2015

# Holocene Settlement History of the Dundas Islands Archipelago, Northern British Columbia

Bryn Letham
*University of British Columbia*

Andrew Martindale
*University of British Columbia*

Duncan McLaren
*Hakai Institute*

Thomas Brown
*Portland State University*

Kenneth M. Ames
*Portland State University*, amesk@pdx.edu

*See next page for additional authors*



## Citation Details

Letham, B., Martindale, A., McLaren, D., Brown, T., Ames, K. M., Archer, D. J. W., & Marsden, S. (2015, August 18). Holocene Settlement History of the Dundas Islands Archipelago, Northern British Columbia. BC Studies: The British Columbian Quarterly.

## Authors

Bryn Letham, Andrew Martindale, Duncan McLaren, Thomas Brown, Kenneth M. Ames, David J.W. Archer, and Susan Marsden

# HOLOCENE SETTLEMENT HISTORY OF THE DUNDAS ISLANDS ARCHIPELAGO, NORTHERN BRITISH COLUMBIA

Bryn Letham, Andrew Martindale, Duncan McLaren, Thomas Brown, Kenneth M. Ames, David J.W. Archer, and Susan Marsden

## INTRODUCTION

Archaeological work in the traditional territory of the Northern Tsimshian has predominantly focused on the mainland in and around the Prince Rupert Harbour and the Skeena River (Ames 2005; Ames and Martindale 2014; Archer 2001; Coupland 1988; Coupland, Bissell, and King 1993; Coupland, Colten, and Case 2003; MacDonald and Cybulski 2001; MacDonald and Inglis 1981; but see Menzies, this volume).[1] Perhaps inspiring this research, ethnographic records highlight the importance of these areas for the Northern Tsimshian (e.g., Boas 1916; Garfield 1951; Halpin and Seguin 1990). Ames and Martindale (2014) argue that the Prince Rupert Harbour is a "flagship region" for fisher-hunter-gatherer archaeology, partially because of its high density of large village sites, many of which appear to have been occupied contemporaneously and were likely home to thousands of people. Much less attention has been paid to the "seemingly marginal insular environments" (Ames 1998, 82) on the offshore periphery of Northern Tsimshian territory, such as the Dundas Islands, although brief forays to these islands (e.g., Haggarty 1988) found tantalizing evidence of significant prehistoric occupation. Tsimshian oral histories (*adawx*) also make specific reference to the occupation and use of the offshore islands as well as to significant events that took place there (Marsden 2000).

The Dundas Islands Archaeological Project, initiated by Andrew Martindale, David Archer, and Susan Marsden, is an interdisciplinary study of the archaeology, paleoenvironments, and Indigenous oral history of the Dundas Island archipelago, fifteen kilometres from the northerly

[1] Martindale and Marsden (2003) use the term "Northern Tsimshian" to refer to the ancestors of the Allied Tsimshian Tribes of Lax Kw'alaams and Metlakatla.

entrance to Prince Rupert Harbour (Martindale et al. 2010). This project was explicitly designed to assess the record of human occupation on the offshore islands of Northern Tsimshian traditional territory in order to compare this record with the better known mainland record. A major component of this research was a systematic survey of both the modern shoreline and relict paleoshorelines for archaeological sites in order to assess the nature, scale, and intensity of occupation throughout the Holocene. Many of these sites were radiocarbon dated to establish temporal trends in human settlement on the Dundas Islands.

As this article demonstrates, the Dundas Islands have been home to humans for at least eleven thousand years. This occupation was at times very extensive; this relatively small group of islands was likely home to a population of several thousand people by about two thousand years ago. While geographically on the "outer shores" of Northern Tsimshian traditional territory, these islands were in no way marginal as locations for settlement. We outline the settlement history of the archipelago by presenting the results of the Dundas Islands Archaeological Project, including the radiocarbon dating program results combined with data from three previous small-scale surveys (Archer 2000; Haggarty 1988; Inglis 1975). We discuss different types of habitation sites and chronological trends in their occupation to argue that the Dundas Islands have been near-continuously occupied for at least the entire Holocene and that this was central, not peripheral, to the broader history of human occupation in the region.

## THE STUDY AREA

The Dundas Islands include five main islands (from northwest to southeast: Zayas, Dundas, Baron, Dunira, and Melville) and hundreds of other small islets (Figures 1 and 2). They are situated at the eastern end of Dixon Entrance, southeast of the Alexander Archipelago in southeast Alaska (see Moss, this volume) and northeast of Haida Gwaii. The islands are generally low relief; the majority of topography is less than one hundred metres above sea level. Extensive areas are forested with pine (*Pinus contorta*), hemlock (*Tsuga heterophylla*), cedar (*Thuja plicata* and *Callitropsis nootkatensis*), and Sitka spruce (*Picea sitchensis*), and there are many large flat areas of peat bog. The shoreline is convoluted with a mixture of bedrock cliffs and platforms as well as extensive intertidal sand and mud flats.

While not as far offshore as Haida Gwaii, the Dundas Islands are exposed to the Pacific Ocean via Dixon Entrance to the west and Hecate Strait to the south. The western coastlines of the islands are exposed to

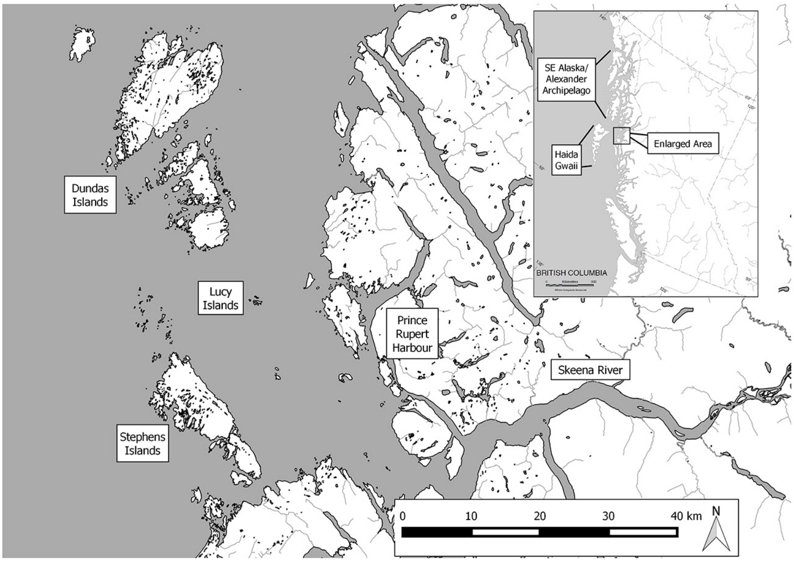


Figure 1. Location of the Dundas Islands group and other areas mentioned in the text.

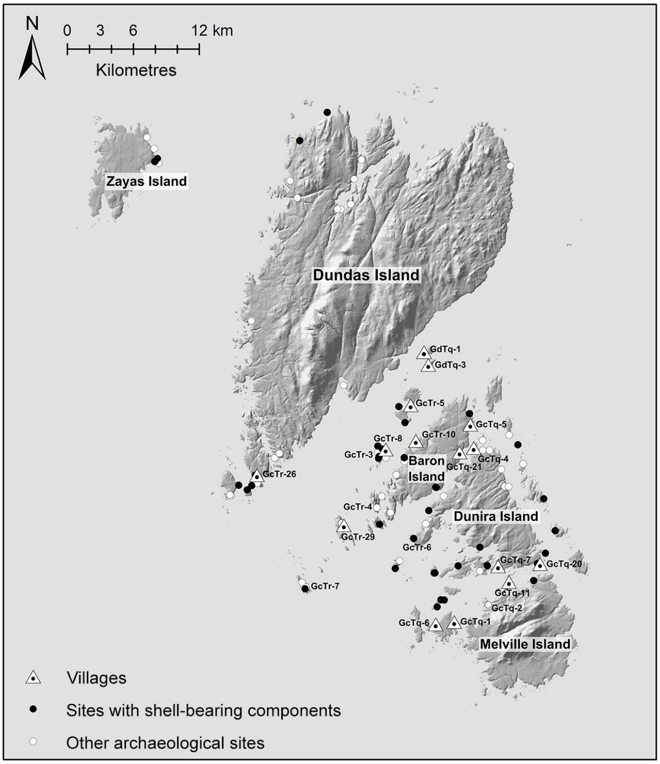


Figure 2. The Dundas Islands group and identified archaeological sites. Sites mentioned in the text are labelled. Base map and data provided by Kisha Supernant.

Pacific swell, with no islands between them and Haida Gwaii, sixty kilometres to the southwest. This effectively makes the Dundas group an "outer coast" locale, although the passes between the islands and the many embayments along the coastlines provide shelter from the extremes associated with outer coast exposure. The islands are currently uninhabited except for a few seasonal sport fishing camps and cabins used by contemporary Northern Tsimshian from Lax Kw'alaams and Metlakatla on the mainland. However, these semi-protected passes and bays, along with their extensive associated intertidal zones, provided the setting for an intensive human settlement history of the Dundas Islands.

## SEA LEVEL HISTORY AND SHORELINE CHANGE

The shorelines of the Dundas Islands group have changed since the end of the Pleistocene, and understanding the dynamism of the coastal landscape is important to understanding the history of human settlement. Sea level histories effectively constrain human occupation to elevations above the vegetation line, and since evidence of occupation on the Northwest Coast tends to cluster along shorelines, they can provide guidance to surveys for archaeological material (Carlson and Baichtal 2015; Fedje et al. 2005; Mackie et al. 2011; McLaren et al., this volume). Relative sea levels on the Northwest Coast have changed dramatically since the end of the last glacial maximum (around 19,300 cal yr BP;[2] Blaise, Clague, and R.W. Mathewes 1990; Clague et al. 1982; Hetherington et al. 2004; Mandryk et al. 2001). These sea level changes resulted from global (eustatic) sea level rise caused by the melting of continental ice sheets, the isostatic readjustment of continental plates relieved of downward depression caused by these ice sheets or of unglaciated areas forebulged upwards by mantle material displaced outwards from beneath the ice sheets, and tectonic uplift or subsidence caused by the movement of tectonic plates against each other. Because southeast Alaska and British Columbia were covered by ice of different thicknesses in different areas (e.g., Carrara, Ager, and Baichtal 2007), and because tectonic conditions and events vary from place to place, relative sea level histories are also very localized (Shugar et al. 2014). The Dundas Islands are located between two extremes of post-glacial relative sea level impacts, close to an area hypothesized by McLaren (2008; McLaren et al. 2011) to operate as a "hinge" between the forebulged outer coast and heavily depressed inner coast (McLaren et al.

[2] All dates discussed in text are presented as calibrated years Before Present (1950), or "cal yr BP."

2014; Mobley 1988, 265), making relative sea level change since the last glacial maximum less dramatic than in areas to the east or west.

McLaren (2008; McLaren et al. 2011) conducted a detailed study of relative sea level change on the Dundas Islands group and found that relative sea levels dropped from at least 14.5 metres ASL[3] from the end of the Pleistocene and through the entire Holocene and, unlike many locations on the mainland coast, never fell below the current sea level (Figure 3). Significantly, McLaren identified a nearly three-thousand-year period of relatively stable sea level at 7.5 metres ASL from about 8850 cal yr BP until 6100 cal yr BP.[4] After this time, sea levels dropped again, though the overall rate declined around 4300 cal yr BP and relative sea level slowly fell from five metres ASL to its current position. During periods of stability, shoreline features formed that are preserved inland, such as stranded beach ridges. Landforms associated with these elevated shorelines were stable enough for the accumulation of archaeological material from repeated human occupation at the same place. As relative sea level was falling throughout the Holocene (ca. 12,000 cal yr BP to the present), the elevation of archaeological deposits can indicate the *earliest* time at which a location could have been occupied. For example, the areas closer to the modern shoreline were only subaerially exposed and habitable in the latter half of the Holocene; earlier they were in the intertidal zone due to higher relative sea level. This understanding of the relative sea level history of the Dundas Islands is critical for both designing an archaeological survey of the landscape and for understanding shifting patterns of settlement through time.

