Prehistoric Subsistence Patterns in the Fraser Delta: The Evidence from the Glenrose Cannery Site

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The aboriginal people of the Northwest Coast had a way of life that was unique among hunters and gatherers, including such unusual traits as inherited social rank, large winter villages, division of labour, large social units and elaborate art. Likewise, salmon fishing and the hunting of sea-mammals are not common among hunters and gatherers and, in fact, the special subsistence pattern is usually thought to be responsible in some way for the other unusual aspects of the regional ethnographic culture (e.g., Drucker, 1955a:3).

In published theories about the origin of Northwest Coast culture we often find a major concern with subsistence patterns. The Asian migration theories of Drucker (1955b) and, at times, Borden (1951) have the maritime subsistence pattern introduced by "Eskimoid" migration. Other views suggest that Northwest Coast culture, including the subsistence pattern, is basically an indigenous development. According to this perspective, espoused by Kroeber (1939) and, at times, Borden (1962, 1968), the development of the Northwest Coast pattern took place *in situ* without major external influences. Implicitly, in this view, the subsistence pattern developed first and, by some mechanism, later allowed the other socio-cultural aspects to come into being.

On the southern coast of British Columbia, development of the local ethnographic pattern is thought to have been fully attained by at least 1500 B.P. at the beginning of the last Gulf of Georgia phase, called "San Juan," "Stselax," "Late," "Developed Coast Salish" and "Gulf of Georgia" by different workers in this area. The preceding "Marpole" phase (1500-2400 B.P.) is also thought to be broadly similar. The third oldest phase, "Locarno Beach" (2400-3200 B.P.), is very much an unknown in terms of subsistence pattern, but workers have suggested that it too is basically similar to that of the ethnographic Northwest Coast (see Borden, 1970; Matson, 1974; Mitchell, 1971a for further details). Examples of older occupations include components dating ca. 5000-3000 B.P. and variously called the St. Mungo, Mayne or Charles phase. One

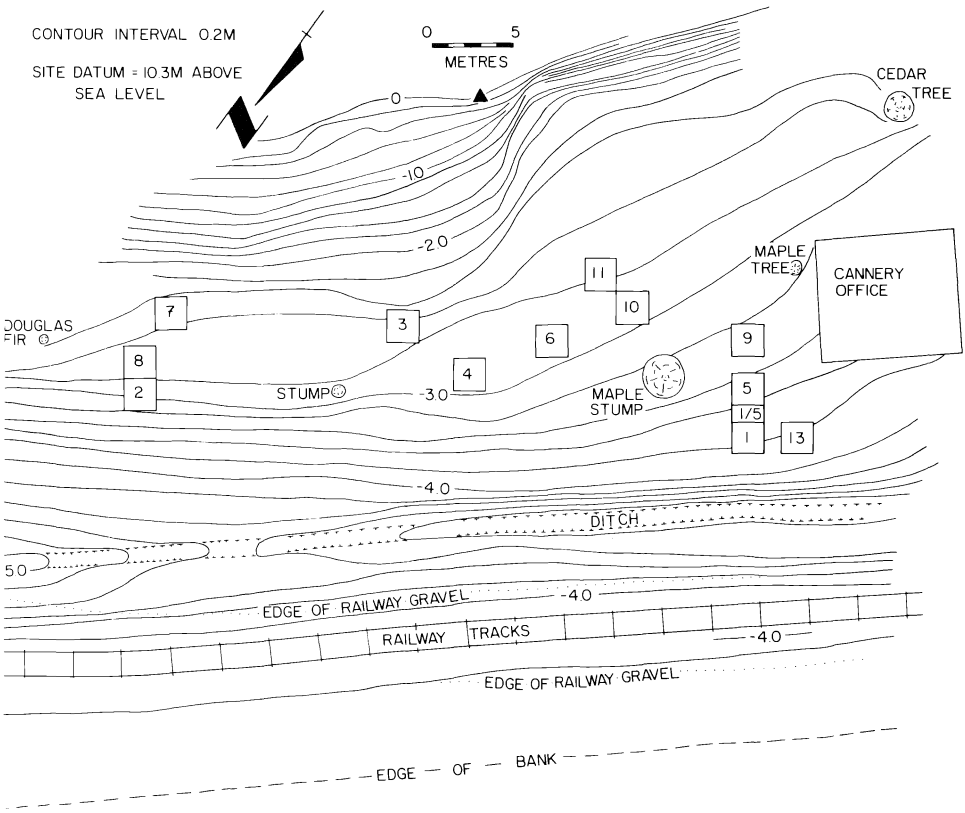

FIGURE 19. Contour map of the excavated area of the Glenrose Site, lower Fraser River, B.C.

of the larger samples from this period and of even earlier occupations occurred at the Glenrose site. The Glenrose site (Figure 19), situated on the south arm of the Fraser River delta opposite Annacis Island, was initially tested by R. Percy in 1969 and later excavated by T. Loy in 1972. On the basis of this latter excavation it was thought that the top of Glenrose was either Marpole, Locarno or "Stselax," and that the bottom of the shell midden was at least as old as the oldest component at the nearby St. Mungo site, i.e., about 3000-4000 B.P. Glenrose thus looked like an ideal place to obtain information about the development of the Northwest Coast subsistence pattern and to further explore the question of the relationship between mode of subsistence and the unique socio-cultural aspects of the Northwest Coast.

REVIEW OF ARCHAEOLOGY

The last glaciation seems to have receded from southwestern B.C. by at least 11,500 years ago (Mathewes, Borden, and Rouse, 1972). Since we know populations were living just to the south and east by 10,500 years ago (Rice, 1972), we can expect people to have been established here by at least 10,000 years ago. However, the earliest known level at Glenrose is about 2,000 years younger than this.

By 8,000 years ago the vegetation was similar to today's, but the relative sea level was perhaps as low as 10 m below that of present. At the time of the first occupation of Glenrose, most immediate post-glacial environmental traumas had passed, and except for the probable absence of the large delta west of the site, a situation not too different from that of today probably prevailed.

From Glenrose we now have eleven radiocarbon dates (Figure 20). The oldest cultural component is dated at 5700-8150 B.P. and is termed the Old Cordilleran component.[1] This is similar to the Milliken-Mazama phase (Borden, 1968), and to some of the material at The Dalles, Oregon, reported by Cressman (1960). This oldest assemblage includes leaf-shaped projectile points, scrapers, lots of pebble tools, retouched flakes, antler wedges, hammerstones and one barbed antler point (Figures 21, 22).

[1] Borden (1975:79) refers to a volcanic ash layer in the Old Cordilleran Component "presumably of Mt. Mazama eruption." This statement was based on an unpublished preliminary report; in fact the "ash" was later examined by an expert and found not to be volcanic ash and so no reference to it was made in published accounts, except this unfortunate mention. The argument presented by Borden for earlier dating of this component is substantially weakened by the absence of ash.

