A CULTURAL ANALYSIS OF FAUNAL REMAINS FROM THREE ARCHAEOLOGICAL SITES IN HESQUIAT HARBOUR, B.C.

by

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Abstract

This study examines the proposition that among the prehistoric hunter-gatherers of Hesquiat Harbour, west coast of Vancouver Island, British Columbia, the geographical area exploited, and hence animal resource selection, was controlled by land use patterns limiting local groups to specific tracts of territory. It suggests that the interaction of the land use system with the environmental diversity of Hesquiat Harbour creates a sub-regional level of resource specialization recognizable in archaeological sites as variation in emphasis on animals from different habitats among the faunal assemblages.

A specific proposition, developed from pertinent ethnographic and environmental information, relates land use patterns with a specific pattern of diversity among the faunal assemblages from three archaeological sites, DiSo 1, DiSo 9 and DiSo 16. The emphasis on different habitats one would expect to find at each site are predicted. The faunal assemblages, comprising 49,770 skeletal elements and 135,777.4 grams of shell, are described and compared, using relative frequency of skeletal element count and shell weight. The differences and similarities are discussed in relation to sampling and preservation factors, local environmental change, season of exploitation, change through time in material culture and habitats exploited.

A statistically significant association of assemblages with different habitat emphases is found to account for the major proportion of the inter-assemblage variation. Observed patterns of habitat emphases are compared with those predicted. Actual emphases in the assemblages of DiSo 16 and DiSo 1 are positively correlated with the predicted patterns, but those of DiSo 9 differ. The differences are consistent with demonstrated local environmental change and a wider territory of exploitation.

The analysis suggests that a simple, autonomous local group level of sociopolitical organization was present in Hesquiat Harbour at least 1,200 years ago and demonstrates that the natural environment defined by socio-cultural organizational factors is an important influence on regional faunal assemblage patterning on the Northwest Coast.

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Chapter I

Introduction

Archaeologists have generally related cultural differences among contemporary faunal assemblages in the same region to either technological variation or the seasonal exploitation of different microenvironments. Less attention has been paid to the way in which organizational principles of sociocultural systems might function in channeling the selection of resources by a particular group. This dissertation examines the proposition that among the prehistoric hunter-gatherers of the west coast of Vancouver Island, the geographical area exploited by a group, and thus the microenvironments and seasonal resources within it, was delineated and controlled by cultural patterns of land use that associated groups with clearly defined tracts of territory. It is suggested that because of environmental diversity along the west coast of the island, the actual resource base of a culturally defined sub-unit of a regional adaptation was not necessarily the same as the regional resource base available to the whole adaptive system. This would result in differing intra-regional emphases on particular resources. Consequently one might expect considerable diversity among faunal assemblages from archaeological sites in the same region, which could not be satisfactorily explained by technological differences or variations in season of exploitation.

Jochim, writing of the value of an ecological approach to archaeology, recognizes the difference between the ecologically available resource base of an area and that actually exploited by a group, but stresses technology and value systems rather than the operational principles of the socio-cultural organization as the defining factors:

> "This approach focuses on the structuring of the relationship of a group to its natural environment, with primary consideration given to characteristics of the natural environment...it must be remembered, however, that the exploited natural environment is c culturally defined, so that the "cognized" environment may differ from that seen by the ecologist. Specifically, the definition of exploitable and desirable resources depends, to a large extent, upon technology and value systems, and this process of definition must be examined."
>
> (Jochim 1976:9)

Martinez also distinguishes a "cultural environment" from the ecological environment, but like Jochim, focuses on technological and ideational variables.

> "Not all the environment that surrounds a given society is consciously realized by its members; there is a neutral or indifferent part of their surroundings that does not affect the development of their social life because the cultural baggage of the moment does not contain the knowledge and tools necessary for its exploitation. On the other hand, there is another part of the environment composed of a series of elements considered to be subsistence resources, which taken together constitutes a "culturally integrated space"; the latter is an abstract idea of the environment in the collective mind of the group, which could be called the "cultural environment".
>
> (Martinez 1979:313)

It is a "cognized", "culturally" defined natural environment that is here considered the major contributing factor to inter-assemblage variability among eight faunal assemblages from three archaeological sites in Hesquiat Harbour, west coast of Vancouver Island, but one defined primarily by socio-cultural organizational principles rather than technology or ideas of what is or is not edible.

Technological and value system variables operate at the regional level, affecting sub-regional units equally, except perhaps in the case of individual or family food taboos or the like. But the socio-cultural organization of a regional population into discrete units of production and consumption with set territories, <u>creates</u> a sub-regional level of variation directly related to individual site use and season of occupancy. If the autonomous socio-political group inhabiting a site is also the autonomous socio-economic unit of production and consumption within a clearly defined and strictly maintained territory, the resource base available to the inhabiting group is territorially bounded and fixed by culturally imposed limits. When the territories so bounded also differ among themselves in habitats, the result must be differing local group adaptations to local faunal resources and differing faunal assemblages in the sites of different territorial units of the same regional adaptation.

An examination of Nootkan ethnography indicates that this was the case in Hesquiat Harbour immediately prior to contact. It is suggested here that it was also the case for the earlier prehistoric inhabitants of the harbour, and that the effects of such a socio-cultural organization are observable in the manner in which faunal assemblages differ among archaeological sites in the harbour.

The implications of this approach to the Hesquiat faunal assemblages are broader than the accurate reconstruction of a particular regional prehistoric adaptation. In the Northwest Coast, where faunal assemblages are often large and well preserved records of extractive, productive and consumptive activities, the importance and potential of this data set is becoming increasingly apparent. The inclusion of faunal analyses in Northwest Coast archaeological site studies, rather than brief and uninformative lists of species present, is becoming more common, as is witnessed by recent works (Friedman 1976; Gleeson 1970; Matson 1976; Monks 1977; Connover 1972). It is accordingly important that the interpretation of faunal patterning be improved, taking into account all possible sources of variation.

Customarily we distinguish four major sources of variation in observed faunal frequencies and distributions within and among sites: differences in the adaptive systems responsible for the deposition of the remains; variation in preservation attributable to the effects of the depositional environment on different faunal remains, or to differing depositional environments; variation resulting from post-depositional disturbances; and sample bias arising from archaeological techniques of recovery and quantification.

Archaeologists are accustomed to considering the patterning exhibited among faunal assemblages in the light of the last three s sources of variation, as all have received considerable attention in recent literature (Binford 1977). The clustering of remains within sites in activity areas and among sites because of varied site use and purpose have been studied with increasing sophistication (Abbott 1972; Binford 1962; Plog 1974; Streuver 1971), while recently Jochim (1976), Schiffer (1976), Yellen (1977) and Binford (1978) have ably demonstrated the complicated nature of the relationships between living systems and the spatial patterning of their material remnants in and on the ground. Thus archaeologists are increasingly knowledgeable about the difficulty of translating static archaeological facts into living systems.

