SETTLEMENT PATTERNS ON THE CENTRAL COAST

PREHISTORIC SETTLEMENT PATTERNS ON THE CENTRAL COAST OF BRITISH COLUMBIA

BY
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A Thesis
Submitted to the Department of Anthropology
and the School of Graduate Studies
in Partial Fulfillment of the Requirements
for the Degree of
Master of Arts

McMaster University

MASTER OF ARTS (2015) McMaster University
Department of Anthropology Hamilton, Ontario, Canada

TITLE: Prehistoric Settlement Patterns on the Central Coast of British Columbia

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NUMBER OF PAGES xiii, 216

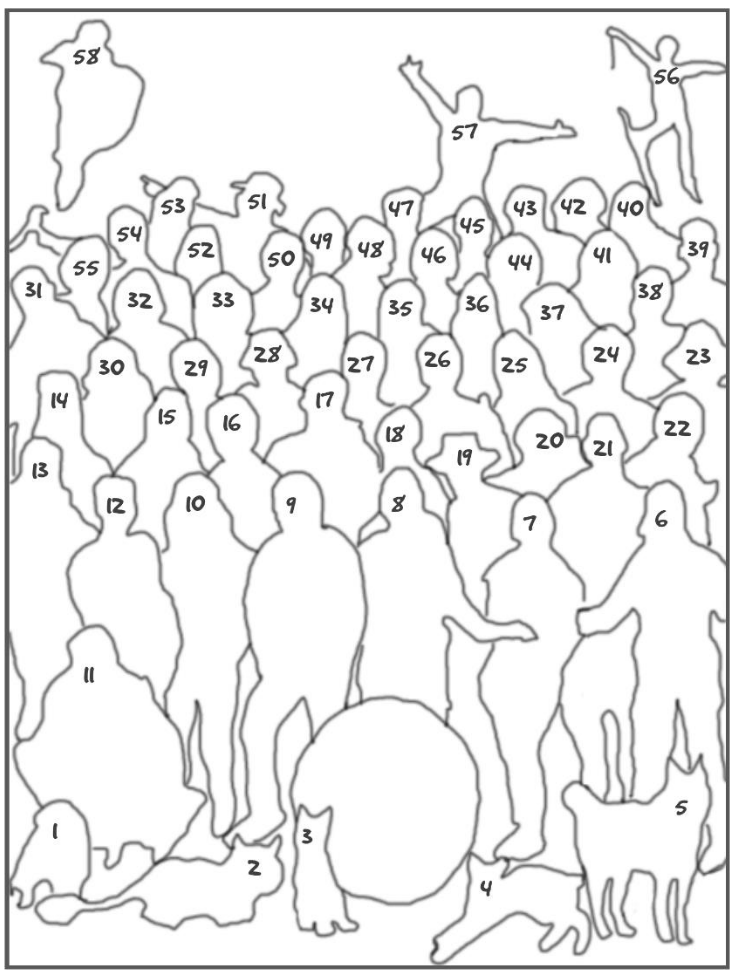
Thesis Abstract

Over the past half century, archaeologists have been interested in how the environmental variation of the Central Coast has affected settlement patterns. Archaeologists relied on ethnography and subsistence models to explain settlement distribution but were unable to analytically demonstrate influencing factors. The objectives of this thesis were to investigate: (1) the spatial arrangement of sites to examine the types of locations people utilized; and (2) test if the occupational history of a site is reflected by its geographic locations. In this project, site dimension was used as a relative indicator of settlement occupational intensity, and over twenty environmental attributes were tested. Analysis was systematically conducted at multiple spatial scales using GIS. In the first stage the location of shell middens (n=351) were compared against an environmental baseline, derived from a sample of random points. For the second stage, small and large shell middens were compared to test if their locations significantly differed. It was found that shell middens do show an association with certain environmental settings. For some attributes, there was an observable difference in the location of large and small shell middens. However, immense variability was identified and the environmental context of sites greatly determined whether locational preferences could be empirically demonstrated. Overall, large middens, more so than small middens, are located in areas with higher resource diversity. These conclusions support other studies that indicate the relevance of multiple determinants and emphasizes the local nuances of settlement patterning affected by environmental and cultural factors. My results oppose the simplistic and static notion about a prehistoric annual cycle of sedentary winter villages and seasonal resource-specific camps. Improvements to an understanding of settlement distribution can aid in contextualizing specific sites within their regional setting and contribute to our knowledge regarding larger cultural practices such as subsistence and land use practices.

Acknowledgments

Thank you to those that offered me their guidance and patience
Thank you to my friends and family for their support and love
Finally, thank you to all the people that made this journey a little easier and more enjoyable

1. Hamilton, Ontario
2. Woodstock
3. Cypress
4. Eszter Bell
5. Kimi
6. Beth Tobiasz
7. Kari Carter
8. Kandace Bogaert
9. Aubrey Cannon
10. Julianna Rees
11. Rachelle Sangret
12. Lian Kwong
13. James Conolly
14. Lindsay Van Wert
15. Anna Tobiasz
16. Laura Lockau
17. Daniel Schmidtke
18. Diane Doran
19. Rob Stark
20. Zack Batist
21. David Wills
22. Andy Roddick
23. Tyler Murchie
24. Meaghan Peuramäki-Brown
25. Kalyna Horocholyn
26. Jeff Dillane
27. Sean Doyle
28. Eric Toffin
29. Antonia Rodrigues
30. Eric Tobiasz
31. Mike Robinson
32. Delia Hutchinson
33. Colleen Hughes
34. Daiana Rivas-Tello
35. Christine Cluney
36. Madison Isenor
37. Joelle Ingram
38. James Williams
39. Dorian Jurić
40. Christina Rees
41. Meghan Burchell
42. Sally Lynch
43. John Silva
44. Brandi MacDonald
45. Graham Schiebel
46. Lindsay Amundsen-Meyer
47. Lance Evans
48. Gerry Oetelaar
49. Kee Yong
50. Maddy Mant
51. Dale Walde
52. Allee Jaagumagi Holland
53. Chelsey Geralda Denise
54. Andrew Dreyer
55. Melissa McDermott Dreyer
56. Yurek Tobiasz
57. Matthew Tobiasz
58. Chris Paul



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List of Abbreviations

BBV	Bella Bella Vicinity
BC	British Columbia
BP	Before Present
CMT	Culturally Modified Tree
CRM	Cultural Resource Management
DEM	Digital Elevation Model
GIS	Geographic Information Systems
WH/m^2	Watt-hour per meter square

Chapter 1: Introduction

British Columbia's Central Coast is home to the Heiltsuk, Wuikinuxv, Nuxalk, and Hasla First Nations. Prior to European contact the occupants of this land were maritime orientated hunter-fisher-gatherers who utilized a wide assortment of resources for their subsistence and material culture needs. These resources were spatially distributed and varied in their reliability, abundance, and seasonal availability. People required some form of mobility strategy to accrue necessary supplies since they could not all be gathered from a single location. Shell middens built up on the landscape over the past several millennia provide evidence for where people chose to live. These represent an array of settlement types, ranging from major residential bases to specialized resource camps (White 2006:21). The distribution of these sites provides insight into subsistence strategies, land use practices, and sociopolitical engagements. They reflect the choices that people made within the parameters set by their environment. Archaeological surveys have provided information for where people lived, but substantial knowledge gaps still exist for explaining location suitability and its effect on site occupational history (Monks 2011:136).

Archaeologists were first present on the Central Coast beginning in the 1930s (Drucker 1943). The area attracted heightened interest after the discovery of the early occupation date at Namu (9720±140 BP) (Carlson 1979:214). Early on, archaeologists documented the locations of sites and offered explanations for site distribution (Hester 1968[1]; Pomeroy 1980). Archaeologists adopted accounts from elsewhere on the Northwest Coast and the ethnographic record heavily influenced interpretations. According to the Northwest Coast cultural pattern, people gathered for the winter ceremonial season in large villages and dispersed into smaller groups to gather resources from spring to fall (Fladmark 1975:7). The only systematic analyses for the Central Coast were based on economic optimization models that used salmon as the main influencing factor, but were unable to explain settlement distribution (Hobler 1983; Pomeroy 1980). At present, archaeologists are left with generalized patterns for settlement locations that describe a homogenous prehistoric

[1] Archaeological reports submitted to the Government of British Columbia are listed by the year the permit was issued, not the year the report was submitted.

culture system (Maxwell et al. 1997; Pomeroy 1980). These generalized accounts are not reflective of the settlement diversity that is apparent in the archaeological record.

Today, archaeologists are in a better position to re-explore questions pertaining to settlement patterns. Geographic Information Systems (GIS) enables archaeologists to manage substantial datasets and conduct spatial analysis. Since the previous settlement studies on the Central Coast, further investigations led to discovering additional sites (Maxwell et al. 1997; McLaren 2011). Physiographic and species spatial data are available and facilitate testing new environmental variables in relation to site locations. Systematically examining settlement patterns is possible using GIS, the provincial inventory of archaeological sites, and digital environmental data.

Figure 1. Study Area Map

Purpose

The objective of this thesis was to examine the spatial arrangement of settlements in order to evaluate the types of locations people utilized in the past. I looked for patterns in the environmental setting of shell middens based on site dimensions, which is reflective of some measure of occupational intensity (Stein et al. 2003:301). Essentially, I address whether the physical setting of large shell middens differs from that of small shell middens. Several environmental variables were analysed using fluctuating spatial scales at a regional and local level. This project aimed to contribute to the discussion of whether people chose settlement locations to be within a range of resources or in close proximity to key resources (Hobler 1983; Monks 2011; Pomeroy 1980). My research design, which involved comparing the location of recorded sites to a random sample of locations within given areas, provided a way to identify the extent to which specific environmental and cultural circumstances influence land use patterns.

Gaining a better understanding of the natural setting of middens in relation to site size can better inform archaeologists about how environmental factors influenced human settlement choices and about activity use at these locations. My results help contextualize sites based on their physiographic position in relation to regional patterns and variability of site placement. Further developed explanations for why and how people lived in certain locations is increasingly possible with a proper inventory of site settings. This study also demonstrates the advantages and shortcoming of different spatial scales for observing settlement patterns, and advocates for a multi-scalar approach.

Methodology

This project began with the construction of a GIS-model of the Central Coast and the incorporation of physiographic and species distribution data. I gathered existing information on 351 shell middens from the provincial archaeological database. I began my analysis by identifying which environmental variables were relevant to settlement placement based on all known shell middens by comparing site locations to a random sample of locations within the environment. This random sample represents the baseline rate of environmental conditions. A combination of statistical tests was used to find associations between site locations and environmental variables, first for the entire study area and then for sub-areas within the region.

The purpose of the next stage in the analysis was to identify whether large and small shell middens occupied different environmental settings. This was based on the assumption that site size is reflective of the function and intensity of use (Cannon 2013:26; Mackie 2003:262; Maschner and Stein 1995; Stein et al. 2003). Rather than using the exact site dimensions, midden size categories (large and small) were created. Once again, midden locations – separated into size groups – were compared against baseline environmental conditions, and then compared to each other. Lastly, the presence and absence of variables that could be related to resource availability, including species distribution and proxies for resources (i.e. sandy beaches), were tallied for each site. Settlement resource counts were compared among the geographic subdivisions and between the site size categories.

The environmental attributes chosen for this project were based on what other researchers have suggested are important for site selection. Data accessibility and GIS analysis capabilities also dictated which variables were included. When covering a vast geographic area, analysing patterns at smaller scales can provide local and environmental context for distribution patterns. Similar GIS-based studies on the Northwest Coast have examined differences in land use through time, but have not systematically compared site patterning based on physical settings (Cookson 2013; Mackie and Sumpter 2005; Maschner and Stein 1995).

Findings

Settlements are not randomly distributed; rather, multiple environmental and resource factors influenced the suitability of locations. There are some observable trends showing shell middens in association with particular environmental variables. Environmental conditions are not equally important, and some may have played a larger role in the distribution and formation of sites than others did. These variables work together, and multiple determinants contribute to location suitability. Most shell midden locations fulfill basic physiographic conditions, such as level terrain and sheltering from natural elements. More variability is apparent with respect to resource proximity. Shell middens, particularly large ones, are more likely to be in areas with more resource diversity, rather than in proximity to a key resource or because of some other single factor. Different combinations of site settings are apparent between small and large middens, which supports the working assumption of this research that site dimensions are indicative of distinct settlement types. Large middens showed a stronger association to herring and intertidal resources, while small middens demonstrated an association with lakes.

The ultimate finding is that settlements display substantial variability in their placement on the landscape. Part of the diversity is derived from large scale environmental variation over the geographic area. The gradient in physiographic characteristics from west to east and the uneven distribution of resources has affected the arrangement of sites. There are smaller areas that share commonalities in their physical setting, yet the configuration of shell middens differ. This demonstrates the combined influences that cultural and environmental dimensions had on locational preferences.

Thesis Overview

Chapter 2 provides descriptions of traditional lifeways on the Central Coast, the environmental setting, and a local history of the period following European contact. An overview for the history of archaeological research on the Central Coast and the current inventory of archaeological sites is given. To systematically assess the extent of archaeological inquiry in the area, I compiled information on all previous archaeological projects that involved subsurface investigations and evaluated whether the proportion of sampled sites is representative of the current inventory. The most revealing discrepancies observed were the dominance of extensive excavations on large shell middens and the complete omission of small shell middens from any testing until the 1990s. Following this, I include the main perceptions about settlement patterns in the study region. I review Northwest Coast studies with GIS-based approaches that are similar to my own. Lastly, I discuss how my approach to settlement patterns on the Central Coast builds on the foundation of previous work and what new insights it offers.

Chapter 3 provides the details of my methodologies. I start by explaining an appropriate classification of shell midden sites and the geographic spatial boundaries used for analysis. I then describe the preparation and combination of archaeological data into a model of the Central Coast environment. Attribute values were extracted at site locations and additionally from random points that acted as a basis for comparison. Subsequent analysis and statistics were based on these spatial zones and site categories.

I present my observations and statistical results in Chapter 4. Initially, I compare environmental variables between shell midden locations and a sample of random locations. This was done to demonstrate if shell midden locations showed an association to particular environmental characteristics. For this section and the following one, I present results first for the entire region and then the subregions. Comparing geographic areas aided in revealing differences in settlement patterns that may be indicative of environmental circumstances. Next, I present results from the same comparison process done separately for small and large shell middens. I also provide an in-depth look at the rate of occurrence or average for favourable environmental conditions among settlements. Lastly, I present results from tallying resource proximity between site size categories.

Chapter 5 is a synthesis of the main results and how they relate to the current understanding of settlement patterns on the Northwest Coast. Attention is devoted to conclusions related to economic aspects of site spatial distribution, while also acknowledging the incomplete nature of the archaeological record that inhibits a complete understanding of settlement patterns. I mention the results for specific sites and areas of interest, particularly for sites that have been thoroughly studied. I evaluate the efficacy of the methodological approach and data coverage. Finally, I reiterate the importance of this investigation and make suggestions for future inquiries.

Chapter 2: Background on region and archaeology of the Central Coast

This chapter begins with a brief overview of the traditional inhabitants of British Columbia's Central Coast and the environmental setting. I have included a summary of the Post-contact era up until the turn of the 20th century to demonstrate the cumulated circumstances and influencing factors underway when the earliest anthropologists entered the region. These ethnographic records provided the foundation for early Northwest Coast archaeologists' understanding of traditional lifeways – a legacy that continues to govern subsequent perceptions of prehistory. Next, there is an account of the region's archaeological surveys, which offers background information on that investigation into the distribution of sites. I provide the current site inventory for the study region, and a description of the types of archaeological sites. I pay particular attention to shell middens and the current conception of how they are indicative of settlement types.

In Section 3, I deviate slightly and provide a mini-project about the coverage of archaeological testing on the Central Coast. This was done to evaluate if the quantity and type of sites that have been subsurface sampled or excavated are proportional to the complete inventory of shell middens. This revealed discrepancies that could be linked to trending research agendas, such as the focus of excavations on large, recently occupied middens. Small shell middens make up the majority of midden sites, but were never subsurface sampled during the first half century of archaeological work in the area, and remain the least investigated size group. Through these results, it becomes apparent that there were substantial data gaps and a lack of evidence that prevented a reasonable account of settlement type variability when archaeologists formulated conclusions about settlement patterns and site activities.

This segues to the next section where I describe the general perception of settlement patterns on the Northwest Coast, and then the Central Coast specifically. Previous approaches taken by archaeologists have been unable to account for site distribution and the outcomes have been mostly descriptive about site locations. The last section of this chapter outlines the use of Geographic Information Systems (GIS) for studying settlement patterns. I present similar studies on the Northwest Coast that either evaluated the relationship between site placement and environmental/cultural variables, or leveraged GIS for researching site distribution. I discuss their similarities and distinctions with my project. Throughout this chapter, I have tried to provide context on the existing literature and demonstrate how my project seeks to build upon foundational work and, at times, contradicts it.

Figure 2. Southeast view of intertidal area from shell midden EjTa-4 on Calvert Island.

The Central Coast Overview

The People

The Central Coast of British Columbia is the unceded traditional territory of the Heiltsuk, Wuikinuxv, Haisla, and Nuxalk First Nations (Figure 3). The Heiltsuk are Hailhzaqvala-speaking people, part of the Northern Wakashan language family (White 2006:17). The Haisla and Wuikinuxv also belong to this language family, while the Nuxalk are the northernmost speakers of the Salish language family (Hilton 1990:312). Traditionally, the inhabitants of the Central Coast were semi-sedentary, maritime-based people that had a distributed population living among the many miles of rugged coastline. From the bountiful environment, they had access to a range of resources obtained through gathering, fishing, hunting, and horticulture (Deur and Turner 2005). The people utilized the sea, land, rivers, and lakes for their subsistence needs and material culture (White 2006:12). The Heiltsuk, Wuikinuxv, and Nuxalk maintained ties through geographic proximity and intermarriage (Pomeroy 1980:2). Maritime connectivity, facilitated by watercraft technology and sea-faring capacities, enabled long-distance exchange networks. Key trade routes existed between the outer and inner coast and the interior plateau due to variability in species availability (Hobler 2000:9).

The annual settlement pattern of people was connected to their economic practices and socio-political structures. The generalized pattern was that groups gathered during the winter months at permanent winter villages and lived in rectangular plank-houses (big houses) (White 2006:20). Activities were centered on ceremonies, equipment manufacturing, and artwork. People relied on stored food provisions that had been gathered during the warmer months (White 2006:21). Beginning in spring and lasting until the fall, the village would disperse into smaller groups and move around to specialized resource procurement camps. Families owned rights to seasonal camp locations and controlled access to resources (White 2006:21). The location and timing of seasonal resources was predictable. Food security was enhanced through fish traps, clam gardens, and root gardens (Groesbeck et al. 2014).

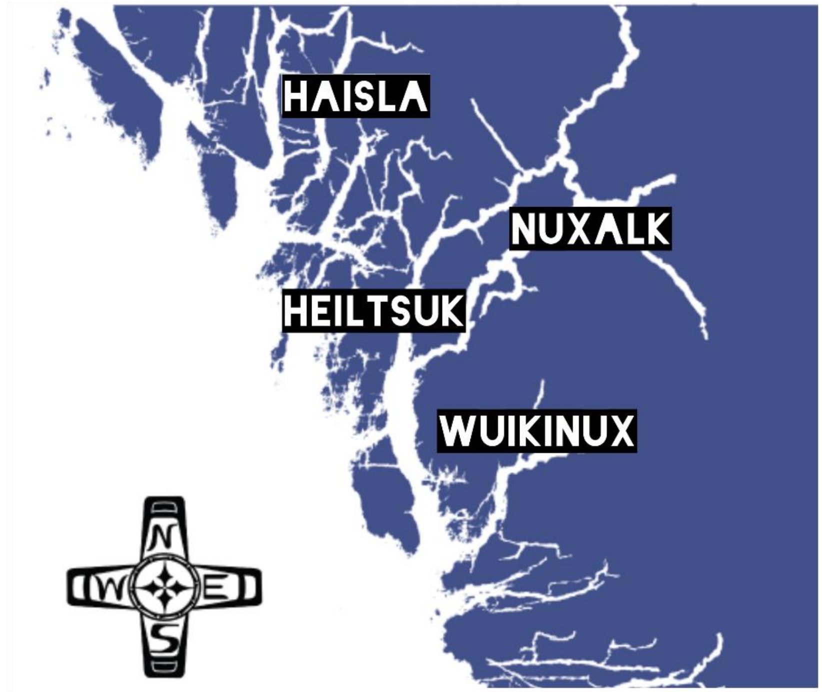

Figure 3. Traditional territories map. Areas are very approximate.

The Place

Nestled between the Pacific Ocean and the Coast Mountains, the Central Coast is part of the Great Bear Rainforest and classified as Coastal Western Hemlock biogeoclimatic zone (Pojar et al. 1991:96). The abundant rainfall in the area permits a temperate rain forest, where massive timbers form a dense canopy. Subalpine forests, bog forests, and wetlands also make up the terrestrial vegetation cover. The forests are comprised of many plant species including western hemlock, western red-cedar, Sitka spruce, amabalis fir, mountain hemlock, and yellow cedar (Pojar and MacKinnon 1994). Several varieties of shrubs provide edible berries, such as thimbleberries, huckleberries, blueberries, salmonberries, gooseberries, and salal (Pojar and MacKinnon 1994). In addition to sustenance, plants are important to coastal people for medicine, tools, clothing, and building materials (Turner 2014).

A range of environmental settings provides habitats for a rich diversity of flora and fauna. Large terrestrial mammals that inhabit the landscape include black-tailed deer, mountain goat, black bears, grizzly bears, and wolves (Hilton 1990:312). Also residing in the area are several small mammals such as minks, beavers, marmots, martens, weasels, and river otters. Archaeologists have identified all of these terrestrial mammals at sites within the area[2]. The Central Coast is part of the Pacific Flyway, a major migration route for birds travelling north and south along the coast heading to breeding grounds and wintering spots (Wilson 2010:16). Cranes, grouse, eagles, and ravens are some of the residential birds that are present year round. Several migratory and residential bird species have been found in archaeological contexts on the Central Coast[3]. Seasonal fluctuations in biomass occur from migrating marine species coming in vast quantities. Salmon sweep in from the ocean and surge up the rivers and streams (Quinn 2005). Herring come to spawn along sheltered coastline, laying their eggs on marine vegetation (Haegele and Schweigert 1985:40). Migrating sea mammals share the water with residential species such as sea otters and seals. Nearshore and intertidal zones were valuable resource procurement areas for First Nations people, offering plants, fish, and invertebrates (Moss 1998:90).

Towards the inner coast, the partly submerged mountains create a deeply indented coastline with waterways that serve as transportation corridors leading into the interior. Fjords and steep shorelines frame these channels, limiting access to the land along the water's edge (Hobler 1983:153). Partitions of level land occur among the twisted inlets and the wide deltas that creep along the river ways. Precipitation levels are higher on the inner area than the outer coast islands (Kendrew and Kerr 1956:80). Species that live at high altitudes reside here. The major rivers of the Central Coast are found in the eastern portion, as are the spawning grounds of all five major salmon species. Additionally, eulachon, an oily anadromous fish, spawns in seven of the rivers[4] in the early spring (Moody and Pitcher 2010:23–24). River outflow affects water salinity, impacting which species of shellfish can survive in the waterways (Cannings and Cannings 2015:61; Moss and Erlandson 2010:3359).

The mountainous terrain on the inner coast drops down to the low-lying outer coast. Here, the landscape consists of islands, saltwater lagoons, coves, and bays. Breaks in the rugged coastline offer protection from the ocean swells and prevailing winds. Sandy beaches are found throughout the outer islands (White 2006:15). There are many salmon spawning streams spread throughout

[2] For thorough fauna analyses see: Pomeroy 1980:324 (ElTb-10); Cannon 1991 (ElSx-1); Crockford and Frederick 2011 [Appendix C in Rahemtulla 2011] (EjTa-4)
[3] See previous footnote
[4] Kwatna, Quatlena, Clyak, Kilbella, Chuckwalla, Wannock, and Nikite Rivers.

the area. Most contain one or two salmon species. Resources are distributed more widely and are less concentrated than on the inner coast (see Appendix A for species distribution).

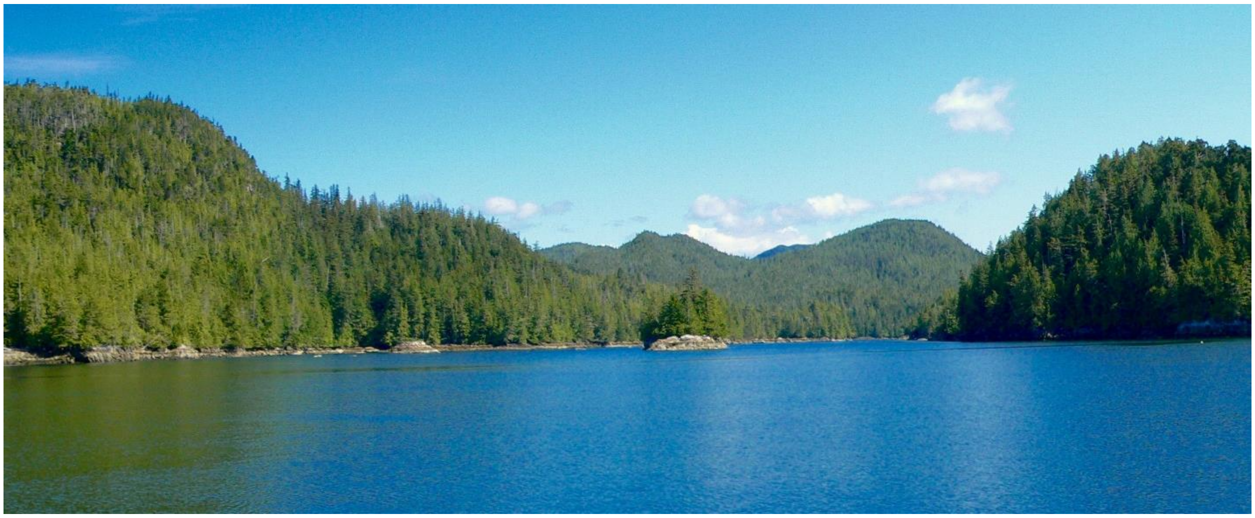

Figure 4. Northeastern view of Whirlwind Bay, just north of ElSx-1 (Namu). Forefront centre is Sunday Island, the location of ElSx-17, a small shell midden.

The History

The first recorded European contact with the Indigenous people of the Central Coast was by Captain Vancouver in 1793 at Restoration Bay. Forty-three days later, Alexander MacKenzie descended the Bella Coola River to reach the Pacific Ocean, making him the first European to cross the continent by land. By then, the maritime fur trade was already underway on the Northwest Coast, with traders selling sea otter pelts to markets in China (Johnson 1958:5).The exchange of European goods for animal furs and provisions operated within the Indigenous economic systems that possessed familiar aspects like bargaining, warfare, and accumulating profits. The Heiltsuk were strategically positioned to act as a middleman between other Native groups and the Europeans since the maritime fur traders avoided traveling through the inner waterways. There was a well-established west-east trade dynamic between the Heiltsuk (outer coast – marine resources), the Nuxalk (inner coast- riverine resources), and the Carrier and Chilcotin (interior-plateau resources) (Hobler 2000:9). Furs and other resources acquired inland were sent west through intermediaries, accumulating on the outer coast. In return, European goods were sent east, along with traditional resources, through long-held trade routes (Hobler 2000:9).

The Hudson's Bay Company trading post Fort McLoughlin (Old Bella Bella) operated between 1833 and 1843 (Hobler 2000:7). It was the only trading post on the coast between Vancouver and Prince Rupert. The Native population began to amalgamate here as people were attracted to the post and set up houses outside the fort's palisade walls (Hobler 2000:8). The introduction of the *Beaver* steamship in 1835 enabled Europeans to trade directly with inland groups. This eliminated the necessity of the Heiltsuk as middlemen and led to the fort's closure (Burton 1985:41). After the closure of Fort McLoughlin, Old Bella Bella remained a major Heiltsuk settlement. Travelers opting for smoother waters would utilize the Inner Passage, passing by Old Bella Bella, providing continued access to European goods (Hobler 2000:13).

In the next few decades the fur trade continued, though gradually declined (Burton 1985:41). Native commerce expanded in the 1850s to include the sale of firewood needed to power steamboats, until it was terminated due to the use of coal (Hobler 2000:12). The Heiltsuk population suffered a great loss from the smallpox epidemic in 1863. Many of the surviving groups further amalgamated at Old Bella Bella since they no longer had enough people to maintain traditional socioeconomic practices (Hobler 2000:14). Olson (1955:320) reported that the six subdivision of the Heiltsuk all moved the surviving members of their villages to Old Bella Bella in 1870. In addition to disease, the Wuikinuxv population suffered from warfare with neighbouring groups, leading to their amalgamation at the Wannock River (Mitchell 2004:17).

In 1880, the first missionary came to Old Bella Bella with the intention of 'civilizing' the people (McKervill 1964:45). In 1871, British Columbia joined the Confederation and as part of the terms, the Native people of the province came under the jurisdiction of the Canadian Federal Government. Assigning of reserves and regulations on natural resources created government enforced systems that separated the Indigenous people from their economic practices and facilitated the retrieval and exploitation of First Nations land for non-Indigenous development. Additional important changes included: government and Christian regulation of internal tribal disputes; a ban on potlatching in 1885; forced school attendance for children; loss of one work day per week to abide by the Sabbath (Crosby 1914:70); the availability of government welfare and social assistance from the Church; and the sale of exclusive rights for resource extraction to non-Natives (Hobler 2000:14). The Methodist missionaries and increased government regulation challenged the ability of Indigenous peoples to maintain traditional economic practices, lessening their political autonomy and causing fundamental irreversible change (Fisher 1977:96).

Around the turn of the 20th century, the Central Coast entered an era where the attention focused on industrial resource extraction. The intensity of this capitalist cash economy further increased the imbalance of power relations between Natives and non-Native people (Brown 1993:15). Prior to this, there was commercial enterprise in the area but the scale of resource exploitation was small. Hand-logging had been done to supply firewood for forts and steamboats, and gradually increased to commercial logging (Hobler 2000:12). Shifts in technology followed resource demand, with fishing originally being done by traditional means such as fish traps, then shifting to fishing from boats, and then the massive exploitation of fish stocks during the cannery days (Brown 1993:12). The shorelines of the Central Coast became the sites of logging float camps and canneries (Hobler 1990a:18). These canneries clustered at Rivers Inlet and dotted other areas of the Central Coast (Figure 5). Thousands of people come to work at the canneries and huge quantities of salmon were extracted from the waters (McKervill 1964:100). The Wuikinuxv, who were less involved in the fur trade than the Heiltsuk, were heavily involved in the salmon and logging industries (Mitchell 2004:17). First Nations people supplied the bulk of labour for canneries, and entrepreneurs profited on their intimate knowledge of the territory and the fisheries (Brown 1993:13). Employment requirements aligned with other traditional seasonal practices since Native people would work at the canneries between April and October (Brown 1993:11). The canneries operated in the summer and fall during the salmon runs, and then people returned to Bella Bella for the winter months (Luebbers 1971:10). The hospital at Bella Bella would shut down during the summer months so that the staff and equipment could be transported to Rivers Inlets in order to service the canneries and hundreds of fishermen who came to work in the area (McKervill 1964:21). The population of non-native workers also fluctuated seasonally since they would come during the summer and then return to other areas of British Columbia.

Settlers gradually moved into the area, increasing whenever new opportunities for resource exploitation were developed. According to a provincial census of BC in 1881, there were less than 100 Europeans living along the coast north of the Strait of Georgia and south of the Skeena River (Galois 1994:140). By 1909, the town Ocean Falls had begun to develop, located off Burke Channel (Ramsey 1971:46). Settlers displaced Indigenous people in resource rich locations through the enforcement of European concepts of land-ownership (Fisher 1977:86). Lighthouses were scattered throughout the area and traffic increased in the Inner Passage. These events and the presence of foreign people and materials in the area occurred alongside significant landscape alterations that came as a result of industrial resource extraction causing environmental degradation such as species decline and deforestation. Around the middle of the century, advances in technology and modern machinery reduced the labour requirements at canneries, dwindling the job prospects for the Native people (Luebbers 1971:10). After the closure of the canneries, there was a mass exodus of settlers out of the Central Coast and the remaining First Nations communities were left with high rates of unemployment (Brown 1993:16).

During the span of less than two centuries, the people of the Central Coast were active contributors in the fur trade, the settler and missionary period, and the industrialization of natural resource extraction. The culture forms present during the ethnographic era represent the responses of the Heiltsuk, Wuikinuxv, Nuxalk, and Haisla. These exchanges took place at different times, in different places, with particular groups of Europeans and Indigenous people, and had context-specific outcomes. Decades of industrial capitalism existed on the coast before the earliest ethnographers set their gaze on the Central Coast people. Franz Boas came to the Rivers Inlet in 1897 and to Bella Bella in 1923 (Boas 1928). Olson did work in 1935 and 1945, visiting the Haisla and Wuikinuxv, and using informants from Bella Bella (Olson 1954; 1955). Ethnographers conducted work at the centers of population amalgamation, neglecting the rest of the traditional territory. These influential anthropologists disseminated their conception about Aboriginal lifeways prior to having supplemental archaeological data (Grier 2007:284). These slices of time and space governed many future interpretations about the Pre-Contact period that became framed within ethnographic understandings of coastal lifeways. Ethnographic analogies should not be (and cannot be) avoided, but they need to be carefully and critically applied (Grier 2007; Moss 2011:23). This includes being aware of the local exchanges and culturally specific circumstances, rather than settling for a standard Contact narrative of British Columbia.

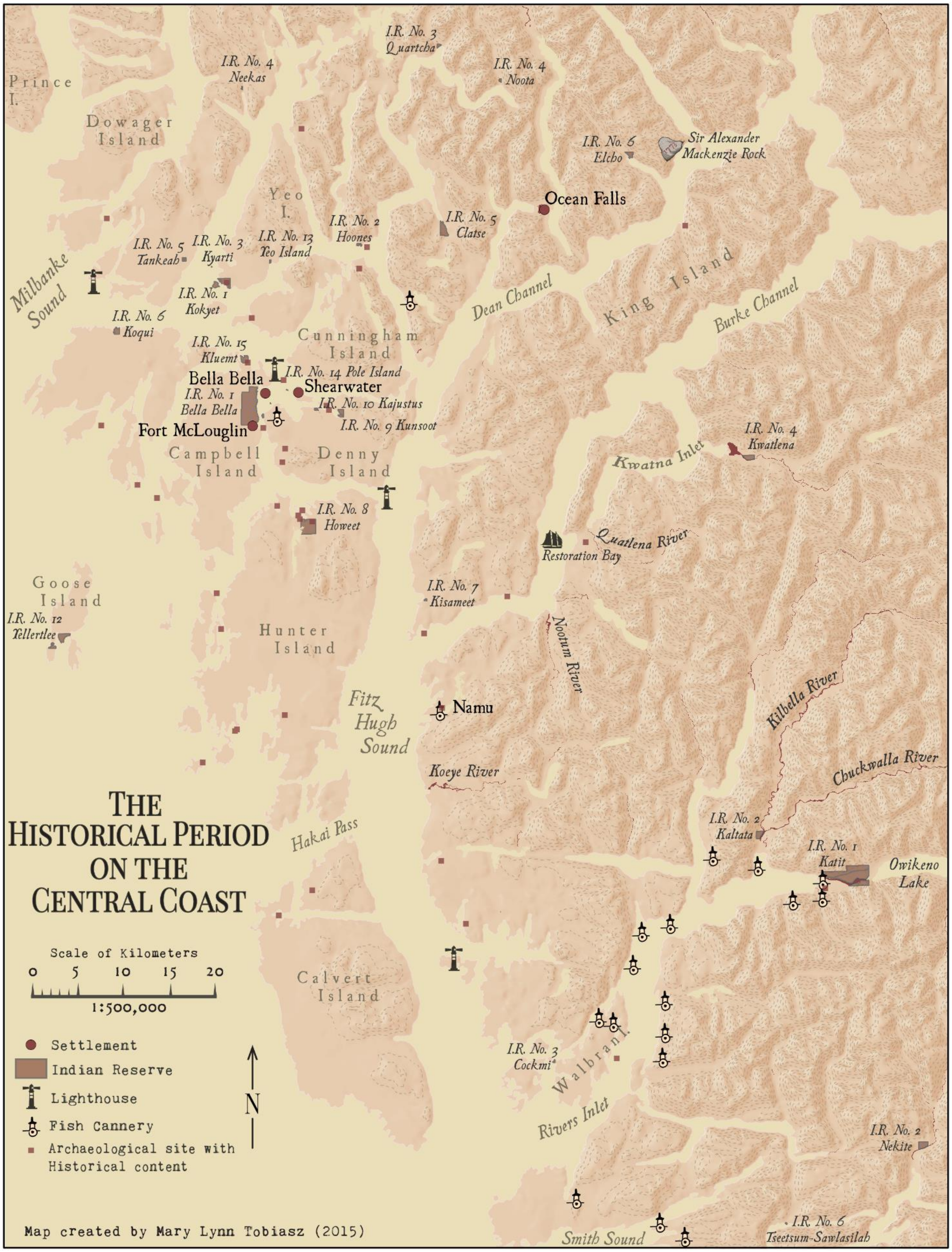

Figure 5. Map of Historical Period on the Central Coast.

Archaeology on the Central Coast

Previous Survey Work

Early archaeological investigations on the Central Coast focused on identifying site locations and constructing a culture history (Hobler 1982:11). Philip Drucker was the first archaeologist to work in the area, in 1939. Drucker (1943) excavated four villages, all with historical occupations and applied a direct historical approach to their interpretation[5]. After this, no archaeological work was done in the area for 30 years until Hester (1968; 1969) did a reconnaissance survey of the Bella Bella region[6] in 1968. He was the first to explore regional site patterning, looking for an explanation of site distribution based on environmental potential (Hester 1968:6). Donald Mitchell (1969) also did a surveying project in Fish Egg Inlet and Rivers Inlet.

On the Central Coast, two survey projects have prepared comprehensive regional site inventories, covering large areas to record sites and their associated features. The first was by Pomeroy (1980), who used archaeological evidence in conjunction with historical and ethnographic sources to explore settlement and subsistence patterns. In total, he visited 210 shell midden sites, documenting their attributes and physical settings, and paired his survey work with an excavation at McNaughton Bay (ElTb-10). The private archaeological firm Millennia Research Limited performed the second mass survey of the Central Coast (Maxwell et al. 1997). The Heiltsuk Nation commissioned this project with the intention of summarizing the current extent of archaeological sites in the area and to generate rules for creating predictive models based on the physiographic characteristics of sites as determinants of location suitability. This was a site inventory project – mapping the area, supplying more details on site features, and updating provincial records. The projects by Pomeroy and Millennia Research Ltd. were concerned with characterizing the environmental setting of sites based on their typology and provided generalized descriptions of site distribution.

Recent archaeological projects continue to work towards addressing land use patterns. Cannon (2000a; 2000b; 2002; 2013) has been researching the history of regional settlement on the Central Coast by tying regional patterns to developments at Namu, the most thoroughly investigated site

[5] EjSw-1, FbSx-6, FbTb-4, FbTb-5
[6] Hester includes Calvert Island but does not include River's Inlet and only a bit of Fish Egg Inlet

in the area. He has sampled midden sites in the Namu vicinity and Rivers Inlet to provide dates and data from matrix composition. This work helps to situate information about local developments at specific sites into larger regional context using various lines of evidence (Burchell 2013; Cannon and Yang 2006; MacDonald 2008). A survey of fish traps by White (2006) provided a much needed internalist perspective on the archaeology of his ancestor's land. McLaren's (2011; et al. 2014) on-going project is concerned with the regional occupation during the early Holocene. On the Central Coast, the cultural resource management sector is dominated by forestry related mitigations, so work has been concentrated on culturally modified trees (CMTs) and has not contributed a great deal of information about settlements (Maxwell et al. 1997:68).

Archaeological Sites

As of June 2014, there were 769 registered archaeological sites within the study area (Table 1), exclusive of sites containing only culturally modified trees[7]. The most common non-CMT sites are shell middens, making up exactly half of the archaeological sites with listed types (n=351/702). Fish traps are the second most common site type and are found at 175 sites. These stonewalls are often found in the vicinity of shell middens and have been built in several different forms (Pomeroy 1980:166). Other types of archaeological sites that are found in the area include rock art, burials, historical sites, and canoe skids (Maxwell et al. 1997:78). Many of the archaeological sites designated with a single Borden classification number are comprised of a combination of these site features.

Recently, archaeologists working in the area have started to recognize clam gardens after having overlooked them for decades, unaware of their function. Currently the count of these sites is low for the Central Coast but will likely increase as archeologists are now aware of their existence and form (Williams 2006). Clam gardens increase the area of shellfish habitats through artificial terracing of the intertidal zone (Groesbeck et al. 2014:2). Surprisingly, 9% of non-CMT sites are registered in the provincial database with the typology listed as unknown. Since compiling these sites, I have accessed additional information that reveals some of these are shell middens (n=10)[8] (McLaren 2011). Sites listed as unknown were not included in any of my analysis.

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[7]CMTs are actually the dominant site type for the area.
[8] EiTa-1, EjSx-10, EjSx-11, EjTa-14, EjTa-18, EjTa-19, EjTa-23, EkTa-37, EkTa-38, EkTa-42

Table 1. Inventory of all registered archaeological sites in study area (n=766). Many sites contain several elements and share a Borden number.

Site Typology	Primary Feature for Site Classification	Feature Count in Area
Shell Midden	351	351*
Fish Trap	146	172*
Rock Art	104	120
Surface Cultural Material	33	82
Human Remains	26	38
Historical Feature	25	78*
Canoe Skid	6	27
Rock Shelter	4	16
Clam Garden	2	6
Smokehouse	1	7
Hunting Trap	1	5
Unknown/ Not Listed	67	-
Total Sites and Features	**766**	**905**

*These features were given the most attention for the project and are accurate counts. The other site features were noted during the research process but were not the focus of this study. I noted the presence of the features whenever I could but did not actively look to confirm counts.

Most of the early archaeologists relied on local informants and traditional place names to locate sites (Drucker 1943; Hester 1978; Pomeroy 1980). This method considerably reduced the arduous task of surveying for sites along the intricate shorelines and dense vegetation (Eldridge and Mackie 1993:13). Ground travel is difficult due to vegetation cover and rugged terrain so archaeologists do most surveying by boat. Hester (1978:1) attempted to search for sites by scanning the shoreline in a boat, but after a poor return of one site found per day, switched his approach to interviewing residents. Old sites are difficult to find if they lack later occupations or are not on contemporary shorelines (Hobler 1990b:304). Small sites are hard to locate due to their low visibility. Erosion of middens by natural forces may also create gaps in the settlement history, particularly on the outer coast (Simonsen 1989:22). When Millennia Research Ltd. did their systematic survey, they found that the majority of unrecorded middens in the area are most likely small sites that lack place names (Maxwell et al. 1997:58). In addition to the natural processes affecting site preservation, the approach archaeologists used for locating sites affects the current inventory of sites and the subsequent archaeological interpretations.

Shell middens are complex features, comprised of anthropogenic sediments that are the by-product of human-activity (Andrus 2011:2892). Shell middens are formed by cultural materials being deposited as a result of individuals' actions that accumulate and are transformed over time (Bailey

2007:203). These sites are difficult to investigate since they are often multi-component occupations and can have huge volumes of accumulated cultural materials. Different processes and actions lead to the formation of shell middens, preventing any two sites from having identical histories and forms (Moss 2011:123). Archaeologists are left with a palimpsest of human activity, biased by the constant subjection to taphonomic effects. The sites that are found are the ones where there has been enough successive events that the material signature is visible. On the Central Coast, the majority of shell middens are found along the margins of the shoreline. Relatively stable sea-levels have permitted locations to be utilized over several millennia (Cannon 2000a; McLaren et al. 2014). Four middens[9] have deposits extending back 10,000 years and demonstrate repeated occupation (McLaren et al. 2014:166). Shell middens often contain multiple features, and it is not uncommon to have middens containing human burials and house pit depressions still visible on the surface.

Settlement Size Differences

The complex form and usage history of shell midden sites on the Northwest Coast, as with many other forms of archaeological habitation sites, make it difficult to classify these sites into settlement types based on the occupants' activities. Typically, middens are organized into two settlement types, either villages or (specialized) camps. Archaeologists heavily rely on midden dimensions as an indicator of site type (Fladmark 1975), though the degree to which this factor is representative of the occupation history of settlements has been debated amongst archaeologists (Pomeroy 1980:90; Stein et al. 2003). Some have critiqued the tendency to use midden size to define the type of residency and seasonality of particular sites. The typical Northwest Coast pattern, underpinned by ethnohistoric sources, was that large middens, especially those with visible architectural features, indicated winter villages (Fladmark 1975). More recently, scholarship still associates large middens with villages, as the settings for general economic activities based on the abundant accumulation of culture materials, but has dropped the assumption of winter occupation (ex. summer aggregates) (Mackie 2003:262; Orchard and Clark 2014:200). When midden expanses are small, archaeologists categorized them as (spring/summer/fall) short-term residences that were used intermittently, usually based on seasonal resource fluctuations, and occupied by fewer people.

[9]EjTa-15 (Pruth Bay), EkTb-9 (Triquet Island), ElSx-1 (Namu), ElTa-18 (Kildidt Narrows)

The one additional midden type that has been widely accepted in Northwest Coast archaeology is defensive sites – forts or refuges that may have been used during times of inter-tribal conflict. Typically sites are designated as such when there is a small amount of midden deposit and are located on high knolls, small islands, or steep rocky shorelines that make it difficult for canoe landings (Moss and Erlandson 1992:74). They are thought to have been occupied during times of increased competition or warfare. Similar to ascribing shell middens as camps or villages, these sites are most often designated as defensive sites while archaeologists are in the field based on location properties (Martindale and Supernant 2009:219). More recently, scholars have developed methods to quantify and demonstrate the defensive qualities of site locations (Bocinsky 2014; Martindale and Supernant 2009; Supernant 2011).

Archaeologists need to go beyond the dichotomy of villages and camps in order to account for the variability seen in middens. The least addressed are the many ambiguous sites that fall within the spectrum between village and seasonal camp. For instance, when Cannon (2002:318; 2013:26) organized 17 midden sites in the vicinity of Namu into categories, he ended up with five site types[10]. The range of settlement types that archaeologists imagine are not reflective of the diversity of middens that exists. The designation of a small camp is too general of a term to say much about the site's usage. In addition, the use of these terms still carries the burden of assuming seasonality even if not explicitly stated. A single site on its own only represents a fragment of the complete settlement system, and thus, research projects should be expanded to account for greater variety (Pomeroy 1980:227).

People are correct to argue that the length of a midden cannot be the sole indicator of the inhabiting population size. Pomeroy (1980:90) cautions against this assumption, pointing out that different areas of a site could be occupied at different times. It is also therefore equally inappropriate to use midden dimensions to derive population estimates or to classify a site as a winter village. However, a large midden does represent a different type of occupational history than a small midden. Instead of using site size to classify the site type, it can still be considered representative of the activity use and intensity of occupation. Sites with the largest middens represent the coordinated behavior of either a large group of people over a short (or long) period of time, or fewer people over a long

[10]Winter village, Seasonal village, Base camp, Camp, Islet Camp

time. Some archaeologists have used midden area as a correlate of the site's usage intensity (Maschner and Stein 1995:62; Mackie 2003:262). Cannon (2013:26) demonstrated a correlation between the density and variety of fish bones and the size of shell middens, and thus the intensity of site activities.

The general assumption that I am making based on site size is that small and large middens have different histories of occupation, but I cannot specify the type of occupation. This is why I have excluded medium middens from the main analysis, since the middle range sites would likely contain an overlapping variety of site types, whereas the small and large middens are more likely to be distinct in their pattern and history of use. Sites that are found in similar environmental contexts and have comparable culture features will likely share more similarities in their usage. For instance, two middens that are both beside salmon streams on the outer coast but have different dimensions were likely not used to the same degree of intensity. Comparing midden lengths between a specialized salmon-fishing site versus a site in front of a huge clam bed is not productive for illuminating differences in demographics, but it can tell us – along with additional forms of archaeological evidence – about how different activities led to distinct forms of middens. Robust distinctions in site sizes are appropriate proxy for broad differences in site histories. By using relative size categories, the aim is determine how the intensity of site occupation is related to its locational characteristics.

Settlement Patterns

The Northwest Coast Settlement Pattern

Settlement patterns reflect the strategies people employed to sustain themselves on the coast as hunter-fisher-gatherers. Arrangements of sites are a response to the natural environment, and political and socio-economic practices. Settlement configuration reflects the daily, seasonal, and annual movement of people and how they organized themselves. The conditions that led to establishing settlements at particular locations are multifaceted and locally specific. A simplistic notion of land use is centered on resource optimization and local availability of food. The diverse suite of resources utilized by coastal people and their uneven distribution inhibits the ability to obtain all necessary resources at one place, thus requiring multiple locations to acquire vital resources. Sites were not necessarily occupied simultaneously or continuously. People would select and re-select locations to occupy, and the function may have shifted over time. A site may be a winter village at some point, then a seasonal satellite camp, go through periods of abandonment, or be used later for burials (Hobler 2000:16). Seasonality is a major concern when examining settlement patterns since it relates to resource availability and weather conditions, affecting which preconditions were important (Amundsen-Meyer 2014:257). Shifts would have occurred in group composition and size, affecting the political structure (Mitchell 1983:97). Cultural factors, such as territory rights and proximity to other people, influence site locations. The multiplicity of influencing factors and nuances of history contribute to the difficulty of deducing settlement patterns from the fragmented archaeological record.

The assumed typical Northwest Coast pattern of annual movement is that people gathered in large groups during the winter months – the ceremonial season when they relied on stored food. From the spring to the fall, a portion of the population would disperse into smaller groups targeting resource procurement locations (Fladmark 1975:91). This dominant framework is primarily derived from the ethnographic record and does not account for local variability. Reliance on the ethnographic pattern has elicited critique for extending concepts of seasonal mobility into prehistory and assuming cultural stability (Ford 1989). Karpiak (2003) constructed a model of Nuu-chah-nulth land use using ethnographic descriptions to test if the qualities identified by ethnographers as requirements for village locations corresponded to the location of archaeological habitation sites. She found that very few shell middens were located in areas her model had deemed favourable (Karpiak 2003:106). The non-conforming results between the model's predicted suitable locations and the actual site locations suggests either problems with the model/data and/or that the ethnographic accounts are not reflective of pre-Contact land use. Acknowledgement of the cultural mosaic and the local historic particularities on the Northwest Coast (Moss 2011:78) should prevent a generalized pattern of seasonal settlement patterns. Mitchell's (1983) work on Vancouver Island and its vicinity exemplified that even the most common pattern of annual movement appeared in under 20% of the groups. No single pattern prevails and yet many archaeologists have accepted the interpretation that large winter aggregates were positioned with respect to sheltering, and camps were determined by the availability of subsistence resources.

Central Coast Settlement Pattern

This standard settlement pattern has been generally accepted for the Central Coast and used to explain the distribution of sites. According to Cannon (2002:324), the pattern of permanent winter villages and specialized resource camps extends back to 5000 B.C., but the quantity and variety of shell middens increased over time. People lived in large villages in the winter, where security and comfort were the main factors affecting location suitability. Access to resources such as salmon streams or good clam beds was not necessarily a concern for the residents (Pomeroy 1980:224; Drucker 1983:91), since during the winter months few substantial resources are available (Cannon and Yang 2006:125). During the spring and summer, smaller groups of people dispersed to camps to target specific resources. The spatially dispersed and seasonally available resources required a mobility strategy. Spring locations were chosen for security from raiding, while summer villages were situated to maximize access to resources (Pomeroy 1980:225).

Economic models have been used to explain settlement distribution – conclusions that are often assumed rather than demonstrated. Resource proximity was alleged to be the main determinant in the location of settlements (Jochim 1976:50; Monks 2011:129), aside from winter villages. Archaeologists have attempted to support this by using salmon as a major determining factor (Pomeroy 1980; Hobler 1983). According to Pomeroy (1980:222), people utilized more than one stream location because of fluctuations in salmon stream productivity. Also, the duration of a stream's salmon run is not correlated with midden size (Pomeroy 1980:209). Hobler (1983:154) focused on the density of sites in relation to salmon streams and their productivity, but found that it was not a sufficient explanation for site patterning. Both Pomeroy and Hobler agree that a combination of factors were important for settlement locations, especially for the location of non-salmon specialized sites, such as other resources and trade access.

Despite knowing that not all sites would be associated with salmon, this was the only resource archaeologists systematically examined in relation to site distribution. This was probably partially due to the emphasis on salmon's central role in Northwest Coast societies (Monks 1987). Furthermore, government data are available for salmon spawning streams due to its contemporary economic importance. However, the same line of enquiry could have been possible with other species, such as herring, which has been recorded by the Department of Fisheries and Oceans since

1928 (Hay and McCarter 2006). At the time, archaeologists underemphasized the importance of herring to coastal First Nations groups (McKechnie et al. 2014; Monks 1987). The systems of mobility that archaeologists imagined did not include much consideration for human modifications of the land to enhance food security, aside from fish traps. Archaeologists were unaware of clam gardens and overlooked the importance of horticulture/plant species, so these were not included in the conceptualization of economic optimization models. One of the questions posed by Hobler (1983:150) – "To what extent does variation in resource distribution relate to variation in the distribution of archaeological sites?" – could not be resolved by using salmon as the only determining factor. Today archaeologists are better equipped to address this question due to increased availability of data and computational methods, such as GIS, but are still unable to capture the range of aboriginal food resources and cultural considerations for site placement.

Archaeologists have struggled to understand settlement patterns because of the complexity that cannot be explained by economic systems. Explanations for site locations based on subsistence are temporarily suspended for winter settlements, and are instead attributed to comfort and security criteria (Pomeroy 1980:224). This is only because there are no sufficient economic explanations based on resource abundance (Cannon 2002:328) that would supersede all other considerations. Yet there is a variety of shell midden locations that cannot be explained by resource proximity or wintering locations. Thus far, our explanations inadequately account for social and political cultural dimensions. Archaeological evidence demonstrates that people were flexible with their diets and that they were local-consumers. At Namu, when the salmon runs failed, people began consuming greater quantities of ratfish (Cannon 1995:55). This exemplifies the flexibility of people's economic practices and their attachment to places that goes beyond the availability of staple resources (i.e. salmon).

Seasonality is a large part of settlement patterns. Again, a lot of information on the seasonal usage of locales has been from the ethnography rather than founded on direct evidence from sites. Even when site materials are examined, archaeologists rely on a limited range of faunal remains and often a small sample size to determine the seasonal occupancy of a site (Ford 1989:137). As will be demonstrated below, no small site on the Central Coast received subsurface investigation until the 1990s. Small sites signifying specialized resource camps was inferred from non-archaeological sources. Researchers commissioned information from Bella Bella community members for insight into the seasonal use of sites and the related economic activities (Hester 1978:3). Isotopic analysis of shellfish have shown that the seasonal occupation of sites is more complicated than the conventional conception of seasonal movements (Burchell et al. 2013). Burchell's results indicate that shellfish harvesting was site-specific, multi-seasonal, and varied through time. Her findings included demonstrating the small and medium shell middens had patterns of multi-seasonal use. Thorough investigations of Namu, a winter village, have shown that a portion of the population stayed at Namu throughout the year. Salmon harvesting was intensively conducted in the summer and fall and herring was targeted in the late winter and early spring (Cannon 2002; Cannon and Yang 2006).

Archaeological work on the Central Coast has emphasized cultural continuity and stability rather than change and disruption. In part, this has been due to the relative stability of sea-levels in the area that enable the same locations on the landscape to be occupied over several millennia, unlike many other coastal places of British Columbia (McLaren et al. 2014). The focus on Namu and its extended occupation has also underscored this conception. Some sites show remarkable consistency in their usage over several millennia based on the variety and density of faunal remains[11] (Cannon 2002:324). This has permitted a continued tolerance for extending ethnographic analogy into the deep past among certain scholars. Pomeroy (1980:220) believed the ethnographic pattern was in place for least two thousand years prior to European contact, and Hobler (1990b:298) pushed it back to four to five thousand years ago. Burton (1985:56) opposes this view and thinks that there were major changes in settlement patterns following contact. She suggested that specialized resource utilization sites have less antiquity than general activity sites around Bella Bella. This may have been due to people amalgamating in coalescent communities during the historical period and exploiting nearby resources.

It is necessary to find a balance between the archaeological evidence, historical documents, the ethnographic record, and traditional knowledge sources. This is difficult, especially when they contradict each other. For instance, abalone is important to the Wuikinuxv and Heiltsuk (Heiltsuk Tribal Council 2005:25), but can this knowledge be applied to hypothesizing the function and activities of sites? Hester (1969:32) describes small outer coast sites as being used seasonally to

[11]ElSx-5 and ElTa-25

gather seaweed and abalone. But the only archaeological sites on the Central Coast where abalone has been found are Namu, Kisameet (Luebbers 1971[12]), and McNaughton (pers. comm. Cannon 2015), and none of these are small outer coast sites. In some cases, archaeologists point out when their evidence does not match the ethnography. Pomeroy (1980:89) found that, according to local informants, the largest and deepest middens did not always have place names or significance, whereas some of the sites that the informant said were winter villages were not deep middens. Researchers designed the early large-scale excavations to test the continuity of prehistory into the historical period. Archaeologists targeted large villages with post contact occupations, hoping to find stratigraphic continuity and apply a direct historical approach (Drucker 1943; Hester 1969; Carlson 1970). The confirmation of pre-affirmed perceptions allowed archaeologists to fill in the gaps about prehistory using ethnography without having to demonstrate their conclusions using archaeological evidence. Large sites were automatically designated as winter villages since the middens that were targeted for excavations were winter villages in the historical period. This has left subsequent researchers with the plight of untangling what the archaeological evidence actually shows versus the embedded bias of earlier work.

The History of Previous Archaeological Research on the Central Coast

I have compiled all previous archaeological work on shell middens from the Central Coast of British Columbia to see how the proportion of sites that archaeologists have sampled compares to the inventory of recorded middens. The materials from these subsurface sampled sites have provided much of the foundation for the current understanding of the area's history. On the Central Coast, one fifth of shell middens have received subsurface testing (n=78/351). However, the quantity and quality of the sampling does not proportionally represent the diversity of settlements. There are clear trends in the prevailing research agendas and methodologies of archaeologists, reflected by the targeting of certain types of middens. The most intensive archaeological research has concentrated on shell middens containing three traits – a large extent, habitation features, and late or historical occupation. Despite recent efforts to draw upon a wider range of midden forms, there remain substantial gaps in our sample. This is most notable for small shell middens, which

[12]Leubers 1971: Appendix Table 11

comprise half of all known settlement sites on the Central Coast, yet no one has excavated a small midden. The following section describes the area's history of archaeological investigation, and details how the focus has shifted in conjunction with methodological advances and anthropological motivations. Deeply embedded in the discipline is the legacy and biases of work prior to the 1990s, which continues to govern interpretations. There needs to be more archaeological work on a wider range of sites to ensure that perceptions of cultural practices for the area are not predominately based on large, recently occupied sites.

Methods and Definitions

Reports submitted to the Government of British Columbia were the predominate source of information about site investigations. Supplementary data from publications filled in gaps, particularly for sites with reports that were either not made accessible online or were done before increased government regulations pertaining to site documentation practices. The archaeological site information and associated reports represent what was available through the Provincial Archaeological Report Library as of June 2014.

I have created two categories of subsurface investigation based on method types. The first category, *excavation*, is generally self-evident. The one caveat is that the excavation must exceed a single excavated test pit (1m by 1m). A single excavated test pit falls within the second category, broadly labeled *tested*. This category includes augering, coring, and shovel tests. The only type of subsurface testing that has been excluded from this summary is probing, which is commonly done to learn the extent of the midden based on basic presence/absence of cultural material. When using probes, the contents of the midden are not analyzed and thus do not constitute subsurface investigation. When determining if the site had faunal analysis, the criterion was that the archaeologist needed to have a basic level of identification. The standard for this was low, counting most work that mentioned what kinds of species were found. The only time I did not include the faunal information from site reports was when it was identified simply as shell or fish.

Results

Of all the recorded shell midden sites on the Central Coast, 22% have had subsurface testing (Figure 6). This is an equivalent proportion to other regions of the Northwest Coast, such as Prince Rupert Harbour, where 18% of shell middens have been sampled (27 out of 157 recorded middens) at varying levels of intensity (Ames and Martindale 2014:146). At first appearance, investigations on one fifth of settlement sites seems to be a reasonable sample of the area's archaeological record. Once these 78 middens are distinguished based on the type of investigation and site features, the discrepancies between the sample and the population are revealed. A summary of each investigated site, the method used, principle archaeologists, and site features is available in Appendix E.

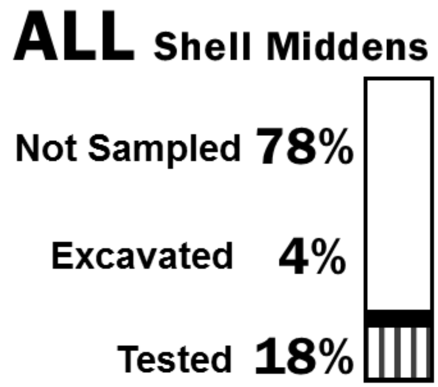


Figure 6. Proportion of shell middens that have received subsurface investigation.

As discussed in detail elsewhere in my thesis, shell midden dimensions are reflective of settlement activities and usage. Of shell middens with recorded lengths, 50% are small, making them the dominant midden type on the Central Coast (Figure 7). Despite their prevalence, this group is the least investigated midden type (Figure 8). Prior to the 1990s, not a single small midden received subsurface testing (Figure 10). Since then, 22 have been tested; representing 22% of all small middens, but no small midden has ever been excavated. It is the opposite situation for large middens, which have been the focus of most excavations (12 out of 15 excavated sites are large middens). The low

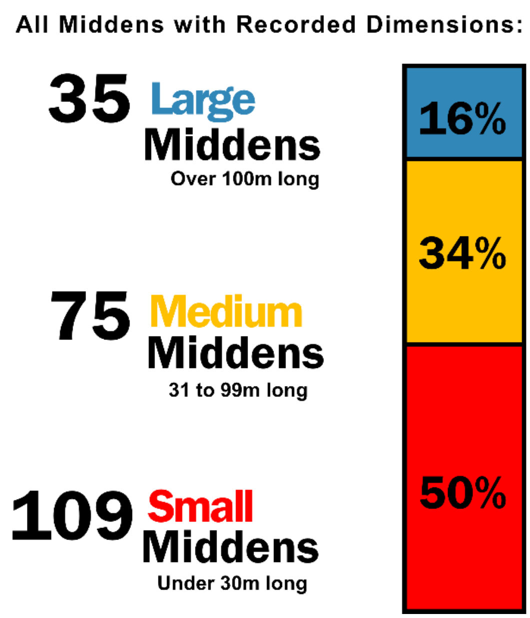


Figure 7. Proportion of shell middens in each size category for study area.

frequency of large sites and their attractive features (i.e. house depression, historical components) has resulted in 69% of large shell middens having received subsurface sampling.

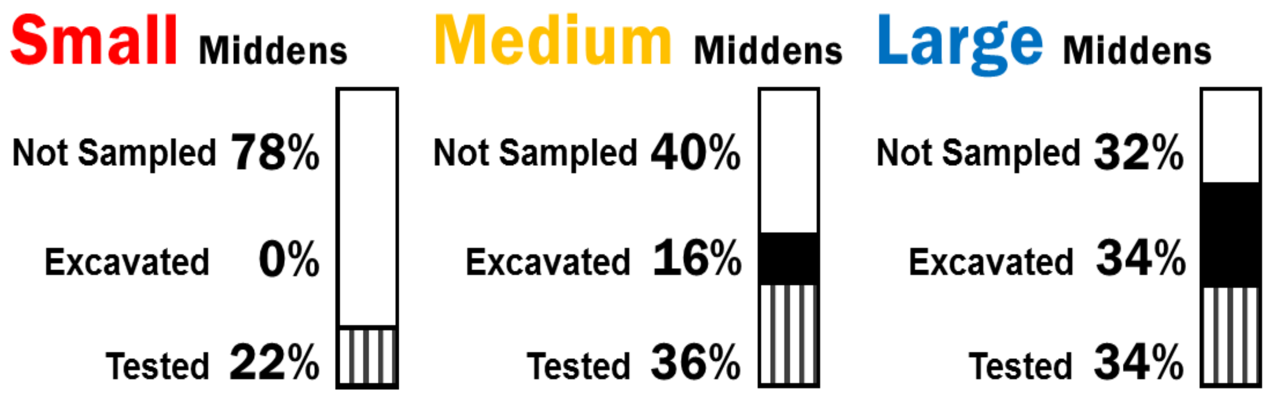


Figure 8. Percentage of each midden size category that has been investigated and the method of sampling.

