dense breeding colonies on all seven of the islands (USFWS 2012). Nunivak Island also has similarly dense bird colonies (Hoffman 1990; Pratt 1990). Birds are not well represented at Iyatayet. Researchers documented abundant shellfish layers and lenses at Iyatayet, Nunivak Island, Hagemeister Island, and Summit Island. It is probable that shellfish and fish were important food sources to coastal Norton peoples, but direct archaeological evidence is lacking. According to Shaw and crew, fish bones were abundant in some portions of the Summit Island matrices, but very few of these made it into the faunal lots. Netsinkers from Round Island, Summit Island, Hagemeister Island, Chagvan Bay, Nunivak Island, and Iyatayet point indirectly to fishing in Norton coastal subsistence economies, but they may have also been used for netting other kinds of animals.

The strong orientation toward marine mammals evidenced in the Norton coastal sites differs from the subsistence practices described for the northern Alaska Peninsula, which place salmon and caribou as primary resources. Bundy (2007), Dumond (1977, 1981, 1984, 2005a, 2011, 2016), Henn (1978), Hoffman (2009) and Saltonstall et al. (2012) have noted that major Norton occupations (typically identified as winter villages) tend to be located near rivers with major salmon runs. The network of rivers on the northern Alaska Peninsula ultimately empty into Bristol Bay where marine mammals (such as beluga; Citta et al. 2016) seasonally congregate to take advantage of the same salmon runs that Norton peoples used. Marine mammals head upriver into fresh water to eat fish, and it is probable that residents farther inland had seasonal access to marine mammals as well. Saltonstall et al. (2012:61) recovered walrus bone specimens from 49-UGA-050 (Penguq Site), located along the King Salmon River, approximately 5-10 km south of Ugashik Bay, which provides some evidence that people away from the coast harvested marine resources to an unknown extent. Shaw (1983) documented a similar pattern at the interior Manokinak Site in the Yukon-Kuskokwim Delta. The site is located on the Manokinak River 35 km from the mouth of Hazen Bay, which feeds into the Kuskokwim Bay. Despite how far inland the site is located, the river is subject to tides (Shaw 1983:45) that brought marine animals nearby, but also provided site residents with a water route to the ocean. Shaw recovered a large faunal assemblage from the Manokinak Site, which included many seal bones, with low numbers of puffin, blue mussel, and cockle specimens. Shaw noted that caribou and anatids were represented in the assemblage, as were fish. He suggested that the fish were mostly salmon, but did not provide any data to support this. Other animals included canids, bald eagle, ptarmigan, mink, beaver, and fox.

CHAPTER VIII

SYNTHESIS AND CONCLUSION

Coastal Norton and a Marine-oriented Subsistence Economy

The analysis of 9,981 faunal specimens indicates that Norton peoples who lived on Summit Island between 2740 and 980 cal B.P. were definitively marine-oriented in their subsistence economies. Despite living on a nearshore island, only 6 km off the coast of the mainland shore, the Summit Island residents preferred to intensively harvest murres, common eiders, cormorants, ringed seals, bearded seals, and walrus from the Walrus Islands rather than pursue terrestrial animals. Site residents lived on the island year round, hunting marine mammals and birds in each major season. Marine mammals provided the primary source of food and by-products throughout the Late Holocene. Summit Island residents harvested these marine animals from open water, mudflats, and island beaches during the summer and fall and from the sea ice environment during the winter through spring break-up. While site residents targeted seals on a year-round basis, walrus hunts were restricted to the spring and fall, when mother-calf pairs were present.

In the spring, summer, and fall, site residents harvested murres from any one of the several massive colonies located on rocky cliffs throughout the islands, cormorants from a smaller colony local to Summit Island, and common eiders from nesting colonies spread out over rocky beaches. Site residents harvested nesting birds and eggs during this time, but they also targeted the numerous migrating birds including white-winged scoters and long-tailed ducks that stopped over in Bristol Bay on the way to their own nesting and breeding grounds. From winter through spring break-up, site residents focused on taking marine mammals on the ice, but they also supplemented this diet by netting common eiders that flocked to open water in the sea ice environment.