The first source of variation is, of course, that which we seek to decipher. That archaeological faunal assemblages are cultural, representing the <u>selected</u> exploitation of certain animalrresources from the total available animal resources base, by a particular group of people at a particular place and time, has been recognized for a long time (Bokonyi 1973; Daly 1969; Reed and Braidwood 1960). It is the identification of what structures that selection that is important.

Many archaeologists agree that characteristics of the natural environment interact with socio-cultural variables, that the interrelations define the adaptive structure specific to a particular socio-cultural system, and that these interrelations influence the selection of resources. The definition of those interrelations, then, must take into account the variables of both spheres. Considerable attention has been paid to the constraints of the natural environment in shaping adaptive structures. Such factors as seasonal availability of resources, microenvironmental localization of resources and predictability of resources have all received attention (Coe and Flannery 1964; Roll 1974; Schalk 1977; Stewart 1975; Yesner and Aigner 1976). The constraints and opportunities of particular technologies (Kew 1976; Oswalt 1976) and the relationship between predator and prey (Casteel 1973; Elder 1965; Shawcross 1973) have also been considered. The application of systems theory and a revitalized cultural ecology to archaeological data has emphasized the complexity and multidirectional interactions of particular adaptations to particular environments. As a result, archaeologists understand more clearly how technology, scheduling, and the natural environment interact to structure the faunal resources selected for exploitation by a particular prehistoric group. What has received short shrift to date, is the influence on resource selection and therefore faunal patterning in sites, of the manner in which a society organizes access to its animal resources.

Catchment analysis has attempted, with some success, to define culturally delineated geographical areas associated with specific sites. In the classic catchment analysis as used by Vita-Finzi and Higgs (1970:687) and by Rossman (1976:98), geographical areas likely to have been exploited from a site are defined by measures of either temporal or physical distance from the site, without regard to possibly conflicting claims. While Zarky (1976:118-120) refines this approach by considering, in a regional context, the percentage of various environmental zones contained within a catchment area, the assumption is still that the site occupants have unrestricted access to all territory within a determined distance of that site. These analyses essentially place the site occupants in cultural vacuums, with territories determined solely by physical access, i.e. distance.

The approach used by Flannery, "empirical determination" of site catchment areas (1976a:103-104), is closer to that used in this study. He also begins with the empirical evidence of resource exploitation, the faunal and floral remains, to determine the types of environmental zones exploited by the site inhabitants. Flannery is also well aware, in his use of the phrase "other factors being equal" (1976b:180) and a reference to the influence of social factors (1976a:117) on village spacing, that socio-political factors influence the catchment area associated with sites in Mesoamerica.

This study differs from previous studies in examining the influence on faunal resource selection of specific socio-political factors and in starting from the dictum that "other things" are not equal. Cultural distance and site catchment area is defined as much by organizational principles as by kilometres or hours. A resource location may be less than a kilometre away from a habitation site, but if the society so organizes access to resources that the right to use that resource location is not associated with the inhabitants of that particular site, the resource location might as well be several hundred kilometres distant. It is not available to the site inhabitants.

The manner in which a society organizes and maintains access to its animal resources is an important possible source of variation in faunal assemblages, particularly on the Northwest Coast, where territorial ownership was a strongly developed part of the sociocultural systems. If predictive regional archaeological models are built on faunal as well as artifactual data, it behooves us to understand the influences which shape the faunal data in specific archaeological contexts. By identifying those factors within a region, we will be better able to realize the predictive power of these data.

This study uses ethnographic data and knowledge of the present and past environments of Hesquiat Harbour to predict the differing emphasis on animal resources from particular habitats, that one would expect to find among faunal assemblages from Hesquiat Harbour sites if the ethnographically described organization of access to resources was in operation prehistorically as well as more recently. Eight faunal assemblages from three sites in two differing environmental settings are described and compared, and their differences characterised according to the kinds of habitats being exploited most heavily. The observed patterns of habitat emphasis are compared with the expected patterns and the results discussed in relation to the known changes in local environment during the past 2,700 years and to the ethnographic system of organizing access to resource locations.

Chapter II describes the study area. Both present and past environment are described in terms of relevant geology, hydrography, climate, flora and fauna. The faunal species are covered in some detail, relating their occurence in the harbour to seasons and habitat categories in which they are most likely to be found. The distribution of these habitat categories in Hesquiat Harbour is illustrated and related to the location of the sites under study. The ethnographic adaptation to the harbour is discussed and previous archaeological work on the west coast of Vancouver Island briefly detailed.

In Chapter III the problem being examined is outlined in relation to Nootkan prehistory, and specific expectations given for the three archaeological sites as regards their faunal assemblages. Chapter IV describes the sites from which the faunal assemblages were recovered, the methods of recovery, stratigraphic relationships, dating and associated artifact assemblages.

Chapter V outlines the methods used to identify and quantify the faunal remains, presents the faunal assemblages, and identifies their differences and similarities. Chapter VI relates these differences and similarities to possible sources of variation and compares the assemblages with the predicted patterns of habitat emphasis. The results are then discussed, and the success of the approach evaluated in Chapter VII. Detailed faunal data are contained in Appendix A.

Chapter II

The Study Area

Forty-eight kilometres north of Tofino on Vancouver Island's west coast a broad, low-lying peninsula reaches out into the Pacific Ocean, ending in the bedrock outcrops of Estevan Point (Fig. 1). This western edge of land is pounded by the full force of winds and waves sweeping in fromtthe open Pacific. In the southern shelter of the tongue of land lies Hesquiat Harbour. It is a short, broad inlet about 9.6 kilometres long and 6.4 kilometres wide, opening to the south. North of LeClaire and Rondeau Points, which jut out from the western and eastern shores respectively, the harbour waters and shores are protected from the full effects of Pacific winds and waves (Fig. 2). To the south, the inlet gradually widens, the eastern and western shorelines swinging outwards in a pattern of alternating beaches and sculptured rock outcrops.

Hesquiat Harbour is a brief space of sheltered water, bordered on the west by the flat, low plain of Hesquiat Peninsula and on the north and east by the feet of the mountains, flanked on both sides by headlands and beaches fully exposed to the open Pacific. The harbour and short stretches of the outer coast to the north and south are claimed by the Hesquiat speaking peoples as their traditional territory.

