CHAPTER 1

Introduction

The vertebrate faunal remains recovered from the Central Coast site of Namu (ElSx-1) (Fig. 1) are a rich source of information concerning the changing patterns of fauna utilization in the region. The descriptive data of taxonomic abundance and fauna characteristics presented in Chapter 2 are the basis for an interpretation of the prehistoric economy and settlement of the site over the period from 7000 cal. B.P. to approximately the time of European contact. The data indicate a long-term pattern of marine resource utilization, in which changes in the availability of salmon played a key role in the scale of site settlement and cultural activity (Chapter 4). The faunal data also make it possible to monitor long-term changes in minor resource utilization,

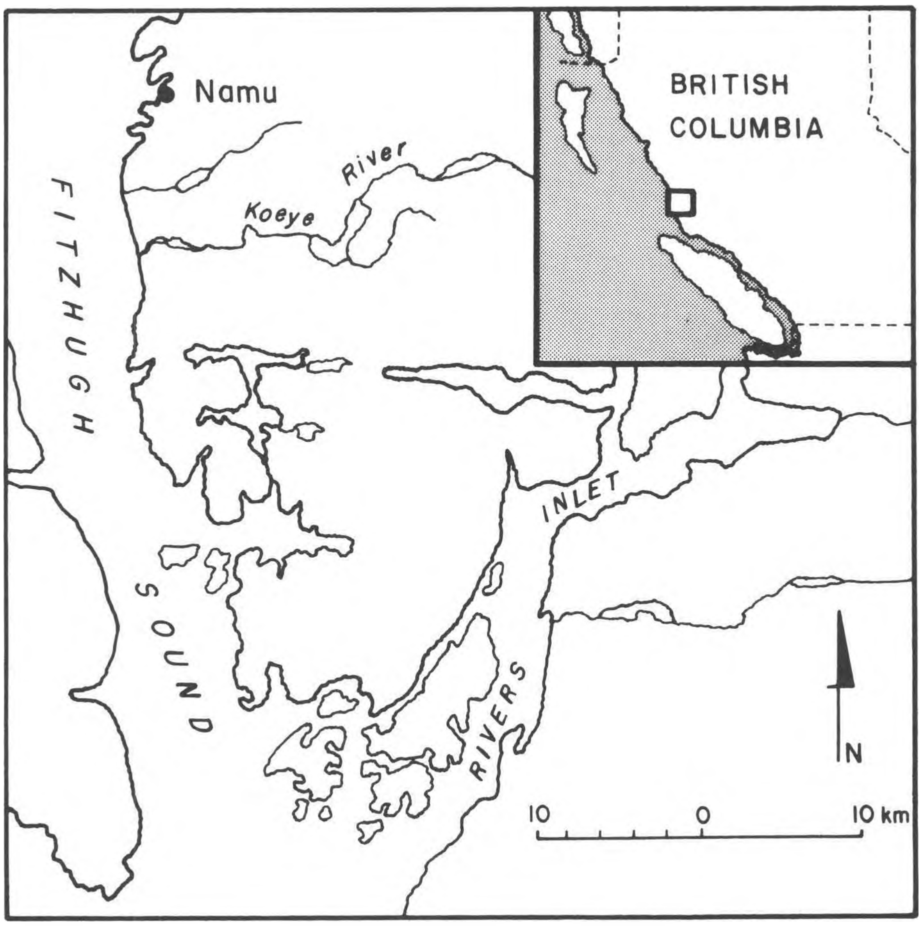

Figure 1. Map Showing the Location of Namu on the Central Coast of British Columbia.

which appear to reflect a combination of shifting cultural emphasis and fluctuations in resource availability in the site vicinity.

The interpretation of economic trends is based on the data generated from the recovered faunal remains, but the economic interpretation of faunal data requires more than the simple recovery and identification of faunal remains; it also requires the mutual resolution of three individually complex analytical problems, which include: 1) the quantification and comparison of zooarchaeological materials; 2) the determination of shell midden site formation processes; and 3) the explanation of culture change. In the chapters that follow, the evidence and procedures used to resolve these problems are discussed at length.