It is probable that the Summit Island residents preferred island living because it allowed for better access to the abundant marine life inhabiting the Walrus Islands vicinity. The location of Summit Island was crucial to winter hunting, because it allowed site residents to live at the edge of shorefast ice (where they could find ringed seals), but also be closer to walrus and bearded seals that frequented the open leads and polynyas out in the more dynamic pack ice. The faunal assemblage indicates that pagophilic species were of primary importance to Summit Island residents throughout the Late Holocene.

Summit Island residents in Early Norton I (2740-2380 cal B.P.) and Late Norton (1390-980 cal B.P.) harvested some caribou for food and by-products. People living during Early Norton II used caribou antler and bone to make implements, but based on the lack of any identifiable faunal remains, it does not appear that they relied upon them as a regular food source. Neither caribou nor any other terrestrial animal were primary food sources to the Summit Island residents. Fox, marmot, beaver, river otter, and ptarmigan were represented in the Summit Island faunal assemblage in very low abundances. Caribou by-products (bone, hide) do not seem to have been used as much as marine mammal by-products (bone, hide, etc.).

The Summit Island residents also harvested salmonids and shellfish including mussel and dogwinkle. The limited recovery of these taxa, despite their supposed prevalence in the excavation units, suggests fish and shellfish remains are underrepresented in the faunal lots. This makes it difficult to assess the level of importance fish and shellfish had in Summit Island subsistence.

The results from the Summit Island faunal analysis, when compared with faunal assemblages from other coastal sites in southwest Alaska, provide evidence of a marine-oriented Norton culture stretching from Norton Sound to the Walrus Islands. Both the Summit Island faunal assemblage and the Iyatayet faunal assemblage are sizeable, allowing for useful comparison of these two sites. Although the sites are located far apart, they both are situated along the west-southwest Bering Sea coast, with access to many of the same migratory species. At both locales, site residents focused on hunting small seals that inhabit the nearshore zone, with seasonal harvest of larger marine mammals (walrus and beluga). The abundance and diversity of birds found at Summit Island, however, was not indicated in the Iyatayet faunal assemblage, though Iyatayet peoples harvested goose and ptarmigan to some extent. Iyatayet and Summit Island residents similarly did not target caribou as a primary food source, though both used antler and bone to make worked objects. Caribou by-products appear to have been slightly more important to Iyatayet residents than Summit Island residents, who had ready access to walrus ivory. Even though the faunal assemblages from the Old Beach Site, Nunivak Island, Hagemeister Island, and Round Island are smaller and not as well-documented, they do not differ significantly from my characterization of the Iyatayet and Summit Island faunal assemblages.

The study of faunal remains from Summit Island (and Iyatayet) provides direct evidence of the subsistence practices of coastal Norton peoples, and indicates a heavy focus on marine animals rather than caribou or salmon. I say this recognizing that fish are underrepresented in the Summit Island faunal assemblage and that some artifacts recovered from Iyatayet and Summit Island are typically associated with fishing. The direct evidence from Summit Island includes a small amount of fish bones recovered from the faunal lots that I identified as salmonid. The indirect evidence from Summit Island comes from the crews' fieldnotes, which discuss a couple of layers and features that contained numerous fish specimens and an unknown number of bi-notched netsinkers. It is not possible to assess importance from the fieldnotes, but it is telling that identification of fish bones was restricted to discrete spots within the excavation, rather than abundant and pervasive like the marine mammal and bird bones and shell. This could indicate seasonal harvest of fish, rather than the year-round harvest identified for seals. I consider it likely that Norton peoples living on the coast valued fish and shellfish, but I cannot evaluate their level of importance. Large-bodied pinnipeds are overwhelmingly abundant in the coastal faunal assemblages (or at least represented in small faunal assemblages), in comparison to small-bodied fish and bird remains. Based on meat weight alone, one marine mammal would provide considerably more food and by-products than several birds or fish.

