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# Beyond Foraging and Collecting

## Evolutionary Change in Hunter-Gatherer Settlement Systems

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*Chapter 2*

# *Going by Boat*

## The Forager–Collector Continuum at Sea

KENNETH M. AMES

### INTRODUCTION

In 1990, Binford argued that logistical mobility strategies...

> are the consequence of two major evolutionary changes that occurred long ago: (1) the "aquatic resource revolution" with its early occurrence primarily in higher latitudes, and (2) the perfection of transport technologies, particularly water transport vessels and the use of pack and draft animals. (Binford 1990: 138)

Hunter-gatherers that pursue aquatic resources will be strongly logistical in their mobility strategies. In fact, they are virtually obligatory collectors (Binford 1990). Following Binford, I will accept these statements as guides to further research. The purpose of the current paper is to explore two broad implications of these statements.

First, it has long been recognized that in contrast with terrestrial, pedestrian hunter-gatherers, aquatic hunter-gatherers tend to have higher population densities (e.g., Renouf 1988; Keeley 1988), to be residentially more stable, i.e., more sedentary, and to be perhaps more socially and economically complex than most terrestrial hunter-gatherers. Explanations for the causes of these apparent distinctions commonly focus on the relative or absolute productivity and dietary value of aquatic relative to terrestrial resources. In these discussions, lip service is paid to the importance of

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"transport technologies," but their importance is rarely investigated. However, access to waterborne transportation alone can have a significant positive impact on population size and stability (Batten 1998). This implies a more complex (and interesting) interplay between environment and technology in the evolution of mobility strategies than is generally appreciated.

Secondly, most aquatic hunter-gatherers are collectors, following Binford's basic definition that collectors move resources to people. However, archaeological expectations for recognizing collectors and foragers are based on terrestrial hunter-gatherers. There are important differences between aquatic and terrestrial hunter-gatherers, due, in part, but not exclusively, to differences in transport. These differences mean that the archaeological record of terrestrial and aquatic collectors may be quite different from each other, at least in degree. A question arising from these considerations is whether these differences in degree are, cumulatively, differences in kind. If this is so, a further question is whether comparative analyses, such as those of Binford (1980, 1990), Keelley (1988), and Kelly (1995) that are based on ethnographic samples with significant numbers of aquatic hunter-gathers, are therefore flawed (see Yesner 1980 for an early argument to this effect).

This paper is about boats, but it is about boats as transportation, about the integration of boats into production on a daily basis, about boats being used to haul material 100 meters across a lake or 1000 kilometers over difficult seas. It is not about the evolution of boats or about evidence for the earliest boats, or about boats as the only way to get to Australia, or as a means to people the Americas. It is about boats as instruments of production and whether the use of boats is theoretically important.

## AQUATIC HUNTER-GATHERERS

What to call the people who are the focus of this paper? Binford (1990) uses the term "aquatically oriented hunter-gatherers." These are people who are "dependent" on aquatic resources, by which he means aquatic hunting and fishing, but not collecting aquatic or hydrophytic plants. When Kelly (1995) speaks of aquatic resources, he clearly means fishing and sea-mammal hunting. My meaning of the term is somewhat broader. Aquatic hunter-gatherers are those whose production activities rely on water for procuring food, other resources, and for transportation. I use this term because there is no alternative that clearly distinguishes these from terrestrially based economies. "Maritime hunter-gatherer" generally refers to people who exploit marine environments, be they close inshore littoral environments or distant pelagic ones. The phrase has always struck me as both too broad and too narrow. It is too broad because it can be applied,



and often is, equally to people, like the Aleut, who hunt whales in open water with highly evolved tackle, including their vessels, and to those who are essentially strandloopers, collecting mollusks and exploiting near-shore environments without specialized gear or tackle. Lyman (1991) calls the latter a "littoral" adaptation and reserves the title "maritime" for the former, with its specialized gear and knowledge. This distinction is at the heart of Lyman's debate with Hildebrandt and Jones over whether people along the Oregon coast hunted seals from boats in open water or clubbed or speared them in their rookeries (Hildebrandt and Jones 1992; Lyman 1995; Jones and Hildebrandt 1995). Lyman's distinction, useful as it is, does not capture my meaning. Maritime is also too narrow because it does not apply to people who exploit wetlands, rivers, lakes etc.

The Chinookan peoples who lived in the Wapato Valley region of the lower Columbia River are a case in point. Although riverine fishing was central to their economy, they harvested a wide array of terrestrial, wetland, lacustrine, and riverine resources. It would, in fact, be difficult to categorize them as either terrestrial or aquatic hunter-gatherers based solely on the sources of their food resources. They, however, relied very heavily on canoes of a variety of shapes and sizes. They used these canoes to move resources and themselves across the landscape. It is as much this dependence on canoes that makes them aquatic hunter-gatherers as it is the salmon and sturgeon they harvested from their boats.

Binford's seminal paper on collectors and foragers (Binford 1980) was published in the same year as Yesner's on "Maritime Hunter-Gatherers: Ecology and Prehistory (Yesner 1980)." Yesner's article was something of a manifesto for the study of and theory building about maritime hunter-gatherers. He argued that modern hunter-gatherer studies may have little direct relevance for understanding ancient hunter-gatherers because, according to Yesner, most modern hunter-gatherers occupy marginal environments. He also criticized the methodology used by Binford and others to look for broad regularities or correlations between environment and economy, suggesting that such studies masked important dimensions of variability. He strongly implied that these studies are flawed by the use of the wrong scales of "cultural and ecological units for analysis (to avoid spurious correlations) (Yesner 1980: 728)." Yesner went on to argue that maritime hunter-gatherers are and were significantly different from modern, terrestrial hunter-gatherers in marginal environments. Like many others, Yesner also addressed the productivity of marine environments as a source of dietary calories, protein, and nutrients relative to terrestrial environments.

For Binford (1990: 134), the apparent increasing use of aquatic resources in the Holocene is "one of the major problems archaeologists have yet to address realistically in terms of the issues of complexity and human evolution." Debate over this question generally focuses on the ecological productivity of aquatic (usually understood as marine) and terrestrial environments (e.g., Erlandson 1988, 1994; Keeley 1988; Osborne 1997; Perlman 1980; Schalk 1981; Yesner 1980). Here, I do not directly address the relative merits of the arguments of these authors; rather I explore an alternative or supplementary position, which is that the availability of efficient (or effective) transportation can have a significant positive impact on the net productivity of aquatic environments.

## AQUATIC TRANSPORT

Batten examined the population histories of 327 European cities in the period from 1500 to 1800 A.D. to determine the relationship of city growth (as a measure of urbanization) and transportation. His actual concern was the impact of transportation on urbanization in ancient Mesoamerica. However, the European data provided (1) good estimates of population size, (2) precise estimates of age, and (3) good control over systems of transportation. Cities were assigned to three "transportation" categories: landlocked, river, and ocean (see Batten 1998: 494–496, for the way these seemingly broad categories relate to transportation). As a result of his analyses, Batten concluded:

> 1. Ocean cities (those accessible from the ocean, port cities) exhibited faster and more sustained growth during the period of his study.
> 2. Median populations of cities on water (both ocean and river) far surpassed those of landlocked cities.
> 3. Population sizes of landlocked cities were more subject to fluctuations. They were the only cities to lose populations during this period.
> 4. "Population should be proportional to the size of the food producing hinterland ... if ... food supply is an important part of the relationship between transport and population size (Batten 1998: 510).

Batten's results cannot be translated directly to hunter-gatherers. He was not certain they could be directly applied to urbanization in Mesoamerica from Europe. However, the implications are suggestive and do find some support from recent comparative work on modern hunter-gatherers. For example, both Keeley's (1988) and Kelly's (1995) data sets indicate that population densities for coastal hunter-gatherers are generally higher than among terrestrial peoples, although Keeley indicates that the differences are not large. However, if one compares coastal groups with adjacent terrestrial groups, rather than comparing them globally, the differences are more marked.