SITE EXCAVATION AND TEMPORAL UNITS

Faunal data are grouped and presented (Appendix A) according to the excavation units illustrated in Figure 2. The bulk of the faunal material was recovered from two main excavation units: the Central Main Trench excavated in 1977 and the Rivermouth Trench excavated in 1978. The data from the excavation units illustrated in Figure 2 are listed by unit in Appendix A; they are grouped by the major temporal divisions outlined below.

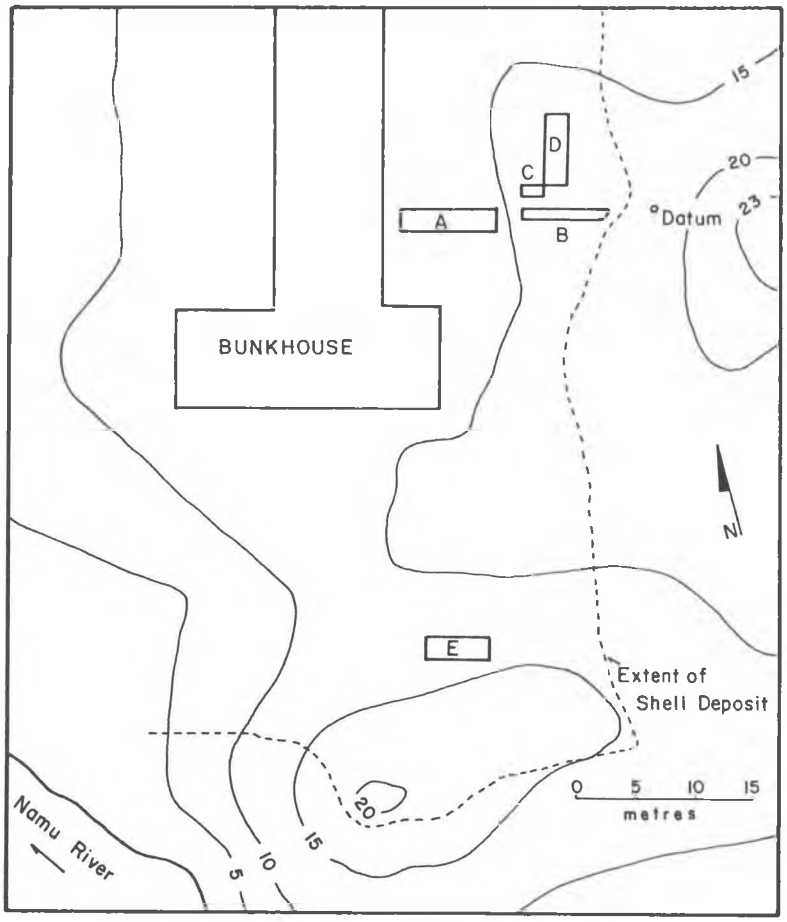

Figure 2. Site Map Showing the Location of Excavation Units. (See Table 1 for Unit Designations)

The simple description of faunal-class abundance by horizontal and vertical provenience units is an acceptable presentation format, but it provides a very limited basis for the discovery and interpretation of patterns and trends in faunal-resource utilization. Low per-unit frequencies and unknown sampling effects introduce too many extraneous sources of variability at this scale of analysis. The interpretation of changes in faunal abundance is greatly improved by grouping the materials within meaningful larger-scale temporal units. Ideally these would be based on the finest stratigraphic divisions for which accurate temporal resolution was available. Moderate to fine-scale stratigraphic divisions identified in the course of the Namu excavations cannot be assigned precise dates, but even if these micro-stratigraphic units could be dated they could not provide a clear picture of trends in faunal abundance. Variable deposition factors and low faunal frequencies within some strata would have obscured larger-scale patterning, especially among the less abundant faunal classes.