The middle component, dated 4300-3300 B.P., is identical with the oldest levels at the St. Mungo site, 1 km downstream (Calvert, 1970), termed the St. Mungo phase. The Glenrose collection from this period includes a few ground-slate leaf-shaped points and incised decorative slates; lots of bone pendants; bone wedges or "fleshers"; bone awls; leaf-shaped and contracting stemmed points; well-made flaked scrapers; and some pebble tools. One fragment of a small bilateral barbed harpoon — like that found at Helen point on Mayne Island by Carlson (1970) — and some fixed barbed points were uncovered. There are no microblades, ground slate knives or stone celts (one mussel-shell celt was found in this component). Since the Glenrose sample is quite large these absences are significant.

A sterile zone exists in several excavation units between the St. Mungo level and the uppermost component at Glenrose, which belongs to the Marpole phase. The small and not too typical assemblage of Marpole phase artifacts includes many ground slate knives, ground slate beads, a few scrapers, knives and ground slate points. There are also seven microblades, three cylindric microblade cores, a few flaked points, small amounts of chipped stone, various bone and antler tools and two possible harpoons.

Along with the artifacts in all components there were abundant faunal remains. The mammalian and avian remains were analyzed by S. Imamoto, the shellfish remains by L. Ham, and the fish by R. Casteel. All of these are reported at length by the analysts in the site report (Matson et al., 1976). These reports will be first summarized and compared with each other; then subsistence activities will be inferred for each of the three components discussed.

RESULTS OF FAUNAL ANALYSES

Mammals and Birds

The most surprising result of Imamoto's (1976) analysis is the apparent stability in frequency of mammalian remains through all three components at Glenrose. One way of comparing faunal frequencies is through "Minimum Number of Individuals," relatively conservatively calculated. The Minimum Number of Individuals (MNI) is the smallest number of individual animals that would be necessary to account for all the faunal remains found, after eliminating sources of error such as butchering effects and the effect of different species having different numbers of

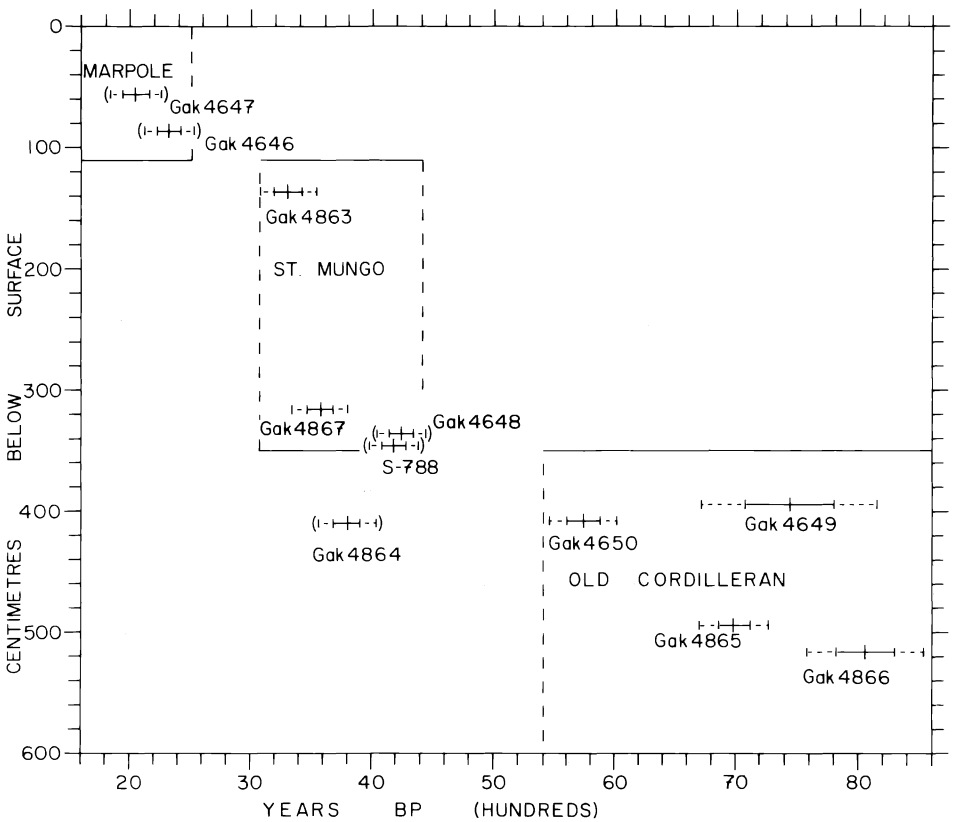

FIGURE 20. Radiocarbon dates from Glenrose plotted against stratigraphic position. Dates from units 1, 5 and 1-5 are shown in the correct provenience. Others (in parentheses) are plotted according to their relative stratigraphic position. One and two standard deviations are shown.