I calculated median, mean, and standard deviations (Table 2.1) and constructed box and whisker plots (Fig. 2.1) of the population densities for aquatic and terrestrial hunter-gatherers in western North America, including California (aquatic and terrestrial[1]), the Northwest Coast and Plateau,[2] and the Arctic and Subarctic.[3] I used the density figures in Kelly's Table 6-4



**Table 2.1. Descriptive Statistics of Population Densities (individuals/100/km²) for Aquatic and Terrestrial Hunter-Gatherers in Western North America (density estimates from Kelly 1995, Table 6-4, 222–226)**

| Region | N | Mean Density | Std. Dev. | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| California | | | | | | |
| Aquatic | 18 | 203.7 | 199.8 | 173 | 25 | 843 |
| Terrestrial | 25 | 125 | 91 | 103 | 12 | 103 |
| Northwest Coast/Plateau | | | | | | |
| NW Coast | 16 | 68.3 | 49.2 | 61 | 10 | 195 |
| Plateau | 10 | 14.6 | 13.1 | 9.5 | 2 | 38 |
| Arctic/Subarctic | | | | | | |
| Coast | 16 | 11 | 16.9 | 3.4 | .5 | 65 |
| Interior | 23 | 1.5 | 1.9 | .8 | .2 | 7.6 |

[1]I assigned groups to the "aquatic" and "terrestrial" classes based on my reading of ethnographies, particularly the accounts in the Handbook (Heizer 1978). This assignment was not always straightforward. Some groups located on or near the Pacific coast made almost no use of coastal resources, for example. On the other hand, salmon was an important resource for many peoples living in the interior of central and northern California. In this latter case, I generally assigned these groups to the terrestrial category because fishing was usually their only "aquatic" harvest, the rivers did not provide usable transportation routes, and they made little use of water plants.

[2]This comparison is between coastal peoples and those of the continental interior, rather than a clear-cut comparison between aquatic and terrestrial economies. The peoples along the Northwest Coast are straightforward examples of aquatic hunter-gatherers, although many groups generally considered maritime by anthropologists may have relied more heavily on terrestrial plant foods than typically thought (Duer 1999). The Plateau is not so straightforward. The Plateau of North America is the topographically complex region between the Cascade/Coast Ranges of the Pacific coast and the Rocky Mountains from southern Oregon to central British Columbia. Many peoples (but not all) of the Plateau heavily relied on salmon and other fish; canoe travel was also important, although how important is not known. However, Plateau groups also were very dependent on roots (e.g., Thoms 1989; Peacock 1998) and terrestrial mammals. Rather than trying to class Plateau groups as more or less aquatic and terrestrial, I compare the two large regions.

[3]All of the groups in the "aquatic" class are coastal, and most are found in the North American Arctic. Kelly's sample includes only the Aleut and Chugach from the Pacific coast of Alaska, not the Koniag of Kodiak Island and adjacent mainland areas. Virtually all the "terrestrial" groups are subarctic hunters, and most are Athabaskans. Interior Inuit groups include Nunamuit and Copper Eskimo.

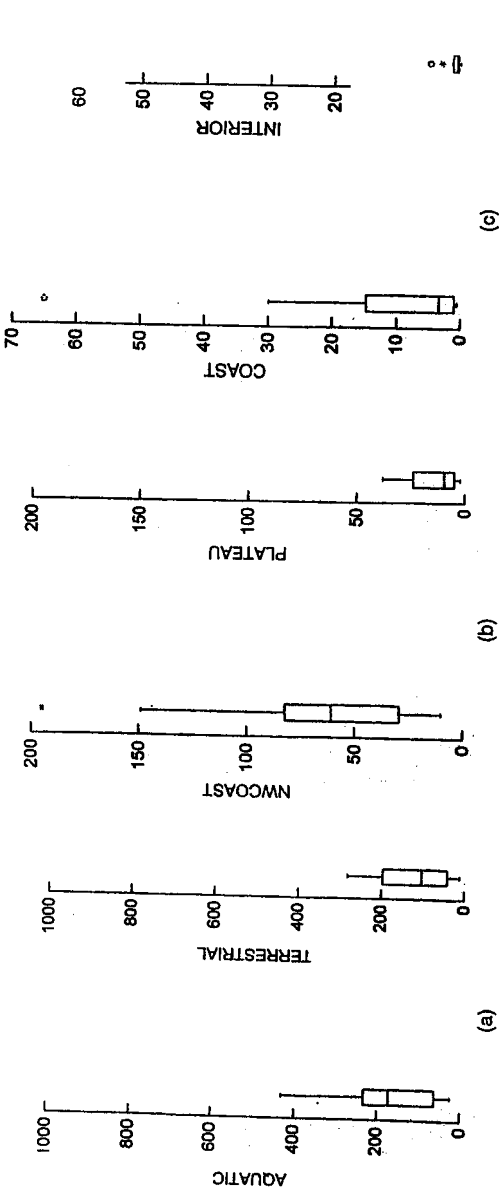


**Figure 2.1.** Box and whisker plot of the population densities of aquatic and terrestrial hunter-gatherers in western North America, including California (a), the Northwest Coast and Plateau (b), and the Arctic and Subarctic (c). Note differences in scale of the y axes.



(Kelly 1995) and the descriptions of territories, subsistence practices, and material culture in the relevant volumes of the Handbook of North American Indians (Damas 1984; Heizer 1978; Helm 1981; Suttles 1990b; Walker 1998). It is not possible to separate the effects of environmental productivity and those of transportation by using these data. However, they are quite clear on a number of points.

In North America, aquatic hunter-gathers consistently have higher mean and median population densities, as suggested by Batten. There is consistently greater variation in population density among aquatic hunter-gatherers, although the distribution of variation around the mean and median differs among the three aquatic groups. The patterns of variation among the terrestrial groups are more regular, and the median is consistently smaller than the mean. Population densities of both aquatic and terrestrial groups can be equivalently low, whereas the higher densities of aquatic groups are consistently much larger than among terrestrial groups.

These data do not address Batten's first conclusion: that populations (cities) on the ocean will grow faster than those in the continental interior. This would also be difficult, although not impossible, to test archaeologically. In any event, that test is beyond the scope of the current work.

The data do support his second conclusion: that peoples on coasts or using aquatic environments have higher median (and mean) population densities than those in continental interiors or those who are adjacent to coasts but who are primarily terrestrial in economy and transportation. Thus, the pattern he detects for preindustrial cities can be generalized more broadly.

Taken at face value, these data seem to contradict his third conclusion that there is greater variability in population sizes among interior groups or put in another way, that coastal groups have more stable populations. However, his conclusion is about variation through time; these data show variation in space. Further, his evidence indicates that interior cities are likely to lose population in times of stress. What these data do show is that the upper limits on population densities of terrestrial hunter-gatherers are consistently lower than those on aquatic population densities, regardless of local population size. Population densities of terrestrial groups in California are huge relative to those of the Subarctic, but the pattern is the same.

The rest of this paper addresses, at least indirectly, Batten's fourth point.

## TRANSPORT TECHNOLOGY OF THE NORTH PACIFIC

In this section, I will briefly look at these aspects of boat use: freight capacities, universality, distances and speed, and their disadvantages. This discussion draws on two sets of examples: umiaks and kayaks in the North

American Arctic and Northwest Coast dugout canoes. These examples also illustrate two contrasting approaches to boat use: using a general-purpose boat for many tasks[4] versus using multiple specialized hulls. They also illustrate two quite different forms of hull construction. Umiaks are hide boats, whereas Northwest Coast vessels were dugouts made from logs.

## Vessels

### *North Pacific Skin Boats (This Discussion is Based Primarily on Durham (1960), Chappelle (1994), and Rousselot (1994) Unless Otherwise Cited.)*

Skin boats were widely used along the most northerly shores of the North Pacific and in the North American Arctic. They have a variety of names, but they are most widely known as umiaks and kayaks. Umiaks are open, generally flat-bottomed boats with an internal frame covered by sea-mammal hides. Walrus hide was preferred because of its toughness. The vessels ranged in size from 4.6 m (15 ft) to more than 12 m (40 ft), although early European sailors off Greenland observed umiaks 18 m (60 ft.) long (Chappelle 1994). Chappelle suggests that there is no practical reason why even longer skin vessels would not be possible. The most common size apparently was about 9 m (30 ft) long by 2 m (6 ft) wide, and about 15 cm (6 in) deep. Although umiaks could carry as many as 40 people, 10 to 20 people, with their gear, was the usual number. Umiaks are seaworthy, fast, and easily maneuvered, particularly when empty. They are also light, and, because of their construction, easily taken apart. In the recent past, hulls apparently varied greatly in detail, depending upon the vessel's function and local water and wind conditions. Kayaks are decked boats, usually with single cockpits for their one-person crews. Two-person kayaks were also used in some areas. Kayaks were used principally for hunting, sometimes in seawaters, but also in rivers and lakes. Kayak hulls varied markedly through their distribution. Rousselot (1994) documents 22 different hulls in North America and adjacent Siberia.