Site Feature Preferences

In addition to the areal extent of middens, the likelihood that archaeologists would investigate a shell midden is influenced by the presence of particular features. The attraction to sites with habitation features or historical occupation is evident, particularly prior to the 1990s (Table 2). Shell middens with these features are over represented in the sample of investigated sites compared to the actual frequency of these features among all middens. Shell middens with habitation features and historical features represent 60% and 40% of excavations, respectively. Yet these features are only found on 15% and 12% of all recorded shell middens. The difference is lower when considering all subsurface testing; dropping to 29% and 24%, though these remain double the expected frequency.

Table 2. Temporal trends in the features of sites targeted by archaeologists.

Temporal Trends in Feature Targeting	Middens with **habitation** features 		Middens with **Historical** Occupation 	
All Subsurface Investigation	**29%**	(23/78)	**24%**	(19/78)
Prior to 1970	80%		30%	
1970-1979	63%		25%	
1980-1989	25%		50%	
1990-1999	18%		25%	
2000 to Present	22%		18%	
Actual Midden Frequency	**15%**	(51/351)	**12%**	(42/351)

Temporal Trends

The focus on specific midden types illustrates broader trends in the discipline of archaeology. Table 2 and Figure 9 show the shifts through the decades in archaeologists' interest and the methods used for investigating sites. Prior to the 1990s, archaeologists did all subsurface work through excavations[13]. More lenient expectations and governmental regulations in the treatment of extracted cultural materials permitted the bulk excavation of huge volumes of middens. Initially, researchers were trying to establish culture histories for the area (Hester 1968; Hobler 1982:11; Simonsen 1969). On the Central Coast, much of the work was targeted towards optimizing the removal of artifacts, human burials, and architectural features. Throughout these early decades, archaeologists relied on artifacts for determining phases and information about the site's purpose (Erlandson and Moss 1999:432). Low recovery rates of artifacts and high use of perishable materials that rarely survive in the archaeological record counter this (Hobler 1990b:298). Therefore, early excavations in the area removed huge quantities of midden to recover information-generating artifacts (Lyman 1991).

The 1990s mark a distinct shift where the number of sites being excavated dramatically drops, and archaeologists opt instead for less invasive sampling methods such as shovel tests and coring

[13] Aside from the one 'test excavation' at FbTb-5 by Drucker, though the extent of this excavation in unknown.

(Cannon 2000a; Cannon 2000b) (Figure 9). Archaeologists are able to sample sites faster, resulting in a more even distribution of testing among the different site sizes. Small shell middens finally have subsurface materials removed[14] (Figure 10). Today the underlying motivations for archaeological work in the area have become more variable, though there is an emerging interest in early sites and locations that were continuously utilized over long periods (McLaren et al. 2014; Rahemtulla 2014).

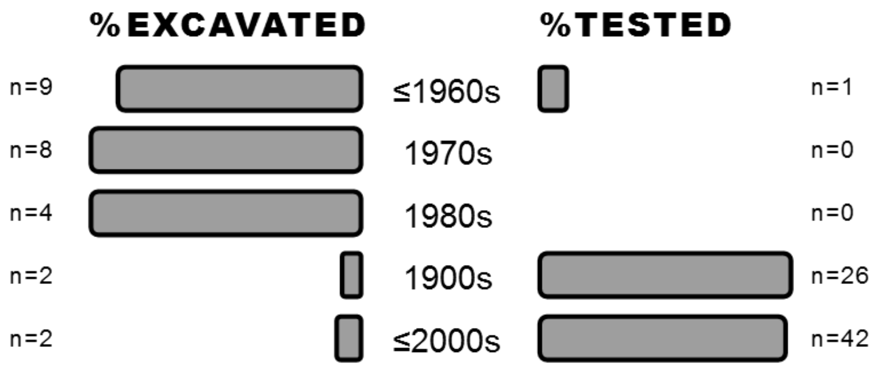


Figure 9. Method of subsurface investigation per decade.

After the 1990s, culture resource management (CRM) archaeology begins contributing to the sampling of sites for the area. Shell middens are tested when threatened by development, making the selection of sampled sites dependent on their location rather than their features. Although this led to a more even representation of settlement types, the projects are not designed to optimize the subsequent analysis of materials and dissemination of data. Low rates of development on the Central Coast equate to little CRM work, with the majority of mitigation work relating to forestry. Shell middens that have exclusively been sampled by CRM companies make up 21% of sampled sites (16 out of 78), while at the same time there are now over 700 culturally modified tree (CMT) sites within the study area, most of which are the result of forestry-related impact assessments.

[14] Arcas shovel test of EjTa-ll is the first small site tested on the Central Coast (permit 1993-0052).

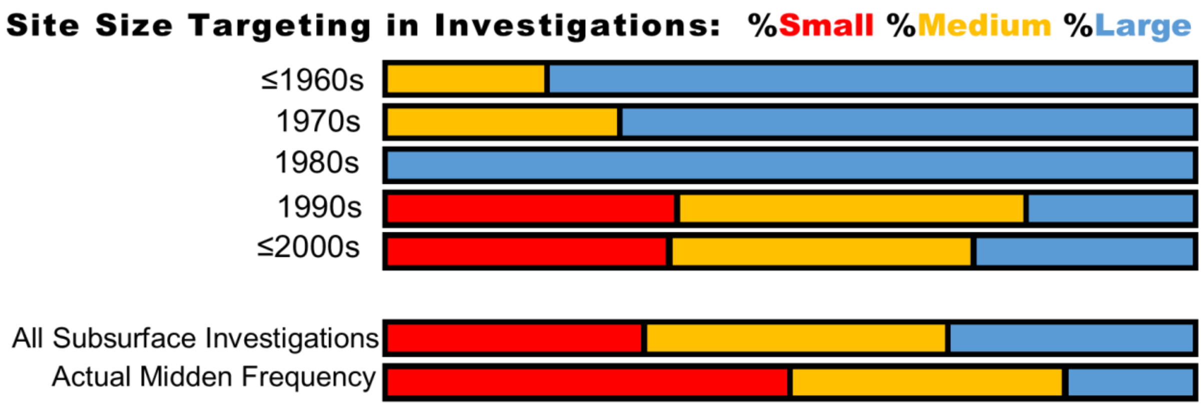


Figure 10. Sampled shell midden sizes by decade.

Geographic Distribution

In general, the geographic coverage of sampled sites extends throughout the region but there is some clustering (Figure 11); a result of localized research projects and mitigation work. Archaeologists have conducted excavations in nine Borden blocks out of the 41 in the study area that contain shell midden sites. These nine Borden blocks dominate archaeological investigation and are higher than their relative proportion of shell midden sites. The two Borden blocks with the highest number of excavated sites, FaSu and FbSx, each have five recorded shell middens, of which 80% and 60% have been excavated, respectively. The opposite is true of EkTa, which contains 26 shell middens, yet no midden site in EkTa has ever had any subsurface testing. Other notably underrepresented Borden blocks include EjSw, FbTa, EiSv, and FaTb.

Prior to the 1990s very little of the study area south of Namu received any subsurface investigation. This is another example of how the ethnographic record was instrumental in influencing archaeological interest since more ethnographic work was conducted on the Heilstuk and the Nuxalk than the Wuikinuxv in the south. Archaeological investigations should be better geographically representative of local environmental and cultural contexts rather than treating the Central Coast as a general unit.

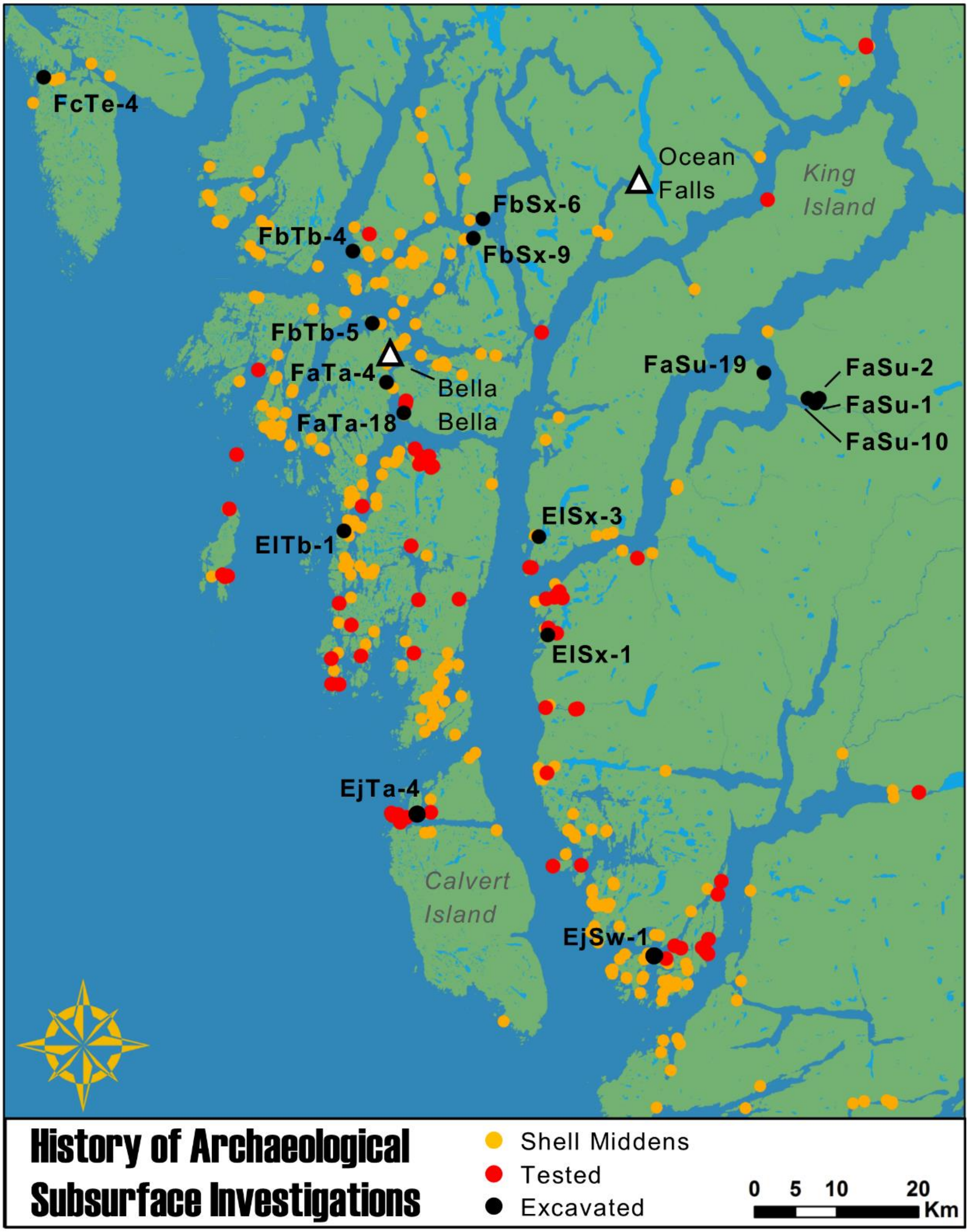


Figure 11. Location of all subsurface investigated sites.

Subsequent Investigation of Materials

Innovative, low-impact methods of material extraction from middens can still produce information that is comparable to excavations and is significantly more feasible to analyze for things such as faunal frequencies. Materials can also be radiocarbon dated, which is desirable information for any site (Erlandson and Moss 1999). However, if no subsequent work is done on the materials retrieved, then the efficiency of these methods remains in the fieldwork alone. Half of all sampled middens have been dated or had faunal analysis; varying slightly depending on the size of midden, the type of sampling, and when the investigation was conducted (Table 3). Once again, small middens have received the least examination of extracted cultural materials. Thirty-three percent of sampled small middens have been dated and 46% have had faunal analysis completed. Identification of floral remains is almost completely absent in archaeological investigation, only emerging in the past decade (Jackley 2012; MacDonald 2006; McLaren 2011).

Following 1990, the proportion of sampled sites directly dated falls from around seventy percent to half the shell middens being radiocarbon dated. Faunal analysis on removed materials remains just over 50% before and after 1990. Therefore, even though recent archaeological work targets a broader range of sites, the rate of subsequent analysis of cultural materials has not improved. Despite improving provincial regulations for archaeological recording practices in British Columbia, this reflects the inadequate development of government legislation in relation to the treatment of removed cultural materials. Ultimately, the analysis of cultural materials is left to the archaeologist's discretion.

Table 3. Subsequent analysis of sampled subsurface materials from shell midden sites.

Subsurface Investigation Type	**Total Middens**	**Radiocarbon Dated**		**Faunal Analysis**	
All Sampled Shell Middens	**78**	41	53%	40	51%
Excavated Shell Middens	**15**	11	73%	9	60%
Tested Shell Middens	**63**	30	49%	29	48%
Subsurface Investigated Sites:					
Small Middens (≥30m)	**24**	8	33%	11	46%
Medium Middens (31-99m)	**29**	17	59%	15	52%
Large Middens (≤100m)	**24**	15	63%	14	58%
Time of Investigation:					
Pre 1990s	**13**	9	69%	7	54%
Post 1990s	**68**	34	50%	36	53%

Discussion

My review of previous archaeological investigations on the Central Coast makes apparent the disproportionate distribution and quality of subsurface sampling. By quantifying the investigated sites against the known proportion of all middens, results demonstrate trends in research interests and methodologies. The research patterns are clear, beginning with intensive bulk excavations of large, recently occupied shell middens. This continued until the 1990s when archaeological work became dominated by lower-impact sampling methods and a wider range of settlement types were investigated.

Most archaeological excavations occurred on the Central Coast between the late 1960s and the 1980s. Archaeologist's search for the origins and rise of cultural complexity affected what types of sites were investigated (Mackie 2001:9). With the 'type form' of complex societies pre-emptively envisioned, the targets were large shell middens thought to represent high populations, stored food provisions, and social hierarchy. Archaeologists were interested in the extension of the ethnographically documented cultural pattern into prehistory, motivating research on the terminal layers of recently occupied sites with visible structural features (Burton 1985; Carlson 1970; Drucker 1943; Hester 1969). The content of sites determined to be unlikely to contribute to these debates were ignored. Varying midden types and their features were recorded as part of survey projects, but the excavations used to complement the surveys were done on large middens (Luebbers 1971; Pomeroy 1980; Simonsen 1969). This creates a problem since the foundation of our understanding of the archaeology of the Central Coast was generated from a limited sample of sites, many of which represent a similar form of occupation. Archaeologists conceptualized prehistoric lifeways based on archaeological evidence from large middens and ethnographic information. The lasting result has been the perpetuation of a static and simplistic narrative of Central Coast prehistory.

The massive amounts of materials retrieved from these big excavation projects early on are often the materials that continue to be studied and analyzed today, including the application of new analytical techniques to archived artifacts (Lynch 2015; Rahemtulla 2006). While it is admirable that people are revisiting materials and maximizing their potential to produce further information, rather than digging up new sites unnecessarily, the use of existing collections perpetuates the use of large, late occupation sites as the foundation of our archaeological interpretations. Even as the driving anthropological questions change, the established framework and reliance on data from a few shell midden forms means that our archaeological investigations are further ingraining these biases. The legacy of these sites has impacts on almost all aspects of archaeological inquiry, including studies of settlement patterns, economies, and social organization.

This discrepancy is most obvious with the complete omission of investigation on small sites until the 1990s. Despite comprising 50% of all shell middens in the area, they are the least sampled site category and none have been excavated. Decades have passed since archaeological practices made a substantial shift, but small sites have yet to be adequately represented as the focus of investigation and only 7% have been dated. The occurrence of subsurface investigation does not necessitate subsequent release of information from the testing or excavating. The quality of analysis of extracted materials has been uneven, with around half of all sampled sites subject to dating and faunal analysis. In contrast, there have been some small and medium shell middens tested using core and auger sampling that have received extensive analysis, dating, and interpretation (Cannon 2000b; 2000a; 2002; 2013; Cannon and Burchell 2009). The on-going work by Cannon and colleagues has helped alleviate some of the gaps in our knowledge about activities and site usage history at a greater range of settlements.

While hindsight allows us to see the biases of previous work, the attraction of large middens continues today. Since 1990, only one shell midden has been newly excavated. Starting in 2011, Farid Rahemtulla (2014:5) began excavating EjTa-4 as a field school project. Excavation of this site represents a slight departure from previous trends since it does not have a historical component or architectural features. Still, it is a large midden with recent occupation and aligns with the contemporary fixation on early sites that were occupied over long durations of time (McLaren et al. 2015:163). At present, there is one publication providing information from this excavation (McLaren et al. 2015), and as more information is released, the EjTa-4 project will balance some of the geographic discrepancy in investigation since only one other shell midden south of Namu in the study area has been excavated (EjSw-1 in 1939 by Drucker (1943)).

In Northwest Coast archaeology ignoring small midden sites often occurs. In Orchard and Clark's (2014:201) recent publication about regional trends of subsistence patterns, they chose only to include villages and large middens. The authors justifies this by advocating for a simplification of subsistence variability by omitting sites that may be specialized or limited activity locations. They also note that small middens typically produce only small samples of faunal remains. Orchard and Clark's rationale for focusing on large village sites is understandable, but also exemplifies the perpetuation of reliance on one type of site as representative of the 'most important' Northwest Coast trends. Archaeologists are quick to acknowledge the culture mosaic of the Northwest Coast (Moss 2011:95) but then some do not follow through with designing research projects that appropriately addresses the temporal and spatial variability. Culture histories and regional chronologies were constructed from large sites without including dates from small shell middens (Taylor et al. 2011:288). The initial conclusion that small sites most often represent specialized resource targeting was not substantiated from recovered midden materials. Within the past few decades, this has improved since archaeologists have started investigating a wider variety of settlements.

Conclusions and Recommendations

A summary of the main points are as follows:

> Archaeologists predominately focused excavations on large shell middens with late prehistoric or early historical occupation and habitation features.
>
> A shift happens after 1990 when excavations are replaced with lower cost exploration methods. The rate of small and medium shell middens represented in the sample rises but still trails behind the work done on large sites. No excavation has been conducted on a small midden and only two excavations have targeted medium-sized middens.
>
> Geographically, testing is reasonably spread but excavations have been concentrated around Bella Bella and clustered at Kwatna River. The southern area has been under-investigated. Some Borden blocks have been over-emphasized while others have been completely ignored.

Comparing the types of investigated sites versus the actual frequency of midden types and features highlights what has had a disproportionate influence in forming our current conception of Central Coast history. Advances in theoretical and methodological approaches have inclined archaeologists to revisit previous conclusions. In some cases these alternative ways of thinking are applied to the same sample of archaeological materials previously collected, further perpetuating a narrow view of settlement types. In part, the complete absence of small midden excavation has been mitigated by the use of less-intrusive sampling techniques, followed by intensive analysis of the extracted materials.

Occupation of the area covers 5900 kilometers of shoreline and ten millennia. Archaeological reconstructions are always going to be based on a fragmented view of the past. Archaeologists can try to alleviate these biases by making a conscious effort to generate a sample of shell middens that is more representative of all known shell middens in the area. Future investigations should continue to target small and medium middens, particularly in the southern portion of the study area. Better follow-through with materials removed from all subsurface investigation should be encouraged to better understand activities conducted at the sites.

Geographic Information Systems for Studying Settlement Patterns

GIS in Northwest Coast Archaeology

Geographic Information Systems (GIS) provides the means to formally and systematically study spatial relationships. It is computer mapping software that acts as a data management tool, which stores locations with associated attributes, and is able to generate new information from a variety of geographically distributed data (Savage 1990:23). In archaeology, GIS has improved methods for analysing the spatial distribution of sites. The ease of data exploration can open opportunities for posing new or prevailing questions to existing data. The sophistication of the software offers new strategies for connected lines of evidence that are spatially grounded.

Spatial modeling of sites is founded on the assumption that archaeological sites are not randomly distributed on the landscape. The patterning of site locations is determined by environmental and social factors (Savage 1990:26). Predictive modeling is used to determine the likelihood of sites being located in certain areas (Conolly and Lake 2006:179). It is reliant on the concepts that environmental conditions largely influenced the settlement patterns of past people and that these environmental conditions are still somewhat present on the land (Warren and Asch 2000:7). The British Columbia provincial government began integrating predictive modeling into land management practices in the early 1990s (Moon 1993; Eldridge and Mackie 1993). Some First

Nations groups commissioned their own predictive modeling projects (e.g. Maxwell et al. 1997 for the Heiltsuk). The success of predictive models is measured based on their ability to predict the occurrence of unrecorded sites. The primary concern for constructing predictive models in CRM has been to reduce costs of archaeological mitigation and determine the best areas for high returns (Eldridge and Anaya-hernandez 2005:7). These models tend to be simplistic with no intention of providing explanations for site patterning (Verhagen and Whitley 2012:50). The underlying economic motivation encourages generalization of site locations and minimization of outliers. Variability in site locations is only important for extending the criteria of what areas people occupied, though this is problematic since the aim of the model is to reduce the areas that would require mitigation.

Many predictive models for coastal British Columbia include distance to coastline, distance to fresh water, elevation, and slope (Maxwell et al. 1997; Arcas 2002; Karpiak 2003). Elsewhere, most models are made for land-locked areas in which fresh water is used as an indicator for suitable locations. This can greatly decrease the area deemed as high potential for archaeological sites. When these models are applied to coastal settings, their efficiency for reducing possible land is lessened due to widespread waterways (Manning Diversified Forest Products Ltd. 2014:460). Researchers on the Northwest Coast have worked with spatial models using the same environmental characteristics to investigate site patterning (Cookson 2013; Mackie and Sumpter 2005; Maschner and Stein 1995). The private sector and government reliance on predictive modeling strengthens the need for resolving past assumptions and outstanding questions concerning settlement placement.

Similar Studies

Beginning in the mid-1990s, archaeologists started to use GIS to examine settlement patterns on the Northwest Coast. Existing questions were addressed with new methods of inquiry made possible by the sophisticated software. GIS has been used by Northwest Coast archaeologists in other ways, such as in intra-site spatial analysis (Shepard 2014) and palaeo-environmental modeling (Punke 2001; Sanders 2009). This section is an overview of studies that examine the distribution of sites on the landscape using GIS. I discuss some settlement studies conducted that are not GIS-driven, but contain themes that transcend the varying methodological approaches.

Maschner and Stein (1995): The environmental characteristics important to settlement locations were southern exposure and protected beaches suitable for landing boats. No correlation was found between site area and the five geographic factors analyzed.

Maschner (1996): Through time there was a transition from settlements emphasizing locations with good resource proximity (access to salmon and good intertidal area) to locations that were more defensive (linear shorelines with better visibility).

Cookson (2013): Social factors were the main variables influencing of site placement (i.e. defensibility and social memory), more so than proximity to subsistence features. This is pronounced for villages that were occupied after periods of warfare (2000-1500 BP). Through time people resided amid larger groups and villages were more clustered.

Supernant and Cookson (2014): Village interconnectedness increased through time, corresponding to periods of increased conflict, as determined by intervisibility between villages and water travel time. Proximity to other villages was more important than environmental factors.

Mackie and Sumpter (2005): Early period (9500-9400 BP.) and late period (2000-200 BP) sites often do not occur in the same locations and people organized themselves differently for land use activities. Early settlements suggest a generalized subsistence strategy. Late period sites were more specialized and exhibit more variability.

Lepofsky (1985): A range of food resources was most preferable for settlement locations. All villages had access to salmon but there is a slight association between large villages and productive salmon streams, and small villages and highly fluctuation salmon streams.

Mackie (2003): From the 576 middens, there are 5 to 9 central settlements based on network analysis calculated using site area and distance between sites. The connection people had to places and the intensity of occupation at locales was a result of *habitus* rather than optimal interconnection between villages.

Karpiak (2003): The types of archaeological features found in different physiographic settings could be predicted by a model based on ethnographic, historic, and traditional knowledge sources. Environmental variables that were identified as important for winter villages did not coincide with the location of shell middens.

Letham (2014): Annual settlement patterns are similar for prehistory and the ethnographic period, although there was a great amount of variability. People occupied the inlets during the spring to fall, and the outer coast during the winter.

McLay (1999): Settlements are associated with critical resource areas, particularly sandy beaches with good intertidal zones. The occupational intensity of settlements (reflected in site size) is correlated with the productivity of nearby resource habitats. Faunal materials indicate people exploited nearby resources.

Figure 12 (previous page). Location of similar studies on the Northwest Coast addressing settlement patterns and the author's main conclusions.

I include a brief summary of the conclusion of each study, along with the location of each project (Figure 12). Then I discuss the methods and motivations of these studies, drawing out comparisons to my own project.

Factors/Variables Considered

The main focus of settlement pattern studies on the Northwest Coast has been proximity to resources. Archaeologists assign economic values to locations based on resource availability, either through data on species distribution or other indicators (e.g. habitat types) (Cookson 2013; Mackie and Sumpter 2005; Maschner and Stein 1995). Some critiques have spoken against explaining settlement patterns based on energy maximization models since they reduce the environment to its use-value and ignore social, political, and historical dimensions (Kosiba and Bauer 2012:64). While at times this may be the result of settlements studies, I believe this is rarely the intended outcome for the Northwest Coast. Maschner (1996:187) describes the earlier sites as being economically maximizing (then transitioning to political maximization) but his only variable for resource availability (other than fresh water) was beach habitat. He was unequipped to conclude if sites were optimizing proximity to resources because he lacked sufficient data. In contrast, Mackie and Sumpter (2005) used many more resource indicators and found associations with site locations. Instead of describing their findings as suggestive of economic optimization, they center their discussion on the different subsistence strategies people employed. McLay's (1999) project evaluated the placement of settlements in relations to critical marine resources. He found that sites were situated in resource rich areas, particularly locales with predictable and abundant resources (i.e. herring and shellfish). Optimal models will never suffice as explanation for site distributions, but preferences for favorable conditions can be demonstrated.

Archaeologists have included non-environmental factors in an attempt to avoid settlement analysis that is entirely based on economic factors (Conolly and Lake 2006:180). Calculations for the area visible from sites has been considered a cultural variable that is relevant for security and social/hostile relations (Bocinsky 2014; Cookson 2013; Maschner 1996). The interconnection between settlements has been modeled based on the distances apart (Mackie 2003; Supernant and Cookson 2014). Mackie (2003) and Supernant and Cookson (2014:182) have described their work as social geography since they go beyond just the interaction between people and their environments (also, Lepofsky 1985). Instead, they attempt to deal with social, historical, and sacred elements in relation to site patterning. These then become the explanations for site distribution, rather than models based on maximizing energy output. Supernant and Cookson (2014:182) criticize the use of social explanations only when economic optimization models fail to account for site distribution, citing Maschner (1996). When results deviate from expectations based on optimal resource positioning, it is sometimes attributed to other aspects of human behavior (e.g. security in Supernant and Cookson 2014).

Any settlement pattern study can only include a fraction of the environmental and cultural factors that could have been relevant to location suitability. In part, the variables chosen by the archaeologists are governed by the research questions. To substantiate claims about the role of resource preferences (or an association with any environmental factor), the locations of site are compared to non-sites to see if they differ from the expected occurrence of those characteristics[15] (Mackie and Sumpter 2005; Maschner and Stein 1995). This same methodological standard used to validate economic models has not been applied to non-environmental variables. Unsurprisingly, when researchers set out to demonstrate if social or political factors influenced site placement, they have successfully demonstrated their importance[16]. Bocinsky (2014) stresses the need to build a null-model to assess if sites were actually positioned in defensive locations beyond the expected baseline. Maschner (1996) and Supernant and Cookson (2014) describe fluctuations in the preference for defensible locations through time, but did not assess if sites were particularly better suited for this compared to the average location on the land. Some cultural factors that influence settlement distribution will never be known or cannot be quantified; thus, they are difficult to examine using GIS-based spatial analysis. However, in the cases when archaeologists want to use GIS methods to demonstrate the importance of cultural factors, then they should adhere to the same rigorous standards that are expected when examining environmental factors. In this project, I included viewshed analysis on sites but did not conduct it on the random sample of points from the area. Because of this, I cannot claim that people chose locations due to visibility standards,

[15] This is done in GIS by generating random points as a representative sample of environmental conditions.
[16] To be fair, Supernant and Cookson (2014) do show convincing results for changes through time.

although this is possible in future work. Instead, my interpretations about site visibility are limited to comparing settlement categories.

Site area is a consideration in all of the studies, at least indirectly as a proxy for site type. Select researchers have sought to examine if favorable environmental conditions are reflected in site size, following the assumption that site dimensions are indicative of occupational intensity. McLay's (1999:27) results indicate a correlation between midden sizes and productive resources zones, and that the faunal materials of these middens matched the ecological habitat type in the vicinity. In the Bella Coola valley, Lepofsky (1985:123) identified an association between village size and the productivity and reliability of salmon streams. Maschner and Stein (1995:72) were the only ones that found site area to be independent of their environmental variables. Potentially, this could be because none of their variables[17] were explicitly indicative of resource distribution. My own project contributes to this debate since, in part, I am comparing the locational characteristics of small and large shell middens.

Issues of Scale

Undertaking settlement analysis requires careful consideration when defining the study area since the spatial extent influences patterning and the extrapolated conclusions. Covering a large area has the benefit of including an abundance of sites and being able to make regional observations. Areas can be partitioned into smaller extents to contextualize sites within their environmental setting and to compare local patterning. Karpiak (2003) does this by examining land use activities based on distinct physiographic zones[18]. Sumpter and Mackie (2005) compare their regional results to a smaller subdivision as a control to validate their findings[19]. Archaeologists need to find an appropriate scale of analysis for balancing detail and regional overview. GIS easily facilitates toggling between spatial scales and attribute groups for analysing large quantities of data. For my research, I am covering a large area but partition it into smaller areas. From this, I am able to compare site patterning in varying environmental contexts.

[17] Their variables were beach quality, direction, landmass, distance to water, and exposure.

[18] Karpiak (2003:10) does a good job of testing her model in different environmental settings rather than having general expectations for site locations for the whole area. She uses inside/outside coast, inlets, estuaries, river valleys, lakes, coastal/inland mountains.

[19] The Hecate North Inner Coastal Region was selected to act as a control since the shorelines were protected and therefore less likely to have lost sites from coastal erosion (Sumpter and Mackie 2005:341).

In some cases (Cookson 2013; Maschner and Stein 1995; McLay 1999) the initial study area is so small that is it not possible for further spatial division since the sample size will become too small and the research is already locally orientated. By using a small study boundary, Letham (2014:282) argues that he can reasonably assume that site occupants would have interacted since the settlements are in close proximity. A small areal boundary is preferable for finer detail or when including additional sources of evidence (Letham 2014; McLay 1999). However, it needs to be emphasized that the patterns observed are locally contingent and do not necessarily represent the region. As I uncovered in my own project, the locational characteristics of settlements are rarely ubiquitous.

The quality of settlement pattern analyses is improved when the temporal and spatial dimensions of archaeological data are integrated (Mackie 2001:13). The ability to do this is contingent upon the availability and quality of chronological indicators. If sites are radiocarbon dated, they can be allocated time periods and archaeologists can look for temporal changes (Cookson 2013; Maschner 1996). However, this requires a certain level of investigation into a sufficient proportion of sites. Those who have done this have also been examining relatively small geographic extents (Figure 12). In my study area there are 45 sites that have been directly dated and 35 with evidence of post-Contact occupation (total n=74), but this only represents 21% of the shell middens (Appendix G). Over such a large expanse of land, and being aware of the variation that exists, the 21% of sites is not sufficient to make any substantial claims about changes through time. At present, no GIS-based settlement study on the Northwest Coast has examined the differences between pre-Contact and historical sites.

In other circumstances, archaeologists have been able to use indirect indicators of occupation period. In areas with known fluctuating sea-level histories, the distances between the site and the shoreline is used as a chronological proxy (Mackie 2003; Mackie and Sumpter 2005). Where this has been applied, the projects have included the largest number of sites[20] over the biggest area (Figure 12). For the Central Coast, the stable sea-levels prohibit using the position of the site in relation to the modern shoreline as an indicator of occupation chronology. Unfortunately, the temporal dimension of settlement patterns on the Central Coast will not be dealt with in this thesis.

[20] Mackie (2003) includes 576 middens. Sumpter and Mackie (2005) use 436 sites (lithic scatter and middens).

Like Karpiak (2003), which is the only one of the aforementioned settlement studies that does not have chronological data, I will be focusing on differences in patterning based on physiographic zones.

In the majority of these studies, patterns were observed based on some sort of settlement categorization. Most often this was done by time periods (Cookson 2013; Mackie and Sumpter 2005; Maschner and Stein 1995), or by site size (McLay 1999), or spatial zone (Karpiak 2003). Some degree of partitioning is necessary since shell middens are not homogenous – they are from varying environmental contexts, and represent different site types and occupational histories. Understanding the distribution of settlements on the landscape cannot be done if all the settlements are treated as a collective group. For instance, Cookson (2013) determined that distance to salmon was not a suitability factor for villages in Prince Rupert Harbour. Yet these are all villages in proximity to the Skeena River (one of the main salmon rivers in British Columbia), in what has been described as an area of 'extreme salmon specialization' (Coupland et al. 2010). Rather than accepting Cookson's results as contradictory to the general archaeological understanding of the area, the issue could have stemmed from expecting all middens to require the same locational criteria. Organizing middens into meaningful categories is one way to circumvent ascribing ubiquitous standards of settlement suitability.

Number of Variables

Availability of data and the prevailing research agenda dictate what variables archaeologists include in their spatial analysis. Through time, the amount of variables included in such analysis has increased. Karpiak (2003:105) acknowledged that the failure of her model to predict the location of winter settlements may have been, in part, due to the small number of variables included (n=3). The efficiency of completing such projects increases as researchers build upon the work of others. Computational technologies have improved and more data have become accessible. Interestingly, several settlement studies conducted prior to adoption of GIS in archaeology used salmon stream data to explain site distribution (Hobler 1983; Lepofsky 1985; Pomeroy 1980), but the earliest GIS projects did not include this variable (despite Maschner and Stein (1995) addressing economic maximization in regards to site placement). Mackie and Sumpter (2005) were the first to include species distribution data in their GIS project: salmon, harbour seals, and seabird nesting areas. Cookson (2013) looked at the distance of site to salmon, herring, and kelp. I use the same resource variables as Cookson, with the addition of eulachon.

In most cases, the distribution of sites is examined separately from the midden's archaeological contents. Data on faunal samples have been used successfully in conjunction with site patterning, but only in projects that examined a small area (Letham 2014; McLay 1999). While this approach is advantageous for aligning observations about locational preferences with the material remains from site occupants, it is costly in terms of fieldwork and material analysis, and thus, limits the ability to conduct such a project. Most often, the synthesis of settlement pattern analysis and tangible archaeological evidence comes later. In my project, I did not included any specific site evidence (e.g. faunal, artifacts, seasonality data) but these could be incorporated in the future.

Conclusion of Similar Studies

The few settlement pattern studies that have been conducted on the Northwest Coast have varied in their methodological approach, geographic extent, and research intent. These local studies cannot speak to other areas of the Northwest Coast. Reaction to economically driven models led to the incorporation of cultural factors to explain site patterning. Environmental or cultural variables have yet to sufficiently enable archaeologists to determine why settlements are located where they are or explain why certain locations were more intensively occupied.

One of the problems with settlement analysis is that it is difficult to make neat statements about site patterning. The locations of sites are extremely variable – a result of different settlement types, seasonality, and the long occupational history of the coast. Archaeologists can increase the complexity of their models and research design to better describe real-world phenomena. However, this leaves archaeologists with equally complex results in need of deciphering. Simple and singular conclusions about site patterning are suspect. Even though these spatial models allow for quantifying environmental variables, the results still need to be sifted through our current understandings of these cultures that comes from Indigenous knowledge, archaeological evidence, and ethnographic and historical documents.

My project does not resolve this. Rather, the results underscore the variability of settlement locations. I have included more variables and used a larger geographic area than any of the previous studies in an attempt to test several influencing factors. Pomeroy's (1980) work of settlement patterns on the Central Coast remains vital but updates to his conclusions are required. In the thirty-five years since his project, additional archaeological sites have been located and more research has led to a better understanding of specific sites. Roughly, 130 middens have been additionally recorded, although the boundaries of Pomeroy's and my study areas are not exactly the same. By borrowing approaches used in similar studies on the Northwest Coast, I have systematically incorporated multiple environmental and cultural factors to discern settlement patterns on the Central Coast.

Chapter 3: Methods

This chapter describes the steps I used to analyze settlement patterns of archaeological sites on the Central Coast of British Columbia. I began by constructing a database of archaeological sites and their properties using compiled information from previous archaeological projects. I created a model of the area using GIS with environment and species data from various sources. The attributes I selected for investigation were based on potential relevance to settlement patterns and data availability. Using the GIS model, I ascribed attribute values/categories to each shell midden. Several hundred random points were generated and given values for the same attributes to create a representative sample of environmental baseline values. I analyzed the results in several stages at multiple spatial scales and based on site properties using statistical and manual observations. The following diagram is an outline of the processes I used for this project (Figure 13).

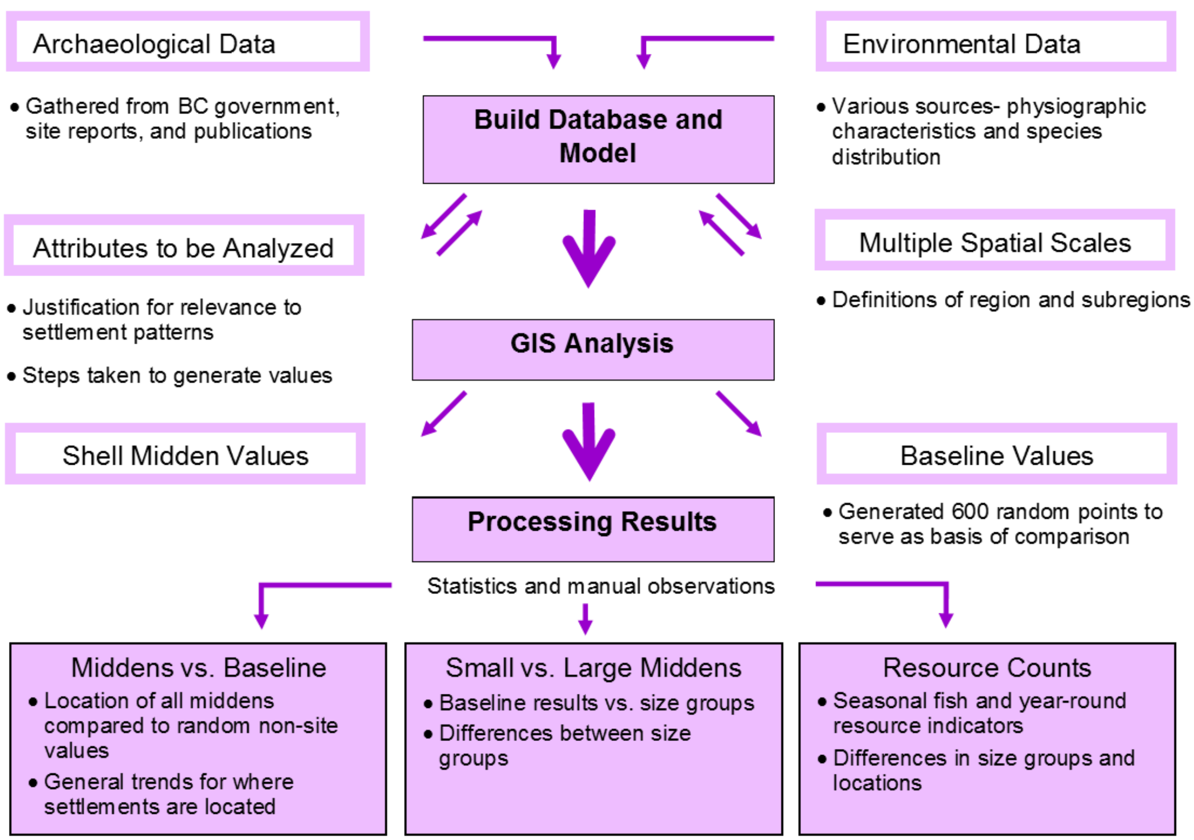


Figure 13. Summary diagram of the main stages for data acquisition and analysis.

A database was created for all the inventoried archaeological sites on the Central Coast, excluding culturally modified trees. The location and attributes of each site were obtained with Remote Access to Archaeology Data (RAAD) – the government of British Columbia's provincial database of archaeological sites. Available site reports and scholarly publications were used to fill in missing details. Within the boundaries of my study area there are 766 archaeological sites[21], 351 of which are unique shell midden sites. The dataset includes site features, previous archaeological investigations, and information from subsequent analysis of materials (faunal, radiocarbon dates). These sites represent the cumulative archaeological work in the area from the year 1938 to June of 2014.

A model of the Central Coast environment was constructed using ArcGIS 10.3. The foundation was established using a digital elevation model (DEM) obtained from GeoBC at 25 m resolution. Several sources were used for environmental data and species distribution and included in the model (Appendix B). Selection was based on a combination of what was deemed potentially relevant to site patterning and what data were digitally available. After the model was built, archaeological components were added into the GIS from the compiled database.

After values had been generated for the sites and randomly distributed points, the attributes were analyzed using a combination of statistical tests and manual observations. This was conducted in three stages, progressing from a general view to a narrower scope. First, I confirmed non-random distribution and differences in subregions based on all middens. This was repeated but processed separately for site size groups. Lastly, I analyzed trends in settlement association with resources. I completed the results for each stage before starting the next, so the initial results influenced later directions. Improvements to the process included modifying spatial boundaries and using distance categories rather than absolute values. This is an advantage of constructing a GIS model and database since the attribute values were already generated and as new questions arose they could immediately be addressed.

One aim of this project was to examine how various geographic contexts affected the observable patterns of site location. Each stage of analysis began at the broadest regional scale, and then was repeated for smaller subregions. These subregions did not remain the same for all analyses. I

[21]Not including culturally modified trees.

shifted the boundaries whenever alternatives were more appropriate, often to accommodate sample sizes and to group similar environmental settings. Results were produced at multiple scales so observations could be compared against each other from fluctuating vantage points.

Methodology for Comparing Shell Middens to Environmental Baselines (Results Section 1)

This initial stage examined if the locations of shell middens have an association to particular environmental attributes to demonstrate non-random distribution. This was done by comparing sites locations to the expected baseline values of environmental attributes. Variation in site distribution was observed by subdividing the study area into smaller spatial boundaries. This process identified which attributes showed an association with sites, but could not necessarily demonstrate which factors were relevant to people in the past.

For this project, the *region* refers to the entirety of my Central Coast study area (Figure 1). The initial conceptualization of this work began with Namu (ElSx-1) as the central location. The final boundaries were determined based on Borden blocks. In total, the region has 77 Borden blocks (11 East-West and 7 North-South), though only 63 contain land. They run 130 km north to south and 120 km east to west. Altogether, this region includes 5900 km of shoreline. Initially the region was divided into six subregions to group areas with more uniform physical characteristics (Figure 14). The region was split into an East and West side (inner and outer coast) with the dividing line running along Fitz Hugh Sound and separating the land west of Ocean Falls. Next, the area was split three ways latitudinally based on breaks in island groups. The resulting subregions and their shell midden totals are: Northwest (n=51), Centre West (n=145), Inner Area (n=44), Southwest (n=14), and Southeast (n=97). These subregions were created based on geography,

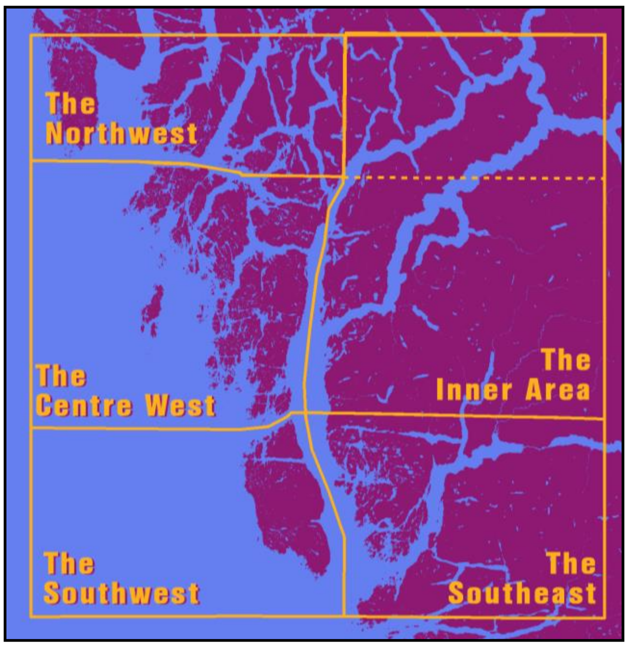


Figure 14. The Central Coast study area divided into five subregions.

without taking into account the number of archaeological sites, so the total numbers of sites are not equal. Initially, I created Northeast and Centre East subregions but the small number of shell midden sites in these subregions led to combining them for analysis and terming it the Inner Area[22].

These five subregions were used for the part of my analysis that looked at the location of all recorded shell middens and therefore had the largest sample sizes (n=351). Because of this, these subregions have the smallest assessed spatial boundaries. There are areas that could be studied on a smaller scale while maintaining sufficient site counts, such as parts of the Centre West and Southeast, but I did not explore them here.

Randomly Distributed Points

A representative sample of random points were used as a foundation for understanding the environmental properties and variation of the region. This permitted shell midden locations to be compared to estimates of expected environmental traits at multiple scalar levels. In total, 600 random points were generated for the region, with 100 in each of the original six subregions (Figure 14). For this project, averages and proportions generated from these random points are referred to as *baseline* values. All random points are within 200 m of the shoreline to emulate the coastal orientation of archaeological sites. For each attribute included, the process of calculating values or assigning categories was done in the same manner for the random points and the shell middens, unless otherwise noted.

Data Analysis for Section 1

The analysis was first done for the whole region, comparing the values from all shell middens (n=351) to the random points (n=600). The same steps were then done within the five subregions. For the subdivided areas, only random points from those subregions were used for the comparison. An unpaired *t*-test was used for comparisons on attributes with numerical values[23]. Categorical attributes with two possibilities were assessed with the Fisher's exact test. Chi-square tests were used for all other categorical attributes. The threshold value for significance was set at a p-value of 0.05. Attributes were noted as being 'nearly significant' when p-values were 0.1 to 0.05.

[22] Their geography is relatively similar. Shell midden counts for the Northeast were n=9 and for the Centre East were n=35.
[23] In retrospect, a Wilcoxon signed-rank test would have been a more appropriate statistical test to use.

Manual visual inspection of the averages and categories was done, and when it appeared there was a discernable difference between observed site and random point distributions – even if it was not detected in the statistical tests – it was noted. The associations I identified using this method are explained individually in Appendix C and labeled as 'Value Judgements'. For the entire project, there were only five associations identified as 'Value Judgements' out of the 360 statistical tests run and all have p-values below 0.2. Due to conducting such a high number of tests, approximately 5% or more of the results are expected to show a positive association even when none actually exists. Therefore, the consistency of results was considered during my interpretation and discussion. Analysis for Section 1 had the largest sample sizes for shell middens since it did not differentiate based on length, and all middens were treated as a single group. I present these results in Chapter 4: Section 1.

Methodology for Comparing Shell Midden Size Groups (Results Section 2)

The Section 2 of analysis was done the same was as the previous stage but with the objective to determine if there were differences between site sizes in their association with environmental attributes. This was done to see if there was a discernable difference in the location of small and large shell middens – a reflection of the occupational intensity of the settlements. I compared spatial groupings of small and large shell middens to the same sample of random points from Section 1, and then compared the size groups against each other. Shell midden sites with reported dimensions were fit into size categories. Of the 351 shell middens, unfortunately only 62% have accessible information on their dimensions (n=218). Shell middens in this area range in length from under 1 meter (EjTa-10 and FbTa-30) up to 800 meters (EiSw-7 and FaTc-4) (Figure 15).

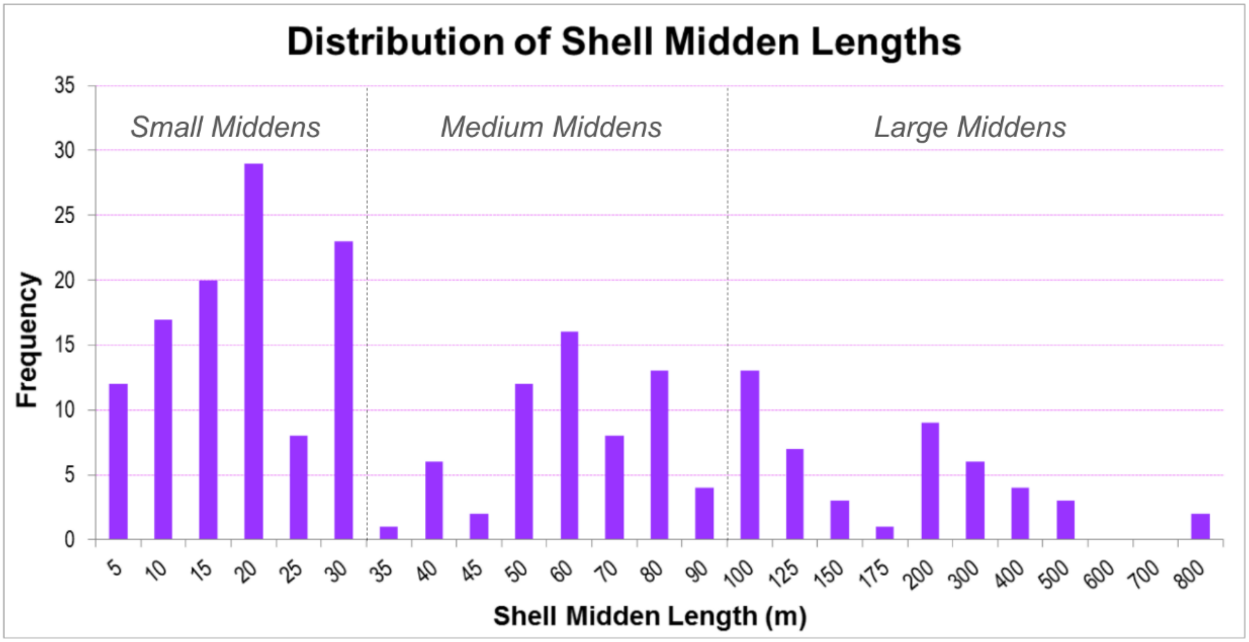


Figure 15. Histogram of the length of shell middens with recorded dimensions (n=219).

Three size categories were created – small, medium, and large shell middens. Small middens included any site that was 30 m or less in length. Any midden with a recorded length between 31-99 m was designated as medium. The large middens were those that were 100 m or longer. The medium middens were excluded from parts of my analysis where differences in locational settings among sites sizes were examined. This reduced the ambiguity of the middle range middens[24] by focusing on groups clearly distinguished by size (Figure 16).

[24] In earlier stages, I was including this medium category in my investigations and almost always this size group would display the most variability in results.

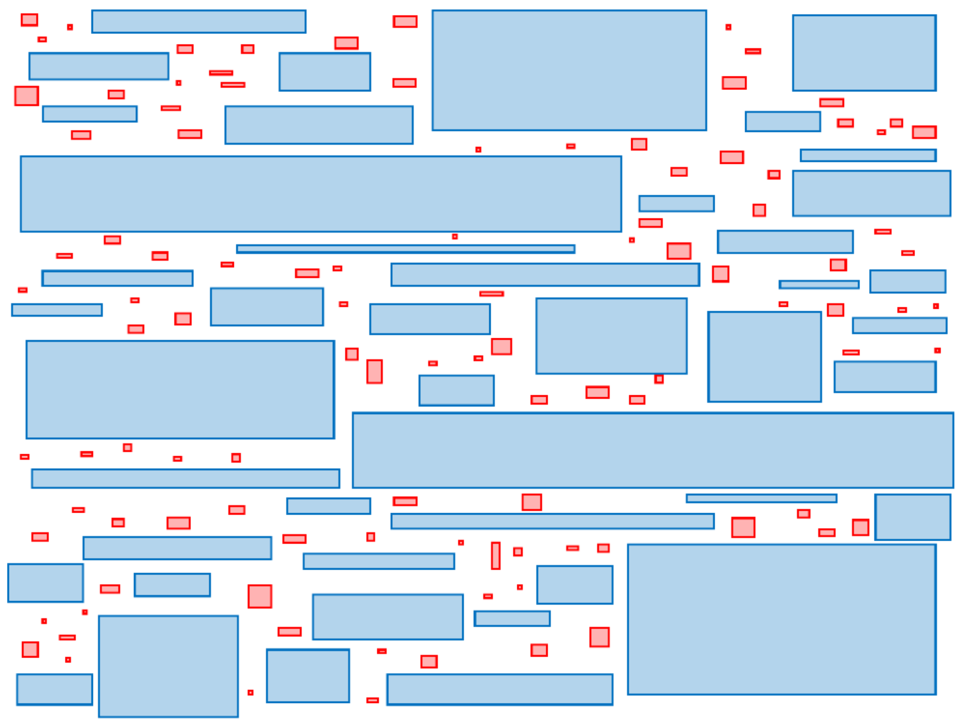


Figure 16. Relative size of small (red) and large (blue) shell middens. Rectangles are proportional to the length and width of shell middens. This shows the clear difference in form between size groups.

For this stage of analysis, the grouping of shell middens into categories reduced the sample size, making the subregions from Section 1 not conducive to statistical testing. In order to make up for this, the spatial extent of the subregions needed to be expanded to still be able to run statistics and look for robust patterns. Pairs of subregions were joined together to create larger extents and include more shell middens. The Inner Area remained the same. The Northwest and Centre West were grouped as the Outer Area. The Southwest and Southeast formed the South Area (Figure 17). Previous research on the patterning of sites in this area indicated the significance of the East and West divide, both environmentally and culturally (Hester 1969:32; Hobler 1983:153). The decision to have the South Area as a third group, as opposed to using only an east and west side, prevented any juxtaposition between the groups from automatically being attributed to environmental differences in the

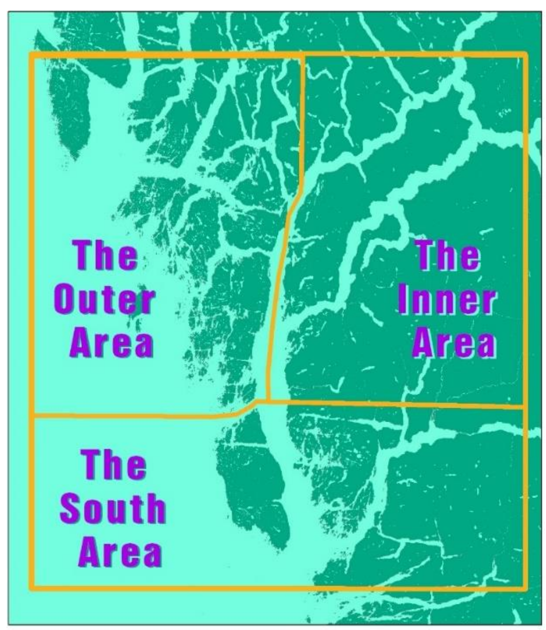


Figure 17. Boundaries for the three subregions used in Section 2 Results.

inner and outer coast. Furthermore, it was not obvious geographically how the South Area could have been split into the east and west groupings.

Data Analysis for Section 2

Small and large middens were compared separately against the random distribution values for each environmental variable, first for the whole region and then for three subregions (Figure 17). Results are presented in Chapter 4: Section 2. For all of the attributes at each spatial level, the small and large middens were compared against each other to see if there was an apparent difference in the locations they occupied. The same statistical tests from Section 1 were used. Personal judgment was necessary for this stage, more so than the previous one, since the reduced midden sample sizes affected the ability to return statistically significant results (Appendix C).

Methodology for Tallying Resource Proximity (Results Section 3)

The final stage of analysis specifically examined settlement proximity to resources, as an indication of generalized economies and specialized resource targeting. I did this to test if there was a difference in the nearby resource base of small and large shell middens, and again, to observe differences between geographic areas. To simplify this process, shell middens were ascribed a count of resources in their proximity based on distance cut offs. Resource affiliated attributes were

Table 4. The criteria used for attributes to constitute if sites have resource indicators in their proximity.

Seasonally Available Resources	**Salmon**	within 1 km of a salmon spawning stream
	Herring	within 1 km of herring spawning area
	Eulachon	at mouth of a eulachon river, done manually rather than by a set distance
Year-Round Resource Indicators	**Wide Beach**	within 250 m of a wide beach
	Kelp	within 1 km of bull or giant kelp
	Lake	within 1 km of any lake
	Shoreline Intricacy	if the shore length was greater than 50% of the baseline values for the subregion (the 6 original) based on high tide and low tide line within 500 m
	Persistent Stream	within 500 m of a stream that is connected to a lake
	Sand	if the shore in front of site contains sand, in any substrate combination

split into two groups. The first group was seasonally available species, all of which were based on fish spawning areas. The next group, year-round resource indicators, was based on favorable environmental conditions or habitats. The criteria for resource proximity to sites are listed below (Table 4).

For Section 3 analysis, I first compared the resource counts between all large and small shell middens in the region. For the geographic comparison, I used two subregions that contain a similar range of environments. I retained the South Area used during Section 2, then created an additional spatial boundary that better suited the objective of the analysis. The new subregion, the Bella Bella Vicinity (BBV), is based on a 40 km radius around Old Bella Bella (Fort McLoughlin, FaTa-4) (Figure 18). Not all shell middens were included for this portion of analysis, which helped create a buffer between the subregions. It omitted sites that were extremes or outliers.

Figure 18. The Bella Bella Vicinity and the South Area subregions used in Section 3 Results.

Both subregions have areas of the outer and inner coastal zones. They also have similar quantities of large and small middens within each size group. These areas represent portions of the traditional territories of the Heiltsuk and Wuikinuxv First Nations. However, these boundaries were not used to examine variation between these Indigenous groups.

First, the tallied resource counts were compared between all large and small shell middens in the region. Next, the same suite of comparisons was done between the South Area and the BBV. The baseline values derived from the random points were not part of this stage of analysis. All statistical analysis was conducted using t-tests or chi-squared tests.

Attributes Investigated

After completing the archaeology dataset and environment model, attributes that would be analyzed for site patterning were chosen based on their potential relevance to location suitability. These attributes could all be quantified or categorized. The following section describes each attribute, the justification for considering it, and the calculation processes.

Ideally, other attributes would have been included because of their discussion in the literature or their documented significance to coastal people, but they were not digitally available. This was most often a problem for species distributions, especially vegetation. The pertinence of some attributes that were included was more uncertain, but the available data made their exploration possible.

Fish Spawning Areas – Salmon, Herring, and Eulachon: For this project I utilized spatial data on the spawning locations of salmon, herring, and eulachon. These fish are fundamental to the subsistence of coastal First Nations (McKechnie et al. 2014:807; Mitchell and Donald 2001:21; White 2006:21). Salmon and herring are abundant in midden deposits. Eulachon remains are less common but have still been recovered in shell middens (Cannon 2000b:730). Eulachon also has the most limited distribution, with runs in only seven rivers in the region. The data sources used provide information for the spawning locations of these fish. It is possible that people caught them in areas other than their spawning locations, such as along salmon migration routes.

Spawning habitats are predictable in their timing and location. Their seasonality is connected to the annual cycles of other animals that also take advantage of these surges of available food (e.g. Ben-David et al. 1997:804). Seals follow the eulachon up the narrow channels, bears rely on the salmon, and flocks of birds feed on schools of fish. Even coastal bears and wolves eat the eggs deposited by herring along the shorelines (Fox et al. 2015). The forests around these areas are fertilized by the marine nutrients deposited from feeding animals and decomposing fish (Reimchen et al. 2003). People would be able to utilize the abundance and variety of resources connected to these food webs. The straight distance between shell midden sites and the closest spawning location was calculated for each fish species.

Kelp: Kelp is edible and serves a variety of material functions. Kelp forests provide habitats for a variety of marine organisms, some of which (e.g. sea otters, greenling, and urchin) were used by coastal people (Turner 2003:286). The Heiltsuk harvest herring roe that is deposited on kelp (Brown and Brown 2009:39). The distance from shell midden sites to the closest bull kelp and giant kelp was calculated.

Fresh Water Streams: Streams are important as predictable sources of fresh water. They provide specific habitats for animals and plants that may have been utilized. In some situations, inland travel may be easier along waterways than through the thick brush. The distance between shell middens and streams was measured.

Lakes: Lakes provide reliable fresh water sources and a variety of fish species. The ecosystem surrounding lakes is an important habitat for mammals, birds, and plants. There are reports indicating that the timber that grows around lakes is better for woodworking than the trees on the coast that are exposed to the wind and waves (Eldridge 1992). In some cases, lakes can also be used for inland travel. For example, the Wuikinuxv used Owikeno Lake and a short inland route to connect with the Nuxalk (Hilton 1990:314; Olson 1954:214). The distance between shell middens and lakes was calculated.

Shore substrate: The substrate of the beach in front of the site has an impact on what shellfish species can live there and can indicate what resources may have been available to residents. Certain types of shoreline substrates may be desired based on the intended activities of the settlement's occupants. Shellfish habitat suitability is largely determined by beach composite. For instance, bay mussels (*Mytilus trossulus*) are found on rocks, while butter clams (*Saxidomus giganteus*) and littleneck clams (*Protothaca staminea*) require mud and sand to burrow (Moss and Erlandson 2010:3359). Shoreline conditions affect land and water access based on the ability to beach canoes. Some archaeologists have identified middens sites as defensive 'forts/refuges' based on their inaccessibility and/or steep shorelines (Maschner 1997:80; Moss and Erlandson 1992:74). The physical properties of the shoreline came from a government inventory on the geomorphology and sediment (Howes et al. 1994). Shell middens were assigned the physical characteristics of whichever shoreline was closest to the site at the high tide line. I reduced the number of categories by combining shore types that had the same substrate combinations. Shell midden sites had the following shore type categories: Estuary, Marsh or Lagoon; Rock Cliff; Rock with Sand; Rock with Gravel; Sand Beach/Flat; Gravel Beach; Sand and Gravel Beach/Flat; and Rock, Sand and Gravel Beach. In total, 341 out of 351 shell middens were categorized by shore type. Problems arose for sites that were too far from the shoreline (e.g. ElSx-11 on Strawberry Island in Namu Lake), were on shores classified as manmade (e.g. FbTb-39), and where shoreline data were unavailable.

Intertidal Area: The size of the intertidal zone affects the habitat availability for intertidal resources (e.g. seaweeds and shellfish). The extent of this zone could be correlated with the type of activities conducted at the site and the size of the population that lived there. For instance, if shellfish harvesting was a major activity then it is expected that the intertidal zone should be large. It is also a good indicator of a generalized resource base used to supplement stored foods (White 2006:23). Based on this, there could be a difference between small and large settlements in the size of the intertidal zone. For this attribute, I calculated the total intertidal area within a 500 m radius of each shell midden. To do this, polylines of the high tide and low tide were converted into polygons. Then the high tide polygons were subtracted from the low tide polygons. The remaining polygons represented the intertidal area (Figure 19). The sum of the area within 500 m of each midden was calculated. This attribute was not calculated for the randomly distributed points, which prevented comparison of shell middens against the baseline average of this trait.