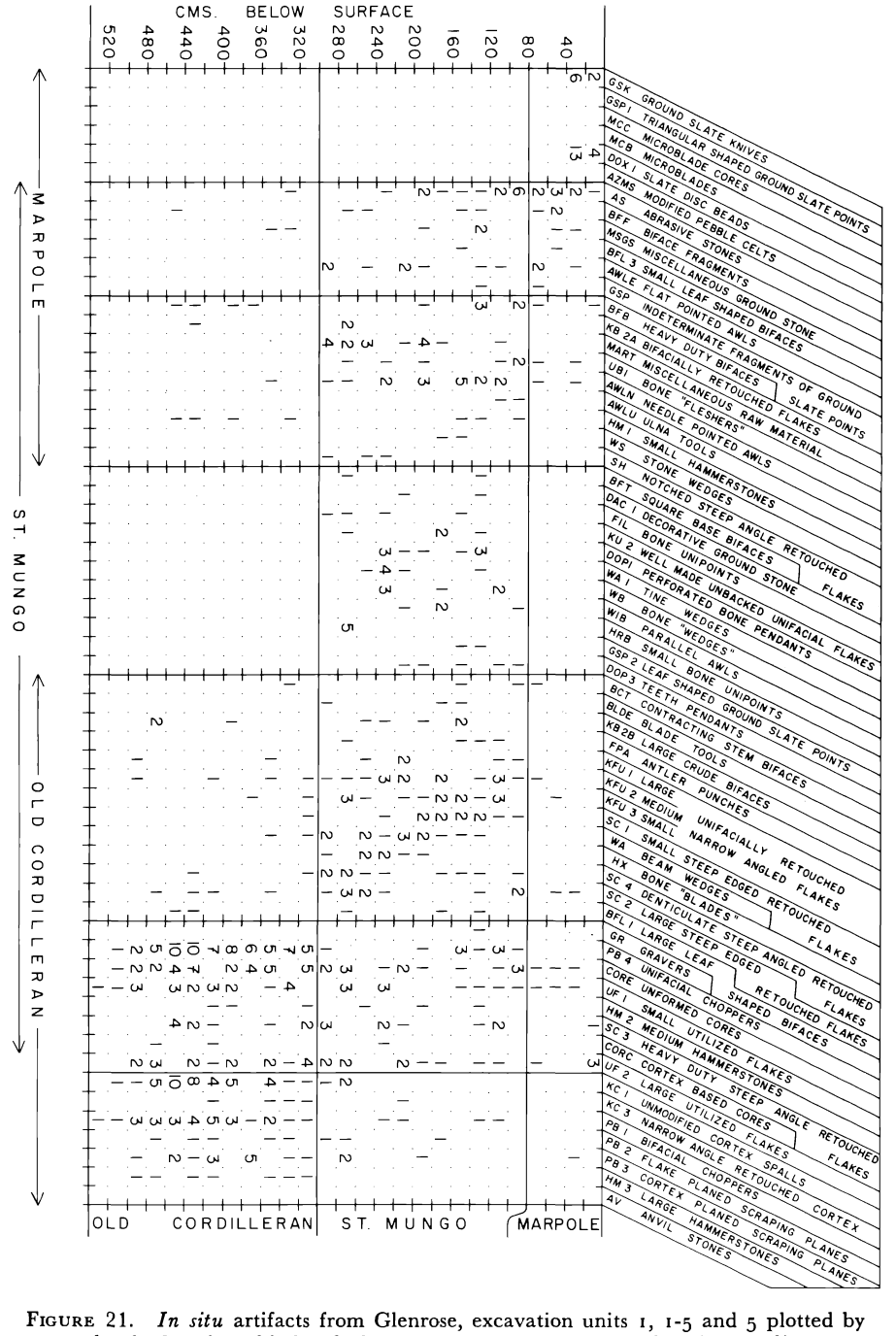

FIGURE 21. *In situ* artifacts from Glenrose, excavation units 1, 1-5 and 5 plotted by 20 cm levels. Stratigraphic breaks between components were used, so levels adjacent to them in this figure are actually 10-30 cm thick. Artifact types are ordered from left to right in relation to the components in which they were most common, as shown by the arrows at the bottom of the figure.

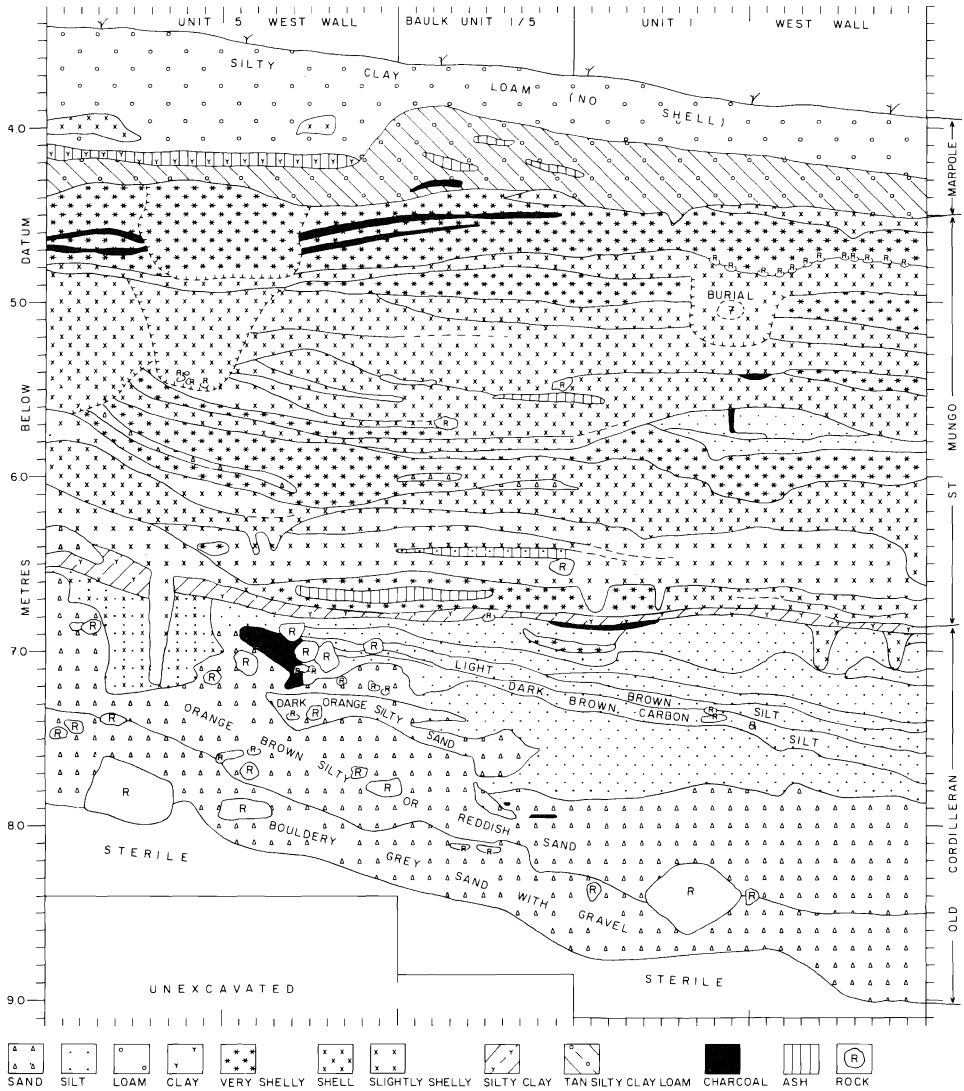

FIGURE 22. Stratigraphic profile of west wall of trench formed by excavation units 1, 5 and the intervening baulk (1-5), Glenrose.

bones. In Table 6 the MNI and identifiable bones are listed according to component. As can be seen, the St. Mungo component (Component II), has greater MNIs than the Marpole component (Component I) or the Old Cordilleran component (Component III).

The results for all genera with MNIs of 4 or greater were statistically tested for significance using all three components.[2] It was found that no mammals — even seals — were distributed in a way that would not occur at least one time in twenty just through sampling error (Matson, 1976: Table 6-1). The same result also occurs if the Old Cordilleran component is compared with St. Mungo and Marpole lumped together. This finding is startling in light of the often stated thesis that sea-mammal hunting developed only recently on the Northwest Coast, perhaps in Locarno Beach times (Borden, 1951; Drucker, 1955b). But, as noted by Imamoto (1976), seals used to regularly ascend the lower Fraser River and their presence does not necessarily indicate an elaborate sea-mammal hunting technology.

While mammals appear to be equally represented among the three components, avian remains appear more common in the St. Mungo and Marpole components (Table 6). Both duck and merganser occur in greater frequency in the St. Mungo and Marpole components than in the Old Cordilleran component and, statistically, goose remains are also probably significantly more common in the recent components (Matson, 1976; Table 6-2). Lumping all bird remains together, the Old Cordilleran component is seen to have significantly lower numbers than the other two components. Additionally, there is probably a more frequent use of birds in the Marpole than St. Mungo phase. Mergansers, in particular, are found significantly more frequently in the Marpole than St. Mungo components.