### *Northwest Coast Dugouts [This is Based on Durham 1960; Waterman and Coffin 1920; Drucker 1951; Swan 1967; Sproat 1987; Holm 1994; and Olson (1927) Unless Otherwise Cited.]*

Northwest Coast canoes, with exceedingly rare exceptions (e.g., de Laguna 1972), were "dugouts" made from logs of western red cedar (*Thuja*

[4]Of course, many groups using umiaks also used kayaks, a highly specialized hunting vessel, although some did not. However, the point remains that for many purposes, one craft was used in contrast with the Northwest Coast.



*plicata*). The techniques used to make these vessels are described in many sources (e.g., Boas 1909; Drucker 1951) and need not be reviewed here.

There was great diversity in hull form and size along the coast, although this variety probably declined during the nineteenth century. Suttles (1990b) illustrates 10 nineteenth century hull forms but does not exhaust the variability. This diversity has a number of dimensions, including geography, water conditions, function, and hull size. Regional specialization in boat building overlay and partially obscured local variation in vessel form. The coast had two major boat-building groups: the Haida people of the Queen Charlotte Islands on the northern Coast and the NuuChahNulth peoples along the west coast of Vancouver Island. Both made canoes for export, and their craft were widely distributed (Fig. 2.2). Haida canoes were widespread on the northern coast, although both Coast Tsimshian and Tlingit also made their own. The Tlingit appear to have been particularly dependent on this trade for their large, seagoing vessels. NuuChahNulth hulls were traded broadly on the central and southern coasts. As with the Haida, they were probably their region's primary source for large freight and seagoing canoes. Distinctive vessels were found among the Coast Salish and the Chinookans of the lower Columbia River. In both cases, the vessels were adapted to the particular conditions of the local waters.

Despite this variability, there were three or perhaps four basic hulls. The largest canoes were what Durham (1960) calls great canoes, a term I will use here. Great canoes included so-called "war" and freight canoes. Freight canoes were 10 or more meters long, broad-beamed, and high-sided. War canoes were narrower, but usually as long, if not longer. A nineteenth century Haida canoe is described as almost 25 m (80 ft) long although Durham (1960) suggests that a length of 18 m (60 ft) was their practical limit, and 12 m (40 ft) the most common. War canoes had beams of about 2 m (6–7 ft), whereas those of freight canoes were somewhat wider. War canoes were used for warfare and also as the coast's seagoing vessels, both far from shore and on long voyages. It is not altogether clear that "war" and freight canoes were separate classes of hulls everywhere, although hulls were designed specifically for warfare in some places.

There was a range of medium-sized vessels [length: 5.5–11 m (18–35 ft); beam: 1–2 m (3–6 ft)] that some authors (e.g., Durham 1960; Shackleton and Roberts 1983) term "family canoes." The hulls of these canoes were apparently very similar to those of the larger styles. Additionally, there were even smaller vessels that carried one, two, or three people. The smaller vessels were evidently quite numerous, and though the capacities of the largest vessels were spectacular, it may be that these small vessels were more important. The smallest vessel on the lower Columbia River, for example, was only about 4 m long (10–14 ft) with a beam of 0.5 m (21 in.) and a depth of 0.2 m (9 in.) and was used by one person.

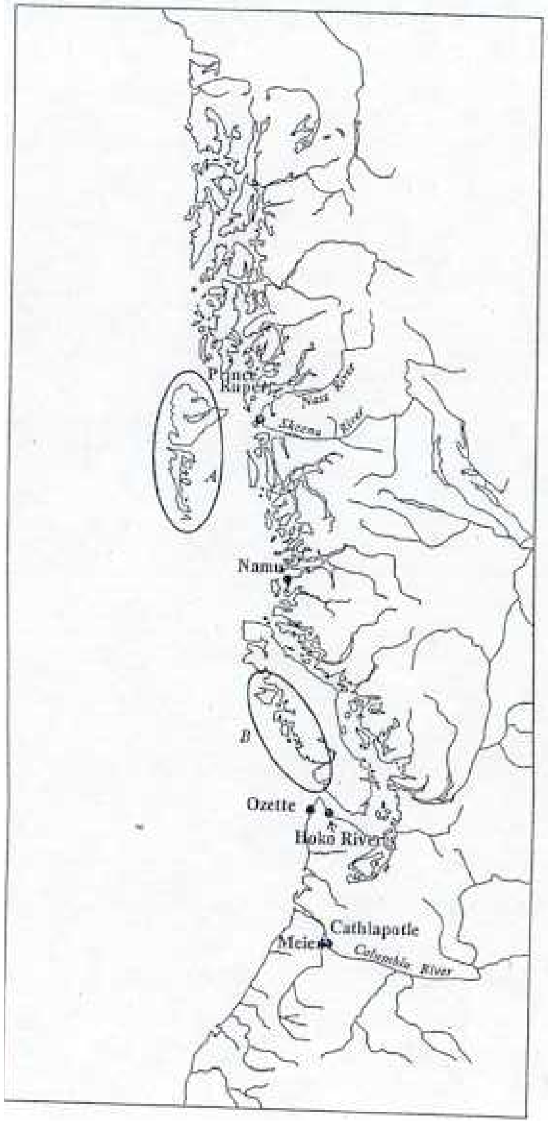


**Figure 2.2.** Archaeological sites and locations on the Northwest Coast mentioned in the text. The ovals enclose groups specializing in making and exporting canoes: A: Haida; B: NuuChahNulth.



Specialized hulls included hunting and whaling canoes and canoes designed for use in rivers and in relatively placid waters. These specialized hulls varied in size; some were as large as great canoes, although most were usually closer to the family canoes in size.

### *Capacities*

Umiaks were quite commodious. Larger ones could hold as many as 60 passengers or 5 tons of cargo (Durham 1960). Ten to 20 people were a more typical crew. Small, one to two-person umiaks were used in some places. Jochelson left this description of the capacity of the Koryak version of the umiak:

> The Koryak skin boat can carry fairly heavy loads … [I]n two boats … we carried about two thousand pounds of cargo, and our party consisted of twenty-five members …In addition, each boat carried eight dogs in harness, which lay in the stern. Notwithstanding this heavy load, the boats were not more than half in the water. (Jochelson 1908: 538; as quoted in Rousselot 1994: 248)

The largest Northwest Coast vessels carried equally enormous loads. Meriwether Lewis (Moulton 1990: 267–272) estimated that freight canoes on the lower Columbia River could carry as much as 4 to 6 tons. Ethnohistoric sources more often give an indication of capacities in terms of the numbers of people carried rather than the loads. Great canoes usually carried 20 to 30 people, and the "household canoes" carried 10 to 15 with their loads. For example, the Reverend Myron Eells traveled up Puget Sound in January 1878 with a party of 65 in seven canoes, or about nine per vessel (Castile 1985). The group included women, children, and men on their way to a potlatch. In 1813, a group arrived at Fort Astoria, the fur-trading post at the mouth of the Columbia, in six canoes and two boats. The party included 53 people and "116 packs Beaver, Baggage, etc. etc. (Jones 1999: 190)."

On the coast, freight canoes ferried house planks from one village to another. Sometimes two freight canoes were lashed together about 4 m (12 ft) apart, and the house plank placed across them. Household goods were then stacked on the planks. According to Drucker (1951: 88), these rafts were "slow and cumbersome" but in good weather "transported heavy and very bulky cargoes in good style."

In discussing capacities, it is easy to focus on canoes for hauling freight. However, they were employed in a variety of productive ways, including whaling and sea-mammal hunting. They were also central to many less spectacular, but probably more important tasks. Meriwether Lewis observed Chinookan women harvesting the corms of *Sagittaria latifolia* by wading out into a lake where the plant grew, loosening their bulbs with their feet, and, when the bulb floated to the lake's surface, throwing them into the smallest style of Chinookan canoe (Moulton 1991: 30). In this instance, the women had to portage the full canoes a short distance to a river to take the corms away, but many lakes and wetlands in this area had outlets.

Two additional points need to be made here. First, both the skin boats and dugouts are described as very seaworthy, even when fully loaded. Their crews were also quite skilled. Secondly, heavily loaded traveling groups included dogs and children as well as women and men. Both men and women handled boats, including paddling and navigating.