## THE DUNDAS ISLANDS SURVEYS

Before the survey portion of the Dundas Islands Archaeological Project was conducted from 2005 to 2007, archaeologists had only cursorily examined the archipelago. In 1975, Richard Inglis flew over the northern coast of Dundas Island, around Zayas Island, and over Hudson Bay

3 All elevations are given above mean sea level, abbreviated as ASL. These elevations were calculated in the field, following Cannon (2000b), from the barnacle line, which on the Dundas Islands is ~1.5 metres ASL (McLaren 2008, 112). Discrepancies between the current article and the elevations published in McLaren (2008) and McLaren et al. (2011) are due to adding 1.5 metres to field measurements in order to correct the elevations to metres ASL. McLaren (2008, 112) notes that the vegetation line on the Dundas Islands (i.e., the elevation at which terrestrial vegetation begins to grow) is an average of two metres above the barnacle line, or 3.5 metres ASL.

4 Because we present dates in calibrated years Before Present (cal yr BP), the dates presented here differ from those in McLaren (2008) and McLaren et al. (2011), which were published in radiocarbon years BP.

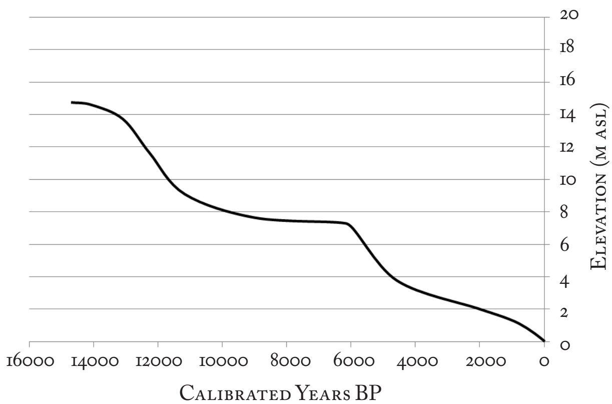


Figure 3. Relative sea-level curve for the Dundas Islands group (modified from McLaren 2008 and McLaren et al. 2011).

Passage between Dundas and Baron islands, recording nine archaeological sites that were recognized by the presence of standing historic architecture (Inglis 1975). In 1987, James Haggarty surveyed many of the same shorelines by boat, focusing on Zayas Island and the north end of Dundas Island (Haggarty 1988). Haggarty visited many of the sites identified by Inglis and identified a handful of canoe runs, stone fish traps, and sites with subsurface shell-bearing components. One of the sites (GcTr-5), on an islet in Hudson Bay Passage between Dundas Island and Baron Island, was a village that was large enough (9,850 square metres) to parallel any of those known in the Prince Rupert Harbour and suggested that these islands on the northwestern periphery of Northern Tsimshian territory may have been important settlement areas in times past.

In 1998, David Archer recorded, mapped, and dated another large (9,800 square metres) village (GcTq-1) on an islet west of Melville Island, which he proposed could have been home to two hundred to three hundred people nearly two thousand years ago (Archer 2000). He identified several other sites on and around Melville and Baron islands, including small shell midden sites, fish traps, and culturally modified trees. The discoveries of such large and abundant archaeological sites during these brief projects justified a systematic archaeological survey of the Dundas Islands, a task that was proposed by Archer (2000) and that was taken up by the Dundas Islands Archaeological Project.

We conducted a survey of the entire modern coastline of all islands and islets in the region from the southern shore of Dundas Island to the north shore of Melville Island (Figure 2). Using air photographs, digital elevation models, and in-field nearshore observations, we evaluated the potential for archaeological sites on landforms in this area. We focused our field efforts on well drained and low relief areas on the modern shoreline and on 7.5-metre ASL terraces from the relative sea level still-stand dating to 8850 to 6100 cal yr BP (Martindale et al. 2009; 2010). We also judgmentally surveyed some higher areas for very early occupation sites (McLaren 2008; McLaren et al. 2011) and for non-shell-bearing sites typically found in inland areas, such as rock shelters and culturally modified trees. Primarily, however, our survey methods focused on identifying shell-bearing sites through the examination of wave-cut banks at the vegetation line and other exposures, such as tree-throws or erosion faces, and through subsurface testing at even intervals along target landforms with Oakfield soil probes. In many cases shell-bearing sites were identifiable through their surface topography; the largest sites are accumulations of shell up to eight metres in depth that form high ridges rising up from the natural forest floor around the back of the sites. These large sites often have rows of rectangular surface depressions indicating the previous locations of houses. These depressions formed either through the excavation of shell midden material for the construction of the structure or from the accumulation of shell and other debris around the outside of the standing structure (Archer 2001).

Each site was mapped and – following Cannon (2000a, 2000b) – shell-bearing sites were percussion cored and augered to retrieve organic cultural material for radiocarbon dating and to obtain samples of faunal remains for subsistence studies (Brewster and Martindale 2011; Martindale et al. 2009). Percussion core samples allowed for an efficient but coarse assessment of the stratigraphy of the sites and targeted radiocarbon dating of the basal and terminal components. Percussion coring does not readily allow for the recovery of artefacts, and we only conducted a few small-scale excavations that yielded few artefacts (Martindale et al. 2010; McLaren 2008), so comparisons with other excavated archaeological datasets are limited. The following analysis focuses on the variability of occupational site types recorded in the Dundas Islands surveys and the chronological patterns observable by radiocarbon dating a sample of sites. We examine the scale of settlement as well as how this settlement changed through time on these islands.

## RESULTS: SHELL-BEARING SITE DIVERSITY ON THE DUNDAS ISLANDS

As the early surveys of the Dundas Islands group indicated, there is a rich archaeological record directly above the current shoreline and paleoshorelines that shows intensive occupation and land use in ancient times. Cumulatively from the archaeological surveys of the archipelago there are currently ninety-seven recorded sites (Figure 2), consisting of multiple archaeological features, including culturally modified trees, scatters of lithic tools and debitage, stone fish traps, canoe skids, rock shelters, standing historic cabins, and shell-bearing deposits. All are evidence of a long history of occupation by people well adapted to thriving on this offshore island landscape.

Over half of the recorded sites on the Dundas Islands have subsurface shell-bearing components (n = 54, 56 percent). This result is partly because our survey methods targeted shell-bearing sites (Martindale et al. 2010) and partly because shell is one of the most ubiquitous, easily preserved, and easily identified archaeological materials in the Northwest Coast's highly acidic soils (Stein 1992). As a result, such sites are well represented in our sample, while our survey likely missed more deeply buried sites or those with slighter material traces, such as lithic scatters. However, many of the shell-bearing sites are massive, and many mark past village locations. They were significant settlement locations and, therefore, warrant detailed analysis.

There is a great diversity in size, shape, and surface features of the shell-bearing sites; they are neither homogenous deposits nor the result of identical depositional behaviours (cf. Claassen 1991; Letham 2014; Waselkov 1987). Consequently, we suggest that many of these sites are much more than just middens as per the formal definition of the word: places of primary discard for food by-products (see Claassen 1991; Stein 1992, 6). Additionally, shell accumulations can be natural phenomena, although the biogenic and anthropogenic shell deposits are usually distinguishable (Erlandson and Moss 2001). All shell-bearing sites recorded in the Dundas Islands Archaeological Project survey were evaluated as being anthropogenic.

At the most basic level, we divide shell-bearing sites into those with surface house depressions (n = 15; 28 percent of all shell-bearing sites), which we term villages when there are more than a single depression,[5] and those without (n = 39, 72 percent of all shell-bearing sites), which are

5 Our use of the term "village" corresponds to Mackie and Sumpter's (2005) and Acheson's (2005) use of the term "town" at sites on Haida Gwaii.


Figure 4. Sequentially arranged plot of Dundas Islands group shell-bearing sites by size showing a multi-modal distribution of site areas. Major clusters of site sizes indicated in boxes with solid lines; dashed lines indicate small potential clusters.

usually smaller than villages and likely represent smaller camps or refuse middens. However, there is diversity even within this basic division. We have also classified the horizontal area of shell-bearing deposits in order to compare sites by size. Shell-bearing sites on the Dundas Islands range in size from twenty-five square metres to over eighteen thousand square metres.[6] Figure 4 shows a plot of the areas of shell-bearing sites.

Several patterns are apparent in the physical characteristics of shell-bearing sites on the Dundas Islands. There is a multi-modal pattern formed by two breaks in the size range of shell-bearing sites (Figure 4). The majority (n = 28, 57 percent) are small, ranging from twenty-five to fourteen hundred square metres, displaying a continuous range of sizes with no modality. Sites in this cluster, with the exception of one of the largest (GcTq-19, at 1,330 square metres), do not have surface features such as ridges, terraces, or house depressions. The even spread within this size range and their limited areas suggest that these sites do not represent intensive occupations and that there was no real architectural goal of shell

6 Data from five of the fifty-four shell-bearing sites were insufficient to be included in site area calculations.

deposition beyond perhaps creating a flat well-drained surface to live upon. The range between fourteen hundred and three thousand square metres, with only three sites, represents a notable gap in size distribution. Eight sites (16 percent) cluster between three thousand and four thousand square metres and tend to have visible surface features such as shell ridges and house depressions. After four thousand square metres there is a gap in site size until six thousand square metres, with only one site falling in this range. From six thousand to twelve thousand square metres there is potentially a continuous spread of eight sites (though the sample size is small and spread over a large size range) with size clustering around six thousand to sixty-six hundred square metres and again around ninety-eight hundred to ten thousand five hundred square metres. The largest site, GcTr-10, at over eighteen thousand square metres, is a notable outlier that is discussed below.

Site size modalities are known elsewhere on the Northwest Coast. Marshall (2006) finds a similar multi-modality within the sizes of sites in Nootka Sound, western Vancouver Island, though her size clustering and distribution differs from that found on the Dundas Islands (see McKechnie, this volume). Acheson (1995, 1998) finds a bimodal distribution of site sizes on southern Haida Gwaii, as does Maschner (1997) for settlements in Tebenkof Bay on Kuiu Island, southeast Alaska. Marshall argues that patterning and clustering in site sizes suggest thresholds in the growth of settlements and constraints that cluster sites around optimum sizes for specific functions. The gap after fourteen hundred square metres in the Dundas Islands site areas may indicate the threshold range for small group logistical resource collection, and the modality of sites at three thousand to four thousand square metres may be indicative of different deposition processes associated with longer-term residence. The presence of surface features such as terraces, depressions, and ridges indicates a more formalized organization of space at the larger sites. The fact that 96 percent of shell-bearing sites fewer than fourteen hundred square metres lack visible surface features, and the majority of sites greater than three thousand square metres (n = 14, 78 percent) have surface features indicates that these larger sites are functionally different and are the result of formalized deposition processes guided by different behavioural and/or architectural "conventions." Fourteen of the fifteen villages – sites with multiple visible house depressions – are above the fourteen-hundred- to three-thousand-square-metre threshold; the exception (GcTq-10) is 2,144 square metres. Given the lack of a continuous range of site sizes between the two clusters and lack of house depressions among the smaller sites,

TABLE 1
*Characteristics of villages on the Dundas Islands group*

| Site | Area ($m^2$) | House rows[1] | House depressions[1] | Offset houses | Row shape | House size and variation | Location of largest houses | Possible village type |
|---|---|---|---|---|---|---|---|---|
| GcTq-21 | 2140 | 1 | 6 | N | Straight | All small | n/a | Small village, straight house row |
| GcTq-20 | 3020 | 2 | 6 | N | Straight | All small | n/a | Small village, straight house rows |
| GcTr-26 | 3080 | 2 | 8 | N | Straight | All small | n/a | Small village, straight house rows |
| GcTr-29 | 3250 | 2 | 5 | N | Straight | All small | n/a | Small village, straight house rows |
| GcTq-4 | 3480 | 2-3 | 8-13 | Y | Straight | All small | n/a | Small village, straight house rows |
| GdTq-3 | 3750 | 2-3 | 8-10 | Y | Straight | All small | n/a | Small village, straight house rows |
| GcTq-11 | 3920 | 1 | 6 | N | Curved | All small | n/a | Small village, curved house row |
| GcTq-6 | 6050 | 3 | 17 | n/a[2] | Straight | Small-large | n/a[2] | Large village, straight house rows |
| GdTq-1 | 6690 | 3 | 21-24 | Y | Straight | Small-large | Centre front | Large village, straight house rows |
| GcTq-5 | 8250 | 2 | 20-25 | Y | Straight | Small-large | Centre front | Large village, straight house rows |
| GcTq-1 | 9810 | 2 | 20 | Y | Straight | Small-large | Centre back | Large village, straight house rows |
| GcTr-5 | 9840 | 2 | 37 | Y | Curved | Small-large | Centre back | Large village, curved house rows |
| GcTr-8 | 10460 | 1-3 | 20-22 | Y | Curved | Small-large | Centre back | Large village, curved house rows |
| GcTq-7 | 11360 | 2 | 14 | Y | Straight | All large | n/a[3] | Large village, straight house rows |
| GcTr-10 | 18310 | 3-7 | 30-50 | Y | Straight | Small-large | Unclear | Large village, straight house rows |

[1] Ranges in house rows and numbers of houses offer a minimum and maximum where some depressions or rows are ambiguous.
[2] Insufficient field information to know whether or not there are offset houses at GcTq-6 and to know the location of the largest houses.
[3] Insufficient field information to know where the location of the largest houses are at GcTq-7.

we suggest that villages cannot be explained as a gradual accumulation of cultural material and organic growth in size; rather, they appear to be planned enterprises that were constructed and curated with an architectural vision in mind. This vision included the alignment of houses in rows and the patterning of shell deposition in order to form ridges, terraces, and flat, well drained living surfaces (Moss 2011, 123).