PRESENT ENVIRONMENT

Landforms and Geology

Hesquiat traditional territory contains portions of two major landforms, the Estevan Coastal Plain and the Vancouver Island Mountains. The Estevan Coastal Plain is a narrow, low-relief coastal plain, seldom

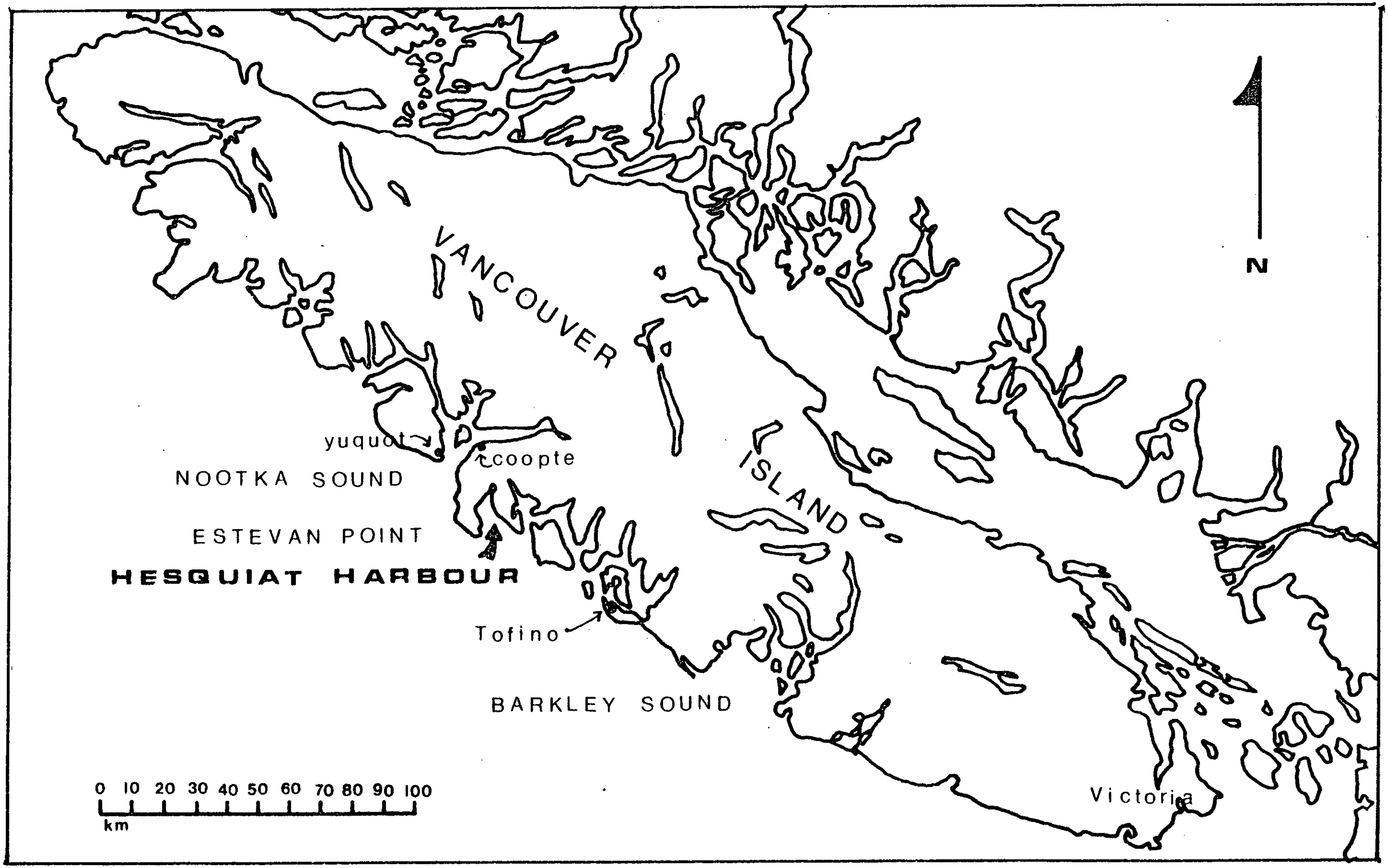


Figure 1. Vancouver Island, Showing Location of Hesquiat Harbour, British Columbia.

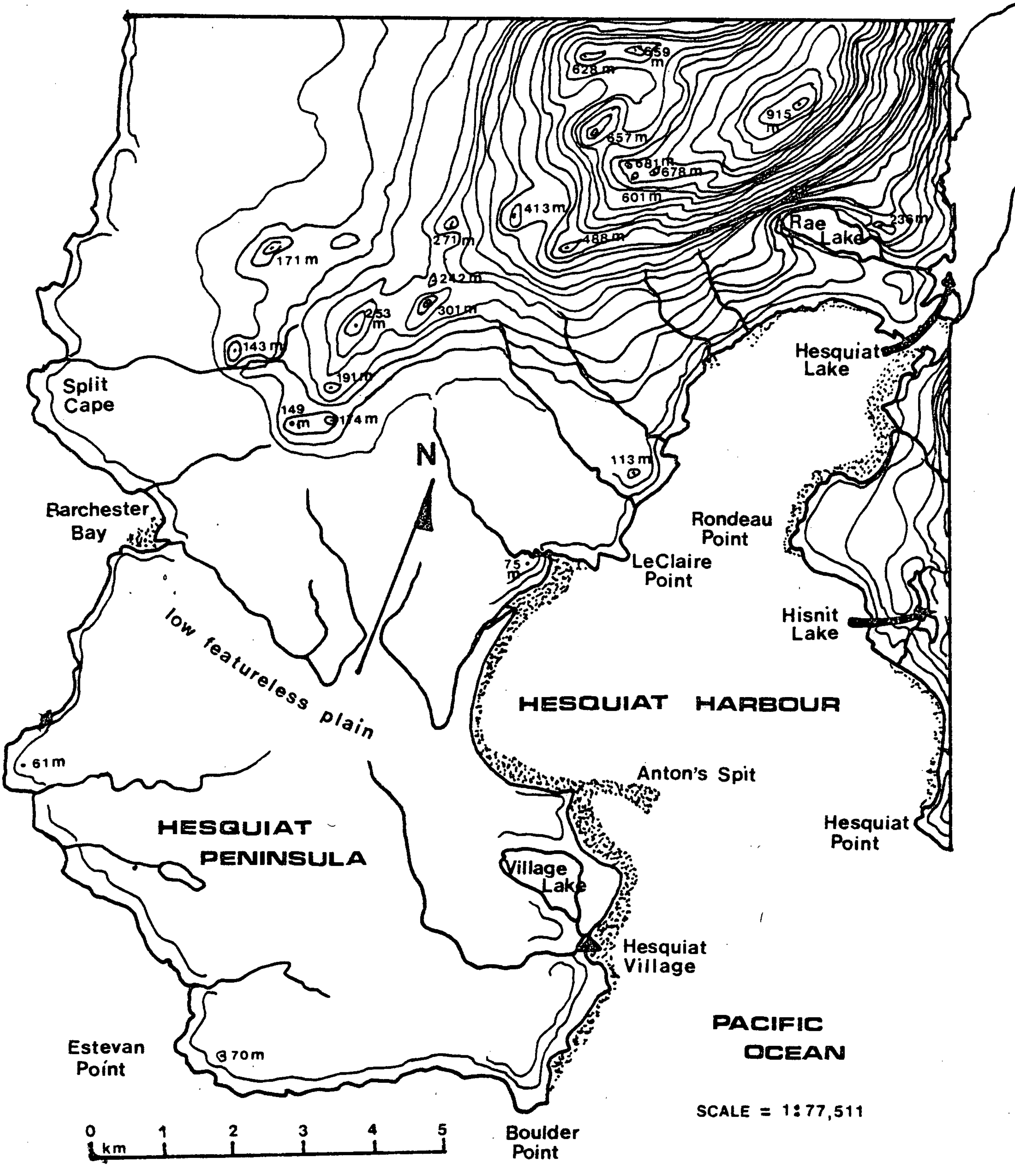


Figure 2. Topographic Features of Hesquiat Harbour. (From Hydrographic Survey Map 3640)