### *Distances and Speed*

Although the peoples of the North Pacific undertook very long voyages, I am interested here in daily distances under normal travel conditions. I could find little information on distances traveled in umiaks. Durham (1960) comments that people sailed only in good weather, and "progress over long distances was usually very slow (p. 23)." In contrast, there is better evidence for distances traveled on the Northwest Coast. Gilbert Sproat, for example, commented in his 1866 memoir of his time on Vancouver Island that two people could easily "paddle a medium-sized canoe 40 miles on a summer's day (Sproat 1987: 83)."

Myron Eells provides what may be the best data on distances traveled and speed for the Northwest Coast. He made two trips along his route of January 1878, the January trip and an earlier one in the summer of 1876 (Castile 1985). The route was from Skokomish, Washington, in Puget Sound to Dungeness at the eastern end of the Straits of Juan de Fuca. He gives the mileage as 90 miles. The January trip, with the large party, took 21 "traveling" hours from Skokomish to Dungeness and 33 hours back. The quicker trip was with favorable winds. The 1876 summer trip was done in one boat with two women and two men. The women paddled, one of the men steered, and the other "rowed." The outbound leg took 31 hours and the home trip 23 hours, again with favorable winds. The faster speeds for both trips, with favorable winds, averaged 6.5 km/h (3.5 knots/h), and the slower average speed was 4.4 km/h (2.4 knots/h). At these speeds, Sproat's two men in a medium boat would take 10 to 13 hours to travel their 40 miles. Croes and Hackenberger (1988), using somewhat different sources, estimated canoe speeds of 4.5 km/h in good weather and 2.7 km/h in bad. These translate to somewhat slower estimated speeds of 2.5 and 1.5 knots/h.[5] These estimates may be a better reflection of speeds in "normal" short distance travel than mine, which may be traveling speeds. It does not appear from Eells' figures that crew or boat size had much affect on speed, at least for smaller vessels. The very largest canoes may have been underpowered for their size and slower than smaller boats (Durham 1960).

Of course, people do not always just travel, and the habits or patterns of movement can affect speed and distance. Hunter-gatherers particularly embed information gathering in their movements. The experiences of Swan, Sproat, and Eells may tell us something about the way canoe trips were conducted. Both Swan (1857) and Sproat (1987) observed a distinctive rhythm to canoe travel. Crews would paddle hard for some distance, and then stop to discuss things (in water or on land) that they had observed or to recall a story. It is likely that these pauses were crucial to collecting information about water conditions and for navigation. Once the discussion was ended, paddling resumed. In Eells' summer trip, the party traveled straight through, arose before dawn, and paddled for 12 or more hours with few, brief pauses. In the winter trip, the group traveled for 6 to 8 hours and then made camp. On both trips, they were forced to remain in camp to allow unfavorable winds to die down.

### *Universality*

By this I mean two related things: (1) the number of boats available and access people had to them and (2) their centrality to the conduct of everyday business and life. On the North Pacific, boats were numerous, ubiquitous, and central to life. It is difficult to assess the numbers of umiaks. However, in 1881, Edward Nelson (1899) observed a camp of about 150 conical lodges with more than 60 umiaks and 200 kayaks. Early traveler's accounts suggest swarms of kayaks.

The numbers of boats are better documented for the Northwest Coast. Durham (1960) asserts, based on his readings of early accounts, that villages usually had enough to be completely waterborne. He cites, for example, George Simpson's account in the 1840s of encountering 800 Comox in 40 to 50 canoes in the Gulf of Georgia. In November 1805, William Clark counted 52 canoes at a Chinookan village in what is now Portland, Oregon. He states that the village contained 200 men. In the spring of 1806, the Lewis and Clark expedition passed another village in the same general area and recorded 100 small canoes of the kind used by women to collect *Sagittaria latifolia* and other aquatic resources. The village, it was estimated, had 100 people. In short, boats were both very numerous and ubiquitous.

[5]The lowest speed for which I can find a record is a passage across the 15-mile wide Strait of Juan de Fuca that took place in a severe storm. The trip took 11 hours (Durham 1960), for a speed of 1.3 knots/hour. This suggests to me that Croes and Hackenburger's bad weather estimate is probably too slow for normal travel.

It also seems clear that literally everyone, at least on the Northwest Coast, had one. One class of canoe made by the Nuuchahnuulth was called the "children's canoe." Sproat (1987) describes small children managing boats in swift streams. People also had access to good boats. In many cases, the hulls of "family canoes" were simply somewhat smaller versions of the largest seagoing canoes. It also appears that access to umiaks was unrestricted.

The largest Northwest Coast vessels were made by specialists, who worked on commission. Thus, only chiefs could command the resources to pay for a great canoe. Durham (1960) suggests that chiefs might have one or two such vessels that were used for a variety of purposes. Among the Tlingit, at least, canoes belonged to the household (Oberg 1973). It is not clear that specialists made all of the canoes on the coast, but as Swan put it,

> "The manufacture of a canoe is a matter of great moment ... It is not every man among them that can make a canoe, but some are, like our white mechanics, more expert than their neighbors." (Swan 1967; 80)

It may be that many of these expert boat builders were what I have termed "embedded specialists (Ames 1996)."

I could find no indications whether specialists made umiaks and kayaks. My sense is that they did not. However, I would suspect that, as with canoes, some makers were more expert than others, and were probably sought after, particularly given the potential costs of an ill-made vessel.

The general accessibility and widespread use of well-made, seaworthy craft on the North Pacific is in marked contrast to the availability of seagoing boats among the Chumash of southern California. The Chumash made a seagoing plank canoe, a canoe type unique to them, at least in western North America. These canoes were owned and controlled by the individuals who could afford to pay for them. Durham estimates that a village of 500 might have only 10 of these canoes. Arnold (1995) has argued that control of these canoes and related production were central to the development of social inequality among the Chumash. That kind of control over sea-worthy craft had no obvious parallels on the Northwest Coast and Arctic. It was always possible on the Northwest Coast to vote with your feet, or your paddle, when chiefs became too autocratic, as they did. There is some evidence, however, that the Chumash also made dugout and oceangoing balsa canoes (Grant 1978). If so, then there may have been wider access to more humble vessels.

### *Disadvantages of Boats*

Boats are trouble, as anyone who has owned one knows. They are used in environments that can be quite hazardous and unpredictable. Even seemingly placid waters can drown both the unwary and the highly skilled. A storm that is mildly inconvenient ashore can be exceedingly dangerous in an open boat.



Boats are also subject to wear and tear and design problems. They require constant attention and maintenance. They can represent a major initial investment and a high ongoing one. For skin boats, the major maintenance problem is the skin hull. The skins are waterproofed by oiling them. They require drying and reoiling after about 4 days of use (Chappelle 1994). This may explain, in part, the slow progress of long journeys in these vessels noted above. Groups on long trips sometimes took a spare umiak and alternated them, with the wet boat turned hull up to dry over the one in use. Durham (1960) estimates that an umiak crew blown out to sea had 10 days to get back to land before the vessel failed completely. Differences in skin quality also affected the seaworthiness of boats. Walrus hides were better than fur-seal hides, for example.

The hulls of Northwest Coast canoes were made extremely thin so that the vessels would be light, and easy to paddle. Western red cedar splits readily, and these thin hulls required constant care and repair. Boats were wet down on sunny days, even in use, and kept moist and covered when beached to prevent splitting and checking. The maximum life of a Northwest Coast hull may have been about 12 years (Durham 1960). The thin hulls did not have internal frames and could flex. As a result, under certain sea conditions, the canoes might split open lengthwise (Drucker 1951; Durham 1960) and sink. The rafts made by lashing house planks across freight canoes broke up easily in choppy seas (Drucker 1951). Such an event could spill an entire village into the sea. Both wooden and skin vessels had to be launched and beached carefully to protect their hulls.

Umiak frames were wooden, and in some parts of the Arctic, finding the right wood for the vessel might have been problematic. On the Northwest Coast, western red cedar did not grow everywhere. The Tlingit homeland of southeastern Alaska is north of the red cedar's range, and they had to trade for boats, particularly for larger vessels. The Makah, famous whalers, had no boat-quality red cedar in their territories and had to trade for whaling boats from their Nuchahnuulth kin. The Coast Salish, Chinook, and others also traded for hulls from Vancouver Island. In short, boats are costly to construct and maintain.