My assessment of coastal Norton subsistence practices differs from that of Giddings (1964) who considered salmon and caribou to be the primary resources for Iyatayet residents, and seals a secondary resource. Tremayne (2015) similarly noted that Giddings' assessment was not based on the faunal remains, and with his own research, Tremayne asserted that seals must have been the primary focus at Iyatayet. Tremayne concluded that Norton peoples at Iyatayet displayed a well-developed marine orientation that was not noticeably different from Nukleet peoples who also lived at Iyatayet. Given the higher abundances of marine mammals at Summit Island compared to the lower abundances at Old Togiak (and the better representation of mainland species), the Norton peoples living in northwest Bristol Bay appear to have had more interest in marine resources than Thule peoples.

Norton peoples living at Iyatayet and Summit Island most likely valued interior or terrestrial resources, and may have spent some time away from the coast harvesting caribou, other land mammals, non-migratory birds, and freshwater fish, but such interests are not represented in the faunal assemblages. The limited number of caribou specimens in any of the coastal Norton assemblages may indicate that caribou populations were sporadic enough that Norton peoples did not view them as a reliable or consistent resource. Based on the faunal remains from Old Togiak, as well as historic accounts from Russian explorers, it is possible that caribou are relatively “new” (as a common species) to the northwest Bristol Bay area, circa the late Thule-era (Kowta 1963; VanStone 1988).

The faunal analyses from Iyatayet and Summit Island present results that are noticeably different from the Norton subsistence practices documented for the northern Alaska Peninsula, which highlight the importance of salmon (taken from interior riverine settings) and caribou (Dumond 1981, 2005a, 2011, 2016). This is not surprising given the differences in environment between the Arctic Bering Sea coast and the more temperate northern Alaska Peninsula. The faunal assemblages from Summit Island and Iyatayet demonstrate that the subsistence practices of Norton people reflect local ecological conditions more than a cultural preference for caribou and fish, but this inference requires more research.

To fully address the variation in Norton subsistence practices, it will be necessary to analyze other Norton faunal assemblages, notably the Nunivak Island assemblage, which comes from a remote island in the Bering Sea, and the Manokinak Site assemblage, which comes from an interior locale with onsite access to an anadromous river. Marine animals have been recovered from interior sites, notably the Manokinak Site in the Yukon-Kuskokwim Delta, which is 35 km from Hazen Bay (Shaw 1983). Some walrus specimens were also recovered from the Penguq Site, along the King Salmon River, approximately 5-10 km from Ugashik Bay (Saltonstall et al. 2012). Given the range of animal specimens recovered from the Norton sites discussed in this study, it is likely that Norton peoples had the ability to adapt to the local environment, whether coastal, island, or interior, but were more opportunistic and ultimately more generalist than they have been previously characterized. Norton peoples harvested all available resources, and were not limited to specific fauna by their toolkit.

One complicating factor of using faunal analysis to understand variation in Norton subsistence is the differential preservation of organic remains noticeable in archaeological sites throughout southwest Alaska. Many of the faunal assemblages discussed in this study were recovered from coastal settings, and in places where there is permafrost and/or expansive shell midden matrices, both of which facilitate organic preservation. Frozen ground is anaerobic, which reduces organic decay. Similarly, decaying shell (composed of calcium carbonate), promotes an alkaline environment rather than an acidic one. The Summit Island faunal assemblage was recovered from shell midden matrices as well as frozen soils (Shaw 1986). The Iyatayet, Round Island and Manokinak Site faunal assemblages also came from frozen soils (Giddings 1964; Schaaf

2015; Shaw 1983), while the Hagemeister Island and Nunivak Island faunal assemblages came from shell midden matrices (Bailey 1991; Nowak 1982, 1988). On the north Alaska Peninsula, in the interior riverine and upland locales of Dumond's study area, shellfish were not a readily available resource. As a result, organic materials discarded by Norton peoples quickly decayed in acidic soils (Dumond 1981). While permafrost is present on the north Alaska Peninsula, it is patchy, and Dumond (1981, 2011) did not record excavating through frozen soils.