In general, after applying the statistical test,[2] we can conclude that at Glenrose all mammals occur in the same proportions in all three components. This statement is especially true of seals, the only sea-mammal

[2] If we assume that the MNI are a random sample of the faunal remains from the site we can calculate the probability of the observed frequency of a single genus occurring by repeated sampling of a single homogeneous population. By doing this we can discover which classes of faunal remains do differ significantly between components. Thus if a kind of animal is unlikely to occur in the observed frequencies by repeated sampling of a single population we can be relatively certain that it was not used in the same frequency in all thirteen components. The test used is a variant of the Median extension tests called a quantile test (Bradley, 1968:207, 237; Conover, 1971:107). The null hypothesis that we are testing in this case is that the proportion (or quantile) of each class of faunal remains is the same in each component. The test statistic used is an approximate chi square.

SPECIES	CULTURAL COMPONENT	NO. INDIVIDUAL FRAGMENTS	MIN. NO. OF INDIVIDUALS	ANTLER	SKULL FRAGMENTS	MAXILLA	MANDIBLE	ATLAS/AXIS	SCAPULA	HUMERUS	RADIUS	ULNA	INOMINATE	FEMUR	PATELLA	TIBIA	CARPAL	TARSAL	CALCANEUM	ASTRAGALUS	METAPODIAL	PHALANX FIRST	PHALANX SECOND	PHALANX THIRD	OTHER POSTCRANIAL
ELK	I	5	2																						
CERVUS	II	57+	14	6	2		2		2	1	1	1	.	2		3		3	3	4	1	6	4	5	10+
CANADENSIS	III	12	3	2												3						2			3
DEER	I	34+	8		1		2		2	2	1	1									4	3	5	2	9+
ODOCOILEUS	II	44+	13	2							3	3	1			1	1	4		1	9	4	3	2	10+
HEMIONUS	III	11	4	1									1				1	1			6			1	
BEAR	I	4	4					1		2															1
URSUS	II	5	2																1	1					3
AMERICANUS	III																								
CANIS?	I	19+	7		X	1	5+			2		1		3		5									2+
	II	36+	17		X	5	6+	1	5	4	2	2				5		2	1			X	X	X	2+
	III	2	2																						2
BEAVER	I	6	3			1				1								1							3
CASTOR	II	44	17			1	7		3	2	2		4	2		4	1		3						15
CANADENSIS	III	4	4				1			1				1											1
RACCOON	I	1	1																						
PROCYON	II	4	2			2	1			1															1
LOTOR	III																								
MINK	I	1	1		1																				
MUSTELLA	II																								
VISON	III	2	2				2																		
SMALL RODENT	I																								
FAMILY	II	3	3				3																		
PEROMYSCUS	III	1	1											1											
SEAL	I	6+	3			1	1			7	1		3			1		2				X	X	X	1
PHOCA	II	23	10		2	1	2			1		1	1	1		1									5
VITULINA	III	3+	2																						X
GOOSE	I	6	5																						6
SUBFAMILY	II	22	16							1						1									20
ANSERINAE	III																								
DUCK	I	7	5																						7
SUBFAMILY	II	1	1							1															
ANATINAE	III																								
MERGANSER	I	5	5																						5
SUBFAMILY	II																								
MERGINAE	III																								
SWAN	I																								
SUBFAMILY	II	5	4							3							1								1
CYGNINAE	III																								
COMMON LOON	I																								
GAVIA	II	1	1																						1
IMMER	III																								
WESTERN GREBE	I																								
AECHOMORPHUS	II	1	1																						1
OCCIDENTALIS	III																								
BALD EAGLE	I																								
HALIAEETUS	II	X	2				VERY				FRAGMENTED														
LEUCOCEPHALUS	III																								

TABLE 6

Summary of Faunal Remains Found at Glenrose

found in any frequency. In contrast to great stability in mammalian frequencies we find that avifauna are generally more common in St. Mungo and Marpole than in Old Cordilleran components, and are most frequent in the Marpole component. While it would be tempting to assume that this difference is due to changes in hunting technology, it may also be correlated with the build-up of the Fraser Delta.

Imamoto (1976) calculated the relative dietary importance of different animals by multiplying MNI by "average amount of usable meat" supplied by an average individual of each kind. The results by component are shown in Figure 23. Here it is easily seen that elk (or wapiti) contributes the largest single amount of usable meat to the aboriginal Glenrose diet.

Less than half as important as elk are deer and seal, which seem to contribute equally to the diet. Note that while seal occurs early, its importance remains constant and is second only to elk. It is also worth noting that while avifauna are important indicators of activities, they are almost insignificant sources of usable meat.

Fish

R. Casteel's (1976) analysis of the Glenrose fish remains seems to support Imamoto's main conclusions of stability in animal resource utilization. In fact Casteel concludes that the fish found at Glenrose do not significantly differ from those in the lower Fraser today. Casteel analyzed two samples of fish remains. One was picked from the screens of a single complete excavation unit during the excavation and the other was two sets of small column samples collected, examined and sorted according to an exacting methodology he has developed. As he argues, even though the amount of fish remains recovered is much less in the column samples than in the excavation unit samples, they are superior in most ways to those collected from the screens because of their greater sampling reliability. The results of this analysis are shown transformed into percent of identified remains found in each component, in Figure 24. Note that this is not MNI, or percent of usable meat. The whole unit screenings were dominated overwhelmingly by salmon and sturgeon, from late Old Cordilleran through Marpole times (Figure 25) (Casteel, 1976).

Examination of Figure 24 shows that the identifiable bone elements of major fish types are numerically constant throughout Glenrose. Salmon dominates the assemblage from the beginning and, taking into account the