The aim of this study was to define and interpret larger-scale patterns and trends in fauna utilization. The analysis is based on major stratigraphic divisions, which can be placed within an absolute chronological framework, and which contain sufficient faunal material to allow for clear identification of within unit characteristics and between unit variations. Five major time periods are represented by the fauna-bearing deposits, which date between 7000 cal. B.P. and the period of European contact. For each of the excavation units shown in Figure 2, Table 1 lists the excavation levels associated with these major time periods. The lowermost fauna-bearing levels of the Rivermouth Trench represent intrusions of Period 2 shell and faunal remains into what are otherwise Period 1 levels. None of the Period 1 deposits yielded faunal remains. Table 2 is a summary listing of the stratigraphic designations and range of radiocarbon dates associated with each major time period.

(See Carlson: Appendix B for a full discussion of the dating and periodization of the deposits).

FAUNA RECOVERY AND ANALYSIS

Recovery

All excavated matrix was screened through 1/8 inch (3.2 mm) mesh screen, and all visible faunal material retained in the screens was recovered for later identification. Different screening techniques were used during the course of the site excavations. Much of the site matrix was dry-screened (the matrix was shaken through screens), but a significant proportion was wet-screened (water from a pressurized hose was used to wash the matrix through the screen). The humic portion of the matrix was black and sticky, and the visibility of faunal material varied according to the humic content of the deposits and the screening method used. Water-screening significantly increased the visibility and recovery of faunal remains, particularly the smaller remains such as fish.

A variable proportion of material from different periods was wet- or dry-screened (Tab. 3), which undoubtedly affected the quantity of identified fauna. Faunal abundance should be greater for periods in which a greater proportion of the matrix was water-screened. The potential for distortion is compounded by the likelihood that the recovery of faunal remains varied according to their size. Periods with a greater proportion of dry-screened matrix might exhibit an over-representation of larger fauna such as deer, and an under-representation of smaller fauna such as fish. Given this potential for distortion, and the implications for subsequent interpretation, it was necessary to gauge the impact of the water-screening effect.

Table 1. Temporal Periods and Associated Excavation Units.

Period	Unit	Levels
A - Central Main Trench 32-34S, 2-10W (1977)		
5	2-4W	30-90 cm. DBS
	4-6W	45-90 cm. DBS
	6-8W	60-130 cm. DBS
	8-10W	80-180 cm. DBS
4	2-4W	90-130 cm. DBS
	4-6W	90-(150-160)/(160-170) cm. DBS
	6-8W	130-(170-180) cm. DBS
	8-10W	180-193 cm. DBS
3	2-4W	130-170 cm. DBS
	4-6W	(150-160)/(160-170)-240 cm. DBS
	6-8W	(170-180)-280 cm. DBS
	8-10W	193-280 cm. DBS
2	2-4W	170-190 cm. DBS
	4-5W	190-220 cm. DBS
	6-8W	—
	8-10W	—
B - 32-33S, 0-7E (1977)		
6	0-2E	— 2-4E 40-120 cm. DBS
	4-6E	40-150 cm. DBS
	6-7E	40-140 cm. DBS (No Fauna)
5	0-2E	40-90 cm. DBS
	2-4E	120-160 cm. DBS
	4-6E	150-200 cm. DBS
	6-7E	140-190 cm. DBS
4	0-2E	90-110 cm. DBS
	2-4E	—
	4-6E	—
	6-7E	—
3	0-2E	110-120 cm. DBS
	2-4E	—
	4-6E	—
	6-7E	—
2	0-2E	120-170 cm. DBS
	2-4E	160-210 cm. DBS
	4-6E	200-230 cm. DBS
	6-7E	190-230 cm. DBS (No Fauna)

(Unit Designations in Metres from Site Datum; Levels in cm. DBS (Depth Below Surface)).

Continued...