A second complicating factor, noticeable in the Summit Island faunal assemblage, is the differential recovery of animal remains from archaeological sites. The crew excavating on Summit Island did not recover representative samples of fish and shellfish, though they noted specimens from each animal class in their fieldnotes. The disinterest in small taxa (when present) was also true for Bailey's excavations on Hagemeister Island, Nowak's work on Nunivak Island, and Giddings' work at Iyatayet (at least with shellfish specimens). In the past, the recovery of faunal specimens has not been prioritized in Arctic excavations, particularly with small-bodied animals, and researchers many times did not see the value in using small mesh screens or collecting bulk samples from middens that would allow for future consideration of small-bodied taxa. Only Schaaf (2015) and Tremayne (2015) noted the systematic use of 1/8 in. mesh screens (rather than 1/4 in. mesh screens) during the Round Island and more recent Iyatayet excavations. Future excavations should involve a combination of fine mesh screening and bulk sampling to insure the recovery of fish and shellfish remains; otherwise the economic roles of these animals will be left undocumented.

One research avenue to address differential preservation and recovery of faunal remains would include comparing coastal Norton toolkits with interior Norton toolkits. Is there an obvious difference in the projectile points (or other tool type) or the proportions of various types of projectile points that might indicate the harvest of caribou or marine mammals? The comparison of toolkits would be bolstered by a comparison of faunal remains, with the potential to link particular tool types with the harvest of specific animals. Such linkages, however, may not be possible. Giddings (1964) associated endblades and sideblades with hunting caribou, but these same tools are present in the Summit Island assemblage, as well as many other Norton assemblages.

The Timing and Origins of Norton Culture

The radiocarbon dating of the Summit Island sites, 49-XHI-043 and 49-XHI-044, resulted in the identification of three components, Early Norton I (2740-2380 cal B.P.), Early Norton II (2400-2000 cal B.P.), and Late Norton (1390-980 cal B.P.). There are now four sites with radiocarbon-dated Norton components in northwest Bristol Bay including 49-XHI-016 on Hagemeister Island, 49-XNB-043 on Round Island, and the two sites on Summit Island. Several other sites on Summit and Crooked islands may contain the remnants of Norton occupations. Many of these sites are described as large village sites, with numerous house features and associated middens and cache pits (AHRS 2010; Bailey 1986; Shaw 1979, 1998). The density of the archaeological sites on the islands located in northwest Bristol Bay, and the results of archaeological work from Hagemeister Island, Round Island, and Summit Island suggest that the locality may have been heavily populated during the Norton era. Of course, more dating would be needed from the 14 archaeological sites documented in the Walrus Islands to confirm this. Given the age range of the Summit Island components, which extends from early Norton to terminal Norton, this has implications for understanding the origins, development, and dispersal of Norton culture.

The earliest component on Summit Island, Early Norton I (2740-2380 cal B.P.) is one of the oldest Norton Stage components known to exist, with the exception of Phase I/II at the Chagvan Bay Site (2850-910 cal B.P., Ackerman 1986). The Early Norton I components, however, have excellent organic preservation unlike the Chagvan Bay Site, which presents a unique opportunity to study early Norton organic tools as well as provide direct evidence of early subsistence practices through faunal analysis, as demonstrated in this study. The Early Norton I component is temporally and physically distinct from other Summit Island components, unlike the Chagvan Bay Site, which had numerous overlapping radiocarbon dates that make it difficult to pick out discrete occupations within the lengthy Norton occupation the site (see Appendix). Future research could be directed to isolating artifacts from the earliest components at Summit Island to document the toolkit to potentially link it to other core areas such as Norton Sound and the Naknek Region.