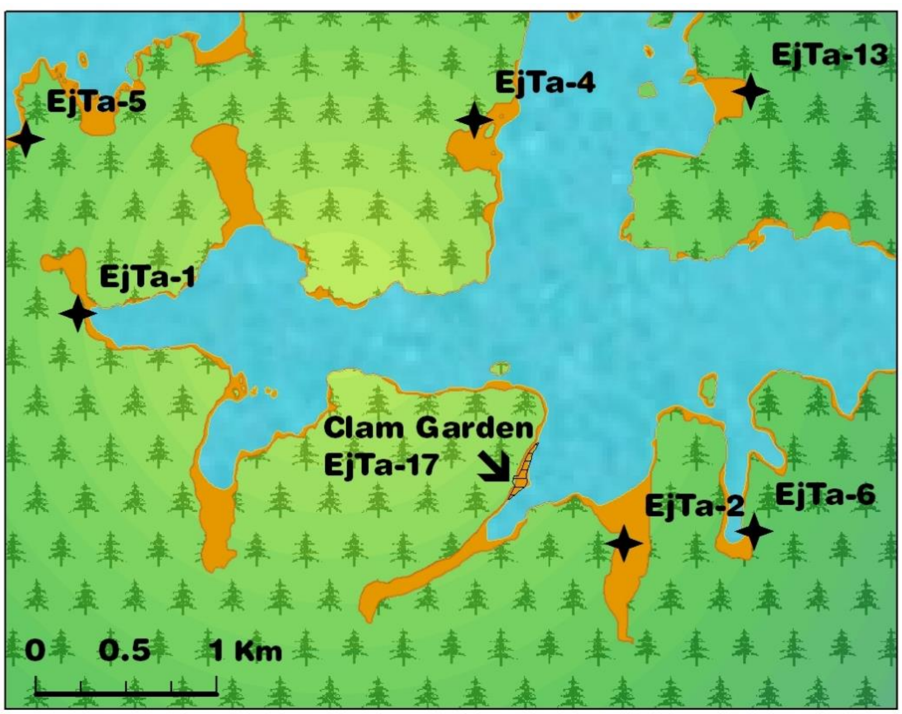


Figure 19. Map of shell middens at Pruth Bay on Calvert Island. The orange represents the intertidal zone. EjTa-17 was included to showcase the resolution of the shoreline data and that the method used to derive the intertidal zone is able to detect clam gardens.

Beach Width: The same reasoning for examining intertidal area applies to the beach width attribute. This was an alternative way of comparing sites using categories rather than exact values. The classification of beach width is based on the distance between the high and low tide lines. A dataset with this attribute predetermined for the shorelines was used. Wide beaches have more than 30 m between the tide lines and narrow beach have less than 30 m. The beach width of the shoreline closest to each shell midden was recorded.

Some sections of shoreline lacked classification for this physical property; only 319 shell middens could be analyzed by this trait (n=319). In addition to the ten shell middens without shore types, sites that were on estuaries did not have an indication of whether their beaches were wide or narrow. Beach width was processed using the random points to provide a basis for the baseline distribution of this trait, which was not done for the exact size of the intertidal area. Beach width and intertidal area are complementary attributes (but from different data sources) that can be used to indicate preferences for certain intertidal zone properties.

Shoreline Intricacy: The length of the shoreline around the site is a relative indicator of resource availability. The rationale for using this attribute was based on the work of Mackie and Sumpter (2005:351) who reasoned this variable could indicate ecological productivity and biodiversity. The longer the shore length within a fixed area, the larger area there is for species habitats in the intertidal and subtidal zones. Greater biodiversity is a result of variations in the microenvironment and differing habitats. Part of the explanation of their results for site locations in Gwaii Haanas was that people living on sites with intricate or elaborate shorelines may have followed more generalized subsistence strategies since they were located in areas with higher biodiversity (Mackie and Sumpter 2005:352). Sites that were on linear shorelines may have been targeting select resources that occur in greater abundance such as shellfish and salmon.

The sum of the high tide line and low tide line within 500 m of the sites was used for the shoreline intricacy value. Neither the low nor high tide line worked well for all of the sites on its own. Sites with huge intertidal areas returned small numbers for their low tide line, which was not reflective of the expanse of shoreline near the site. Similarly, high tide lines were misrepresentative of shoreline intricacy because sometimes the high tide line was intricate but the section of low water mark that made contact with the ocean was small, such as at the end of bays. Therefore, I added the low and high tide shore length for each site to ensure that I was including the advantages and disadvantages of both sets of data.

At some stages of analysis the exact length of the shoreline was used for comparisons. At other times I sorted the sites into categories based on their shore length and adopted the categories used by Mackie and Sumpter (2005): Linear, Sinuous, Intricate, and Elaborate. For each analyzed subregion, I took 100 random points, plotted their shore lengths, and organized each subregion into quartile categories (Figure 14). Each shell midden was assigned a group based on where their shoreline length fell within the categories for their subregion. This made it possible to demonstrate whether people were selecting areas with more convoluted shorelines within the local environmental context. Lake and river delta sites were omitted from the analysis because the tide lines did not reach the sites. There were also some sites where gaps in the shoreline data prevented the calculation of this attribute. In total, seven shell midden sites were omitted from this attribute analysis.

Small Island Area: Settlements could be associated with nearby small islands for a variety of reasons. The presence of islands would increase the shoreline intricacy and intertidal area, beneficial for reasons previously stated. Presumably, these landforms provide shelter by blocking the wind and waves. Forts and refuges are said to be on tiny islands near sites (Moss and Erlandson 1992:74), so people may have wanted islands nearby for security purposes. Islands that were smaller than 10,000 m^2 within 500 m of a site were identified. Their count of small island and the total area were calculated.

Tidal Islands: Tidal islands are islands that are connected to other bodies of land during low tide but separated during high tide. The possibility of this specific island type being pertinent to location suitability is partly derived from the presence of a tidal island in front of Namu. Several sites have portions of the midden extending onto tidal islands (e.g. EjTa-4) and other middens on tidal islands have their own Borden designation (e.g. FaSu-1 – Axeti). They may have served a distinctive purpose or provided the same advantages as any small island in front of a settlement.

This attribute was assessed by manually viewing each site in the model and recording if there was a tidal island in front of the site (Figure 20). There was no set maximum distance that the tidal island could be from the site. It needed to be reasonably close (roughly within 250 m) or in the same bay at the site. Because this was done manually the attribute was not processed for the randomly distributed points.

Figure 20. Example of a site located on a tidal island (EjTa-11) and a site with a tidal island in front (EjTa-9).

Landmass: The size of a landmass has an impact on the terrestrial ecosystem and the abundance of available resources (Darimont et al. 2004:1868). To some extent, there is a distinction between the species that live on the mainland and islands [e.g. mountain goats and grizzly bears usually reside on the mainland (Darimont et al. 2004:1871)] A small landmass may restrict the expansion of a settlement due to unavailability of land or a limited terrestrial resource base. It could also impact land transportation – whether people had reason to travel inland, such as ties with neighbouring groups (Hilton 1990:314).

For this attribute, the high tide shoreline was converted into polygons and split into five categories based on the shape's area.

Mainland	-
Large Island	larger than 50 km^2 (e.g. Calvert I., King I., Hunter I.)
Medium Island	between 1 km^2 and 50 km^2 (e.g. Triquet I., Spitfire I., Duck I.)
Small Island	between 0.1 km^2 and 1 km^2 (e.g. Seafire I., Starfish I., Limit I.)
Tiny Island	less than 0.1 km^2 (e.g. Sunny I., Mouse I., Cliff I.)

The type of landmass on which each shell midden was located was identified and associated with the site. For the comparison between shell midden locations and baseline distributions, rather than use the random points, the shoreline length of each landmass type was summed to provide the exact amount of each category (map in Appendix A).

Exposure: Data used for this attribute were based on the wave exposure of shorelines. People may have sought protected shorelines to avoid strong wave energy and ocean storms. According to Pomeroy (1980:224), protection from the elements was one of the main determinants for winter villages. It is possible that this property had greater importance during the winter since the weather is most turbulent then. A basic level of protection is likely to be important for most settlements, even in the summer. The provincial system of classifying the shorelines includes a rating for exposure based on wave fetch sorted into five classes (Howes et al. 1994:Section 3.4). This is measured based on the distance that waves are generated before reaching the shoreline.

Exposed	Wave fetch over 500 km
Semi- Exposed	Wave fetch between 50 and 500 km
Semi-Protected	Wave fetch between 10 and 50 km
Protected	Wave fetch between 1 and 10 km
Very-Protected	Maximum wave fetch under 1 km

The exposure classification was taken from the shoreline that was closest to the shell midden.

Wind: Considerations for wind levels would be relevant for people to avoid exposure. During the winter, when wind speeds are highest, there is a prevailing southeast wind (Haggarty et al. 2003:23). As such, it is possible that there is a seasonal basis for avoiding winds and from particular directions, which presumably could have been a relevant consideration for people selecting locations for settlements. Data on wind speed and power are available for five kilometer blocks at 30 m above the ground. The wind values for shell midden locations were collected. Statistics for this attribute were run using the annual wind power. Seasonal wind information is also available from this data source, but was not used in the final analysis. The low spatial precision of these data limits their capacity for showing variation between site locations. They can provide a general indication of wind patterning in the region and can reveal differences between areas such as the outer and inner coasts.

Direction: Direction is related to sunlight exposure, maximized by facing south and west. The direction a site faces could be selected for personal comfort and warmth and/or to needing a southern exposure for optimal growing conditions for plants (Karpiak 2003:57). It could be related to reducing exposure to seasonal prevailing winds (McLaren 2008:175). This attribute has been examined in other contexts on the Northwest Coast (Mackie and Sumpter 2005:350; Maschner and Stein 1995:66)[25]. Determining the direction a point (a site) faces is most commonly done in ArcGIS using the Aspect tool on a DEM. I determined this tool to be ineffective for this study area. Sixty five percent of shell middens were categorized as 'flat' instead being assigned a direction because the terrain on which they are situated does not have any slope (n=218), especially on the outer coast. Changes in elevation (i.e. slope) are necessary to determine a direction for the Aspect tool in ArcGIS. The alternative solution I used was to calculate the angle between the site and the ocean shoreline using the Near (*Analysis*) tool (Figure 21). This works because Northwest Coast settlements predominately face the waterfront. Once the angle was calculated, I converted it into the corresponding cardinal direction. The same process was done for the random points. The Near angle method is not perfect, but the results are more accurate than the Aspect tool. Spot checking was done to validate the results.

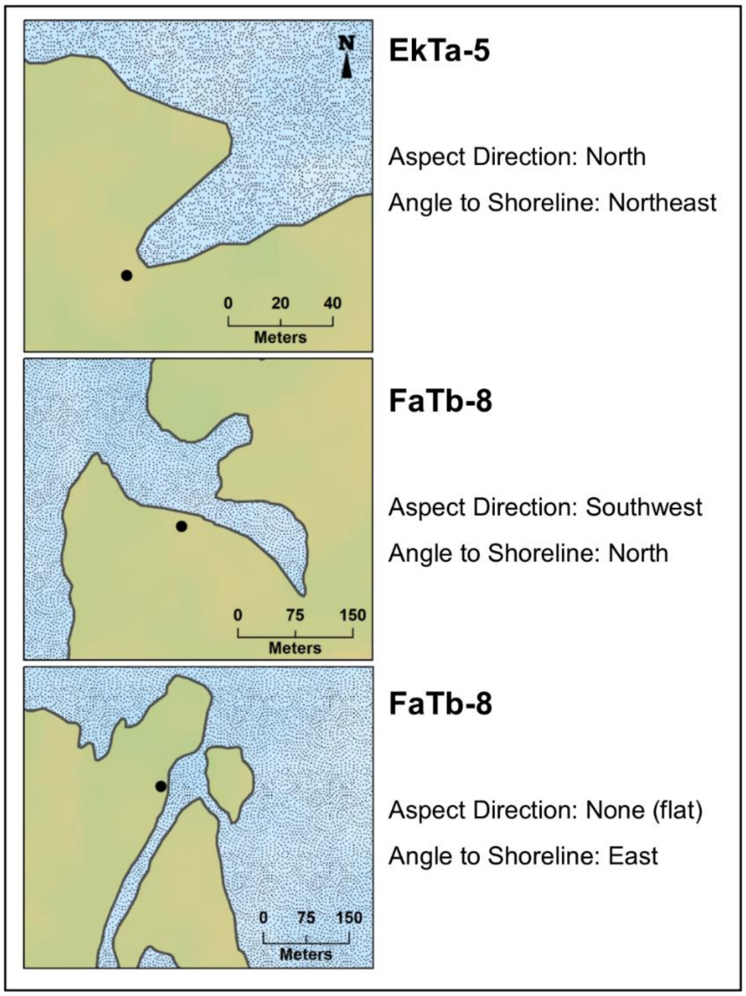


Figure 21. Example of results for the direction sites face based on Aspect method and Angle method.

[25] Maschner and Stein (1995) found significance but was only using North and South. Mackie and Sumpter (2005) found a difference in site direction between Early and Later Period sites.

Elevation: Elevation is an attribute where the desired conditions are unknown and context specific. Greater height may be better for visibility and drainage. Too much elevation would make access to the site from the water difficult. The height above sea level could be important for longevity of a settlement due to shifts in the sea level. The elevation at shell midden locations was taken from the DEM.

Slope: Flat terrain is better suited for settlements. Areas with too severe a slope would be inhospitable. Shell middens were assigned a slope value that was derived from the DEM.

Sunlight: Increased exposure to solar heat is presumed to be a desirable trait for basic comfort. Archaeologists have sometimes explained a tendency for sites to face west and south and to avoid northward exposure in relation to the desire to gain greater exposure to sunlight (Lepofsky 1985:6; Maschner and Stein 1995:66; Punke 2001:68). This could be an environmental factor that ranged in importance depending on the season of occupation, such as maximizing sunlight on a settlement during the winter. ArcGIS software comes with tools for calculating the amount of solar radiation an area receives. This technique allows users to quantify solar energy over a specified time on a DEM. The parameters for the Solar Radiation tool were set to run for each month: for the year 2014, over a duration of 7 days, at a 0.5-hour interval. The accumulated watt-hour per square meter (WH/m^2) for each month was recorded for the shell middens. Statistics were calculated on the July results. There are limitations to this method and it can only serve as a benchmark, not an exact measure. For instance, the Northwest Coast receives lots of cloud cover and trees would cause shade over sites. However, the results from this tool are systematically produced and therefore can be compared between sites.

Visibility: This variable was examined to assess what areas were visible from settlements. On the Northwest Coast visibility requirements are most often tied to defensive concerns and the need to see incomers (Moss and Erlandson 1992:74). The need for defensive locations on the Central Coast is currently unclear in the literature. Within my study area there are eight sites suggested as being defensive forts[26], usually tiny islets thought to operate as a refuge. Ethnographic accounts describe the areas around Koeye River and Schooner Passage as being major locations of tribal contact (Drucker 1943:99; Olson 1954:218). Elsewhere on the Northwest Coast

[26] EjTa-1, ElTb29, ElTb-34, FaTa-26, FaTa-45, FbSx-12, FbTc-11, FcSu-1.

archaeologists have used GIS to systematically assess the defensibility of sites (Bocinsky 2014; Martindale and Supernant 2009; Maschner 1996). The placement of villages in Prince Rupert Harbour has been shown to be strongly tied to violent and turbulent times (Supernant and Cookson 2014). Systematic analysis of site defensiveness has yet to be done on the Central Coast. This is not the intended purpose of this project but since viewsheds were generated for shell middens it is possible to contribute to the debate over settlement defensiveness on the Northwest Coast, at least to the extent that larger viewsheds can be presumed to provide a defensive advantage for site residents.

There are multiple reasons why it is advantageous to have good visibility at a site. People may have monitored the movement of others to control access to resources. People could have wanted to be in strategic locations for observing migrating animals or environmental conditions. Visibility would have varying importance depending on residents' intended activities, settlement permanence, and historical circumstances. Therefore, it is reasonable to estimate that this attribute should differ between settlement types and possibly the time of occupation. The final visibility value generated for each site represents the proportion of the ocean that is

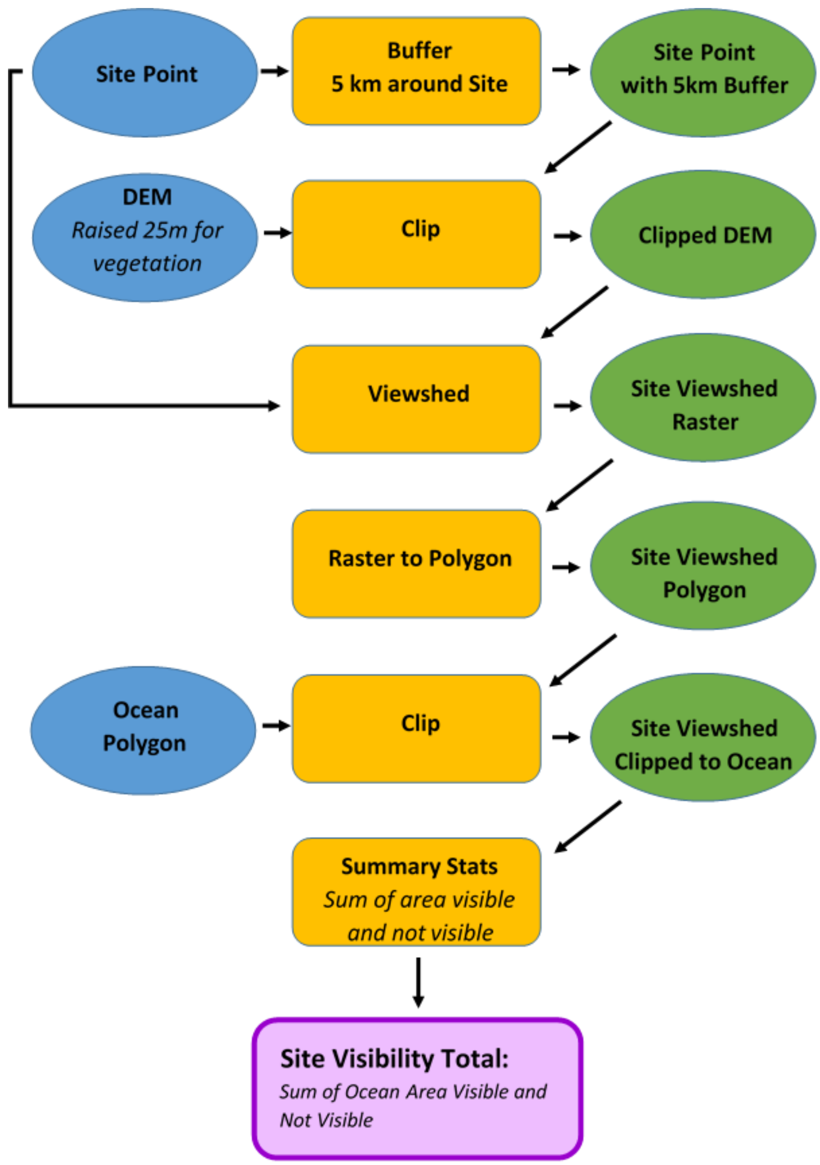


Figure 22. Processing steps for calculating viewshed. Blue indicates existing data files, yellow are ArcGIS tools, and green are resulting data files.

visible within five kilometers of the site (Figure 22). This value does not include the amount of land that is visible from the sites. This was done based on the assumption that the majority of travelling was done by watercraft (Ames 2002:31) and that people were more concerned with actions happening on the water. A five kilometer radius was chosen since it is a reasonable distance threshold for how far people can see with the naked eye. The observer height was set to 1.7 m to represent a standing person. To account for vegetation, I modified the DEM by adding 25 m elevation to the land except for 200 m around sites and not for the ocean[27]. This makes allowances for clearings around sites and assumes that most of the land around the shoreline was forested[28].

This method was not suitable for shell middens that are located up rivers or on lakes since they are not oceanfront. Also, 4 sites in the FcTe Borden block did not work because of problems with the shoreline data in their vicinity. Due to time requirements, visibility values were not generated for the random points.

Data Limitations and Problems

There are potential errors in the archaeological data used for this project. It was collected by various people over a span of several decades, so the quality of the records varies considerably. Mistakes in the provincial database not detected when the permit reports were cross-checked will carry through to the analyses and their results. Therefore, any conclusions should be based on robust patterns. There were some sites in which the coordinates gave a location that was over the water. When there was no site report map to verify the location, I edited the point to be on the closest shoreline.

The 351 shell middens used are the total recorded for the study area by archaeologists. Survey work has been extensive on the Central Coast but these sites do not constitute all of the settlements that exist. The ability to analyze all sites is further diminished since a substantial number of sites are missing information on basic features. There are 133 shell middens (38%) that do not have any

[27] This was required because of the flat terrain on the outer coastal area. Much of the land around shorelines is flat and at sea level. Without accounting for vegetation, viewshed results showed that sites would be able to see over islands and coastlines. This is problematic since even the slightest vegetation would prevent this.
[28] In retrospect, one thing I would modify for this process is creating a 25m buffer of the ocean onto the land to represent the beach and would not have raised the elevation there.

information on their dimensions[29]. For many sites, this information existed at one point, but was either lost or not transferred to the provincial database. Pomeroy (1980) used site dimensions as one of the features he examined after surveying the Central Coast, but several of the sites he visited lack this information. Kisameet (ElSx-3), a site that has had multiple investigations, did not have dimension data in its provincial site record; this had to be acquired from site maps.

Ideally, for this analysis I would have used polygons to represent shell middens rather than points. Polygon files were only available for approximately half the sites, so to be consistent I relied on points. This does influence some results, particularly the ones related to terrain. Most attributes are not affected by it, such as those involving distance measurements. Midden length is only one part of a site's dimensions and it would have been better to work with site area. However, a mere 7% of shell middens had site area included in the site report. The quality and accountability of the archaeological reports for this area is problematic when you consider that 91% of sites off the coast of Vancouver Island (n=526) have recorded areas (Mackie 2001:47).

A major source of potential error, as with many regional archaeological GIS projects, is low resolution of base maps. I obtained the best resolution DEM I could find and only used additional data sources that were detailed enough for local contexts. Some of the attributes examined are naturally correlated to each other or share the same data source. To attempt to obtain the most robust results, I used similar attributes from different data sources even when the attributes were sometimes redundant (e.g. beach width and intertidal area).

Archaeologists encounter problems when trying to analyze the locations of prehistoric settlements in relation to resources and are limited in their interpretations for several reasons. To begin with, I am relying on recent environmental data about the current range of species. Using contemporary data on species' locations acts as a departure point for considering the distribution of resources in earlier times. Recent data represent a baseline configuration that can be pushed backwards, but with caution (Parsons 1972:146). There are problems that arise from using contemporary information and assuming continuity over previous millennia. Residual effects from human exploitation of fish and modern fishing practices have a huge impact on the distribution and

[29] Technically the number is higher if you just use RAAD as the data source since I filled in many site sizes using permit reports.

quantity of species. Still, data are available for the present situation and are worth using to indicate the presence of resources that were potentially exploitable.

The number of species for which we currently have distributional data for the Central Coast are only a tiny fraction of the resources that would have been used by people living in this area. Those that are available are more indicative of their current commercial value. Salmon and herring have a long history of recording due to their commercial importance (Hay and McCarter 2006; Pomeroy 1980:175). The other species data that may be available for British Columbia are animals or plants that are indictors of ecological conditions. Unfortunately, surveys tend to not extend far enough north along the British Columbia coast to include the study area. Sometimes when species data are available, the spatial ranges are so generalized that they do not have the detail necessary to examine difference between sites in the region. This was most often the case for birds and sea mammals. Other important animals have no open access data on their ranges, such as terrestrial mammals. Data on vegetation is one of the largest resource groups absent from the model[30]. Therefore, the information available for this project is reflective of contemporary commercial and social interests and is far from a complete picture of biodiversity. Higher resolution data and the incorporation of more species into the model would have been very useful.

Chapter Conclusion

The attributes listed in this chapter were chosen based on what was deemed potentially relevant to settlement placement and what could feasibly be tested. High criteria of significance levels and standardized methods were used to help circumvent uncertainties in data accuracy that originate from both the archaeological and secondary-environmental data. It is still possible that some associations were incorrectly identified, while others could not be detected with this approach. These methods could be repeated, using the same data sources, in other coastal areas of British Columbia. There is potential for improvement in certain areas where there is more detailed information for archaeological sites and additional environmental data.

[30] I was able to access seaweed data but any other information on plant species is very limited. Landcover data is available but the resolution is poor and reflective of modern day forestry practices.

Chapter 4: Results

This chapter is divided into three sections that each pertain to the spatial patterning of shell middens and their locational characteristics. The objective of Section 1 was to document which types of locations people were utilizing in the past, and if settlements were non-randomly distributed in relation to particular environmental variables. This was done by demonstrating associations between settlement locations and environmental variables through a series of statistical tests. All shell middens within the study area were compared to baseline values that were generated from random points. In this section, and all the subsequent ones, I begin with the results taken from the whole study area and then proceed through smaller spatial boundaries. Table 5 shows which attributes in each spatial zone were identified as having statistical significance. I discuss the combined attribute results for each subregion. Overall, several variables were identified as being relevant to the locational suitability of settlements. Variability in settlement patterning is, in part, reflective of the differences in the environmental characteristics of an area.

A similar process was followed in Section 2, except that shell middens were divided into groups based on their dimensions. This follows the assumption that the size of a midden is related to the site's occupational intensity. Small shell middens are defined as being equal to or less than 30 m in length. Large shell middens are defined as being 100 m or longer in length. Each midden size group was compared to baseline values within their respective areas. The distributions of large and small middens are compared to see what types of locations were occupied more intensively than others. In addition to presenting the combined results for each subregion, this section includes a summary of the occurrences/averages of environmental characteristics.

Lastly, Section 3 focuses on the resources that are in immediate proximity to settlements. I divided the relevant environmental attributes into seasonally available resources (fish spawning areas) and year-round resource indicators. These resources were tallied for each settlement using distance cut-offs. Once again, small and large shell middens were compared to identify differences in their resource bases. I found that large shell middens are more likely to have a more diverse resource base than small shell middens. Distinctive site configurations and their proximity to resources were observed between subregions.

Section 1: Locational preferences for all shell midden sites

The locations of shell middens on the Central Coast demonstrate people's preferences for particular environmental settings. Results strongly confirm that shell middens are not randomly distributed, but instead show orientation to specific types of locations. There are multiple environmental parameters that contributed to location suitability. I calculated whether the location characteristics of shell middens differed from environmental baseline values, and the following section describes those results. This was done at multiple scales of analysis, starting with the whole study area and then five smaller subregions (Figure 23). All shell middens (n=351) were included in this part of the analysis, regardless of their dimensions. Table 5 summarizes the results of whether shell midden locations were statistically distinct from baseline values (random points). A complete list of the p-values is provided in Appendix C.

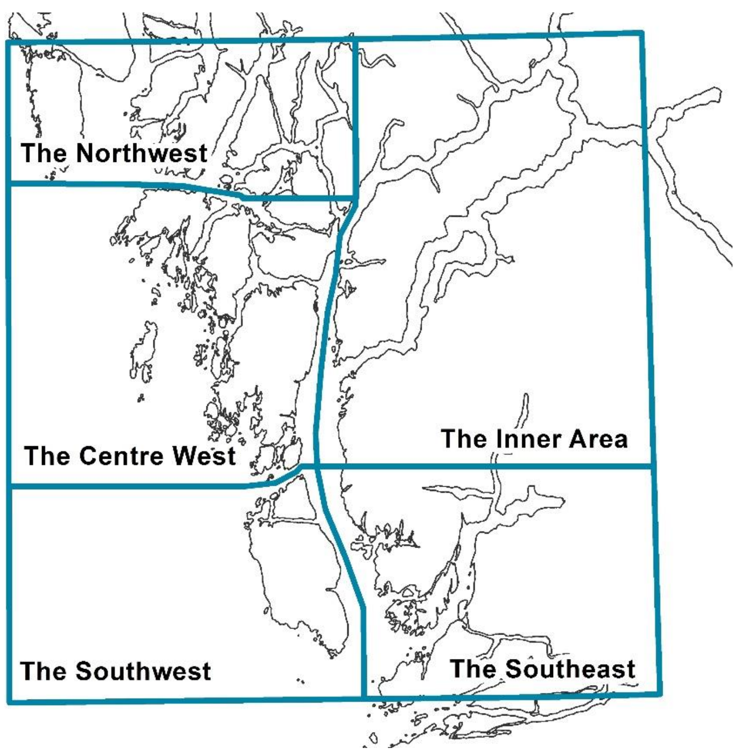
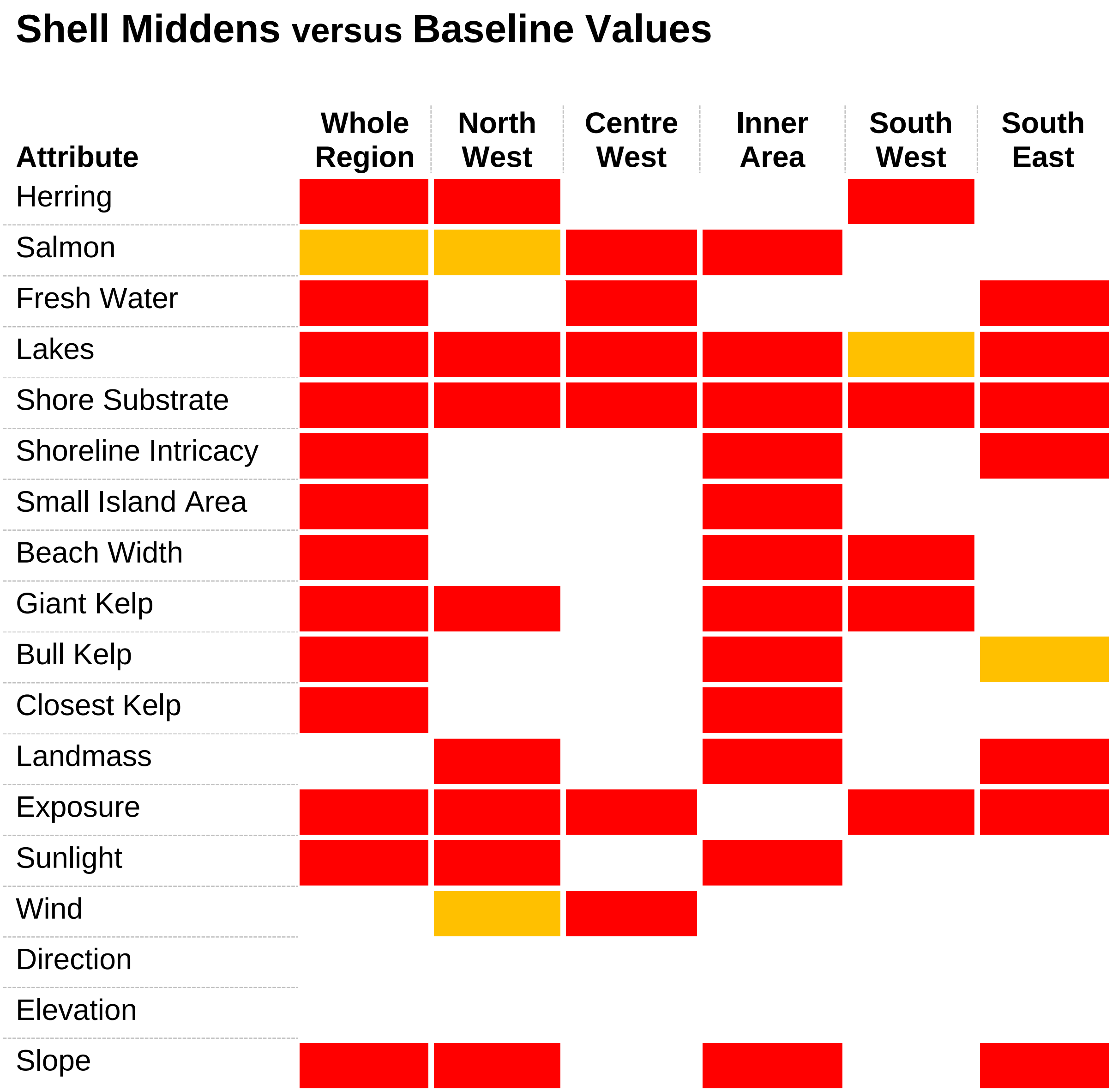


Figure 23 Map of study area showing the boundaries of the five subregions used for analysis in Section 1.

Table 5 Summary of statistical results for Section 1. The location of shell middens compared to baseline values for the whole area and subregions. Red cells indicate the difference is statically significant (p-value ≤ 0.05). Yellow cells signify nearly significant (p-value 0.1 – 0.05 or based on manual observation).



The Whole Study Area:

Fourteen of the eighteen attributes produced statistically significant results that indicate shell midden locations (n=351) are distinctive from the baseline value (600 random points) for the region (Table 5). The region's results indicate strong patterning of locational criteria for habitations.

The following attributes were returned as significantly different among all the shell middens and the baseline value, aligning with the predicted desired traits:

- Distance to herring spawning areas
- Distance to salmon spawning streams
- Distance to fresh water
- Distance to lakes
- Particular types of shore substrate
- More intricate shorelines
- More nearby islands
- More wide beaches
- Distance to kelp (all)
- More sunlight
- Less wave exposure
- Less slope

Neutral results that did not indicate any pattern of location suitability were (no difference between midden locations and the baseline values):

- Size of landmass
- Wind
- Direction-faced

Attributes where the values of shell middens were opposite of what was predicted:

- Elevation[31]

From these results it can be stated that multiple environmental characteristics were relevant to the suitability of a settlement location and that shell middens are not randomly distributed throughout the region. However, the overwhelmingly positive results of so many attributes presents a false sense of confidence in locational preferences for settlements. This is because the large spatial extent of the study area encompasses a wide range of environment types that have been picked up by the 600 random points. Since the locations of settlements are not as variable as these random points, it is not surprisingly that the results were statistically different. A spatial reduction in the units of analysis is required to account for this environmental variability. Part of the reason for so many significant results is the size of the sample, since it is easier to get a significant result with a large number of cases. The attributes returned as statistically significant at the regional level are not repeated perfectly in any of the subregions, nor do any two subregions have identical results, as will be revealed in the following sections. This raises skepticism about conclusions concerning

[31] The elevation of settlements and random points were significantly distinct but opposite of what was expected since sites were, on average, at lower elevation. All subregions had the same results, except the Southwest. This is discussed later in Section 2 and not in the individual subregion sections.

settlement patterns generated from a large area when the variability of the environment is obscured by generalized analysis.

The Northwest Subregion

The location of shell middens from the Northwest subregion indicates a strong association with optimizing protection from natural elements and being situated near resources. Table 5 summarizes the attribute results, indicating which ones appear to be relevant or not to location suitability.

Locational preferences for the Northwest subregion based on all of the shell middens (n=51) compared to the baseline values for the subregion revealed the following attributes as being significantly different:

- Distance to herring spawning areas
- Distance to salmon spawning streams
- Distance to lakes
- Particular types of shoreline substrates
- Distance to giant kelp
- Size of landmass
- Less wave exposure
- More sunlight
- Less wind
- Less slope

The attributes that did not significantly differ between middens and baseline results were:

- Fresh water
- Shoreline intricacy
- Nearby islands
- Bull kelp
- Direction-faced
- Beach width

Attributes where the values of shell middens were opposite of what was predicted:

- Elevation

Shell middens in the Northwest subregion show an association with being positioned near resources. This includes herring and salmon spawning locations, and proximity to giant kelp. The middens show a disposition for proximity to lakes but not to fresh water streams. Eighty-eight percent of shell middens are within 1 km of a stream, indicating that was likely still a factor in site suitability, but that streams are prevalent enough in the area that it would not have been difficult to position oneself near one.

Fewer middens than expected were located on the mainland or large islands; instead, the preference was disproportionally high for medium islands. These islands make up 11% of the shoreline in the subregion but constitute 35% of midden locations. As with most subregions, there appears to be an avoidance of rock cliff shorelines, with people instead opting for estuaries and rock/gravel beaches. The Northwest is the only subregion that returned strong results for the following combination of attributes: less exposed shorelines, lower wind levels, and higher amounts of sunlight. An increased need for protection from the natural elements was probably due to the proximity to the exposed outer coast.

The Centre West Subregion

Compared to the baseline frequency of location types, shell middens in the Centre West subregion (n=145) returned significant results for the following attributes:

- Distance to salmon spawning streams
- Distance to fresh water
- Distance to lakes
- Particular types of shore substrates
- Less wave exposure
- Less wind

The attributes that did not significantly differ between middens and baseline results were:

- Herring spawning streams
- Shoreline intricacy
- Nearby islands
- Wide beaches
- Giant kelp
- Size of landmass
- Slope
- Amount of Sunlight
- Direction-faced

Attributes where the values of shell middens were opposite of what was predicted:

- Distance to bull kelp
- Elevation

The Centre West subregion demonstrates that when desirable conditions are limited in their availability, shell middens show a substantial association with those locations (i.e. salmon). However, when the optimal conditions occur frequently throughout the area (i.e. herring and kelp) then the results are not returned with significant p-values even though other lines of evidence suggest these resources were important. Half of the sites in this subregion are within a kilometer of herring, compared to 18% of sites being within the same distance of a salmon stream, yet the herring results did not have statistical significance and the salmon results did. In the Centre West subregion there are many salmon streams, but because these streams only intersect with the coastline at a single point, the access to salmon is somewhat restricted. This increases the possibility of identifying significance between shell midden locations and salmon streams compared to random points. In contrast, herring spawning areas and kelp habitats run parallel to the shoreline and are abundant in the Centre West subregion. The results did not indicate any sort of orientation to herring or kelp; in fact sites were statistically further from bull kelp than the baseline values. This speaks more to the prevalence of these resources in this subregion rather than people not being concerned with their availability near settlements. The widespread distribution of herring and kelp meant that many areas would fulfill this requirement. Likewise, shoreline intricacy was not returned as being an important consideration for the Centre West subregion because the midden average was the same as the baseline value. In actuality, this subregion has the highest average for shoreline intricacy out of all the subregions, meaning sites are indeed located in spots that permit access to an abundance of related resources.

Turning now to the physical characteristics of the land, Centre West shell middens had results indicating an association with protection from the natural elements. The Centre West and Southwest subregions are the windiest in the area. It comes as little surprise then that middens show a strong disposition for being in lower wind areas compared to the subregion average (the wind data are based on 5 km blocks so it is not reflective of the hyper local). Moreover, sites are located on better-protected shorelines.

With more shell middens than any other subregion (n=145), the Centre West subregion shows association with settlements being located near resources, even though some of those resources are widely spread and therefore do not show a statistical difference between middens and baseline values. The ease of fulfilling resource proximity is matched by the requirement to inhabit areas that are protected from the elements. Once again, the local physiographic characteristics lead to shell midden distributions that vary from the regional pattern.

The Inner Subregion

The Inner subregions returned more significant results for attributes than any other subregion. The attributes that returned statistically significant associations between shell middens (n=44) and the area's environmental characteristics were:

- Distance to salmon spawning streams
- Distance to lakes
- Particular types of shore substrates
- More intricate shorelines

- More nearby islands
- More wide beaches
- Distance to kelp (all)
- Size of landmass
- More sunlight
- Less slope

The attributes that returned non-significant results for the Inner subregion were:

- Herring spawning streams
- Fresh water
- Direction-faced
- Exposure
- Wind

Attributes where the values of shell middens were opposite of what was predicted:

- Elevation

The Inner subregion are different from the other subregions in that there is much less area that is suitable for settlements based solely on topography. Steep shorelines limit land access from watercraft and there is little flat land on the rugged terrain. Suitable locations to beach canoes or establish residency could also be associated with some of the attributes analyzed. For instance, river deltas create low-lying breaks in the relief, which would permit people to inhabit the area while at the same time being in extremely close proximity to salmon spawning locations. This pattern was also noted by Hobler (1983:153), who saw the connection on the inner coast between suitable land, elevation, and salmon streams. The extremes of the Inner subregion create a divide between suitable and unsuitable land that is more pronounced than in any other subregion. The combined area of the Inner subregion is larger than any other subregion, but has the second lowest shoreline length of all of the subregions, which further impacts the availability of suitable locations.

Shoreline exposure and wind levels were not found to be a significant determining factor in site locale. Exposure was determined to be a significant factor for all of the other subregions and wind had positive results in two of the three outer subregions. Those living in the Inner Subregion settlements did not prioritize this attribute, which can be accredited to the sheltered nature of the area. It is the only subregion that does not have any shorelines exposed to the open ocean. A basic level of protection from the elements is essential for any settlement. People living in this area would not have had a hard time fulfilling those requirements since most of the waterways are protected. Still, middens had higher protection values than the subregion baseline, aligning with the assumption that less wind and waves are better.

If protection is the advantage of this subregion then the downside is the patchiness of other desirable conditions and resources. Dominated by linear shorelines, the options for suitable areas are greatly reduced. Unsurprisingly, shell middens showed a strong association with being located in areas with more intricate shorelines. This maximizes the resource gathering area within a close distance of the site. On average, shell middens are located on shorelines that are 30% longer than the baseline length. Similarly, more middens are found on small or tiny islands compare to the baseline. Small and tiny islands are rare in this area, constituting less than 5% of the shorelines yet 18% of middens are found on them. Some of these include middens that are found on river delta islands, such as FaSu-1 (Axeti) right in front of the Kwatna River. The Inner subregion showed a strong association with settlements being located on wide beaches. Less than 3% of the beaches in the area are characterized as being wider than 30 m, but 25% of middens are found on wide beaches. This suggests the importance of maximizing intertidal resources directly at settlement locations and not just nearby since this attribute was calculated based on the beach right in front of the site. Shell middens are significantly closer to salmon streams. The average distance of all shell middens to a salmon stream is 1.35 km, while the baseline value is 2.82 km. This is the only subregion that returns significant results indicating an association with both giant and bull kelp. I believe this is because kelp habitats are not as widely distributed here as they are in the other subregions. Therefore it would be easy to be located near kelp in the other areas, but would probably need to be a conscious choice for people in the Inner subregion.

A surprising result was that the average distance to herring was similar for the shell middens and the random points. Unlike the Centre West subregion where herring spawning areas are widespread and therefore shell middens were not significantly different from baseline values, the Inner subregion have a much smaller distribution of herring, which should permit recognition of orientation to these areas. However, only 20% of shell middens in this subregion are within 1 km of herring spawning areas (n=9) - the lowest percentage of all the subregions and equivalent to the baseline values. This suggests that herring was either targeted at few locations within this area (the sites near herring range in size) or that people travelled to other areas of the coast to obtain this key resource.

The Southwest Subregion

The Southwest subregion is distinctive for its physiographic characteristics and the distribution of shell middens. The subregion is dominated by unprotected linear shorelines, much of which are exposed to the open Pacific Ocean. All reported shell middens are located on the northern tip of Calvert Island or Hecate Island, with the exception of a single midden in the southeast of Calvert Island (EiSx-1).

Results indicate shell middens (n=14) have a significant association with the following environmental parameters:

- Distance to herring spawning stream
- Distance to lakes
- Particular types of shoreline substrates
- More wide beaches
- Distance to giant kelp
- Less wave exposure

Attributes that did not produce significantly differing values were:

- Fresh water
- Shoreline intricacy
- Small island area
- Bull kelp
- Size of landmass
- Direction-faced
- Wind levels
- Slope

Attributes where the values of shell middens were opposite of what was predicted:

- Distance to salmon spawning streams
- Elevation
- Amount of sunlight

Settlements in this subregion do not show any association with salmon streams, and were actually significantly further away than the baseline. In part this could be attributed to the small number of salmon streams in the area. However, the subregion is not completely devoid of salmon streams, yet no shell midden is within a kilometer of one. Other indictors of resource foci were noted as being significant (herring, lakes, and giant kelp) and others still had higher than the baseline values (intertidal area, shoreline intricacy, bull kelp). The concentration of middens in the west suggests that they would have been focused on outer coast resources. This does align with some settlement patterns derived from ethnography, in that people went to Calvert Island to harvest outer coast species (Olson 1954:213). The cluster of shell middens in this area occurs in conjunction with the distribution of herring spawning areas, which are mostly limited to Kwakshua Channel –

separating Calvert Island and Hecate Island. Due to the overlap of concentration, 64% of shell middens are within one kilometer of herring, compared to the 24% of the random points in the baseline. Given this, it is likely that the abundance of sites here is related to some extent to the concentration of herring spawning grounds.

Intertidal resources may have been a substantial factor in attracting people to certain spots in the Southwest subregion. Seventy-nine percent of shell middens are located on wide beaches, and the majority of those are on beaches with some combination of substrate that includes sand. The concentration of sites of the northwestern portion of the study area is the highest density of large shell middens within a small radius for the whole study area. The buildup of so many large middens in an area, plus the abundance of other middens, suggests that shellfish harvesting was a major activity for people. EjTa-1[32] (Luxvbalis) is a huge midden (430 m long and 6645 m^2) but relatively shallow (1.75 m deep) and is located on a wide beach containing sand. EjTa-17 (Nusi Cikva 'Moon clam') is a clam garden located in Kwakshua Channel, just around the corner from EjTa-1. This emphasis on shellfish aligns with shell growth studies conducted on materials from EjTa-4 that suggest intensive shellfish harvesting at this site (Way et al. 2015).

The desire to access outer coast resources creates a need to balance close proximity to these resources and at the same time fulfill a basic requirement of protection from the elements. Sites are located on more protected shorelines than the baseline for the subregion. People are able to choose protected bays or nooks that still allow close access to the open ocean. These sheltered locations were attractive for people but would also provide important habitats for an array of species with related requirements (sea otters, seals, seaweeds which bring in other fish, temporary stopovers for travelling mammals). Similar preferences for habitat locales would mean that people could access those species. The wind levels are not different than the subregional average but this is more of a reflection of the lack of high-resolution wind data than it is of sites not being particularly protected from the wind.

Shoreline intricacy did not return a significant result, which is surprising due to the linear nature of much of the shoreline. The need to position settlements in sheltered spots may have created the

[32] This is reported to be an ethnographic village. The site has never been directly dated unfortunately, preventing estimations of the span of the midden formation.

need to travel short distances to the targeted resource areas. Still, there are two shell middens located on exposed shoreline. One of these, EiSx-1, is situated right off the southwestern coast of Calvert Island on a small island with an exposed rock shoreline. No salmon stream is in the immediate proximity, it is not a known herring spawning area, and the shoreline substrate is not the typical habitat of shellfish. The elimination of these resource foci, the positioning on the exposed outer coast, and the site's isolation from other sites, suggests that this shell midden may be orientated to an explicitly outer coast resource base. Unfortunately, the species distribution data required to better support this proposition are not available.

The Southeast Subregion

In the Southeast subregion shell middens (n=97) showed significant results for their location differing from the baseline values for the following attributes:

- Distance to fresh water
- Distance to lakes
- Particular types of shoreline substrates
- More shoreline intricacy
- Distance to bull kelp
- Size of landmass
- Less wave exposure
- Less slope

The attributes that were not statistically significant were:

- Herring spawning streams
- Nearby islands
- Wide beaches
- Direction-faced
- Amount of sunlight

Three attributes produced significant results opposite to the baseline:

- Distance to salmon
- Amount of sunlight
- Elevation
- Distance to giant kelp
- Wind levels

The Southeast and Southwest are the only subregions that did not show a positive correlation with the distance to salmon streams. They actually had opposite results, showing that on average sites were further away than the baseline. In the Southwest no sites are located within one kilometer of salmon streams. But in the Southeast the average distance is slightly misleading. Most shell middens are not close to salmon streams but nine sites are within 500 m of a stream. The other shell middens distort the average, making it appear as if proximity to salmon streams was not important. This demonstrates the diversity in resources targeted by these settlements. Proximity to salmon is not the major consideration for suitable locations but it would have been important for some of the settlements. Likewise, 29% of shell middens are within 250 m of herring spawning grounds (baseline rate is 20%). Certain settlements may have been occupied for herring fishing but not to extent that it would produce a statistically significant association. The location of shell middens in this area is variable and probably related to a combination of resource availability, people's seasonal movements, and changes through time.

Other attributes support the hypothesis of shell middens being orientated to resources, including distance to fresh water, lakes, wide beaches, and shoreline intricacy. Results indicate a variety of settlements targeting herring and salmon spawning locations. One important environmental consideration for the Southeast is that drainage from Owikeno Lake and other major rivers creates brackish water unsuitable for many shellfish species (Olson 1954:214). People could not stay in the vicinity of these rivers if they wanted to acquire clams and would need to travel west to the outer coast. Within the Southwest subregion the gradient of variations in environmental conditions from outer to inner coast is more pronounced than any of the other subregions. This may mean that the sites included within this spatial boundary represent a greater range of targeted resources. Within Rivers Inlet there are major salmon rivers, eulachon, large lakes, and mainland terrestrial faunal. On the western portion, amidst the bountiful island groups, there are habitats for shellfish and other aquatic invertebrates. This area is also along the migratory route of sea mammals and birds. The range of ecosystems and diversity of settlements impedes the ability to make generalized observations of the area when all shell middens are treated as a single unit of analysis.

Results indicating that shell middens are in much windier locations compared to the baseline average is probably due to the majority of middens being concentrated in the part of the subregion that is closest to the open ocean, whereas the random points are more evenly distributed. Still, the need for protection against the elements is demonstrated by the orientation to more protected shorelines than the baseline rate. Shoreline exposure levels are more informative of micro-environmental conditions since the resolution of the data is superior over the 5 km blocks that are used for wind levels.

Section Summary

The locations of shell middens indicate preferences for certain environmental characteristics that differ from the baseline values of the area. This non-random distribution is most evident when all the shell middens in the entire study region are included. When examined as a collective, most of the attributes that were predicted to be relevant to site suitability were returned with positive results. However, each subregion returned different combinations of results that indicated an association between site locations and environmental variables.

Settlement locations in the Northwest subregion indicate a preference for resource proximity and protection for the natural elements. An association between resource-related variables and sites was not always detected for the Centre West subregion, most likely due to the widespread abundance of targeted species and productive habitats. This is contrary to the Inner subregion, where resources and baseline terrain conditions are much more spatially limited. Therefore, statistical significances for attributes were more readily detected, signifying the suitability criteria for settlements. Shell middens in the Southwest subregion showed a strong association with herring and intertidal resources but not with salmon streams. Settlements here appear to be positioned to limit exposure while still enabling the exploitation of outer coast resources. Lastly, the Southeast subregion does demonstrate an association with some resource variables. However, the substantial variability in the locational characteristics of site (possibly a result of specialized resource procurement sites caused by the pronounced gradient of environmental conditions) caused problems for using these statistical tests to detect general suitability preferences.

Taken on their own, results from the whole region tell little about the range of settlements that exists on the Central Coast. A level of homogeneity in settlements is suggested when these results stand-alone. A breakdown into smaller spatial ranges is necessary to begin dissecting the variability of settlement surroundings. Furthermore, grouping all sites together is problematic since locational suitability is dependent on the intended activities of the residents and is not expected to be ubiquitous among different settlement types. In the next section I continue to use multiple spatial scales but separate shell middens into size groups to begin to unravel distinctions in settlement placement based on site form.

Section 2: Differences between Small and Large Shell Middens

The following analyses are based on the assumption that the occupational history and intensity of site usage is reflected in the size of the midden. For example, shell middens which were long-term residential sites with a large population should be bigger than, for instance, small resource specialized camps. The intention is not to say what was happening at these sites or designate their exact settlement type. Shell midden dimensions simply provided a means to create relative categories of settlement forms to look for patterns in their environmental settings.

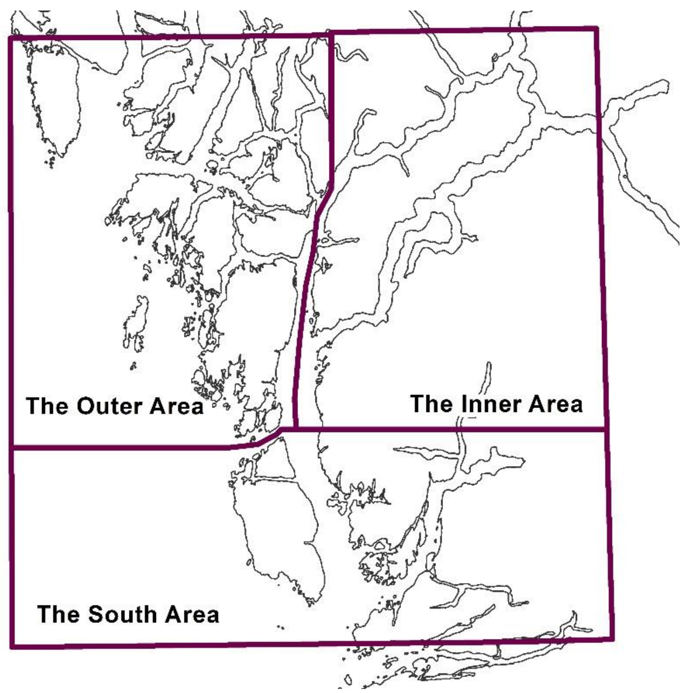
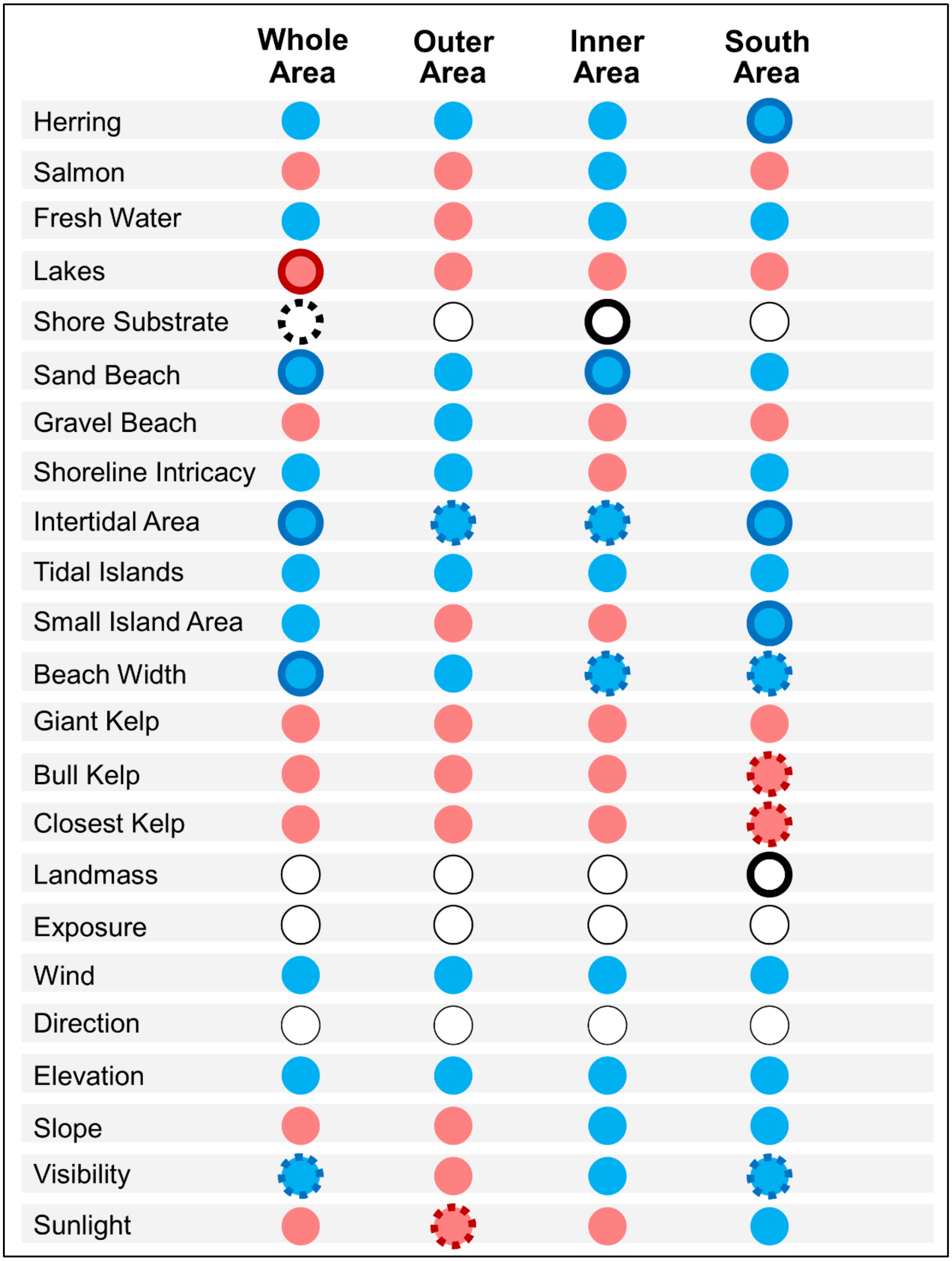


Figure 24. Map of subregions used for Section 2 analysis.

The main distinction is between small middens (30 m long or less) and large shell middens (100 m and longer). These two categories of habitation sites are expected to represent different types of occupation, whether it is intensity of use, population size, or the focus of activity. As in the overall analyses, I compared the locational characteristics of shell middens to environmental baseline values, then the two size categories against each other. The goal was to see if small and large middens differed in their parameters for location suitability. New spatial boundaries were used for analysis to accommodate the reduced sample size. Only 62% of shell middens (219 out of 351) have recorded dimensions, and additionally, the middens were separated into size categories. The area needed to be increased to maintain sample sizes that could produce meaningful results. Three new subregions were created, the Inner, Outer, and South (Figure 24). Two summaries of all the results are first provided (Table 6, Figure 25), as well as individual tables alongside the initial discussion of results for each subregion. Exact results from the statistical tests can be found in Appendix C.

Table 6. Summary of significance identified between shell middens locations and baseline results, separated by spatial boundaries and midden size groups. Red cells indicate the difference is statically significant (p-value ≤ 0.05). Yellow cells signify nearly significant (p-value 0.1 – 0.05 or based on manual observation).

	Whole Region vs. Baseline		**Outer** vs. Baseline		**Inner** vs. Baseline		**South** vs. Baseline	
Attribute	**Small**	**Large**	**Small**	**Large**	**Small**	**Large**	**Small**	**Large**
Herring	Red	Red			Yellow		Red	Red
Salmon			Red		Red	Red		
Fresh Water	Red	Yellow	Red					Yellow
Lakes	Red	Yellow	Red		Red		Red	
Shore Substrate	Red	Red	Red	Red	Red	Red	Red	Red
Sand Beach	Red	Red	Red	Red		Red	Red	Red
Gravel Beach	Red				Yellow		Red	
Shoreline Intricacy	Red	Red			Red	Red	Red	Yellow
Small Island Area					Red	Red		
Beach Width		Red				Red		Yellow
Giant Kelp	Red				Yellow			
Bull Kelp	Red							
Closest Kelp	Red			Red				
Landmass			Red	Yellow	Red		Red	
Exposure	Red	Yellow	Yellow				Red	Red
Wind			Red	Red				
Direction					Red			
Elevation								
Slope	Red	Red	Red		Red	Red	Red	Yellow
Sunlight	Red	Yellow			Yellow	Yellow		



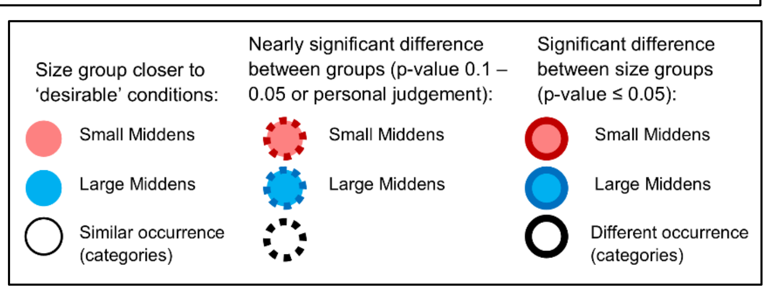


Figure 25. Summary of comparing attributes between small and large shell middens. This is a compilation of all the results, so the viewer should not expect to see any obvious patterning.

The Whole Study Area:

The results from comparing small and large middens separately against the baseline values showed similar locational associations (Table 6). Small shell middens returned statistical significance for more traits (13 out of 20). Large middens showed associations with 10 out of the 20 attributes, though the significance for some of them was not as strong as the small middens. Rather than suggesting that these attributes were of lesser importance for large settlements, I believe this indicates the sample size of large middens was insufficient to detect significance in the attributes. The majority of the attributes matched between the size groups except that small middens had an association with gravel shoreline substrates and were closer to all the kelp classes. The only attribute that was returned as significant for large middens and not for small middens was wide beaches. It could be argued that all the attributes that differed between the size groups relate to specific resource habitats. For many of these attributes it makes sense that the significance is the same for small and large shell middens since regardless of the settlement type or season of occupation, people had to meet needs related to specific location characteristics in order to reside there (ex. slope, distance to fresh water, and shoreline intricacy).

Next, the properties of all the known small middens and large middens were compared (Figure 25). Only six out of the twenty-three attributes showed a significant difference between small and large middens. These attributes and the size group that was closest to the predicted preferred conditions were: sandy shoreline substrate (large), intertidal area (large), beach width (large), shore substrate (large), visibility (large), and distance to lakes (small). The first four are related to favourable conditions for harvesting intertidal resources, suggesting that large sites show a strong association with being situated in these locations.

As identified in the previous section, using a regional scale of analysis blurs the variability of site settings, but positive results at the regional scale should indicate higher potential for significance within subregions as well. The differences and consistencies between the whole study area and the subregion results will be discussed below following presentation of the results for each subregion.

The Outer Area:

In the Outer subregion, as in all of the subregions, the small middens showed a strong association with more attributes (9 out of 20) than large middens (5 out of 20) (Table 7). Four of these attributes were consistently significant for the size groups: shore substrate, sandy shoreline, particular landmasses, and protection from the wind.

Small shell middens show a strong association with salmon, fresh water, and lakes. This would suggest that people producing large middens were not targeting areas with these traits with the same intensity as small middens since their results were not returned as significant. In addition to using average distances, the proportion of sites within a reasonable distance to these locations can be examined. Thirty-one percent of small middens (14 out of 45) and 11% of large middens (2 out of 18) are within 500 m of a salmon stream. So too, 56% of small middens (25/45) and 39% (7/18) are within 500 m of a fresh water stream. Even when using distance categories, the differences between the size groups remains valid. However, 73% of small middens (33/45) and 78% (14/18) are within 1 km of a lake, so it is surprising that these had differing statistical significance outcomes. Small shell middens also have an association with kelp. Although the attributes of salmon, streams, lakes, and kelp are only part of the attributes that would determine what people were doing at these sites, they do suggest an orientation toward fishing and offshore activities. Neither size group showed an association with herring, which is probably a testimony to the widely distributed herring spawning areas on the outer coast that make it easy to attain proximity to this resource. On average large middens were closer to herring spawning areas than small middens.

All of the attributes that act as proxies for shellfish habitats and intertidal resources were more prevalent for large middens than small middens, though intertidal area was the only attribute significantly different between them. Also surprising was the equivalent results between size groups and baseline values for intertidal area since most other trends in the data thus far have suggested that large middens have a higher association with intertidal resources. Again, this speaks to the nature of the environment on the outer coast where the elaborate shorelines make for a large intertidal area. Large shell middens have a greater average intertidal area, occurrence on wide beaches, and shoreline intricacy. They are also more often found with sand and gravel substrates in the beaches in front of the sites. The combination of these results suggests that large shell middens were more orientated to locations with heightened access to intertidal recourses.

In the Outer Area the proportion of settlements on particular landmass categories differs from the baseline distribution. No large midden is found on a tiny island and only one is on a small island (FbTc-3). This does seem intrinsically obvious, but there are examples of large middens elsewhere in the study area on lesser islands (ex. EkSt-6). Tiny and small islands in the Outer Area constitutes 37% of all the shorelines, so the almost complete avoidance of these areas is noteworthy. The majority of both small and large middens are found on large islands, 51% and 56% respectively, while the actual proportion of large islands is 31%. People selecting settlement locations on the outer coast would have been highly conscious of exposure to the wind and waves. Much of the shoreline in this area is exposed to the Pacific Ocean but there are many bays and nooks in the shoreline that offer protection. Results indicate that people were choosing to live in areas with lower wind power than the average regardless of the settlement size. For the Outer Area, the average proportion of ocean visible surrounding from site locations is equivalent between small and large middens.

Although the Outer Area subregion has the majority of all shell middens on the Central Coast (56%), it has the lowest proportion of middens with recorded dimensions among the subregions – only 42% (82 out of 196). This sizeable data gap represents a missed opportunity to improve our understanding of the local context. It also means that the analysis is being conducted on a highly fragmented sample of the recorded midden sites. This Outer Area subregion had the fewest attributes showing significant difference between size groups, with only intertidal area and sunlight being nearly statistically different. For the attributes that are measurable (n=19), small sites had the higher average value for ten attributes and large sites had nine. It was surprising that they were not more distinctions that emerged to separate the patterning of small and large shell middens in the Outer Area. The most substantial dissimilarity is the higher proportion of small sites orientated towards salmon streams. The limited discernible difference between small and large shell middens lacks an explanation, especially since there are distinctions between the size groups in other subregions. Because there are so many shell middens within this area, going forward it would be beneficial to do a spatial analysis that utilized more attributes relating to cultural factors (e.g. distance between settlements).