Table 1. Continued

Period	Unit	Levels
C - 30-31S, 0-2E (1977)		
5	—	30-90 cm. DBS
4	—	90-120 cm. DBS
3	—	120-150 cm. DBS
2	—	150-180 cm. DBS
D - 24-30S, 2-4E (1977)		
6	24-26S	50-70 cm. DBS
	26-28S	50-(110-130) cm. DBS
	28-30S	40-130 cm. DBS
5	24-26S	70-130 cm. DBS
	26-28S	(110-130)-160 cm. DBS
	28-30S	130-160 cm. DBS
3	24-26S	130-180 cm. DBS
	26-28S	160-180 cm. DBS
	28-30S	160-190 cm. DBS
2	24-26S	180-210 cm. DBS
	26-28S	180-240 cm. DBS
	28-30S	190-250 cm. DBS
E - Rivermouth Trench 68-70S, 4-10W (1978)		
5	4-6W	30-(140-150) cm. DBS
	6-8W	50-160 cm. DBS
	8-10W	50-160 cm. DBS
4	4-6W	(140-150)-280 cm. DBS
	6-8W	160-280 cm. DBS
	8-10W	160-260 cm. DBS
3	4-6W	280-290 cm. DBS
	6-8W	280-290 cm. DBS
	8-10W	260-280 cm. DBS
2	4-6W	290-360 cm. DBS
	6-8W	290-370 cm. DBS
	8-10W	280-350 cm. DBS

A water-screening effect is evident in the frequency of bone recovered from individual excavation units. The effect is most evident in the Rivermouth Trench. In unit 68-70S, 6-8W the matrix was dry-screened to an excavated depth of 290 cm. DBS (Periods 3-5); the remainder of the unit (Periods 1-2) and the whole of the two adjacent units were wet-screened. Dry-screening resulted in a significantly lower rate of faunal recovery (Tab. 4). Given this absolute recovery effect, and its expected size bias, the problem was to determine the comparability of fauna recovered from different strata and different excavation units.

Table 2. Temporal Periods, Field Strata-Designations, and 14C Date Range.

1977 Excavations

Period	Strata	14C Range
6 - 2000 cal. B.P. - contact	7,8	1405±120 B.P.
5 - 4000-2000 cal. B.P.	5D,5E,6	3330±90 - 2185±85 B.P.
4 - 5000-4000 cal. B.P.	5B,5C 4	300±125 B.P.
3 - 6000-5000 cal. B.P.	4	4775±130 - 4700±125 B.P.
2 - 7000-6000 cal. B.P.	2B,4A	6060±100 - 5240±90 B.P.

1978 Excavations

Period	Strata	14C Range
5 - 4000-2000 cal. B.P.	IV,V	3500±100 - 2530±160 B.P.
4 - 5000-4000 cal. B.P.	IIIC,IIID	4390±160 -3825±105 B.P.
3 - 6000-5000 cal. B.P.	IIIB	4680±160 B.P.
2 - 7000-6000 cal. B.P.	IIB	5700±360 - 5170±90 B.P.

Table 3. Screening Methods Used for Each Excavation Unit and Temporal Period.

Water-Screened	Dry-Screened
	A - 32-34S, 2-10W (All Periods)
	B - 32-33S, 0-7W (All Periods)
C - 30-31S, 0-2E (Period 2)	C - 30-31S, 6-8W (Period 5)
D - 24-30S, 2-4E (All Periods)	
E - 68-70S, 4-6W (All Periods)	E - 68-70S, 6-8W (Periods 3,4,5)
6-8W (Periods 1,2)	
8-10W (All Periods)	

Although less bone was recovered from dry-screened deposits, the potential for distortion of temporal trends also depended on variation in the recovery of bone from different faunal classes and different period deposits. A recovery effect based on screening technique was likely to vary according to the humic content of the period matrix and the size of the faunal remains. Unfortunately it is difficult to compare wet- and dry-screen recovery because the abundance of faunal remains can vary as the result of a variety of deposition factors. It was only possible to gain a rough appreciation of the potential distortion of screening effects by comparing the recovery of fauna from adjacent units of the Rivermouth Trench.