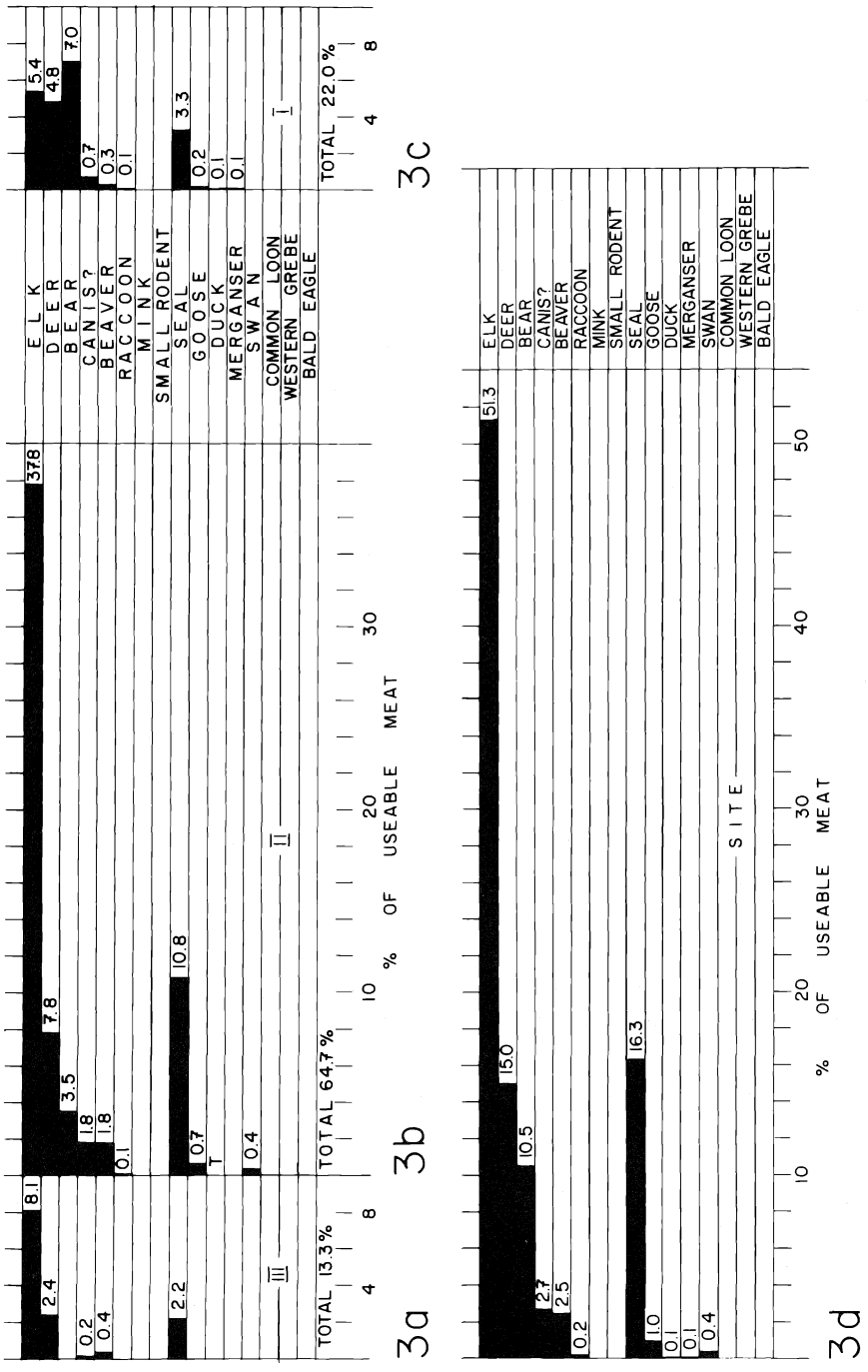

FIGURE 23. Calculated usable meat represented by Glenrose faunal remains: (a) Old Cordilleran; (b) St. Mungo; (c) Marpole; (d) Site totals.

size of sturgeon, it also must have been very important (see also Figure 25). However, some of the smaller and presumably less important fish do show changes through time. The most obvious of these is herring, which is found only in the two column samples from the Marpole component (no herring were found in the screened sample). Statistically, the absence of herring from the St. Mungo and Old Cordilleran components is significant.[3] Herring, which were historically taken by "rakes," seem to have been a recent addition to the fishing activities.

Another fish which seems to vary in importance through time is stickleback. Sticklebacks (*Gasterosteus aculeatus*) are not ethnographically known to have been used in the Gulf of Georgia area. Sticklebacks are very small, but even today in the Yukon Delta they are trapped in wickerwork traps (McPhail, pers. comm.). A small, clear, freshwater stream does flow near the Glenrose site and may have been the source of these fish. Whether sticklebacks were deliberately trapped or caught by youngsters at play, they indicate site use in late spring and summer. The fact that they did turn up in six of sixteen column samples suggests that they were originally caught in large numbers. Sticklebacks are statistically more common in the older (lower) part of the midden.

Neither sticklebacks or eulachon remains were found in the two column samples from the Marpole component. Since these are both good late spring-early summer seasonality indicators it would be desirable to know if their absence in the Marpole samples could be accorded to chance. However, statistical tests showed that these indicators of the late spring-early summer season are indeed absent in the Marpole component. This, of course, is in good agreement with the presence in this component of herring, which are most easily obtained in large numbers in late winter.

With these exceptions, the fish remains show a pattern of marked stability through time, with even the relative importance of various species generally remaining constant. However, samples from the Old Cordilleran levels may not date back to the beginning of this component because the radiocarbon dates are from units which did not have preserved faunal remains. Salmon is by far the most important species throughout, with sturgeon probably next, in terms of dietary value. Both of these increased in importance in St. Mungo and Marpole times (Figure 25). The minnow/suckers and flounders are of secondary importance, perhaps followed by eulachon. Finally, in the Marpole component, herring may also be of some importance while eulachon are absent.

[3] The Fisher Exact Test; at .01 significance level (Bradley, 1968:195; Matson, 1976).

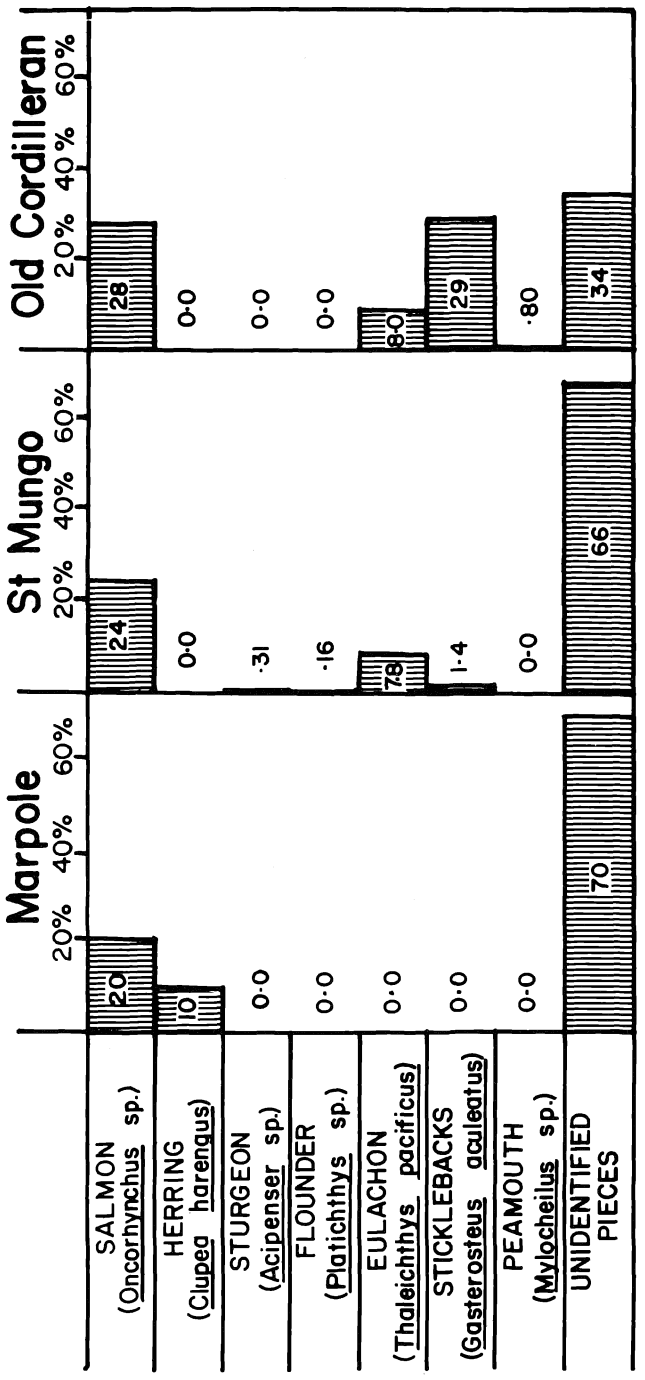

FIGURE 24. Percent of total fish remains from Glenrose column samples. Note that these figures do not represent minimum numbers of individuals.