The Outer Area

Attribute	**Small** vs. Baseline	**Large** vs. Baseline	**Small** vs. **Large**
Herring			Large
Salmon			Small
Fresh Water			Small
Lakes			Small
Shore Substrate			Same
Sand Beach			Large
Gravel Beach			Large
Shoreline Intricacy			Large
Intertidal Area	n/a	n/a	Large
Tidal Islands	n/a	n/a	Large
Small Island Area			Small
Beach Width			Large
Giant Kelp			Small
Bull Kelp			Small
Closest Kelp			Small
Landmass			Different
Exposure			Same
Wind			Large
Direction			Same
Elevation			Large
Slope			Small
Visibility	n/a	n/a	Small
Sunlight			Small

Table 7. Results of small and large shell middens in the Outer Area compared to baseline results. Also showing the difference between small and large middens. Red cells indicate the difference is statically significant (p-value ≤ 0.05). Yellow cells signify nearly significant (p-value 0.1 – 0.05 or based on manual observation).

The Inner Area:

Shell middens in the Inner Area returned significant results for more attributes than any other area for each size group. Small middens showed a statistical association with 12 (out of 20) attributes and large middens were associated with eight attributes (Table 8). There were six common attributes for the site group: Shore substrate, shoreline intricacy, small island area, elevation, slope, and sunlight. This indicates that the physical properties of the shoreline were extremely important for settlement location in terms of suitable living areas and shoreline resources. These results corroborate with results from Section 1, but demonstrate that terrain and resource factors were important to settlements regardless of their type.

For the fishing and fresh water attributes, large shell middens only showed a significant association with distance to salmon. On average large middens were closer to herring, salmon, and fresh water streams. Small middens had significant results for herring, salmon, and lakes. This supposed association with herring is slightly misleading since only one small midden (ElSx-17) and two large middens (ElSx-1 – Namu and FaSv-4 – Tesque) are within a kilometer of herring. There is not a lot of herring in this subregion compared to the others, but there are some areas that are reported to be spawning locations. In particular, the southwestern shores of King Island and some of the shore across Burke Channel onto the mainland (see Appendix A). Yet these shorelines contain very few sites, which may be a result of the steep banks that inhibit settlement.

Large middens were determined to be closer to salmon streams (0.98 km) on average compared to small middens (1.1 km). However, 44% of small middens (4 out of 9) were within 250 m of salmon streams and 25% of large middens (2 out of 8) were within the same distance. Even though small middens are slightly more likely to be near salmon streams, their average distance is greater. The most reasonable interpretation of this is that large and small middens were similar in their orientation to salmon streams. This contradicts the perception that for the inner coastal area large middens are located right beside major salmon rivers. The important point is that 37% of all middens (17 out of 44) are within 250 m of salmon streams compared to the 7% for the Outer Area and 5% for the South. This indicates that the location of salmon spawning streams was a more important indicator of site locations for the Inner Area compared to the other two subregions and there is no discernable difference between small and large middens.

Small shell middens occur on small or tiny islands at a higher rate than the baseline. A third of small middens are found on these islands (3 out of 9), which only make up 3% of the actual shore length. This does show the active selection of a landscape feature that is rare (there are three additional middens on tiny islands – one medium and two unknown). Most of the large shell middens are found on the mainland, which conforms to baseline proportion of this landform class. This subregion is the only one that had significant results for shell midden orientation to places with small islands nearby. The scarcity of lesser islands in this area makes it easier to detect the possibility of conscious selection of locations with nearby small islands. While this does align with the results for shoreline intricacy, suggesting an association with longer shorelines around settlements, there may have been other motivations for inhabiting landscapes with these characteristics.

Although both small and large shell middens returned significant results for several attributes that relate to intertidal resource abundance, large middens showed an association with conditions that are more specific to shellfish habitat. Large middens are located on sandy and wide beaches much more frequently than small middens. Small sites were actually on gravel beaches at rates higher than the baseline. Even though small sites had a higher value for shoreline intricacy, their rate was lower for intertidal area. In general, the combination of different characteristics may suggest that the types of resources people targeted at small and large settlements differed. It is possible large sites targeted intertidal resources (shoreline intricacy, sand, intertidal area, wide beaches) and small sites targeted near shore resources (shoreline intricacy, gravel, kelp, lakes) though this is still rather speculative. The last of the five attributes that were notably different between small and large shell middens is visibility. On average, large middens have twice the proportion of ocean visible than small middens.

The Inner Area

Attribute	**Small** vs. Baseline	**Large** vs. Baseline	**Small** vs. **Large**
Herring			Large
Salmon			Large
Fresh Water			Large
Lakes			Small
Shore Substrate			Different
Sand Beach			Large
Gravel Beach			Small
Shoreline Intricacy			Small
Intertidal Area	n/a	n/a	Large
Tidal Islands	n/a	n/a	Large
Small Island Area			Small
Beach Width			Large
Giant Kelp			Small
Bull Kelp			Small
Closest Kelp			Small
Landmass			Same
Exposure			Same
Wind			Large
Direction			Different
Elevation			Large
Slope			Large
Visibility	n/a	n/a	Large
Sunlight			Small

Table 8. Results of small and large shell middens in the Inner Area compared to baseline results. Also showing the difference between small and large middens. Red cells indicate the difference is statically significant (p-value ≤ 0.05). Yellow cells signify nearly significant (p-value 0.1 – 0.05 or based on manual observation).

The South Area:

For the South Area, once again, small sites had more attributes return significant p-values (9 out of 20) than large shell middens (8 out of 20) (Table 9). These were consistent for six attributes: herring, shore substrate, sandy beaches, shoreline intricacy, exposure, and slope. Some attributes returned significant values for small sites, but not large ones; they are: lakes, gravel shoreline, and landmass size. Large middens, but not small middens, show an association with distance to fresh water and beach width.

This is the only area that showed a significant association for herring between both size groups and the baseline values, and the only subregion to have a significant difference between the small and large middens. Herring spawning areas are patchy in the South Area, which may be why the significance was detected, as opposed to the Outer Area, which is widely distributed. Regardless, it is clear that in the South Area proximity to herring spawning areas was an important consideration for the location of many of the middens. If we use 250 m as the cut off for immediate proximity and the likelihood of resource targeting, then 25% of small middens (14 out of 55) and 45% of large middens (9 out of 20) are near herring.

The statistical test done to examine the association with salmon indicated that neither size group is strongly orientated to salmon and that small sites are closer to salmon on average. This is quite misleading since 20% of large middens are 250 m from a salmon stream (or river in this case), while no small middens have this resource in the immediate proximity. Some large sites are clearly connected to the salmon runs (EkSu-2, EkSt-1, EkSt-5, and EiSv-18). Because there is not a big enough proportion of large middens near salmon and because there are so many large middens on Calvert Island that are a considerable distance from salmon streams, the statistical results could not indicate an association with this resource. Therefore, based on manual observations, small sites do not appear to be orientated to salmon streams, while a proportion of large middens are situated with salmon streams in their vicinity.

Using broad distance categories, around half of small and large middens are within 500 m of fresh water streams. The difference that is identified comes from seven large middens (35%) being within 250 m of streams compared to 18% of small middens. This is not a big difference but does indicate that a greater proportion of large shell middens were situated right beside fresh water sources rather than just having water nearby. There are more small shell middens close to lakes compared to large middens. Both small and large middens returned significant results for the attributes used to signify intertidal resources and shellfish harvesting. The one exception is that location on wide beaches is statistically significant for large but not for small middens. Large middens always had higher values for the occurrence of sand, shoreline intricacy, intertidal area, small island area, and beach width. These are all connected to access to resources, suggesting that the location of large sites was more likely to be chosen based on resource availability. They also, on average, have a statistically higher proportion of the surrounding ocean visible. In Section 3, the distribution of settlements in relation to resources is discussed in depth.

The South Area

Attribute	**Small** vs. Baseline	**Large** vs. Baseline	**Small** vs. **Large**
Herring			Large
Salmon			Small
Fresh Water			Large
Lakes			Small
Shore Substrate			Different
Sand Beach			Large
Gravel Beach			Small
Shoreline Intricacy			Large
Intertidal Area	n/a	n/a	Large
Tidal Islands	n/a	n/a	Large
Small Island Area			Large
Beach Width			Large
Giant Kelp			Small
Bull Kelp			Small
Closest Kelp			Small
Landmass			Different
Exposure			Same
Wind			Large
Direction			Same
Elevation			Large
Slope			Large
Visibility	n/a	n/a	Large
Sunlight			Large

Table 9. Results of small and large shell middens in the South Area compared to baseline results. Also showing the difference between small and large middens. Red cells indicate the difference is statically significant (p-value ≤ 0.05). Yellow cells signify nearly significant (p-value 0.1 – 0.05 or based on manual observation).

Summary of Attribute Relevance for Settlement Suitability based on Site Size

This section is a brief summary of individual attribute results so that the midden size groups can be compared among the subregions. The importance of the environmental variable in relation to location suitability is discussed. In most cases, results are displayed based on the percentage of middens in each attribute category or distance class, but should be viewed in conjunction with Table 6 and Figure 25.

Herring: A greater proportion of large middens are within 500 m of herring spawning areas than small middens for all the subregions, except for the Outer Area, which is equivalent between the two groups (Table 10). Consistently, the average distance of large middens is closer than the small middens for each subregion.

Table 10. Percentage of small and large middens that are close to herring spawning areas in each subregion.

	Outer		Inner		South	
Distance to Herring	Small Midden	Large Midden	Small Midden	Large Midden	Small Midden	Large Midden
Under 500 m	44.4%	44.4%	11.1%	25.0%	29.1%	65.0%
Over 500 m	55.6%	55.6%	88.9%	75.0%	70.9%	35.0%

Salmon: The proportion of sites in close proximity to salmon varies between the subregions (Table 11). In the Outer Area, there are more small middens near salmon streams, and in the South Area, there are more large middens. The Inner Area has similar proportions for the size groups. The only midden groupings that had a significant association with salmon streams were small middens in the Outer Area, and both size groups in the Inner Area (Table 6). This does not align with the results from Section 1 where the majority of subregions indicated that middens collectively showed an association with salmon streams. The inconsistencies of midden size group and distances to salmon streams on the Central Coast demonstrates the regional variability in how people settled and met their subsistence requirements. Nowhere were the majority of sites in close proximity to salmon streams. The low rates, excluding the Inner Area, are surprising and call into question what conditions were necessary for settlements to persist through time. The arrangement of sites around salmon streams is greatly variable and no robust pattern appears, regardless of the scale of inquiry used.

Table 11. Percentage of small and large middens that are close to salmon spawning streams in each subregion.

	Outer		Inner		South	
Distance to Salmon	**Small Midden**	**Large Midden**	**Small Midden**	**Large Midden**	**Small Midden**	**Large Midden**
Under 500 m	20.0%	11.1%	44.4%	37.5%	1.8%	20.0%
Over 500 m	80.0%	88.9%	55.6%	62.5%	98.2%	80.0%

Fresh Water: The proportion of sites in close proximity to fresh water are reasonably consistent between the site sizes (Table 12). It is possible that people were using water sources that are not detectable on GIS watershed models, such as small springs, or water sources that no longer exist. Otherwise, these results would indicate that people either used alternative sources of water or that they were willing to establish settlements without having a water source in the immediate vicinity. This is particularly intriguing for large settlements who presumably had a greater population at some points in their history. White (2007:4–6) described that people sometimes resided in spring and summer camps without streams.

Table 12. Percentage of small and large middens that are close to fresh water streams in each subregion.

	Outer		Inner		South	
Distance to a Fresh Water Stream	**Small Midden**	**Large Midden**	**Small Midden**	**Large Midden**	**Small Midden**	**Large Midden**
Under 500 m	55.6%	38.9%	44.4%	62.5%	45.5%	50.0%
Over 500 m	44.4%	61.1%	55.6%	37.5%	54.5%	50.0%

Lakes: For two subregions, a greater proportion of small middens are found nearby lakes than large middens, and the rate is nearly equivalent for the Inner Area (Table 13). A significant difference between small and large middens was only detected at the regional level. Thirty-two percent of all small middens are less than 500 m from a lake whereas just under 20% of large middens are of the same distance. For each subregion the small middens had significant results compared to the baseline values and the large middens did not. The average distance to lakes was always shorter for small middens. This was one of the two attributes in Section 1 that consistently had an association with middens for all the subregions. The orientation of small sites to lakes is one of the most consistent and robust results of all the attributes but unmatched by a substantial explanation. It is possible that this occurrence is related to the timber supply around lakes and other resources available in lake habitats. In some cases, it could be connected to providing inland transportation routes (e.g. Lake Owikeno).

Table 13. Percentage of small and large middens that are close to lakes in each subregion.

	Outer		Inner		South	
Distance to a Lake	Small Midden	Large Midden	Small Midden	Large Midden	Small Midden	Large Midden
Under 500 m	31.1%	16.7%	22.2%	25.0%	34.5%	20.0%
Over 500 m	68.9%	83.3%	77.8%	75.0%	65.5%	80.0%

Sand: For all the subregions and whole area, large shell middens are more often found on sandy beaches than small middens and the association was always significantly higher than the baseline frequency (Table 14). The most pronounced difference is the Inner Area where no small middens are located on sandy beaches and the majority of large middens are. Small middens did return higher than baseline frequency on sandy beaches for the Outer and South Area. Altogether, this suggests that there is a strong tendency for middens to have sandy substrate in their beach fronts sites and that the occurrence is particularly high for large settlements. This could indicate choosing sites with particular intertidal habitats or personal comfort/ease of movement (i.e. canoe landings).

Table 14. Percentage of small and large middens that are found on beaches that have sand in their substrate for each subregion.

	Outer		Inner		South	
Beach Substrate	Small Midden	Large Midden	Small Midden	Large Midden	Small Midden	Large Midden
With Sand	59.1%	77.8%	0.0%	71.4%	50.9%	68.4%
No Sand	40.9%	22.2%	100.0%	28.6%	49.1%	31.6%

Beach Width: Large middens are consistently found on wide beaches more often than small middens (Table 15). This is statistically significant compared to the baseline results for all the subregions except the Outer Area. The percentages of small middens found on wide beaches is similar to the baseline portions for the subregions (Baseline values: Outer 27%, Inner 3%, and South 26%). For the Inner Area, where the baseline value is less than 5%, the proportion of large middens on wide beaches is exceedingly high. The results from all the subregions strongly suggest that small middens were not particularly concerned with beach width, but the locational suitability for many large settlements included this component.

Table 15. Percentage of small and large middens that are found on wide beaches for each subregion. A wide beach is constituted as ≥ 30 m.

	Outer		Inner		South	
Beach Width	**Small Midden**	**Large Midden**	**Small Midden**	**Large Midden**	**Small Midden**	**Large Midden**
Wide Beach	25.6%	41.2%	0.0%	42.9%	19.2%	43.8%
Narrow Beach	74.4%	58.8%	100.0%	57.1%	80.8%	56.3%

Intertidal Area: Corresponding with beach width just discussed, large shell middens consistently have a greater average intertidal area compared to small shell middens (Figure 26). This demonstrates that many large settlements were situated in locations that provided access to a higher abundance of intertidal resources.

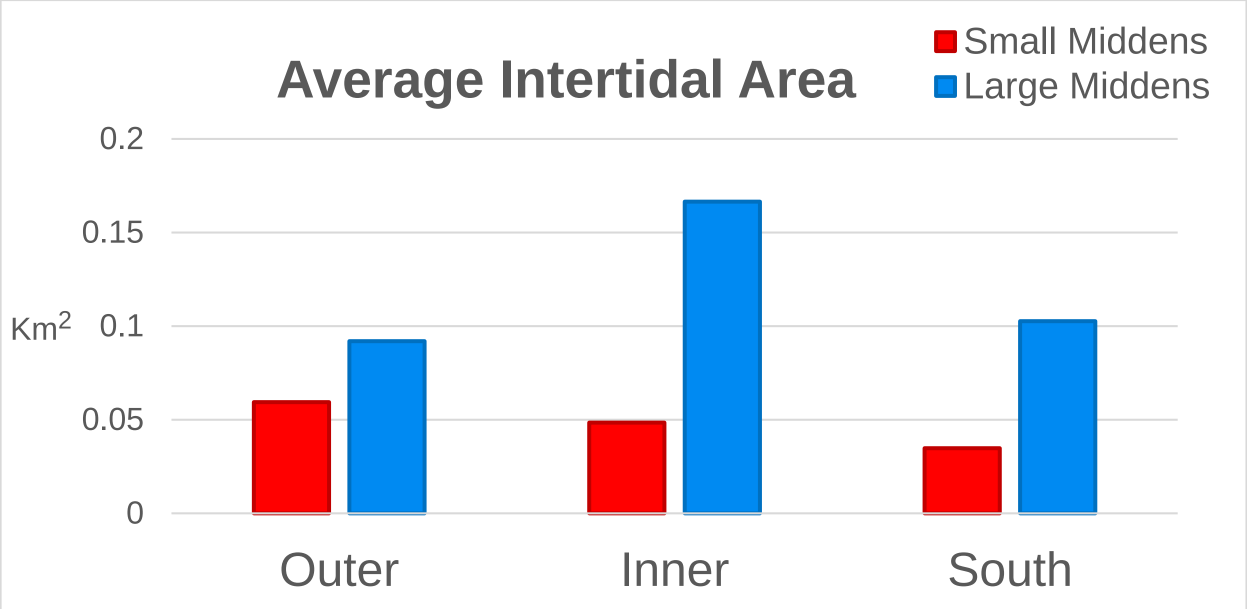


Figure 26. Average intertidal area for small and large shell middens for each subregion. The area was calculated based on the space between the high and low tide lines within a 500 m radius of the sites.

Tidal Islands: Large middens are more often in proximity to a tidal island than small sites (Table 16). This could be tied to the desire to have greater shoreline intricacy or more intertidal areas around sites, and thus may be an indicator of resource proximity.

Table 16. Percentage of small and large middens that have tidal islands in front of the site. This includes some sites that have part of the midden on the tidal island.

	Outer		Inner		South	
Tidal Islands	Small Midden	Large Midden	Small Midden	Large Midden	Small Midden	Large Midden
Present	48.9%	55.6%	22.2%	50.0%	32.7%	45.0%
Not Present	51.1%	44.4%	77.8%	50.0%	67.3%	55.0%

Elevation: On average, large middens were slightly higher above sea level than small middens for all the subregions. However, this was never a significant difference. Elevation was predicated to be higher for shell middens than each area's average. Instead, the average elevation was much lower for shell middens than the baseline value (most were significantly lower). This is because many of the random points fall along parts of the shoreline that are inaccessible due to their high elevation, such as cliffs. This does not mean that having settlements high above the waterline was not important, but rather that this method of analysis is not conducive for creating meaningful results for this particular attribute.

Slope: All size groups in each subregion were located on terrain with less of a slope than the baseline, on average. There was never any significance detected between small and large middens. Ninety percent of middens have less than a 10° slope. This strongly reinforces the importance of flat land for settlements.

Direction: The direction small shell middens is evenly distributed among the cardinal and ordinal directions. Large shell middens show an avoidance of facing southwest or northeast (Figure 27). The directions that middens faced did not appear to have any clear patterns or show a significant deviation from the baseline results. Pomeroy (1980:148) did not identify any robust patterning in the direction sites face, other than noting some variation between areas. My results demonstrated the same variation among the subregions.

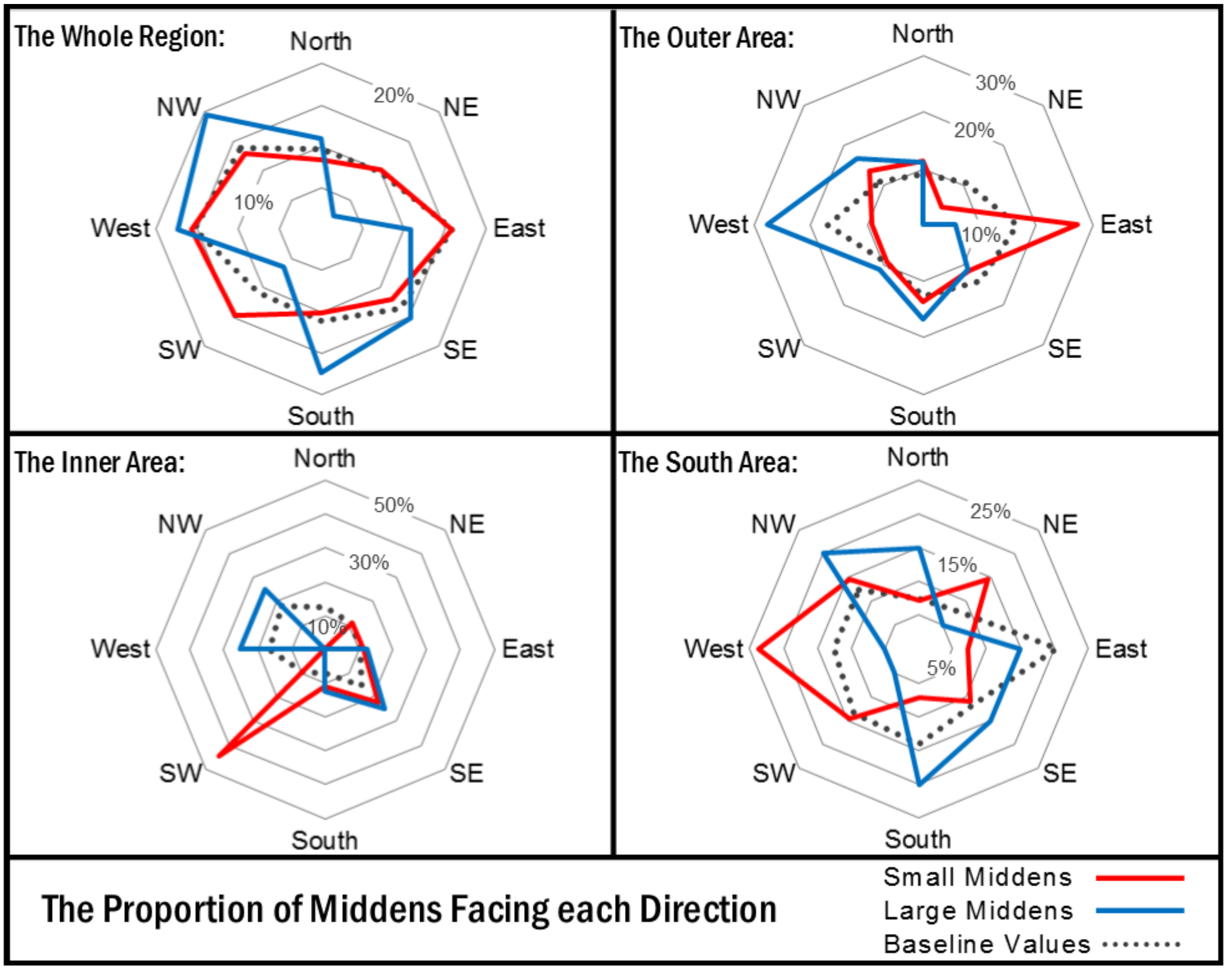


Figure 27. Comparison of the direction middens face. This is based on the proportion of middens in each spatial boundary and according to size grouping.

Exposure: Middens are located on shorelines with lower exposure classes relative to the range of shorelines that are available and the exposure rate of the subregion. There was no discernable difference between the size groups.

Visibility: For the South and Inner Area, large middens have a greater proportion of the ocean visible than small middens (Figure 28). This is opposite of the Outer Area, where small middens have a slightly greater average. This could in part be attributed to the physiographic conditions of each area, since it influences the ability to position settlements in locations with high visibility. For the Inner Area, the elevated terrain, linear shorelines, and few waterways makes it easier to see a greater share of the water. In the Outer Area, the ability to see the surrounding water is made difficult by the maze of islands, complex shorelines, and low-lying topography. The South Area is a combination of the Inner and Outer Area's physiographic conditions. However, this does not explain why large middens in the Inner Area (and to a lesser degree the South Area) have bigger viewsheds than smaller middens.

Table 17. Percentage of small and large middens that have at least 25% of the surrounding ocean visible from the site.

	Outer		Inner		South	
Visibility	Small Midden	Large Midden	Small Midden	Large Midden	Small Midden	Large Midden
Over 25% of water visible	20%	12%	11%	50%	22%	32%
Under 25% of water visible	80%	88%	89%	50%	78%	68%

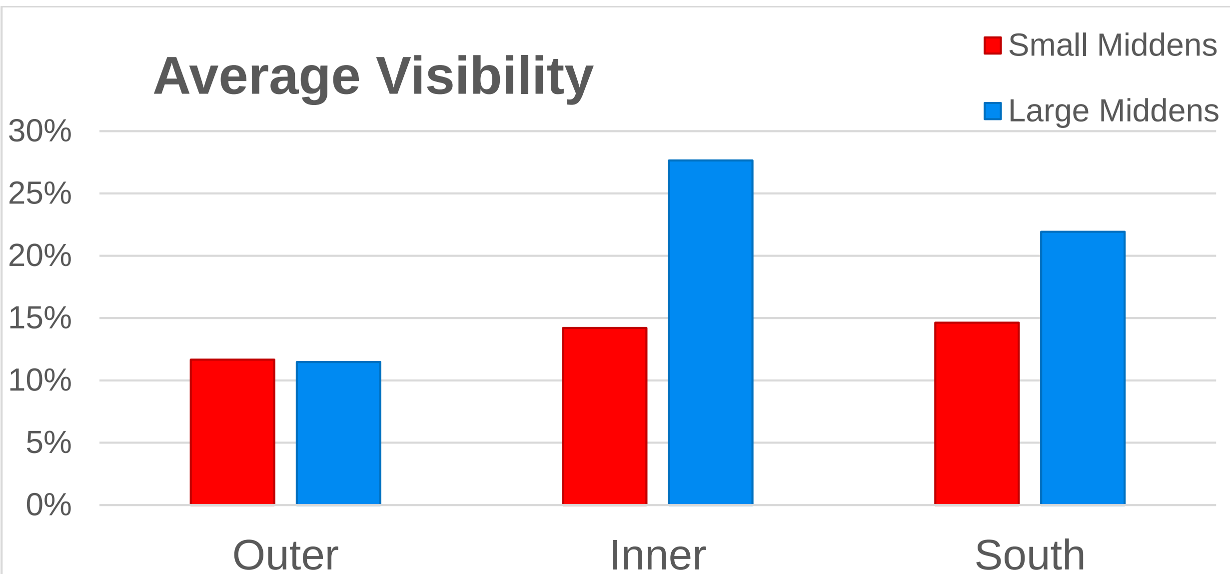


Figure 28. The average proportion of ocean visible from sites.

There is also some correlation between site viewsheds and their distance to salmon streams. Large shell middens that are closer to salmon streams have bigger viewsheds than large shell middens further from salmon streams (Figure 29). The average viewshed of large middens less than 500 m from a salmon stream is statistically different compared to large middens over 1 km from a salmon stream (p-value=0.0053). The same pattern is not true of small middens. The average viewshed of sites within 500 m of salmon is three times bigger for large middens than small middens, and is statistically significant (p-value=0.0309). For shell middens that are over one kilometer from salmon streams, the visibility proportion is similar between the size groups.

Viewshed results are too preliminary to make substantial contributions about the importance of visibility, and how it relates to strategic placement for security and control. Preliminary viewshed results suggest that people may have sought out locations that enabled coverage of important waterways. Sites with viewsheds that completely intersect water passages appears to be important for the positioning of some sites. Further analysis about the patterning between staple resources and visibility may reveal interesting results that have the potential to be quite informative about socioeconomic dimensions.

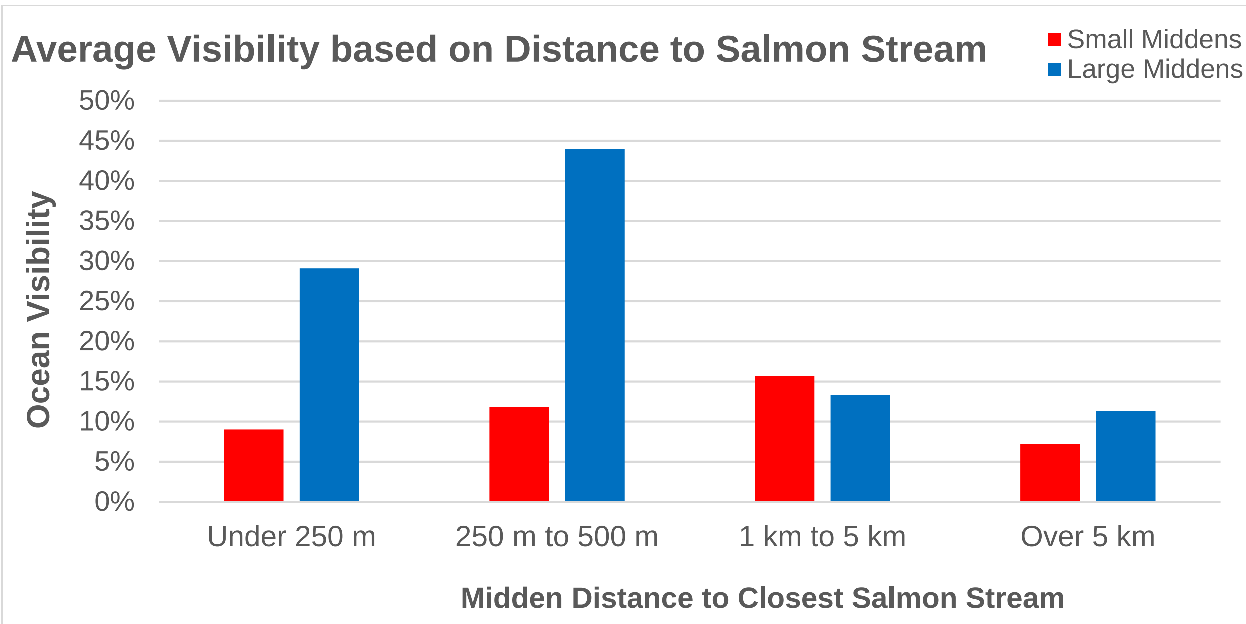


Figure 29. Comparing the distance of shell middens from salmon streams (separated into size groups) against the average proportion of the ocean that is visible from sites.

Section Conclusion

Analysis from Section 1 showed the effects of environmental conditions on the distribution of middens between subregions. This variability continues for the distribution of small and large shell middens depending on the spatial area of analysis. There is overlap in the environmental characteristics of settlement locations between the size groups. However, some distinctions were consistently observed. Large middens show a stronger association with intertidal area, presence of sand, and beach width. All of these attributes are connected to the intertidal zone in front of the sites, and indicate greater likelihood of residing at locations based on the intertidal habitat and abundance of associated resources, e.g. shellfish harvesting. A focus on shellfish harvesting would increase the overall volume and area of midden deposits, which would explain the more frequent occurrence of these characteristics at large midden locations. Large middens have a greater likelihood of being near herring spawning areas, which could suggest late winter occupations for some. On average, they are also in less windy locations and positioned at higher elevations than small middens. Small middens were consistently associated with lakes and kelp. Altogether, these results indicate that the most robust differences between small and large shell middens are related to their resource bases.

Section 3: Resource Proximity and Counts based on Midden Sizes

This section takes an alternative approach to describing patterns in the abundance of resources near shell middens based on site sizes and geographic area. Resource indicators are tallied and viewed in combination, rather than individually, as was done in the previous sections. Counts were derived from data on species distribution and using other indicators of resource availability. These were then separated into seasonally available resources, which are all spawning locations of fish, and consistently available resource indicators such as lakes (Table 4). Once again, results are described for the whole study area and then partitioned into smaller geographic areas to look at more local circumstances.

The Whole Study Area:

Based on all of the shell middens with recorded dimensions, large middens have higher resource counts in their proximity than small middens (Figure 30). This pattern is consistent for both seasonal and year-round resources. Based on a statistical t-test, there is a significant difference between large and small shell middens for seasonally available resources (p-value=0.0077) and all resources (p-value=0.0187) but not for year-round resources. Overall, this suggests that large settlements were more likely to be nearby a more diverse suite of resources than small settlements. This supports the idea that large settlements were based on generalized economies and that people were selecting areas where multiple resource requirements could be met. Relative to this, small settlements were more likely to be selected based on fewer resource considerations and may have been specialized resource locations.

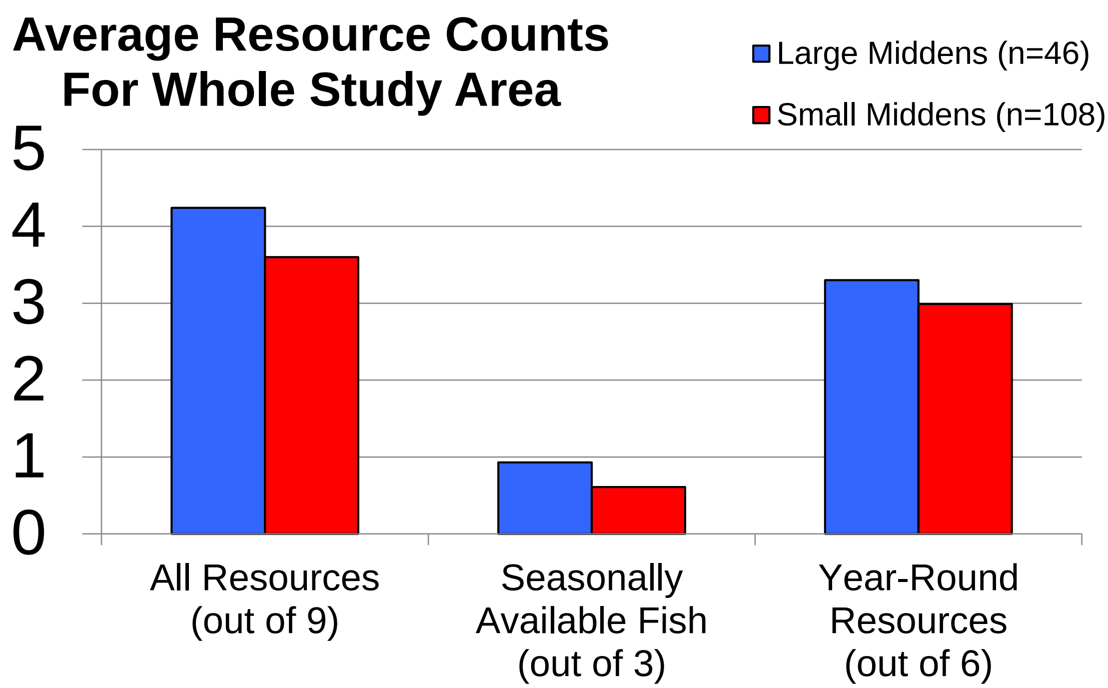


Figure 30. Average count of resource in proximity to large and small shell middens for the whole study area.

Seasonal Fish Resource Counts

Large shell middens are more likely than small middens to be located near the spawning grounds of at least one of the three fish species. Seventy percent of all large middens are within 1 km of a spawning area, compared to 55% for small middens. Large shell middens are also more frequently located in proximity to more than one spawning species. No small (or medium) shell midden is positioned near all three fish species. Only three large shell middens are within 1 km of all three species. These sites are all in the south zone (EkSt-5, EkSt-6, and EkSu-2) and have low constant resource counts (respectively: 1, 2, and 1). The higher proportion of small middens not near fish spawning grounds hints at the possible diversity of specialized sites since their location suggests that the occupants were not targeting productive fish spawning grounds.

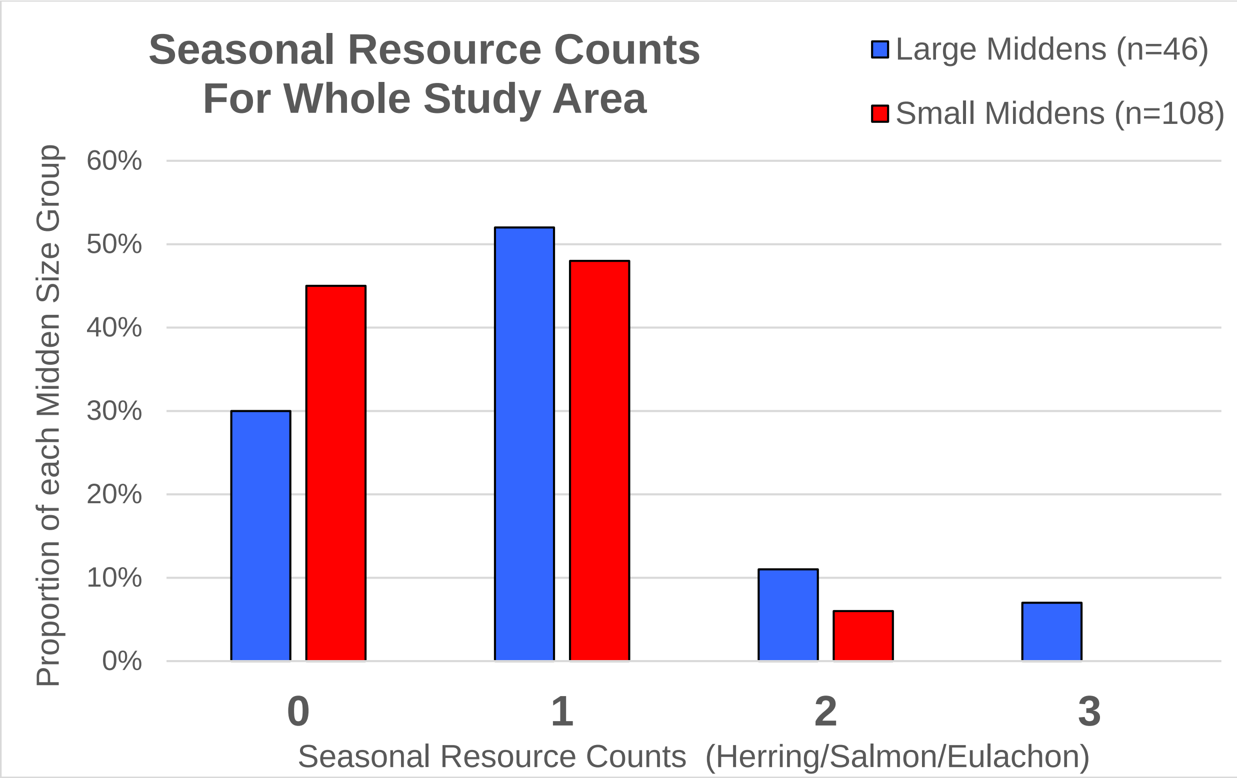


Figure 31. Percentage of shell middens in each size group according to the number of fish species spawning locations they are nearby.

Of the three seasonal fish spawning areas, the most similar occurrence among the midden size groups is salmon (Figure 32). Twenty-two percent of small sites and 28% of large middens have a salmon stream within 1 km. There is a greater difference for herring, which is present at 52% of large sites but only 39% of small middens. Eulachon is the resource most limited in its distribution, and there are only eight shell middens near eulachon rivers. Of these, six are large and two are medium in size. No small site has eulachon nearby.

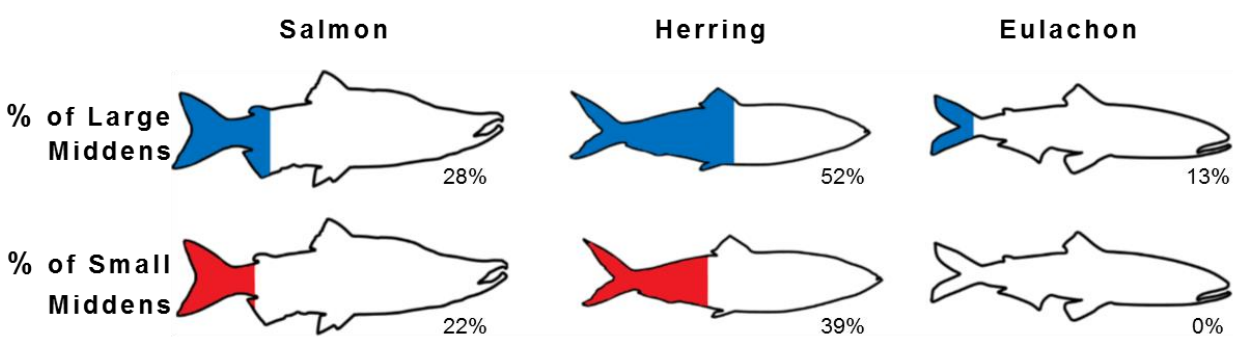


Figure 32. Percentage of shell middens in each size group with each fish species nearby. Exact values are available in Appendix F.

Year Round Resource Counts:

Small shell middens have a normal distribution of year-round resource counts, with most of the sites being located near three consistent resources (F). Medium middens follow the same normal distribution as small sites. The large middens follow a similar distribution for resources up to three, and then are skewed to the right, showing a spike at five year-round resources.

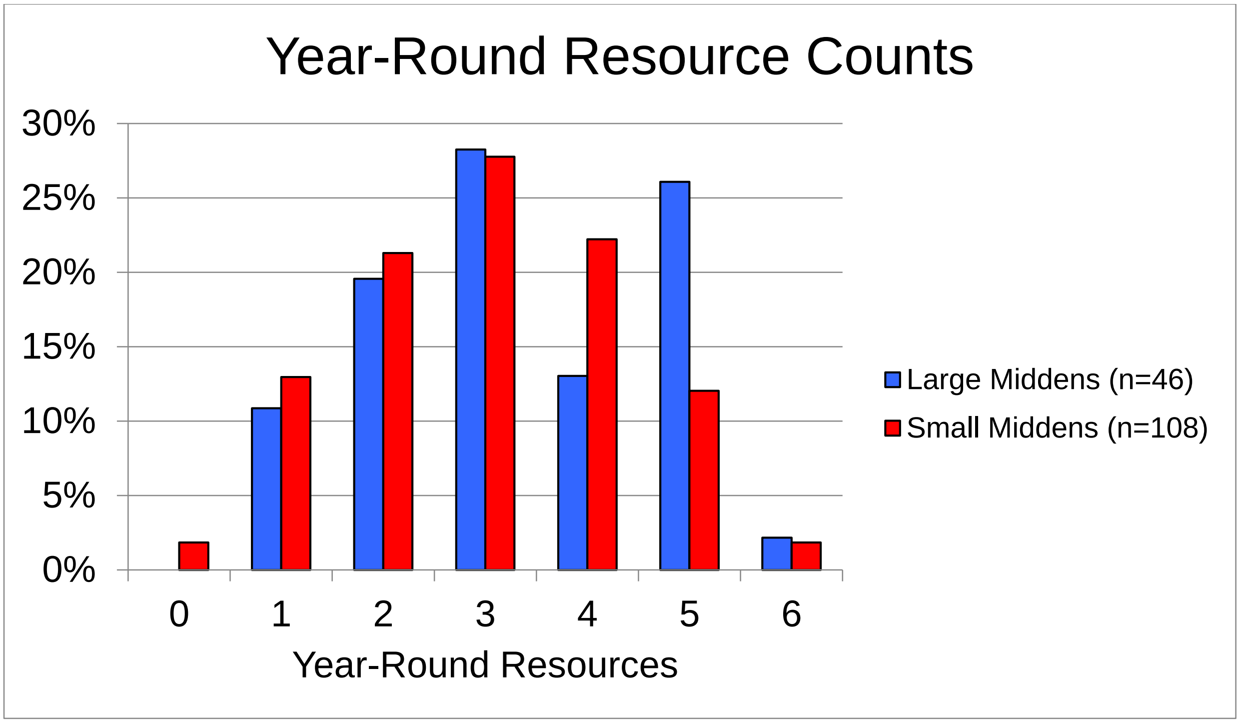


Figure 33. Count of year-round resource indicators nearby sites based on the percentage of shell middens in each size group.

The majority of year-round resource indicators are found at similar proportions of small and large shell middens (Table 18). Wide and sandy beaches are statistically more frequently found in the proximity of large shell middens. This reiterates the results from Section 2 about large middens being orientated to areas with specific intertidal conditions.

Table 18. Percentage of shell middens in each size group with each year-round resource indicators nearby.

	Small Count (n=108)	Small %	Large Count (n=46)	Large %
Wide Beach	34	31.5%	23	50.0%
Kelp	48	44.4%	22	47.8%
Lake	75	69.4%	29	63.0%
Intricate Shoreline	72	66.7%	27	58.7%
Permanent Stream	42	38.9%	19	41.3%
Sand	52	48.1%	32	69.6%

Year Round Resources versus Seasonal Resource:

For large shell middens, there appears to be a trade-off for being in close proximity to more than one fish resource and the amount of year-round resources (Figure 34). The sites that are located near two or more fish spawning areas have low consistent resource counts. No large middens have three seasonal fish sources and over three constant resources. The most popular resource combination for large middens occurs where there is one fish spawning area and five year-round resources nearby. The distribution of large shell middens shows the compromise that occurs between access to highly productive fishing areas and year-round resources. Namu is the sole large shell midden that has two seasonal resources (salmon and herring) and five year-round resources.

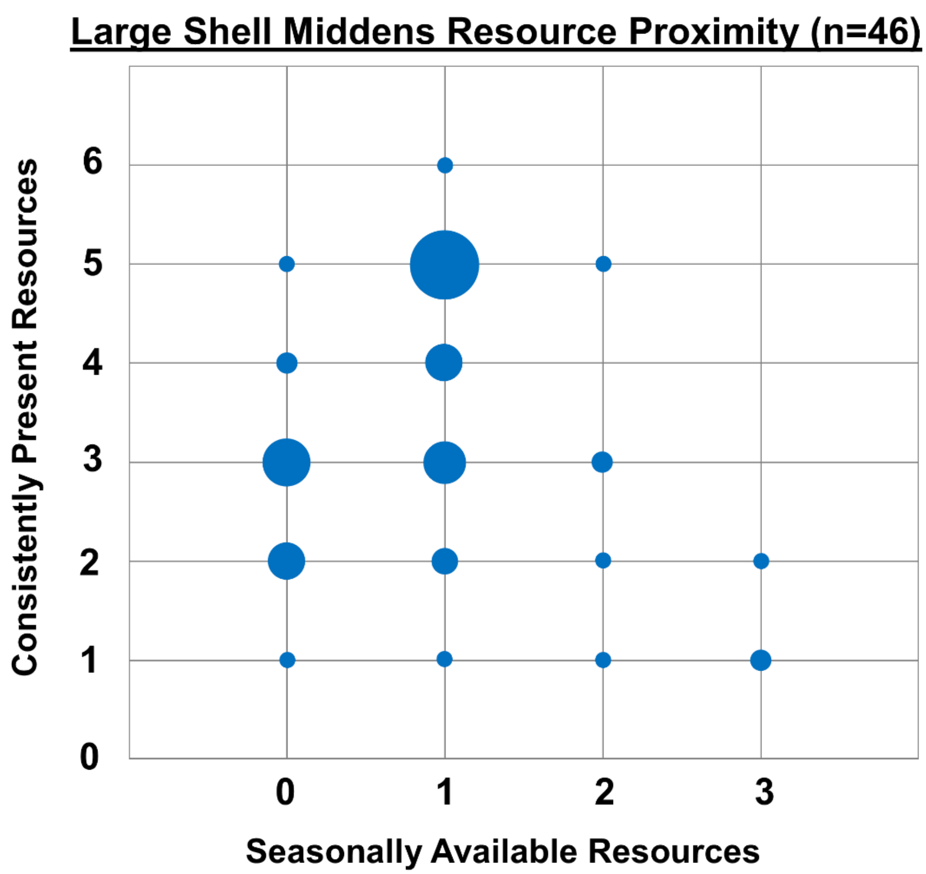


Figure 34. Count of seasonal and consistent resources for each large shell midden. Dot sizes are relative to the number of middens.

Small shell middens do not demonstrate the same pattern and have a normal distribution in year-round resource counts for sites with zero or one fish resource (Figure 35). There is an anomaly where six small sites are near two fish spawning resources and at least four year-round resources[33]. The high resource count at these locations is an indicator that resource proximity is not the main determinant of the history and usage of settlements.

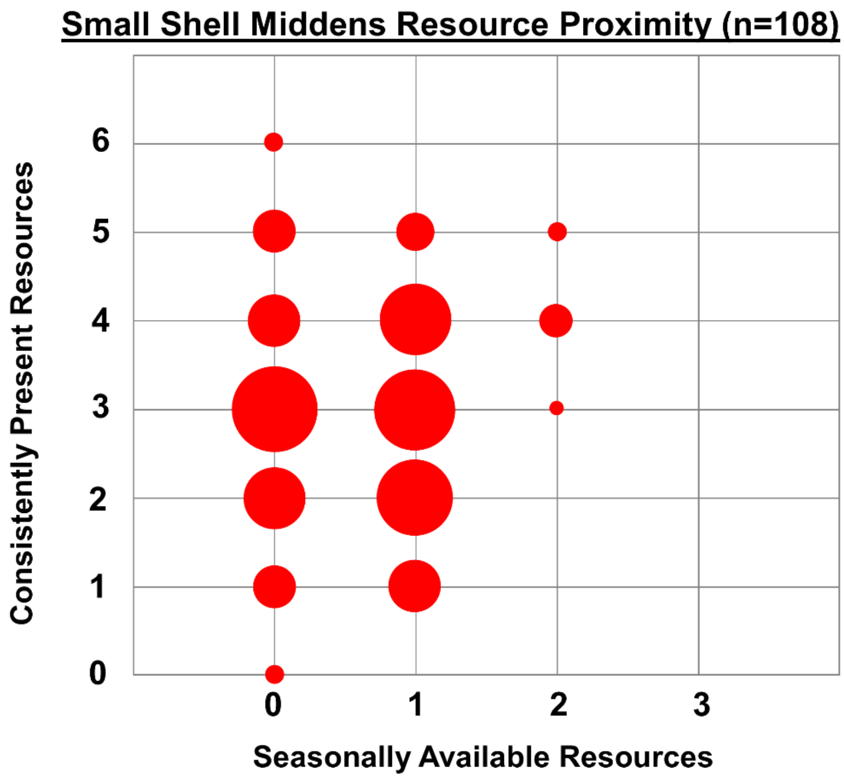


Figure 35. Count of seasonal and consistent resources for each small shell midden. Dot sizes are relative to the number of middens.

For both midden size groups, sites without salmon have higher year-round resource counts than sites with salmon nearby (Table 19). Sites nearby salmon streams are less likely to be in areas that were good general resource spots. Results from Section 2 indicated the importance of resources other than salmon. Table 19 exemplifies the incompatibility of being situated near salmon and having abundant other resources, which is reflective of the distinct ecological settings (e.g. salmon streams and sandy intertidal area).

[33] These are ElTb-22, ElTb-23, ElTb-33, FbTa-25, FbTb-39, and FcTe-2. All of these small sites are within 1 km of salmon and herring.

Table 19. Percentage of shell middens in each size group with salmon and the average count of year-round resource indicators.

				Average of Constant Resources (out of 6)	% with over 3 Constant Resources	
Large Middens (n=46)	With Salmon	28%	n=13	2.38	15%	n=2
	No Salmon	72%	n=33	3.67	52%	n=17
Medium Middens (n=65)	With Salmon	23%	15	2.80	27%	n=4
	No Salmon	77%	50	3.08	40%	n=20
Small Middens (n=108)	With Salmon	22%	n=24	2.67	25%	n=6
	No Salmon	78%	n=84	3.08	39%	n=33

Resource Counts for the South versus the BBV:

This section compares the differences in site resource proximities using the boundaries of the South Area and the Bella Bella Vicinity (BBV) (Figure 36). This has been done to contrast areas that have relatively similar environmental settings but obvious differences in archaeological features. The BBV is the area within 40 km of Old Bella Bella (FaTa-4), which was chosen for its historical significance and the continued centrality to the Heiltsuk people. The forty-kilometer radius includes Namu and some of the Inner Area. Both the South and the BBV have areas that are exposed to the outer coast, other parts that are comprised of several small islands, and waterways leading inland. Both have salmon and herring spawning areas, though differing in the abundance and concentration. The South has eulachon while the BBV does not. Lastly, there are similar numbers of middens in each size group (BBV: Small n=44, Large n=21; South: Small n=54, Large n=20).

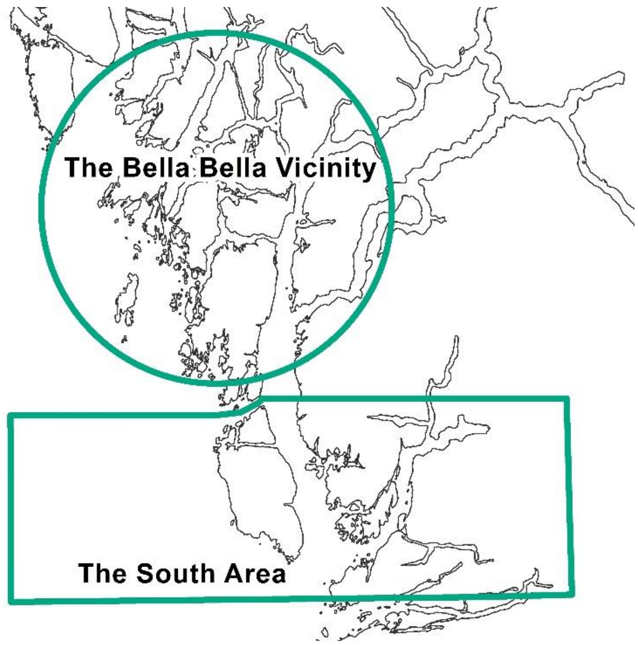


Figure 36. Map showing the boundaries of the South and the BBV (Bella Bella Vicinity).

The general pattern of large middens being in proximity to more year-round resources than small middens remains true for both the South Area and the BBV (Figure 37). But the South and BBV have opposite patterns for the seasonal resources. In the South, the large middens have a higher average for fish species nearby, whereas in the BBV small middens have the higher count.

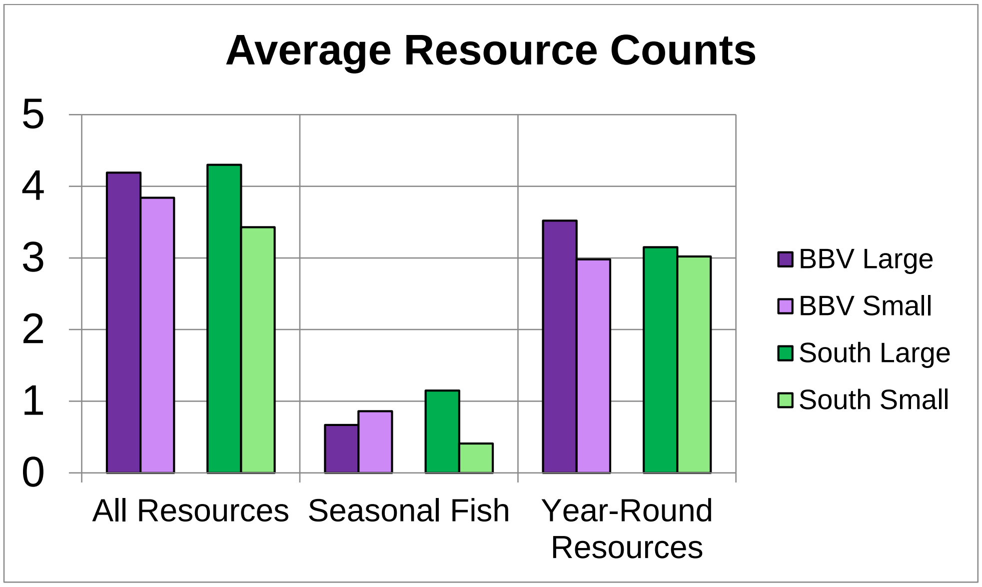


Figure 37. Average resource counts for the two subregions separated by midden size groups.

The South: Small vs. Large

In the South Area, large middens have a much higher average for fish spawning areas than small middens (Figure 37). Seventy-five percent of large middens have at least one fish resource nearby, in contrast to 41% of small middens. One quarter of large middens have salmon streams nearby, while only 7% of small middens are near salmon (Table 20). At the eulachon spawning rivers in this area, there are only large shell middens nearby (n=4). Herring is present near 33% of small sites and 70% of large middens. There is no small site in the South that has more than one seasonal fish resource nearby.

The most frequent large shell midden combination (50%) is proximity to herring (and no other fish) and a high year-round resource count (average = 4.1). There are seven large sites[34] located near herring that also have over three year-round resources. These tend to be clustered and near the outer coast. The other common resource grouping for large middens is being situated near a high number of fish species but a low year-round resource base. These sites are found near Lake

[34]EiSw-5/6/7, EjTa-5/13/15, and EkSx-1

Oweekeno and the Kilbella and Chuckwalla River. In the South, no large site has salmon as its only proximate fish resource.

In comparing the occurrence of year-round resources nearby sites, large shell middens had higher frequencies for all of the resources except for intricate shoreline and lakes. Based on contingency tests, there was never a significant difference for year-round resource availability between small and large middens.

Table 20. Proportion of sites from the South in each size group with the resource indicator nearby. The frequency counts were compared using a contingency table.

	Small % (n=54)	Large % (n=20)	Contingency Test p-value	Significance
Salmon	7%	25%	0.0541	**Nearly Significant**
Herring	33%	70%	0.0076	**Significant**
Eulachon	0%	20%	0.0042	**Significant**
Wide Beach	32%	40%	0.5826	
Kelp	39%	55%	0.2917	
Lake	69%	55%	0.2891	
Intricate Shoreline	74%	55%	0.1580	
Permanent Stream	41%	45%	0.7946	
Sand	48%	65%	0.2945	

The Bella Bella Vicinity:

Large middens in the BBV have a higher total resource count than small middens (Figure 37). In this outer coast area, the small sites have higher fish resource counts and lower year-round resource counts than the large middens. The difference between midden sizes for their year-round resource indicators is more pronounced than in the South, but less so for the fish resources.

In the BBV, 24% of large middens and 34% of small sites have salmon nearby (Table 21). The herring numbers are very similar between size groups, and there is no eulachon within the boundaries of the BBV. The distribution of resources in the BBV is different from the South. Here herring spawning areas are abundant and small salmon streams are well spread out. There is no eulachon, so to acquire the oil of this greasy fish, people must have travelled or traded it in. The only resources that appear to be different between size groups are wide beaches and sand, which are found at the majority of large sites.

Table 21. Proportion of sites from the BBV in each size group with the resource indicator nearby. The frequency counts were compared using a contingency table.

	Small % (n=44)	Large % (n=21)	Contingency Test p-value	Significance
Salmon	34%	24%	0.5669	
Herring	52%	43%	0.5977	
Eulachon	0%	0%	1	
Wide Beach	32%	57%	0.0628	Nearly Significant
Kelp	50%	48%	1	
Lake	73%	76%	1	
Intricate Shoreline	57%	67%	0.5898	
Permanent Stream	36%	29%	0.5873	
Sand	50%	76%	0.0610	Nearly Significant

Discussion of the South versus the BBV:

Opposite patterns exist between the South and the BBV for site sizes in respect to seasonal fish proximity. In the South, the proportion of large middens near fish spawning areas is significantly higher than small middens. Whereas in the BBV, small sites are more often found near fish locations, though the difference is not statistically significant. The resource composition of these areas differ, but not hugely, so there was reason to speculate that the archaeological sites would have similar configurations. The environmental similarity between these areas is exemplified by the similar averages of constant resources for both areas and size groups. This points towards the idea that seasonally limited resources have a greater impact on differences between the South and the BBV.

One other difference between these areas is the specialization of seasonal resources. In the BBV, sites are infrequently near more than one fish area. There are also only two large sites (out of 21) with salmon and herring, and six small sites (out of 44). This suggest that people were specifically targeting certain species rather than situating themselves in locations to access both species. In the South, five large middens (out of 20) have at least two fish species nearby, but no small middens have this resource base. All large sites with salmon also have another resource close-by. Herring is the only fish that occurs on its own for large middens, but usually in conjunction with several year-round resources. In the South, all middens that only have salmon, and no other fish resource, are small and medium[35]. Some of these could represent resource specialized sites (and likely do).

[35] Small middens – EjSw-37, EjSw-38, EkSs-1, EkSv-1. Medium middens – EiSt-1, EiSt-9, EiSw-13, EjSv-12.

Upon manual inspection of the distribution of fish spawning areas, in the BBV there are many areas that have overlapping salmon and herring so there was the potential for people to target those locations. In the South, some salmon rivers do not overlap with herring. But because the large middens that have salmon also have herring, this suggests that people sought this species overlap. Locations where there was no species overlap were not utilized as extensively. It is possible that, in addition to salmon, there needed to be other major resources at a location in order for a more substantial settlement to be built up in the South. The fact that large middens, more than small middens, are located near abundant resources is a pattern that is more apparent in the South. In the BBV, there appears to be more specialization and targeting of specific resources.

Lastly, the South and BBV have a stark difference in their archaeological assemblage – the quantity of fish traps. The BBV has 136 stone fish traps within the area while the South only contains five. The fish traps speak to the technologies utilized by people to obtain their food supplies. The major rivers of the South had a more consistent fish supply, lowering the chances of years without enough fish in the stocks. On the outer coast, the streams have fewer species in them, are smaller, and have more severe fluctuations in the salmon run. It could be that differences in resource reliability contributed to the abundance of fish traps in the BBV and the low rate of large sites near several fish spawning areas. Whereas in the South, different fishing techniques (more suited to the major rivers) were utilized and rich fishing locations were occupied more intensively.

Chapter 5: Discussion & Conclusion

This chapter begins by reviewing the determinants of location suitability and how these factors are spatially contingent. I discuss the differences detected between small and large middens, and present conclusions about orientation to resources, acknowledging the merit of economic explanations but recognizing their partial nature. I also talk about specific sites and areas that were of particular interest due to being the focus of previous studies or having unique circumstances. I consider the overall relevance of this study to the understanding of settlement patterns on the Northwest Coast, and reflect on how these results align with or contradict other findings. In offering suggestions for future work and areas left in need of investigation, I discuss my methods, the issue of analytical scales, and the impact of data quality on the results. In the end, I summarize the main conclusions of my analysis but also acknowledge how much we still do not know about the history of settlement patterns on the Central Coast.

Settlement Locations: Multiple Determinants and Environmentally Contextualized

I have demonstrated that multiple environmental factors contributed to the suitability of settlement locations. This study showed an association between site locations and certain physiographic conditions and resource availability. It is impossible to address the totality of location requirements that may have existed. On its own, no single attribute is sufficient to constitute a suitable location to establish a settlement. The traits that determined locational suitability are multifaceted and have a hierarchy of importance. For instance, protected shorelines were significant for the majority of the region but it could not be said that an area was occupied solely because it was protected from the elements. Rather, these traits work in unison. Even seemingly significant qualities, such as a productive salmon stream, would not have been the singular reason people chose to occupy a location. The importance of certain conditions and their combination is affected by the surrounding environment, settlement type, and by cultural preferences. Due to the dynamic nature of location preferences, a general pattern may emerge but a great amount of variability is expected.

Some environmental characteristics would have been desirable regardless of the type of settlement. The two attributes that were consistently significant for all spatial boundaries were distance to lakes and shore substrate. Altogether 65% of shell middens were within one kilometer of a lake, compared to the 40% of random points. The distance between middens and lakes was identified as statistically significant for every single subregion (Table 5), which suggests that archaeologists may have been overlooking lakes as a requirement for settlement locations. This common occurrence should encourage further enquiry into why these land features may have been so important to the region's inhabitants. The other consistent result was the type of substrate in front of sites, suggesting that the character of the intertidal zone was a major consideration for settlements across the area.

Environmental features are not only related to the subsistence resources they can provide. I have discussed features that relate to comfort or the ability to establish settlements such as terrain and sheltering. But the appeal of these physiographic characteristics can go further, such as the aesthetic of landscape or places of memory. There are explanations that cannot be simplified to model parameters. External factors would influence location suitability, and the qualities deemed acceptable are temporally and spatially specific. For example, FbSx-6 (Roscoe Inlet/ Xụnís) is a traditional winter village used by the Heiltsuk. When missionaries banned potlatches, people started using FbSx-9 ('Húmáta) so they could continue to potlatch (Burton 1985:119). FbSx-9 does not have some of the advantageous characteristics that were present at FbSx-6; it lacks good sunlight necessary for warmth in the winter and has poor visibility of the surrounding area (Burton 1985:120).