Table 5 lists the quantities and unit percentages of selected faunal classes for each of the 2x2 metre excavation units of the Rivermouth Trench. The dry-screened unit (6-8W) produced much less fish bone than either of the two adjacent units. The quantity of mammal bone is also generally less in the dry-screened unit. To compare the recovery rates from the period deposits it was necessary to convert the faunal frequencies to percentages. The period frequency of each faunal class was divided by its total abundance in the excavation unit. The percentage figures then could be compared between units to determine whether the proportional recovery of fauna was consistent for each period within the wet- and dry-screened units.

Table 4. Frequencies of Identified Fauna from Units of the Rivermouth Trench

	Unit 6-8W	Unit 4-6W	Unit 8-10W
Identified Mammal			
Period 5	65	49	164
Period 4	283	384	456
Period 3	7	19	47
Identified Bird			
Period 5	9	6	30
Period 4	6	18	36
Period 3	10	2	9
Identified Fish			
Period 5	1179	1511	5085
Period 4	6159	29638	11891
Period 3	38	1283	5647

(Unit 6-8W - dry-screened, Units 4-6W, 8-10W - water-screened).

The figures in Table 5 indicate that the period proportions of deer *(Odocoileus hemionus)* and harbour seal *(Phoca vitulina)* are consistent for the wet- and dry-screened units. On this basis it would appear that the variable humic content of the deposits did not affect the proportionate recovery of large mammal bone. The absolute quantity of recovered mammal bone will vary according to the proportion of deposits that are wet- or dry-screened (Tab. 6), but the nature of the period matrix does not appear to introduce any additional distorting effect.

The proportionate recovery of fish remains (salmon *(Oncorhynchus sp.)* and rockfish (*Sebastes sp.*)) also appears to be comparable between wet- and dry-screened units, at least for Periods 4 and 5. However, fish are proportionately under-represented in the dry-screened Period 3 deposits (Unit 6-8W). The Period 3 matrix has a greater humic content, and the absence of water-screening evidently decreased the visibility of fish remains in these deposits. The abundance of fish in Period 3 is probably greater than is indicated by the recovered and identified specimens. This problem is taken into account in the interpretation of temporal trends in fauna utilization (Chapter 4).

The most serious distortion of temporal trends is likely to result from differential screening of variable proportions of period deposits. As the figures in Table 6 indicate, the volume of water-screened matrix is roughly comparable for Periods 4, 5, and 6. Screening effects should have little affect on comparisons of faunal abundance between these periods. The most significant variation in water-screened volume is in Periods 2 and 3. Relatively little of the Period 3 matrix was water-screened, and an under-representation of fish, bird, and small mammal might be expected as a result. Taken as a percentage of period fauna, mammal remains will be somewhat over-represented in Period 3 (see Chapter 4). Eighty-five percent of the Period 2 matrix was water-screened, and some over-representation of small faunal remains might be expected as a result. However, because of the low shell content and higher acidity of the Period 2 deposits, the enhanced recovery of small bone is probably offset by poorer preservation.

It is impossible to quantify the effects of recovery and preservation. It is only possible to note where the effects are comparable between periods, and where significant differences exist that might affect interpretations. Taking these cautions into account, the recovered vertebrate faunal remains can still provide a sound basis for the interpretation of change in the site economy.

Table 5. Frequencies and Period Percentages of Selected Fauna within Dry- and Wet-Screened Units of the Rivermouth Trench (68-70S,4-10W).