### *Summary*

These major points emerge from the preceding: seaworthy watercraft were common and ubiquitous on the North Pacific; they could carry enormous loads; a wide range of vessels was employed, whose variability reflects differences in the purpose of the boat, wind and water conditions, and available material; everyone, men, women, and children, had access to and used boats. This use and dependence on boats came with costs. These costs included the hazards of boat use, and the demands of boat-building and of ongoing attention and repair.

The preceding discussion has been a lengthy but necessary background to discussing aquatic collectors, the subject of the next section.

## COLLECTORS AT SEA

### Introduction

#### *Foragers and Collectors*

The distinctions between foragers and collectors are well known: foragers move people to resources; collectors move resources to people. Foragers exploit resources within a foraging radius of the residential base, and processing of resources occurs within that radius (6 km) or at the residential base. Collectors also exploit resources within the foraging radius, but, more importantly, they acquire more distant resources by sending out task groups that harvest or collect the resource (whatever it is), process it in the field, and return to the home base with the processed product. Mass processing, therefore, usually will occur away from home.

The predicted archaeological record for collectors and foragers is equally well known. Foragers are expected to produce only two kinds of sites, residential bases, and locations. Locations are places where "extractive tasks are exclusively carried out" (Binford 1980: 9). Among foragers, these have low archaeological visibility. Collectors generate residential bases, field camps, stations, and caches. These are likely to have higher archaeological visibility because bulk processing occurs in the field, often repeatedly at the same place. Stations are information-gathering places, and caches are places where high-bulk resources are stored or cured in the field using temporary storage facilities.

A crucial difference between foragers and collectors, as described by Binford (1980), is that collectors, who are delayed-return foragers in Woodburn's terms (1980), do bulk extraction and processing of resources, which foragers do not do. Because of this, Binford regards that differential transportation cost is the central consideration in whether groups are collectors or foragers (Binford 1990: 139), except under conditions of demographic packing, under which logistical strategies will evolve regardless of cost. Issues of cost in time and energy are central to the discussion in the next section, and bulk processing to that in the following section.



#### *Implications of Boats for Hunter-Gatherer Mobility*

Kelly (1995: Chap. 4) provides a useful basis for examining the impact of boats on hunter-gatherer mobility strategies, and this section follows that discussion. Kelly identifies five dimensions that structure the variation in hunter-gatherer mobility strategies: the number of residential moves/year, the average distance moved/residential move, the total distance moved cumulatively/year, the total area used/year, and the average length of logistical forays, as he terms them (Kelly 1995: 120–121). I will discuss these and two additional topics he raises: foraging radius and sedentism.

#### *Foraging Radius, Size of Areas Exploited, and Length of Logistical Forays*

The concept of foraging radius is central to considerations of mobility patterns. The point of diminishing returns sets this distance. After a camp is established, foragers explore and harvest resources within an easy walk of camp. As nearby resources are consumed, people must go farther afield. At some point, the distance is judged too great, and the camp is moved. Kelly concludes,

> The effective foraging radius ... is largely a product of the return rates of the available resources and the degree of dependence on them (which, in turn, is a function of how many people are foraging for each family, family size, and per capita caloric needs). (Kelly 1995: 135)

Collectors, of course, deal with these problems by sending task groups beyond the foraging radius. Kelly's data indicate that this radius is generally about 4–6 km. He also suggests that 20–30 kilometers is the maximum distance hunter-gatherers can comfortably walk in a day across varied terrain. This is a walking speed of around 3 km/h, which is about the same as the slower canoe speeds calculated above. The 20–30 km figure can be taken as the maximum distances task groups traveled on foot in a day.

The foraging radii of boat-using groups could theoretically be considerably greater than those of pedestrian hunter-gatherers. The potential area that waterborne groups can exploit is large, particularly at radii greater than 10 km (Fig. 2.3). Four to six kilometers are 1–2 hours by boat, and 20–30 kilometers are a 4–10 hour trip one-way. Therefore, the foraging radius of a settlement, depending on water conditions, could be as great as 30 kilometers (Fig. 2.3).

The potential distance and scope of multiday logistical forays also significantly increase with boats, again depending on conditions. A fast-moving party, in good conditions, might cover 50 kilometers or more in a single day. Such parties could include men, women, children, and dogs, a composition that is somewhat different from our expectations for a "fast-moving" task group.

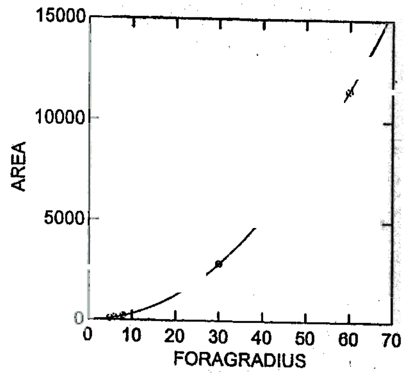


**Figure 2.3.** Total areas in square kilometers within foraging radii of 5, 6, 8, 30, and 60 km.

Despite this potential, foraging areas on the Northwest Coast, at least, are not much larger than those expected for pedestrian hunter-gatherers. I calculated foraging radii based on the size of village territories and group territories on the Northwest Coast (Table 2.2), using figures developed by Schalk (1978). Village foraging radii are usually less than 10 kilometers. They commonly range from 3.5 to 8 km. Only in three instances are they greater. Generally, the foraging radii based on tribal territories represent a single day's one-way trip, with the clear exception of the Southern Tlingit. The radii for three other groups, the Gulf Salish, Kwakwaka'wakw, and Northern Tlingit probably represent 2-day trips, except under good weather and sea conditions. In comparing these distances with the foraging radii for pedestrian foragers (4–6 km) and the distance they can cover in a day (up to 20–30 km), we see that though they are not much larger overall (and there is considerable overlap), they are somewhat larger. In addition, the potential for long logistical forays is clear, even if such forays are not the rule.

Figure 2.4 shows the areas within three levels of trips from the Coast Tsimshian principal towns in Prince Rupert Harbor, British Columbia. The smallest circle encloses a 15-kilometer radius, or a round trip of 30 kilometers, a one-way trip of 3–5 hours. The next circle encloses a 30-kilometer radius, or a 6 to 10 hour trip. This probably represents the maximal daily foraging area. The outer circle has a 60-km radius, a one-way trip of 10–20 hours. This is likely to be the extreme maximum for a 1-day one-way foraging trip (i.e., out to an island where a base camp is located). Interestingly enough, the boundaries of almost all of Coast Tsimshian territory fall between the middle and outer circles (Halpin and Sequin 1990: 268), with the exception of the Skeena River, where the boundary is farther upstream.



**Table 2.2. Estimated Tribal Territories, Numbers of Winter Villages, Village Areas, and Approximate Foraging Radii for Some Northwest Coast Groups (from Schalk 1978, Table 4-5)**

| Group | Area | Foraging Radius (km) | Winter Villages | Villages Area (km²) | Foraging Radius (km) |
|---|---|---|---|---|---|
| Wiyot | 1300 | 11.5 | | 31.7 | 1.8 |
| Yurok | 1900 | 13.9 | | 35.2 | 1.9 |
| Karok | 3200 | 18 | | 29.6 | 1.7 |
| Tolowa | 2100 | 14.6 | | 91.3 | 3.0 |
| Chinook | 3190 | 18 | | 118.2 | 3.5 |
| Quineault | 2190 | 14.0 | | 109.5 | 3.3 |
| Puyallup-Nisqually | 6480 | 25.6 | | 190.7 | 4.4 |
| Makah | 950 | 9.8 | | 190.1 | 4.4 |
| Quileute | 1190 | 11 | | 185 | 4.3 |
| Twana | 2960 | 17.3 | | 211.7 | 4.6 |
| Upper Skagit | 7300 | 27.2 | | 202.9 | 4.5 |
| Nooksack | 3200 | 18 | | 355.8 | 6.0 |
| Straits Salish | 3190 | 18 | | 58 | 2.4 |
| Gulf Salish | 34080 | 58.8 | | 631.1 | 8.0 |
| Kwakwaka'wakw[a] | 21100 | 46.3 | | 727.6 | 8.6 |
| Oowekenoo | 4470 | 21.3 | | 639 | 8.1 |
| NuuChahNulth | 8550 | 29.4 | | 356.4 | 6.0 |
| Nuxalk | 15000 | 39 | | 625 | 8.0 |
| Haisla | 8000 | 28.5 | | 4000 | 20.1 |
| Haida | 10300 | 32.3 | | 926.9 | 9.7 |
| S. Tlingit | 74200 | 86.8 | | 1952.6 | 14.1 |
| N. Tlingit | 25000 | 50.4 | | 2500 | 15.9 |
| Mean | | 27.8 | | | 6.6 |
| Median | | 21.3 | | | 4.6 |

[a] A number of the tribal names used by Schalk and Kelly have been changed or are presently spelled differently. Kwakwaka'wakw has replaced Southern Kwakiutl, Oowekeeno is preferred to Owkino, Nuxalk for Bella Coola, and NuuChahNulth for Nootka.