exceeding 46 metres in height above mean sea level, stretching along the outer coast of Vancouver Island from the Brooks Peninsula in the north to the area of Port Renfrew in the south. It reaches its greatest width, 13 kilometres, at Hesquiat Peninsula (Holland 1976:32).

Much of the underlying bedrock is flat, gently tilted beds of relatively soft Tertiary shales, siltstones, limey sandstones and shelly limestones of marine origin. Where not exposed by erosion, the bedrock is overlain by Pleistocene boulder clays and stratified sands, gravels and clays, and by recent alluvial and beach deposits (Jeletzky 1954:2). The areas of Hesquiat Peninsula underlain by these rocks are flat and almost featureless, with many swampy areas drained by slowly meandering streams. Where such rock formations occur at the water's edge, the shoreline is marked by broad, rocky flats dotted with huge boulders and long stretches of sand or pebble beaches. The boulder beaches of the inner harbour provide good substrata for rocky shore intertidal shellfish that prefer a sheltered habitat while the sandy beaches are good clam habitat. The boulder beaches also attract small fishes such as sculpins, toadfishes and surf perches.

Throughout much of Hesquiat Harbour, however, these softer rocks alternate with harder, more resistant sandstones and conglomerates of Tertiary age and marine origin. The beds of sedimentary rock are broken here and there by smaller exposures of the strongly faulted and folded granitic rocks of the older Coast Intrusions and the porphyritic lavas, schists and limestones of the Karmutsen Group of Upper Triassic age (Jeletzky 1954:2-3, 11). The latter formations, associated with the Vancouver Island Mountains, are found along the eastern and northern shores of Hesquiat Harbour, separated from the Tertiary siltstones, shales, sandstones and conglomerates underlying the whole of Hesquiat Peninsula and the tip of Hesquiat Point by a major disconformity running northwest southeast across the harbour.

Where the harder sandstones, conglomerates and igneous rocks occur, the shoreline is typically rugged with long sculptured rock promontories stretching out into the ocean. Those promontories on the open coast, such as Boulder Point, Estevan Point and Hesquiat Point (Fig. 2), provide excellent substrata for rocky shore intertidal shellfish such as California Mussels, which are adapted to the exposed environment. The intensely faulted and contorted nature of the formations, combined with the resistant rock types, produced a typically precipitous shoreline marked by wave cut gullies, caves and bluffs eroded by marine action along fault lines. The drainage system of the land also follows this criss-cross pattern of faults and sheer zones, with streams marked by waterfalls and rapids (Jeletzky 1954:2-3). The complicated tectonic history of the Hesquiat area has left the underlying bedrock cut by numerous faults and sheer lines, along which local movement is possibly still occuring.

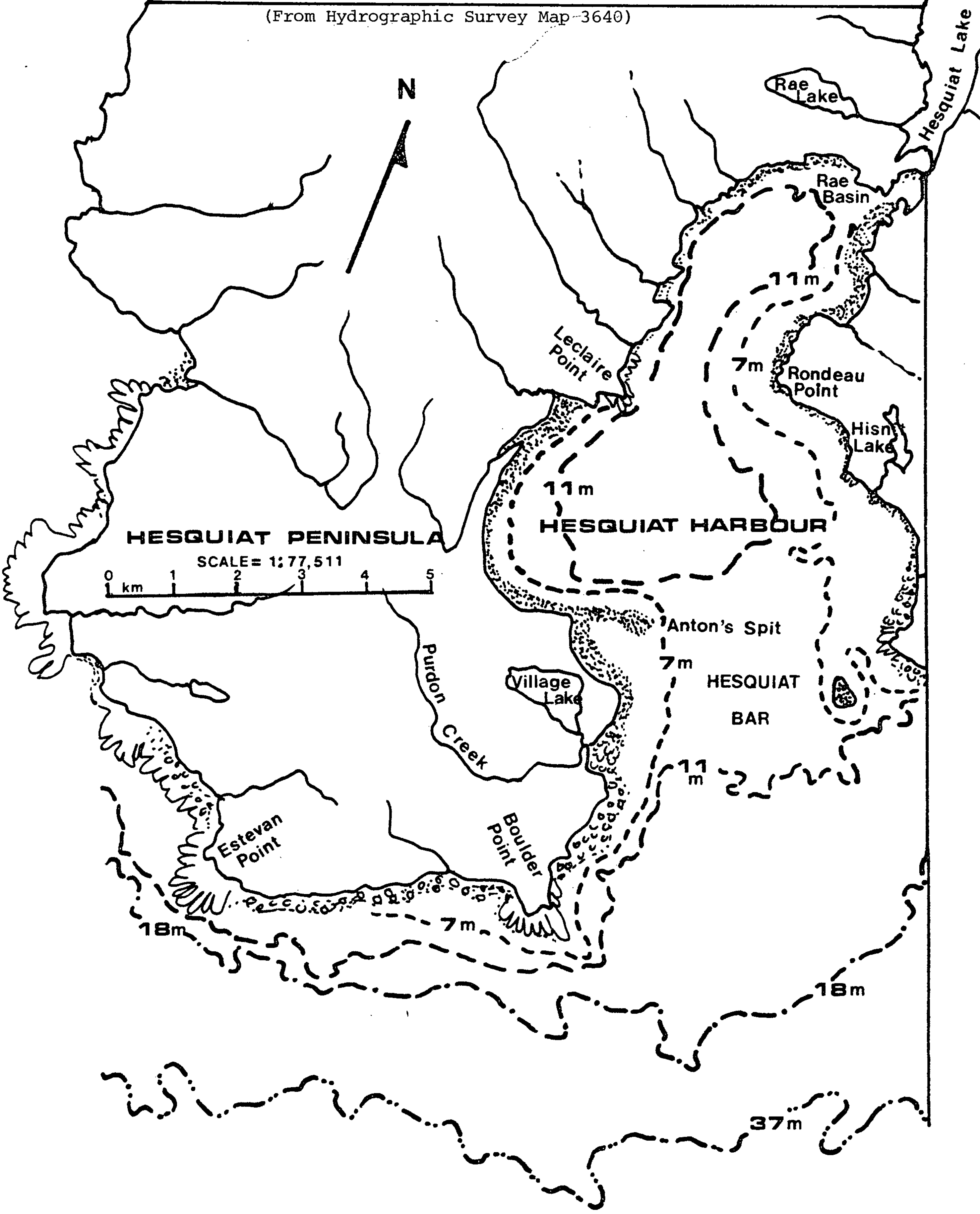
The eastern edge of the Estevan Coastal Plain is formed by the western foothills of the Vancouver Island Mountain Range. At Hesquiat Harbour these glacially rounded mountains rise upwards from the northern and eastern shores of the harbour waters to heights of 900 metres above mean sea level. It is this mountain bedrock that is the source of the sedimentary formations of the Estevan Coastal Plain and the more recent Pleistocene deposits.