How do the ages of the earliest components at Summit Island and Chagvan Bay fit into the current understanding of Norton culture? They are noticeably older than the earliest components in Norton Sound (2580-2520 cal B.P.). Dumond (1982, 1990, 2000a, 2000b, 2016) has used the early dates from Norton Sound to make a convincing case that Norton culture developed in situ in northwest Alaska approximately 2500 cal B.P. and spread to other locales, which have slightly later dates, such as the Smelt Creek Phase on the northern Alaska Peninsula (2400 cal B.P.). Dumond also hypothesized that peoples from southern maritime cultures in the Gulf of Alaska or Aleutians migrated to northwest Alaska sometime in the Middle Holocene bringing ground slate, labrets, or pecked stone bowls, which ultimately accounts for the blend of southerly and northerly influences (pottery and small finely chipped stone implements of Choris and Denbigh Flint Complex) that comprise the Norton toolkit. The early dates from Chagvan Bay and Summit Island may be the connection that Dumond is seeking, though slightly earlier (pre-2500 cal B.P.) and in a more southerly location than the previous evidence suggested. Southern marine-oriented peoples may have moved to northwest Alaska during the Middle Holocene, and they may have left some of the earliest evidence of this migration on the southwest coast of Alaska on Round Island, Summit Island, and Chagvan Bay. The focus on pagophilic species noted in the Summit Island faunal assemblage could provide evidence that peoples from the Aleutians followed the ice north, as Dumond (2016) postulated. The dates from Early Norton I and Chagvan Bay (2850-2740 cal B.P.) provide a temporal link between Arctic Small Tool (ASTt) and Norton, which has a hiatus of approximately 800 years on the northern Alaska Peninsula (3200-2400 cal B.P.). It is possible that ASTt peoples from the northern Alaska Peninsula migrated to northwest Bristol Bay, possibly to avoid volcanic disruption, and may have played a role in the development of Norton culture. Study of the tool assemblage from the earliest component from Summit Island will be crucial to ascertain if Early Norton I has developmental markers that connect it to other cultural traditions or phases (such as Choris and Denbigh Flint Complex).

My faunal analysis does not provide much insight into the material culture of the Summit Island residents, which could be used to potentially see typological similarities in geographically separate culture regions (such as northern Alaska Peninsula and northwest Bristol Bay). At this point in the research, the dates I procured for Early Norton I muddy the waters when considering the timing and origins of Norton culture. The limited review of the material culture from Summit Island, as well as the radiocarbon dates, do indicate that the site residents had Norton culture. What this means in relation to how we currently understand Norton, its range, timing, and origins, however, requires a more thorough analysis of the Summit Island artifact assemblage.

There are some lingering issues with the timing of the Summit Island occupations that I could not address in this study. Several radiocarbon dates from other strata and excavation units hint at more extensive occupation of Summit Island during the Norton era, as well as more lengthy occupations that potentially range as early as 3000 cal B.P. to as recent as 550 cal B.P. The potential of even earlier components at Summit Island obviously relates to understanding the timing of Norton as well as considering them in relation to the pre-Norton components on Round Island. The two dates from Stratum 2 at 49-XHI-044 (1780-1550 cal B.P., 1520-1300 cal B.P.) also hint at a Middle Norton occupation on Summit Island. If Norton peoples shifted their use of the island to a temporary stopover between 2000 and 1400 cal B.P., we should determine if changes in site use were related to climatic fluctuations or some other factor. Round Island contained Norton components dated from 2365 to 1530 cal B.P. Summit Island residents may have shifted subsistence practices during Middle Norton to take advantage of the large populations of summer walrus that haul-out on Round Island, in response to changes in sea ice environment, which limited access to marine mammals during the winter and spring break-up.

The Deep History of Human Use of the Walrus Islands

The analysis of the Summit Island faunal assemblage, combined with the work conducted at Round Island (Schaaf 2015) and Old Togiak (Kowta 1963), provides a picture of the long-term human use of the Walrus Islands starting as early as 6310 cal B.P. and extending through the Thule era. The reliance on animals that inhabit the Walrus Islands continued through the historic era (VanStone 1988) and endures today. The importance of the Walrus Islands to contemporary Alaska Native communities is documented in numerous subsistence reports (Fall et al 1991, 1998, 2012, 2013; Coiley-Kenner et al. 2003; Holen et al. 2005; Huntington et al. 2013; Krieg et al. 2007; Naves 2015a, 2015b; Wentworth 2007; Wolfe et al. 1990; Wolfe and Paige 2002). The people who live in Togiak and other nearby communities also speak for themselves, noting the importance of the islands, as well as affirming their long-term traditions and rights to harvest animals in their ancestral territory (BBNA n.d.a, n.d.b.; Chythlook 2006; Chythlook and Fall 1998; EWC 2016; ISC 2015, 2016).