These large villages are the best indication that the outer islands of Northern Tsimshian traditional territory were important occupation areas in the past. Table 1 lists these villages, including their size and the number and organization of house depressions in rows. Villages can be subdivided into two groups: those with fewer houses (below fifteen, of which most have fewer than ten) and those with a large number of houses (more than fifteen, most having between twenty and twenty-four). These two clusters correspond with the three-thousand- to four-thousand-square-metre area range and the greater than six thousand-square-metre area range, respectively, and we designate them as small and large villages. Small villages have small house depression dimensions, usually around four by six metres. The larger villages typically show a range of house depression sizes, from smaller to larger (the latter greater than ten by five metres).

Taken together, the clearest typological division for all villages is between small villages with uniform house sizes and large villages with variable house sizes. There is, however, variation between the layouts of large villages on the Dundas Islands (Figure 5). Large villages have more complex surface features, such as multiple terraces, structural depressions offset from the linear rows, or even small wings of a few houses constructed beside the main house rows (Figures 5a and 5b). The offset depressions and house rows are undated, though they may represent structures other than residences (Ruggles 2007), houses that were appended to the existing villages by groups of people joining the village, or occupations not contemporaneous with the main one and limited to a certain area, leaving a composite of patterns on the surface of one site. This latter option seems the case at the largest site on the archipelago, GcTr-10 (18,300 square metres), which has up to four distinct and overlying village patterns indicated by house rows of different house shapes aligned perpendicular or offset from each other, suggesting abandonments and reoccupations of this location or occupations shifting with changing relative sea level or other geomorphological alterations.

At five large villages there are a few square house depressions in front of the rows of better defined rectangular house depressions. These different-shaped house forms may again be from a separate, less intensive

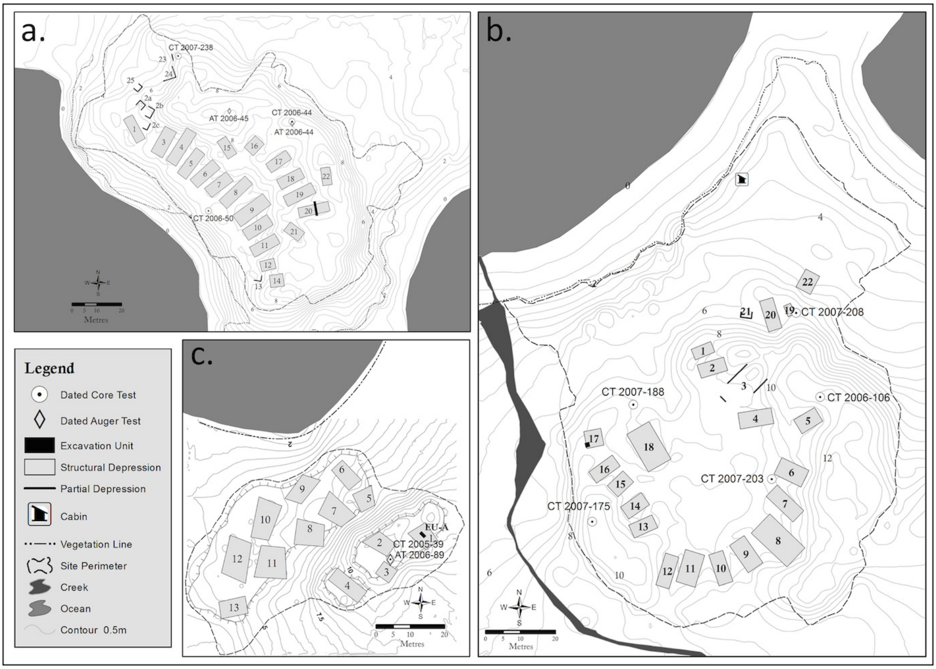


Figure 5. Select villages on the Dundas Islands. a.) GcTq-5, a large village with linear house rows, largest houses in the front-centre, and several offset structural depressions at the periphery of the site. b.) GcTr-8, a large village with a curved house row, the largest house set at the back centre of the site, and several offset structural depressions at the periphery of the village. c.) GdTq-3, a small village with a set of houses on a lower post-6100 cal BP terrace and up to four structural depressions on a 12.5 m upper terrace. The occupation of the upper terrace dates between 7000 and 5000 cal BP, when relative sea-level was higher. Note that contour elevations on all maps are relative to the barnacle line; elevations above sea level are 1.5 m higher. Maps by Sue Formosa.

occupation with a less formalized structure compared to that of the linear house rows, or they may represent different structure types within the same village occupation. In a study of standing house remains in Nuu-chah-nulth territory on southwest Vancouver Island, Mackie and Williamson (2003) demonstrate that multiple architectural styles of houses could be contemporaneous at single villages. Only intensive radiocarbon dating of these villages will allow us to sort out the contemporaneity of different architectural expressions in the past.

The most common architectural arrangement for villages in Prince Rupert Harbour is a pattern of linear rows with the largest house – considered to be the highest-ranking household in the village – being near the centre of the front row closest to the water (Archer 2001; Coupland

2006). Most of the sites designated as villages on the Dundas Islands group have linear rows, but the location of large houses varies from the Prince Rupert Harbour style, with some in the centre-front (Figure 5a), others in the centre-back, and others that are unclear or undefined (Table 1). In further contrast, two villages on the Dundas Islands have rows of houses that curve inwards on the ends to the point at which they face into the centre of the site rather than out to the beach in front (Figure 5b). These rows are set back into the woods following the curve of a back shell ridge. The largest houses are in the centres of these back rows rather than at the front of the site. As demonstrated below, these large villages with different architectural arrangements are contemporaneously occupied, perhaps signalling different group identities on the Dundas Islands archipelago.

## SETTLEMENT PATTERNS AND CHRONOLOGICAL TRENDS

To work towards understanding the settlement history of the Dundas Islands, we obtained seventy-eight radiocarbon dates on samples from thirteen sites (Table 2, Figure 6). Of these thirteen sites, all but two (GcTr-7 and GcTq-2) have shell-bearing components. Most dates were taken as basal and terminal bracketing dates from percussion core samples that captured the entire sequence of archaeological stratigraphy (Martindale et al. 2009), although a few dates were collected from auger samples (Hallmann et al. 2013) and conventional excavation (McLaren et al. 2011). We assessed the association of dates with the basal and terminal components of specific site types as well as analyzed the overall pattern of dates via summed probability – a statistical method of combining the calibrated ages of multiple radiocarbon dates. The dates accord with the Dundas Islands relative sea level curve. Dates older than 6100 cal yr BP are consistently above 7.5 metres ASL, and there is a general trend towards lower elevations as the dates get younger, indicating that habitation site locations followed regressing sea levels (McLaren et al. 2011).

Taken together, these radiocarbon ages suggest continuous long-term occupation of the Dundas Islands for the entire Holocene, although the scale and form of the settlement has changed – often dramatically – through this long period. In general, settlements increased in size through time, although small sites persisted into later times, indicating that the range of site types is additive rather than a replacement. Sometime between 1900 and 1300 cal yr BP, however, occupation shifted away from the large villages, although resource collection continued on the islands up to the present day. What these data concretely demonstrate is that these outer islands have the oldest currently recorded archaeological record in Northern Tsimshian territory and that, by at least the mid-Holocene, the occupation of these islands was of a scale comparable to that on the mainland coast.

### *11,000 to 5000 BP: Early Marine Adaptations and the Emergence of the First Small Villages*

One of the most notable aspects of the archaeological settlement data from the Dundas Islands is the number of components that date to the early or mid-Holocene (Figure 6), a time period for which there are relatively few known archaeological sites on the Northwest Coast (Mackie et al. 2011; Moss, Peteet, and Whitlock 2007). Our data are also fairly sparse; there are fewer sites before than after 5000 cal yr BP, although our sample for dating was focused on large villages that tend to be later in the sequence. Six sites, however, produced ages older than five thousand years; five of these sites have shell-bearing components from this time period. The oldest dated archaeological site on the Dundas Islands archipelago is Far West Point (GcTr-6), which has yielded a basal date of 11,204 to 10,885 cal yr BP (Figure 6, Table 2) (McLaren 2008; McLaren et al. 2011).[7] Some of the early components are spatially associated with or buried by later village sites, indicating continuity of use of particular locations through time. GcTq-4 and GdTq-3 (Figure 5c) both have more recent small village components near the modern shoreline, with steep natural paleoshoreline ridges behind them that are topped with shell components dating to the 7.5-metre ASL still-stand at 8850 to 6100 cal yr BP. The early date at GcTr-8 (7415 to 7020 cal yr BP) comes from an elevated and landward portion of this site (Figure 5b, Figure 6), where a small shell component on a raised relict beach terrace was subsequently buried by a large late Holocene village occupation (Martindale et al. 2009, 1,572). Likewise, the early basal age from beneath the village at GdTq-1 (6555 to 6102 cal yr BP) comes from twelve metres ASL. Given that the terminal dates from the village above are much more recent, we

[7] All radiocarbon dates presented in the text are given as two-sigma calibrated probability ranges, indicating that there is a 95 percent probability that the actual age in years before present of the sample comes from within that range (by convention, the "present" is defined as AD 1950). All dates were calibrated using OxCal 4.2.3 (Bronk Ramsey 2013). All terrestrial dates were calibrated using IntCal13 atmospheric curve (Reimer et al. 2013). All marine dates were calibrated using Marine13 marine curve (Reimer et al. 2013) and using Delta-R = 288 +/- 69 (Ames and Martindale 2014).

TABLE 2

*All Dundas Islands and select Stephens Islands radiocarbon dates*

All dates were calibrated using OxCal 4.2.3 (Bronk Ramsey 2013). All terrestrial dates were calibrated using IntCal13 curve and all marine dates were calibrated using Marine13 curve (Reimer et al. 2013) and using Delta-R of 288±69 (Ames and Martindale 2014).