Much of the Hesquiat Peninsula bedrock is overlain by Pleistocene boulder clays and stratified sands, gravels and clays. There are more localized areas around stream mouths and in the bays of recent alluvial and beach deposits, where they provide soft substrata for clams and good spawning beaches for herring. Along the western shoreline of the harbour between Anton's spit and LeClaire Point and along the eastern shoreline, a series of Pleistocene and recent beach ridges are visible in aerial photographs of the forest behind and paralleling the present shoreline. The most prominent area of recent beach and alluvial deposits is the area behind Anton's Spit now occupied by Village Lake (Fig. 2). The present alluvial and beach areas of the harbour are today building outwards in many locations, with sea strand vegetation, followed by the establishment of strandline Sitka Spruce, gradually clothing the more recently formed beach ridges. In other areas, notably at the head of the harbour and on the northern side of Anton's Spit, local wave action, winter storm action, currents and stream development are eroding earlier shoreline and delta deposits.

Hydrography

Eight small streams drain the mountain slopes of the northern and eastern shores of Hesquiat Harbour between Hesquiat Point on the east and LeClaire Point on the west (Fig. 3). One of the streams is large, but all except one are of sufficient size and of suitable formation to support runs of salmon. At present, Tofino Fisheries Office records show runs of coho and/or dog salmon in these streams of about 1,000 to 10,000 fish annually. Another three streams rise among the swampy meadows in the interior of Hesquiat Peninsula, emptying into the harbour at locations along the western shore between LeClaire and Boulder Point. All three contain similarly sized coho runs today and one drains the meadows southwest of Anton's Spit on the western shore.

Figure 3. Hydrographic Features of Hesquiat Harbour.
(From Hydrographic Survey Map 3640)



Several other streams, some seasonally intermittent, enter the Pacific along the outer coast north of Boulder Point.

Besides Village Lake, a shallow lake with a depth of 2 to 3 metres that is gradually filling in, there are three other lakes in the study area. Hisnit Lake, a small, shallow lake very like Village Lake, is located on the eastern shore between Rondeau and Hesquiat Points (Fig. 3). Hesquiat Lake, lying at the head of the harbour in a deep, glacially scoured valley, is the largest of the lakes. It is connected to salt water at high tide by a small exit stream flowing into Rae Basin and has a tributary network of streams along the eastern shore and a tributary lake, Rae Lake, to the west (Fig. 3). According to Fisheries records, only the Hesquiat Lake system now contains sockeye salmon, but steelhead run into both Hisnit and Hesquiat Lake systems, while coho salmon spawn in the streams of all three systems.

The waters of Hesquiat Harbour are not deep. Immediately off Boulder and Hesquiat Points the ocean waters reach depths of 11 to 22 metres over a gravel and rock bottom. Between Anton's Spit and Hesquiat Point the gravel and rock bottom shelves rapidly upwards to form Hesquiat Bar, stretched across the harbour entrance from shore to shore. Here the water has a depth of about 7 metres and the rocky substratum provides attachment for two major kelp beds paralleling the eastern and western entrance shorelines. The kelp beds attract rockfish, greenlings and lingcod from the deeper waters offshore. A reef off Hesquiat Point is part of the eastern, seaward edge of the bar, while Anton's Spit is building up along the inner, western edge of the bar. Inside Hesquiat Bar, the waters deepen to 15 metres over a muddy bottom with depths of 2 to 7 metres over a sandy bottom along the eastern inner shoreline. The numerous streams emptying into the inner harbour basin provide the sand and silt deposits covering the ocean floor inside the bar. This is the soft bottom, shallow water type of habitat favoured by several species of flatfish.

Highest tides in this area reach 3.9 metres while low tides seldom fall below 0.2 metres, with highest tides occuring in November to March and lowest in June and July. As the entrance to Hesquiat Harbour is wide and open, there are no rip tides in the harbour itself, but once outside the inner harbour there are strong offshore currents associated with falling tides and the generally southerly trend of the main offshore coastal current patterns. Within the inner harbour the local current pattern is clockwise.

Climate

The climate of the study area is mild and wet. Average annual precipitation is 313.4 centimetres, most falling in the form of rain during October through March, although the winter months may see some snow in colder years. January is the coldest month with an average temperature of 5° C and a range of -7° C to 10° C. July and August are the hottest months, with an average temperature of 14° C and a range of 7° C to 24°CC. The average annual temperatures is 9° C. These data are based on the records of the Estevan Point Weather Station for the years 1940 to 1976 (B.C. Department of Agriculture 1940-1976).

The fall through spring months are usually times of rain and storm, with winds up to 100 kilometres per hour. In August and September, thick banks of fog lie heavily on the horizon just off shore. On cool mornings the fog bank moves into the harbour in a thick blanket, but most mornings a thinner, misty fog that burns off in the sunshine by noon drifts into the harbour.

The most pleasant months are June and July, when the storms are fewer and the sunlight strong. In summer the prevailing winds are from the north and northwest, bringing sunshine tempered by brisk winds. The main storm tracks come from the south and southwest, and it is these bad weather winds that add their force to the ocean wave patterns to produce huge rollers and pounding surf in the winter months.

In Hesquiat Harbour the weather patterns are a major constraint of the natural environment. People living here are dependent on and must adapt their activities to the vagaries of the elements over which they have no control.