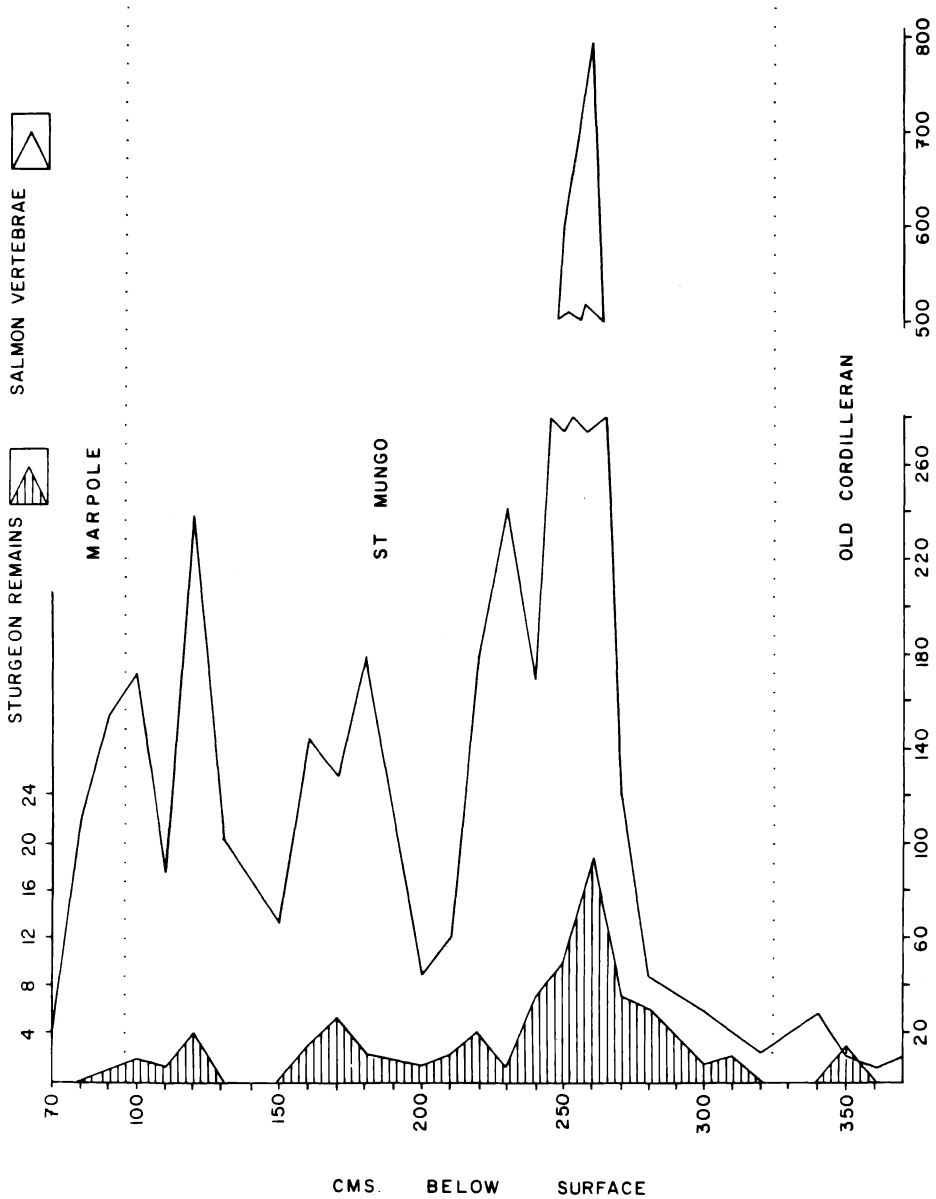

FIGURE 25. Whole unit screenings from Glenrose excavation unit 1: Salmon and sturgeon remains. Numbers at left of graph refer to the numerical frequency of identifiable sturgeon elements; numbers at right refer to the numerical frequency of identifiable salmon elements.

Shellfish

The shellfish remains were analyzed by L. Ham (1976), who produced a number of interesting results. The bulk of his analysis was based on column samples taken from three excavation units. As is seen in Figure 25, shellfish are essentially absent in the Old Cordilleran component, but are very frequent in the more recent components. The great majority of shells are *Mytilus edulis*, the bay mussel, with lesser amounts of barnacles also occurring (Ham, 1976).

Ham (1976) calculated a rough food value measure for the mussels by collecting live specimens and determining the relative proportion of meat-to-shell, by weight. He was thus able to come up with a figure showing how much meat was represented by a given amount of shell (Figure 26). We were also able to estimate from the column samples the total amount of shellfish meat represented in the volume of the Glenrose midden actually excavated. This was compared with the avian and mammalian usable meat weights, based on MNI. For the St. Mungo and Marpole components the calculated meat weight of mussel was more than that for all mammals combined (e.g., 2,050 kg for Marpole mussel; 1,191 kg for all Marpole mammals; 6,078 kg for St. Mungo bay mussel; 3,509 kg for all St. Mungo mammals). Even granting the uncertainties involved in calculating these figures for both shellfish and mammals, the bay mussel must have been at least as important overall as the most important mammal in the aboriginal diet.

No other shellfish except barnacles occurred in any significant amount. While bay mussel was found in places in the Old Cordilleran component, it occurred in only small amounts, as shown in Figure 26. However, shellfish are not only important as a component of diet, they also can be used to infer seasonality. This is because shells grow by a series of seasonally incremental rings, which can be studied and interpreted. The few relatively complete mussel valves from the Old Cordilleran component indicate a summer occupation, agreeing with Imamoto's (1976) interpretation of the mammalian fauna. In the St. Mungo and Marpole components some relatively complete clams were recovered. Ham (1976) was able to show that these reflect an increasing presence of silt tolerant species, to be expected as the Delta built up. On the basis of shellfish growth rings Ham concluded that the Marpole component was occupied during the winter and the St. Mungo component occupied throughout the year.