Ultimately, there is much variation in site distribution. Some of the differences in site placement are influenced by the season and type of occupation. Others are a result of the local environmental setting since it determines what conditions were available. Settlements had different location requirements for resource availability, since particular species would have been important for a portion of the settlements. For instance, even though the majority of the subregions showed a preference for proximity to salmon (Table 5), it is clear it was not always a consideration since only 15% of middens are within 500m of salmon. This means there will be many settlements in locations that do not fulfill a simplistic hypothesis of where middens are expected to be. It was expected that a significant portion of sites would be close to salmon, due to the species' perceived centrality to northwest coast cultures (Drucker 1965:10; Mitchell and Donald 1988:301). Contemporaneous settlements would have had different strategic considerations and interests.

Patterns differ depending on the spatial extent being examined. This is a result of discrepancies between resource availability and physiographic conditions. Most attributes were returned as being associated with site placement when analysis was conducted on the regional scale. This was partly a function of the number of cases, since it increases the probability of achieving a significant statistical result. When broken down into small spatial zones, fewer attributes demonstrated statistical relevance. Once areas are segmented, nuanced patterns appear. Decreasing the scale of analysis produces results that are more indicative of local circumstances. Distinctions that emerge between the subregions can be revealing of irregularities of environmental characteristics or cultural practices. Overall, there were similar patterns of attribute significance between the subregions and the whole region, but no analyzed area returned results completely the same as those from another region. Therefore, conclusions about locational patterning of shell middens must account for local circumstances.

I use a resolution of data that can empirically investigate the spatial and physical variability that is the time-averaged result of long-term, complex processes (Bailey 2007:203; Stern 1994). I have presented large patterns based on their ordering in space. My investigation did not contend with the fine details of individual sites. For this project, there were limitations to making conclusions about individual's actions or experiences – limitations heightened by the absence of a high-resolution temporal dimension. Shell middens are palimpsests, formed by successive events at the same location as part of long-term processes. My analysis was conducted on the remnants of these settlements, as they appear today.

The toggling that occurred between scales is one of a geographic definition. The level of detail or resolution of data did not change as the spatial boundaries changed. The main factors that affected the ability to detect patterns were sample sizes and environmental context. Large-scale views can bring into focus long-term processes undetectable on the small scale (Bailey 2007:201). I maintained that same large-scale resolution throughout my analyses, despite changes in spatial boundaries. The patterns that were detected are the result of actor's lived experiences and circumstances, cumulated over millennia and manifest as my observations. Inquiry into short-term processes are possible through other avenues of investigation with higher resolution data. Truly understanding land-use patterns and settlements histories will only be possible by linking the results of investigations conducted at various scales (Bailey 2007:201; Mackie et al. 2011:3).

Archaeologists are better able to appreciate how environmental variation is reflected in cultural formations when they contextualize sites within their environment (Monks 2011:130). Depending on the attribute, some subregions have environments with an abundance of the perceived desired conditions. This is pronounced in the need for protected shorelines at settlements. All the subregions except for the Inner subregion show middens being orientated to more sheltered shorelines (Table 5). The Inner subregion middens did not show any difference from the random point distribution because the majority of this inner coast area is well protected. Finding suitable locations in this area would not require the same consideration that is necessary for settlements on the west side that are more vulnerable to the wind and wave forces from the ocean.

Identifying significant attribute associations with middens was more successful when there was limited distribution of the particular trait. When a desired environmental condition is pervasive it is difficult to know if shell middens are associated with that characteristic or randomly distributed. For factors such as protection from the waves and wind it is entirely reasonable to maintain that it was important for settlement locations. Other factors are not as clear, making it difficult for archaeologists to make conclusions about their desirability. Certain attributes and subregions do not show a statistical correlation, thus requiring other forms of assessment to demonstrate if the attribute is a factor in site location. The distribution of herring spawning areas, for example, is vastly different in the three subregions. In the Outer Area it is difficult to say if people were choosing settlements with the intention of targeting herring spawning areas. This was the only subregion that did not return significant results of any kind for distance to herring but it actually has the most sites within 250m of herring (41%). In contrast, in the South Area, which has fewer herring areas, 32% of shell middens are within 250m of herring, which produced significant results for both small and large midden groups. The subregion with fewer sites close to herring paradoxically produced statistical results suggesting greater importance for this attribute. When resources are homogenously available, it is not always possible to empirically demonstrate their relevance as a determinant. This was part of the motivation to include Section 3 in my project since it used resource tallies for each midden to analyze resource availability, rather than only looking for distinctions from the baseline values. It is difficult to find a balance for explaining observations that are complicated by differences in the environment and cultural patterns. A combination of statistical tests and manual observations are required to understand site and attribute associations.

Small and Large Shell Middens and Resource Proximity

Overall, I found that large and small shell middens have observable differences in their placement with respect to certain factors though the results were ambiguous for others. In general, large shell middens are more likely than small shell middens to be located in proximity to a greater range of resources. Small and large shell middens represent more than two types of settlement, and certainly do not simply signify large winter villages and specialized resource camps. Even though it is better to use them as a unit of comparison rather than lumping all middens together, these size groups are still each comprised of a variety of middens. The type of activities conducted at settlements produce different quantities of cultural materials deposited at sites. Although it cannot be stated with certainty what activities were conducted at each site, there are small and large middens that have the same types of resource availability. Therefore, the presence of a certain resource (or a combination) is not a singular cause for the resulting shell midden size. Additionally, large middens can represent a series of smaller occupations as different areas of the site could have been used at different times (Pomeroy 1980:90; Stein et al. 2003). The inability to define obvious location differences between small and large middens does not leave us without implications. It contributes to the growing advocacy against the ethnographically-rooted binary model of a few large winter villages and many small seasonal resource camps (Burchell et al. 2013:635; Ford 1989). If this was actually the case then there should have been a clear difference between large winter locations and small summer sites. Acknowledgement of settlement location variability reinforces the need to question long-standing assumptions about settlement patterns.

No definite trend was observed for settlement proximity to salmon when considering site sizes and different geographic areas (Table 11), other than to say collectively that sites demonstrated an association with salmon streams (Table 5). Regional inconsistencies are why Pomeroy (1980) and Hobler (1983) were unable to explain settlement patterns in relation to salmon streams and site densities since they used salmon as the sole resource indicator. Pomeroy (1980:208) did postulate that fluctuations in salmon stream productivity impacted the distribution of settlements. A level of flexibility was required when salmon runs were low in streams, i.e. on the outer coast where there are many small middens oriented to salmon streams that have smaller runs than the larger rivers on the inner coast. For the Inner Channel Zone, Pomeroy (1980:151) said that large middens are found in association with major rivers and very few fish traps are present. He felt that, in part, differences in the distribution, abundance, and reliability of salmon could have led to these two styles of resource attainment. My results have slightly contradicted Pomeroy's conclusions, since in the Inner Area there is a roughly equal proportion of small and large middens near salmon streams. However, there is still some legitimacy in Pomeroy's conclusion that there were differences between spatial areas in how sites are oriented to salmon streams. The use of stone fish traps in the Bella Bella Vicinity but not the South Area signifies differences in social and economic practices in regards to salmon harvesting.

Pomeroy's explanation about the dependability of resource availability could be applied to the relationship between site distribution and herring spawning locations. Compared to salmon, the location of herring spawning grounds is more uncertain since they vary year to year. Salmon spawn in the same streams in which they were born (Quinn 2005:6). Within a period of 75 years, herring were recorded spawning on 19% of British Columbia's coast, but only 1-2% of the coast was used repeatedly for spawning (Hay and McCarter 2006). The distribution of herring is widespread but their reliability is more uncertain, which could have required flexibility in spring settlement locations.

Eulachon locations are the most spatially restricted. There are no small shell middens located near eulachon rivers and most of the shell middens found at these locations are large. This suggests some sort of continuity in cultural practices concerning harvesting this fish. It is possible that there were smaller occupations near eulachon rivers but the meandering rivers and flood plains wiped out their records. The four middens that have been dated (out of the eight in total near eulachon) all date to within the past 2000 years[36] (Appendix G). The restricted locations for eulachon, its economic significance, and association with large middens suggest that lots of people were present at these rivers annually to harvest eulachon.

Shoreline characteristics has been successfully demonstrated by other researchers to be relevant to settlement patterns (Mackie and Sumpter 2005; Maschner and Stein 1995; McLay 1999). In all my spatial boundaries and site groupings, the proportion of shore substrate types at middens differed from the anticipated baseline quantities. Intertidal characteristics appear to have been of greater

[36] EkSt-1, FaSu-1, FaSu-2, FaSu-10

importance for large midden location suitability. This bolsters the idea that despite shellfish being widely available, they did have a significant effect on the type of occupation and location of settlements.

Connecting faunal evidence and site environmental characteristics can offer explanations for why settlements are situated where they are and demonstrate the location orientation of resource use (Monks 2011:130). Shellfish species have particular habitat requirements based on the characteristics of the intertidal area (i.e. exposure, salinity, and substrate). The habitat availability in shorelines adjacent to sites is often reflected by the types of shellfish recovered in middens (McLay 1999:24; Monks 2011; Moss and Erlandson 2010:3360). It can show the influence of the microenvironment on the actions of people and potential flexibility in their diets. Namu and Kisameet are thought to represent two similar residential types – winter villages –for at least part of their occupational histories (Cannon 2002:318). Certain shellfish can be found at the beach in front of Namu but the area is not abundant in mussels and not conducive to barnacles. Suitable habitats for barnacles and mussels are present in front of Kisameet since the bay and ocean floor is more rugged and exposed than Namu's shorefront. These differences are reflected in the faunal remains from the two close-by sites, where mussels and barnacles occur in higher abundance at Kisameet than Namu[37] (Luebbers 1971:122). This suggests that the immediate proximity of species influenced the makeup of people's diets and that people had some flexibility in their locational requirements.

Economic strategies influenced where settlements were located, at least in part, and may have required compromise in regard to other conditions. Six middens are recorded on the Goose Islands group, a somewhat isolated island group on the outer coast[38]. To access the resources that would be available there, and possibly not in other locations, people would have to compromise wind and wave protection. Excellent positioning for key resources may supersede the desire for low exposure, though even in these circumstances people can still select locations that enable proximity to outer coast species but still offer some protection, such as a tucked away bay.

[37] There is variation through time (Conover 1978:76)
[38] ElTc-1, ElTc-5, ElTc-6, ElTc-7, FaTc-14, FaTc-21

I included as many as possible resource indicators or species distributions, although it is far from an exhaustive list. There are 81 sites (23%) that are not within 500m of herring, salmon, or eulachon, or within 250m of a wide beach (to signify shellfish). If there is validity to the assumption that most sites are strategically located in proximity to resources, then this indicates a gap in the model for key resources. The proportion of sites without easily discernable resource targeting is higher for small middens (30%) than large middens (17%), since intensive occupation is more likely contingent on the main resources listed above[39]. There is more likely to be a wider range of resources targeted through numerous small sites than large settlements. This specific result does align with the conception of winter village locations on the Central Coast being chosen for protective qualities rather than food availability (Pomeroy 1980:224). The 23% of sites without one of these resource indicators may suggest that the location of sites cannot solely be attributed to economic explanations.

A lack of data on species distribution sets limits on what can be concluded about the selection of locations near a diversity of resources. The analysis of fauna from sites is one way archaeologists could estimate the specialization or generality of a site's use. The faunal remains cannot indicate with certainty the full range of species that may have been obtained in the immediate proximity of the site but it can provide a suggestion for an economic focus of the settlement or the types of activities conducted there. On the Central Coast at present, no one has yet undertaken examining site faunal materials in unison with the site's locational characteristics. Observations may be limited by a restricted sample size of sites with faunal analysis already conducted, but the success of similar projects elsewhere (e.g. McLay 1999) warrants this research in the future.

The easiest answer would be to say that people were where they were due to resource proximity. This is a simplistic view point and contributes little to understanding occupations, especially since more accurate evidence could be acquired directly from site remains. The use-value of resources is not the singular human motivation. We know that resources did have a significant effect on the location of settlements and their history of usage, but my results show that this is an incomplete picture. There are sites with a rich resource base that do not have evidence of large settlements.

[39] Small middens with none of the four listed resources nearby is 32/108. For large middens it is 8/46. Using a contingency test the difference is not significant (p-value=0.1593).

There were reasons apart from resource availability for why those locations were never occupied more intensively.

Select Sites and Areas of Interest

This section briefly describes observations about select sites and areas that are deemed particularly interesting. In some cases, information from previous research is used to demonstrate confidence in the model and results.

Namu

Namu is the only large midden (or medium midden) with at least two seasonal resources and over three constant resources (Figure 34). It is also the only large midden with salmon nearby that has over four constant resources. The only resources from my list that Namu does not have are kelp and eulachon. These results contribute to the argument for why Namu is a unique site on the Central Coast and affirms the attention it has been paid by archaeologists (Cannon 2011:55; Carlson 1998:32; Moss 2011:76; Pomeroy 1980:217; Rahemtulla 2006:4). Based on my results, no other site exhibits all of the same locational qualities as Namu, which could be part of the reason why Namu demonstrates a consistent pattern of occupation over at least seven millennia (Cannon 2002) (Appendix G). There are sites close to Namu that have kelp (ElSx-10, ElSx-17, and ElSx-18). The closest eulachon spawning river is Quatlena River (shortest distance is 25 km). The area around Namu has immediate access to the inner coast water channels, which is important for trading, and also has resources prevalent on the outer coast (i.e. herring). Namu is also situated on the mainland, possibly providing a more stable supply of terrestrial animals.

Nulu

Nulu (ElTb-1) has three times the amount of herring as Namu and low levels of salmon (Cannon 2002:319). According to my model, the site is over 2.5 km from salmon and less than 50m from herring spawning locations. This offers validity to my model and confidence in the species distribution data, and demonstrates that people were eating what was close by.

FbTa-10

There are two other concentrations of high resource counts for sites in the study area. One is the outer coast of Hunter Island, which includes McNaughton (ElTb-10) and Nulu (ElTb-1). The other prime area is Seaforth Channel, which separate Dufferin Island and the mainland (Borden blocks FbTc, FbTb and the center west part of FbTa). FbTa-10 is the only site with all six constant resource plus salmon and herring. It is located in Morehouse Bay on Chatfield Island, right across from the Yeo Island Reserve. It has no place name, no date, or recorded extent. The site is protected, very close to a stream, has a low slope, is located on a sand and gravel flat, is near a number of tiny islands, and has a fish trap. It is peculiar in that neither it, nor any of the five[40] other middens in the same bay within 1.5km, have ever been archaeologically tested. They also lack place names, and this lack of interest and information is unusual considering the close proximity of the area to Bella Bella. Based on the excellent position for resource availability, future investigations at FbTa-10 and the surrounding sites could reveal a substantial occupational history.

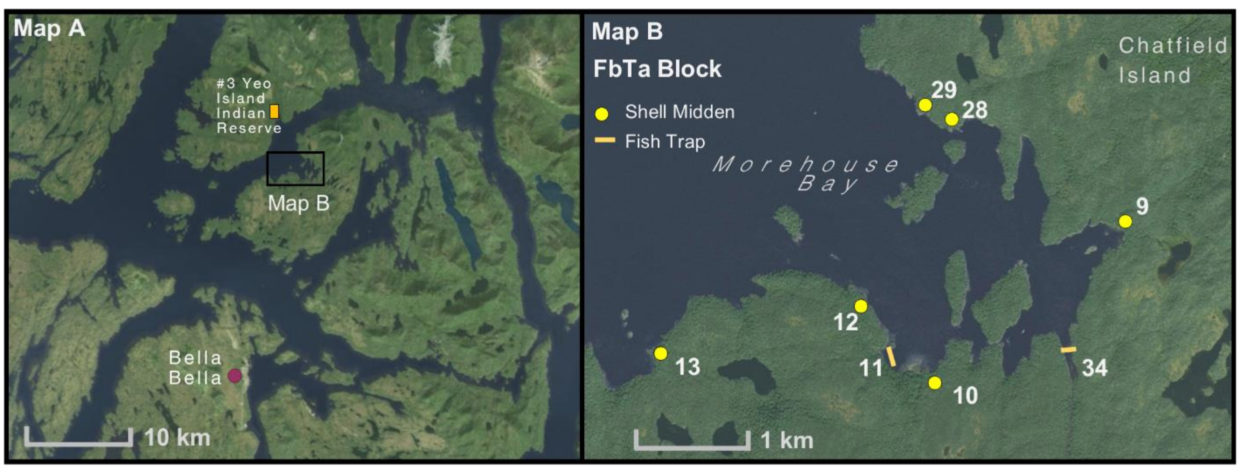


Figure 38. Map of FbTa-10 and overview of area. Basemap from ArcGIS Online World Imagery. Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, FSA, USGS, AEX, Getmapping Aerogrid, IGN, IGP, swisstopo, and the GIS user community.

Calvert Island and Hecate Island

The South Area is distinctive from the other subregions due to the site concentration and resource distribution. The Kwakshua Channel between Calvert Island and Hecate Island has four large shell

[40] FbTa-9 (unknown size), FbTa-12 (unknown size), FbTa-13 (unknown size), FbTa-28 (small), and FbTa-29 (small).

middens (all within a 5km radius) and no reported salmon streams. From the evidence of species distribution today, the locations of these large middens and abundance of other middens in this area is not associated with a salmon economy. Intensive shellfish harvesting is suggested for the area, based on the presence of a clam garden (EjTa-17) and shell growth increment analysis from EjTa-4 (Way et al. 2015). People may have been attracted to the area to access outer coast resources. The absence of sites on the majority of Calvert Island, suggests there were other considerations for settlement suitability beyond outer coast resources.

Contributions to Understanding Settlement Patterns on the Northwest Coast and Suggestions for Future Work

Early archaeological investigations on the Northwest Coast sought to uncover why settlements are located where they are. Today, research projects are still underway in hopes of providing more insight (Monks 2011:136). Some of my results parallel conclusions made elsewhere on the coast and are widely accepted, such as multiple determinants, rather than a single determinant, being relevant for site locations (Lepofsky 1985; Mackie and Sumpter 2005; Pomeroy 1980). This explains why those that tried to explain site patterning in relation to a single key resource have had limited success (e.g. Hobler 1983; Maschner and Stein 1995). It is generally accepted that variability in resource availability and abundance along the Northwest Coast impacts the settlement patterns of cultures (Lepofsky 1985:167). My project has helped illuminate the distinctions in settlement patterns that can be observed within a limited spatial boundary.

Economic explanations for spatial arrangements have been criticized or proven false, but in reality many of these projects were ill-equipped or poorly designed to adequately address this proposition due to data or methodology limitations (Maschner and Stein 1995). Even today, with the advances in sophisticated software and the relative plethora of available data, the ultimate question of ‘why are sites located where they are?’ remains unresolved. In circumstances where researchers feel confident they have revealed further insight into this query, their results cannot be transferred to explain distribution in another area [(e.g. security concerns in Prince Rupert Harbour (Supernant and Cookson 2014)]. My conclusion that large sites are situated near a greater resource base than small sites matches the correlation McLay (1999) showed between resource productivity and the occupational intensity of settlements. My approach has stressed the importance of particular local conditions and environmental context: without examination of similar conditions in other regions, there would be much uncertainty in extrapolating these results elsewhere.

What can be shared between these investigations is the methodology; it can be replicated and improved upon. All data used in my project are available online[41]. By making site data available online, the Government of British Columbia has facilitated the opportunity for archaeologists to analyze big spatial extents and large numbers of sites. These repositories hold a wealth of information. Archaeologists can benefit by utilizing existing data, particularly in situations like this, since it merges records from both academic and government research and private mitigation work. The ability to conduct innovative, efficient, and effective research is made possible by the time and labour of previous researchers and the government agency responsible for the repositories. The use-value of existing data can be maximized in lieu of costly excavations or removing additional cultural materials from sites.

Stable sea-levels on the Central Coast (McLaren et al. 2014:165) prevents using the distance of sites from shorelines as a chronology proxy, as has been done elsewhere (Mackie 2003; Mackie and Sumpter 2005). However, this makes the area a uniquely suitable context in which to address questions about shifts in settlement patterns through time. There is evidence for extended occupation of locations over millennia. Archaeologists know of four sites[42] that have been occupied for over 10,000 years (McLaren et al. 2014:166). In comparison, in Gwaii Haanas, only 4% of sites were occupied both during the Early and Late Period. Here, Mackie and Sumpter (2005:345) found that between these two time periods people had different criteria for location suitability. On the Central Coast, persistent places and multi-component sites suggest that there was some kind of stability, even as the environment went through fluctuations and cultural changes occurred. Of the 27 shell middens that predate the Common Era, all but four[43] have evidence of occupation post AD 1. This trend is reversed for continual occupation pre and post contact, since from the forty shell midden sites that have evidence of occupation during the Historical Period,

[41] Archaeological data are housed by the Government of British Columbia and permission is required to access the Remote Access to Archaeological Data application. High resolution DEM data were generously provided by GeoBC. All other data were acquired freely and are available to the general public.
[42]Namu (ElSx-1), Kildidt Narrows (ElTa-18), Triquet Island (EkTb-9), and Pruth Bay (EjTa-15); see Appendix G.
[43] EjSw-4, EjTa-5, EjTa-13, and EkTb-9

only eight have prehistoric dates. At present, this is reflective of the lack of radiocarbon dated sites, more than being suggestive of changes to land-use practices. Future exploration into settlement patterns through time should be undertaken to substantiate conclusions about culture changes and continuities. An emerging narrative on the Central Coast is one of cultural stability prehistorically, and then disruption following contact. The incredible variability of site locations, as identified in this project, should raise some scepticism about this narrative. Furthermore, investigations about shifts occurring pre- and post-contact could reinforce the questionability of relying on ethnographic and historical documents for understanding settlement patterns.

Consideration of changes over time was given some consideration in the early stages of this research project but the effort was abandoned due to data and time limitations. A different methodology and set of statistical tests would be required to compare site locations through time, since the sample sizes are small. This project has illuminated which attributes may be most worthwhile to process. If such a project is ever undertaken, it will likely reveal that there is as much temporal variability in settlement patterns as the spatial variability already observed.

My project examined settlement patterns using contemporary environmental data. While the area experienced relative climatic stability over the past 7000 years (Cannon 2002:317; McLaren et al. 2014:165), there would have been local environmental fluctuations. Results are dependent on sites in their current setting but when people initially settled (and resettled) the conditions may have been different. Humans are also active participants in modification of the landscape (Erlandson and Rick 2010; Kirch 2005). Site patterning is comprised of a combination of where people chose to live at a previous point in time and how their presence is reflected in the landscape today. From the results of my research, I predict that shorelines (intertidal size and substrate) will have the greatest potential for examining the interplay of location suitability and anthropogenic modification. Consistent between the subregions, large middens always had a higher average of intertidal area and were more likely to be located on wide beaches. Clam gardens are detectable in the model based on the tide line data and are known methods of altering the landscape (Caldwell et al. 2012; Williams 2006). Even aside from clam gardens, human consumption impacts the distribution and abundance of shellfish (Moss and Erlandson 2010:3360). Shorelines are dynamic in their composition and configuration. More insight into the influence of people on these features would be applicable to a richer understanding of the relationship between settlements and their environmental contexts.

Discussion of Methodological Approach and Data Reliability

Scales of Analysis

The area of spatial analysis affects whether shell midden locations show an association with particular environmental attributes. For this study, sites were compared to the baseline distribution of environmental characteristics derived from random points. When viewing the whole region, these random points imply a generalized environment despite encapsulating different physiographic zones. Using this system, shell middens on the outer coast are being compared to a sample that also represents the conditions of the inner coast. The disparities in the conditions from different environmental zones make it more likely to identify a significant difference between shell midden settings and the baseline values. Dividing the region into smaller spatial boundaries was necessary to be able to identify settlement patterning within local contexts. Using multiple scales tested the resilience of the identified spatial patterning and the statistical results. Primarily, it led to the conclusion that the configuration of sites is largely determined by local circumstances. Results for the whole area were rarely the same for all of the subregions. This should caution archaeologists about taking these results, or similar ones, and applying them to a broader scale on the Northwest Coast, since it will fail to address local environmental and cultural characteristics.

In addition to the issues of treating the environment as homogenous, the project demonstrated problems in analysing settlement patterning when all sites are grouped together. Small and large shell middens may often have represented different kinds of occupations, which had a role in where people positioned their settlements. However, low sample sizes are a challenge when trying to shrink the scale of inquiry, particularly when sites are grouped based on features. Small sample sizes make it difficult to statistically demonstrate an association with environmental variables. Additionally, further reduction in the spatial scale to view microenvironmental conditions was limited in some cases by the absence of high resolution data (i.e. wind, elevation).

The use of multiple scales for attribute analysis demonstrated advantages and disadvantages at each level. Ultimately, it is favourable for archaeological research to operate at multiple scales when possible, presenting the possibility to account for local circumstances while still being able to make generalizations for a study area.

Area Coverage

The Central Coast has been the recipient of several large-scale survey projects. The inventory of sites is good, but certainly not complete and more settlements likely exist. The site of ElSx-17[44], a midden 1 km from Namu, was first recorded by Cannon in 1996, despite archaeologists being in that area since 1968 (Cannon 1997:2; Hester 1968). McLaren's (2011) thorough survey of Calvert Island uncovered ten new middens. Millennia Research Ltd. (Maxwell et al. 1997:58) determined that small sites are the most likely to be unknown. For some settlements, any physical trace of them may have been lost through erosion processes. The objective with this project was to look for robust patterns knowing that the coverage of settlements was incomplete. Therefore, as more sites are recorded they should not contradict the observations, but will likely add to the inventory of variability.

While the survey coverage of the Central Coast is reasonable, the quality of records is poor. Only 62% of shell middens have recorded dimensions in the provincial inventory. By comparison, 91% of the 576 middens on western Vancouver Island have recorded dimensions (Mackie 2001:47). Many details on site features had to be filled in manually using site reports. Even Kisameet (ElSx-3), which has been excavated and revisited multiple times, is missing key information for site features, including site size. Additionally, there are 75 archaeological sites classified as 'unknown' types. Improvements to site records in the provincial database are needed to make sure information is complete and accurate.

Implications for Predictive Models

The Government of British Columbia relies on predictive models for assessing the potential presence of archaeological sites in a given area. Therefore, it is important that their models account

[44] Cannon originally thought this midden was ElSx-6, a previously recorded site, but corrected his observation and the site was designated as ElSx-17 (Cannon 1997:2).

for the range of settlement types that exist, as well as considering local contexts. Criteria for location requirements should not be derived only from well-investigated sites since these tend to be a restricted subset of known settlements. Additionally, models will need to be updated as more sites are uncovered, particularly to account for small midden patterning since these are the type of settlements that were underappreciated in initial constructs and are most likely to be newly discovered (Maxwell et al. 1997:58).

Our current concepts of where settlements are most likely to exist do not always reflect reality. Even the most seemingly obvious traits demonstrate the uncertainty that exists for shell middens. Proximity to fresh water is an example of locational criteria that tops the list in relevance to placement and is often a main factor for predictive models. I found that only 50% of shell middens are within half a kilometer from a fresh water source, and 83% are within a kilometer. This means that nearly 60 shell midden sites are farther than one kilometer from a fresh water source. Stream locations were acquired from the provincial government, and therefore is the same dataset that most archaeologists will use if incorporating distance to water in their predictive model. Not all water sources are present in this dataset, particular those that are small or intermittent. There were instances where according to the data, a site was not located near a stream, but detailed site maps from fieldwork indicated that there is a fresh water source directly beside the midden [e.g. ElSx-4 and ElSx-5 (Cannon 1997:41,45)]. No solution is offered here, but based on the range of locational determinants observed for settlements, when constructing a model it would be possible to suggest areas with high potential of archaeological sites, but unlikely to be able to identify areas with little potential.

Conclusion

This project has investigated the distribution of settlements in relation to environmental conditions on the Central Coast. Settlement patterns are poorly understood for the Central Coast, and they have not been examined in three decades (Pomeroy 1980; Hobler 1983). Since then, archaeologists have recorded additional sites and there are improved computational methods for organizing and analyzing data. With a large-scale approach, I systematically analyzed shell midden locations using information from previous site investigations and incorporating applicable environmental data. I used the dimension of shell middens – a proxy for the intensity of settlement occupation resulting from the time-averaging of long-term processes – to identify different patterns based on settlement histories. The observed patterns have been empirically calculated and I have relied purely on the archaeology to be confident in the associations detected with particular attributes.

Interpretations are limited by the resolution of spatial and temporal data, as well as the impossibility that modeling can ever fully represent the complex intricacy of real world phenomena. This project contributes an environmental context for settlements that other archaeologists can use in conjunction with other lines of evidence to make interpretations about the small-scale decision-making processes that resulted in shell midden forms as they appear today. My results demonstrate the diversity of site settings and the importance of being situated nearby resources, which aligns with recent scholarship that has identified the wide variety of activity focus at shell middens (Burchell et al. 2013; Cannon 2013). Altogether, various approaches point to settlement variability, and future investigations of site contents will likely continue to deepen our understanding of land-use while moving away from simplistic notions of settlement patterns.

In summary, the data presented in this study have demonstrated the following conclusions:

> Settlements are not randomly distributed and show an association with particular environments. There is no single determinant for settlement location. Rather, multiple determinants contributed to location suitability, and subsequent intensity of occupation. There are basic requirements of physiographic conditions (low exposure, flat land, etc.)
>
> Site locations differ between small and large shell middens, but not drastically. There were some consistent distinctions including large middens having more of an association with herring and intertidal resources, and small middens having a stronger association with lakes. Large shell middens are more likely than small middens to be located near a greater range of resources. There is more variability in location placement for small middens than large middens.

> Settlement patterns vary based on local context and depend on the spatial scale of the unit of analysis. Sites need to be contextualized within their environmental and socio-political settings, preventing simple translations of results from one area to another. Ultimately, there is an incredible amount of variability in where people settled.
>
> Archaeological subsurface investigations on the Central Coast are not proportional to the range of shell middens that exist. Excavations targeted large shell middens, with recent occupations and architectural surface features. No small shell midden received any subsurface testing until after 1990, and to date, none has been excavated.

All of the activities and events of history happened somewhere and at some time. To some degree, archaeologists can uncover where activities took place based on the accumulated material signatures. Even with advances in technology and data accumulated over decades, archaeologists are still unequipped to resolve why people chose certain locations. We know that site locations are one way that cultures adjust to environmental variation and that these locations are somewhat dependant on economic factors. The complexity of the phenomenon is acknowledged by recognizing that determinants are multifaceted and we can only seek to empirically investigate a fraction of them. Optimistically, the objective was to find commonalities among site placements, searching for general trends. Site dimension, and by extension, the intensity of occupation, was thought to help reduce the variability of settlement types and reveal patterns. Success was achieved for some environmental variables but the unique circumstances of sites always resulted in exceptions to identified patterns. This is to be expected since there are 11,000 years of human occupation representing generation after generation of decision-making people. The construction of reasonable groupings and the irregularity of site locations kept emphasizing the variability that exists. We can create models to find robust patterns of site locations but these models cannot encapsulate the individual histories of each site and the unique features that go along with them.

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Appendix A: Additional Reference Maps

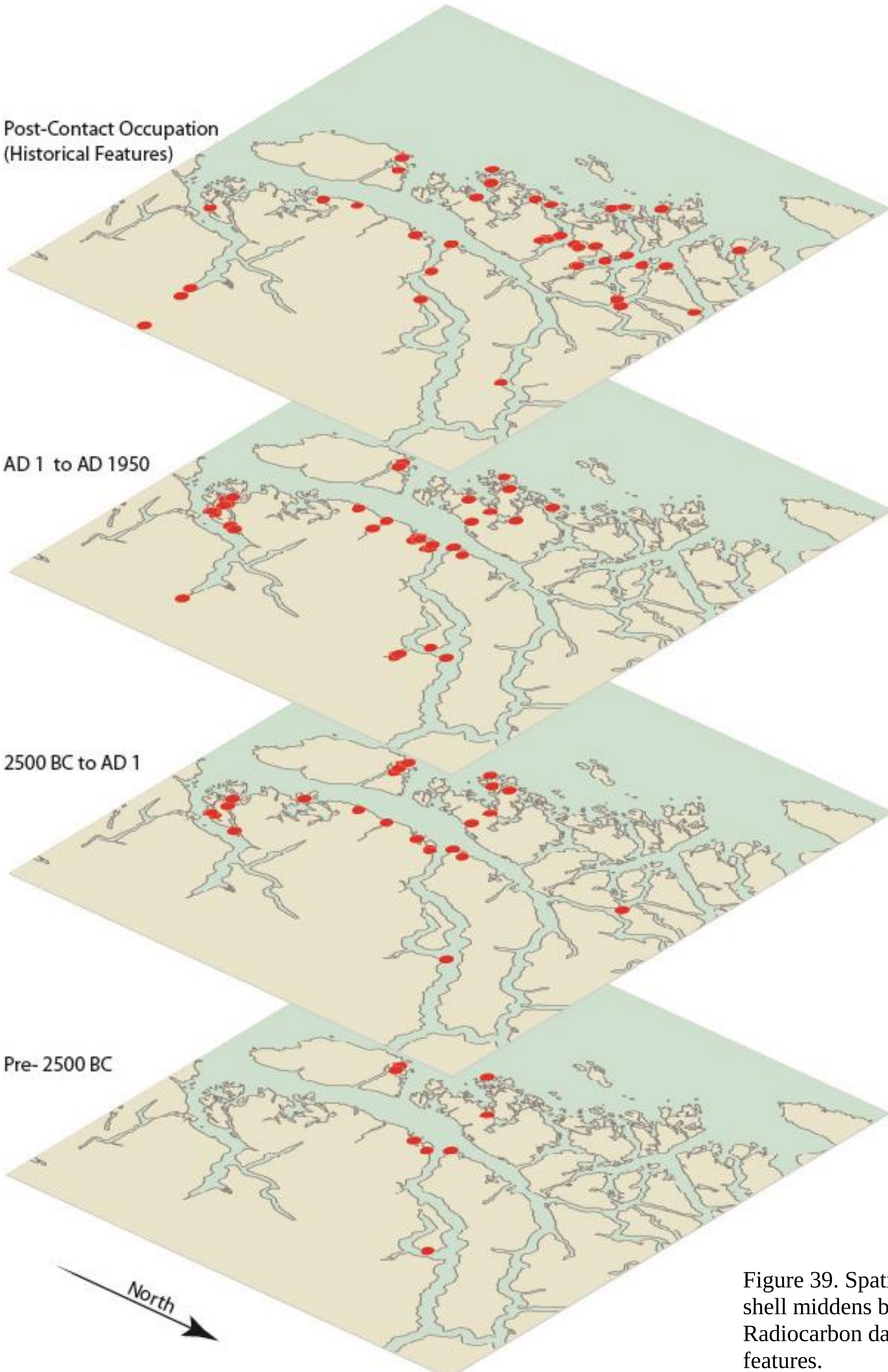


Figure 39. Spatial distribution of shell middens based on Radiocarbon dates and historical features.

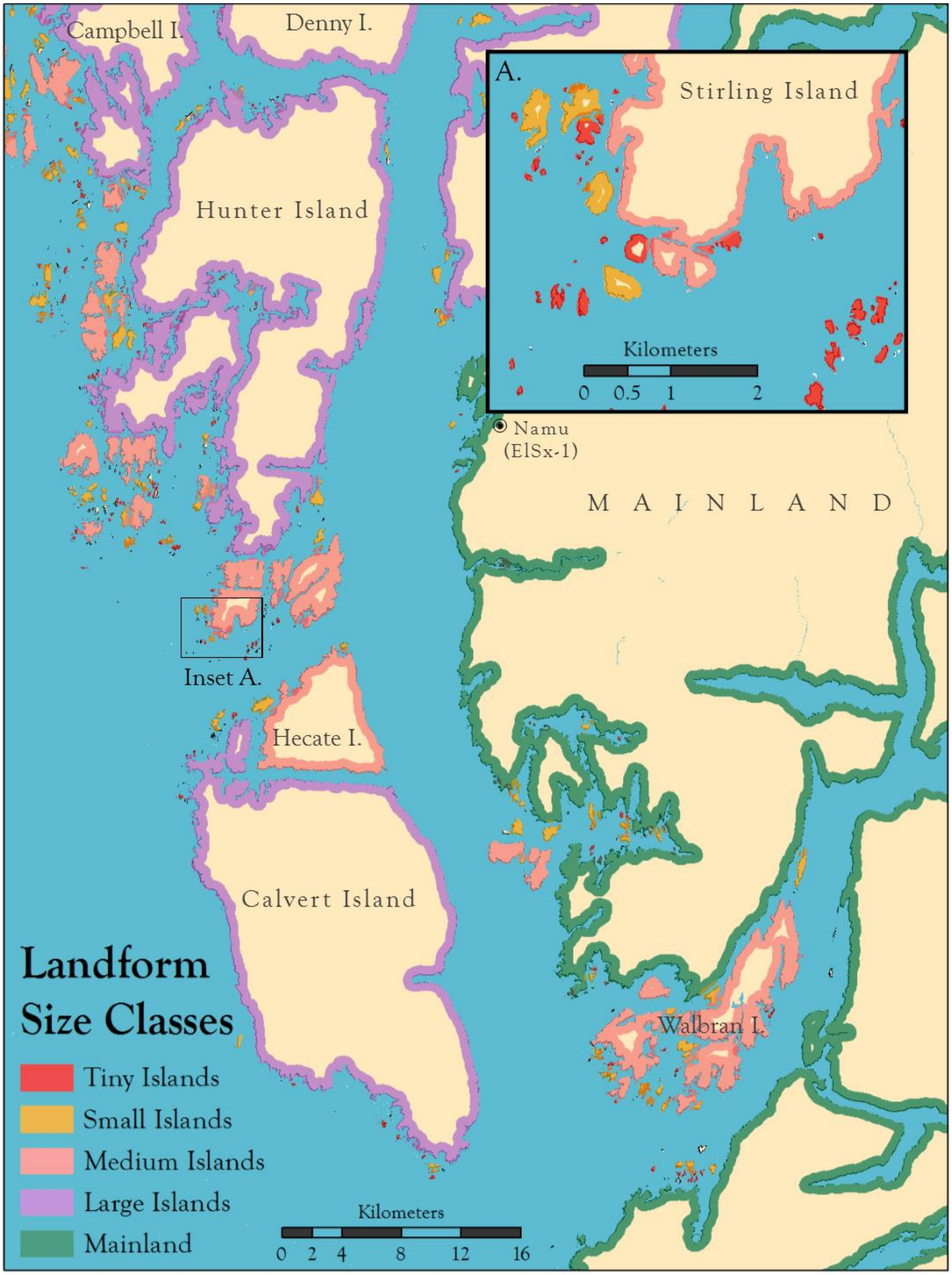
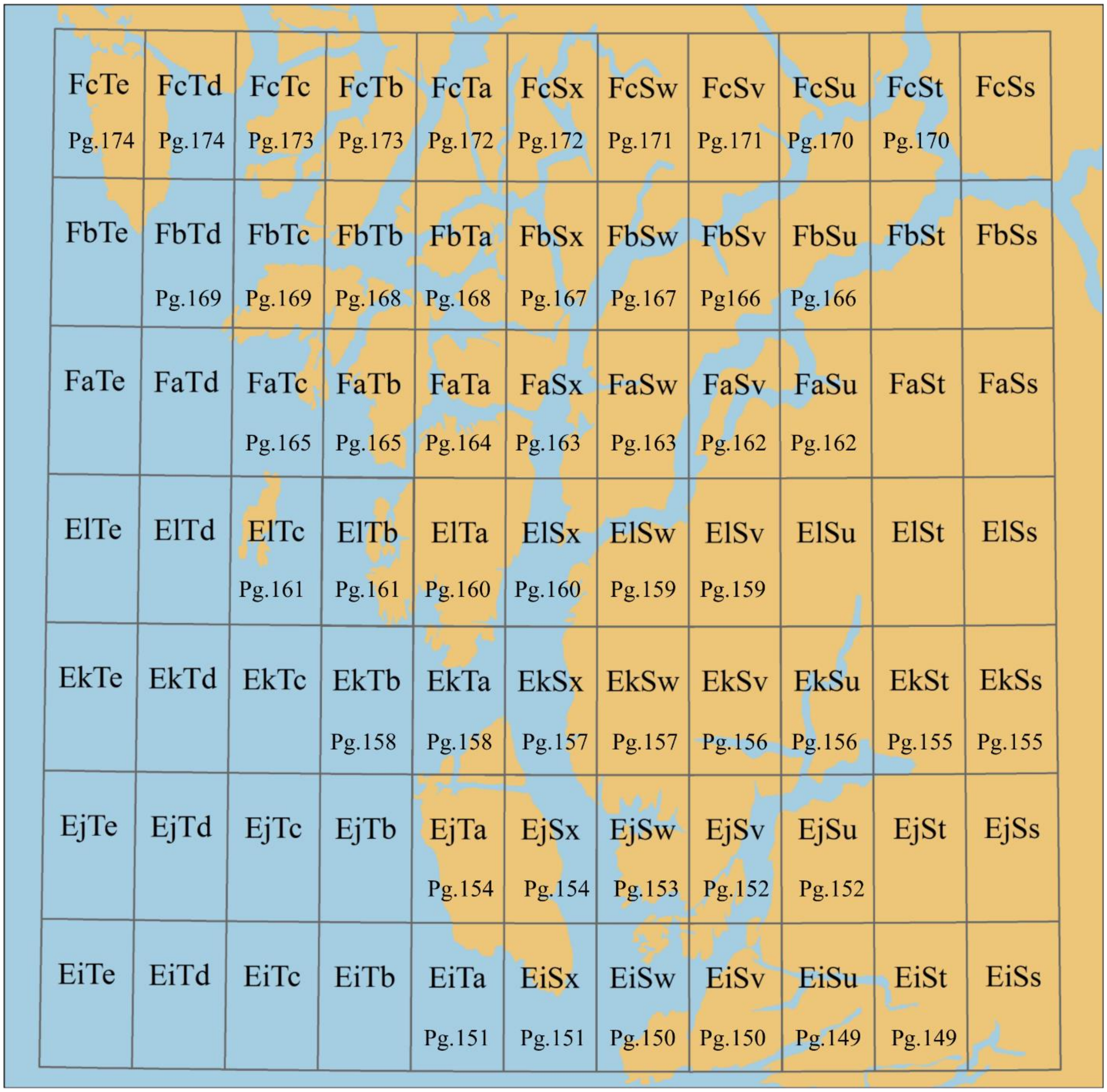


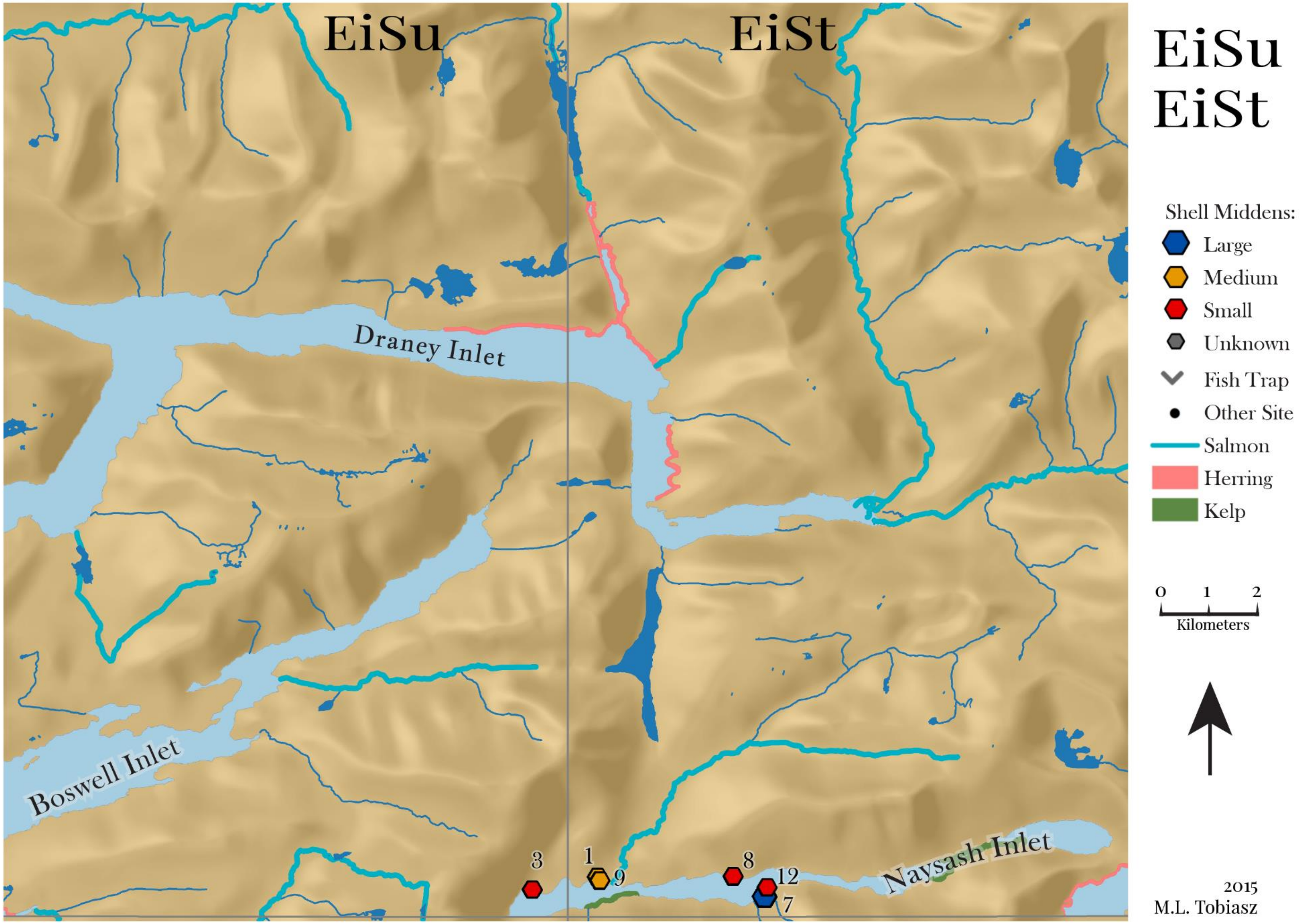
Figure 40. Map showing landmass classification system.

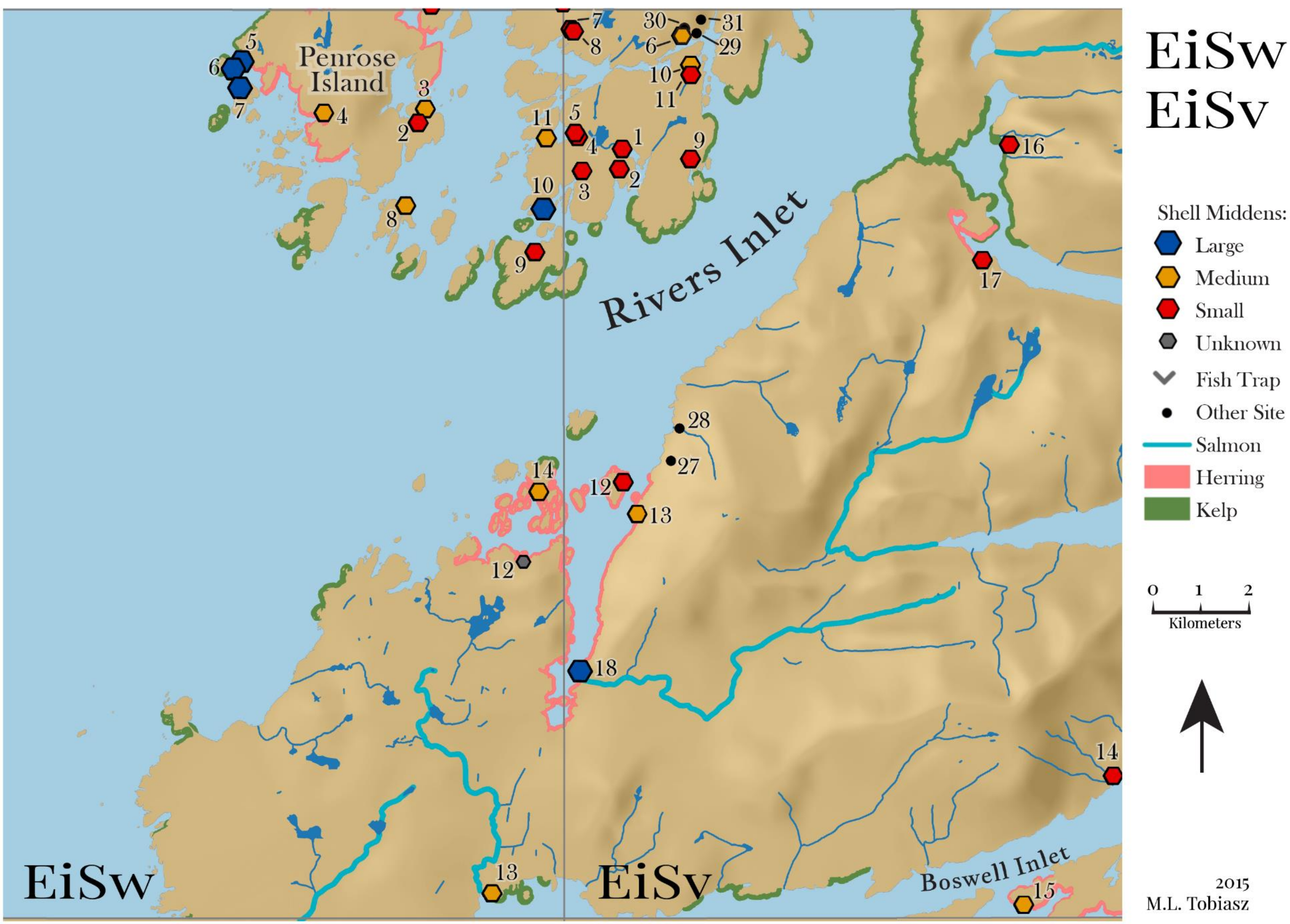
Site Location and Resource Reference Maps



All labels for archaeological sites are placed on the side of the Borden block they correspond to.

For map data sources see Appendix B.


EiSu
EiSt
Draney Inlet
Boswell Inlet
Naysash Inlet
3
1
9
8
12
7
EiSu
EiSt
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz


EiSw
EiSv
Penrose Island
Rivers Inlet
Boswell Inlet
EiSw
EiSv
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz


EiTa
EiSx
Calvert Island
Fitz Hugh Sound
North Passage
1
1
EiTa
EiSx
Shell Middens:
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Fish Trap
Other Site
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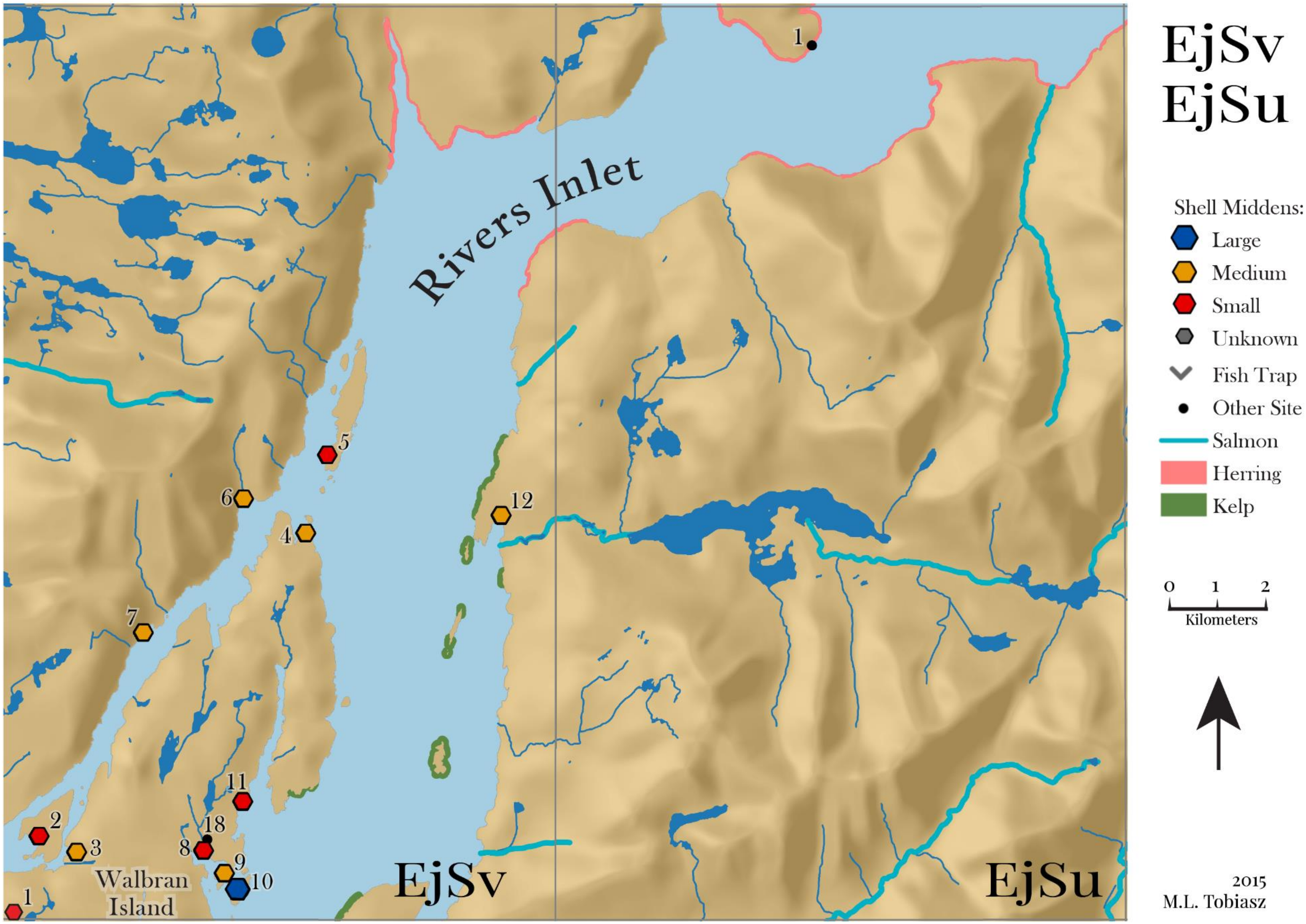
M.L. Tobiasz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Shell Middens:
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Fish Trap
Other Site
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2015
M.L. Tobiasz
Rivers Inlet
Walbran Island
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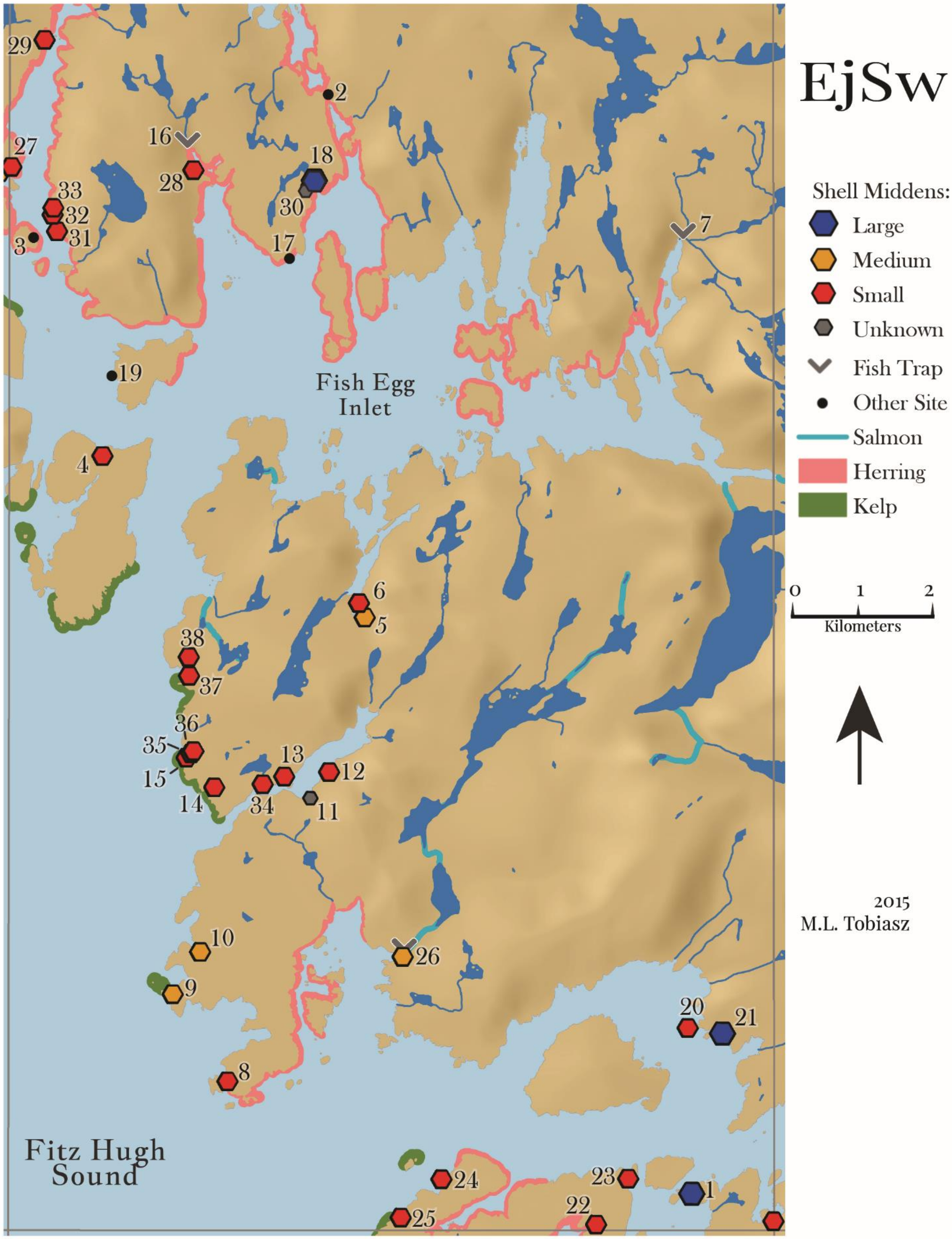
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Other Site
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M.L. Tobiasz
Fish Egg Inlet
Fitz Hugh Sound
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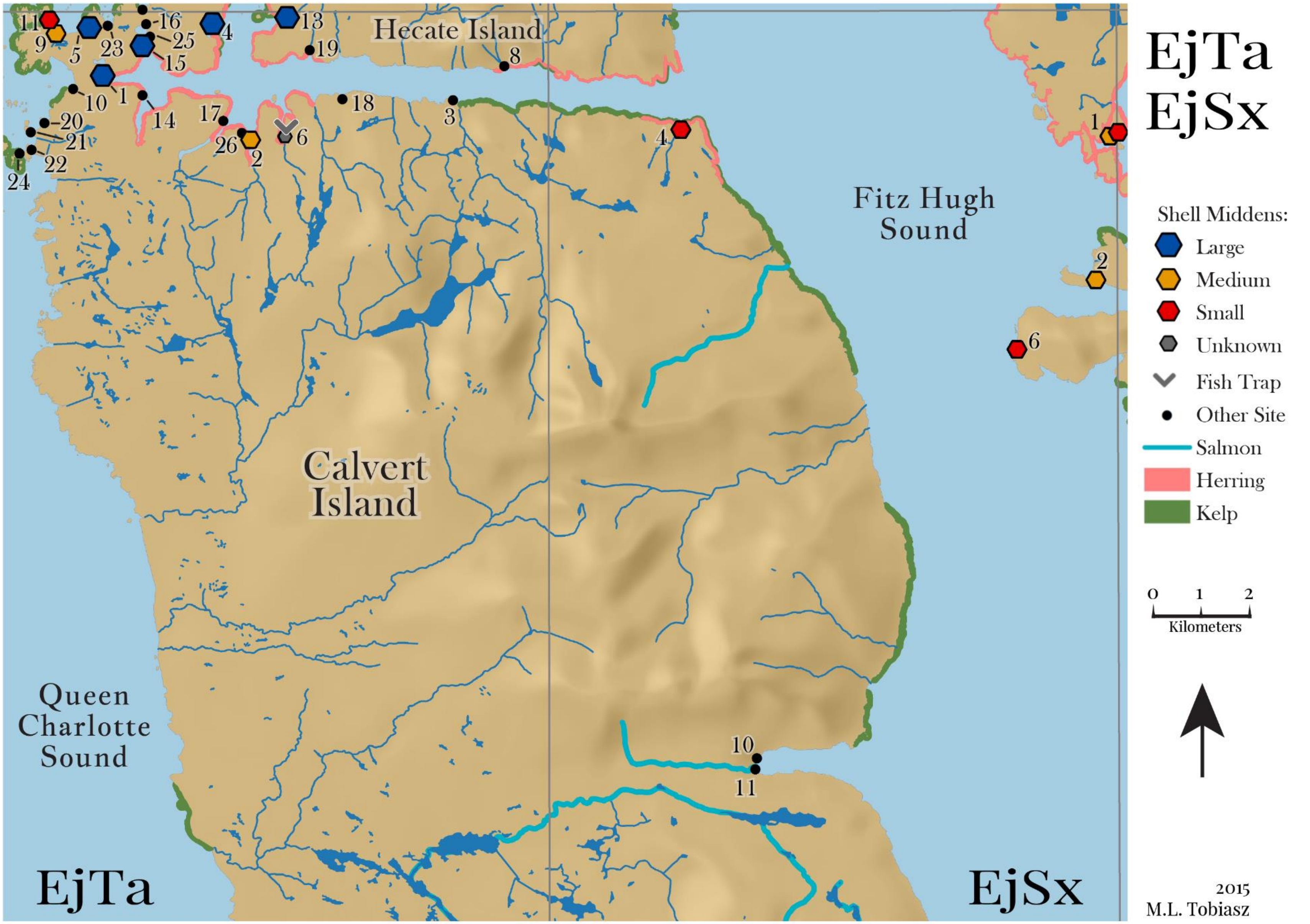
EjTa
EjSx
Hecate Island
Fitz Hugh Sound
Calvert Island
Queen Charlotte Sound
EjTa
EjSx
Shell Middens:
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Small
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Fish Trap
Other Site
Salmon
Herring
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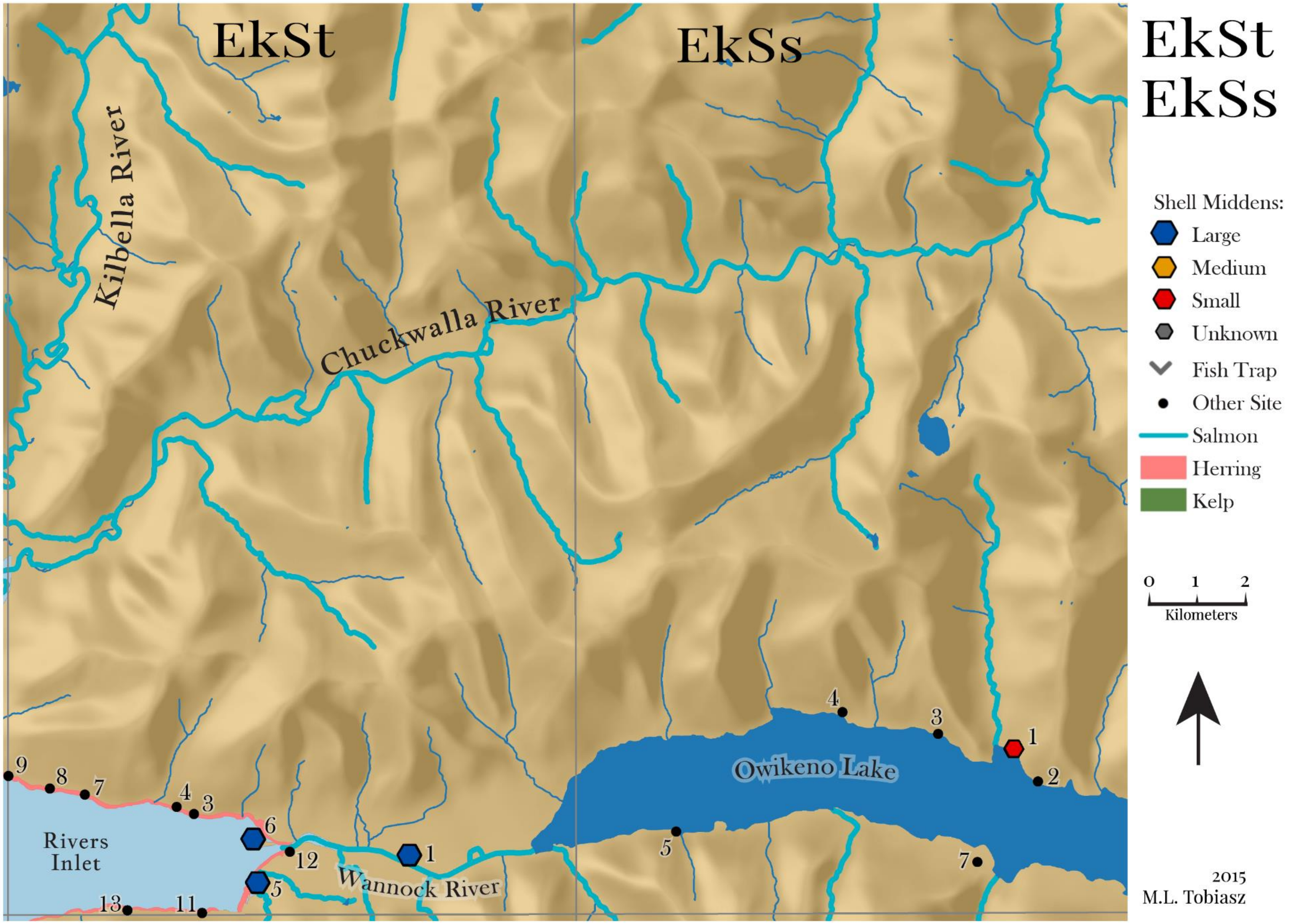
Kilometers
2015
M.L. Tobiasz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EkSs
Kilbella River
Chuckwalla River
Owikeno Lake
Rivers Inlet
Wannock River
EkSt
EkSs
Shell Middens:
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Medium
Small
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Fish Trap
Other Site
Salmon
Herring
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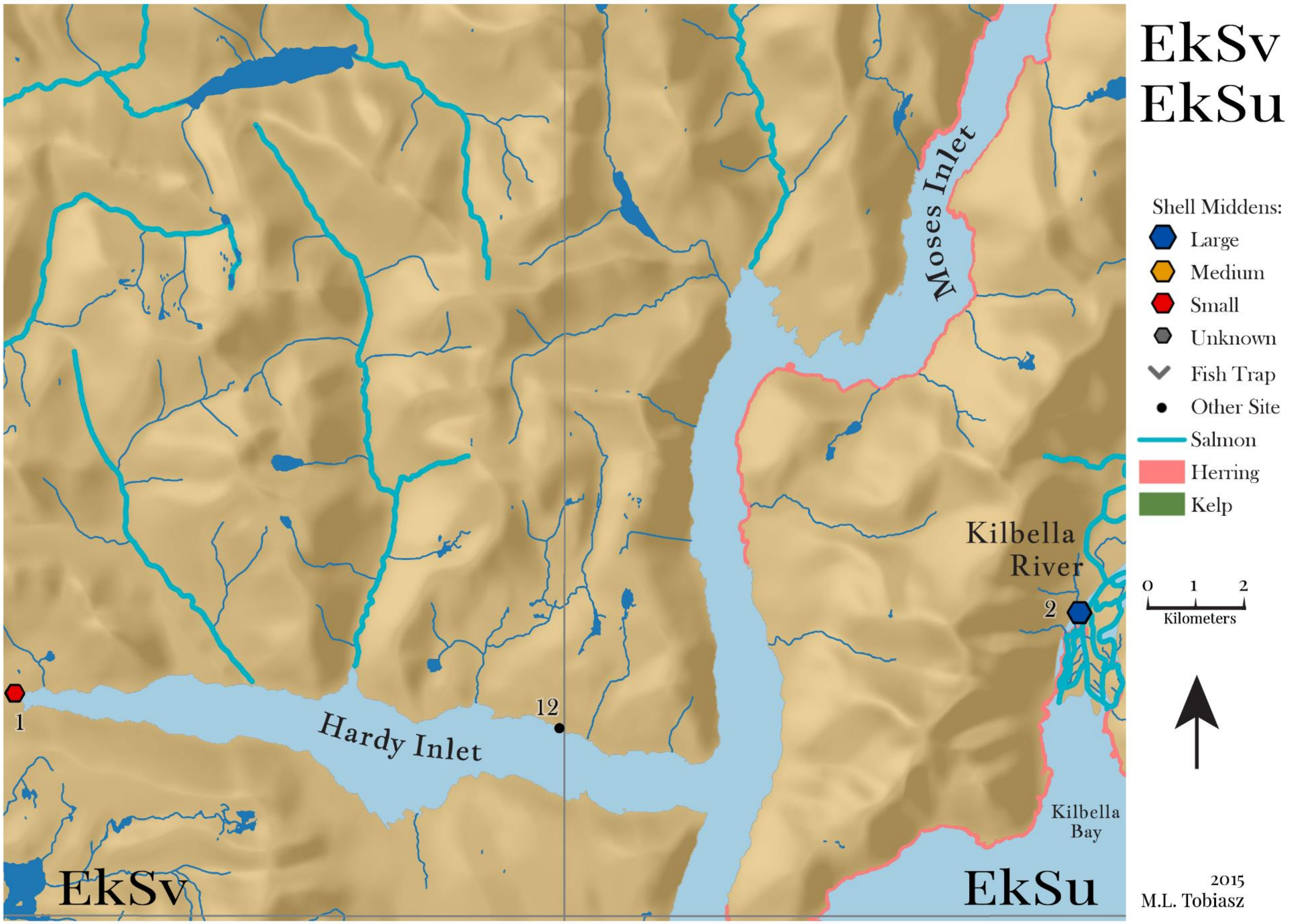
Kilometers
2015
M.L. Tobiasz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Shell Middens:
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Other Site
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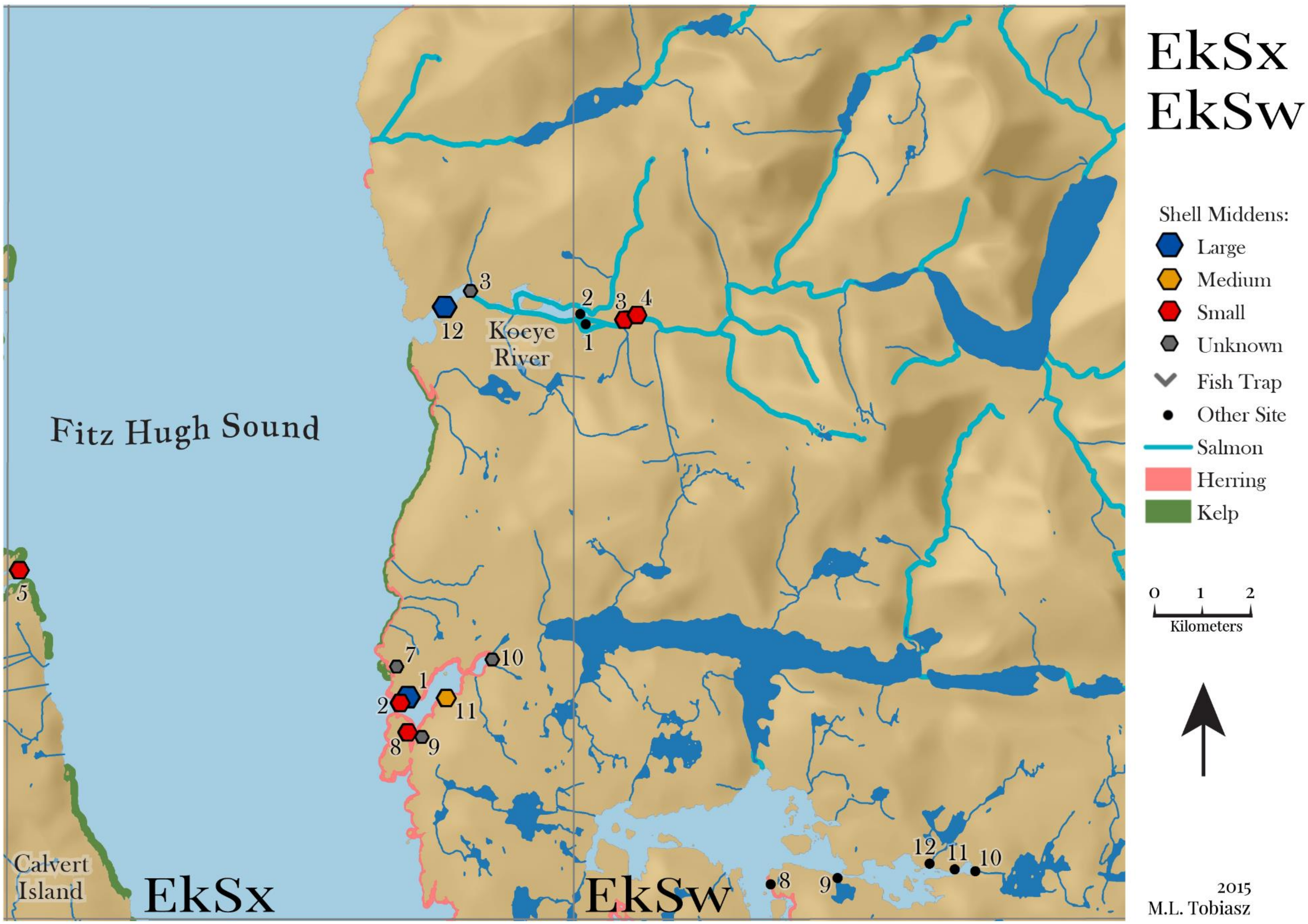
EkSv
EkSu
2015
M.L. Tobiasz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Koeye River
Calvert Island
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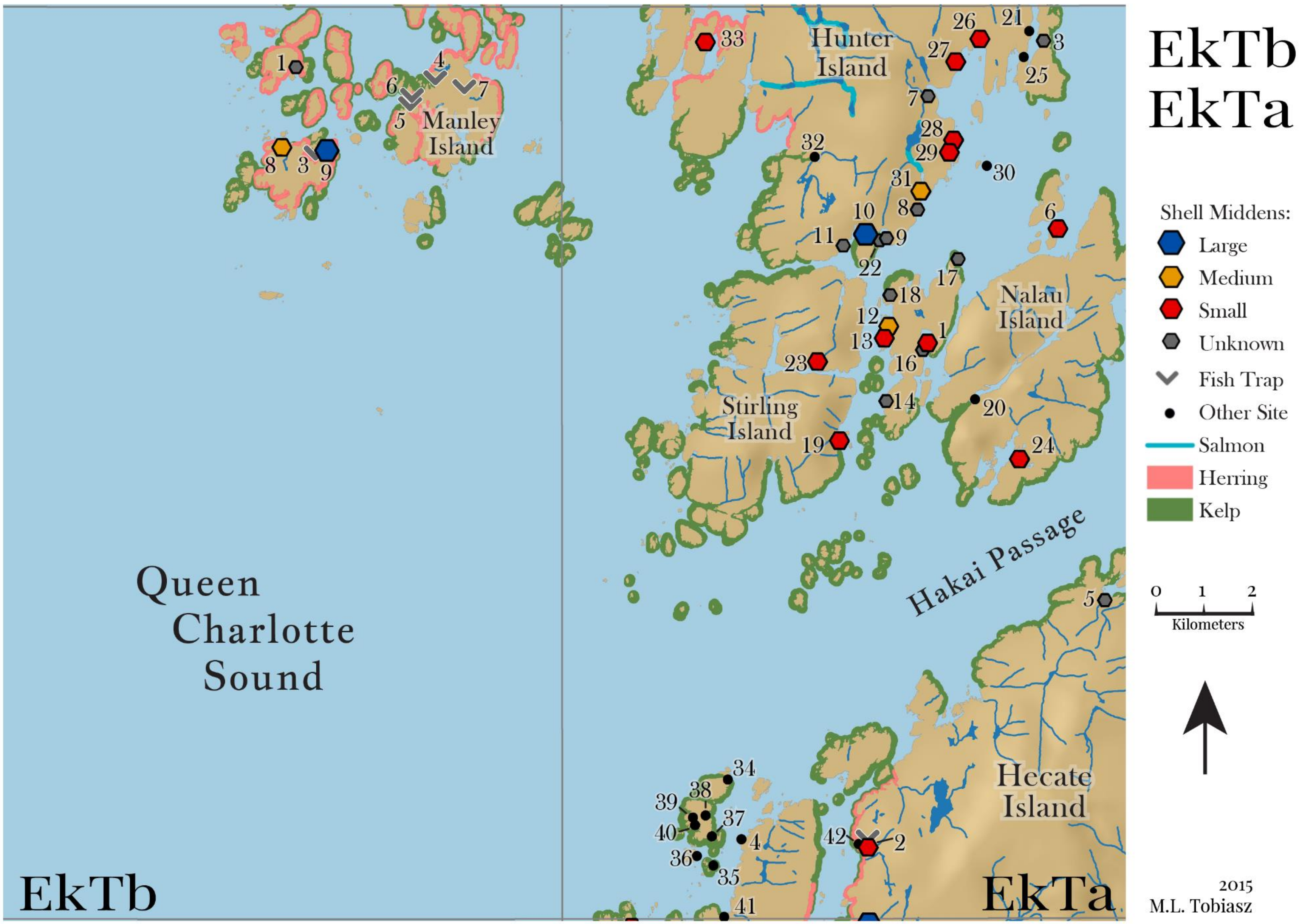
M.L. Tobiasz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Hunter Island
Manley Island
Nalau Island
Stirling Island
Hecate Island
Hakai Passage
Queen Charlotte Sound
EkTb
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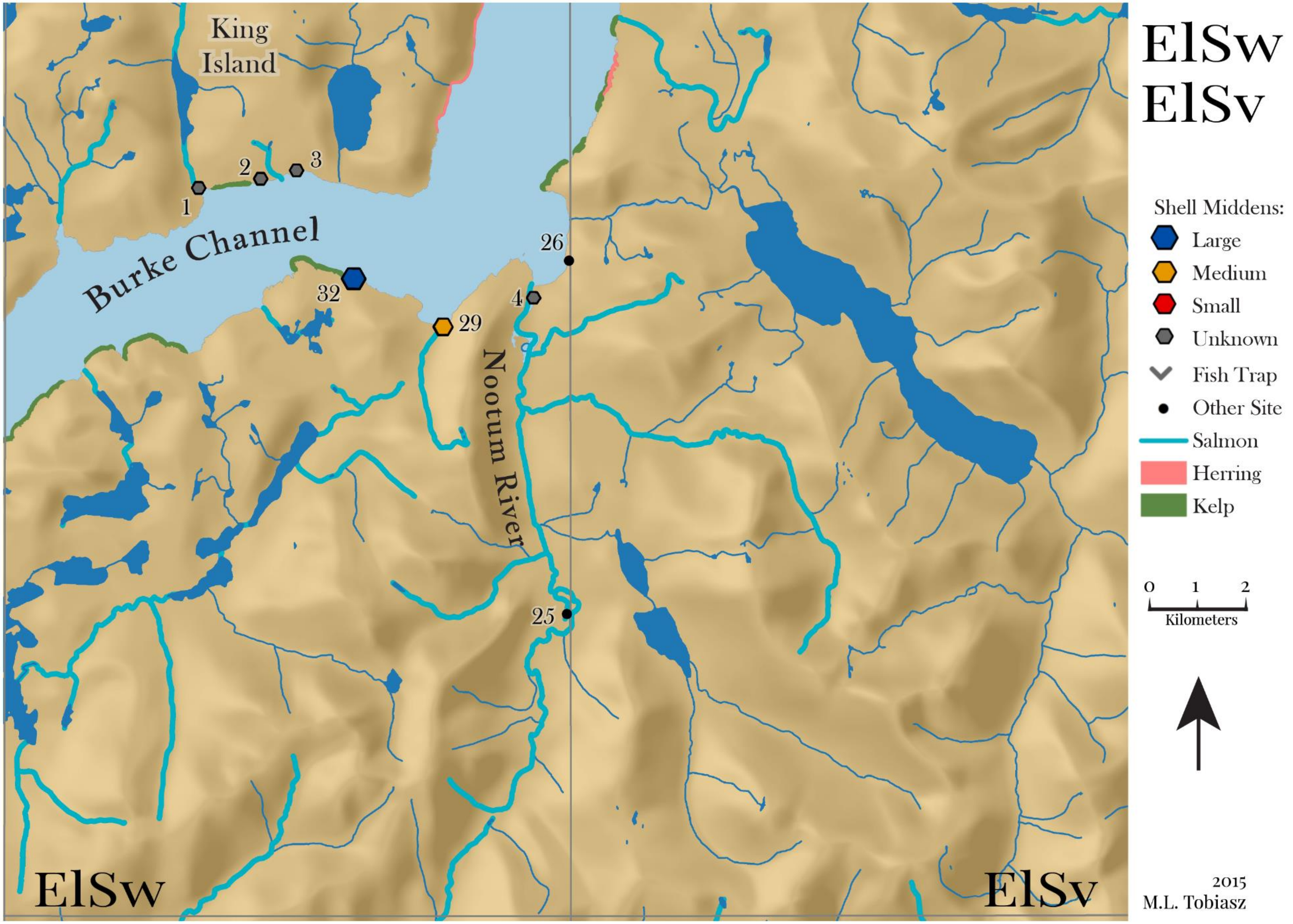
2015
M.L. Tobiasz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Shell Middens:
Large
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Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
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Kilometers
2015
M.L. Tobiasz


ElTa
ElSx
Shell Middens:
Large
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Fish Trap
Other Site
Salmon
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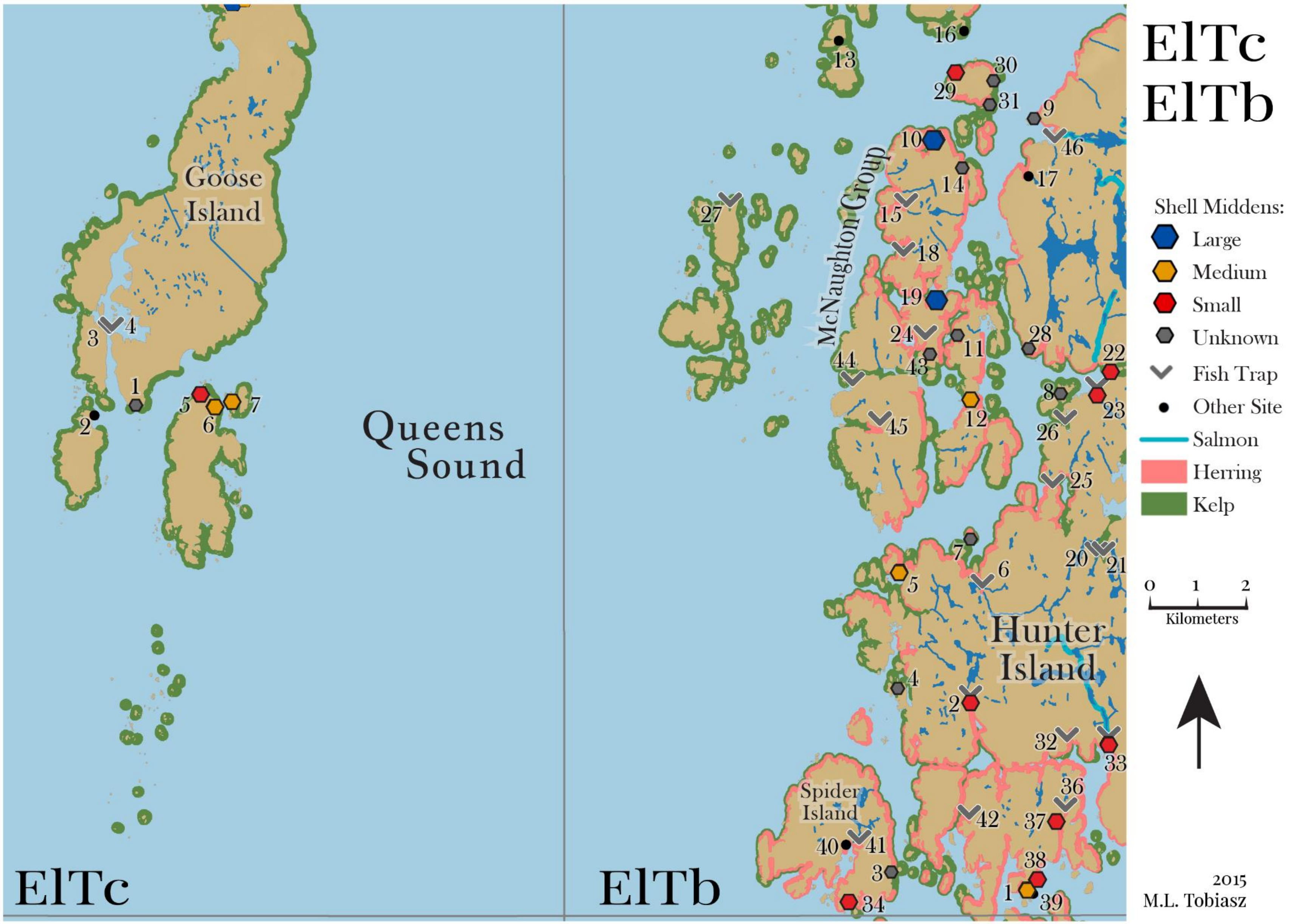
M.L. Tobiasz
King Island
Fisher Channel
Kisameet Bay
Burke Channel
Hunter Island
Fitz Hugh Sound
Namu Lake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Fish Trap
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Goose Island
Queens Sound
McNaughton Group
Hunter Island
Spider Island
ElTc
ElTb
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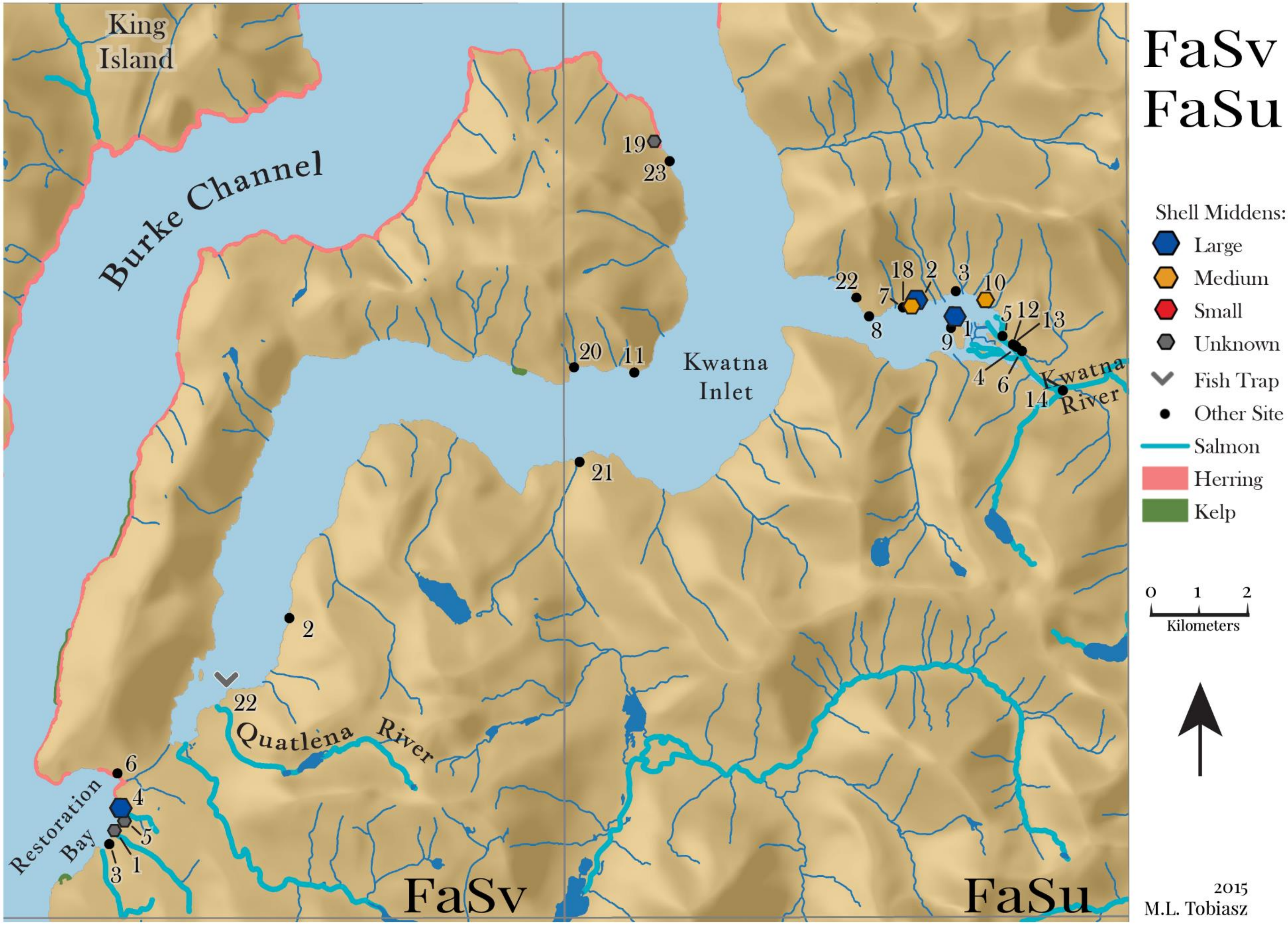
M.L. Tobiasz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FaSu
Shell Middens:
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Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
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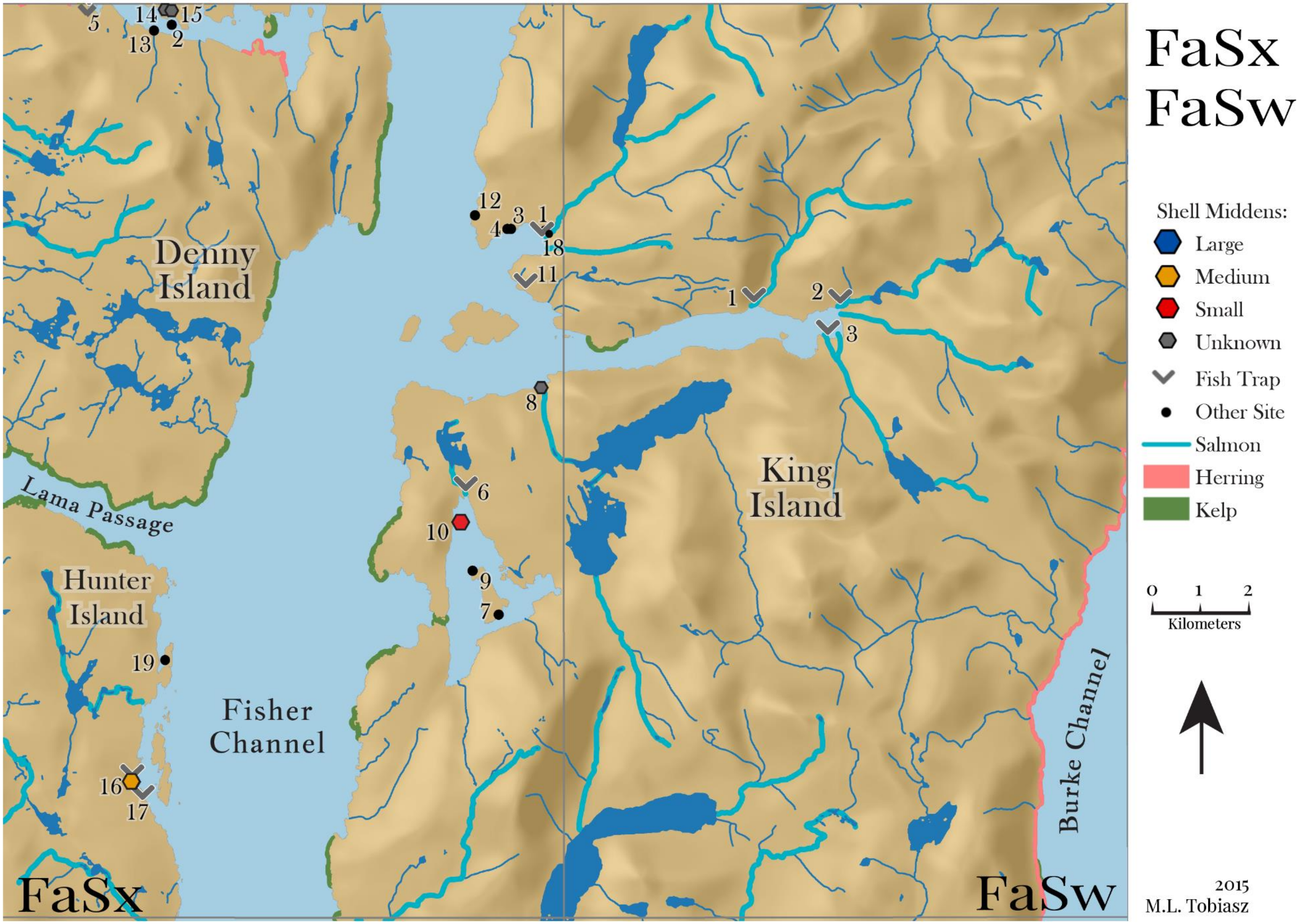
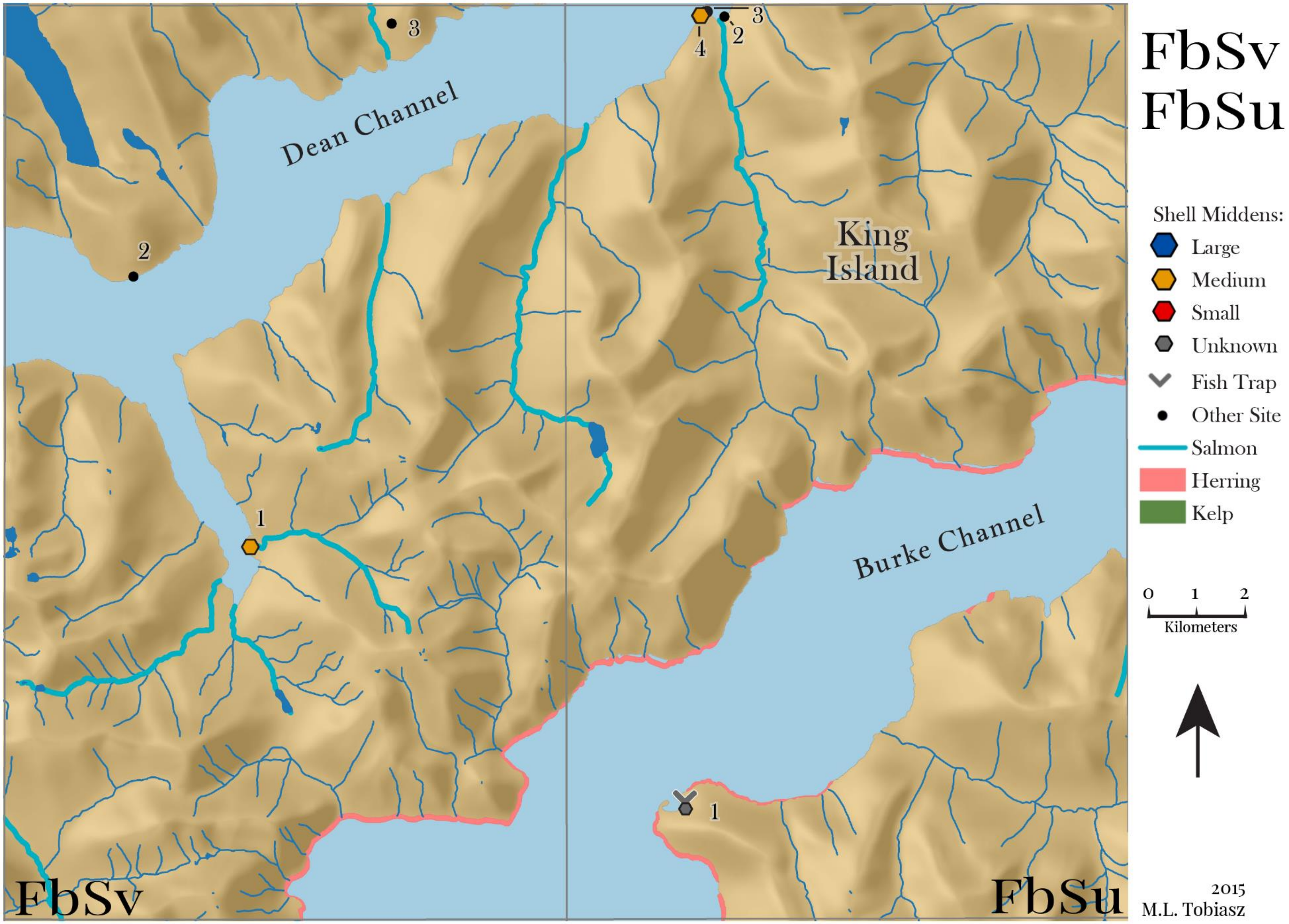
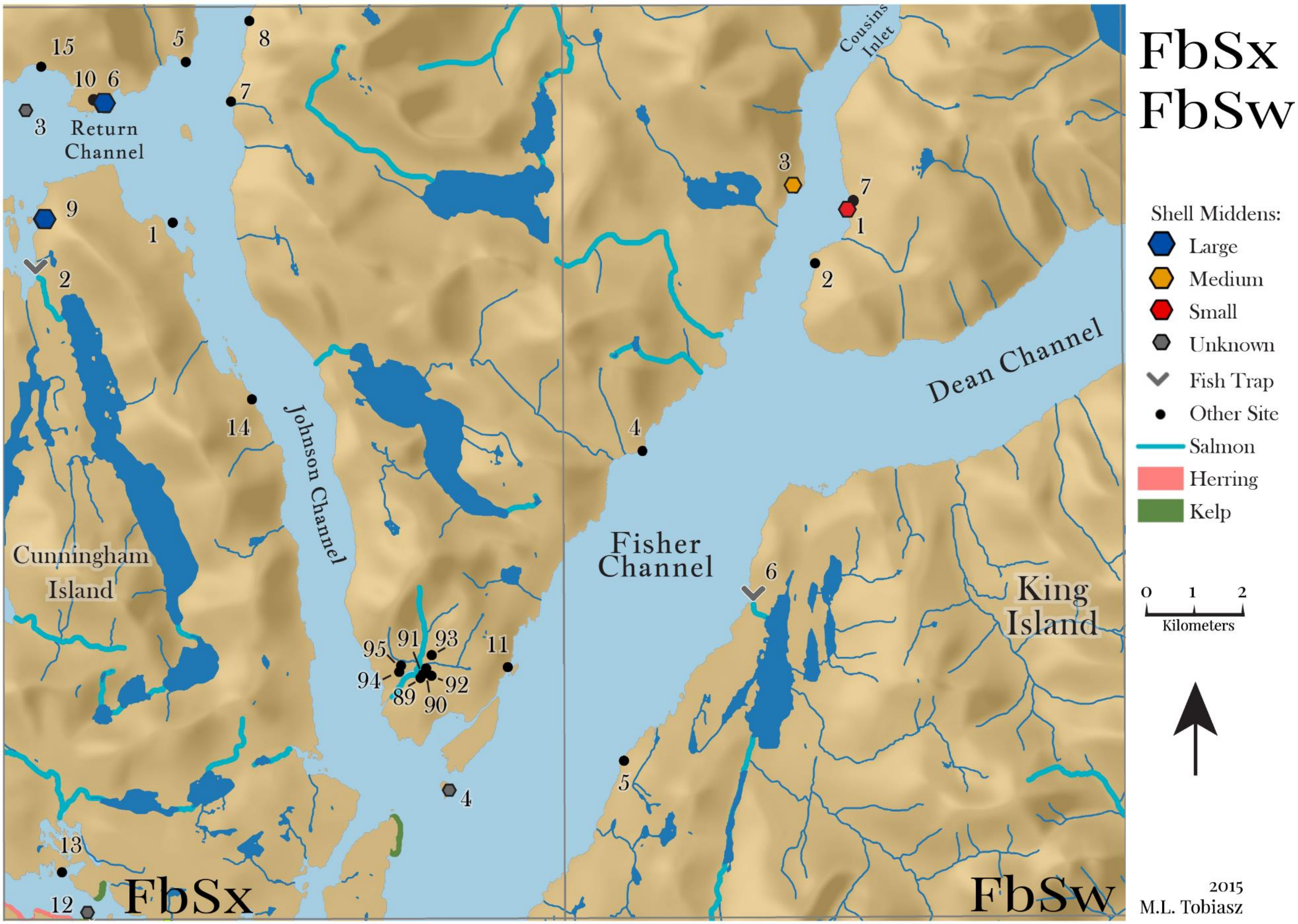
Kilometers
2015
M.L. Tobiasz
King Island
Burke Channel
Kwatna Inlet
Kwatna River
Quatlena River
Restoration Bay
FaSv
FaSu

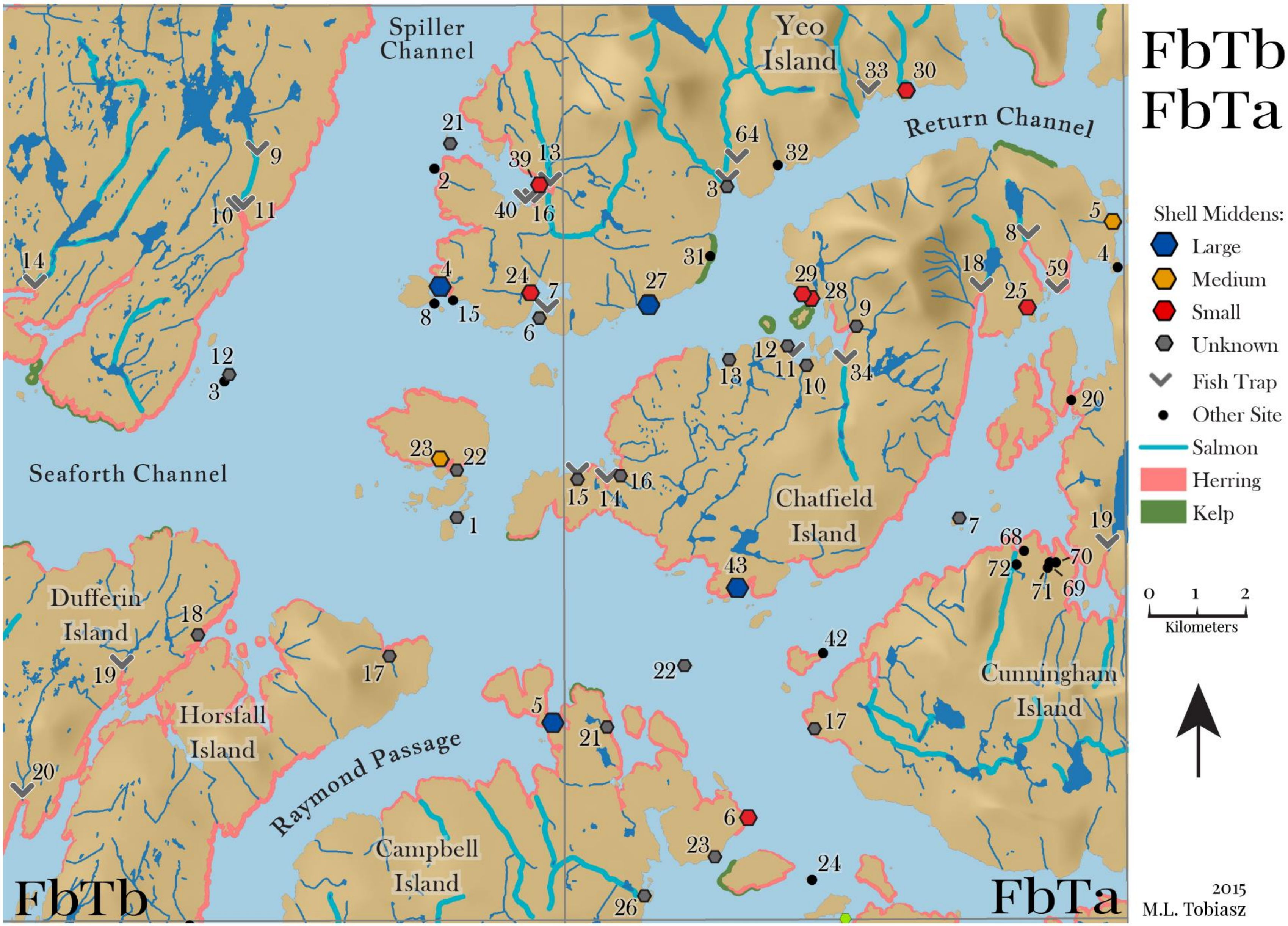

FaSx
FaSw
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz
Denny Island
Hunter Island
King Island
Lama Passage
Fisher Channel
Burke Channel
FaSx
FaSw


FaTa
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz
Campbell Island
Denny Island
Lama Passage
Hunter Channel
Hunter Island
A
Inset A

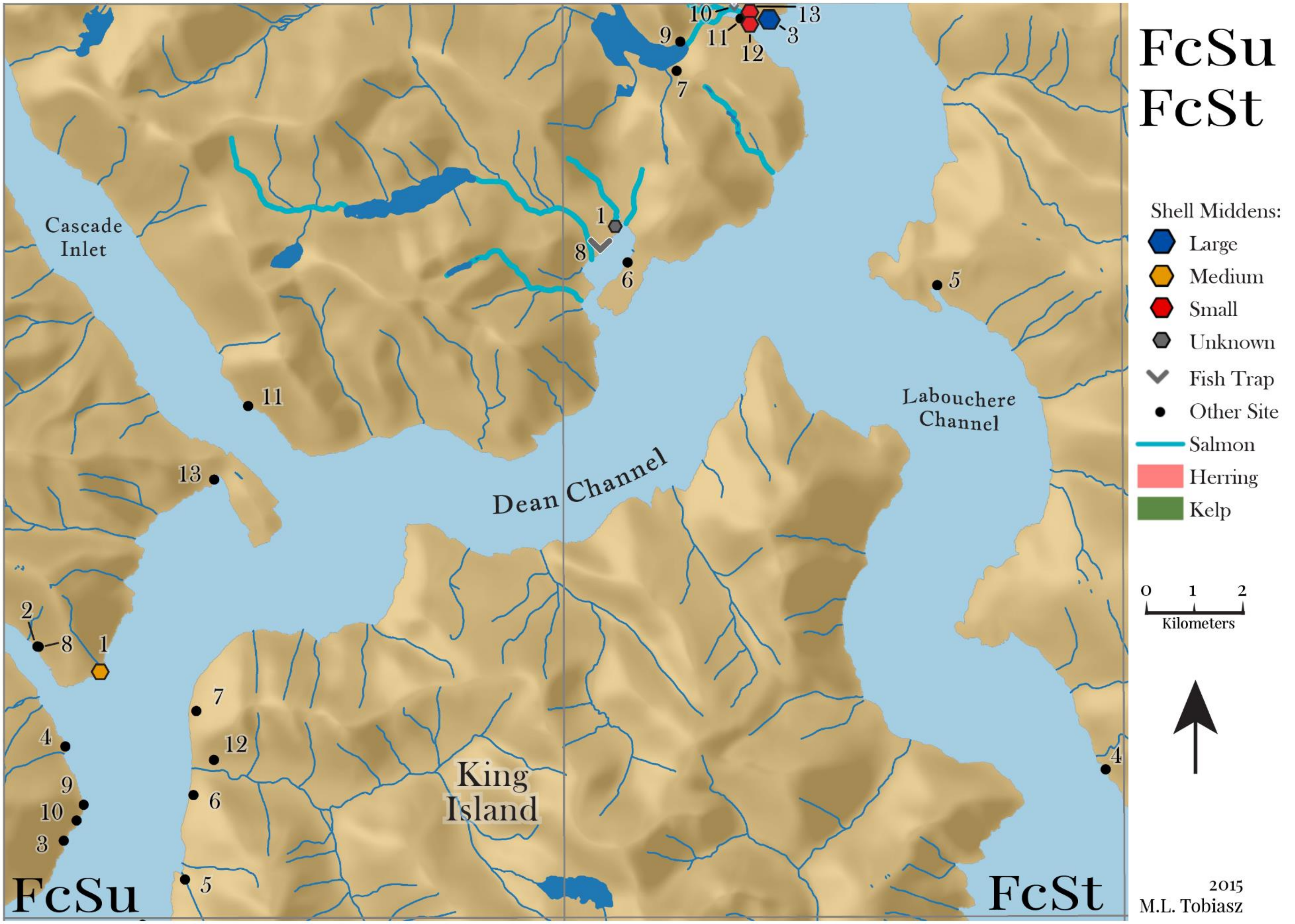

FaTc
FaTb
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz
Athlone Island
Dufferin Island
Raymond Passage
Thompson Bay
Stryker Island
Campbell Island
Golby Passage
Gouse Group
Hunter Passage
FaTc
FaTb


FbSv
FbSu
Dean Channel
King Island
Burke Channel
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
FbSv
FbSu
2015
M.L. Tobiasz

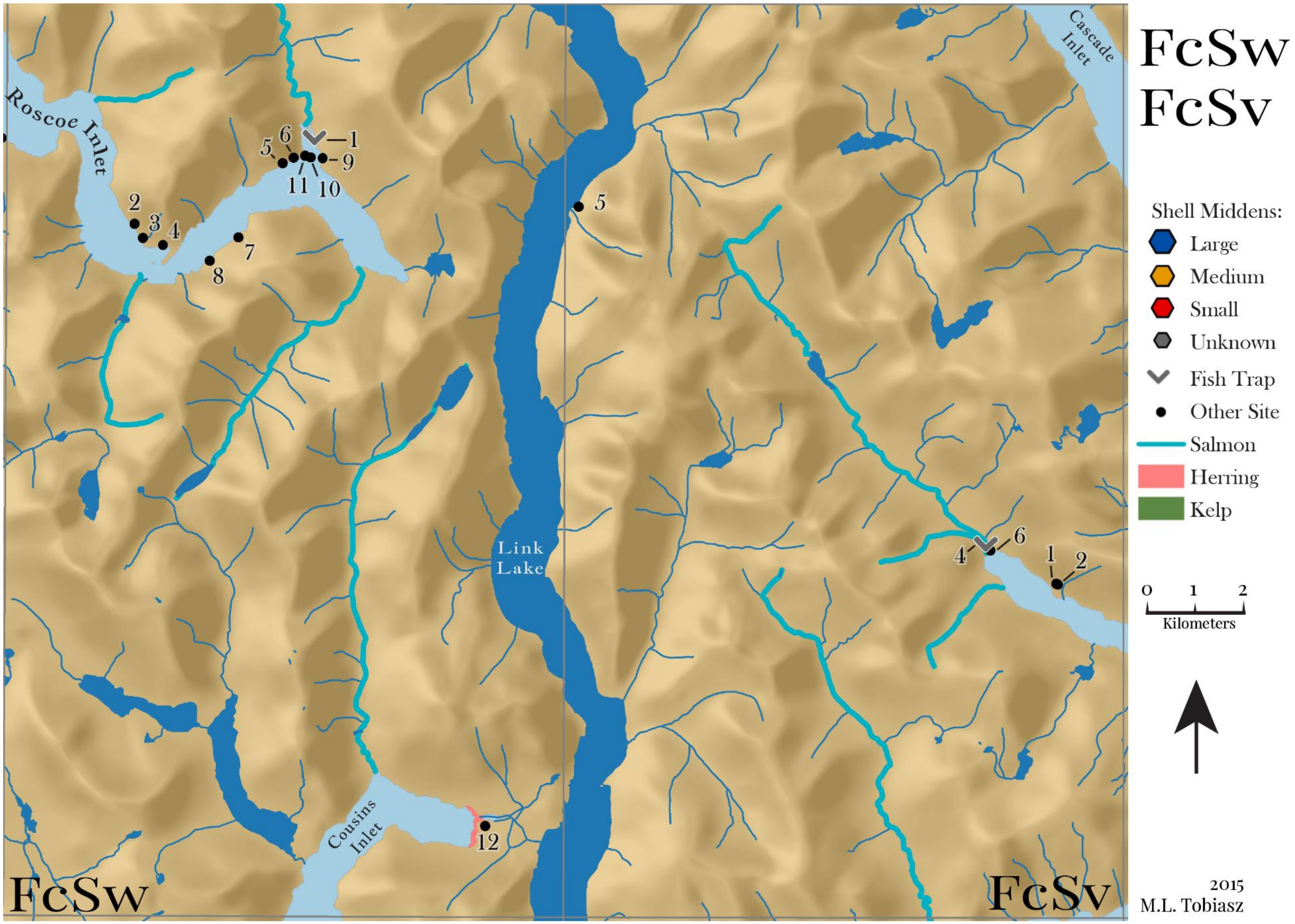

FbSx
FbSw
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz
Return Channel
Johnson Channel
Cunningham Island
Fisher Channel
Dean Channel
Cousins Inlet
King Island
FbSx
FbSw
15
5
8
10 6
7
3
9
1
2
14
95 91 93 11
94 92
89 90
4
13
12
3
7
1
2
4
6
5

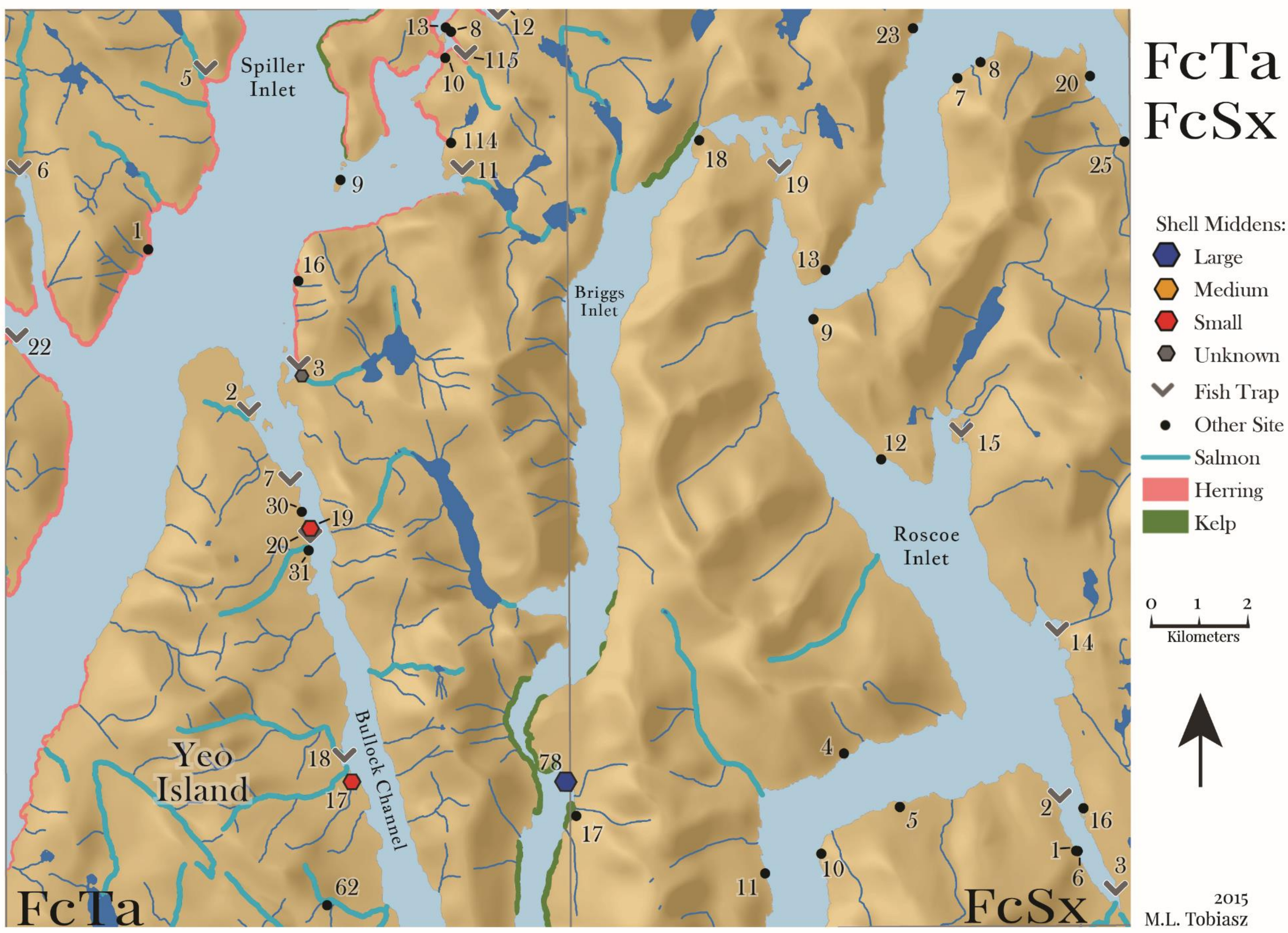

FbTb
FbTa
Spiller Channel
Yeo Island
Return Channel
Seaforth Channel
Chatfield Island
Dufferin Island
Horsfall Island
Raymond Passage
Campbell Island
Cunningham Island
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz


Prince Island
Lady Douglas Island
Milbanke Sound
Seaforth Channel
Athlone Island
Dufferin Island
FbTd
FbTc
FbTd
FbTc
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz

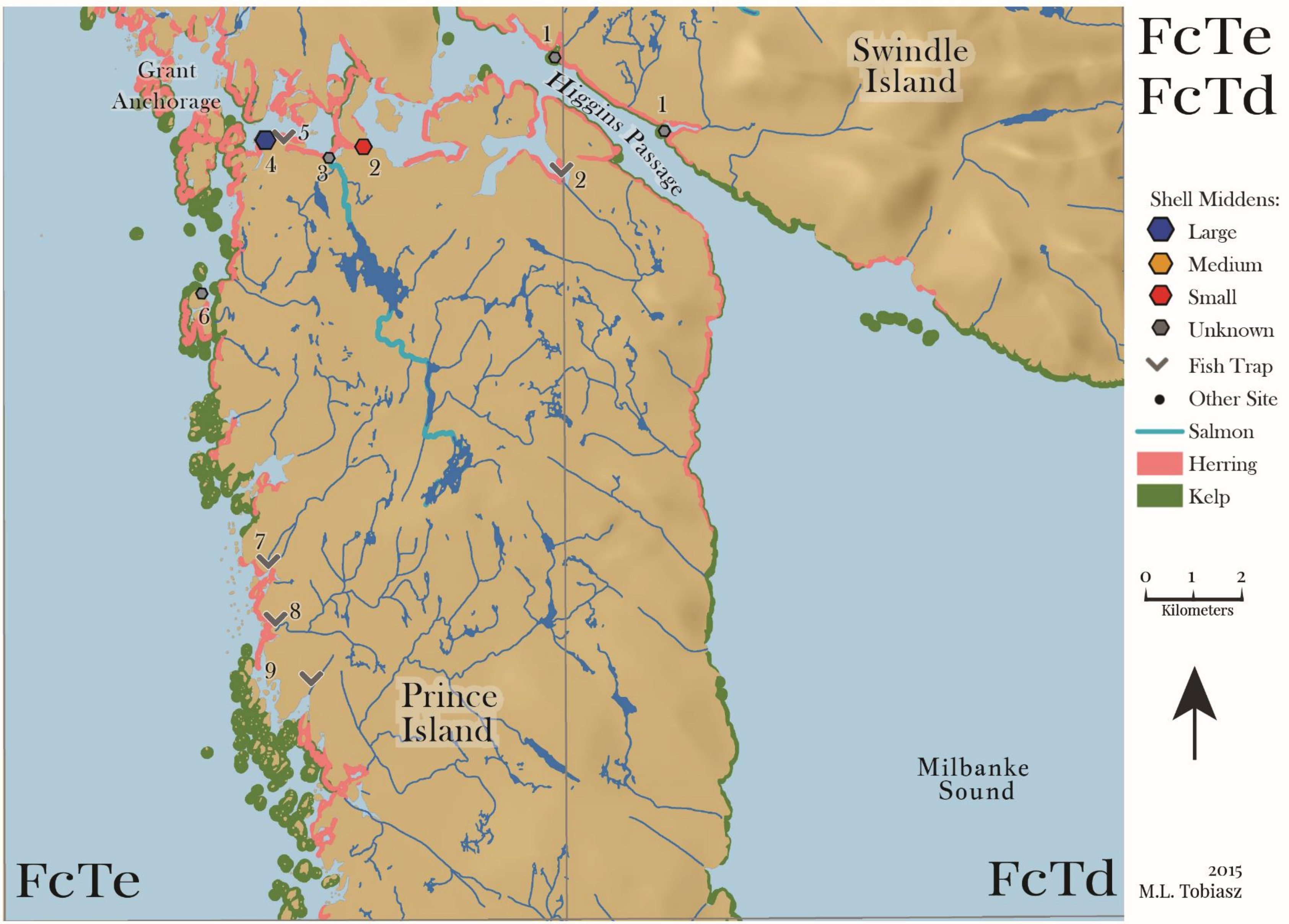


FcSu
FcSt
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz
Cascade Inlet
Dean Channel
Labouchere Channel
King Island
FcSu
FcSt


FcSw
FcSv
Roscoe Inlet
Cascade Inlet
Link Lake
Cousins Inlet
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
FcSw
FcSv
2015
M.L. Tobiasz


FcTa
FcSx
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz
Spiller Inlet
Briggs Inlet
Roscoe Inlet
Bullock Channel
Yeo Island
FcTa
FcSx


FcTc
FcTb
Swindle Island
Susan Island
Oscar Passage
Finlayson Channel
Mathieson Channel
Dowager Island
Moss Passage
Lady Douglas Island
Spiller Channel
FcTc
FcTb
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
2015
M.L. Tobiasz



FcTe
FcTd
Grant
Anchorage
Swindle
Island
Higgins Passage
Prince
Island
Milbanke
Sound
1
1
2
2
3
4
5
6
7
8
9
Shell Middens:
Large
Medium
Small
Unknown
Fish Trap
Other Site
Salmon
Herring
Kelp
0 1 2
Kilometers
FcTe
FcTd
2015
M.L. Tobiasz

Appendix B: Data sources

GIS Data and Resource Distribution Information:	
Name	Digital Elevation Model
Source	Basemap Online Store- GeoBC
Year	2015
URL	http://openmaps.gov.bc.ca/imfows13/imf.jsp?site=idt&request=rasterMap&mapSeries=DigitalElevationModels
Attributes	• Direction • Elevation • Slope • Visibility • Sunlight
Name	CHS Low Water Mark SP
Source	Ministry of Forests, Lands and Natural Resource Operations- GeoBC
Year	2013
URL	http://catalogue.data.gov.bc.ca/dataset/chs-low-water-mark-sp
Attributes	• Exposure • Shore length • Substrate • Intertidal area • Tidal islands • Small island area • Beach width • Landform
Name	CHS High Water Mark SP
Source	Ministry of Forests, Lands and Natural Resource Operations- GeoBC
Year	2013
URL	http://catalogue.data.gov.bc.ca/dataset/chs-high-water-mark-sp
Attributes	• Exposure • Shore length • Substrate • Intertidal area • Tidal islands • Small island area • Beach width • Landform
Name	Canadian Wind Atlas
Source	Environment Canada
Year	2008
URL	http://www.windatlas.ca/en/maps.php
Attributes	Wind
Name	Known BC Fish Observations and BC Fish Distributions
Source	Ministry of Environment- Knowledge Management
Year	2011
URL	http://catalogue.data.gov.bc.ca/dataset/known-bc-fish-observations-and-bc-fish-distributions
Attributes	Salmon

Name	Herring Spawn- Coastal Resource Information Management Systems
Source	Ministry of Forests, Lands and Natural Resource Operations- GeoBC
Year	2011
URL	http://catalogue.data.gov.bc.ca/dataset/herring-spawn-coastal-resource-information-management-system-crims
Attributes	Herring
Name	Watershed Atlas- Stream Routes
Source	Ministry of Environment – Knowledge Management
Year	2011
URL	http://catalogue.data.gov.bc.ca/dataset/wsa-stream-routes-50-000
Attributes	Fresh Water
Name	Giant Kelp Bioband
Source	BC Marine Conservation Analysis
Year	2008
URL	http://bcmca.ca/datafeatures/eco_kelp_giantkelp_bioband/
Attributes	Giant Kelp
Name	Bull Kelp Bioband
Source	BC Marine Conservation Analysis
Year	2008
URL	http://bcmca.ca/datafeatures/eco_kelp_bullkelp_bioband/
Attributes	Bull Kelp
Name	Freshwater Atlas- Lakes
Source	Ministry of Forests, Lands and Natural Resource Operations- GeoBC
Year	2011
URL	http://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-lakes
Attributes	Lakes
Name	Eulachon
Source	Committee on the Status of Endangered Wildlife in Canada
Year	2011
URL	http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=C2D0CBF6-1
Attributes	Eulachon
Name	Remote Access to Archaeological Data
Source	Ministry of Forests, Lands and Natural Resource Operations, Archaeology Branch
Year	2015
URL	https://arcmaps.gov.bc.ca/ess/sv/raad/Index2.html
Attributes	Archaeological Sites

Appendix C: The p-value results from statistical tests.

Table 22. Results of comparison between Midden locations and Baseline Values

Table 23. Results of comparison between Midden Size Groups and Baseline Values

Table 24. Results of comparison between Large and Small shell middens

Summary of Significance evaluation

Significant: p-value ≤ 0.05
Nearly Significant: p-value 0.1 – 0.05
Value Judgement: based on manual observation that a notable difference exists (an explanation for each provided is below)

Table Abbreviations

M.O. = middens opposite; the shell middens had the opposite results from what was predicated and the baseline value is closer to the 'desirable' conditions

Explanation for Associations determined by Value Judgements:

Wind: All Northwest Shell Middens vs. Baseline (Random Points)
The average wind power for all shell middens in the Northwest Subregion was 325 W/m^2, which is 16% less than the expected baseline value (p-value=0.1027). An association was identified for the Centre West (p-value= 0.0013). There the shell middens were 15% lower than the expected value.

Lakes: Whole Region Large Shell Middens vs. Baseline (Random Points)
The average distance from lakes for all large shell middens (1194 m) in the Region was 19% lower than the expected distance (1469 m) (p-value= 0.1020).

Beach Width: South Area Large Shell Middens vs. Baseline (Random Points)
In the South Area, 43% of large shell middens are located on wide beaches, compared to the 26% expected baseline (p-value= 0.1456).

Intertidal Area: Inner Area Small Shell Middens vs. Large Shell Middens
For the Inner Area, small shell middens (0.048 km^2) have an average intertidal area that is 29% of the average area for large shell middens (0.166 km^2) (p-value= 0.1371).

Beach Width: Inner Area Small Shell Middens vs. Large Shell Middens
No small shell midden in the Inner Area is located on a wide beach (n= 0/7). Three large shell middens (out of seven) are found on wide beaches (p-value= 0.1923). The small sample size of the Inner Area decreased the likelihood of detecting a difference between small and large shell middens.