Flora

The marine terraces and mountain slopes of Hesquiat Harbour support a typical temperate marine forest, classified within the Coastal Western Hemlock Biogeoclimatic Zone (Krajina 1965) and dominated by Western Hemlock (*Tsuga heterophylla* (Rafinesque-Schmaltz) Sargent) and Western Red Cedar (*Thuja plicata* Donn) with lesser amounts of Amabilis Fir (*Abies amabilis* (Douglas) Forbes), Yellow Cedar (*Chamaecyparis nootkatensis* (D.Don) Spach) and Sitka Spruce (*Picea sitchensis* (Bongard) Carriere). These trees are associated with a ground cover of shrubs, among which the most abundant are Salal (*Gaultheria shallon* Pursh), Salmonberry (*Rubus spectabilis* Pursh), Huckleberries (*Vaccinium* spp.), Wild Gooseberry (*Ribes divaricatum* Douglas), Black Twinberry (*Lonicera involucrata* (Richards) Banks) and Red Elderberry (*Sambucus racemosa* Linnaeus) (Szczawinski 1970). Higher up the mountain slopes the shrub underbrush is replaced by a thinner ground cover of shrubs, ferns and other herbs, but on the lower slopes and the marine terraces the underbrush is thick, choked with windfalls and almost impenetrable.

In the interior of the peninsula the forest cover is broken by large swamp areas surrounded by boggy meadows. Here the dominant v vegetation cover is Sweet Gale (*Myrica gale* Linnaeus) with hemlock, pine, various grasses, sedges, ferns and other herbs (Hebda and Rouse 1976).

Areas immediately adjoining the shoreline are characterized by a forest cover dominated by strandline Sitka Spruce associated with Pacific Crab Apple (*Pyrus fusca* Rafinesque-Schmaltz), Western Red Cedar, Red Alder (*Alnus rubra* Bongard) and Douglas Fir (*Pseudotsuga menziesii* (Mirbel) Franco). Dominant shrubs are those already mentioned plus Wild Rose (*Rosa nutkana* Presl.), Thimbleberry (*Rubus parviflorus* Nuttall), False Azalea (*Menziesia ferruginea* Smith), Willows (*Salix* spp.), Saskatoon Berry (*Amelanchier alnifolia* Nuttall) and Cascara (*Rhamus purshiana* de Candolle). A wide variety of herbs is found in these areas including various ferns, grasses, wild strawberries, wild onions, horsetail and wild sweet pea (Szczawinski 1970).

The marine flora contains many species of algae, chief among which are the sea weeds Bull Kelp (*Nereocystis leutkeana* (Mertens) Postela and Ruprecht), Rockweed (*Fuscus furcatus* C. Agardh) and Eel Grass (*Zostera marina* Linnaeus). As mentioned above (page 15) the principal kelp beds occur on either side of the entrance to the harbour and paralleling the outer coasts.

Fauna

The present fauna of the Hesquiat Harbour region is rich in marine and intertidal species. Land species are less abundant and less varied. Many species are only present during certain seasons of the year. The abundance and concentration of animals also varies among the different species.

The animal species can be grouped into several main associations within each major taxon (i.e. bird, fish, mammal and shellfish) according to the type or types of habitat to which they are adapted. These habitat categories are not communities in the strict zoological sense, but group together those species likely to be found most consistently and in greatest abundance wherever the particular habitat conditions occur. It must be stressed that these habitat categories, with the associated animal species, do not have strict boundaries. A series of habitats may represent a continuum of conditions with considerable overlap where one habitat grades into another. The categories describe the optimal habitats and therefore the optimal areas of availability for the species groupings, not, in many cases, the only ar areas of availability. Obviously, non-sedentary species are free to move in and out of an area and many intertidal molluscs are tolerant of a wide range of variation in habitat conditions. Many of these habitat categories have both resident and seasonal populations, and animals found in one habitat in one season may be found in another at other seasons.

The information used to place species in habitat and seasonal categories was obtained from direct observation in Hesquiat Harbour during May through August of 1973, May of 1974 and July of 1975; a survey of the intertidal zone of Hesquiat Harbour that involved walking the harbour shoreline at low tides recording species present in particular locations; Tofino Fish and Wildlife Office records; and published references. The scientific names of species are those used by Banfield (1974) for mammals; Hart (1975) for fish; Godfrey (1976) for birds and Morris (1966) for shellfish.

Mammals:

The land mammal fauna of Hesquiat Harbour is limited in the number of species that are present. All are resident in the study area year r round and there do not appear to be major fluctuations in abundance, although this is difficult to determine because of recent habitat disruption by logging. All but the deer, herd animals, would normally be encountered either as individuals or as members of small family groups. Land mammals present in the area and identified in the archaeological record include: Coast Black-tailed Deer (*Odocoileus hemionus columbianus* (Richardson)); Black Bear (*Ursus americanus* Pallas); Cougar (*Felis concolor* Linnaeus); Wolf (*Canis lupus* Linnaeus); River Otter (*Lontra canadensis* (Schreber)); Marten (*Martes americana* (Turton)); Mink (*Mustela vison* Schreber); Raccoon (*Procyon lotor* (Linnaeus)); Red Squirrel (*Tamiasciurus hudsonicus* (Erxleben)); Townsend's Vole (*Microtus townsendii* (Bachman)); and the Navigator Shrew (*Sorex palustris* Richardson).

More varied in number of species, the sea mammal populations in the region are also larger, more migratory and composed of large sized species with great potential food value. Sea mammals found in the area and identified or possibly identified in the archaeological record are: Northern Sea Lion (*Eumatopias jubata* (Schreber)); California Sea Lion (*Zalophus californianus* (Lesson)); Northern Fur Seal (*Callorhinus ursinus* (Linnaeus)); Harbour Seal (*Phoca vitulina* Linnaeus); Northern Elephant Seal (*Mirounga angustirostris* (Gill)); Sea Otter (*Enhydra lutris* (Linnaeus)); Harbour Porpoise (*Phocoena phocoena* (Linnaeus)); Dall's Porpoise (*Phocoenoides dalli*O(True)); Killer Whale (*Orcinus orca* (Linnaeus)); Grey Whale (*Eschrichtius robustus* (Lilljeborg)) and Humpback Whale (*Megaptera novaeangliae* (Borowski)). Some of these sea mammals are either seasonally available or vary seasonally in abundance and group composition. They tend to occupy more discrete habitats than the larger land mammals.

Table 1 summarizes the seasonal availability and the habitat categories in which these mammals are most likely to be found. Accurate information on the present abundance of these animals in Hesquiat Harbour and the immediately surrounding seas is unfortunately not available. A gross measure of their estimated relative abundance is given in Table 1, using the symbols C for Common, P for Present and R for Rare. The habitat categories themselves are defined below and their geographical distribution in Hesquiat Harbour illustrated in Fig. 4.

Pelagic: open ocean, off shore waters from about 15 to 25 kilometres offshore well into the Pacific.