The finding of year-round occupation for the St. Mungo component

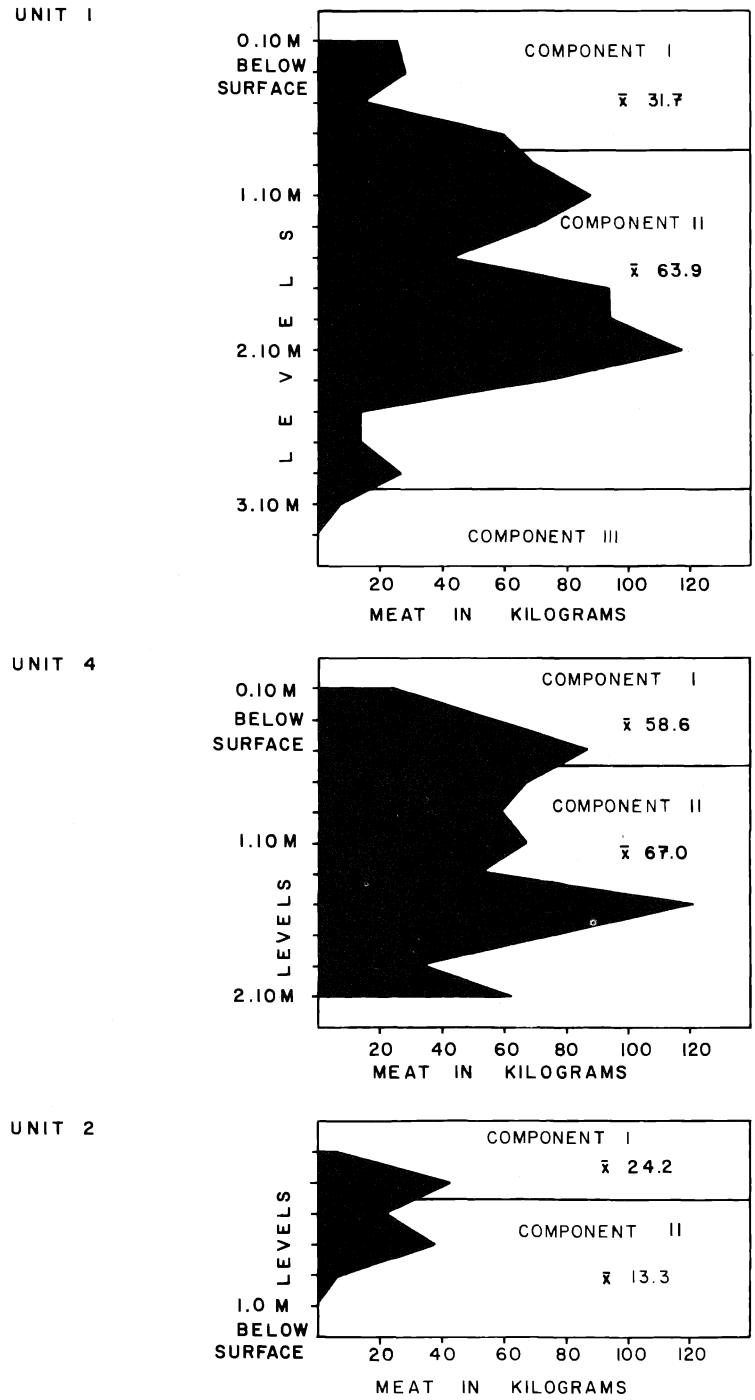

FIGURE 26. Reconstructed meat value of Glenrose shellfish, by level.

agrees with Imamoto's (1976) results for the mammalian and avian remains. However, Imamoto interpreted a summer and fall occupation for the Marpole component. When I re-examined the seasonality evidence from the Marpole component it was clear that the fish and shellfish data were much more precise than the mammalian and the evidence referred to by Imamoto could be consistent with fall or early spring, as well as summer.

SUMMARY OF SUBSISTENCE PATTERNS

Old Cordilleran Component

In the Old Cordilleran component (at least that portion for which we have faunal remains) elk was the most important land-mammal in terms of usable weight, followed by equal proportions of deer and seal, which were only about one-third to one-quarter as important as elk. No other mammalian remains contribute as much as 10 percent of elk. During this time mussels were gathered, at least during the summer, and fishing focused on salmon, distantly followed by sturgeon, flounder, eulachon, squawfish and sticklebacks. The relative importance of these resources is difficult to evaluate but, in terms of recovered remains, mammals seem to be most important, followed by fish, with shellfish occurring rather rarely. There are no indicators for seasons other than summer. The dominance of land-mammals in the lowest component of Glenrose is also in accord with other, inland, Old Cordilleran sites, where fishing and freshwater shellfish collecting were also carried out (Bense, 1972:41).

St. Mungo Component

In the St. Mungo component we find an increase in all sorts of faunal remains, but a disproportionate increase in the amounts of shellfish and fish remains. Elk persists as the most important mammal, followed by seal and deer, which are individually only one-third as important. Smaller numbers of bear, *Canis* and beaver occur, with relatively insignificant amounts (in terms of usable meat) of racoon, goose, duck and swan. Mussel is very common, averaging about 25 percent by weight of the midden. As we have shown, this probably makes *Mytilus* more important than any of the mammalian fauna.

Among the fish, salmon remains are found in very large quantities, with lesser amounts of flounder, peamouth, sturgeon, eulachon and, in the lower levels, stickleback. Salmon may represent the most important faunal resource for this component, whereas other fish categories occur in

much smaller amounts and are probably not as important as elk or bay mussel.

Almost all of the summer and fall indicators found in the Old Cordilleran component also occur in the St. Mungo component. Thus juvenile deer, elk, seal and beaver indicate a summer and fall occupation. However, stickleback and eulachon suggest a late spring or early summer occupation, with salmon again possibly indicating fall. Clam growth-rings point to summer as well as winter use and the avian fauna also suggest a winter occupation. This apparent year-round occupation could, of course, be the result of the site having been used for alternating seasons over short periods of time. No trends from one season to another were discovered with the St. Mungo component, but the evidence for seasonality and the nature of the site suggest that such trends could exist and not be detected by us.

In contrast to the Old Cordilleran component, dominated by land-mammal hunting, the St. Mungo subsistence pattern is dominated by riverine and foreshore resources. Bay mussel appears to be the most important resource, probably followed by salmon. With the addition of other kinds of fish and sea-mammals (seal), land-mammals become a subordinate part of the pattern. However, the Old Cordilleran and St. Mungo components share most of their artifact types, although differences in frequency certainly do occur (Matson et al., 1976).

Marpole Component

In the Marpole component the three important mammals are elk, deer and seal, as before. While bear contributes a lot of the calculated usable meat, this is probably due to using the MNI concept with low numbers of identified bear remains. These four mammals are followed in importance by smaller amounts of *Canis*, beaver and raccoon. Goose, duck and merganser are not very important in terms of usable meat, but they do occur in much larger amounts than before, indicating a definite change in resource utilization.

Ham's (1976) shellfish analysis shows that mussel is important in this component and that less frequent clam species show a shift to more silt-tolerant varieties. Fish remains from the level-bags show that salmon was still important and that lesser amounts of sturgeon and flounder were recovered, while the column samples show that salmon and herring occurred in this component. The late spring and summer indicators of eulachon and stickleback are significantly absent from the Marpole com-

ponent. Thus, while mammalian fauna were seen to be the same as in the older components, significant shifts occurred in all other categories, along with an apparent change in seasonality.