Table 22. Results of comparison between Midden locations and Baseline Values

Attribute:	Spatial Boundary of Analysis:						Statistical Test Type:
	Whole Region	North West	Centre West	Inner Area	South West	South East	
Herring	0.0001	0.0041	0.9458	0.9541	0.0085	0.9425	Unpaired t-test
	Significant	Significant			Significant		
Salmon	0.0664	0.0515	0.0375	0.0001	0.0182	0.0131	Unpaired t-test
	Nearly Significant	Nearly Significant	Significant	Significant	Significant (M.O.)	Significant (M.O.)	
Fresh Water	0.0102	0.5147	0.0005	0.3195	0.101	0.0380	Unpaired t-test
	Significant		Significant			Significant	
Lakes	0.0001	0.0278	0.0014	0.0269	0.0545	0.0018	Unpaired t-test
	Significant	Significant	Significant	Significant	Nearly Significant	Significant	
Shore Substrate	0.0001	0.0022	0.0001	0.0001	0.0149	0.0003	Chi-square test
	Significant	Significant	Significant	Significant	Significant	Significant	
Shoreline Intricacy	0.0001	0.2069	0.2752	0.0001	0.1815	0.0025	Unpaired t-test
	Significant			Significant		Significant	
Small Island Area	0.0001	0.7153	0.5263	0.0001	0.7119	0.3901	Unpaired t-test
	Significant			Significant			
Beach Width	0.0004	0.4300	0.4547	0.0001	0.0071	0.5198	Fisher's Exact Test
	Significant			Significant	Significant		
Giant Kelp	0.0001	0.0339	0.7869	0.0002	0.0201	0.8260	Unpaired t-test
	Significant	Significant		Significant	Significant	(M.O.)	
Bull Kelp	0.0001	0.5447	0.0637	0.0014	0.4338	0.0713	Unpaired t-test
	Significant		Nearly Significant (M.O.)	Significant		Nearly Significant	

Table 22. continued

Attribute:	Spatial Boundary of Analysis:						Statistical Test Type:
	Whole Region	North West	Centre West	Inner Area	South West	South East	
Closest Kelp	0.0001	0.4007	0.0155	0.0014	0.3643	0.1177	Unpaired t-test
	Significant		Significant (M.O.)	Significant			
Landform	0.3174	0.0001	0.3606	0.0222	0.6885	0.0105	Chi-square test
		Significant		Significant		Significant	
Exposure	0.0001	0.01693	0.0018	1.0	0.0087	0.0005	Chi-square test
	Significant	Significant	Significant		Significant	Significant	
Sunlight	0.0001	0.0271	0.2087	0.0003	0.7830	0.1578	Unpaired t-test
	Significant	Significant	(M.O.)	Significant			
Wind	0.737	0.1027	0.0013	0.9508	0.3978	0.0365	Unpaired t-test
	(M.O.)	Value Judgement	Significant			Significant (M.O.)	
Direction	0.9836	0.6149	0.1515	0.512	0.2517	0.4799	Chi-square test
Elevation	0.0001	0.0004	0.0121	0.0001	0.3250	0.0001	Unpaired t-test
	Significant (M.O.)	Significant (M.O.)	Significant (M.O.)	Significant (M.O.)	(M.O.)	Significant (M.O.)	
Slope	0.0001	0.0002	0.1543	0.0001	0.3710	0.0001	Unpaired t-test
	Significant	Significant		Significant		Significant	

Table 23. Results of comparison between Midden Size Groups and Baseline Values

Attribute:	Whole Region vs. Baseline		Outer vs. Baseline		Inner vs. Baseline		South vs. Baseline	
	Small	Large	Small	Large	Small	Large	Small	Large
Herring	0.0344	0.0109	0.6471	0.9340	0.0622	0.9501	0.0127	0.0029
	Significant	Significant			Nearly Significant		Significant	Significant
Salmon	0.1584	0.8495	0.0180	0.3948	0.0192	0.0177	0.3011	0.6257
			Significant		Significant	Significant		
Fresh Water	0.0431	0.0754	0.0068	0.2965	0.4743	0.5717	0.5002	0.0638
	Significant	Nearly Significant	Significant					Nearly Significant
Lakes	0.0001	0.1020	0.0034	0.1628	0.0463	0.7799	0.0128	0.9431
	Significant	Value Judgement	Significant		Significant		Significant	
Shore Substrate	0.0001	0.0001	0.0005	0.0183	0.002	0.0001	0.0001	0.0001
	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant
Sand Beach	0.0001	0.0001	0.0039	0.0005	1	0.0007	0.0001	0.0001
	Significant	Significant	Significant	Significant		Significant	Significant	Significant
Gravel Beach	0.0008	0.1232	0.2382	0.3191	0.0834	1	0.0013	0.2004
	Significant				Nearly Significant		Significant	
Shoreline Intricacy	0.0001	0.0003	0.3344	0.1836	0.0001	0.0017	0.0139	0.0504
	Significant	Significant			Significant	Significant	Significant	Nearly Significant
Small Island Area	0.5420	0.1560	0.5605	0.3956	0.0001	0.0003	0.1946	0.1381
					Significant	Significant		
Beach Width	0.6737	0.0008	1.	0.2598	1.	0.0015	0.3633	0.1456
		Significant				Significant		Value judgement

Table 23. Continued

Attribute:	Whole Region vs. Baseline		Outer vs. Baseline		Inner vs. Baseline		South vs. Baseline	
	Small	Large	Small	Large	Small	Large	Small	Large
Giant Kelp	0.0009	0.2072	0.2854	0.8669	0.0705	0.2200	0.0002	0.0103
	Significant				Nearly Significant		Significant (M.O.)	Significant (M.O.)
Bull Kelp	0.0007	0.1955	0.1718	0.2585	0.5751	0.1472	0.6679	0.0038
	Significant							Significant (M.O.)
Closest Kelp	0.0007	0.1965	0.3595	0.0001	0.5751	0.1472	0.8412	0.3406
	Significant			Significant				
Landform	0.1195	0.2098	0.0107	0.0857	0.0016	0.263	0.0066	0.4887
			Significant	Nearly Significant	Significant		Significant	
Exposure	0.00334	0.05288	0.07577	0.3617	0.7787	0.6671	0.0001	0.0018
	Significant	Nearly Significant	Nearly Significant				Significant	Significant
Wind	0.7951	0.1686	0.0196	0.0387	0.1681	0.8042	0.1102	0.1747
			Significant	Significant				
Direction	0.9728	0.4481	0.571	0.6428	0.0463	0.7765	0.1153	0.6539
					Significant			
Elevation	0.0001	0.0003	0.0169	0.1412	0.0057	0.0101	0.0170	0.1551
	Significant	Significant	Significant		Significant	Significant	Significant	
Slope	0.0001	0.0001	0.0128	0.2470	0.0055	0.0023	0.0043	0.0640
	Significant	Significant	Significant		Significant	Significant	Significant	Nearly Significant
Sunlight	0.0009	0.0599	0.1899	0.9849	0.0758	0.0781	0.3906	0.8104
	Significant	Nearly Significant			Nearly Significant	Nearly Significant		

Table 24. Results of comparison between Large and Small shell middens

Attribute:		Whole Region	Outer Area	Inner Area	South Area
Herring	p-value	0.2267	0.7142	0.3289	0.0186
	Group closer to desired	Large	Large	Large	Large
	Significance				Significant
Salmon	p-value	0.5122	0.5015	0.8604	0.2412
	Group closer to desired	Small	Small	Large	Small
	Significance				
Fresh Water	p-value	0.6327	0.2143	0.9269	0.1849
	Group closer to desired	Large	Small	Large	Large
	Significance				
Lakes	p-value	0.0165	0.4712	0.2202	0.1366
	Group closer to desired	Small	Small	Small	Small
	Significance	Significant			
Shore Substrate	p-value	0.09497	0.5211	0.0386	0.1074
	Group closer to desired	Different	Same	Different	Different
	Significance	Nearly Significant		Significant	
Sand Beach	p-value	0.0117	0.2434	0.0079	0.2821
	Group closer to desired	Large	Large	Large	Large
	Significance	Significant		Significant	
Gravel Beach	p-value	0.7126	1.0	0.5962	0.6039
	Group closer to desired	Small	Large	Small	Small
	Significance				
Shoreline Intricacy	p-value	0.8085	0.4966	0.4363	0.7144
	Group closer to desired	Large	Large	Small	Large
	Significance				
Intertidal Area	p-value	0.0001	0.0843	0.1371	0.0001
	Group closer to desired	Large	Large	Large	Large
	Significance	Significant	Nearly Significant	Value Judgement	Significant
Tidal Islands	p-value	0.2143	0.7816	0.3348	0.4164
	Group closer to desired	Large	Large	Large	Large
	Significance				
Small Island Area	p-value	0.3833	0.5720	0.6367	0.0263
	Group closer to desired	Large	Small	Small	Large
	Significance				Significant
Beach Width	p-value	0.011	0.3441	0.1923	0.0947
	Group closer to desired	Large	Large	Large	Large
	Significance	Significant		Value Judgement	Nearly Significant
Giant Kelp	p-value	0.2350	0.4976	0.7605	0.7274
	Group closer to desired	Small	Small	Small	Small
	Significance				

Table 24. Continued

Attribute:		Whole Region	Outer Area	Inner Area	South Area
Bull Kelp	p-value	0.2491	0.8122	0.5968	0.0559
	Group closer to desired	Small	Small	Small	Small
	Significance				Nearly Significant
Closest Kelp	p-value	0.2443	0.6903	0.5968	0.0586
	Group closer to desired	Small	Small	Small	Small
	Significance				Nearly Significant
Landform	p-value	0.3313	0.1104	0.2566	0.016
	Group closer to desired	Same	Different	Same	Different
	Significance				Significant
Exposure	p-value	0.9485	0.9287	1	0.909
	Group closer to desired	Same	Same	Same	Same
	Significance				
Wind	p-value	0.2163	0.5953	0.3517	0.6800
	Group closer to desired	Large	Large	Large	Large
	Significance				
Direction	p-value	0.348	0.1751	0.4308	0.2164
	Group closer to desired	Different	Different	Different	Different
	Significance				
Elevation	p-value	0.6164	0.7362	0.9036	0.9339
	Group closer to desired	Large	Large	Large	Large
	Significance				
Slope	p-value	0.6234	0.2088	0.6381	0.9353
	Group closer to desired	Small	Small	Large	Large
	Significance				
Visibility	p-value	0.0835	0.8843	0.1106	0.0976
	Group closer to desired	Large	Small	Large	Large
	Significance	Nearly Significant			Nearly Significant
Sunlight	p-value	0.5262	0.0988	0.8777	0.7103
	Group closer to desired	Small	Small	Small	Large
	Significance		Nearly Significant		

Appendix D: Shell Midden site data and individual attribute values

Table 25. Part one out of three listing attribute results for each shell midden.

Borden Number	Site Name	Listed Associated Features	Site Length (m)	Site Width (m)	Depth (m)	Site Size Category	Subregion (6)	Subregion (3)
EiSt-1	Tseetsum-sawlasilah		60	10			Southeast	South
EiSt-12			20	5		Small	Southeast	South
EiSt-7			100	30	0.35	Large	Southeast	South
EiSt-8			5	5		Small	Southeast	South
EiSt-9			75	25	1.37		Southeast	South
EiSu-3			5	5	0.37	Small	Southeast	South
EiSv-1			30	15		Small	Southeast	South
EiSv-10			60	15			Southeast	South
EiSv-11			20	10		Small	Southeast	South
EiSv-12			30	10		Small	Southeast	South
EiSv-13			80	25			Southeast	South
EiSv-14			30	15		Small	Southeast	South
EiSv-15			50	50			Southeast	South
EiSv-16			20	5		Small	Southeast	South
EiSv-17			30	10		Small	Southeast	South
EiSv-18			200	20		Large	Southeast	South
EiSv-2			25	10		Small	Southeast	South
EiSv-3			20	15		Small	Southeast	South
EiSv-4			15	10		Small	Southeast	South
EiSv-5			20	10		Small	Southeast	South
EiSv-6			60	20			Southeast	South
EiSv-7			25	6		Small	Southeast	South
EiSv-8			30	10		Small	Southeast	South
EiSv-9			20	20		Small	Southeast	South
EiSw-10			100	40		Large	Southeast	South
EiSw-11			60	20			Southeast	South
EiSw-12		Human Remains	-	-			Southeast	South
EiSw-13			50	10			Southeast	South
EiSw-14			50	20			Southeast	South
EiSw-2			20	15		Small	Southeast	South
EiSw-3			90	20			Southeast	South
EiSw-4			80	30			Southeast	South
EiSw-5		Habitation Feature	150	120		Large	Southeast	South
EiSw-6			100	40		Large	Southeast	South
EiSw-7		Habitation Feature	800	100		Large	Southeast	South
EiSw-8		Habitation Feature	40	10			Southeast	South
EiSw-9			30	10		Small	Southeast	South
EiSx-1			73	1			Southwest	South
EjSv-1			18	12	1	Small	Southeast	South
EjSv-10			100	25	3.6	Large	Southeast	South
EjSv-11			20	15	1.4	Small	Southeast	South
EjSv-12			40	10			Southeast	South
EjSv-2			20	30	2.5	Small	Southeast	South
EjSv-3		Habitation Feature	50	10	1.5		Southeast	South
EjSv-4			60	15	1.5		Southeast	South
EjSv-5		Habitation Feature	30	20	2.1	Small	Southeast	South
EjSv-6			80	20			Southeast	South
EjSv-7			70	10			Southeast	South
EjSv-8			30	15	2	Small	Southeast	South
EjSv-9		Historic Feature	80	20	2.6		Southeast	South
EjSw-1	Cockmi	Habitation Feature	300	40	5.3	Large	Southeast	South
EjSw-10			45	10			Southeast	South

Borden Number	Site Name	Listed Associated Features	Site Length (m)	Site Width (m)	Depth (m)	Site Size Category	Subregion (6)	Subregion (3)
EjSw-11		Habitation Feature	-	-			Southeast	South
EjSw-12			20	10		Small	Southeast	South
EjSw-13			20	10	0.5	Small	Southeast	South
EjSw-14			15	4	0.5	Small	Southeast	South
EjSw-15			15	3	0.5	Small	Southeast	South
EjSw-18			120	50		Large	Southeast	South
EjSw-20		Habitation Feature	25	20	1	Small	Southeast	South
EjSw-21			160	40	4	Large	Southeast	South
EjSw-22		Habitation Feature	20	20		Small	Southeast	South
EjSw-23			20	10		Small	Southeast	South
EjSw-24			20	10		Small	Southeast	South
EjSw-25			30	10		Small	Southeast	South
EjSw-26	Giya'zawa|Ga'yaxawa| Crosswise at the Mouth	Fish Trap; Canoe Skids	85	70	1.8		Southeast	South
EjSw-27		Historic Feature	30	23		Small	Southeast	South
EjSw-28		Fish Trap	2	3	0.2	Small	Southeast	South
EjSw-29			20	10	0.3	Small	Southeast	South
EjSw-30			-	-			Southeast	South
EjSw-31			15	8		Small	Southeast	South
EjSw-32			10	5		Small	Southeast	South
EjSw-33			30	4		Small	Southeast	South
EjSw-34			14	13		Small	Southeast	South
EjSw-35			17	4		Small	Southeast	South
EjSw-36			12	8		Small	Southeast	South
EjSw-37			18	3		Small	Southeast	South
EjSw-38			12	8		Small	Southeast	South
EjSw-4			10	4		Small	Southeast	South
EjSw-5		Habitation Feature	35	25			Southeast	South
EjSw-6			8	4		Small	Southeast	South
EjSw-8			12	3		Small	Southeast	South
EjSw-9			60	2			Southeast	South
EjSx-1			61	30			Southeast	South
EjSx-2		Habitation Feature	65	35			Southeast	South
EjSx-4			15	6		Small	Southwest	South
EjSx-6			8	3.5	0.5	Small	Southeast	South
EjTa-1	Lux balis	Historic Feature	430	22	1.75	Large	Southwest	South
EjTa-11		Defensive Feature	30	15	0.9	Small	Southwest	South
EjTa-13		Rock Shelter; Human Remains	300		3	Large	Southwest	South
EjTa-15			285	40		Large	Southwest	South
EjTa-2			82	55			Southwest	South
EjTa-4		Rock Shelter; Human Remains	100	60	4.7	Large	Southwest	South
EjTa-5			105	10	2.5	Large	Southwest	South
EjTa-6		Fish Trap	-	-			Southwest	South
EjTa-9			50	7	0.8		Southwest	South
EkSs-1		Historic Feature	30	10		Small	Southeast	South
EkSt-1	Katit	Human Remains, Historic Feature	137	40	2	Large	Southeast	South
EkSt-5		Historic Feature	400	30		Large	Southeast	South
EkSt-6			100	30		Large	Southeast	South
EkSu-2			100	20		Large	Southeast	South
EkSv-1			20	10	0.5	Small	Southeast	South
EkSw-3		Habitation Feature	30	25	0.9	Small	Centre East	Inner
EkSw-4			4.5	1.5	0.75	Small	Centre East	Inner
EkSx-1			121.92	15.24		Large	Southeast	South
EkSx-10			-	-			Southeast	South
EkSx-11		Habitation Feature; Historic Feature	50	30			Southeast	South
EkSx-12	Koeye Village	Habitation Feature	200	10	3.8	Large	Centre East	Inner

Borden Number	Site Name	Listed Associated Features	Site Length (m)	Site Width (m)	Depth (m)	Site Size Category	Subregion (6)	Subregion (3)
EkSx-2			30	30		Small	Southeast	South
EkSx-3			-	-			Centre East	Inner
EkSx-5			20	15		Small	Southwest	South
EkSx-7			-	-			Southeast	South
EkSx-8			10	3		Small	Southeast	South
EkSx-9			-	-			Southeast	South
EkTa-1			12	6		Small	Centre West	Outer
EkTa-10			183	137		Large	Centre West	Outer
EkTa-11			-	-			Centre West	Outer
EkTa-12			55	6			Centre West	Outer
EkTa-13			27	23		Small	Centre West	Outer
EkTa-14			-	-			Centre West	Outer
EkTa-16			-	-			Centre West	Outer
EkTa-17			-	-			Centre West	Outer
EkTa-18			-	-			Centre West	Outer
EkTa-19	Wolf Midden	Habitation Feature	25	20		Small	Centre West	Outer
EkTa-2		Fish Trap; Canoe Skids; Historic Feature	20	12	1	Small	Southwest	South
EkTa-22			-	-			Centre West	Outer
EkTa-23			24			Small	Centre West	Outer
EkTa-24			20			Small	Centre West	Outer
EkTa-26			20			Small	Centre West	Outer
EkTa-27			6	5		Small	Centre West	Outer
EkTa-28			10	6		Small	Centre West	Outer
EkTa-29			9	7	1.5	Small	Centre West	Outer
EkTa-3			-	-			Centre West	Outer
EkTa-31			40	20			Centre West	Outer
EkTa-33			15	10		Small	Centre West	Outer
EkTa-5			-	-			Southwest	South
EkTa-6			12	9		Small	Centre West	Outer
EkTa-7			-	-			Centre West	Outer
EkTa-8			-	-			Centre West	Outer
EkTa-9			-	-			Centre West	Outer
EkTb-1			-	-			Centre West	Outer
EkTb-8		Fish Trap; Historic Feature	70	70	2.5		Centre West	Outer
EkTb-9		Fish Trap; Habitation Feature	150	50	5	Large	Centre West	Outer
ElSw-1			-	-			Centre East	Inner
ElSw-2		Habitation Feature; Historic Feature	-	-			Centre East	Inner
ElSw-29			79.8	83			Centre East	Inner
ElSw-3			-	-			Centre East	Inner
ElSw-32			367	159.7	0.6	Large	Centre East	Inner
ElSw-4			-	-			Centre East	Inner
ElSx-1	Namu	Fish Trap; Human Remains; Historic Feature	400	130	4.2	Large	Centre East	Inner
ElSx-10	Fougner Bay		57	30	2.5		Centre East	Inner
ElSx-11	Strawberry I.	Rock Art	48	31			Centre East	Inner
ElSx-14	Conover Site		-	-			Centre East	Inner
ElSx-15			-	-			Centre East	Inner
ElSx-16			46	8	1		Centre East	Inner
ElSx-17			17.5	15	0.75	Small	Centre East	Inner
ElSx-18		Canoe Skids	62.5	32.5	2.8		Centre East	Inner
ElSx-2			9	6		Small	Centre East	Inner
ElSx-3	Kisameet Bay	Fish Trap	75	20	2.6		Centre East	Inner
ElSx-4		Historic Feature	17.5	7.5	1.8	Small	Centre East	Inner
ElSx-5			110	22	4.57	Large	Centre East	Inner
ElSx-6			46	23	0.6		Centre East	Inner
ElSx-8		Fish Trap	94.4	9.4	0.95		Centre East	Inner

Borden Number	Site Name	Listed Associated Features	Site Length (m)	Site Width (m)	Depth (m)	Site Size Category	Subregion (6)	Subregion (3)
ElTa-18		Fish Trap	37	30	0.85		Centre West	Outer
ElTa-20			-	-			Centre West	Outer
ElTa-21		Fish Trap	37.9	4.8	0.6		Centre West	Outer
ElTa-24			8	3		Small	Centre West	Outer
ElTa-25	Kiltik Cove	Fish Trap	55	32	2.8		Centre West	Outer
ElTa-3	Watt Bay	Fish Trap; Hunting Feature	8.8	5		Small	Centre West	Outer
ElTa-4		Historic Feature	10	8		Small	Centre West	Outer
ElTb-1	Nulu	Habitation Feature; Historic Feature	68.5	12.9	4.5		Centre West	Outer
ElTb-10	McNaughton	historic, habitation feature, Rock Art	450	10		Large	Centre West	Outer
ElTb-11		Canoe Skids; Historic Feature	-	-			Centre West	Outer
ElTb-12		Habitation Feature	60	30			Centre West	Outer
ElTb-14			-	-			Centre West	Outer
ElTb-19			200	100		Large	Centre West	Outer
ElTb-2		Fish Trap	15.8	6.1	1.2	Small	Centre West	Outer
ElTb-22			30	10		Small	Centre West	Outer
ElTb-23		Fish Trap	13	0		Small	Centre West	Outer
ElTb-28			-	-			Centre West	Outer
ElTb-29		Defensive Feature	15	12		Small	Centre West	Outer
ElTb-3			-	-			Centre West	Outer
ElTb-30			-	-			Centre West	Outer
ElTb-31			-	-			Centre West	Outer
ElTb-33		Fish Trap	3	2	0.1	Small	Centre West	Outer
ElTb-34		Rock Art; Habitation Feature; Defensive Feature	28	6	0	Small	Centre West	Outer
ElTb-37		Fish Trap	10	2	0.4	Small	Centre West	Outer
ElTb-38		Historic Feature	0.5			Small	Centre West	Outer
ElTb-4			-	-			Centre West	Outer
ElTb-43		Fish Trap; Habitation Feature	-	-			Centre West	Outer
ElTb-5			60	20			Centre West	Outer
ElTb-7			-	-			Centre West	Outer
ElTb-8			-	-			Centre West	Outer
ElTb-9			-	-			Centre West	Outer
ElTc-1	Yellertlee		-	-			Centre West	Outer
ElTc-5		Habitation Feature	10	5	0.9	Small	Centre West	Outer
ElTc-6			50	20	0.6		Centre West	Outer
ElTc-7			75	20			Centre West	Outer
FaSu-1	Axe.ti	Habitation Feature	125	20		Large	Centre East	Inner
FaSu-10	Anutcix	Habitation Feature	90	50	2		Centre East	Inner
FaSu-18			50	10			Centre East	Inner
FaSu-19	Joashila		-	-			Centre East	Inner
FaSu-2	Mutitiqotank/ Nutlitliquotlank	Human Remains; Habitation Feature	180	13	2.8	Large	Centre East	Inner
FaSv-1	Restoration Bay		-	-			Centre East	Inner
FaSv-4	Tesque	Historic Feature	125	20	5	Large	Centre East	Inner
FaSv-5	Portion of Tesque		-	-	0.6		Centre East	Inner
FaSx-10		Fish Trap	15	5		Small	Centre East	Inner
FaSx-14			-	-			Centre West	Outer
FaSx-15			-	-			Centre West	Outer
FaSx-16		Fish Trap	45	45	0.3		Centre West	Outer
FaSx-8			-	-			Centre East	Inner
FaTa-10		Fish Trap	67	50	1.1		Centre West	Outer
FaTa-13		Fish Trap	-	-			Centre West	Outer
FaTa-14			-	-			Centre West	Outer
FaTa-15			-	-			Centre West	Outer
FaTa-16			-	-			Centre West	Outer
FaTa-17		Historic Feature	-	-			Centre West	Outer

Borden Number	Site Name	Listed Associated Features	Site Length (m)	Site Width (m)	Depth (m)	Site Size Category	Subregion (6)	Subregion (3)
FaTa-18	'Qvu'stus	Human Remains; Historic Feature	180	30	1.5	Large	Centre West	Outer
FaTa-19		Fish Trap	-	-			Centre West	Outer
FaTa-22			10	10	0.6	Small	Centre West	Outer
FaTa-24			-	-			Centre West	Outer
FaTa-26		Defensive Feature	-	-			Centre West	Outer
FaTa-27			-	-			Centre West	Outer
FaTa-30			-	-			Centre West	Outer
FaTa-31			-	-			Centre West	Outer
FaTa-32		Habitation Feature; Historic Feature	60	25	3.5		Centre West	Outer
FaTa-33		Historic Feature	-	-	0.5		Centre West	Outer
FaTa-35			-	-			Centre West	Outer
FaTa-4	Old Bella Bella|Fort McLoughlin	Historic Feature	800	100		Large	Centre West	Outer
FaTa-44			-	-			Centre West	Outer
FaTa-45		Fish Trap; Defensive Feature	-	-			Centre West	Outer
FaTa-47		Fish Trap; Historic Feature	-	-			Centre West	Outer
FaTa-49		Historic Feature	-	-			Centre West	Outer
FaTa-5		Rock Art; Canoe Skids; Habitation Feature; Historic Feature	410	25	2	Large	Centre West	Outer
FaTa-52			-	-			Centre West	Outer
FaTa-57		Historic Feature	30	15	0.9	Small	Centre West	Outer
FaTa-61		Fish Trap	7	4	0.6	Small	Centre West	Outer
FaTa-66		Hunting Feature	3	1.5	0	Small	Centre West	Outer
FaTa-7		Smokehouse; Historic Feature	71	65	0.5		Centre West	Outer
FaTa-72			14	11		Small	Centre West	Outer
FaTa-73		Fish Trap; Historic Feature	185	35	0.8	Large	Centre West	Outer
FaTa-74		Fish Trap	30	15	0.8	Small	Centre West	Outer
FaTa-75			30	7	0.65	Small	Centre West	Outer
FaTa-76		Fish Trap	15	10		Small	Centre West	Outer
FaTa-9		Fish Trap	-	-			Centre West	Outer
FaTb-10			70	70	1.5		Centre West	Outer
FaTb-13			-	-			Centre West	Outer
FaTb-14			-	-			Centre West	Outer
FaTb-15			-	-			Centre West	Outer
FaTb-16			-	-			Centre West	Outer
FaTb-17		Fish Trap	-	-			Centre West	Outer
FaTb-2	Schacash (phonetic spelling)	Historic Feature	-	-			Centre West	Outer
FaTb-24			-	-			Centre West	Outer
FaTb-28			-	-			Centre West	Outer
FaTb-32			-	-			Centre West	Outer
FaTb-35		Rock Art; Canoe Skids	4	2	0.6	Small	Centre West	Outer
FaTb-38		Habitation Feature	60	20			Centre West	Outer
FaTb-39			5	3		Small	Centre West	Outer
FaTb-7			-	-			Centre West	Outer
FaTb-8		Fish Trap	-	-			Centre West	Outer
FaTc-1		Habitation Feature; Historic Feature	-	-			Centre West	Outer
FaTc-10		Fish Trap	-	-			Centre West	Outer
FaTc-11			-	-			Centre West	Outer
FaTc-12			-	-			Centre West	Outer
FaTc-13		Habitation Feature	-	-			Centre West	Outer
FaTc-14	Old Rediscovery Camp		50	40	1.5		Centre West	Outer
FaTc-16			21	5		Small	Centre West	Outer

Borden Number	Site Name	Listed Associated Features	Site Length (m)	Site Width (m)	Depth (m)	Site Size Category	Subregion (6)	Subregion (3)
FaTc-17		Canoe Skids	25	10		Small	Centre West	Outer
FaTc-19			60	40	1		Centre West	Outer
FaTc-2			-	-			Centre West	Outer
FaTc-21		Fish Trap	110	70		Large	Centre West	Outer
FaTc-3		Historic Feature	-	-			Centre West	Outer
FaTc-4		Fish Trap	-	-			Centre West	Outer
FaTc-7		Fish Trap	-	-			Centre West	Outer
FaTc-8			-	-			Centre West	Outer
FaTc-9			-	-			Centre West	Outer
FbSu-1	Sinuthemitl (Where it Spoke)	Fish Trap; Habitation Feature	-	-			Centre East	Inner
FbSu-4	Old Indian Village	Habitation Feature; Historic Feature	40	10	0.45		Northeast	Inner
FbSv-2			91	69			Northeast	Inner
FbSw-1			30	8		Small	Northeast	Inner
FbSw-3			76	9			Northeast	Inner
FbSx-12		Fish Trap; Habitation Feature; Defensive Feature	-	-			Centre West	Outer
FbSx-3	Rochester		-	-			Northwest	Outer
FbSx-4			-	-			Centre West	Outer
FbSx-6	Roscoe Inlet/ Xunis	Rock Art; Canoe Skids; Habitation Feature; Historic Feature	210	60	3	Large	Northwest	Outer
FbSx-9	Deer Pass, 'Humata'	Canoe Skids; Habitation Feature; Historic Feature	100	50	0.5	Large	Northwest	Outer
FbTa-10		Fish Trap	-	-			Northwest	Outer
FbTa-12			-	-			Northwest	Outer
FbTa-13			-	-			Northwest	Outer
FbTa-15		Fish Trap; Historic Feature	-	-			Northwest	Outer
FbTa-16		Fish Trap	-	-			Northwest	Outer
FbTa-17			-	-			Centre West	Outer
FbTa-21			-	-			Centre West	Outer
FbTa-22			-	-			Centre West	Outer
FbTa-23			-	-			Centre West	Outer
FbTa-25		Habitation Feature	12	35	2	Small	Northwest	Outer
FbTa-26			-	-			Centre West	Outer
FbTa-27		Habitation Feature	100	50	1	Large	Northwest	Outer
FbTa-28			18	9	0.8	Small	Northwest	Outer
FbTa-29			6.4	6	1	Small	Northwest	Outer
FbTa-3	Kwakiusdis	Fish Trap; Rock Art	-	-			Northwest	Outer
FbTa-30			1	1	0.3	Small	Northwest	Outer
FbTa-43		Canoe Skids; Habitation Feature	100	18	0.5	Large	Northwest	Outer
FbTa-5		Habitation Feature	80	20			Northwest	Outer
FbTa-6		Historic Feature	30	15		Small	Centre West	Outer
FbTa-7			-	-			Northwest	Outer
FbTa-9			-	-			Northwest	Outer
FbTb-1		Canoe Skids	-	-			Northwest	Outer
FbTb-12			-	-			Northwest	Outer
FbTb-17			-	-			Centre West	Outer
FbTb-18			-	-			Centre West	Outer
FbTb-21	Kyahti	Rock Art; Habitation Feature	-	-			Northwest	Outer
FbTb-22			-	-			Northwest	Outer
FbTb-23		Habitation Feature	53	30	1		Northwest	Outer
FbTb-24		Surface Cultural Material	15	15	1	Small	Northwest	Outer
FbTb-39		Fish Trap	22	15	1.2	Small	Northwest	Outer
FbTb-4	Koyet|Kilkitei Village	Rock Art; Clam Garden; Canoe Skids; Human	200	20	3	Large	Northwest	Outer

Borden Number	Site Name	Listed Associated Features	Site Length (m)	Site Width (m)	Depth (m)	Site Size Category	Subregion (6)	Subregion (3)
		Remains; Habitation Feature; Historic Feature						
FbTb-5	Knyumpt Harbour|Strom Bay	Rock Art; Habitation Feature; Historic Feature	250	50	0.75	Large	Centre West	Outer
FbTb-6		Fish Trap	-	-			Northwest	Outer
FbTc-1		Fish Trap	-	-	3		Centre West	Outer
FbTc-10			-	-			Northwest	Outer
FbTc-11		Fish Trap; Defensive Feature	-	-			Centre West	Outer
FbTc-12		Habitation Feature	75	0	0.6		Centre West	Outer
FbTc-13		Habitation Feature	-	-			Centre West	Outer
FbTc-2			-	-			Northwest	Outer
FbTc-3		Canoe Skids	100	0	0.3	Large	Northwest	Outer
FbTc-4			-	-			Northwest	Outer
FbTc-5		Historic Feature	-	-			Northwest	Outer
FbTc-6			-	-			Northwest	Outer
FbTc-7			-	-			Northwest	Outer
FbTc-8		Historic Feature	-	-			Northwest	Outer
FcSt-1		Fish Trap	-	-			Northeast	Inner
FcSt-12		Fish Trap	5	3	0.6	Small	Northeast	Inner
FcSt-13		Fish Trap; Habitation Feature	12	1	0.1	Small	Northeast	Inner
FcSt-3	Nusgate|Nusquatl		400	200		Large	Northeast	Inner
FcSu-1	Elcho Harbour	Rock Art; Habitation Feature; Defensive Feature	51	30			Northeast	Inner
FcTa-17		Fish Trap	2	2	0.6	Small	Northwest	Outer
FcTa-19			19	2.25	0.3	Small	Northwest	Outer
FcTa-3		Fish Trap; Historic Feature	-	-			Northwest	Outer
FcTa-78			190	100		Large	Northwest	Outer
FcTc-2			-	-			Northwest	Outer
FcTc-3		Historic Feature	-	-			Northwest	Outer
FcTc-4		Habitation Feature	-	-			Northwest	Outer
FcTc-5			-	-			Northwest	Outer
FcTc-7		Fish Trap	-	-			Northwest	Outer
FcTc-9			-	-			Northwest	Outer
FcTd-1			-	-			Northwest	Outer
FcTe-1		Canoe Skids; Habitation Feature	-	-			Northwest	Outer
FcTe-2		Defensive Feature	20	15		Small	Northwest	Outer
FcTe-3	Guxw'i		-	-			Northwest	Outer
FcTe-4	Grant Anchorage	Habitation Feature	250	30	2.5	Large	Northwest	Outer
FcTe-6			-	-			Northwest	Outer

Table 26. Part two out of three listing attribute results for each shell midden.

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m^2)	Annual Mean Wind Power (W/m^2)
EiSt-1	Mainland	Rock Cliff	<30 m	Protected	22	South	27	137173	191
EiSt-12	Mainland	Rock Cliff	<30 m	Protected	1	Northwest	0	144086	175
EiSt-7	Mainland	Sand and Gravel Beach	<30 m	Protected	32	Northwest	18	139116	175
EiSt-8	Mainland	Rock Cliff	<30 m	Protected	34	Southwest	33	126182	175
EiSt-9	Mainland	Rock Cliff	<30 m	Protected	4	Southwest	2	150650	175
EiSu-3	Mainland	Sand and Gravel Beach	<30 m	Protected	13	South	18	151023	234
EiSv-1	Medium I.	Estuary, Marsh or Lagoon		Protected	1	South	0	150332	270
EiSv-10	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	East	0	150587	374
EiSv-11	Medium I.	Sand and Gravel Beach	<30 m	Protected	1	East	0	150537	374
EiSv-12	Small I.	Rock Cliff	<30 m	Semi-Protected	1	East	0	131682	191
EiSv-13	Mainland	Sand and Gravel Flat	<30 m	Semi-Protected	6	Southwest	8	131463	191
EiSv-14	Mainland	Rock Cliff	<30 m	Protected	14	Northeast	6	149445	224
EiSv-15	Mainland	Rock, Sand and Gravel Beach	<30 m	Protected	1	Southwest	0	151720	224
EiSv-16	Mainland	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	37	West	23	155798	304
EiSv-17	Mainland	Sand and Gravel Flat	>30 m	Protected	1	Northeast	2	146359	207
EiSv-18	Mainland	Sand and Gravel Flat	>30 m	Protected	1	Northwest	0	127391	191
EiSv-2	Medium I.	Sand and Gravel Flat	<30 m	Protected	1	Southwest	0	152409	270
EiSv-3	Medium I.	Sand Flat	>30 m	Protected	1	West	0	150470	270
EiSv-4	Medium I.	Gravel Beach	<30 m	Protected	1	West	0	147769	374
EiSv-5	Medium I.	Gravel Beach	<30 m	Protected	1	West	0	152111	374
EiSv-6	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	34	Southwest	14	150432	374
EiSv-7	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Protected	28	Northwest	5	149406	374
EiSv-8	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	27	Northwest	5	147396	374
EiSv-9	Medium I.	Sand and Gravel Beach	<30 m	Protected	1	Northeast	0	150203	270
EiSw-10	Medium I.	Rock Cliff	<30 m	Protected	1	East	0	150625	164
EiSw-11	Medium I.	Rock Cliff	<30 m	Protected	1	North	0	128953	374
EiSw-12	Mainland	Rock with Gravel Beach	<30 m	Protected	8	North	16	141561	191
EiSw-13	Mainland	Sand Beach	<30 m	Semi-Exposed	3	Southeast	2	159748	183
EiSw-14	Small I.	Rock Cliff	<30 m	Semi-Protected	1	Southeast	0	150645	191
EiSw-2	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Northeast	0	160179	285
EiSw-3	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Northeast	0	150488	285
EiSw-4	Medium I.	Sand Beach	<30 m	Protected	9	Southwest	14	150642	285
EiSw-5	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Southeast	0	150642	432
EiSw-6	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	South	0	159222	432
EiSw-7	Small I.	Rock, Sand and Gravel Beach	>30 m	Protected	1	North	0	153689	285
EiSw-8	Small I.	Sand Beach	<30 m	Semi-Protected	1	East	0	153771	285
EiSw-9	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	North	0	150595	164
EiSx-1	Tiny I.	Rock Cliff	>30 m	Exposed	1	Southeast	0	150657	576
EjSv-1	Medium I.	Mud Flat	>30 m	Protected	6	North	4	151974	374
EjSv-10	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Northwest	0	150531	344
EjSv-11	Medium I.	Rock Cliff	<30 m	Protected	1	Southwest	0	150586	344
EjSv-12	Mainland	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	Southeast	0	150577	150
EjSv-2	Small I.	Rock with Sand Beach	>30 m	Protected	1	Southwest	0	150707	374
EjSv-3	Medium I.	Sand and Gravel Beach	<30 m	Protected	44	West	19	150711	374

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m^2)	Annual Mean Wind Power (W/m^2)
EjSv-4	Medium I.	Rock Cliff	<30 m	Protected	3	Southeast	5	150716	337
EjSv-5	Small I.	Sand Beach	<30 m	Protected	1	South	0	150689	337
EjSv-6	Mainland	Sand and Gravel Flat	<30 m	Protected	8	Southeast	20	150653	337
EjSv-7	Mainland	Rock, Sand and Gravel Beach	>30 m	Protected	9	Southeast	27	150762	245
EjSv-8	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	East	0	150796	344
EjSv-9	Medium I.	Rock with Gravel Beach	<30 m	Protected	1	West	0	147221	344
EjSw-1	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	North	0	146933	374
EjSw-10	Mainland	Rock with Gravel Beach	>30 m	Protected	1	Southwest	0	150378	528
EjSw-11	Mainland	Rock with Gravel Beach	<30 m	Protected	4	Northeast	5	150290	528
EjSw-12	Mainland	Rock, Sand and Gravel Beach	<30 m	Protected	3	Northwest	2	149963	528
EjSw-13	Mainland	Rock with Gravel Beach	<30 m	Protected	1	Southeast	0	153570	528
EjSw-14	Mainland	Rock Cliff	<30 m	Semi-Exposed	1	Southeast	0	150338	528
EjSw-15	Mainland	Rock with Gravel Beach	>30 m	Semi-Exposed	1	Northwest	0	148192	528
EjSw-18	Mainland	Sand and Gravel Beach	<30 m	Very-Protected	1	Southeast	0	153724	535
EjSw-20	Mainland	Rock Cliff	<30 m	Protected	3	Southeast	5	150693	268
EjSw-21	Mainland	Sand Beach	<30 m	Protected	4	South	11	147852	268
EjSw-22	Medium I.	Estuary, Marsh or Lagoon		Protected	1	North	0	149492	285
EjSw-23	Medium I.	Sand and Gravel Beach	<30 m	Protected	1	Northeast	0	150527	374
EjSw-24	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	West	0	150664	432
EjSw-25	Medium I.	Rock Cliff	<30 m	Semi-Protected	1	West	0	150663	432
EjSw-26	Mainland	Rock Cliff	<30 m	Protected	3	West	5	140585	432
EjSw-27	Small I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Southwest	0	150544	519
EjSw-28	Mainland	Rock, Sand and Gravel Beach	<30 m	Very-Protected	20	Northeast	15	150471	535
EjSw-29	Mainland	Rock, Sand and Gravel Beach	<30 m	Protected	2	Southeast	2	150613	540
EjSw-30	Mainland	Rock Cliff	<30 m	Protected	1	East	0	146104	535
EjSw-31	Mainland	Rock Cliff	<30 m	Protected	1	South	0	156706	519
EjSw-32	Mainland	Rock Cliff	<30 m	Protected	1	Southwest	0	150595	519
EjSw-33	Mainland	Rock Cliff	<30 m	Protected	1	West	0	150556	519
EjSw-34	Mainland	Rock, Sand and Gravel Beach	<30 m	Protected	1	South	0	150665	528
EjSw-35	Mainland	Sand Beach	<30 m	Semi-Protected	1	Northwest	0	150676	528
EjSw-36	Mainland	Sand Beach	<30 m	Semi-Protected	1	Northwest	0	148139	528
EjSw-37	Mainland	Rock with Gravel Beach	<30 m	Protected	3	West	4	150550	537
EjSw-38	Mainland	Rock with Gravel Beach	<30 m	Protected	2	Southwest	1	141756	537
EjSw-4	Medium I.	Sand Flat	>30 m	Protected	1	West	0	151007	537
EjSw-5	Mainland	Rock with Gravel Beach	<30 m	Very-Protected	3	Northwest	7	150506	435
EjSw-6	Mainland	Rock with Gravel Beach	<30 m	Very-Protected	1	West	0	150481	435
EjSw-8	Mainland	Rock with Sand Beach	>30 m	Protected	1	West	0	150163	432
EjSw-9	Mainland	Sand Beach	<30 m	Semi-Protected	1	Northwest	0	149889	528
EjSx-1	Small I.	Rock Cliff	<30 m	Protected	1	Southwest	0	150587	519
EjSx-2	Small I.	Rock with Gravel Beach	<30 m	Semi-Protected	1	West	0	149131	519
EjSx-4	Tiny I.	Rock Cliff	<30 m	Semi-Exposed	3	Northeast	5	140403	279
EjSx-6	Medium I.	Rock with Gravel Beach	<30 m	Semi-Exposed	1	North	0	151226	519
EjTa-1	Large I.	Sand Beach	>30 m	Protected	1	East	0	150641	597
EjTa-11	Tiny I.	Rock Cliff	>30 m	Exposed	1	Northeast	0	150000	621
EjTa-13	Medium I.	Sand Flat	>30 m	Semi-Protected	3	West	5	144177	597
EjTa-15	Large I.	Sand Flat	>30 m	Protected	1	Northeast	0	150553	621
EjTa-2	Large I.	Sand and Gravel Flat	>30 m	Protected	1	East	0	147168	597
EjTa-4	Large I.	Rock Cliff	<30 m	Semi-Protected	1	East	0	146167	597
EjTa-5	Large I.	Rock with Gravel Beach	>30 m	Semi-Exposed	1	Northwest	0	154324	621
EjTa-6	Large I.	Sand and Gravel Flat	>30 m	Protected	1	West	0	150693	597
EjTa-9	Large I.	Sand Beach	>30 m	Semi-Exposed	1	North	0	150799	621

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m^2)	Annual Mean Wind Power (W/m^2)
EkSs-1	Mainland				28	West	23	150795	221
EkSt-1	Mainland				16	South	9	150741	247
EkSt-5	Mainland	Estuary, Marsh or Lagoon		Semi-Protected	8	Northwest	6	147563	130
EkSt-6	Tiny I.	Estuary, Marsh or Lagoon		Semi-Protected	1	South	0	146428	130
EkSu-2	Mainland	Estuary, Marsh or Lagoon		Protected	44	Southeast	13	154439	174
EkSv-1	Mainland	Sand and Gravel Beach	<30 m	Protected	43	East	21	123733	417
EkSw-3	Mainland	Rock with Gravel Beach	<30 m	Protected	17	Southeast	7	155687	532
EkSw-4	Mainland	Rock with Gravel Beach	<30 m	Protected	22	Southeast	7	157606	532
EkSx-1	Mainland	Sand Flat	>30 m	Semi-Protected	1	Southwest	0	149071	490
EkSx-10	Mainland	Sand and Gravel Beach	<30 m	Protected	13	Southwest	10	143916	513
EkSx-11	Mainland	Rock Cliff	<30 m	Protected	6	Northwest	9	147054	513
EkSx-12	Mainland	Gravel Beach	<30 m	Protected	1	Northwest	0	142555	505
EkSx-2	Tiny I.	Rock Cliff	<30 m	Semi-Protected	1	Southwest	0	150699	490
EkSx-3	Mainland	Rock Cliff	<30 m	Protected	1	West	4	156180	505
EkSx-5	Small I.	Rock with Gravel Beach	>30 m	Semi-Protected	1	Southeast	0	155897	172
EkSx-7	Mainland	Sand Flat	>30 m	Semi-Protected	1	South	0	154860	490
EkSx-8	Mainland	Sand Flat	>30 m	Protected	1	Southeast	0	155072	490
EkSx-9	Mainland	Rock with Sand Beach	>30 m	Protected	4	South	8	150357	490
EkTa-1	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	West	0	137100	258
EkTa-10	Large I.	Sand Flat	>30 m	Protected	8	West	9	150587	261
EkTa-11	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	Southeast	7	142073	261
EkTa-12	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	Northwest	0	150293	261
EkTa-13	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	Northwest	0	153507	258
EkTa-14	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	South	0	150682	258
EkTa-16	Medium I.	Rock with Gravel Beach	<30 m	Protected	1	Northeast	0	150629	258
EkTa-17	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	East	0	150553	261
EkTa-18	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	1	Northwest	0	149173	261
EkTa-19	Medium I.	Rock Cliff	<30 m	Semi-Protected	1	South	6	150548	370
EkTa-2	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	12	Northwest	8	156490	219
EkTa-22	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	North	0	150566	261
EkTa-23	Medium I.	Sand Flat	>30 m	Protected	26	South	13	150593	513
EkTa-24	Medium I.	Rock Cliff	<30 m	Semi-Exposed	1	West	0	150580	258
EkTa-26	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	South	0	150605	256
EkTa-27	Large I.	Rock with Gravel Beach	<30 m	Protected	2	Northeast	5	151233	256
EkTa-28	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	South	0	152573	261
EkTa-29	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	East	0	150151	261
EkTa-3	Small I.	Sand and Gravel Flat	<30 m	Protected	1	South	0	150655	256
EkTa-31	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	East	3	158154	261
EkTa-33	Small I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Southeast	0	150673	349
EkTa-5	Medium I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	11	Northeast	11	150773	172
EkTa-6	Tiny I.	Rock with Gravel Beach	<30 m	Protected	1	East	0	150777	256
EkTa-7	Large I.	Sand Flat	>30 m	Protected	4	East	12	151817	261
EkTa-8	Large I.	Rock with Gravel Beach	<30 m	Semi-Protected	1	Southeast	0	151367	261
EkTa-9	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Southwest	0	150781	261

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m^2)	Annual Mean Wind Power (W/m^2)
EkTb-1	Small I.	Sand and Gravel Flat	>30 m	Semi-Protected	1	Southwest	0	150780	730
EkTb-8	Medium I.	Sand Beach	>30 m	Semi-Protected	1	Northeast	0	150929	721
EkTb-9	Medium I.	Sand Beach	>30 m	Semi-Protected	1	North	0	138329	721
ElSw-1	Large I.	Rock, Sand and Gravel Beach	>30 m	Protected	2	Southeast	2	150700	205
ElSw-2	Large I.	Sand and Gravel Flat	>30 m	Protected	6	South	14	139408	205
ElSw-29	Mainland	Sand and Gravel Flat	>30 m	Protected	29	Northwest	17	150828	138
ElSw-3	Large I.	Rock with Gravel Beach	<30 m	Protected	32	Southeast	26	150825	205
ElSw-32	Mainland	Sand and Gravel Beach	<30 m	Protected	37	Northwest	16	150822	205
ElSw-4	Mainland	Sand and Gravel Beach	<30 m	Protected	9	West	8	150820	138
ElSx-1	Mainland	Sand and Gravel Flat	>30 m	Protected	2	West	2	150857	477
ElSx-10	Mainland	Sand and Gravel Flat	>30 m	Protected	1	Northeast	3	150820	136
ElSx-11	Mainland				24	Northwest	0	150821	477
ElSx-14	Tiny I.	Rock with Sand Beach	>30 m	Semi-Protected	1	Northwest	0	148795	499
ElSx-15	Tiny I.	Rock Cliff	<30 m	Semi-Protected	1	South	0	158018	136
ElSx-16	Mainland	Sand and Gravel Flat	<30 m	Protected	41	North	21	149289	136
ElSx-17	Tiny I.	Rock with Gravel Beach	<30 m	Semi-Protected	1	Southwest	0	158414	477
ElSx-18	Small I.	Sand and Gravel Beach	<30 m	Semi-Protected	1	South	0	146161	136
ElSx-2	Tiny I.	Rock with Gravel Beach	<30 m	Protected	1	Northeast	0	150706	283
ElSx-3	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	West	2	150647	283
ElSx-4	Large I.	Rock with Gravel Beach	<30 m	Semi-Protected	1	Southwest	0	150629	283
ElSx-5	Large I.	Rock Cliff	<30 m	Protected	1	South	0	150503	283
ElSx-6	Tiny I.	Rock Cliff	<30 m	Semi-Protected	1	Southeast	0	150529	477
ElSx-8	Mainland	Estuary, Marsh or Lagoon		Protected	6	West	8	150451	136
ElTa-18	Large I.	Rock Cliff	<30 m	Semi-Protected	1	Northwest	0	143904	471
ElTa-20	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Southwest	0	150724	623
ElTa-21	Large I.	Estuary, Marsh or Lagoon		Protected	1	Southeast	1	150739	599
ElTa-24	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	11	Southwest	9	151403	245
ElTa-25	Large I.	Sand Flat	>30 m	Semi-Protected	1	Southwest	0	150745	565
ElTa-3	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Northwest	1	151156	349
ElTa-4	Large I.	Sand and Gravel Flat	>30 m	Protected	1	Southeast	0	153463	349
ElTb-1	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	South	0	146816	613
ElTb-10	Medium I.	Sand and Gravel Flat	>30 m	Semi-Protected	1	Northwest	0	150423	584
ElTb-11	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	South	0	151900	569
ElTb-12	Small I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	Northeast	0	150521	569
ElTb-14	Medium I.	Sand and Gravel Flat	>30 m	Semi-Protected	1	East	0	153571	584
ElTb-19	Medium I.	Sand and Gravel Flat	<30 m	Protected	1	South	0	150822	569
ElTb-2	Large I.	Sand Flat	>30 m	Protected	1	East	0	150807	613
ElTb-22	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	East	0	150817	540
ElTb-23	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	North	0	150819	540
ElTb-28	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	West	0	150814	569
ElTb-29	Tiny I.	Rock Cliff	<30 m	Semi-Protected	2	North	0	150818	584
ElTb-3	Medium I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	1	East	0	150819	730
ElTb-30	Small I.	Sand and Gravel Flat	>30 m	Semi-Protected	2	Southeast	0	150806	584
ElTb-31	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	East	0	150806	584
ElTb-33	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	East	0	150806	613

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m²)	Annual Mean Wind Power (W/m²)
ElTb-34	Tiny I.	Rock Cliff	<30 m	Semi-Exposed	1	South	0	150819	730
ElTb-37	Medium I.	Sand and Gravel Beach	<30 m	Semi-Protected	1	Southeast	0	150811	613
ElTb-38	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	East	0	150802	613
ElTb-4	Tiny I.	Sand and Gravel Flat	>30 m	Semi-Exposed	1	East	0	150789	631
ElTb-43	Small I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	West	0	150818	569
ElTb-5	Large I.	Sand Beach	>30 m	Semi-Exposed	1	North	0	150817	631
ElTb-7	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	1	Southeast	0	150822	631
ElTb-8	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Protected	1	South	0	150825	540
ElTb-9	Tiny I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	1	East	0	150827	584
ElTc-1	Medium I.	Rock, Sand and Gravel Beach	>30 m	Semi-Exposed	1	South	0	150826	775
ElTc-5	Medium I.	Sand and Gravel Flat	>30 m	Semi-Protected	1	North	0	150826	758
ElTc-6	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	1	East	0	150710	758
ElTc-7	Tiny I.	Sand Flat	>30 m	Semi-Protected	1	Northeast	0	150823	758
FaSu-1	Small I.	Rock with Sand Beach	>30 m	Protected	2	East	0	150809	70
FaSu-10	Mainland	Estuary, Marsh or Lagoon		Protected	17	West	12	150789	70
FaSu-18	Mainland	Sand Flat	>30 m	Protected	2	Southeast	6	150838	70
FaSu-19	Mainland	Rock Cliff	<30 m	Protected	53	Northeast	31	150839	210
FaSu-2	Mainland	Sand Flat	>30 m	Protected	21	Southeast	16	150839	70
FaSv-1	Mainland	Sand and Gravel Flat	>30 m	Protected	10	Southwest	7	151882	190
FaSv-4	Mainland	Sand and Gravel Beach	<30 m	Semi-Protected	18	West	11	156183	190
FaSv-5	Mainland	Sand and Gravel Beach	<30 m	Semi-Protected	28	West	7	150886	190
FaSx-10	Tiny I.	Gravel Beach	<30 m	Protected	2	East	0	149573	345
FaSx-14	Large I.	Sand Flat	>30 m	Very-Protected	11	South	6	148101	414
FaSx-15	Large I.	Sand and Gravel Flat	>30 m	Protected	9	South	5	149910	414
FaSx-16	Tiny I.	Rock with Gravel Beach	<30 m	Semi-Protected	3	Southwest	4	156301	472
FaSx-8	Large I.	Estuary, Marsh or Lagoon		Protected	2	North	1	152687	354
FaTa-10	Large I.	Estuary, Marsh or Lagoon		Semi-Protected	2	North	1	150497	333
FaTa-13	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	Northeast	0	154663	265
FaTa-14	Tiny I.	Rock, Sand and Gravel Beach	>30 m	Protected	2	West	0	149893	156
FaTa-15	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	North	0	155665	322
FaTa-16	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	Southeast	0	149652	510
FaTa-17	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	South	0	149131	322
FaTa-18	Large I.	Sand Flat	>30 m	Protected	2	Northwest	0	150156	192
FaTa-19	Large I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	2	West	0	150629	192
FaTa-22	Large I.	Sand Flat	>30 m	Semi-Protected	2	Northwest	0	150688	333
FaTa-24	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	4	Northwest	11	150636	322
FaTa-26	Tiny I.	Rock Cliff	<30 m	Semi-Protected	2	Northwest	0	150623	604
FaTa-27	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	West	0	150634	604
FaTa-30	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	Northeast	1	150605	322
FaTa-31	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	South	0	150521	322
FaTa-32	Large I.	Sand and Gravel Beach	<30 m	Semi-Protected	3	East	3	141906	510
FaTa-33	Large I.	Sand and Gravel Beach	<30 m	Semi-Protected	2	Northeast	0	149568	333

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m^2)	Annual Mean Wind Power (W/m^2)
FaTa-35	Small I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	Southwest	0	150531	322
FaTa-4	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	5	Southeast	2	150697	192
FaTa-44	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	North	0	150720	168
FaTa-45	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	Northeast	0	148171	168
FaTa-47	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	East	0	150569	168
FaTa-49	Large I.	Sand and Gravel Beach	<30 m	Semi-Protected	2	Northwest	0	150468	168
FaTa-5	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	Southwest	0	150356	241
FaTa-52	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	West	0	150654	333
FaTa-57	Large I.	Rock, Sand and Gravel Beach	>30 m	Protected	2	Northwest	0	150647	192
FaTa-61	Large I.	Rock, Sand and Gravel Beach	<30 m	Very-Protected	2	Southwest	0	150631	192
FaTa-66	Large I.	Rock with Gravel Beach	>30 m	Semi-Protected	2	East	0	150731	192
FaTa-7	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	South	0	150601	333
FaTa-72	Large I.	Sand and Gravel Flat	>30 m	Semi-Protected	6	Southeast	3	150565	189
FaTa-73	Large I.	Estuary, Marsh or Lagoon		Semi-Protected	2	East	1	150731	333
FaTa-74	Large I.	Estuary, Marsh or Lagoon		Semi-Protected	2	West	1	150598	333
FaTa-75	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	Northwest	0	150651	333
FaTa-76	Large I.	Estuary, Marsh or Lagoon		Semi-Protected	3	Northwest	1	150413	333
FaTa-9	Tiny I.	Estuary, Marsh or Lagoon		Semi-Protected	2	Southwest	0	150514	333
FaTb-10	Tiny I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	West	0	150591	604
FaTb-13	Large I.	Sand Flat	>30 m	Semi-Protected	2	Southeast	1	150607	604
FaTb-14	Small I.	Rock with Gravel Beach	<30 m	Semi-Protected	3	West	0	150591	604
FaTb-15	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	North	0	150649	604
FaTb-16	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	East	0	150646	584
FaTb-17	Large I.				2	Southeast	0	150578	604
FaTb-2	Tiny I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	North	0	150825	615
FaTb-24	Small I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	North	0	150745	441
FaTb-28	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	North	0	150823	355
FaTb-32	Tiny I.	Sand Flat	>30 m	Semi-Protected	2	Northwest	0	150802	604
FaTb-35	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	East	0	150851	629
FaTb-38	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	Southeast	0	150916	533
FaTb-39	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	East	0	152609	533
FaTb-7	Medium I.	Rock with Gravel Beach	<30 m	Protected	2	Southwest	0	150838	615
FaTb-8	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	North	0	150838	615
FaTc-1	Tiny I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	2	East	0	150937	629
FaTc-10	Tiny I.	Rock with Gravel Beach	<30 m	Protected	2	South	0	150756	629
FaTc-11	Medium I.	Rock with Gravel Beach	<30 m	Protected	2	East	0	150837	629
FaTc-12	Medium I.	Sand Beach	<30 m	Protected	2	West	0	150835	643
FaTc-13	Medium I.	Sand Beach	<30 m	Protected	2	West	0	150891	643
FaTc-14	Medium I.	Sand Beach	>30 m	Semi-Exposed	2	Northeast	0	150669	718

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m²)	Annual Mean Wind Power (W/m²)
FaTc-16	Small I.	Rock with Gravel Beach	<30 m	Semi-Exposed	2	East	0	150850	629
FaTc-17	Medium I.	Sand and Gravel Flat	<30 m	Protected	2	Northwest	0	150845	643
FaTc-19	Small I.	Sand Flat	>30 m	Protected	2	East	0	150852	681
FaTc-2	Medium I.	Sand and Gravel Flat	>30 m	Protected	2	East	0	150842	629
FaTc-21	Medium I.	Rock with Sand Beach	>30 m	Semi-Exposed	2	Southwest	0	150844	718
FaTc-3	Medium I.	Sand and Gravel Beach	<30 m	Protected	2	Northwest	0	150851	692
FaTc-4	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	South	0	150848	629
FaTc-7	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	East	0	150854	681
FaTc-8	Medium I.	Rock with Sand Beach	<30 m	Semi-Protected	2	Southwest	0	150852	629
FaTc-9	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	East	0	150848	629
FbSu-1	Mainland	Sand and Gravel Flat	>30 m	Protected	42	West	35	150845	230
FbSu-4	Large I.	Rock Cliff	<30 m	Protected	2	Northwest	0	150851	241
FbSv-2	Large I.	Estuary, Marsh or Lagoon		Protected	3	West	5	110083	640
FbSw-1	Mainland	Gravel Beach	<30 m	Protected	25	Southwest	21	147181	83
FbSw-3	Mainland	Sand and Gravel Beach	<30 m	Protected	6	South	10	154961	123
FbSx-12	Large I.	Rock Cliff	<30 m	Semi-Protected	2	Northeast	0	149698	265
FbSx-3	Tiny I.	- NONE -		Semi-Protected	2	West	0	150110	159
FbSx-4	Tiny I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	East	0	151697	233
FbSx-6	Mainland	Sand and Gravel Flat	>30 m	Protected	10	South	11	148193	159
FbSx-9	Large I.	Rock with Gravel Beach	<30 m	Protected	2	West	10	147076	159
FbTa-10	Medium I.	Sand and Gravel Flat	>30 m	Protected	3	Northwest	1	153792	246
FbTa-12	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	Northeast	0	150048	246
FbTa-13	Medium I.	Sand and Gravel Beach	<30 m	Semi-Protected	2	West	0	149545	246
FbTa-15	Medium I.			Semi-Protected	2	Northeast	0	150466	284
FbTa-16	Tiny I.	Rock with Gravel Beach	<30 m	Protected	2	Southeast	0	150538	284
FbTa-17	Large I.	Rock Cliff	<30 m	Semi-Protected	2	West	0	150731	156
FbTa-21	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	Southeast	0	148550	323
FbTa-22	Tiny I.	Rock Cliff	<30 m	Semi-Protected	2	Southwest	0	148603	176
FbTa-23	Large I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	2	North	0	150384	156
FbTa-25	Medium I.	Sand and Gravel Flat	>30 m	Semi-Protected	2	Southwest	0	150723	159
FbTa-26	Large I.	Sand and Gravel Flat	>30 m	Protected	4	Northeast	3	150721	189
FbTa-27	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	South	0	150692	284
FbTa-28	Medium I.	Gravel Beach	<30 m	Semi-Protected	4	Southwest	5	150155	246
FbTa-29	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	3	South	3	150313	246
FbTa-3	Large I.	Estuary, Marsh or Lagoon		Protected	4	South	4	150651	215
FbTa-30	Large I.	Rock Cliff	<30 m	Semi-Protected	2	North	0	154112	244
FbTa-43	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	Southeast	0	149103	176
FbTa-5	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	8	Northwest	10	150036	159
FbTa-6	Large I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	2	East	0	150720	156
FbTa-7	Tiny I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	East	0	150244	159
FbTa-9	Medium I.	Sand and Gravel Flat	>30 m	Protected	7	South	10	152785	246
FbTb-1	Tiny I.	Rock Cliff	<30 m	Semi-Protected	2	Southwest	0	149593	247
FbTb-12	Tiny I.	Rock Cliff	<30 m	Semi-Protected	2	North	0	150783	346
FbTb-17	Medium I.	Sand and Gravel Beach	<30 m	Semi-Protected	2	West	1	148979	247
FbTb-18	Medium I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	North	2	149835	582
FbTb-21	Tiny I.	Rock Cliff	<30 m	Semi-Protected	2	Southwest	0	150673	197
FbTb-22	Medium I.	Rock with Sand Beach	<30 m	Semi-Protected	2	Southeast	0	150750	247
FbTb-23	Medium I.	Rock Cliff	<30 m	Semi-Protected	2	South	0	150747	247

Borden Number	Landform	Shore substrate	Beach Width	Exposure Class	Elevation (m.a.s.l.)	Direction	Slope Degree	Solar Radiation for July (WH/m^2)	Annual Mean Wind Power (W/m^2)
FbTb-24	Large I.	Estuary, Marsh or Lagoon		Protected	2	Southeast	0	150675	197
FbTb-39	Tiny I.	Man-made		Protected	2	West	0	150578	197
FbTb-4	Large I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	West	0	150747	197
FbTb-5	Large I.	Rock, Sand and Gravel Beach	<30 m	Protected	2	North	0	150717	323
FbTb-6	Large I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	West	0	150725	197
FbTc-1	Tiny I.	Sand Flat	>30 m	Protected	2	Northeast	0	150817	593
FbTc-10	Mainland	Rock with Gravel Beach	<30 m	Protected	2	North	0	150768	351
FbTc-11	Tiny I.	Sand and Gravel Flat	<30 m	Protected	2	Southwest	0	150834	635
FbTc-12	Medium I.	Rock, Sand and Gravel Beach	<30 m	Semi-Protected	2	Southeast	0	150833	635
FbTc-13	Medium I.	Rock with Sand Beach	>30 m	Semi-Protected	2	Southwest	0	150831	635
FbTc-2	Tiny I.	Sand and Gravel Flat	>30 m	Semi-Protected	2	Northeast	0	150823	634
FbTc-3	Small I.	Rock, Sand and Gravel Beach	>30 m	Protected	2	West	0	150819	351
FbTc-4	Medium I.	Rock with Gravel Beach	<30 m	Semi-Exposed	2	North	0	150791	433
FbTc-5	Medium I.	Rock, Sand and Gravel Beach	>30 m	Semi-Exposed	4	Southwest	1	151279	646
FbTc-6	Medium I.	Rock with Gravel Beach	>30 m	Semi-Exposed	3	Southwest	1	151347	646
FbTc-7	Tiny I.	Rock with Gravel Beach	>30 m	Semi-Exposed	2	Southeast	0	150824	646
FbTc-8	Tiny I.	Rock, Sand and Gravel Beach	>30 m	Protected	2	East	0	150821	634
FcSt-1	Mainland	Estuary, Marsh or Lagoon		Protected	8	East	4	146143	116
FcSt-12	Mainland	Estuary, Marsh or Lagoon		Protected	7	Southwest	16	130360	198
FcSt-13	Mainland	Estuary, Marsh or Lagoon		Protected	11	South	28	152900	198
FcSt-3	Mainland			Protected	2	Southeast	8	154220	198
FcSu-1	Mainland	Rock Cliff	<30 m	Protected	8	North	18	154647	290
FcTa-17	Large I.	Estuary, Marsh or Lagoon		Protected	2	East	0	148981	244
FcTa-19	Large I.	Estuary, Marsh or Lagoon		Protected	2	Northeast	0	146898	149
FcTa-3	Mainland	Estuary, Marsh or Lagoon		Protected	2	Northwest	5	149423	149
FcTa-78	Mainland	Rock with Gravel Beach	<30 m	Semi-Protected	4	West	7	147808	131
FcTc-2	Medium I.			Semi-Protected	2	East	0	150742	433
FcTc-3	Medium I.	Sand Flat	>30 m	Semi-Protected	2	East	1	150754	433
FcTc-4	Tiny I.	Rock Cliff	<30 m	Protected	2	South	0	150585	198
FcTc-5	Small I.	Sand and Gravel Flat	>30 m	Semi-Protected	2	South	0	150781	375
FcTc-7	Tiny I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	2	East	0	150815	375
FcTc-9	Medium I.	Rock with Gravel Beach	<30 m	Semi-Protected	2	Southeast	0	150811	375
FcTd-1	Tiny I.	Sand and Gravel Flat	>30 m	Semi-Protected	2	Northeast	0	150602	364
FcTe-1	Tiny I.	Rock, Sand and Gravel Beach	>30 m	Semi-Protected	2	North	0	150739	364
FcTe-2	Tiny I.	Sand and Gravel Beach	<30 m	Protected	2	North	0	150637	665
FcTe-3	Large I.	Sand and Gravel Beach	<30 m	Semi-Protected	2	Northeast	1	150052	665
FcTe-4	Large I.	Sand and Gravel Flat	<30 m	Protected	2	Northwest	0	150823	649
FcTe-6	Small I.	Rock with Gravel Beach	>30 m	Semi-Protected	2	East	0	150844	699

Table 27. Part three out of three listing attribute results for each shell midden.