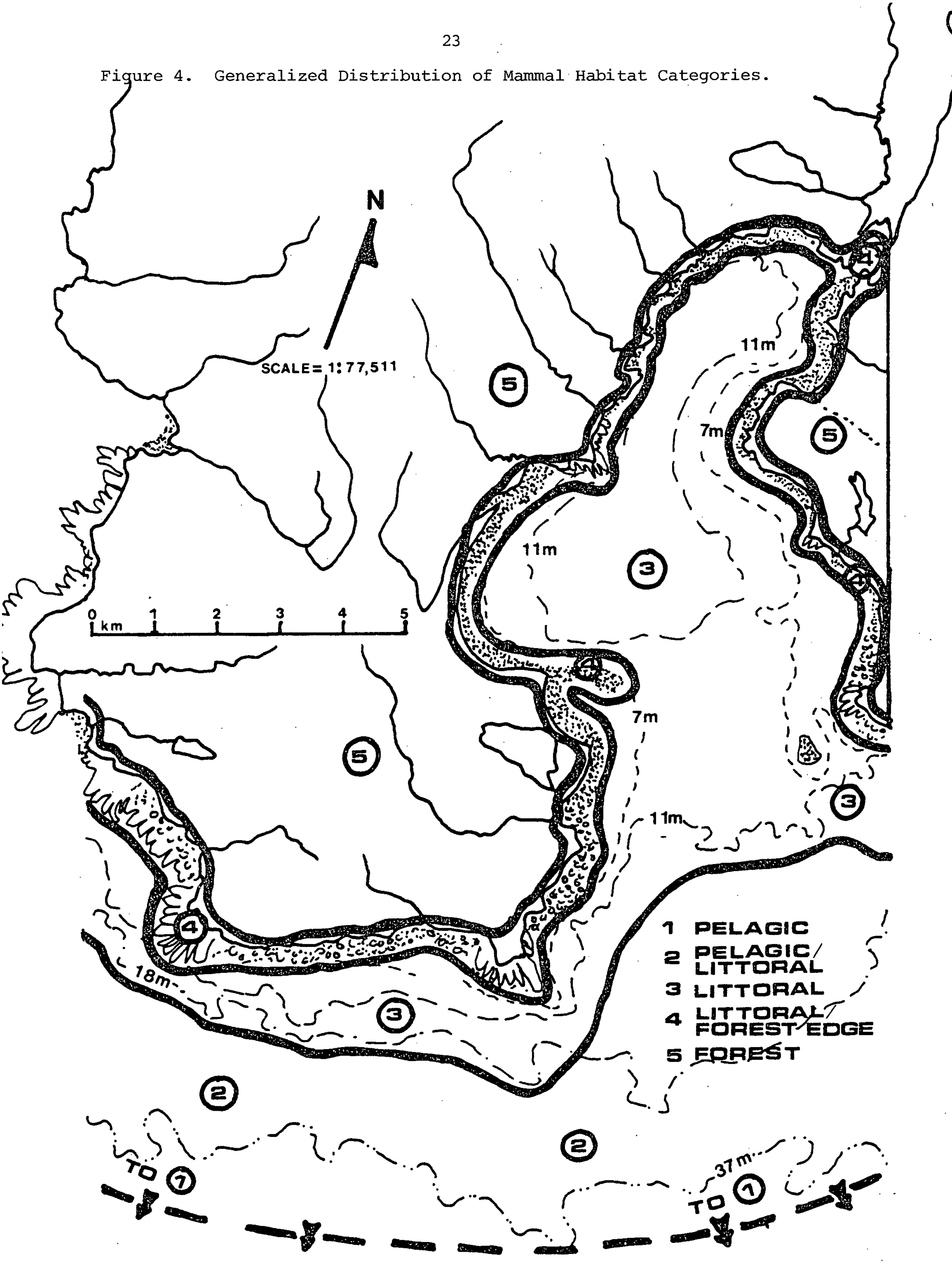
Pelagic-Littoral: the open ocean from about 20 kilometres offshore to the littoral waters, may include deeper bays and estuaries.

Littoral: the waters immediately adjacent to shore, including shallow bays and estuaries.

Littoral-Forest Edge: the beaches and immediately adjacent ocean waters and forest edges.

Forest: the forests, including open meadow and swamp areas within the coastal forests.

Figure 4. Generalized Distribution of Mammal Habitat Categories.



As these mammals vary greatly in size and therefore potential quantity of food, the average weights for males and females are given in Table 2. Specific ecological and biological data for each species are discussed under habitat categories below.

Pelagic Mammals:

Northern Fur Seals are truly pelagic animals with a well defined annual migration associated with pupping and breeding. Their pelagic range extends from southern California to the Bering Sea, but the only breeding grounds known today are in the extreme northern part of their range on the isolated Pribilof, Robben and Commander Islands (Kenyon and Wilke 1953:85-86). For five to eight months of the year the seals are strictly pelagic, generally ranging far out to sea and only in very rare and exceptional circumstances approaching close to land. During the summer and fall months the vast majority of the present population of about one and a half million animals is concentrated at or near the northern rookery islands (Kenyon and Wilke 1953:87; Fiscus 1972:6).

Throughout much of the year the distribution of mature males is different from that of mature females and juveniles of both sexes. During the winter and fall months, after they leave the rookeries, the mature males are dispersed and pelagic, but today they remain in northern waters, moving only short distances south of the Aleutian Islands chain (Kenyon and Wilke 1953:88). There is archaeological evidence from the Ozette site on the Olympic Peninsula that this is a recent, possibly post A.D. 1900, pattern for the males, as adult males over ten years of age form between twenty and thirty percent of the fur seal remains at this site, which spans the time period from about 2,000 years ago to about A.D. 1900 (Gustafson 1968).

Table 1. Seasonal Availability and Habitat Categories of Mammals found in the Hesquiat Harbour Region

Taxa	Habitat Categories				
C - Common; P - Present; R - Rare	1 Pelagic	2 Pelagic/ Littoral	3 Littoral	4 Littoral/ Forest Edge	5 Forest
Northern Fur Seal, *Callorhinus ursinus* C	X(W)	X(SP)			
Killer Whale, *Orcinus orca* C	X	X			
Gray Whale, *Eschrichtius robustus* P		X(W,SP)			
Humpback Whale, *Megaptera novaeangliae* P		X(F,SP)			
Harbour Porpoise, *Phocoena phocoena* C		X			
Dall's Porpoise, *Phocoenoides dalli* P		X(S)			
Northern Sea Lion, *Eumetopias jubata* P		X			
California Sea Lion, *Zalophus californianus* R		X(W)			
Northern Elephant Seal, *Mirounga angustirostris* R		X(W)			
Sea Otter, *Enhydra lutris* R, formerly C		X	X		
Harbour Seal, *Phoca vitulina* C			X		
River Otter, *Lontra canadensis* P				X	
Mink, *Mustela vison* C				X	
Raccoon, *Procyon lotor* P				X	
Coast Black-tailed Deer, *Odocoileus hemionus* C					X
Wolf, *Canis lupus* R, formerly C ?					X
Cougar, *Felis concolor* P					X
Black Bear, *Ursus americanus* P					X
Marten, *Martes americana* P					X
American Red Squirrel, *Tamiasciurus hudsonicus* P					X
Townsend's Vole, *Microtus townsendii* P					X
Navigator Shrew, *Sorex palustris* P					X