Some groups did make extremely long residential moves. Mitchell (1971) calculates the total distance traveled annually by households of three Coast Salish groups: the Cowichan, Nanaimo, and West Saanich. The Cowichan made five household moves/annum at a total distance of 450 km (280 miles). The Nanaimo moved four to five times and 483 km (280 miles) annually, and the West Saanich moved three to five times and up to 328 km (200 miles) annually. All three groups lived on the east side of Vancouver Island and moved across the Gulf of Georgia to the Fraser River to exploit the salmon runs, a round trip that would exceed 100 km for each group.

What all these data show is that using boats can increase foraging areas and allow long logistical forays, but it does not inevitably do so. Foraging areas and forays may be the same size among both aquatic and

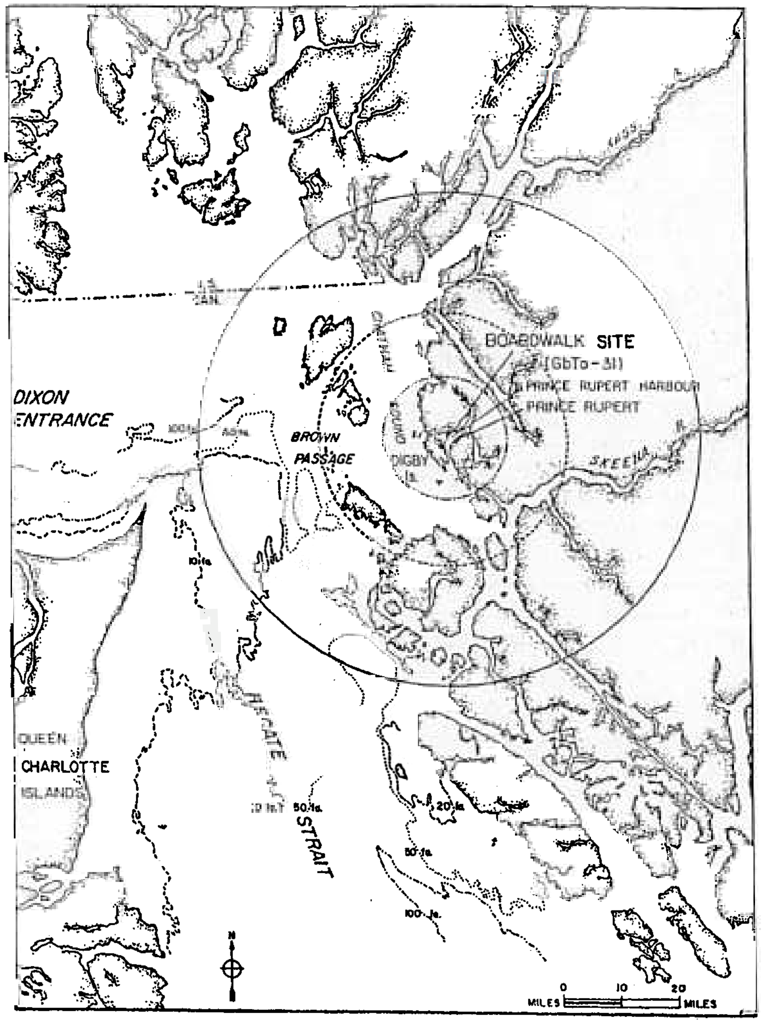


**Figure 2.4.** Map of the northern British Columbia coast. The circles are the areas of the 15, 30, and 60 km foraging radii from Prince Rupert Harbor.



terrestrial hunter-gatherers. Of course, aquatic hunter-gatherers who exploit interior wetlands and lakes may not be able to make long logistical trips. An obvious and not very startling implication of this is that the importance of boats rests with the much greater bulk and weight they can carry than can humans on foot. Another, perhaps less obvious, implication is that boats can facilitate efficient use of small foraging areas by permitting multiple trips on a single day in small areas and the deployment of larger task groups.

## Transport Costs and Bulk Processing

One of the traits that define collectors is large-scale field or bulk processing by task groups. It is this aspect of collectors that creates a distinctive land use pattern and archaeological record. Decisions to field process are based on a variety of factors, including transport costs.

Transport costs are determined by, among other things, the weight and bulkiness of the material to be carried, the available transportation technology, and the transport distance. Pedestrian hunter-gatherers can reduce weight and bulk by field processing before transport. Field processing also increases the net nutritional return from transporting food resources. O'Connell et al. (1990) suggest that three factors affect transport decisions (for meat and bones) among terrestrial foragers: carcass size, size of carrying party, and the distance from the kill site to the residential base. In their work with the Hadza, they found that hunters begin field processing if (1) the piece of meat weighs more than about 15 kg and (2) the residential site is more than about a 2-hour walk away. Transport decisions are also affected by whether the material can be carried in a container and the bulk (weight and volume) of the container (Jones and Madsen 1989; Rhodes 1990). Jones and Madsen, for example, show that the nutritional returns of various Great Basin seeds and insects varied according to the distance they were carried in a burden basket. Some resources, such as grasshoppers, may have very high returns only if the transport distance is very short. The nutritional returns of some resources may increase as transport distance increases. Field processing may also be necessary to permit carrying a resource in a burden basket or pack.

Rhodes (1990) does criticize their modeling on the basis that foragers do not carry foods some of the extreme distances produced in the Jones–Madsen model (e.g., 829 km). However, this does not diminish the point that transport costs affect the net nutritional gains from harvesting foods for people on foot. For aquatic hunter-gatherers, these decisions are based on the load-bearing capacities of boats. Weights that are daunting on foot are trivial in many boats: what is 15 kg in a boat that can easily carry 2000 kg? Even when aquatic hunter-gatherers harvest terrestrial resources, the calculations about whether to transport overland or to process in the field may not be based on the distance to the residential site, but the distance to the boat.

Much of the research on field processing focuses on mammal remains, reflecting in part Binford's focus in his ethnoarchaeological work and his original utility curves (Binford 1978). As noted above, animals taken far from home are butchered in the field, and only the most useful cuts are carried home; the greater the distance, the more rigorous the setting of priorities. In contrast, for aquatic hunter-gatherers, it appears that a great deal of animal processing occurs at the residential site. Not all of it does, but a significant amount will. To a degree, this reflects the realities of fishing and hunting sea-mammals. If a party kills a sea lion in open water, they cannot settle down at the kill site and butcher it, as they might an elk or caribou. The carcass is attached to floats and brought home. It is not surprising then to find archaeological evidence for the return of entire sea-mammal carcasses to residential sites and butchering them there, often indoors (e.g., Huelsbeck 1994). Interestingly, the record on the Northwest Coast is more mixed for terrestrial mammals. At some sites [e.g., Hoko River (Croes 1995) and Ozette (Huelsbeck 1994)], land mammals comprise a trivial part of the faunal assemblage. At Ozette (Fig. 2.2), deer were field butchered, and selected parts were brought back. However, the terrestrial portion of Ozette's catchment was not accessible by boat. At two sites with terrestrial hinterlands accessible by boat—Boardwalk (Stewart 1976; Stewart and Stewart 1996; Ames n.d.) and Namu (Cannon 1991)—deer carcasses came in complete. Where weight or bulk are not significant limiting factors on transport, nutritional returns may not be the prime factor that determine bulk processing and carcass transport. Terrestrial mammals seem to have been hunted as much or more as a source of tool bone as meat in some places. There is evidence of the transport of tool bone to insular logistical sites on the Northwest Coast and Mesolithic Scotland (Ames n.d.; Smith 1992), and to mainland (Huelsbeck 1994) and insular (Ames n.d.) residential sites on the Northwest Coast.

There is little readily available evidence on the spatial distribution of plant processing by aquatic hunter-gatherers. Data from my projects in the Wapato Valley of the lower Columbia River suggests quite strongly that bulk processing occurred primarily at residential sites, at least in the Wapato Valley. At present, the primary evidence for this comes from two Chinookan residential sites located in wetlands close to the Columbia River, near Portland, Oregon. One of these is the Meier site, which contains evidence of a single, large plank structure (Ames et al. 1992), and the other is Cathlapotle, a town of 900 to 1400 people in 1806 that contained at least six very large plank structures (Ames et al. 1999). Both sites were occupied from about 1400 to 1830 A.D. or so.