	DRY-SCREENED				WET-SCREENED			
	Unit 6-8W		Unit 4-6W		Unit 8-10W		Units 4-6W, 8-10W	
	N	Unit %	N	Unit %	N	Unit %	N	Unit %
Oncorhynchus sp.								
Period 5	1099	15.3	1225	3.9	4263	20.3	5488	10.5
Period 4	6056	84.2	28714	92.1	11198	53.3	39912	76.4
Period 3	37	0.5	1241	4.0	5561	26.5	6803	13.0
Sebastes sp.								
Period 5	34	47.9	140	27.9	366	57.7	506	44.6
Period 4	37	52.1	347	69.3	238	37.5	585	51.5
Period 3	0	0.0	14	2.8	30	4.7	44	3.9
Odocoileus hemionus								
Period 5	27	18.2	23	11.7	106	40.2	129	28.0
Period 4	119	80.4	166	84.7	142	53.8	308	67.0
Period 3	2	1.4	7	3.6	16	6.1	23	5.0
Phoca vitulina								
Period 5	6	4.7	3	1.8	4	1.7	7	1.8
Period 4	123	95.3	162	98.2	213	93.0	375	95.2
Period 3	0	0.0	0	0.0	12	5.2	12	3.0

Table 6. Wet- and Dry-Screened Matrix Volume (m3) by Period.

Period	**Wet-Screened**		**Dry-Screened**	
	Volume	%	Volume	%
6	4.0	59.7	2.7	40.3
5	18.6	48.2	20.0	51.5
4	9.6	58.9	6.7	41.1
3	1.2	8.8	12.5	91.2
2	1.4	85.1	2.0	14.9

Identification

The precision of faunal identification is governed by: 1) the skills of the analyst; 2) the availability of a comprehensive comparative collection; 3) the preservation and condition of recovered faunal remains; and 4) the distinguishing morphological characteristics of skeletal elements. Each of these conditions plays some role in determining the faunal-class frequencies presented and discussed below.

All of the fish, bird, and mammal remains were identified by the author with the aid of the Simon Fraser University, Department of Archaeology zooarchaeology comparative collection. Fish and mammal remains were identified in 1977 and 1978; bird remains were identified in 1987. Some slight improvement in the analyst's ability to identify specimens did occur over the period of analysis between 1977 and 1978. Identification consistency was maintained through rechecks of material analyzed earlier. The one major inconsistency concerned the family Cottidae (sculpins), which was only identified in the 1978 assemblage. Although Cottidae was certainly present in the 1977 faunal assemblage, its under-representation is not significant given its low abundance and minimal economic value.

All potentially identifiable specimens of fish, bird, and mammal were catalogued, and only a small percentage remained unidentified at the end of the analysis. Given the fragmentary nature of most of the unidentified bone, it is unlikely that more thorough analysis would change the results appreciably. Certainly no significant classes of fauna have been overlooked. Most unidentified material can be expected to belong to one of the identified classes, while any additional classes would be represented by only a very small number of isolated elements.

The extent to which faunal remains could be dentified was largely a function of the availability of comparative specimens. Fortunately, the Simon Fraser University collection possessed a comprehensive range of specimens from all faunal classes likely to be encountered in a Northwest Coast shell midden. Nevertheless, there were specific collection-imposed limits to identification, particularly of species within families. For example, species within the families Mustelidae (mink, marten, weasel, etc.) and Otariidae (fur seal, sea lion) could not be consistently determined using the available comparative material. Most bird families were missing some member species, and some species were missing from virtually all fish families. Unless morphological distinctions are pronounced, species identification requires that all species be present, and often requires, in addition, that multiple specimens of each species be available in order to assess and account for intra-specific variation.

An additional problem was the partial state of some comparative specimens. In some cases partial specimens restricted identification to family (e.g. Otariidae, for which only a partial sea lion and an immature fur seal were available), while in other cases only a limited range of elements could be identified (e.g. *Enhydra lutris* (sea otter)). However, the restrictions imposed by the collection often were only minor. Even with a complete collection, the ability to identify elements to species often is restricted due to the morphological variation within species or the lack of morphological variation between species.