| Dundas Islands Sites | | | | | | | |
|---|---|---|---|---|---|---|---|
| Site | Field sample from which C14 sample was taken[1] | Context (depth/position; landform elevation; position on site)[2] | Material | Conventional age and error | Cal BP median | Cal BP range (2-sigma) | Laboratory number |
| GcTr-6 [3] | Excavation | B; RT 12.5 m ASL | Charcoal | 9690 +/- 30 | 11148 | 11204-10885 | UCIAMS 28008 |
| GcTr-6 [3] | Excavation | M; RT 12.5 m ASL | Charcoal | 6800 +/- 60 | 7642 | 7784-7566 | TO-13292 |
| GcTr-6 [3] | Excavation | M; RT 12.5 m ASL | Whale bone | 7300 +/- 30 | 7504 | 7644-7380 | UCIAMS 31730 |
| GcTr-6 [3] | Excavation | M; RT 12.5 m ASL | Charcoal | 6940 +/- 20 | 7762 | 7829-7698 | UCIAMS 30930 |
| GcTr-6 [3] | Excavation | M; RT 12.5 m ASL | Charcoal | 6490 +/- 20 | 7421 | 7440-7326 | UCIAMS 30931 |
| GcTr-6 [3] | Excavation | T; RT 12.5 m ASL | Charcoal | 6185 +/- 20 | 7079 | 7165-7006 | UCIAMS 30932 |
| GcTr-6 [3] | CT 2005-DM4 | B; RT 12.5 m ASL | Charcoal | 6925 +/- 50 | 7756 | 7920-7667 | UCIAMS 21984 |
| GcTr-6 [3] | CT 2005-DM4 | B; RT 12.5 m ASL | Marine shell | 7510 +/- 20 | 7688 | 7841-7556 | UCIAMS 21881 |
| GcTr-6 [3] | AT 2006-73 | RT 12.5 m ASL | Marine shell | 7005 +/- 44 | 7246 | 7413-7057 | Poz 30563 |
| GcTr-6 [3] | AT 2006-73 | RT 12.5 m ASL | Marine shell | 6900 +/- 43 | 7130 | 7306-6928 | Poz 30562 |
| GcTr-6 [3] | CT 2005-DM3 | B; RT 6.5 m ASL | Marine shell | 4200 +/- 15 | 3892 | 4087-3685 | UCIAMS 21882 |
| GcTr-6 [3] | CT 2005-DM3 | B; RT 6.5 m ASL | Charcoal | 3645 +/- 25 | 3957 | 4081-3889 | UCIAMS 21985 |
| GcTr-6 [3] | CT 2005-DM3 | T; RT 6.5 m ASL | Marine shell | 3145 +/- 20 | 2604 | 2754-2380 | UCIAMS 21883 |
| GcTq-2 [3] | Excavation | 40-50 cm DBS; RT 13.5 m ASL | Charcoal | 6930 +/- 20 | 7751 | 7823-7689 | UCIAMS 28009 |
| GcTr-3 [3] | CT 2005-25 | B; RT 9 m ASL | Marine shell | 4440 +/- 50 | 4222 | 4442-3965 | Beta 215176 |
| GcTr-3 [3] | CT 2005-25 | T; RT 9 m ASL | Marine shell | 3460 +/- 40 | 2970 | 3175-2765 | Beta 215177 |
| GcTr-3 [3] | CT 2005-DM1 | RT 6.75 m ASL | Seeds | 1850 +/- 35 | 1784 | 1872-1710 | UCIAMS 21987 |
| GcTr-4 [3] | Excavation | 60-70 cm DBS; RT 9.5 m ASL | Charcoal | 2530 +/- 15 | 2702 | 2742-2505 | UCIAMS 28010 |
| GcTr-7 [3] | CT 2005-DM5 | M; RT 18.5 m ASL | Marine shell | 1395 +/- 15 | 667 | 796-530 | UCIAMS 21880 |
| GcTr-7 [3] | CT 2005-DM5 | M; RT 18.5 m ASL | Charcoal | 640 +/- 60 | 606 | 680-537 | UCIAMS 21983 |
| GcTq-4 | CT 2005-033 | B, SI; RT 12.5 m ASL | Marine shell | 5290 +/- 40 | 5356 | 5562-5123 | Beta 215179 |
| GcTq-4 | CT 2005-033 | T, SI; RT 12.5 m ASL | Marine shell | 6830 +/- 70 | 7050 | 7261-6802 | Beta 215178 |
| GcTq-4 | House 1 Excavation | 107-117 cm DBS; RT 12.5 m ASL | Charcoal | 3650 +/- 50 | 3973 | 4141-3843 | TO-13309 |
| GdTq-3 | AT 2006-89 | RT 13 m ASL | Marine shell | 6600 +/- 50 | 6775 | 6989-6558 | Poz 27700 |
| GdTq-3 | AT 2006-89 | M; RT 13 m ASL | Marine shell | 6540 +/- 41 | 6689 | 6899-6494 | Poz 30561 |
| GdTq-3 | AT 2006-89 | M; RT 13 m ASL | Marine shell | 6435 +/- 42 | 6578 | 6772-6391 | Poz 30560 |
| GdTq-3 | AT 2006-89 | M; RT 13 m ASL | Marine shell | 5821 +/- 38 | 5920 | 6140-5720 | Poz 30559 |
| GdTq-3 | AT 2006-89 | T; RT 13 m ASL | Marine shell | 5537 +/- 38 | 5614 | 5825-5445 | Poz 25879 |
| GdTq-3 | CT 2005-39 | B; RT 13 m ASL | Marine shell | 6890 +/- 50 | 7117 | 7303-6907 | Beta 215180 |
| GdTq-3 | CT 2005-39 | T; RT 13 m ASL | Marine shell | 5230 +/- 60 | 5269 | 5505-4978 | Beta 215183 |
| GdTq-3 | House 1 excavation | 113 cm DBS; RT 13 m ASL | Marine shell | 5990 +/- 29 | 6106 | 6265-5934 | D-AMS 008141 |
| GdTq-3 | House 1 excavation | 155 cm DBS; RT 13 m ASL | Charcoal | 5928 +/- 30 | 6749 | 6845-6670 | D-AMS 007908 |
| GdTq-3 | House 1 excavation | RT 13 m ASL | Marine shell | 6474 +/- 29 | 6623 | 6804-6432 | D-AMS 008142 |
| GdTq-3 | House 1 excavation | RT 13 m ASL | Charcoal | 2112 +/- 24 | 2083 | 2148-2004 | D-AMS 007907 |
| GdTq-1 | CT 2006-132 | B | Marine shell | 6190 +/- 70 | 6323 | 6555-6102 | TO 13593 |
| GdTq-1 | CT 2006-132 | T | Marine shell | 5140 +/- 70 | 5141 | 5400-4865 | TO 13594 |
| GdTq-1 | CT 2005-05 | B | Marine shell | 4640 +/- 70 | 4499 | 4790-4235 | TO 13595 |
| GdTq-1 | CT 2005-05 | T | Marine shell | 4160 +/- 70 | 3840 | 4112-3575 | TO 13596 |
| GdTq-1 | AT 2005-07 | SI; S-C BR | Marine shell | 2555 +/- 35 | 1876 | 2083-1687 | Poz 33584 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| GdTq-1 | AT 2005-07 | M, SI; S-C BR | Marine shell | 2840 +/- 35 | 2217 | 2401-2000 | Poz 33579 |
| GdTq-1 | AT 2005-07 | S-C BR | Marine shell | 2475 +/- 35 | 1779 | 1968-1583 | Poz 33566 |
| GdTq-1 | CT 2005-08 | B | Marine shell | 4780 +/- 40 | 4676 | 4845-4447 | Beta 215174 |
| GdTq-1 | CT 2005-08 | T | Marine shell | 2440 +/- 50 | 1739 | 1937-1533 | Beta 215181 |
| GcTr-5 | CT 2005-14 | B; C BR | Marine shell | 3070 +/- 40 | 2522 | 2710-2329 | Beta 215175 |
| GcTr-5 | CT 2005-14 | T; C BR | Marine shell | 2390 +/- 40 | 1682 | 1877-1500 | Beta 215182 |
| GcTr-5 | CT 2006-107 | B; C | Marine shell | 3000 +/- 40 | 2437 | 2691-2245 | TO 13601 |
| GcTr-5 | CT 2006-107 | T; C | Marine shell | 2140 +/- 40 | 1404 | 1575-1254 | TO 13602 |
| GcTr-8 | CT 2007-203 | M; S-C | Marine shell | 6192 +/- 36 | 6323 | 6496-6166 | XA 5804 |
| GcTr-8 | CT 2007-203 | M; S-C | Marine shell | 6306 +/- 31 | 6437 | 6616-6281 | XA 5803 |
| GcTr-8 | CT 2007-208 | B; E EDGE | Marine shell | 3783 +/- 33 | 3377 | 3563-3179 | XA 5806 |
| GcTr-8 | CT 2007-208 | T; E EDGE | Marine shell | 3099 +/- 28 | 2553 | 2719-2350 | XA 5805 |
| GcTr-8 | CT 2007-175 | B; NW BR | Marine shell | 2970 +/- 70 | 2401 | 2680-2145 | TO 13591 |
| GcTr-8 | CT 2007-175 | T; NW BR | Marine shell | 2960 +/- 70 | 2387 | 2675-2135 | TO 13592 |
| GcTr-8 | CT 2007-188 | B; C F | Marine shell | 3984 +/- 38 | 3614 | 3825-3417 | XA 5802 |
| GcTr-8 | CT 2007-188 | T; C F | Marine shell | 2875 +/- 31 | 2255 | 2466-2051 | XA 5801 |
| GcTr-8 | CT 2006-106 | B; SE BR | Marine shell | 7000 +/- 60 | 7239 | 7415-7020 | TO-13289 |
| GcTr-8 | CT 2006-106 | T; SE BR | Marine shell | 2510 +/- 50 | 1821 | 2034-1601 | TO 13288 |
| GcTq-5 | CT 2007-238 | B, SI; NW EDGE | Marine shell | 4620 +/- 50 | 4470 | 4770-4227 | TO 13599 |
| GcTq-5 | CT 2007-238 | T, SI; NW EDGE | Marine shell | 8829 +/- 60 | 9178 | 9411-8973 | TO 13600 |
| GcTq-5 | AT 2006-45 | B; N BR | Marine shell | 3482 +/- 32 | 2997 | 3200-2792 | Poz 25882 |
| GcTq-5 | AT 2006-45 | M; N BR | Marine shell | 3230 +/- 35 | 2714 | 2892-2472 | Poz 27699 |
| GcTq-5 | AT 2006-45 | M; N BR | Marine shell | 3185 +/- 35 | 2652 | 2834-2417 | Poz 27697 |
| GcTq-5 | AT 2006-45 | M; N BR | Marine shell | 3135 +/- 35 | 2589 | 2748-2362 | Poz 27696 |
| GcTq-5 | AT 2006-45 | T; N BR | Marine shell | 2764 +/- 32 | 2133 | 2314-1940 | Poz 25881 |
| GcTq-5 | CT 2006-44 | B; C BR | Marine shell | 3170 +/- 50 | 2627 | 2816-2373 | TO 13291 |
| GcTq-5 | CT 2006-44 | T; C BR | Marine shell | 2780 +/- 50 | 2151 | 2336-1933 | TO 13290 |
| GcTq-5 | House 20 excavation | 170 cm DBS | Charcoal | 1460 +/- 50 | 1355 | 1518-1288 | TO 13310 |
| GcTq-5 | CT 2006-50 | B; C F | Marine shell | 2200 +/- 60 | 1464 | 1677-1284 | TO 13597 |
| GcTq-5 | CT 2006-50 | T; C F | Marine shell | 2180 +/- 60 | 1445 | 1657-1269 | TO 13598 |
| GcTq-6 | AT 2006-67 | B | Marine shell | 2356 +/- 31 | 1643 | 1841-1462 | Poz 25878 |
| GcTq-6 | AT 2006-67 | M | Marine shell | 2420 +/- 35 | 1717 | 1894-1529 | Poz 27705 |
| GcTq-6 | AT 2006-67 | M | Marine shell | 2370 +/- 30 | 1659 | 1854-1486 | Poz 27704 |
| GcTq-6 | AT 2006-67 | T | Marine shell | 2314 +/- 33 | 1595 | 1790-1401 | Poz 25877 |
| GcTq-1[4] | AT 2000-5 | B; W-C BR | Marine shell | 3210 +/- 60 | 2682 | 2894-2402 | Beta 124781 |
| GcTq-1[4] | ST 2000-2 | T; C BR | Marine shell | 3280 +/- 60 | 2772 | 2994-2500 | Beta 123472 |
| GcTq-1[4] | ST 2000-4 | T; W BR | Marine shell | 2960 +/- 70 | 2387 | 2675-2135 | Beta 123474 |
| GcTq-1[4] | ST 2000-1 | T; E BR | Marine shell | 2440 +/- 70 | 1739 | 1977-1514 | Beta 123471 |
| GcTq-1[4] | ST 2000-3 | T; C BR | Marine shell | 2400 +/- 60 | 1694 | 1918-1481 | Beta 123473 |
| Stephens Islands sites | | | | | | | |
| T416-1 | CT 2014-011 | B; RT ~11.5 m ASL | Shell | 6951 +/- 46 | 7188 | 7371-6982 | D-AMS 007887 |
| T416-1 | CT 2014-011 | B; RT ~11.5 m ASL | Charcoal | 6211 +/- 28 | 7096 | 7242-7008 | D-AMS 007904 |
| T416-1 | CT 2014-011 | T; TR ~11.5 m ASL | Charcoal | 4504 +/- 30 | 5164 | 5299-5046 | D-AMS 007903 |
| GaTp-10 | CT 2014-004 | B; RT ~11.5 m ASL | Shell | 9133 +/- 30 | 9503 | 9695-9335 | D-AMS 007883 |
| GaTp-10 | CT 2014-004 | T; TR ~11.5 m ASL | Shell | 6275 +/- 26 | 6403 | 6589-6261 | D-AMS 007882 |
| GaTp-10 | CT 2014-004 | T; TR ~11.5 m ASL | Charcoal | 5662 +/- 28 | 6442 | 6500-6352 | D-AMS 007900 |

1. AT = auger test, CT = core test, ST = shovel test.
2. Context code key: Depth/positions: B = basal date, M = date from somewhere between basal and terminal deposits, T = terminal date, SI = stratigraphic inversion of dates where an older date overlays a more recent lower one. Landform elevations: RT = raised inland terrace; indicates a date taken from a field sample located on a terrace away from the modern shoreline; the ground elevation of the sample is given. Positions on site: a directional guide followed by a position. N = north, E = east, S = south, W = west; N-C = north-central, E-C = east-central, etc. BR = back shell ridge, C = centre of site, F = front of site, EDGE = edge of site.
3. See McLaren (2008) for more information on the contexts of these dates.
4. See Archer (2000) for more information on the contexts of these dates.