As observed above, roots contributed significantly to the Chinookan diet. These roots include *Sagitaria latifolia* (wapato) and *Camassia quamash* (camas). Both plants produce large, nutritious corms or bulbs. Wapato grows along lake margins (Darby 1996), whereas camas is a meadow plant (Thoms 1989). There is extensive wapato habitat close to these sites (Darby 1996), but there is no camas habitat close by. In addition to these plants, the Chinook also exploited nut mast, primarily acorns (*Quercus* sp.) and hazelnuts (*Corylus cornuta*). Oak habitat occurs close to both sites, but hazelnut habitat is farther away.

The lake where Lewis and Clark observed Chinookan women filling their canoes with wapato is about 5 kilometers south of Cathlapotle, the closest known Chinookan town to this lake. Cathlapotle is accessible to the lake by foot, either across gentle terrain, or by boat, along a usually placid river. As Lewis and Clark observed, the canoes had to be portaged perhaps 300 meters across a flat meadow to the river.

Ethnographic sources suggest that the standard Chinook storage basket was about 0.8 m in diameter, about the same depth, and had a capacity of 115 liters. Burden baskets were certainly smaller. I have no estimates for Chinookan carrying baskets, but a large Great Basin basket has a capacity of 64 liters (Jones and Madsen 1989). The capacity of the smallest Chinookan canoe—that used for collecting wapato and other wetland resources—was about 400 liters, or almost three storage baskets and seven to eight burden baskets. In addition to its size, the canoe had other advantages. Women collected the corms directly in the canoe, which functioned as both container and transporter. The corms did not have to be collected in a waterborne container, transferred to carrying baskets, and carried to the village, or transferred to canoes. In this instance, the canoes did have to be portaged, an easy task with one person at either end of the full vessel. It is also likely that many more trips were possible in a single day using canoes than going by foot. Further, the number and range of people who could be involved in moving the harvested roots by boat was probably larger. A child who might find a fully laden basket a difficult, awkward load across 5 km could handle a loaded canoe. In this instance, as we will see below, processing was done in town.

The handling of camas (*Camassia quamash*) in other parts in western North America is an illustrative contrast. Both camas and wapato roots were processed by roasting them in earth ovens (see Peacock 1998 for a description of cooking camas; Darby 1996 for wapato). Camas was a significant resource for the peoples of the Columbia Plateau, east of the region discussed here, and in the Willamette Valley to the south. In these areas, camas ovens are associated with camas meadows, sometimes in large numbers (e.g., Thoms and Burtchard 1986). Such features are very rarely associated with residential sites on the Plateau. Camas bulbs were roasted and than made into flour that was transported in baskets to the residential base. Raw bulbs were also transported, at least after the introduction of the horse. Residential bases were often a few days away from the camas grounds. Thus, although a basket of camas flour probably weighed more than the same basket full of unprocessed roots, the nutritional return was higher, despite the additional work. In contrast, earth ovens are primarily (although not exclusively) associated with village sites in the Portland area. There are not concentrations of earth ovens around wapato and camas habitat there as there are around camas meadows on the Columbia Plateau and in the Willamette Valley.

At Cathlapotle, earth ovens and earth oven debris are densely distributed immediately outside the houses. The ovens contain charred camas roots, acorns, and hazelnuts. Wapato tissue has yet to be identified, but finding it will be analogous to finding a charred, peeled potato that is 400 years old. However, preliminary analyses indicate that the densities of camas bulbs in ovens sampled at Cathlapotle are almost as high as those at major interior root grounds (Stenholm 1995). Using canoes, large volumes of raw roots could easily be transported to the residential site. Ovens were then used to process multiple resources, including roots and nuts, rather than single resources.

Coupled with the evidence for bulk processing at these sites is evidence of stockpiling raw materials. Unmodified stone nodules and cobbles were transported to both Meier and Cathlapotle, where they were tested for suitability as tool stone (Hamilton 1994) and either stored or discarded as unsuitable. Raw material and raw material tests form a significant minority of the lithic artifacts at the Meier site, for example. Antler and bone for tools were also curated.

I do not know at present whether these local patterns can be extended to aquatic hunter-gatherers more generally. However, at least on the Northwest Coast, there does seem to be much more bulk processing at residential sites than would be anticipated based on the collector–forager model.

It is possible from the foregoing to propose a model for the aquatic forager landscape. I suggest that bulk processing activities are likely to be strongly focused at the residential site. Harvesting occurs elsewhere; the raw resources (food, tool stone, etc.) are transported to the residential base and processed (or discarded) there, rather than in the field. Thus, there may be more evidence for processing at the residential sites of aquatic hunter-gatherers, even if overall levels of processing are equivalent to those of terrestrial groups. Further, using boats, more resources and bulkier unprocessed resources can be transported to the residential site for processing. This



pattern is predictable for maritime resources, but it may extend to any resources that are accessible by boat. This does not preclude the existence of specialized task camps. Such sites do exist. However, the implication here is that specialized task camps are embedded in a different archaeological landscape than that predicted by the classic collector models.

### Residential Moves and Residential Bases

Aquatic hunter-gatherers generally make relatively few residential moves per year. This must reflect their ability to position themselves centrally and make multiple, short- and long-distance logistical forays. They can also field larger task groups with broad mixes of people, which means that a wide array of tasks can be undertaken from camps. However, they can and do make major residential moves, sometimes for only short periods. On the Northwest Coast, the distances for these moves can be short or rather long (Table 2.3). These moves were usually done seasonally to reposition people near available resources. The 33-km Coast Tsimshian move, for example, is the one-way distance between Prince Rupert Harbor and summer fishing villages on the Skeena River. In this move, entire households and their possessions were freighted to the summer village by the rafts described before. In the fall, they returned with the winter's store of salmon. Such moves were not unusual on the coast. The early nineteenth century NuuChahNulth great chief Maquinna annually moved his entire village lock, stock, and barrel to a fishing locality for a month in midwinter (Jewitt 1967). I described before the lengthy annual moves made by the Cowichan and others. In a system like this, it becomes hard to distinguish a logistical foray from a residential shift involving an entire settlement.

The capacity of boats to transport a range of personnel, men, women, children, and dogs, also suggests that the makeup of even small task-oriented

**Table 2.3. Numbers and Distances of Residential Moves by Some Northwest Coast Groups (from Schalk 1978, Table 4-11)**

| Group | Annual # of Residential Moves | Mean and Range | Mean Distance (km) | Mean Annual Distance (km) |
|---|---|---|---|---|
| Makah | 2 | 2 | 4–6 | 9.2 |
| Gulf Salish | 2.2 | 0–3 | 22 | 48 |
| Straits Salish | 3 | 2–4 | | |
| Kwakwaka'wakw | 2.6 | 2–4 | 8.5 | 22 |
| NuuChahNulth | 2.8 | 2–4 | 8.5 | 22 |
| Tsimshian | 3 | 3–4 | 33 | 100 |

camps may differ from, and the range of activities there may be much broader than those of pedestrian collectors. On the Northwest Coast, for example, it is notoriously difficult to distinguish village from nonvillage sites in the absence of architectural evidence. The potential availability of large parties will also affect decisions about overland transport and processing. The implications of boats, however, go beyond the nature of residential and task group sites.

One of the factors sometimes thought of as leading to increased residential stability (sedentism) is tethering. Hunter-gatherers in arid climates, for example, may be tethered, tied to, water sources. In a similar way, people can be thought of as tethered by winter stores, both by their bulk and by the facilities required to store them. The availability of large boats, however, would either ease or eliminate this limitation.

The ability to move bulk goods also makes available some very unlikely places for villages. For example, in Prince Rupert Harbor, British Columbia, villages were located on three small islands. One of these, Garden Island, has been extensively excavated (Ames 1976, n.d.). The island is located in shallow salt water that probably supported a kelp forest and is easily defended, but it has no fresh water. Garden Island was regularly occupied after about 1400 B.C., and was a village after 1000 A.D., if not much earlier. Rainwater might have been captured in watertight boxes, but it seems more likely that water was ferried in. The site is not far from a small stream, but fresh-water would have to have come in by boat. This must be very unusual, but it does indicate what is possible with boats.