Borden Number	Distance to Salmon Stream (m)	Distance to Herring Spawn (m)	Eulachon Nearby	Distance To Streams (m)	Steady Stream Nearby	Distance to Lake (m)	Shoreline Intricacy (km)	Intertidal Zone (m^2)	Tiny Island Count	Tiny Island Area (m^2)	Intertidal Island	Giant Kelp Distance (km)	Bull Kelp Distance (km)	Ocean Visibility (%)
EiSt-1	336	7772		336		1107	2.65	86750		0		17.66	0.54	8.17
EiSt-12	2512	5941		154	1	2041	3.82	7871		0		21.10	2.69	14.70
EiSt-7	2527	5977		45	1	1893	2.65	9657		0		21.06	2.64	13.25
EiSt-8	1807	6641		660		2283	2.27	6413		0		20.41	2.04	14.37
EiSt-9	269	7836		269		1047	3.19	89605		0		17.71	0.46	10.02
EiSu-3	1666	8373		1212		1394	2.36	15814		0		16.35	1.21	9.40
EiSv-1	7889	4057		177	1	371	4.64	93862		0		14.72	1.08	0.18
EiSv-10	6243	5110		304	1	588	9.02	76847	2	15604.65		16.76	0.93	0.13
EiSv-11	6246	5131		105	1	406	7.44	8881	4	27266.99		16.55	0.83	0.14
EiSv-12	3985	3		1513		2125	5.87	18777		0		8.23	1.33	30.96
EiSv-13	3342	16		1416		1416	3.30	23459		0		7.66	1.96	23.69
EiSv-14	3048	2396		23		1283	2.31	5941		0		5.39	4.46	24.14
EiSv-15	3070	68		2095		2185	3.83	31745		0		3.31	1.70	29.37
EiSv-16	1863	1676		221		1340	2.46	32742		0		15.06	0.01	6.16
EiSv-17	1805	40		1511		1511	2.45	55372		0		12.65	0.45	4.55
EiSv-18	181	25		181		1213	3.87	137561	1	5812.406		4.27	4.20	23.69
EiSv-2	7767	4184		488	1	558	7.93	93859		0		14.36	0.71	0.03
EiSv-3	8259	3560		637		546	2.65	706	1	6031.095		13.87	1.13	0.04
EiSv-4	8710	3136		423	1	228	2.60	17567		0		14.38	1.73	0.29
EiSv-5	8750	3052		479	1	265	3.29	20074		0		14.41	1.83	0.32
EiSv-6	6426	4920		745		745	5.35	112457		0		17.29	1.46	3.52
EiSv-7	7256	2679		526		469	7.45	47438	1	455.6525	yes	16.16	3.30	0.28
EiSv-8	7324	2728		498	1	432	7.82	47866	1	455.6525	yes	16.15	3.23	0.20
EiSv-9	6609	5401		710		716	6.67	27559	1	18601.2		14.84	0.23	0.08
EiSw-10	8353	3450		1740		1632	11.29	23351	7	104243.7		12.77	0.40	6.35
EiSw-11	8586	2584		1065		858	8.82	27259	5	7788.995		14.00	1.75	1.04
EiSw-12	2674	24		1106		855	3.13	7858	3	546.3414		6.45	2.01	2.46
EiSw-13	248	3541		248	1	2546	2.91	131055		0		0.11	2.84	40.88
EiSw-14	3934	9		2273		2280	13.44	36315	18	122162	yes	7.86	0.57	2.68
EiSw-2	7007	674		1960		1941	7.37	60793	3	6568.368		13.07	2.67	2.72
EiSw-3	6804	405		1839		1821	10.30	85418	6	38317.15	yes	13.38	2.97	4.24
EiSw-4	6336	9		801		774	3.57	3444	1	169.1685		12.66	1.96	0.71
EiSw-5	5339	197		445	1	392	7.05	74835	2	7205.395		13.40	0.29	24.55
EiSw-6	5514	365		662		617	7.92	95294	3	9625.777	yes	13.24	0.21	13.91
EiSw-7	5873	454		828		828	9.41	108381	2	9293.802	yes	12.87	0.49	25.38
EiSw-8	8527	1653		3159		3109	7.18	12000	3	69072.58	yes	11.41	1.05	8.38
EiSw-9	8005	4039		2543		2460	4.82	14098	2	30362.51		11.97	0.38	1.01
EiSx-1	2413	14854		1065		1251	8.11	99840	9	71083.08	yes	1.88	2.06	41.99
EjSv-1	6776	2640		673		514	6.24	20537	1	728.7299		16.55	3.75	0.65
EjSv-10	3997	5494		1120		1611	8.77	61196	4	109471.3		18.19	0.08	28.02
EjSv-11	4871	7050		398	1	291	3.32	6156	1	94.00609		19.97	0.93	24.87
EjSv-12	591	4493		591		596	3.19	13358		0		26.14	0.47	11.90
EjSv-2	5899	4053		765		1008	7.01	17224	3	5142.392	yes	18.44	3.83	4.34
EjSv-3	6518	4668		238	1	240	4.11	2510		0		18.55	3.04	7.00
EjSv-4	3307	6510		1128		1096	6.10	13388	4	20847.31		25.41	3.24	43.76
EjSv-5	2611	5087		943		1205	4.94	2328	1	4059.91		27.00	3.22	7.40
EjSv-6	2104	6974		44	1	1207	2.85	13912		0		26.12	4.59	6.75
EjSv-7	4555	8138		391	1	891	2.92	7812	1	511.1105	yes	23.08	4.33	10.57
EjSv-8	4952	6522		119	1	570	5.08	11089	1	10494.27		19.02	1.13	2.11
EjSv-9	4376	5913		696		1187	11.34	39380	5	84217.61		18.53	0.51	10.76
EjSw-1	5600	1480		414	1	499	8.16	37927	4	24211.01	yes	16.37	4.16	16.44
EjSw-10	3084	1417		876		827	3.67	65476		0		14.68	0.74	3.18
EjSw-11	1742	1582		322	1	322	3.50	10713	1	5455.21		17.43	1.38	0.84
EjSw-12	1624	1922		602		601	4.15	13187		0		17.90	1.75	1.47
EjSw-13	1915	2010		320	1	249	5.07	10916	1	5455.21		17.34	1.11	0.85
EjSw-14	1980	2479		466	1	427	3.71	35152	1	309.3531	yes	16.45	0.06	29.98

Borden Number	Distance to Salmon Stream (m)	Distance to Herring Spawn (m)	Eulachon Nearby	Distance To Streams (m)	Steady Stream Nearby	Distance to Lake (m)	Shoreline Intricacy (km)	Intertidal Zone (m^2)	Tiny Island Count	Tiny Island Area (m^2)	Intertidal Island	Giant Kelp Distance (km)	Bull Kelp Distance (km)	Ocean Visibility (%)
EjSw-15	1688	3090		422	1	582	3.77	63269	2	2976.317	yes	16.47	0.00	63.53
EjSw-18	4429	4		3	1	159	3.24	13464	1	592.5314	yes	22.73	4.91	4.66
EjSw-20	4030	3177		756		1316	4.59	15070	1	5922.279		18.67	4.51	4.47
EjSw-21	4151	3372		591		873	5.55	15200	1	5922.279		18.78	4.95	4.69
EjSw-22	5015	22		1636		1635	5.18	17548		0		15.40	2.87	0.11
EjSw-23	4790	760		1370		1484	5.39	25004		0		16.22	3.19	6.34
EjSw-24	3462	322		867		992	3.85	17015	2	3343.126		15.44	0.47	23.99
EjSw-25	3996	452		896		845	2.88	3834		0		14.77	0.13	30.50
EjSw-26	55	625		55	1	544	3.98	23553	1	256.4203		17.19	3.01	0.87
EjSw-27	5762	29		605		576	8.22	38468	3	20324.12	yes	18.21	2.02	2.26
EjSw-28	4549	46		392	1	777	5.42	101847	6	2211.019	yes	20.91	3.41	0.19
EjSw-29	4936	26		359	1	350	5.77	43578	4	1510.485		18.40	3.99	4.81
EjSw-30	4337	31		123	1	175	2.88	9895	1	592.5314	yes	22.66	4.79	3.41
EjSw-31	4570	10		558		626	4.00	12324	2	108.7175		19.09	1.34	7.34
EjSw-32	4807	27		744		726	3.61	10470		0		18.98	1.52	5.94
EjSw-33	4881	11		761		742	3.24	10471		0		18.97	1.61	5.58
EjSw-34	1937	2053		24	1	89	4.81	9173	1	5455.21		17.02	0.76	0.81
EjSw-35	1596	3089		351	1	509	3.82	62982	2	2976.317	yes	16.57	0.08	53.37
EjSw-36	1556	3089		323	1	478	3.85	63256	2	2976.317	yes	16.61	0.12	46.75
EjSw-37	652	4034		652		441	3.89	58790	1	1792.104	yes	17.40	0.10	50.73
EjSw-38	517	4168		517		440	3.74	53893	1	1792.104	yes	17.61	0.35	19.36
EjSw-4	2195	1510		1799		1794	3.50	8250		0		19.28	1.23	4.81
EjSw-5	2006	3410		463	1	474	3.98	20072	2	3181.919		19.87	2.80	0.35
EjSw-6	2002	3259		240	1	350	5.27	21189	2	3181.919		19.96	2.81	0.46
EjSw-8	3299	7		2454		2431	7.70	51266	3	48448.28	yes	13.96	1.71	20.86
EjSw-9	3552	1472		1602		1561	5.87	87436	2	1146.43		13.97	0.17	51.96
EjSx-1	5808	20		625		586	9.62	63073	7	49998.24	yes	18.06	1.93	2.75
EjSx-2	4313	1670		384	1	380	5.93	34866	3	701.2853	yes	18.39	0.74	18.10
EjSx-4	3300	20		35	1	579	3.48	24034	2	324.0115	yes	9.51	0.01	32.30
EjSx-6	4957	3772		2397		2432	3.54	17089	9	1219.988	yes	17.29	2.16	37.85
EjTa-1	12656	10		969		947	3.12	54338		0		0.82	0.82	4.18
EjTa-11	14155	1479		470	1	430	10.00	135469	20	60718.48	yes	0.07	0.07	9.78
EjTa-13	10321	47		85		703	2.51	48803	1	2709.615	yes	1.25	0.27	2.44
EjTa-15	12276	2		471	1	443	3.02	119469		0		1.49	0.77	1.53
EjTa-2	9401	27		520		1115	3.12	150799	1	297.4532		1.89	2.48	15.49
EjTa-4	11384	94		624		1156	2.87	86436	3	3760.727	yes	0.28	0.90	5.25
EjTa-5	13379	874		554		528	4.32	104005	7	2077.603		0.81	0.08	4.82
EjTa-6	8816	17		151	1	682	3.46	42491		0		2.18	2.46	1.28
EjTa-9	13899	1198		181	1	124	4.97	96921	5	26398.05	yes	0.19	0.19	11.45
EkSs-1	298	14788		298	1	1	0.00			0		54.40	35.13	
EkSt-1	175	2402	Yes	175	1	1506	0.00			0		45.02	23.00	
EkSt-5	215	37	Yes	215	1	1776	3.54	237294		0		42.89	20.00	90.79
EkSt-6	614	264	Yes	504	1	2246	3.81	459018	2	34585.87	yes	43.61	20.36	93.74
EkSu-2	107	319	Yes	107	1	3471	2.74	266632	1	16160.44	yes	45.19	18.88	25.89
EkSv-1	685	8390		427		427	2.64	8653		0		29.79	14.92	69.62
EkSw-3	105	4077		105	1	1182	2.12	76146	1	25.2435		19.20	4.07	1.19
EkSw-4	90	4340		90	1	1364	2.01	59120		0		19.44	4.34	1.71
EkSx-1	6919	1		906		900	4.79	99786	3	6320.201	yes	14.71	0.58	26.86
EkSx-10	5155	17		101	1	346	2.73	36164		0	yes	16.52	2.10	1.27
EkSx-11	6155	10		651		939	3.54	36852	1	1471.287		15.47	1.25	12.97
EkSx-12	611	1406		611	1	1588	4.97	155020		0		15.58	1.03	7.63
EkSx-2	7098	15		1055		1049	4.89	100395	3	6320.201	yes	14.53	0.59	47.62
EkSx-3	103	1959		103	1	1306	4.10	107280		0		16.03	1.62	0.72
EkSx-5	9275	6461		786		786	8.67	82291	8	16231.9	yes	8.17	0.01	53.51
EkSx-7	7097	14		501		494	3.68	53392	7	7098.155		14.59	0.18	18.07
EkSx-8	7009	23		919		907	5.79	132481	5	5943.398	yes	14.60	1.20	1.48
EkSx-9	6726	31		665		654	3.55	105075	4	5873.904	yes	14.88	1.41	1.31
EkTa-1	3534	4896		524		518	6.38	46008	8	3006.331	yes	4.42	0.19	0.45

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EkTa-10	1719	2367		394		899	7.01	80788	5	23066.73	yes	1.88	0.04	2.34
EkTa-11	2201	2299		595		747	4.84	40603	3	1412.187		1.86	0.25	1.16
EkTa-12	3251	4188		616		593	5.33	69281	7	18084.04	yes	3.74	0.74	3.67
EkTa-13	3510	4365		826		796	6.31	76220	10	15516.04	yes	3.93	0.48	2.33
EkTa-14	4762	5555		722		1834	5.55	36449	7	14756.65		5.14	0.33	2.60
EkTa-16	3672	4957		661		652	6.57	53523	9	12510.78	yes	4.49	0.22	0.57
EkTa-17	1965	4113		777		1092	3.18	27981	3	1197.963	yes	3.60	0.03	27.37
EkTa-18	2624	3656		600		600	5.64	45733	5	14537.51		3.18	0.11	2.88
EkTa-19	5755	6091		87		1664	5.50	44676	8	6652.38		5.74	0.13	13.51
EkTa-2	11479	4		2	1	315	4.18	29661	6	6261.223		0.96	0.07	4.55
EkTa-22	1659	2649		320		1207	6.46	63798	5	22548.8	yes	2.15	0.10	6.26
EkTa-23	4433	4436		28		1191	4.25	12204		0		4.11	1.06	0.09
EkTa-24	6224	6844		699		828	8.04	39685	9	6544.248		7.42	0.39	0.34
EkTa-26	2104	4099		454		538	3.50	12736	3	3173.516	yes	4.10	1.37	3.46
EkTa-27	1442	3466		647		582	2.99	10525	2	799.9299		3.48	1.67	7.80
EkTa-28	733	3219		733		642	4.51	14220	6	17914.91		2.89	1.79	26.03
EkTa-29	683	3165		683		626	4.39	16020	6	17769.48	yes	2.79	1.98	21.33
EkTa-3	3022	5297		678		663	6.93	66700	1	698.0296		5.25	0.08	41.10
EkTa-31	431	2808		431	1	836	3.42	52680		0		2.32	1.28	9.34
EkTa-33	1429	265		982		988	12.95	31818	3	941.0796		0.76	1.41	0.38
EkTa-5	9532	5508		35	1	315	5.37	59434	3	671.9395	yes	7.22	0.26	3.15
EkTa-6	3036	5698		617		1176	6.72	16544	4	75604.61	yes	5.21	0.75	17.07
EkTa-7	562	2727		47	1	404	2.63	23411		0		2.64	2.09	1.88
EkTa-8	814	2893		624		1174	2.75	22417		0		2.38	0.98	22.21
EkTa-9	1555	2717		281		1294	5.59	57059	4	22017.18	yes	2.21	0.21	5.00
EkTb-1	6920	19		1681		2040	6.60	90881	7	33616.98	yes	0.07	0.47	1.98
EkTb-8	8308	17		136	1	410	9.58	99189	20	22584.32	yes	0.01	0.33	0.76
EkTb-9	7815	3		772		865	10.61	189377	18	54699.82	yes	0.65	0.10	6.56
ElSw-1	20	4940		20	1	909	2.28	16959		0		18.37	0.31	24.93
ElSw-2	254	3684		254	1	588	2.19	95420		0		19.63	0.28	73.50
ElSw-29	12	3971		12	1	2110	2.14	51539		0		23.00	2.35	54.67
ElSw-3	349	2939		349	1	681	2.22	52335		0		20.38	1.03	59.39
ElSw-32	959	3429		959		766	2.69	12772	1	92.49576		21.25	0.30	56.74
ElSw-4	90	3920		90	1	1606	2.16	156676		0		24.85	2.27	0.38
ElSx-1	189	2		189	1	406	4.57	65186	2	6071.372	yes	14.54	1.68	11.95
ElSx-10	2552	2682		1192		1190	4.96	42097	7	15633.61	yes	13.38	0.85	6.74
ElSx-11	184	837		184	1	3	0.00			0		15.38	2.45	
ElSx-14	4283	3040		2642		2862	6.21	56238	15	17360.61	yes	11.41	0.00	70.67
ElSx-15	2598	4272		805		1155	5.61	26391	15	42685.2		13.10	0.04	66.18
ElSx-16	1671	2766		450	1	450	2.43	29315	1	631.1517		14.35	1.42	24.64
ElSx-17	1017	100		965		994	4.21	7962	3	4489.65		13.86	0.93	45.06
ElSx-18	1915	3452		805		788	9.61	39271	6	18989.5	yes	13.76	0.50	0.43
ElSx-2	519	10459		519		857	10.81	62669	6	80217.73	yes	11.13	0.49	5.31
ElSx-3	67	10234		67	1	388	4.49	30654	3	13639.82		11.55	0.95	2.48
ElSx-4	3774	6844		1292		2385	9.16	44047	13	103752.7	yes	10.06	0.08	14.35
ElSx-5	3833	6958		1403		2459	8.41	42440	12	92307.15	yes	9.84	0.16	14.38
ElSx-6	1056	122		595		723	7.49	22863	6	7860.838		14.15	1.23	21.01
ElSx-8	3470	2655		2084		2077	2.56	58583	3	5934.262	yes	12.48	0.30	0.13
ElTa-18	311	1155		311	1	686	4.44	6009		0		0.05	0.05	3.32
ElTa-20	2186	15		488	1	536	7.07	28956	5	3678.419	yes	0.47	4.55	17.08
ElTa-21	1774	1342		96	1	209	5.49	53951	8	20039.9	yes	2.33	4.50	13.42
ElTa-24	2954	3965		300		627	4.60	19521		0		4.77	1.45	0.36
ElTa-25	589	4588		295	1	851	4.04	207135	1	923.7102	yes	3.65	0.07	7.83
ElTa-3	106	16		106	1	249	4.22	115047	5	2606.552	yes	1.12	2.77	0.34
ElTa-4	1762	6		595		789	4.01	18910	2	957.1023		0.38	2.31	0.65
ElTb-1	3470	12		892		892	8.57	105617	12	41906.43	yes	0.58	2.24	4.37
ElTb-10	2574	60		690		674	5.40	121285	9	10692.96	yes	1.56	0.02	3.47
ElTb-11	2839	10		279	1	258	9.43	76644	12	6854.157	yes	0.01	0.90	0.35

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ElTb-12	2665	22		683		681	8.94	66763	19	24992.28	yes	0.13	1.45	3.76
ElTb-14	2048	11		682		646	5.48	37069	4	5331.81	yes	1.47	0.03	0.77
ElTb-19	3372	96		814		801	11.51	72981	13	26611.13	yes	0.11	0.66	0.41
ElTb-2	1968	10		31	1	80	2.19	70562	1	293.7328	yes	0.58	1.16	0.18
ElTb-22	400	270		400	1	439	7.77	62347	7	41680.15	yes	0.03	0.03	6.44
ElTb-23	692	551		15	1	270	4.80	48736	6	6089.627	yes	0.41	0.41	1.50
ElTb-28	1390	29		435	1	640	4.88	28209	3	696.3528	yes	0.03	0.03	10.29
ElTb-29	2430	29		1561		2026	4.87	29958	7	6357.779	yes	2.57	0.02	21.78
ElTb-3	5179	96		950		911	5.62	58983	8	18499.48	yes	0.06	0.91	7.74
ElTb-30	1744	113		1690		1895	5.53	38777	9	17215.21	yes	2.39	0.01	20.30
ElTb-31	1518	161		1518		1699	7.91	70176	15	37105.85	yes	2.77	0.01	27.04
ElTb-33	68	2		68	1	254	4.77	26082	6	3147.103	yes	0.30	3.46	1.07
ElTb-34	6246	32		1260		1388	9.24	134209	20	41074.74	yes	0.81	0.01	0.45
ElTb-37	1959	35		441	1	441	3.06	74183	1	214.0542		0.84	3.16	0.09
ElTb-38	3200	72		657		657	8.60	106299	13	32507.66	yes	0.55	2.37	0.68
ElTb-4	3217	384		755		752	10.18	128196	13	62283.67	yes	1.34	0.04	35.36
ElTb-43	3396	11		553		531	10.71	63162	8	25240.02	yes	0.08	1.42	0.20
ElTb-5	3368	61		658		642	10.25	153486	11	50838.27	yes	0.18	0.06	1.75
ElTb-7	2659	39		819		790	4.27	37727	4	59100.5	yes	0.04	0.04	15.48
ElTb-8	962	610		723		909	10.92	109745	15	117408.4	yes	0.03	0.03	9.14
ElTb-9	592	117		592		765	5.68	49333	11	16616.28	yes	2.80	0.48	30.07
ElTc-1	19146	14789		1856		1856	3.65	323660	3	1227.128	yes	0.02	1.32	15.61
ElTc-5	17952	13476		1763		1754	4.05	383554	7	3750.381	yes	0.02	0.70	17.69
ElTc-6	17600	13222		1960		1953	6.99	201250	13	32911.28	yes	0.04	0.37	10.95
ElTc-7	17280	12850		1864		1859	8.96	197483	16	112722.6	yes	0.07	0.07	8.21
FaSu-1	657	6915	Yes	358	1	3960	1.87	682485	1	318.6026	yes	48.90	8.82	26.27
FaSu-10	401	7296	Yes	163	1	3718	1.27	353632	2	1309.837	yes	49.58	9.46	24.97
FaSu-18	1145	6031	Yes	305	1	4425	2.44	256012		0	yes	48.17	7.96	13.60
FaSu-19	7077	39		984		1962	2.35	168		0		45.07	5.36	37.04
FaSu-2	1241	6071	Yes	303	1	4499	2.11	268267		0	yes	48.33	8.11	13.75
FaSv-1	49	721		49		980	2.27	103369		0		29.30	1.38	51.41
FaSv-4	76	289		76		764	2.24	55865		0		29.55	1.80	46.53
FaSv-5	171	543		171		754	1.97	69314		0		29.51	1.64	49.24
FaSx-10	582	9774		582		699	4.96	9021	1	739.2769		19.36	1.18	6.59
FaSx-14	2279	1828		130	1	499	4.67	98638	2	11391.55	yes	14.74	1.50	4.59
FaSx-15	2331	1676		28	1	557	5.77	93864	4	13830	yes	14.90	1.65	4.11
FaSx-16	1606	11549		1148		1148	3.79	46066	5	4100.448		11.12	3.25	0.75
FaSx-8	6	8205		6	1	1259	2.59	28994		0		22.53	1.34	21.30
FaTa-10	16	6477		16	1	489	2.30	117560	1	1500.623	yes	9.12	4.22	1.00
FaTa-13	389	70		212	1	243	4.91	97374	1	1028.145	yes	12.16	3.91	3.62
FaTa-14	3165	218		1413		1401	6.62	93887	3	24177.63		6.74	1.90	15.33
FaTa-15	2833	2501		492		1184	7.41	54590	10	39339.51	yes	5.61	1.04	30.74
FaTa-16	3531	2552		201	1	762	4.70	20095	2	3064.564		3.40	2.47	25.79
FaTa-17	2813	2412		672		1297	6.46	52642	9	39197	yes	5.67	0.85	34.24
FaTa-18	3516	1771		533		533	3.81	51488	5	3687.866		8.29	2.58	40.97
FaTa-19	3428	1992		426	1	417	4.45	59786	5	4641.681	yes	8.17	2.41	32.88
FaTa-22	1196	5302		472		881	9.08	137999	4	20163.34		8.88	3.50	9.76
FaTa-24	2989	2841		155		910	6.30	41329	6	25275.73	yes	5.50	1.59	21.14
FaTa-26	1404	1125		747		1035	3.48	10595	2	2330.967		1.68	0.16	43.77
FaTa-27	572	261		448	1	313	4.49	36345	3	14049.11	yes	1.54	0.15	46.12
FaTa-30	2934	2984		70		854	6.73	41947	3	76717.51		5.14	2.07	5.26
FaTa-31	2851	2395		799		1360	6.44	50033	9	39175.97		5.76	0.71	35.96
FaTa-32	1115	5214		510		845	2.81	62859		0		7.98	3.29	4.60
FaTa-33	1548	4796		825		1078	3.58	77381		0		7.95	2.89	5.22
FaTa-35	2299	2280		746		1168	8.48	33988	8	13166.92	yes	4.06	2.62	9.03
FaTa-4	148	2226		148	1	435	2.89	53039	3	980.5489		7.78	4.31	3.86
FaTa-44	847	307		306	1	296	2.07	12204		0		9.03	4.21	7.18
FaTa-45	469	23		351	1	351	5.03	77142		0		9.41	4.66	12.54

Borden Number	Distance to Salmon Stream (m)	Distance to Herring Spawn (m)	Eulachon Nearby	Distance To Streams (m)	Steady Stream Nearby	Distance to Lake (m)	Shoreline Intricacy (km)	Intertidal Zone (m^2)	Tiny Island Count	Tiny Island Area (m^2)	Intertidal Island	Giant Kelp Distance (km)	Bull Kelp Distance (km)	Ocean Visibility (%)
FaTa-47	361	18		361	1	402	5.78	85795		0		9.92	4.93	6.68
FaTa-49	706	21		601		600	5.28	57384		0		9.42	4.78	14.16
FaTa-5	2921	3521		940		917	5.08	100817	1	465.8274	yes	7.69	1.86	3.61
FaTa-52	1415	5040		668		1141	8.73	148499	6	52298.54	yes	8.65	3.24	2.96
FaTa-57	2708	257		99	1	181	6.48	13916	5	18553.99		9.34	4.03	9.31
FaTa-61	2976	664		210	1	433	8.16	33444	4	33996.85		9.06	3.63	0.30
FaTa-66	1064	1283		557		1149	2.44	24682		0		8.64	4.68	29.85
FaTa-7	1667	4754		924		1274	8.85	136328	7	69296.78		8.41	2.95	4.03
FaTa-72	1454	1466		595		592	2.11	41270		0		5.59	2.42	32.37
FaTa-73	147	6363		147	1	579	3.00	124600	1	1500.623	yes	9.14	4.18	1.00
FaTa-74	220	6553		220	1	573	2.67	121732	1	1500.623	yes	9.37	3.97	1.97
FaTa-75	1079	5420		189		753	7.07	57510	4	17309.46		9.29	3.53	26.55
FaTa-76	10	6630		10	1	530	1.58	99043	1	1500.623	yes	9.22	4.16	1.12
FaTa-9	312	6330		312	1	430	3.94	131353	1	1500.623	yes	9.30	4.00	2.42
FaTb-10	1966	1326		1340		1934	4.41	39976	3	51784.7	yes	0.33	0.01	30.37
FaTb-13	4034	973		142	1	503	9.50	125446	17	24001.14	yes	0.16	0.02	0.65
FaTb-14	3840	929		392	1	777	13.01	133506	25	49484.05	yes	0.43	0.29	0.70
FaTb-15	3929	1188		210	1	361	9.20	144997	16	26533.44	yes	0.01	0.07	0.60
FaTb-16	3543	79		114	1	456	6.94	39353	7	89473.69	yes	1.06	0.03	0.17
FaTb-17	3562	2710		530		587	2.33	15583	1	287.8672		0.87	0.48	
FaTb-2	8504	1472		400		1892	5.79	54624	11	6170.955	yes	1.78	0.11	4.95
FaTb-24	5832	1636		614		945	11.02	45661	12	50293.93	yes	1.65	0.50	4.43
FaTb-28	2512	279		626		624	6.69	21584	6	38520.9		1.06	2.48	6.24
FaTb-32	3309	1005		835		941	10.92	107730	16	94665.81	yes	0.20	0.27	1.03
FaTb-35	6654	34		400	1	378	3.75	13432	1	306.3987		1.73	0.04	23.60
FaTb-38	5417	120		427	1	791	11.17	70724	5	14946.46	yes	3.68	0.45	0.48
FaTb-39	5328	351		285	1	484	8.17	61541	4	14188.34		3.91	0.45	0.53
FaTb-7	6073	2069		180		585	9.14	48371	9	38935.86		1.96	0.74	0.13
FaTb-8	6052	2762		190	1	375	5.96	29340	3	2186.927		2.56	0.70	1.37
FaTc-1	9292	11		1145		1145	14.34	197734	31	179875.8	yes	0.40	0.01	1.98
FaTc-10	8081	10		221	1	368	4.63	38326	3	900.64	yes	1.16	1.31	0.54
FaTc-11	7983	8		415	1	718	8.27	60156	12	16732.88	yes	0.23	0.66	1.34
FaTc-12	5762	214		401	1	396	7.39	55106	7	6042.548		2.65	0.75	0.49
FaTc-13	5971	188		226	1	196	5.66	27950	3	13762.9	yes	2.56	0.73	1.23
FaTc-14	16724	9734		1433		1429	5.38	211441	7	8953.018	yes	0.16	0.16	18.84
FaTc-16	8641	29		835		1765	8.87	46959	15	106383.7	yes	0.05	0.03	9.04
FaTc-17	4882	11		813		773	9.38	78660	14	33068.37	yes	0.26	0.62	38.58
FaTc-19	13339	4136		4471		4520	10.20	345084	20	39859.82	yes	0.19	0.12	7.33
FaTc-2	8265	7		0	1	269	3.18	31264	2	592.649		1.15	1.15	0.21
FaTc-21	16959	9897		1531		1519	7.40	318349	16	17426.99	yes	0.13	0.13	9.35
FaTc-3	4721	58		408	1	462	6.11	160850	5	1403.77	yes	1.57	0.64	36.74
FaTc-4	8673	36		250	1	312	6.02	59582	4	3849.598	yes	0.16	0.14	0.27
FaTc-7	9750	4		241	1	227	6.62	144895	9	9601.978	yes	0.00	0.20	0.22
FaTc-8	9286	45		543		530	9.89	118885	15	40601.65	yes	0.05	0.19	0.77
FaTc-9	8884	4		454	1	398	5.18	42393	8	26810.36	yes	0.43	0.54	3.03
FbSu-1	6475	364		1954		3742	3.48	14508		0		47.24	10.26	22.74
FbSu-4	411	9502		411	1	3517	2.63	61622		0		49.40	26.07	96.07
FbSv-2	18	5791		18		2120	2.62	116481		0		38.48	15.97	56.58
FbSw-1	3631	6711		621		1538	2.26	22278		0		29.49	15.45	18.64
FbSw-3	2748	7039		800		635	2.43	5652		0		28.62	15.21	36.06
FbSx-12	2006	294		815		844	5.75	29072	2	906.6724		13.07	0.47	22.60
FbSx-3	3180	1811		2367		2401	0.61	2868	1	3498.18		16.28	1.88	43.96
FbSx-4	2185	4931		2185		2323	4.22	53969	3	24297.32	yes	19.77	1.23	75.50
FbSx-6	3790	3304		1410		2365	3.88	31855	3	2682.168	yes	17.50	2.89	23.04
FbSx-9	1201	2066		746		648	3.63	20634	2	11042.27		15.02	2.49	0.96
FbTa-10	782	881		56	1	426	4.93	63991	4	43846.39		7.88	0.83	10.58
FbTa-12	1234	1032		320	1	648	3.92	41490	3	16293.45		8.04	0.47	15.14
FbTa-13	2340	884		348	1	348	3.59	25937	2	766.9994		7.27	1.02	23.02

Borden Number	Distance to Salmon Stream (m)	Distance to Herring Spawn (m)	Eulachon Nearby	Distance To Streams (m)	Steady Stream Nearby	Distance to Lake (m)	Shoreline Intricacy (km)	Intertidal Zone (m^2)	Tiny Island Count	Tiny Island Area (m^2)	Intertidal Island	Giant Kelp Distance (km)	Bull Kelp Distance (km)	Ocean Visibility (%)
FbTa-15	4944	315		369	1	357	3.32	20572	1	333.5209		4.21	1.36	16.28
FbTa-16	4508	59		97	1	400	6.42	62213	7	29272.6	yes	4.38	2.07	1.76
FbTa-17	1163	29		987		972	2.63	28833		0		4.39	3.19	43.36
FbTa-21	2016	10		5	1	259	3.68	55094		0		0.68	3.80	6.63
FbTa-22	3774	1094		2021		2087	0.80	12541	1	4534.253		1.83	4.08	70.72
FbTa-23	1769	639		1725		1679	3.32	48372		0		4.03	0.43	19.28
FbTa-25	944	449		562		953	5.89	56734	10	38337.28	yes	11.69	2.91	3.56
FbTa-26	231	1698		231	1	290	5.32	114281	4	16788.8	yes	4.18	1.57	33.41
FbTa-27	1833	1193		254	1	1168	2.37	16694		0		7.92	1.11	31.28
FbTa-28	1593	487		121	1	250	5.71	62550	5	42131.32	yes	9.11	0.24	26.03
FbTa-29	1747	663		266	1	273	4.60	46360	4	33769.59	yes	9.12	0.33	31.16
FbTa-3	130	3234		130	1	817	3.62	36273		0		10.60	1.10	29.82
FbTa-30	160	2318		160		1913	3.44	24785		0		13.75	2.17	42.95
FbTa-43	3281	1		744		694	6.26	76932	5	13066.22	yes	3.52	4.25	19.04
FbTa-5	1410	1074		139		1265	5.69	122993	5	76476.56	yes	14.14	1.69	0.29
FbTa-6	2751	7		1764		1756	2.18	33686		0		3.93	0.98	46.23
FbTa-7	1361	826		1059		1659	2.28	5148	2	35792.15		8.10	5.05	58.08
FbTa-9	920	2		81	1	267	3.01	20981	1	878.5012		9.12	0.98	0.46
FbTb-1	5638	932		2863		2823	7.15	57337	10	113523.1		4.23	1.14	31.13
FbTb-12	1895	832		1108		1103	1.01	9760	2	3475.658		8.30	2.43	83.31
FbTb-17	3027	5		44		2175	2.61	13093		0		3.80	3.46	11.45
FbTb-18	3635	5		249	1	515	5.29	19385		0		7.34	2.08	9.16
FbTb-21	1793	310		775		1185	3.67	48548	6	7221.611		9.56	5.33	63.15
FbTb-22	5175	1		2838		2824	8.46	94945	6	47715.27	yes	5.07	1.75	2.95
FbTb-23	5116	55		3150		3138	6.73	85754	6	58075.19	yes	5.38	2.09	6.38
FbTb-24	1294	1497		41	1	212	3.51	17059	2	611.3468		8.07	3.41	0.85
FbTb-39	188	10		188	1	337	4.70	78522	2	685.0273	yes	10.24	3.63	4.88
FbTb-4	2534	68		255	1	388	7.23	52107	4	8495.884		8.59	5.20	15.91
FbTb-5	1566	8		673		673	6.78	106763	2	2664.398		0.65	3.82	16.72
FbTb-6	1693	1776		445	1	442	5.40	38183	3	1109.554		7.57	3.30	14.80
FbTc-1	3163	13		453	1	502	11.63	121522	17	153735.6	yes	2.12	2.79	16.74
FbTc-10	483	14		407	1	399	4.30	375		0		1.89	0.68	4.18
FbTc-11	3258	138		456	1	350	7.55	130341	9	28621.61	yes	2.44	0.16	8.87
FbTc-12	3523	63		227	1	222	6.84	145359	11	25658.6	yes	2.47	0.06	7.09
FbTc-13	3063	111		165	1	379	6.85	127603	10	24101.22	yes	2.70	0.40	10.18
FbTc-2	1587	47		530		520	8.29	127588	14	46084.97	yes	0.01	0.01	4.28
FbTc-3	1241	17		456	1	446	6.69	130414	21	17021.87	yes	1.29	0.97	2.67
FbTc-4	1545	32		1192		1192	5.41	429	1	5888.713		1.98	0.03	22.08
FbTc-5	5802	7		424	1	408	3.12	377	1	4794.301		0.00	0.00	56.99
FbTc-6	5579	20		477	1	475	2.50	297		0		0.22	0.02	69.01
FbTc-7	6211	313		672		665	2.88	329	1	9989.329		0.00	0.00	72.55
FbTc-8	1322	419		917		889	6.24	131007	24	31562.84	yes	0.78	0.78	20.58
FcSt-1	27	19023		27		612	2.24	182627		0		63.58	42.27	1.72
FcSt-12	104	22731		104	1	248	4.56	67680		0		67.87	46.48	22.43
FcSt-13	93	22971		93	1	242	4.22	86658		0		67.97	46.47	12.62
FcSt-3	287	22820		148	1	148	4.10	49532		0		68.26	46.87	43.97
FcSu-1	4685	14720		28	1	51	2.25	4644		0		50.36	31.18	69.71
FcTa-17	306	3730		145		2026	3.18	79410		0		18.09	3.26	15.09
FcTa-19	402	3289		402		1566	3.77	72367		0		18.71	5.21	13.85
FcTa-3	68	173		68	1	1258	3.41	62330		0		19.91	4.53	14.43
FcTa-78	2892	3998		347		2601	2.99	15303		0		19.98	0.41	13.91
FcTc-2	3376	745		737		737	1.67	24		0		2.01	0.00	36.65
FcTc-3	3154	325		577		567	2.09	210		0		1.94	0.53	22.09
FcTc-4	527	34		191		1344	6.14	93542	2	26943.24	yes	3.00	0.54	19.84
FcTc-5	4859	30		552		857	6.28	477	1	12685.18		0.04	0.36	4.96
FcTc-7	6663	799		526		556	6.29	540	1	80776.48		0.00	0.18	7.39
FcTc-9	6672	129		688		1308	4.34	451		0		0.04	0.02	12.42
FcTd-1	2844	145		732		1223	3.26	202405	1	6971.644	yes	0.02	1.08	49.05

Borden Number	Distance to Salmon Stream (m)	Distance to Herring Spawn (m)	Eulachon Nearby	Distance To Streams (m)	Steady Stream Nearby	Distance to Lake (m)	Shoreline Intricacy (km)	Intertidal Zone (m^2)	Tiny Island Count	Tiny Island Area (m^2)	Intertidal Island	Giant Kelp Distance (km)	Bull Kelp Distance (km)	Ocean Visibility (%)
FcTe-1	1955	143		298	1	946	4.94	168434	4	4916.434	yes	0.01	1.17	75.90
FcTe-2	649	57		649		966	4.32		3	6966.616		0.51	2.96	
FcTe-3	13	5		13	1	538	4.30		2	2315.594		0.31	2.28	
FcTe-4	1344	57		802		778	7.57		15	11627.82		0.48	0.97	
FcTe-6	3315	211		552		650	5.23		7	38495.36		0.37	0.16	

Appendix E: Details for Sites with Subsurface Investigation

Table 28. Summary of sites on the Central Coast that have received subsurface investigation.

Site Number	Site Name	Researcher/ Year	Testing Method	Radio-carbon Dated	Faunal Analysis	Description	Permit Report
EjSv-1		Cannon 2005	Auger	Yes	Yes	Small midden	2005-0204
EjSv-10		Cannon 2005	Auger	Yes	Yes	Large midden	2005-0204
EjSv-11		Cannon 2005	Auger	Yes	Yes	Small midden	2005-0204
EjSv-2		Cannon 2005	Auger	Yes	Yes	Small midden	2005-0204
EjSv-3		Cannon 2005	Auger	Yes	Yes	Medium midden, habitation feature	2005-0204
EjSv-4		Cannon 2005	Auger	Yes	Yes	Medium midden	2005-0204
EjSv-5		Cannon 2005	Auger	Yes	Yes	Small midden, habitation feature	2005-0204
EjSv-8		Cannon 2005	Auger	Yes	Yes	Small midden	2005-0204
EjSv-9		Cannon 2005	Auger	Yes	Yes	Medium midden, historic feature,	2005-0204
EjSw-1	Cockmi	Drucker 1938 Cannon 2005	Excavation Auger	Yes	Yes	Large midden, habitation feature	Drucker 1943 2005-0204
EjSw-4		Cannon 2013		Yes	Yes	Small midden	Pers comm.
EjSx-6		Simonsen & Haggarty 2000	Test pit	No	Yes	Small midden, test excavation pit (0.5 x 0.5 m) impact assessment	2000-0022
EjTa-1	Lúx bálís	Arcas 1993	Shovel test	No	No	Large midden, ethnographic village, Impact assessment	1993-0052
EjTa-11		Arcas 1993	Shovel test	No	No	Small midden, defensive features, Impact assessment	1993-0052
EjTa-13		McLaren 2011	Auger	Yes	No	Large midden	2011-0171
EjTa-15		McLaren 2011	Auger Test pit	Yes	No	Large midden, early site pre-5000 BC, two shovel tests and one excavation unit (1 x 1 m)	2011-0171
EjTa-4		Rahemtulla 2011 McLaren 2011	Excavation Core	Yes	Yes	Large midden	Pers comm. 2011-0171
EjTa-5		Arcas 1993 McLaren 2011	Shovel test Core	Yes	No	Large midden, Impact assessment	1993-0052 2011-0171
EjTa-9		Arcas 1993 McLaren 2011	Shovel test Auger	No	No	Medium midden, Impact assessment	1993-0052 2011-0171
EkSt-1	Katit	Cannon 2005	Auger	Yes	Yes	Large midden, major salmon river	2005-0204

Table 28. Continued

Site Number	Site Name	Researcher/ Year	Testing Method	Radio-carbon Dated	Faunal Analysis	Description	Permit Report
EkSw-3		McLaren 2011	ESP Core	Yes	No	Small midden, habitation feature	2011-0171
EkSw-4		Millennia R.L. 1995	Shovel Test	No	No	Small midden, river site	1995-0226
EkSx-11		McLaren 2011	ESP Core	Yes	No	Medium midden, habitation feature, historic feature	2011-0171
EkSx-12	Koeye Village	Cannon 1996	Auger	Yes	Yes	Large midden, habitation feature, major salmon river	1996-0115
EkTb-8		Stafford 2008 McLaren 2011	Auger	No	Yes	Medium midden, historic feature, Impact assessment	2008-0372 2011-0171
EkTb-9		Stafford 2008 McLaren 2011	Auger Test pit	Yes	Yes	Large midden, habitation feature, , early site pre-5000 BC, Impact assessment, excavation (1 x 1 m)	2008-0372 2011-0171
ElSw-29		Millennia R.L. 2007	Shovel test	No	No	Medium midden, Impact assessment	2007-0248
ElSx-1	Namu	Hester & Luebbers 1968-70 Carlson 1978-88 Carlson 1994	Excavation	Yes	Yes	Large site, salmon river, early site pre-5000 BC	1968-0001 1969-0010 1970-0012 1971-0012 1977-0012 1994-0063
ElSx-10	Fougner Bay	Cannon 1997	Auger	Yes	Yes	Medium midden	1996-0115 1997-0063
ElSx-11	Strawberry Island	McLaren 2011	ESP Core	Yes	No	Medium midden, ethnographically documented, in-land lake site	2011-0171
ElSx-16		Cannon 1996	Auger	Yes	Yes	Medium midden	1996-0115
ElSx-18		Cannon 1997	Auger	Yes	Yes	Medium midden	1997-0063
ElSx-3	Kisameet	Hester & Luebbers 1969-71 Cannon 1996	Excavated	Yes	Yes	Medium midden, salmon stream	1969-0010 1970-0012 1971-0012 1977-0013* 1996-0015
ElSx-4		Cannon 1997 McLaren 2011	Auger	Yes	Yes	Small midden, Historic feature, early site pre-5000 BC	1997-0063 2011-0171
ElSx-5		Cannon 1997	Auger	Yes	Yes	Large midden	1997-0063

Table 28. Continued

Site Number	Site Name	Researcher/ Year	Testing Method	Radio-carbon Dated	Faunal Analysis	Description	Permit Report
ElSx-6		Cannon 1996-7	Auger	Yes	Yes	Medium midden	1996-0115 1997-0063
ElSx-8		Cannon 1996-7	Auger	Yes	Yes	Medium midden	1996-0115 1997-0063
ElTa-18		Cannon 1997 McLaren 2011	Auger Test pit	Yes	Yes	Medium midden, early site pre-5000 BC, test excavation (1 x 1 m)	1997-0063 2011-0171
ElTa-21		Cannon 1997	Auger	Yes	Yes	Medium midden	1997-0063
ElTa-25	Kiltik Cove	Cannon 1996	Auger	Yes	Yes	Medium midden	1996-0115
ElTa-3	Watt Bay	Cannon 1996	Auger	Yes	Yes	Small midden	1996-0115
ElTb-1	Nulu	Millennia R.L.1995 Cannon 1997	Test pit Auger	Yes	Yes	Medium midden, habitation feature, historic feature, excavate test pits 4 x (0.5 x 0.5 m)	1995-0226 1997-0063
ElTb-10	McNaughton	Pomeroy 1972 Carlson & Pomeroy 1974 Cannon 2013	Excavation	Yes	Yes	Large midden	1972-0030 1974-0008b Pomeroy 1980 Pers Comm.
ElTb-2		Cannon 1997	Auger	Yes	Yes	Small midden	1997-0063
ElTb-34		McLaren 2011	ESP Core	Yes	No	Small midden, habitation feature, defensive site,	2011-0171
ElTb-5		Stafford 2008	Auger	No	No	Medium midden, Impact assessment	2008-0372
ElTc-5		Stafford 2008 McLaren 2011	Auger	No	No	Small midden, habitation feature, Impact assessment	2008-0372 2011-0171
ElTc-6		Stafford 2008	Auger	No	No	Medium midden, Impact assessment	2008-0372
ElTc-7		Stafford 2008	Auger	No	No	Medium midden, Impact assessment	2008-0372
FaSu-1	Axeti	Carlson & Hobler 1969-1972	Excavation	Yes	No	Large midden, wet site, habitation feature, major salmon river, said they excavated 25% of the site	1971-0011 1972-0011
FaSu-10	Anutcix	Carlson & Hobler 1969-1972	Excavation	Yes	No	Medium midden, habitation feature, major salmon river	1971-0011 1972-0011

Table 28. Continued

Site Number	Site Name	Researcher/ Year	Testing Method	Radio-carbon Dated	Faunal Analysis	Description	Permit Report
FaSu-19	Joashila	Carlson 1978, 1980	Excavated	Yes	No	There is no information about this site in the government report, registered as surface cultural material.	1971-0011 1978-0011* 1980-0012*
FaSu-2	Nutlitliquotlank	Carlson& Hobler 1969-70	Excavation	Yes	Yes	Large midden, habitation feature	1970-0004a 1971-0011
FaTa-10		Jackley 2012	Auger	No	No	Medium midden	2012-0226
FaTa-18	'Qvu'stus	Millennia R.L. 2003	Excavated	No	Yes	Large midden, historic features, Impact assessment	2003-0029
FaTa-22		Jackley 2012	Auger	No	No	Small midden	2012-0226
FaTa-32		Wilson 1994	Shovel test	No	No	Medium midden, habitation feature, historic feature, Impact assessment	1994-0063
FaTa-4	Old Bella Bella, Fort McLoughlin	Hobler 1983	Excavated	No	No	Large midden, HBC Fort, winter ethnographic village	1968-0001 1983-0011*
FaTa-5		Jackley 2012	Auger	No	No	Large midden, habitation feature, historic feature,	2012-0226
FaTa-57		Millennia R.L.1995	Shovel Test	No	No	Small midden	1995-0226
FaTa-61		Millennia R.L.1995	Shovel Test	No	No	Small midden, historic feature	1995-0226
FaTa-7		Jackley 2012	Auger	No	No	Medium midden, historic feature	2012-0226
FaTa-73		Jackley 2012	Auger	No	No	Large midden, habitation feature, historic feature	2012-0226
FaTa-74		Jackley 2012	Auger	No	No	Small midden	2012-0226
FaTa-75		Jackley 2012	Auger	No	No	Small midden	2012-0226
FaTb-10		Stafford 2008	Auger	No	No	Medium midden, Impact assessment	2008-0372
FaTc-14		Stafford 2008	Auger	No	No	Medium midden, Impact assessment	2008-0372
FaTc-17		Stafford 2008	Auger	No	No	Small midden, Impact assessment	2008-0372
FaTc-19		Stafford 2008 McLaren 2011	Test pit Auger	No	No	Medium midden, one test excavation pit (1 x 0.4 m)	2008-0372 2011-0171

Table 28. Continued

Site Number	Site Name	Researcher/ Year	Testing Method	Radio-carbon Dated	Faunal Analysis	Description	Permit Report
FbSu-4	'Old Indian Village'	Simonsen 1996-97	Shovel Test	No	No	Small midden, habitation feature, historic feature	1996-0065 1997-0151
FbSx-6	Xunís/ Roscoe Inlet	Drucker 1938 Hester & Luebbers 1970-71, 78	Excavated	Yes	No	Large midden, habitation feature, ethnographic village	Drucker 1943 1969-0010 1970-0012 1971-0012
FbSx-9	'Húmáta	Carlson 1983	Excavated	No	Yes	Large midden, habitation feature, ethnographic village	1983-0010
FbTb-39		White 2013	Auger	No	No	Small midden, salmon stream	2013-0050
FbTb-4	Koyet	Drucker 1938	Excavation	No	No	Large midden, habitation feature, historic feature, ethnographic village,	Drucker 1943
FbTb-5	Knyumpt Harbour/ Storm Bay	Drucker 1938 Simonsen 1991	Test pit	No	Yes	Large midden, habitation feature, historic occupation	Drucker 1943 1991-0119
FcTe-4	Grant Anchorage	Simonsen 1969	Excavation	Yes	Yes	Large midden, habitation feature	1969-0005
FcSt-12		Millennia R.L.1995	Test Pit	No	Yes	Small site, did one test excavation pit (1 x 1 m)	1995-0056
FcSt-13		Millennia R.L.1995		No	Yes	Small site, excavated an area of (1.2 x 1.2 m)	1995-0056

*Site report cannot be accessed through the Provincial Archaeological Report Library

Appendix F: Tables corresponding to chapter figures with detailed results

Table 29. The proportion of middens with subsurface investigation based on sampling method and shell midden dimensions. Corresponds with Figures 6-8

	Total Middens		**Small Middens** (≤30m)		**Medium Middens** (31-99m)		**Large Middens** (≥ 100m)	
Subsurface Investigation	**78**	**22%**	22/109	22%	29/75	39%	24/35	69%
*Middens **Tested***	63	18%	24/63	38%	27/63	43%	12/63	19%
*Middens **Excavated***	15	4%	0/15	0%	2/15	13%	12/15	80%
Actual Midden Count	**351**	**100%**	109/219	**50%**	75/219	**34%**	35/219	**16%**

Table 30. The temporal trends in the methods of investigation and the features of sites that were targeted. Corresponds with Figure 9.

Temporal & Feature Trends	Total Sites Investigated	Investigation Type: **Excavation**	Investigation Type: **Tested**	Middens with **habitation** features		Middens with **historic** occupation	
All Subsurface Investigation	78	19%	81%	**29%**	23/78	**24%**	19/78
Prior to 1970	10	90%	10%	80%		30%	
1970-1979	8	100%	0%	63%		25%	
1980-1989	4	100%	0%	25%		50%	
1990-1999	28	7%	93%	18%		25%	
2000 to Present	44	9%	91%	22%		18%	
Actual Midden Frequency	351			**15%**	51/351	**12%**	42/351

Table 31. Investigation trends in targeted shell middens based on site size. Corresponds with Figure 10.

Temporal Trends of Site Size Investigations	Total Sites Investigated	**Small** Middens Sampled		**Medium** Middens Sampled		**Large** Middens Sampled	
All Subsurface Investigation	78	**31%**	(24/78)	**37%**	(29/78)	**31%**	(24/78)
Prior to 1970	11*	0%		18%		73%	
1970-1979	8*	0%		25%		63%	
1980-1989	4*	0%		0%		75%	
1990-1999	28	36%		43%		21%	
2000 to Present	44	34%		37%		27%	
Actual Midden Frequency	351	**50%**		**34%**		**16%**	

*One midden has unknown dimension

Table 32. Percentage of shell middens in each size group with each fish species nearby. Corresponds with Figure 32.

	Small Midden Count (n=108)	**Small Midden %**	**Large Midden Count (n=46)**	**Large Midden %**	**p-value**	**Significance**
Salmon	28	22.2%	13	28.3%	0.8426	
Herring	42	38.9%	24	52.2%	0.1554	
Eulachon	0	0.0%	6	13.0%	0.0006	***Significant***

Appendix G: Radiocarbon Dates for Shell Middens on Central Coast

Table 33. All radiocarbon dates from Central Coast shell middens.

Site	Radiocarbon Date		Source
EiTa-1	5991-6174 cal BP		McLaren et al. 2015:168-173
EjSv-1	cal AD 1400-1510 & cal AD 1600-1615 cal AD 645-770		Cannon 2005:90
EjSv-2	cal AD 645-770 1900-1690 cal BC		Cannon 2005:90
EjSv-3	cal AD 1465-1645 cal AD 1260-1325 & cal AD 1345-1395		Cannon 2005:90
EjSv-4	cal AD 255-300 & cal AD 315-465 & cal AD 485-530 cal AD 70-250		Cannon 2005:90
EjSv-5	cal AD 675-87 2275-2255 cal BC & 2225-2015 cal BC & 1995-1980 cal BC		Cannon 2005:90
EjSv-8	cal AD 1320-1350 & cal AD 1390-1455 cal AD 140-385		Cannon 2005:90
EjSv-9	cal AD 1440-1630 1495-1315 cal BC		Cannon 2005:90
EjSv-10	cal AD 25-225 400-200 cal BC 745-690 cal BC & 665-645 cal BC & 590-580 BC cal & 555-390 cal BC 800-540 BC		Cannon 2005:90
EjSv-11	cal AD 1290-1410 2290-2035 cal BC		Cannon 2005:90
EjSw-1	cal AD 1044-1410 & cal AD 1120-1260 cal AD 180-460 50 cal BC-AD 90 400-350 cal BC & 300-210 cal BC 815-735 cal BC & 690-545 cal BC		Cannon 2005:90
EjTa-4	303 ± 18 BP 430 ± 20 BP 453 ± 20 BP 611 ± 18 BP 808 ± 20 BP 1140 ± 18 BP 1253 ± 20 BP 1657 ± 20 BP 1833 ± 83 BP 2075 ± 20 BP 2090 ± 20 BP 2335 ± 81 BP 2395 ± 20 BP	2457 ± 20 BP 2886 ± 20 BP 3095 ± 81 BP 3480 ± 20 BP 3850 ± 81 BP 4860 ± 20 BP 5245 ± 20 BP 5320 ± 20 BP 5665 ± 20 BP 5800 ± 20 BP 5875 ± 82 BP 6450 ± 20 BP 5735-5925 cal BP	Rahemtulla pers comm. 2014 McLaren et al. 2014:155-159 McLaren et al. 2015:168-173
EjTa-5	2346-2362 cal BP 2488-2700 cal BP 2413- 2988 cal BP 3172- 3316 cal BP 3447-3553 cal BP		McLaren et al. 2014:155-159

EjTa-13	3436-3639 cal BP 3486-3709 cal BP 3703-3823 cal BP	McLaren et al. 2014:155-159
EjTa-15	10-273 cal BP 35-251 cal BP 291-419 cal BP 664-674 cal BP 1006-1172 cal BP 1088-1226 cal BP 1717-1811 cal BP 3265-3354 cal BP 3484-3564 cal BP 7623-7679 cal BP 7660-7690 cal BP 7976-8010 cal BP 8019-8155 cal BP 8599-8683 cal BP 8788-9000 cal BP 9005-9025 cal BP 9467-9515 cal BP 9787-10116 cal BP 9924-10151 cal BP 9940-10160 cal BP 9941-10123 cal BP 10229-10260 cal BP 10241-10367 cal BP 10562-10653 cal BP	McLaren et al. 2014:155-159 McLaren et al. 2015:168-173
EjTa-17	803-923 cal BP	McLaren et al. 2015:168-173
EjTa-23	1687-1883 cal BP	McLaren et al. 2015:168-173
EkSt-1	cal AD 1660-1700 & cal AD 1720-1820 & cal AD 1830-1880 & cal AD 1920- post 1950 cal AD 1440-1630 cal AD 1315-1355 & cal AD 1390-1445	Cannon 2005:90
EkSw-3	474-500 cal BP 482-502 cal BP	McLaren et al. 2014:155-159
EkSx-11	663-824 cal BP 1183-1345 cal BP 1932-1988 cal BP	McLaren et al. 2014:155-159
EkSx-12	cal AD 1520-1875 225 cal BC - AD 35	Cannon 1996:45
EkTa-19	1875-1921 cal BP	McLaren et al. 2015:168-173
EkTa-37	4091-4406 cal BP	McLaren et al. 2015:168-173
EkTa-38	7164-7244 cal BP 7423-7560 cal BP	McLaren et al. 2015:168-173
EkTb-9	2459-2699 cal BP 4515-4770 cal BP 5610-5668 cal BP 5657-5712 cal BP 5794-6026 cal BP 6161-6338 cal BP 6674-6726 cal BP 7177-7261 cal BP 7630-7689 cal BP 10238-10288 cal BP 11285-11396 cal BP	McLaren et al. 2014:155-159 McLaren et al. 2015:168-173
ElSx-1	480 ± 80 BP 680 ± 90 BP 980 ± 100 BP 1405 ± 120 BP 1470 ± 80 BP 1840 ± 80 BP 1880 ± 90 BP 2170 ± 40 BP 2185 ± 85 BP 2440 ± 100 BP 2530 ± 160 BP 2540 ± 80 BP 2720 ± 80 BP 2810 ± 100 BP 2880 ± 100 BP 2990 ± 40 BP 3280 ± 100 BP 3330 ± 90 BP 3400 ± 100 BP 3500 ± 100 BP 3690 ± 40 BP 3825 ± 105 BP 4290 ± 120 BP 4300 ± 125 BP 4390 ± 160 BP 4540 ± 140 BP 4680 ± 160 BP 4700 ± 125 BP 4775 ± 130 BP 5170 ± 90 BP 5240 ± 90 BP 5400 ± 50 BP 5590 ± 90 BP 5590 ± 100 BP 5700 ± 360 BP 5740 ± 100 BP 5810 ± 40 BP 6060 ± 100 BP 6550 ± 90 BP 7800 ± 200 BP 8570 ± 90 BP 9000 ± 140 BP 9140 ± 200 BP 9720 ± 140 BP	Carlson 1991:92 Cannon and Yang 2006:131
ElSx-3	1860 ± 105 BP 2360 ± 110 BP	Luebbers 1971:44

ElSx-4	cal AD 1435-1685 890-670 cal BC 320-378 cal BP 565-639 cal BP 567-663 cal BP 566-722 cal BP 1336-1386 cal BP	1630-1713 cal BP 2716-2785 cal BP 3568-3630 cal BP 4087-4148 cal BP 8055-8190 cal BP 8165-8285 cal BP	Cannon 1997:49 Cannon 2000:72-74 McLaren et al. 2014:155-159 McLaren et al. 2015:168-173
ElSx-5	cal AD 1470-1700 4775-4510 cal BC		Cannon 1997:49 Cannon 2000:72-74
ElSx-6	cal AD 1600-1740		Cannon 1997:49
ElSx-8	cal AD 1660-1950 cal AD 140-430		Cannon 1996:45 Cannon 2000:72-74
ElSx-10	cal AD 1665-1950 cal AD 1600-1950	2455- 2145 cal BC 4315-3960 cal BC	Cannon 1996:45 Cannon 2000:72-74
ElSx11	841-1032 cal BP 1131-1292 cal BP		McLaren et al. 2014:155-159
ElSx-16	cal AD 1670-1950 cal AD 1430-1660 cal AD 660-940		Cannon 1996:45 Cannon 2000:72-74
ElSx-17	cal AD 975-1065		Cannon 1996:45
ElSx-18	cal AD 1710-1950 1575-1310 cal BC		Cannon 1997:49 Cannon 2000:72-74
ElTa-3	cal AD 1660-1950 cal AD 1160-1300		Cannon 1996:45 Cannon 2000:72-74
ElTa-18	cal AD 1220-1460 2585-2325 cal BC 9370-9340 cal BC & 9305-9050 cal BC 9250-9605 cal BC 518-596 cal BP 535-655 cal BP 2208-2337 cal BP 2754-2775 cal BP 2793-2858 cal BP 3364-3389 cal BP 3402-3459 cal BP 3479-3844 cal BP	3586-3636 cal BP 3479-3844 cal BP 6023-6207 cal BP 7580-7610 cal BP 9543-9697 cal BP 9706-9888 cal BP 10517-10640 cal BP 10519-10645 cal BP 10692-10745 cal BP 10701-10757 cal BP 11247-11591 cal BP 12701-12858 cal BP 13454-13673 cal BP	Cannon 1997:49 Cannon 2000:72-74 McLaren et al. 2014:155-159 McLaren et al. 2015:168-173
ElTa-21	cal AD 1530-1950 cal AD -425		Cannon 1997:49 Cannon 2000:72-74
ElTa-25	cal AD 1665-1950 2405-2025 cal BC		Cannon 1996:45 Cannon 2000:72-74
ElTb-1	805-410 cal BC		Cannon 1997:49 Cannon 2000:72
ElTb-2	cal AD 1225-1445 cal AD 20-245		Cannon 1997:49 Cannon 2000:72-74
ElTb-10	330±90 BP 900±80 BP 2140 ± 95 BP	2160±130 BP 2420 ± 95 BP 2520±90 BP	Pomeroy 1980:276-279
ElTb-34	670-832 cal BP 1418-1526 cal BP		McLaren et al. 2014:155-159
FaSu-1	240 ± 80 360 ± 90 1280 ± 100		Canadian Archaeological Radiocarbon Database

FaSu-2	AD 480±100 AD 1280±80 0 ± 90 0 ± 120	30 ± 80 330 ± 80 670 ± 80 1470 ± 100	Carlson 1971 Canadian Archaeological Radiocarbon Database
FaSu-10	1760 ± 90		Canadian Archaeological Radiocarbon Database
FaSu-19	320 ± 80 400 ± 80 5340 ± 100		Canadian Archaeological Radiocarbon Database
FaTc-19	2504-2713 cal BP		McLaren et al. 2015:168-173
FbSu-1	1610 ± 80 2210 ± 130		Canadian Archaeological Radiocarbon Database
FbSx-6	2140 ± 100 BP		Luebbers 1971:44
FeTc-4	480 ± 90 2090 ± 100	2110 ± 110 3480 ± 140	Simonsen 1973:67

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