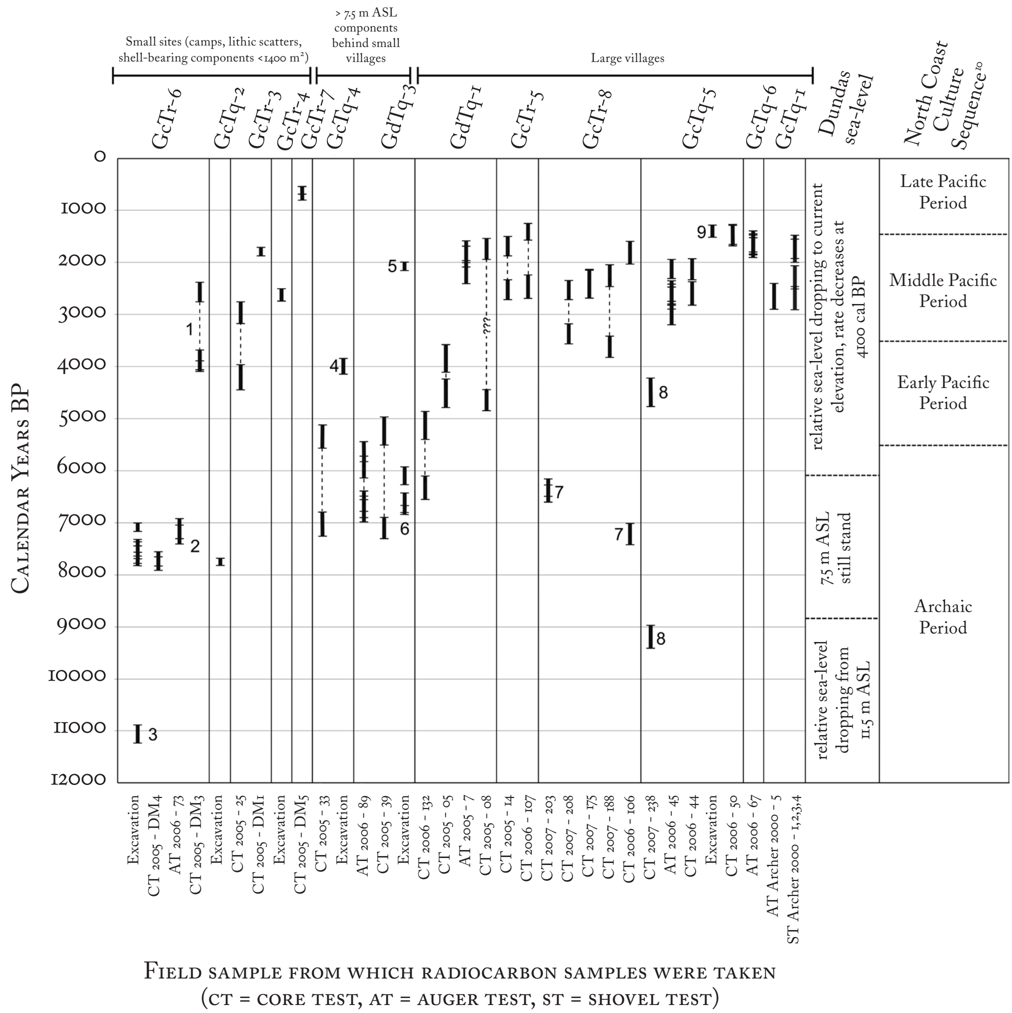


Figure 6. Calibrated radiocarbon dates for the Dundas Islands group sorted by site and field sample against the Dundas Islands relative sea-level curve and Ames and Maschner's North Coast Culture Sequence (1999). Bars indicate 2-sigma probability calibrated ranges as per Table 2. Dotted lines between date ranges indicate potential occupational continuity between basal and terminal dates in percussion core tests or auger tests.

1. Shell-bearing component on lower terrace.
2. Shell-bearing component on 12.5 m ASL terrace.
3. Cultural deposit below shell-bearing component on 12.5 m ASL terrace.
4. Hearth from structure on upper terrace.
5. More recent date from Hearth I. Directly associated with other consistently older dates. Rejected by excavators as a lab error.
6. Dates for Hearth I and a post hole in a structural depression on upper terrace.
7. Samples associated with an old component buried beneath the larger later village occupation.
8. Disturbed, stratigraphically reversed sample taken from the northern edge of the site.
9. Date from hearth excavated in house structure in the back row.
10. North Coast Culture Sequence from Ames and Maschner (1999).

suggest that this may be a case similar to that at GcTr-8, where a small old component is buried beneath a more recent village.[8]

This pattern of later components overlying earlier occupations makes it difficult to identify the earliest village occupation at most sites, although our analysis indicates that small villages first appeared during or prior to the mid-Holocene. Sites GcTq-4 and GdTq-3 (Figure 5c) both have shell-bearing components and potential house depressions on lower terraces parallel to the present shoreline as well as shell-bearing components with a few structural surface depressions on raised inland terraces 12.5 metres ASL that were each occupied by ca. 7000 cal yr BP. The lower terraces at these two sites would have been in the intertidal zone prior to the 6100 cal yr BP sea level regression, indicating that the lower shell components and house depressions represent subsequent reoccupations in more recent times. Both upper components are small (around seven hundred to eight hundred square metres), fitting within the smallest size cluster of shell-bearing sites. While the structures on the upper ridge at GcTq-4 are more recent (Ruggles 2007), two charcoal samples taken from a hearth feature excavated in one of the structural depressions on the upper terrace at GdTq-3 that date 6845 to 6670 cal yr BP and 6804 to 6432 cal yr BP suggest that this may have been a small village of several houses by the middle of the seventh millennium BP. Excavation results indicate that these features are houses (Martindale et al. 2010).

None of the sites older than 5000 cal yr BP are large, nor are they as numerous as the more recent sites situated on the modern shoreline, although this in part reflects preservation issues and limitations in survey methods. Since this is not likely a representative sample, it is not possible at this time to assess the density of occupation on the Dundas Islands during the early and mid-Holocene. However, there is likely a relationship between site size – especially number and area of houses – and demography, and the small surface areas of the known sites suggest that small co-resident groups characterized this period. Excavated faunal remains from Far West Point (GcTr-6) (Martindale et al. 2009, 1,569; McLaren 2008), GdTq-3, and GcTq-4 (Martindale et al. 2010) indicate that the inhabitants relied

---

8 In addition to the early dates discussed in the text, there is an exceptionally old date from GcTq-5 of 9411 to 8973 cal yr BP. It is from an area on the northern edge of the village and is actually a stratigraphically inverted date from the terminal surface of the site, with a younger date (4770 to 4227 cal yr BP) below it. This area is well below 7.5 metres ASL, indicating that the shell that was dated may have been washed down or brought down from an older now-buried shell-bearing component at a higher elevation. Alternatively, there is a chance that the shell was naturally deposited near its current location when sea levels were higher and later human disturbance brought the shell to the surface. We can therefore not say for certain that there was human occupation at GcTq-5 during the early Holocene.

primarily on locally available intertidal and offshore marine resources. The capture of many of these resources, as well as transportation and movement through the island landscape, would have required competent boat technology, demonstrating a well developed marine orientation of the earliest inhabitants on the Dundas Islands.

### *5000 to 2000 BP: Habitation Site Diversification and Large Village Occupation*

Small shell-bearing sites lacking surface features continued to be abundant into the latter half of the Holocene. There is a second discrete 1.8-metre-deep shell component at Far West Point (GcTr-6) on a 4.5-metre ASL terrace that dates from the third and fourth millennia BP, and a cluster of small discrete shell areas at GcTr-3 on a small islet in Hudson Bay Passage with a similar range of dates (Table 2, Figure 6). Both of these dated deposits are inland and may have been parts of small camps as people followed the gradually falling relative sea level over the last sixty-one hundred years. In addition, there are many small, undated shell-bearing sites on the current shoreline that, based on their elevation, likely post-date 4300 cal yr BP.

One of the most striking developments of settlement on the Dundas Islands in the latter half of the Holocene is the construction of very large villages, indicative of larger co-resident groups of people occupying the area. However, large villages with early basal components present interpretive challenges when trying to determine the timing of the appearance of particular architectural layouts. Detailed subsurface exploration of GcTr-8 using percussion coring demonstrated a small early component beneath the later large village, which suggests that the earliest dates at other large villages may not be representative of the initial village occupation (see above and Martindale et al. 2009). A pair of basal and terminal dates from the landward rear portion of GcTq-5 (Figures 5a and 6) indicates that the shell ridge accumulated between 2816 to 2373 cal yr BP and 2336 to 1933 cal yr BP, while the shoreward portion of the site on the same axis from this point dates between 1677 to 1284 cal yr BP and 1657 to 1269 cal yr BP. The site appears to have expanded towards the current shoreline over a period of about fifteen hundred years. This is perhaps the result of occupation expanding shoreward following the regressing sea level. Two metres of shell-rich deposit accumulated very rapidly at this location, suggesting terrace construction at this newly occupied front of the site. A hearth excavated in one of the houses in the back row is contemporaneous with the front terrace, providing evidence that this was a large village in use during the latter half of the second millennium BP.

The rapid accumulation of deposits observed at the front of GcTq-5 is a characteristic observed at several other large villages. Some bracketing dates from basal and terminal deposits have nearly identical calibrated age ranges, indicating that substantial deposits built up extremely rapidly. At GcTr-8, bracketing dates from a sediment core produced calibrated ranges of ca. 2680 to 2140 cal yr BP above and below six metres of deposit. Two dates from the base and top of a terrace near the back of GcTq-6 have ranges from 1800 to 1400 cal yr BP representing two metres of deposition within a short time. Stein, Deo, and L.S. Phillips (2003) have demonstrated that many shell-bearing sites with deep deposits on the San Juan Islands were deposited rapidly and punctuated by periods of abandonment and reoccupation rather than by a long-term consistent occupation. In these cases on the Dundas Islands, these rapidly accumulated deposits may be areas where shell was consciously deposited in high concentrations to build up landforms and terraces upon which to build houses (see also Blukis Onat 1985; Claassen 1991).

Even though we cannot state with confidence when specific large village types were first constructed, a summed probability plot including all calibrated radiocarbon ages on cultural deposits from the region suggests that a major population expansion may have occurred around 3000 cal yr BP (Figure 7).[9] Summed probability plots are constructed by plotting the probability ranges of calibrated dates along a time-scale and summing together all overlapping probability distributions; the logic of using these as a population proxy is based on the assumption that more people leave more dateable material in the archaeological record (Collard et al. 2010; Rick 1987; Shennan and Edinborough 2007). Peaks within these plots indicate higher frequencies of radiocarbon dates for a given time period and, thus, potentially larger populations or more intensive periods of settlement. Although calibration and taphonomic effects can cause spurious patterns in these plots (Surovell and Brantingham 2007; Surovell et al. 2009), this method provides some evidence for demographic trends in settlement. Interpretations from summed probability correlations are strongest with large sample sizes and where calibration

[9] Martindale and Marsden (2003), following MacDonald and Inglis (1981), suggest that a population expansion began about 3500 cal yr BP in broader Northern Tsimshian territory. This date is not necessarily inconsistent with these results as it refers to other lines of evidence, including artefact trends, which may reflect the duration of a process of expansion. However, the difference may also be related to MacDonald and Inglis's (1981, 44) apparent use of uncalibrated dates to form their chronology.