Shellfish seasonality indicators show a strong winter emphasis for the Marpole component. Fish remains, especially the presence of late winter herring and the absence of eulachon and stickleback, indicate a winter use as well. It must be kept in mind that there is a sterile layer representing a 1,000-year hiatus between the St. Mungo and Marpole components, so that a gradual shift over time in site-seasonality is possible.

As in the St. Mungo component, the Marpole faunal remains are dominated by riverine and foreshore resources. At other Marpole sites we have evidence of substantial structures, suggesting that the essentials of the ethnographic winter village pattern had been achieved by this time (Mitchell, 1971a:54). The finding of a winter seasonality at Glenrose is in agreement with this view.

DISCUSSION

How do the subsistence patterns reconstructed from the Glenrose faunal remains relate to the evolution of the Northwest Coast subsistence system? First, if one describes the ethnographic subsistence pattern simply in terms of presence or absence of resources utilized, one is clearly describing a way of life with a long history. Even sea-mammals (seals) are found in parts of the Old Cordilleran component, and appear to be as common then as they were in Marpole times. Salmon is usually considered the most important resource in the ethnographic pattern and it is also abundantly represented in parts of the oldest component at Glenrose. Other ethnographically important resources such as eulachon and sturgeon are also found in the oldest portions of the site. Ethnographically the most important land-mammals were elk and deer, and they were also the most important in the Old Cordilleran component. Even shellfish gathering is found in parts of this component. If such traits are used one would have to grant the existence of the ethnographic subsistence pattern at least 6,000 years ago. Other non-subsistence evidence also suggests continuities with the ethnographic pattern. For instance, antler wedges occur in some quantities in the Old Cordilleran component and these are usually correlated with plank houses and canoes. However, if one looks at relative frequencies of faunal remains one easily sees a vast difference between the Old Cordilleran and Marpole components at Glenrose. Unfortunately the historical relative importance of various resources is not readily available

One interesting result of a switch to winter occupation is that shellfish gathering must have been done mainly at night, because winter has shorter days and low tides tend to be at night. If the shellfish were not primarily gathered at other summer sites during Marpole times, the switch to winter seasonality was costly and would not have been done unless there was some kind of offsetting advantage.

In general, the St. Mungo component appears to be well on the way towards the ethnographic Northwest Coast subsistence pattern. However, other Northwest Coast attributes such as sedentariness, large plank houses and ranked societies do not seem to be in evidence, although one very nicely carved antler object was found. Overall similarities in artifacts and faunal remains between the Old Cordilleran and St. Mungo components suggest *in situ* continuous development, rather than migration from outside.

The exact relationship between the St. Mungo phase and later Fraser Delta phases is unclear. At Glenrose the sequence is interrupted by a 1,000-year hiatus and comparisons with the Locarno Beach phase are hampered by sparse reporting of Locarno components. The only Locarno component which is fully reported is Montague Harbour I, in the Gulf Islands (Mitchell, 1971a), and there the artifacts do appear to be substantially different from the St. Mungo assemblage of Glenrose. However, the distance and different environmental setting may account for some of this variance. Evidence concerning Locarno phase subsistence patterns has been too sparsely reported to allow any specific comparison with the Glenrose data.

At Glenrose, the Marpole component subsistence pattern can be thought of as developing from that of the St. Mungo component, with a switch in seasonality. The artifacts are very different from those of the St. Mungo Component, but again there is the 1,000-year hiatus to consider. It appears that at least by Marpole times the technology had developed to allow for winter sedentary villages, perhaps through development of efficient storage and preservation techniques. It has also been suggested that development of gillnets might have been a factor allowing enough sockeye salmon to be taken along the Lower Fraser for full winter supplies (T. Northcote, pers. comm.). This hypothesis might be tested by an examination of gillnet technology and species level identification of salmon remains (which is now possible under some conditions).

In summary, the Northwest Coast subsistence pattern has a long history of development. It appears possible that the Northwest Coast ethnographic pattern developed *in situ* through some unknown mechanism(s).

from the ethnographic record, and similarities and differences between the Marpole component at Glenrose and the later ethnographic pattern cannot be satisfactorily dealt with at this time. Thus in many respects the whole "larger question" cannot be firmly answered, not because of a lack in the archaeological record, but because of insufficient ethnographic documentation. However, on the basis of strictly archaeological information, the faunal remains from the Marpole component at Glenrose appear to be similar to those at the Marpole sites reported by Carlson (1960) and to an unpublished analysis of mammalian remains from DhRt 3, a Marpole phase site on the Musqueam Indian Reserve (D. Brown, n.d.; Borden, 1970; Monks, 1976). Moreover, the available information on faunal remains of late prehistoric sites suggests a generally similar pattern (Capes, 1964: 22-43; Carlson, 1960).

Given the inadequacies in the ethnographic data, what can be said about changes in subsistence pattern through time on the lower Fraser? First, the stability in frequency of mammalian remains through time is surprising. However, since the first occupation of Glenrose is at least 2,000 years after the probable earliest occupation of southwestern B.C., there was sufficient lead-time for an optimal mammalian harvest pattern to develop. Once developed, it would remain constant, except when it conflicted with, for example, a new fish procurement scheme.

The fact that seals were important in Old Cordilleran time and did not thereafter increase relative to other mammals suggests a very early development of optimal sea-mammal hunting strategies. Moreover, since other kinds of sea-mammals, except for northern sea-lions, are not really available in the Fraser Delta, there is no reason to assume that other sea-mammals could not have been hunted elsewhere in the Gulf of Georgia region at equivalently early dates.

One item that does change greatly through time is shellfish, which apparently begins to dominate the diet about 4,300 years ago. Why and/or how this should happen is not self-evident. Fladmark's (1975a:253) suggestion that it occurred only after a winter village pattern based on salmon was established does not seem to fit with the Glenrose findings, where seasonality evidence for the St. Mungo component suggests that occupation took place during all seasons of the year. Since the Old Cordilleran component was a summer occupation and the Marpole component was a winter occupation, one is tempted to suggest that within the St. Mungo component there was a transition from a summer to a winter utilization of the Glenrose site. However, I am unable to either prove or disprove this idea.

The full development had not yet occurred by 3300 B.P. at the end of the St. Mungo phase, although all or almost all of the elements of the subsistence pattern were present at that time. On the other hand a migration of a group with a sedentary way of life and ranked society could have occurred at the end of the St. Mungo phase, or at the beginning of the Marpole phase. There is some evidence suggesting that Marpole phase people did have inherited social ranking, which might indicate that the full Northwest ethnographic pattern had developed by this time.

It is obvious that there are still many questions about the origins of the Northwest Coast subsistence pattern. Further, the relation between the subsistence pattern and other social-cultural aspects, while generally accepted to be very important, is unclear. These questions are significant ones which need to be recast in light of the Glenrose evidence.