Through the Summit Island faunal analysis, I was able to document the deep history of the spring and fall hunt of walrus as well as the year-round harvest of small seals and bearded seals. I also documented the harvest of murres, cormorants, and sea ducks (and their eggs), particularly the spring and fall harvest of these species. All of these activities occurred throughout the Late Holocene occupations of Summit Island, from 2740 to 980 cal B.P., and most notably, these activities occurred within the area that is now designated the Walrus Island State Game Sanctuary.

Concluding Remarks

The analysis of the Summit Island faunal remains resulted in a detailed description of the marine-oriented subsistence practices of island-based Norton peoples living in northwest Bristol Bay 2740-980 cal B.P. From this study, I was able to evaluate the commonly held concept that Norton peoples were mainly caribou hunters and fishers. In Bering Sea coastal settings, from Norton Sound to the Walrus Islands, Norton peoples had a marine-orientation different from that postulated by Giddings during his seminal work at Iyatayet. The subsistence practices documented at Summit Island also vary from the riverine and caribou-hunting practices documented on the northern Alaska Peninsula. This study provides a more elaborate understanding of coastal Norton subsistence practices in southwest Alaska, while it informs and corroborates the work of Tremayne (2015), who recently addressed the nature of marine adaptations in North Alaska, with Iyatayet as a case study. This study also produced radiocarbon dates from Norton components that are approximately 240 years older than any other Norton Stage sites in Alaska, with the exception of the Chagvan Bay Site (2850-910 cal B.P.). Further research into the earliest components at Summit Island and Chagvan Bay will be crucial to understanding the origins of Norton culture. This will require an analysis of the artifact assemblage from Summit Island as well as more radiocarbon dating.

The Summit Island collection was excavated in 1985 and has remained unanalyzed for 30 years, until this dissertation. As evidenced with this study, the analysis of museum collections has immense value to provide new insight into our understanding of Alaskan archaeological cultural traditions. It also has value to understand the historical ecology of animal populations as well as the antiquity of human harvest of these species. Recognizing the long-term history of subsistence practices related to walrus, seals, seabirds, and sea ducks should inform the management of extant species. It should also be considered when developing management actions that could potentially restrict Alaska Native rights to harvest resources within their traditional territories.