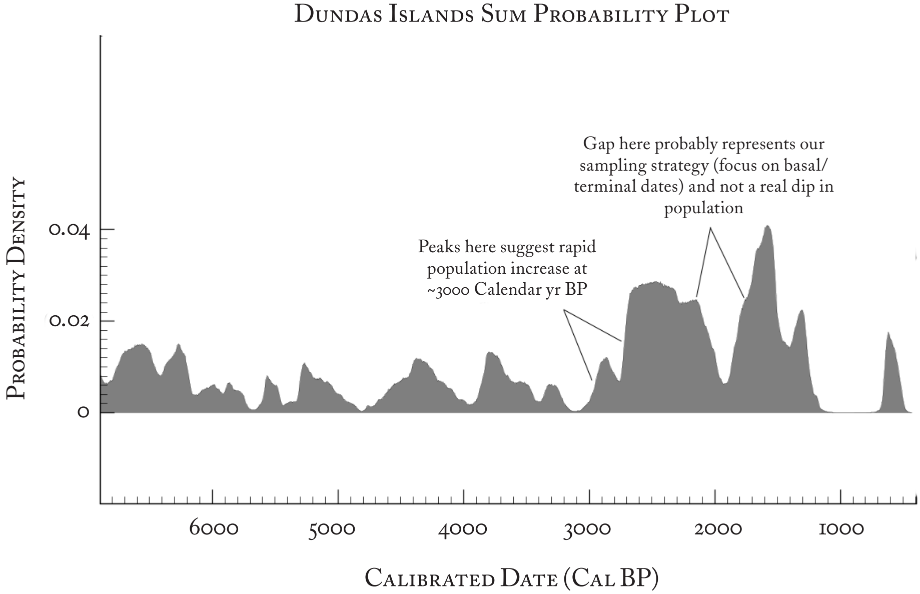


Figure 7. Sum probability plot of Dundas Islands radiocarbon dates showing general demographic trends through time. Model created with OxCal v.4.2.3 (Bronk Ramsey 2013).

effects are modest (e.g., Peros et al. 2010). Despite its limitations, summed probability provides some evidence of trends in settlement that may be associated with the development of new site types. The peak in Figure 7 around 3000 cal yr BP appears to be a result of more site components, hence a higher population associated with the appearance of large villages. Thus we can hypothesize, but not test, a correlation between the two. The steep trough around 2000 cal yr BP is likely a consequence of our focus on basal and terminal dates rather than a demographic trend, demonstrating that sampling biases can also affect the shape of the resulting curve.

Despite the challenges of tracking the mode and tempo of site developments, we can say with some confidence that villages with multiple structures existed on the Dundas Islands before 5000 cal yr BP. Larger villages with many houses of different sizes appeared over the following several millennia. We suggest that the demographic expansion around 3000 cal yr BP suggested by the summed probability plot of our dates coincides with a proliferation of large villages with different architectural layouts (Figure 7). The terminal dates from the villages suggest that the patterns that characterize their most recent occupation – as evidenced in the surface topography – were in place by about 2000 cal yr BP (Figure 6). By this time at least six major villages were contemporaneously occupied.

### *1900 to 1300 BP to the Present Day: Major Population Shifts and Seasonal Resource Collection*

The terminal dates from villages cluster between around 1900 to 1300 cal yr BP, suggesting a major shift in settlement patterns (Figures 6 and 7). The reason for this shift is not yet known, though it broadly coincides with what appears to have been a major settlement hiatus in the Prince Rupert Harbour associated with a regional conflict (Ames and Martindale 2014; Archer 1992, 2001; Martindale and Marsden 2003; McKechnie 2013).

The only dated site from the period after the terminal dates at the large villages is a non-shell-bearing camp at Connell Island (GcTr-7), which dates between 750 and 400 cal yr BP (Figure 6). If occupation shifted from large villages to small camps without shell components during this period, the archaeological record of this occupation would be more ephemeral. In the absence of a sample of dated sites larger than one, we can say comparatively little about this later period other than it appears that population density on the islands was much lower or that people ceased depositing shells on land in the same patterns observed at the village sites. This suggests a significant settlement shift away from sedentary village life on the Dundas Islands. Numerous culturally modified trees demonstrate that the area has been used for bark or wood collection within the last few centuries. Small shell-bearing sites on the present shoreline, rock shelters, and small villages remain undated site types, and they may fill certain gaps in our settlement chronology. The only clearly recent occupation of the Dundas Islands, other than culturally modified trees, is the historic fishing and seaweed-collecting cabins used by Northern Tsimshian who currently reside on the mainland. These cabins stand testament to the continuity of use of particular locations; indeed, on the shoreline at the base of the terrace with the eleven-thousand-year-old occupation site and above a later Holocene shell deposit at Far West Point there stands a cabin owned by Walter Green of Lax Kw'alaams (McLaren 2008).

## DISCUSSION: THE NORTHERN OUTER ISLANDS OF TSIMSHIAN TERRITORY IN CONTEXT

This analysis demonstrates two main points: the outer islands of Northern Tsimshian traditional territory were inhabited by seafaring peoples exploiting the maritime landscape's resources as early as eleven thousand years ago, and these islands were a major, densely occupied population centre by at least the second half of the Holocene. Clearly, these geographically marginal locations were neither culturally nor historically marginal. An understanding of the human history of places now considered "remote" is important for developing a broader understanding of the northern British Columbia Coast. In a recent synthesis of Northwest Coast archaeology, Madonna Moss (2011, 46) argues that "local and regional landscapes embed a complex mosaic of human history." She highlights an overall trend of cultural continuity through the Holocene but emphasizes that this does not mean that Northwest Coast cultures were in a state of stasis. The settlement data that we have for the Dundas Islands span the Holocene, giving a unique view into this "mosaic" and providing a sense of how people occupied the offshore islands of the northern British Columbia coast. In this final section we compare aspects of chronology, spatial patterning, and seasonality and subsistence from the Dundas Islands to other areas of Northern Tsimshian territory, with comments about other areas of the northern Northwest Coast as they are germane. We focus on comparisons that we are able to make with our survey, percussion core, and auger sample data.

Moss (2011) also reminds us that our reconstructions of Northwest Coast history are biased by a material record that becomes more fragmentary further into the past. To date, no sites older than 6000 cal yr BP have been documented on the mainland coast between the Nass and Skeena rivers (Ames 2005; Ames and Martindale 2014; MacDonald and Inglis 1981), though no detailed relative sea level reconstructions and archaeological surveys based upon them have yet been conducted in these areas. In contrast, we know that the outer islands were occupied by at least 11,000 cal yr BP. A brief visit to Stephens Pass in the centre of the Stephens Island archipelago, twenty kilometres offshore and twenty-seven kilometres south of the Dundas Islands (Figure 1), by two of the authors (Letham and Martindale) in June 2014 revealed that this area had villages as large as the largest Dundas Islands and Prince Rupert Harbour villages as well as several smaller shell-bearing deposits on terraces about ten metres above the current shoreline. Two raised components have dates spanning 9500 to 6400 cal yr BP and 7200 to 5000 cal yr BP (Table 2), suggesting that the sea level and settlement histories of Stephens Islands may parallel those of the Dundas archipelago. Recent work at GbTp-1 on the Lucy Islands, about ten kilometres south-southeast of the south end of the Dundas group (Figure 1), has mapped and dated a series of shell-bearing deposits that follow terraces that generally match the relative sea level regression recorded for the Dundas Islands; the highest terrace yielded a date of 9500 cal yr BP (Archer and Mueller 2013; Cui et al. 2013). Furthermore, a structural depression was recorded at GbTp-1, with deposits near its edge dated to sometime between 6400 cal yr BP and 5200 cal yr BP (Archer 2011; Archer and Mueller 2013, 8), suggesting that this structure is roughly the same age as, or only slightly more recent than, that at GdTq-3 on the Dundas Islands. People were apparently constructing buildings analogous to the houses at later large villages by at least the mid-Holocene. This suggests that the outer islands were not simply used for foraging forays by groups from the mainland but, rather, were occupied for long portions of the year, if not year-round.

Further north in southeast Alaska (Figure 1), recent surveys of raised shorelines on Prince of Wales Island, Heceta Island, and Kosciusko Island have identified a rich record of microblade-bearing early Holocene occupation sites (Carlson 2012; Carlson and Baichtal 2015), augmenting the record of several other previously studied early sites there, such as Hidden Falls (Davis 1989), Thorne River (Holmes et al. 1989), On-Your-Knees Cave (Dixon et al. 1997), and Chuck Lake (Ackerman et al. 1985). Notably, the Chuck Lake site on Heceta Island has a shell-bearing deposit with a marine-dominated faunal assemblage dating between 8000 and 7000 cal yr BP (Moss 1998, 99-100). The majority of early Holocene sites identified by Carlson and Baichtal (2015), however, are not shell-bearing sites, whereas those on Dundas Islands, Lucy Islands, and Stephens Islands have shell-bearing components. This may reflect different subsistence economies or different settlement and discard patterns between these regions.

The early Holocene occupation of these offshore islands and the well recorded terminal Pleistocene and early Holocene occupation of Haida Gwaii even further offshore (Fedje and Mathewes 2005; Mackie et al. 2011) suggest that the early occupants of the northern BC coast were proficient maritime-oriented fisher-hunter-gatherers. The increasing recognition of numerous early Holocene sites on raised paleoshorelines on the islands off the coast of southeast Alaska has led Carlson and Baichtal (2015) to suggest that even earlier, during the terminal Pleistocene, when relative sea level was lower, there were many people living in the region. The remains of this occupation would now be submerged because of eustatic sea level rise and isostatic readjustments following deglaciation (see also Dixon and Monteleone 2014). Settlement and use of what are considered to be the "peripheral" "edges" of the coast appears to have been continuous and at times quite intensive over the entire Holocene.

The picture of settlement patterns is clearer for the second half of the Holocene due to our larger sample of dated archaeological sites. Our entire dated sample of large villages was occupied at 2000 cal yr BP.

If all large villages, with at least 197 house depressions (Table 1), were contemporaneously occupied, the population of the area would have been significant. In addition, villages with different architectural layouts were occupied contemporaneously during this late period. Tsimshian oral histories make reference to groups of foreigners from the north moving to the Dundas Islands and at times cohabiting with the Tsimshian residents (Marsden 2000); Martindale and Marsden (2003) suggest that this may have occurred between 3500 and 2500 BP. One explanation for the existence of different village layouts is that these belong to different cultural groups inhabiting the islands; villages with straight rows and the largest houses in the front-centre appear most similar to those in Prince Rupert Harbour. Furthermore, this is known to have been a time when many of the large villages in the Prince Rupert Harbour were contemporaneously occupied, making it one of the most densely occupied regions of the northern coast (Ames and Martindale 2014; Archer 2001; MacDonald and Inglis 1981). Spatially, the Dundas Islands villages cluster on islets along the three passes between the major islands (Figure 2). All three passes run roughly east-west through the archipelago. All large villages are located near large intertidal areas, and many are in semi-protected areas with multiple points of beach access. In Prince Rupert Harbour, a large number of contemporaneously occupied villages cluster in the passes that lead into the inner harbour (Ames 2005; Supernant and Cookson 2014). It is tempting to assume that the functional value of these locations simply creates the cultural tradition. However, settlement patterns in Tlingit territory to the north and Haida Gwaii to the southwest are in similar landscapes yet are quite different (Acheson 2005; Maschner 1997).

Seasonality studies based on oxygen isotope analysis and high resolution growth ring analyses of twenty-seven butter clam (*Saxidomus gigantea*) shells from a range of Dundas Islands sites indicate that shellfish were intensively collected during all seasons, revealing that occupation of these sites was year-round and that subsistence was heavily based on shellfish consumption (Hallman et al. 2013). Significantly, this finding applied to sites from both the early and late Holocene and to both large villages and small shell-bearing sites, though these conclusions should be tested with a larger sample of shells. These results suggest a degree of continuity in subsistence practice even when settlement patterns changed and larger populations occupied the islands.