For many of the identified faunal classes, morphological similarities within families or genera made species distinctions difficult or impossible. Several classes of fish are affected by this problem. Salmon species *(Oncorhynchus sp.)* cannot be distinguished on the basis of morphological differences in most commonly preserved and recovered elements (D. Cannon 1987:5), though a technique for age determination from salmon vertebrae (discussed in detail in Chapter 5) provided some indication of probable salmon species (Cannon 1988). In addition, it is not generally possible to distinguish the many different species of the genus Sebastes (rockfish), or the individual species of Hexagrammidae (greenling) apart from *Ophiodon elongatus* (ling cod).

Among birds, there are a number of problems in distinguishing species within families, except in cases in which there are clear size differences. Ducks present a particular problem since they make up a large proportion of the recovered bird remains, and potentially represent a variety of species from a number of distinct habitats. The identification of duck remains was guided by an exhaustive study of the morphological variations in waterfowl skeletal elements (Woolfenden 1961). Woolfenden's (1961) study clearly indicates that the majority of waterfowl elements cannot be identified below the level of family or sub-family, even with the aid of a complete comparative collection, which has multiple specimens of individual species. This was the only case in which an authoritative guide could be used to help set the limits of taxonomic identification.

The significance of identification limitations depends on the application of the information. The aims of the present study are weighted toward the determination and interpretation of long-term patterns in faunal-resource utilization, environmental change, and the intensity and seasonality of site occupation. The differential condition and identifiability of remains from different species does not seriously impede these goals. Identification limits are comparable across temporal units, and it is temporal change rather than inter-specific comparisons within temporal units that is the main focus of this study. Comparison of taxonomic abundance on a crude ordinal scale also helps to minimize the effects of variable scales of identification.

In most cases, coarse levels of identification make little appreciable difference to interpretation. Unidentified species among the Mustelidae (mink, marten, etc.) and Aythyinae (diving ducks), for example, all share habitat, utilization, and seasonal characteristics. In contrast, the presence of constituent species of the family Otariidae (fur seal, sea lion) would indicate differences in habitat and exploitation technique, but the overall abundance of this class is so low that it is preferable to present the family frequency and acknowledge the presence of both constituent species than it is to present species frequencies when some identifications may be in doubt.

Preservation of faunal remains, particularly in the early deposits, in which the shell content is extremely low, also affected the frequency of recovered bone, though standardized comparison helped to compensate for variable bone preservation (see Chapter 4). Temporal trends indicate that differential preservation between classes is probably not a serious problem. Some classes of large mammal (e.g. harbour seal) are relatively infrequent in the early levels of the site, while some classes of fish (e.g. dogfish) are most abundant in these levels. The reverse is true for other classes of mammal and fish.

Additional Analysis

In addition to taxonomic identification, the side, portion, state of epiphyseal fusion, and other age characteristics were determined for each element. Although some of this information is used in the following analyses and discussions, many of these data were originally determined for the purpose of calculating minimum number of individuals (MNI) estimates. This particular quantitative measure of species abundance has been the subject of much criticism (see Grayson 1979, 1984), and it has been shown that MNI values vary widely according to a variety of different influences. Therefore, MNI is not used to assess relative faunal-class abundance; the number of identified specimens (NISP) is used as the basic measure of relative abundance. NISP also presents problems in interpretation; it varies as a function of the size of the animal and the survivability of its constituent elements, but it is possible to compensate for this problem by basing comparisons on ordinal scales of magnitude.

Shellfish

Although this report presents a comprehensive discussion of the palaeo-ecology and economy of Namu, the recovery and analysis of faunal material concentrated exclusively on mammal, bird, and fish remains. There was virtually no analysis of shell, which is by far the most abundant class of faunal remains within the midden deposit. This exclusion does not imply that shellfish are insignificant to the problems under consideration, but the sampling and analysis of shellfish remains was the major focus of earlier excavations at the site (Conover 1972, 1978), and the results of this earlier analysis are incorporated into the interpretations presented below. A detailed analysis of the shellfish remains from the 1977 and 1978 excavations would have provided little additional environmental or subsistence information.