APPENDIX

NORTON-ERA RADIOCARBON DATES FROM HAGEMEISTER ISLAND, MIDDLE TOGIAK RIVER, AND CHAGVAN BAY SITES

Site	Lab#	RYBP	cal B.P. (1σ)	Notes	Reference
49-XHI-016, Hagemeister Island					
	Beta-24527	1210±80	1260 (1130) 1060*	Bailey identified as Norton	Bailey (1991)
	Beta-24248	870±80	900 (800) 705	Bailey identified as Norton	Bailey (1991)
	Beta-24239	780±70	770 (720) 670	Bailey identified as Norton	Bailey (1991)
49-GDN-233, Middle Togiak River					
	Beta-110098	1230±70	1260 (1160) 1070	Biddle compared to Brooks River Falls/Weir phases	Biddle (2001)
	Beta-109536	1250±50	1270 (1190) 1090	Biddle compared to Brooks River Falls/Weir phases	Biddle (2001)
	Beta-109537	1170±80	1180 (1100) 980	Biddle compared to Brooks River Falls/Weir phases	Biddle (2001)
	Beta-110099	1280±80	1290 (1200) 1090	Biddle compared to Brooks River Falls/Weir phases	Biddle (2001)
	Beta-109538	1200±100	1260 (1120) 1010	Biddle compared to Brooks River Falls/Weir phases	Biddle (2001)
	Beta-110100	1070±70	1060 (990) 930	Biddle compared to Brooks River Falls/Weir phases	Biddle (2001)
	Beta-109539	1290±60	1290 (1220) 1180	Biddle compared to Brooks River Falls/Weir phases	Biddle (2001)
49-XHI-001, Chagvan Bay					
	WSU-722	2173±60	2310 (2190) 2120	Settlement Cluster I	Ackerman (1986)
	WSU-3264	2040±60	2100 (2000) 1930	Settlement Cluster I	Ackerman (1986)
	WSU-3206	2000±70	2040 (2000) 1870	Settlement Cluster I	Ackerman (1986)
	I-4356	1850±100	1900 (1780) 1630	Settlement Cluster I	Ackerman (1986)
	WSU-3216	2710±60	2850 (2820) 2760	Settlement Cluster I	Ackerman (1986)
	I-4354	2350±90	2690 (2420) 2180	Settlement Cluster I	Ackerman (1986)
	WSU-123	1330±60	1300 (1250) 1180	Settlement Cluster I, Ackerman threw out date	Ackerman (1986)
	WSU-3263	2550±155	2770 (2610) 2380	Settlement Cluster II	Ackerman (1986)
	WSU-717	2322±380	2780 (2360) 1890	Settlement Cluster II	Ackerman (1986)
	WSU-720	1830±100	1870 (1760) 1630	Settlement Cluster II	Ackerman (1986)
	WSU-725	2720±80	2920 (2840) 2750	Settlement Cluster I, Ackerman threw out date	Ackerman (1986)
	WSU-725	1725±275	1930 (1670) 1340	Settlement Cluster II	Ackerman (1986)
	WSU-719	650±250	910 (630) 340	Settlement Cluster I, Ackerman threw out date	Ackerman (1986)
	WSU-721	1600±100	1600 (1500) 1380	Settlement Cluster II	Ackerman (1986)
	I-4355	1340±100	1360 (1250) 1100	Settlement Cluster II	Ackerman (1986)

Appendix (continued)

Site	Lab#	RYBP	cal B.P. (1σ)	Notes	Reference
	WSU-3261	1200±95	1260 (1120) 1010	Settlement Cluster II	Ackerman (1986)
	WSU-3214	1520±55	1520 (1420) 1350	Settlement Cluster II	Ackerman (1986)
	WSU-718	900±370	1230 (870) 540	Settlement Cluster II	Ackerman (1986)
	WSU-3213	1510±75	1520 (1410) 1330	Settlement Cluster III	Ackerman (1986)
	WSU-3212	1290±70	1300 (1210) 1100	Settlement Cluster III	Ackerman (1986)
	WSU-452	1260±270	1520 (1180) 910	Settlement Cluster III	Ackerman (1986)
	WSU-119	230±40	310 (210) 0	Settlement Cluster III, Ackerman noted historic intrusion	Ackerman (1986)
	WSU-729	1174±340	1380 (1110) 740	Settlement Cluster III	Ackerman (1986)
	WSU-728	1275±325	1530 (1200) 800	Settlement Cluster III	Ackerman (1986)
	WSU-3211	1565±65	1530 (1460) 1400	Settlement Cluster III	Ackerman (1986)
	WSU-453	1120±180	1260 (1050) 910	Settlement Cluster III	Ackerman (1986)
	WSU-3261	1115±70	1170 (1040) 940	Settlement Cluster III	Ackerman (1986)
	WSU-454	910±710	1520 (990) 290	Settlement Cluster III	Ackerman (1986)
	WSU-3210	1430±65	1380 (1340) 1290	Settlement Cluster III	Ackerman (1986)
	WSU-724	1125±375	1370 (1070) 690	Settlement Cluster III	Ackerman (1986)
	WSI-3207	380±80	500 (420) 320	Settlement Cluster III, Ackerman noted historic intrusion	Ackerman (1986)
	WSU-451	240±150	460 (270) 0	Settlement Cluster IV	Ackerman (1986)

*I calibrated the dates to 1-sigma with Calib7.1 per Reimer et al (2013). Median dates are in parentheses.

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