In contrast, results from sites in Prince Rupert Harbour suggest seasonally focused shellfish exploitation during the autumn and spring (Burchell et al. 2013; see also Coupland, Bissell, and King 1993). Burchell et al. (2013) also suggest less intensive shellfish exploitation in the Prince Rupert Harbour based on the age profiles of a small sample of shellfish from four sites, although the large heaps of shell that comprise the large sites there suggest otherwise. In an analysis of auger samples from eighteen sites on the Dundas Islands, Brewster and Martindale (2011) found a comparatively low density of fish remains compared to Prince Rupert Harbour and the Fitz Hugh Sound region further south. They hypothesize that the relative dearth of fish may be due to the distance from the Skeena and Nass rivers, where salmon and eulachon were abundant. However, McLaren (2008, 250) found thousands of fish remains in a one-metre-by-one-metre excavation at GcTr-6 immediately adjacent to an auger sample that yielded only fourteen fish bones (Brewster and Martindale 2011, 258), suggesting that the conclusion that fish are less abundant on the Dundas Islands requires further testing, especially given that the published faunal samples from Prince Rupert Harbour were recovered through excavation (Ames 2005; Coupland, Bissell, and King 1993; Coupland, Stewart, and Patton 2010; Stewart and Stewart 2001; Stewart, Steward, and Coupland 2009). Patton, Orchard, and Bilton (2012) caution against comparisons of faunal remain densities between sites in different regions that do not take into account the effects of different site matrices on faunal remain densities; one effect of intensive shellfish consumption and shell discard at the Dundas Islands villages would be to reduce the relative number of bones per unit of excavated volume. However, both Brewster and Martindale (2011) and McLaren (2008) record relatively low numbers of salmon from the overall fish population, whereas Coupland, Stewart, and Patton (2010) found a predominance of salmon at sites in Prince Rupert Harbour, suggesting that there was some real difference between types of fish acquired in the two regions.

The overall picture from these studies is that occupants of the Dundas Islands relied heavily on bivalves gathered from the extensive tidal flats of the archipelago and had different access to resources than did the inhabitants of Prince Rupert Harbour (Brewster and Martindale 2011; Burchell et al. 2013). Furthermore, the seasonality studies cited above suggest that settlement of the Dundas archipelago was year-round from potentially the mid-Holocene until the abandonment of the large villages. Preliminary seasonality studies of several sites in Prince Rupert Harbour indicate an as yet unclear pattern that seems to have shifted through time (Burchell et al. 2013; Stewart and Stewart 2001; Stewart, Stewart, and Coupland 2009). The outer islands were clearly distinct in their settlement and subsistence patterns.

Another interesting contrast between the Dundas Islands and Prince Rupert Harbour is that many large villages in the latter were reoccupied after a hiatus in the second millennium BP (Ames 2005; Archer 2001; Supernant and Cookson 2014), whereas the Dundas Islands do not seem to have been reoccupied by large populations of year-round residents living in villages. Rather, the smaller resource procurement sites of the latest period may be part of a logistical seasonal round of large populations that amalgamated in Prince Rupert Harbour. This observation is derived in large part from a comparison of the archaeological record with accounts in Tsimshian oral histories (Marsden 2000; Martindale and Marsden 2003). In a detailed analysis of Northern Tsimshian and Tlingit oral records (*adawx* and *at.oow*, respectively), Marsden (2000) identifies a recurring narrative of invaders moving in from the north and establishing villages in Northern Tsimshian territory, including on the Dundas Islands. Initially, many of these populations were incorporated into Northern Tsimshian society, though a later influx of groups led to conflict and an eventual large-scale war in which the Northern Tsimshian were forced to flee up the Skeena River, where they regrouped and later returned to reclaim their territories. According to the histories, the newly formed alliance of the Tsimshian tribes clustered their winter villages in Prince Rupert Harbour, and the rest of the territory was used for seasonal resource procurement (Marsden 2000). In general, the offshore islands of Northern Tsimshian territory figure largely in Tsimshian oral histories and indicate the importance of politically driven historical events in shaping settlement there. As such, these narratives provide further supporting evidence for the cultural centrality of these geographically peripheral regions. This also serves to remind us that the causes of many of the patterns we observe in the archaeological record may not be located in circumstances of environmental pressures or adaptation but are often rooted in politics, beliefs, or the contingencies of history (Cannon 2002, 2011; Martindale and Letham 2011; Martindale and Nicholas 2014), and evidence towards these sorts of explanations may need to be sought in corroborating datasets, such as Indigenous oral histories (Martindale 2006; Martindale and Marsden 2003).

## CONCLUSION

The archaeological record of the Dundas Islands archipelago, as assessed through several early surveys and the Dundas Islands Archaeological Project (Martindale et al. 2010), provides a picture of eleven thousand years of human occupation on the geographical periphery of Northern

Tsimshian traditional territory. More broadly, it provides a long-term snapshot of the lifeways of offshore island occupation of the Northwest Coast. The Dundas Islands were occupied by adept maritime-adapted fisher-hunter-gatherers by 11,000 cal yr BP. Most early occupations were small and adjacent to the shore, and we observe trends of sites following the changing shoreline throughout the Holocene due to relative sea level regression. Small shell-bearing sites persist throughout the Holocene, but, by at least five thousand years ago, we have evidence for the more formalized construction of sites with surface features such as buildings, terraces, and ridges. In subsequent millennia, a variety of village layouts appeared on the islands, the largest of which have differentially sized houses and can be characterized at the most general level by either straight linear house rows or curved house rows, which may be indicative of different cultural groups occupying the islands. These villages were likely complex engineering feats; they may have been constructed in part through pre-planned terraforming using shell. By 2000 cal yr BP all six of the largest villages dated were occupied, and several thousand people likely plied the archipelago's waterways and shorelines. Occupation shifted away from the large villages between 1900 and 1300 cal yr BP, after which time occupation of the islands appears to be characterized by resource gathering sites, indicated by culturally modified trees and late Holocene and historic period camps.

The dense archaeological record serves testament to the political and cultural centrality of these islands that is referenced in Tsimshian oral histories. The addition of this dataset to the better known record on the mainland coast and rivers contributes additional detail to Moss's dynamic mosaic of Northwest Coast settlement and history. In particular, it contributes to our understanding of outer coast settings and their central place in human history in the region.

## ACKNOWLEDGMENTS

We would like to acknowledge and thank the Lax Kw'alaams and Metlakatla First Nations for allowing us to research their territory and fascinating histories. We also extend our thanks to all of the 2005 to 2007 field crews for their work in this beautiful portion of the coast. We would like to thank Iain McKechnie and Alan McMillan for inviting us to participate in this thematic volume and for their helpful comments on drafts of this article. We would also like to thank the two anonymous reviewers for their comments. Kisha Supernant created Figure 2 and Sue Formosa collected the field data for and created the maps in Figure 5. This project would not have been possible without multiple generous funding sources: funding for the Dundas Islands Archaeological Project fieldwork and the majority of the radiocarbon dates was provided by the Social Sciences and Humanities Research Council of Canada.

Radiocarbon dates for Stephens Islands were funded by NSF Grant #1216847. Additional radiocarbon dates for GdTq-3 were funded by the Portland State University Anthropology Department 2015 Thomas Newman Scholarship.

## REFERENCES

Acheson, S. 1995. "In the Wake of the Iron People: A Case for Changing Settlement Strategies among the Kunghit Haida." *Journal of the Royal Anthropological Institute* 2: 273-99.

—. 1998. *In the Wake of the ya'aats' xaatgaay* ["*Iron People*"]*: A Study of Changing Settlement Strategies among the Kunghit Haida*. BAR International Series 711. Oxford, UK: British Archaeological Reports.

—. 2005. "Gwaii Haanas Settlement Archaeology." In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*, ed. D.W. Fedje and R.W. Mathewes, 303-36. Vancouver: UBC Press.

Ackerman, R.E., K.C. Reid, J.D. Gallison, and M.E. Roe. 1985. "Archaeology of Heceta Island: A Survey of 16 Timber Harvest Units in the Tongass National Forest, Southeastern Alaska." Report on file at the Center for Northwest Anthropology. Project Report No. 3, 144. Pullman: Washington State University.

Ames, K.M. 1998. "Economic Prehistory of the Northern British Columbia Coast." *Arctic Anthropology* 35 (1): 68-87.

—. 2005. *The North Coast Prehistory Project Excavations in Prince Rupert Harbour, British Columbia: The Artifacts*. BAR International Series 1342. Oxford, UK: British Archaeological Reports.

Ames, K.M., and A. Martindale. 2014. "Rope Bridges and Cables: A Synthesis of Prince Rupert Harbour Archaeology." *Canadian Journal of Archaeology* 38 (1): 140-78.

Ames, K.M., and H.D.G. Maschner. 1999. *Peoples of the Northwest Coast: Their Archaeology and Prehistory*. London, UK: Thames and Hudson Ltd.

Archer, D.J.W. 1992. "Results of the Prince Rupert Harbour Radiocarbon Dating Project." Report on file, British Columbia Heritage Trust.

—. 2000. "The Dundas Islands Archaeological Project: A Report on the 1998 Field Season. Permit Report No. 1998-182." Victoria, BC: Archaeology Branch.

—. 2001. "Village Patterns and the Emergence of Ranked Society in the Prince Rupert Area." In *Perspectives on Northern Northwest Coast Prehistory*, ed. J.S. Cybulski, 203-22. Mercury Series Paper 160. Ottawa: Archaeological Survey of Canada, Canadian Museum of Civilization.

—. 2011. "Archaeological Monitoring of a Boardwalk Replacement Project on the Lucy Islands, near Prince Rupert, BC." Permit No. 2012-0352. Victoria, BC: Archaeology Branch.

Archer, D.J.W., and C. Mueller. 2013. "Archaeological Investigations at GbTp-1 on the Lucy Islands, near Prince Rupert, BC." Permit Report No. 2012-0319. Victoria, BC: Archaeology Branch.

Blaise, B., J.J. Clague, and R.W. Mathewes. 1990. "Time of the Maximum Late Wisconsin Glaciation, West Coast of Canada." *Quaternary Research* 34: 282-95.

Blukis Onat, A.R. 1985. "The Multifunctional Use of Shellfish Remains: From Garbage to Community Engineering." *Northwest Anthropological Research Notes* 19: 201–7.

Boas, F. 1916 [1970]. *Tsimshian Mythology Based on Texts Recorded by Henry W. Tate*. London: Johnson Reprint Company (originally published in 1916 in *Annual Report of the US Bureau of Ethnology, 1909–1910*).

Brewster, N., and A. Martindale. 2011. "An Archaeological History of Holocene Fish Use in the Dundas Islands Group, British Columbia." In *The Archaeology of North Pacific Fisheries*, ed. M.L. Moss and A. Cannon, 247-64. Fairbanks: University of Alaska Press.

Bronk Ramsey, C. 2013. OxCal Program V. 4.2.3 http://c14.arch.ox.ac.uk/embed.php?File=oxcal.html.

Burchell, M., N. Hallman, A. Martindale, A. Cannon, and B.R. Schöne. 2013. "Seasonality and Intensity of Shellfish Harvesting on the North Coast of British Columbia." *Journal of Island and Coastal Archaeology* 8: 152-69.

Cannon, A. 2000a. "Assessing Variability in Northwest Coast Salmon and Herring Fisheries: Bucket-Auger Sampling of Shell Midden Sites on the Central Coast of British Columbia." *Journal of Archaeological Science* 27: 725-37.

—. 2000b. "Settlement and Sea Levels on the Central Coast of British Columbia: Evidence from Shell Midden Cores." *American Antiquity* 65 (1): 67-77.

—. 2002. "Sacred Power and Seasonal Settlement on the Central Northwest Coast." In *Beyond Foraging and Collecting*, ed. B. Fitzhugh and J. Habu, 311-38. New York: Kluwer Academic.

—. 2011. "Cosmology and Everyday Perception in Northwest Coast Production and Reproduction." In *Structured Worlds: The Archaeology of Hunter-Gatherer Thought and Action*, ed. A. Cannon, 54-68. London: Equinox.

Carlson, R.J. 2012. "A Predictive Model for Early Holocene Archaeological Sites in Southeast Alaska Based on Elevated Palaeobeaches." PhD diss., University of Cambridge.

Carlson, R.J., and J.F. Baichtal. 2015. "A Predictive Model for Locating Early Holocene Archaeological Sites Based on Raised Shell-Bearing Strata in Southeast Alaska, USA." *Geoarchaeology* 30: 120-38.

Carrara, P.E., T.A. Ager, and J.F. Baichtal. 2007. "Possible Refugia in the Alexander Archipelago of Southeastern Alaska during the Late Wisconsin Glaciation." *Canadian Journal of Earth Science* 44: 229-44.