## TRADE, INTERACTION, AND REGIONAL ECONOMIES

Seaworthy boats permit the movement of people and goods, including very bulky items, over long distances. I will briefly explore two implications of this. The first of these is biological. A central problem for any human group, particularly one that is thinly scattered, is finding appropriate mates (e.g., Wobst 1974). Boats can facilitate the formation of potentially far-flung mating networks [and access to distant resources (e.g., Kelly 1995)], ensuring demographic stability and even growth under conditions that would otherwise lead to population declines. This may be in part what underlies Batten's observation that cities on rivers and the ocean were demographically more stable than those in the interior. The formation of far-flung networks would also be part and parcel of the formation of wide social and exchange networks.

On the Northwest Coast, regional systems of exchange seem to have begun evolving as early as 10,000 years ago, and recognizable interaction spheres may have been present as early as 6000 B.C. (Ames and Maschner 1999). In contrast, on the Columbia Plateau in the interior, interaction spheres may not have formed until after 1000 B.C. (Erickson 1990; Galm 1994). Items exchanged on the Plateau were all small and readily transported by foot (Hayden and Schulting 1997). Although such things were traded along the coast, large, bulky, and awkward items were also traded. Boats were not only central in the evolution of regional systems; they were no doubt equally central to the development of specialized production of goods for trade. I have already noted regional specialization and trade of canoe hulls by the Haida and NuuChahNulth. The trade in Haida canoes was part of what is the best example of the role of canoes in this context on the Northwest Coast—the eulachon trade at the mouth of the Nass River.



Eulachon (*Thaleichthys pacificus*) are a particularly oily smelt. They are anadramous, like salmon, but spawn near the mouths of rivers. The major eulachon run on the northern Northwest Coast is the late February, early March run at the mouth of the Nass River. The eulachon arrive in vast numbers at a time when winter stores are low, and what is left is old, dried fish. The smelt can be the first fresh food of the season in this area. Their oil is highly prized. It was a key part of the regional diet and was traded widely across the northern Northwest Coast. It was also carried by porters well into the interior along grease trails defended by small fortresses (MacDonald 1984). The oil was a prestige good (e.g., Oberg 1973) that was served at feasts and burned at potlatches. The Coast Tsimshian controlled the eulachon trade because they owned the spawning grounds. During the run, groups came from all over the northern coast and traded for the oil. They traded slaves, copper, furs, hides, ocher, dentalium, and halibut for it. As they traded for the oil, they also traded among themselves. The Haida brought their freight and war canoes to exchange. All groups returned home with canoes loaded to the gunnels with oil stored in large watertight boxes. To return home, the Haida crossed the stormy waters of Dixon entrance in their largest freight canoes.

## SUMMARY AND CONCLUSIONS

In 1980, Binford defined collectors and foragers entirely in terms of terrestrial mobility. A decade later, he amplified his discussion of collectors and specifically argued for the importance of transport technology in the evolution of collector strategies (Binford 1990). He was particularly concerned in that paper with looking at the relationship between house form and transportation. In this paper, I have examined several related questions, including the role of boats in shaping mobility and bulk processing decisions and the potential relationship between waterborne transport, higher population densities, and greater demographic stability among aquatic hunter-gatherers. I was also interested in the degree to which the archaeological record of aquatic hunter-gatherers can be expected to be similar to or differ from that of terrestrial collectors, and ultimately whether the collector–forager continuum is even relevant in this case.

The evidence developed here indicates that aquatic hunter-gatherers do have higher median and mean population densities than those of their terrestrial numbers. I was unable to explore whether population densities among aquatic hunter-gatherers are more stable through time than those of terrestrial hunter-gatherers, although it seems likely, given the large mating networks that boats potentially facilitate.

It appears that the hinterlands, or foraging areas, of aquatic and terrestrial hunter-gatherers can be the same size, even when the former includes extensive bodies of water. I confess that this result was something of a surprise. I was expecting consistently larger foraging areas for aquatic hunter-gatherers. For day-to-day production decisions, this means that the capacity of boats to allow more time spent foraging, multiple daily trips, and to haul large and bulky loads is crucial. One consequence of this capacity is that bulk processing is concentrated at residential sites, rather than in the field.

A further implication is that aquatic hunter-gatherers may create few or no task specific sites and that residential sites will contain evidence for what may appear to be intensive processing, but which may simply be localized processing. There may also be evidence for an even greater array of activities than is commonly associated with collector settlements.

For example, Aikens et al. (1986) argued that Jomon settlement patterns should reflect increasing levels of logistical organization, as population growth during the Jomon led to increased settlement packing. Bleed (1992) tested this expectation against the artifact contents of the Yagi site, an Early Jomon settlement in southwest Hokkaido, the northernmost island of Japan. He concluded that the diversity of the stone tool assemblage reflected a diverse range of activities and subsistence pursuits, including fishing and marine mammal hunting (Crawford and Bleed 1998). He also suggested that if these people were collectors, they were an odd sort of collector, because there was no evidence of task-oriented sites in the area. He argued that the site's inhabitants were able to acquire all of their food within the standard foraging radius. Bleed is probably correct in this. His characterization of the Yagi occupation nicely fits the expectations for aquatic hunter-gatherers developed in this chapter; most unprocessed foods were brought into the residential site and processed there, and most activities were based there. However, it may be that task specific sites do exist and that they are some distance from Yagi, or that they are indistinguishable from small residential sites, or that they are other residential sites.



There is another methodological issue beyond the obvious one of distinguishing logistical moves from residential moves. Thomas (1989) showed that in the archaeological literature of the Great Basin of western North America, the distinction between a residential site and a task site is often a consequence of how much of a site is sampled, rather than any intrinsic qualities of the sites themselves. A big sample yields a residential site, a small sample a task-specific site. Lyman (1991) shows that for the Oregon coast, volumetric samples in shell midden excavations of 100 $m^3$ are necessary to ensure recovery of architectural features such as postholes—or to ensure that the absence of these features is not sampling error. Thus sampling issues may compound what appears to be the inherent ambiguity of the sites that aquatic hunter-gatherers may produce.

The final questions to be addressed are whether the collector–forager continuum is even relevant to boat-using peoples and whether aquatic hunter-gatherers are different in kind from terrestrial hunter-gatherers, at least in ways that are theoretically important. In one sense, they are collectors, because they move resources to people. However, they may not generate archaeological records easily accommodated to expectations based on the distinction. Further, they tend to have population densities higher than we might otherwise expect. Using the distinction, then, may obscure variability in the record.

Boats are theoretically important. This importance rests, I think, on the capacity to move and process large amounts of resources even across small distances, thus easing potential problems in intensification of production and simultaneously opening possibilities for intensification which would otherwise not be economical. The eulachon described before is a very small-bodied fish that travels (or traveled) in vast schools. Herring is another such fish. To be effectively exploited, they must be taken in vast numbers with small gauge nets or some other device. Such nets are costly in time and labor (Lindstrom 1996). Moseley (Moseley 1975; Moseley and Feldman 1988) argues that the initial basis for the rise of Andean civilization was fishing for small-bodied schooling fish off the coast of Peru. In any case, these are resources that are really useful only if harvested in very large numbers; large numbers require the capacity to move them once caught or once processed. Presumably, the peoples on the coast of Peru transported the dried fish inland by porter. But boats are more effective.

Does the forager–collector continuum even apply? A yes or no answer does not really matter at this point. What matters is that the distinction has given archaeologists an exceptionally productive means for exploring the variation in hunter-gatherer mobility strategies. By learning that it does not fit and why, we learn a great deal.

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*Chapter 3*

# Jomon Collectors and Foragers

## Regional Interactions and Long-term Changes in Settlement Systems among Prehistoric Hunter-Gatherers in Japan

JUNKO HABU

### INTRODUCTION

The purpose of this chapter is to expand the utility of the forager/collector model (Binford 1980, 1982) by examining the dynamics of long-term system change on an interregional scale. Among numerous models of hunter-gatherer behavior, Binford's (1980, 1982) forager–collector continuum has been one of the most frequently cited models of subsistence and settlement organization during the past two decades. As with most formal models of subsistence and settlement (such as optimal foraging models), the forager/collector model assumes that economic rationality is the basic principle that determines hunter-gatherer subsistence strategies and residential mobility. However, unlike optimization models, which are deductive and formal in their structure, Binford's model was inspired by ethnographic examples. Because of its informal and inductive origins, the

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