Claassen, C. 1991. "Normative Thinking and Shell-Bearing Sites." *Archaeological Method and Theory* 3: 249-98.

Clague, J.J., J.R. Harper, R.J. Hebda, and D.E. Howes. 1982. "Late Quaternary Sea Levels and Crustal Movements, Coastal British Columbia." *Canadian Journal of Earth Science* 19: 597-618.

Collard, M., K. Edinborough, S. Shennan, and M.G. Thomas. 2010. "Radiocarbon Evidence Indicates That Migrants Introduced Farming to Britain." *Journal of Archaeological Science* 37 (4): 866-70.

Coupland, G. 1988. "Prehistoric Economic and Social Change in the Tsimshian Area." *Research in Economic Anthropology* 3: 211-45.

—. 2006. "A Chief's House Speaks: Communicating Power on the Northern Northwest Coast." In *Household Archaeology on the Northwest Coast*, ed. E. Soepel, D.A. Trieu Gahr, and K.M. Ames, 80-96. Ann Arbor: International Monographs in Prehistory, Archaeological Series 16.

Coupland, G., C. Bissell, and S. King. 1993. "Prehistoric Subsistence and Seasonality at Prince Rupert Harbour: Evidence from the McNichol Creek Site." *Canadian Journal of Archaeology* 17: 59-73.

Coupland, G., R.H. Colten, and R. Case. 2003. "Preliminary Analysis of Socioeconomic Organization at the McNichol Creek Site, British Columbia." In *Emerging from the Mist: Studies in Northwest Coast Culture History*, ed. R.G. Matson, G. Coupland, and Q. Mackie, 152-69. Vancouver: UBC Press.

Coupland, G., K. Stewart, and K.A. Patton. 2010. "Do You Never Get Tired of Salmon? Evidence for Extreme Salmon Specialization at Prince Rupert Harbour, British Columbia." *Journal of Anthropological Archaeology* 29 (2): 189-207.

Cui, Y., J. Lindo, C.E. Hughes, J.W. Johnson, A.G. Hernandez, B.M. Kemp, J. Ma, R. Cunningham, B. Petzelt, J. Mitchell, D. Archer, J.S. Cybulski, and R.S. Malhi. 2013. "Ancient DNA Analysis of Mid-Holocene Individuals from the Northwest Coast of North America Reveals Different Evolutionary Paths for Mitogenomes." *PLoS ONE* 8 (7): e66948.

Davis, S.D. 1989. *The Hidden Falls Site, Baranof Island, Alaska*. Aurora Monograph Series. Fairbanks: Alaska Anthropological Association.

Dixon, E.J., T.H. Heaton, T.E. Fifield, T.D. Hamilton, and F. Grady. 1997. "Late Quaternary Regional Geoarchaeology of Southeast Alaska Karst: A Progress Report." *Geoarchaeology* 12: 689-712.

Dixon, J.E., and K. Monteleone. 2014. "Gateway to the Americas: Underwater Archaeological Survey in Beringia and the North Pacific." In *Prehistoric Archaeology on the Continental Shelf*, ed. A.M Evans, J. Flatman, and N. Flemming, 95-114. New York: Springer Science.

Erlandson, J.M., and M.L. Moss. 2001. "Shellfish Feeders, Carrion Eaters, and the Archaeology of Aquatic Adaptations." *American Antiquity* 66 (3): 414-32.

Fedje, D.W., T. Christensen, H. Josenhans, J.B. McSporran, and J. Strang. 2005. "Millennial Tides and Shifting Shores: Archaeology in a Dynamic Landscape." In *Haida Gwaii: Human History and Environment from the Time of the Loon to the Time of the Iron People*, ed. D.W. Fedje and R.W. Mathewes, 163-86. Vancouver: UBC Press.

Fedje, D.W., and R.F. Mathewes, eds. 2005. *Haida Gwaii: Human History and Environment from the Time of the Loon to the Time of the Iron People*. Vancouver: UBC Press.

Garfield, V. 1951. "The Tsimshian and Their Neighbours." In *The Tsimshian: Their Arts and Music*, ed. V. Garfield, P. Wingert, and M. Barbeau, 1-70. Publications of the American Ethnological Society 18.

Haggarty, J. 1988. "Settlement Pattern and Culture Change in the Dundas Group, North Coastal British Columbia." Paper presented at the 41st meeting of the Northwest Anthropological Conference, Tacoma, Washington.

Hallman, N., M. Burchell, N. Brewster, A. Martindale, and B.R. Schöne. 2013. "Holocene Climate and Seasonality of Shell Collection at the Dundas Islands Group, Northern British Columbia, Canada – A Bivalve Sclerochronological Approach." *Palaeogeography, Palaeoclimatology, Palaeoecology* 373: 163-72.

Halpin, M., and M. Seguin. 1990. "Tsimshian Peoples: Southern Tsimshian, Coast Tsimshian, Nishga, and Gitksan." In *Handbook of American Indians*, Vol. 7: *Northwest Coast*, ed. W. Suttles, 267-84. Washington, DC: Smithsonian Institution.

Hetherington, R., J.V. Barrie, R.G.B. Reid, R. MacLeod, and D.J. Smith. 2004. "Paleogeography, Glacially Induced Crustal Displacement, and Late Quaternary Coastlines on the Continental Shelf of British Columbia, Canada." *Quaternary Science Reviews* 23, 3-4: 295–318.

Holmes, C.E., R.J. Dale, and J.D. McMahon. 1989. "Archaeological Mitigation of the Thorne River Site (CRG-177) Prince of Wales Island, Alaska, Forest Highway No. 42, (DT-FH70-86-A-00003)." Office of History and Archaeology Report No. 15, Anchorage.

Inglis, R. 1975. "Archaeological Report for Permit 1975-19, Archaeological Sites Advisory Board of British Columbia." Victoria, BC: Archaeological Branch.

Letham, B. 2014. "Settlement and Shell-Bearing Site Diversity in the Sechelt Inlet System, British Columbia." *Canadian Journal of Archaeology* 38 (1): 280-328.

MacDonald, G.F., and J.S. Cybulski. 2001. "Introduction: The Prince Rupert Harbour Project." In *Perspectives on Northern Northwest Coast Prehistory*, ed. J.S. Cybulski, 1-23. Mercury Series Paper 160. Ottawa: Archaeological Survey of Canada, Canadian Museum of Civilization.

MacDonald, G.F., and R.I. Inglis. 1981. "An Overview of the North Coast Prehistory Project, 1966-1980." *BC Studies* 48: 37-62.

Mackie, A.P., and I.D. Sumpter. 2005. "Shoreline Settlement Patterns in Gwaii Haanas during the Early and Late Holocene." In *Haida Gwaii: Human History and Environment from the Time of the Loon to the Time of the Iron People*, ed. D.W. Fedje and R.W. Mathewes, 337-71. Vancouver: UBC Press.

Mackie, A.P., and L. Williamson. 2003. "Nuu-chah-nulth Houses: Structural Remains and Cultural Depressions on Southwest Vancouver Island." In *Emerging from the Mist: Studies in Northwest Coast Culture History*, ed. R.G. Matson, G. Coupland, and Q. Mackie, 105-51. Vancouver: UBC Press.

Mackie, Q., D.W. Fedje, D. McLaren, N. Smith, and I. McKechnie. 2011. "Early Environments and Archaeology of Coastal British Columbia." In *Trekking the Shore: Changing Coastlines and the Antiquity of Coastal Settlement*, ed. N.F. Bicho, J.A. Haws, and L.G. Davis, 51-103. New York: Springer.

Mandryk, C.A.S., H. Josenhans, D.W. Fedje, and R.W. Mathewes. 2001. "Late Quaternary Paleoenvironments of Northwestern North America: Implications for Inland versus Coastal Migration Routes." *Quaternary Science Reviews* 20: 301-14.

Marsden, S. 2000. *Defending the Mouth of the Skeena: Perspectives on Tsimshian-Tlingit Relations*. Prince Rupert, BC: Tin Ear Press.

Marshall, Y. 2006. "Houses and Domestication on the Northwest Coast." In *Household Archaeology on the Northwest Coast*, ed. E.A. Sobel, D.A. Trieu Gahr, and K.M. Ames, 37-56. Ann Arbor: International Monographs in Prehistory, Archaeological Series 16.

Martindale, A. 2006. "Methodological Issues in the Use of Tsimshian Oral Traditions (*Adawx*) in Archaeology." *Canadian Journal of Archaeology* 30: 158-92.

Martindale, A., and B. Letham. 2011. "Causalities and Models within the Archaeological Construction of Political Order on the Northwest Coast of North America." In *The Archaeology of Politics: The Materiality of Political Practice and Action in the Past*, ed. P.G. Johansen and A.M. Bauer, 323-53. Newcastle, UK: Cambridge Scholars Press.

Martindale, A., B. Letham, N. Brewster, and A. Ruggles. 2010. "The Dundas Island Project." Permit Report 2005-159. Victoria, BC: Archaeology Branch, British Columbia Ministry of Sustainable Resource Development, Registries and Resource Information Division.

Martindale, A., B. Letham, D. McLaren, D. Archer, M. Burchell, and B. Schöne. 2009. "Mapping of Subsurface Shell Midden Components through Percussion Coring: Examples from the Dundas Islands." *Journal of Archaeological Science* 36: 1565-75.

Martindale, A., and S. Marsden. 2003. "Defining the Middle Period (3500 BP-1500 BP) in Tsimshian History through a Comparison of Archaeological and Oral Records." *BC Studies* 138: 13-50.

Martindale, A., and G. Nicholas. 2014. "Archaeology as Federated Knowledge." *Canadian Journal of Archaeology* 38 (2): 434-65.

Maschner, H.D.G. 1997. "Settlement and Subsistence in the Later Prehistory of Tebenkof Bay, Kuiu Island, Southeast Alaska." *Arctic Anthropology* 34 (2): 74-99.

McKechnie, I. 2013. "An Archaeology of Food and Settlement on the Northwest Coast." PhD diss., University of British Columbia.

McLaren, D. 2008. "Sea Level Change and Archaeological Site Locations on the Dundas Island Archipelago of North Coastal British Columbia." PhD diss., University of Victoria.

McLaren, D., D.W. Fedje, M.B. Hay, Q. Mackie, I.J. Walker, D.H. Shugar, J.B.R. Eamer, O.B. Lian, and C. Neudorf. 2014. "A Post-glacial Sea Level Hinge on the Central Pacific Coast of Canada." *Quaternary Science Reviews* 97 (1): 148-69.

McLaren, D., A. Martindale, D.W. Fedje, and Q. Mackie. 2011. "Relict Shorelines and Shell Middens of the Dundas Island Archipelago." *Canadian Journal of Archaeology* 35: 86-116.

Mobley, C.M. 1988. "Holocene Sea Levels in Southeast Alaska: Preliminary Results." *Arctic* 41 (4): 261-66.

Moss, M. 1998. "Northern Northwest Coast Regional Overview." *Arctic Anthropology* 35(1): .88-111.

—. 2011. *Northwest Coast: Archaeology as Deep History*. Washington, DC: SAA Press.

Moss, M., D.M. Peteet, and C. Whitlock. 2007. "Mid-Holocene Culture and Climate on the Northwest Coast of North America." In *Climate Change and Cultural Dynamics: A Global Perspective on Mid-Holocene Transitions*, ed. D.G. Anderson, K.A. Maasch, and D.H. Sandweiss, 491-529. Amsterdam: Elsevier.

Patton, K.A., T.J. Orchard, and D. Bilton. 2012. "Reconciling Irreconcilable Differences: The Variable Importance of Fisheries and Shellfisheries on the Northwest Coast." Paper presented at the 45th Annual Canadian Archaeological Association Conference, May 2012, Montreal, Quebec.

Peros, M.C., S.E. Munoz, K. Gajewski, and A.E. Viau. 2010. "Prehistoric Demography of North America Inferred from Radiocarbon Data." *Journal of Archaeological Science* 37: 656-64.

Reimer, P.J., E. Bard, A. Bayliss, J.W. Beck, P.G. Blackwell, C. Bronk Ramsey, C.E. Buck, H. Cheng, R.L. Edwards, M. Friedrich, P.M. Grootes, T.P. Guilderson, H. Haflidason, I. Hajdas, C. Hatté, T.J. Heaton, D.L. Hoffmann, A.G. Hogg, K.A. Hughen, K.F. Kaiser, B. Kromer, S.W. Manning, M. Niu,