KEY: (W)-Winter; (SP)-Spring; (S)-Summer; (F)-Fall; otherwise year round

Table 2. Weights of Selected Mammals

	Weight in Kg (unless indicated otherwise)	
Taxa	Adult Males	Adult Females
Grey Whale	33.6 metric tons, male and female together	
Humpback Whale	27.1(18.1-39.9) metric tons, male & female	
Killer Whale	No data available; several metric tons	
Northern Elephant Seal	?* (up to 3,629)	? (up to 907)
Northern Sea Lion	? (680 to 999)	? (272-- 365)
California Sea Lion	? (227 - 271)	? (45 - 91)
Northern Fur Seal	192 (150 - 272)	43 (38 - 54)
Dall Porpoise	110 (95 - 132)	95 (67 - 150)
Harbour Porpoise	55 (27 - 88)	about the same size
Harbour Seal	72 (up to 148)	58 (up to 111)
Sea Otter	34 (23 - 36)	20 (17 - 23)
Coast Black-tailed Deer	? (50 - 215)	? (32 - 72)
Black Bear	169 (115 - 270)	136 (92 - 140)
Cougar	? (67 - 103)	? (36 - 60)
Wolf	? (26 - 79) male and female together	
River Otter	8	7
Raccoon	9	8
Marten	.9 (.7 - 1.3)	.6 (.6 - .8)
Mink	1.7 (1.7 - 2.3)	.8 (.8 - 1.2)
Red Squirrel	.2	.2
Navigator Shrew	.01	.01

* ? means information not available. Weights in brackets are ranges. Banfield 1974; Cowan and Guiguet n.d.; B.C. Provincial Museum Archaeology Division records.

The adult females, young of the year and immature animals of both sexes are far more widely dispersed in pelagic waters off the west coast during the winter months, some travelling as far south as the California border. At sea, they are usually solitary, occasionally forming temporary groups of up to twenty animals in areas where there is a concentration of food. They are rarely seen closer than sixteen to twenty-four kilometres off shore. The greatest numbers of seals are found scattered in a band sixteen to eighty kilometres offshore along the outer edge of the continental shelf, approximately the 183 metre contour, where there are abundant food supplies (Fiscus 1972:7; Kenyon and Wilke 1953:87-88; Baker 1957:16; Taylor, Fujinaga and Wilke 1955:49; Bartholomew and Hoel 1953:417). Pelagic winter populations are especially heavy along the continental shelf between mid-Vancouver Island and California, two major concentrations being off Barkley Sound and off the Juan de Fuca Strait - Cape Flattery area (Taylor 1971:1663).

Off the west coast of Vancouver Island, Northern Fur Seals are present in pelagic waters from December to May, with a peak period of concentration during March and April. For as long as the present pattern has held, the population available to Hesquiat Harbour peoples would be composed only of yearlings, immature animals and females. During the peak period of abundance off the harbour, the mature females would be carrying well developed foetuses, two to three months from birth. The animals would be feeding on the herring schools gathered along the continental shelf edge, and some probably followed the schools into Hesquiat Harbour. Most of the animals, however, would be present no closer than sixteen to twenty-four kilometres off shore. Some immature animals may have been present year round, but far out to sea. The archaeological evidence from Ozette indicates mature males may also have been present in the winter and spring months, but this pattern is not yet clear.

The Killer Whale is the largest of the Delphinidae and a common resident of B.C. coastal waters, often hunting closerto shore in packs of up to forty individuals. They feed on seals, porpoises and sea lions as well as fish and frequent the littoral waters where these animals are commonly found. Young are born in November and December. Although some Killer Whale populations are migratory, they are present off the west coast of Vancouver Island year round, possibly with a larger summertime population (Cowan and Guiguet n.d.:257-258; Banfield 1974:264-265).

Pelagic/Littoral Mammals:

Both the Gray Whale and the Humpback Whale are large, migratory, baleen whales inhabiting the shallow continental shelves, with the Humpback frequently entering bays and inlets. Gray Whales winter in the lagoons of Baja California where calves are born in January, and summer in the Bering and Chukchi Seas. They are off the west coast of Vancouver Island in concentrations in April and early May, moving slowly northwards close to shore (within 10 kilometres) in gams of up to a dozen calves and females or bulls, and again in December, moving much more rapidly southwards (Banfield 1974:270-273; Cowan and Guiguet n.d.: 264). There are individual sightings off the west coast of the island at other times of year as well. The Humpback whale spends the winter months off the west coast of Mexico and summer in the Bering Sea. They pass Vancouver Island in May and June, moving northwards in gams of up to 150 individuals and return south in October and November. The young are born in February or March, and a few Humpbacks winter along the B.C.

coast (Banfield 1974:277-281; Cowan and Guiguet n.d.:268-270).

The Harbour Porpoise frequents inshore waters, bays, harbours and channels, seldom venturing more than 30 kilometres offshore. They travel in small groups of two to five animals, with groups of mature males segregated from groups of females, calves and young males. The Harbour Porpoise is migratory, some individuals wintering off the coast of Washington and British Columbia and summering further north, but there is also a resident B.C. population. The young are born in May to early July (Banfield 1974:268-269; Cowan and Guiguet n.d.:260).

The Dall Porpoise frequents the waters of the continental shelf at less than 900 metres, seldom ranging far out to sea nor into shallow bays. Gam size is larger than those of the Harbour Porpoise, up to a dozen individuals, sometimes as many as 100. It is regularly present off Vancouver Island's west coast in the summertime, from June to October. Young are born in July and August (Banfield 1974:269-270; Cowan and Guiguet n.d.:262-263).

The Northern Sea Lion may be present year round, but there are today no breeding and pupping rookeries near Hesquiat Harbour. During the winter and early spring, sea lions are widely dispersed individually or in small groups throughout the coastal waters, usually within 20 kilometres of the shore and feeding in less than 180 metres of water. In spring and fall they tend to concentrate in the areas where there are large schools of spawning fish, and would be present in greater numbers in the harbour area during the spring herring spawning season and again in the fall during the salmon runs. During the spring season adult females would be carrying well-developed foetuses and there would probably be few adult (breeding) males, as these seem to shift northwards during the late winter and spring months. From May to early September the bulk of the population is confined to the breeding rookeries, but immature (non-breeding) animals and very old males associated with hauling out places on Vancouver Island's west coast to the south, might well occur sporadically in the harbour. In the fall season adult males and immature individuals probably follow the salmon into the harbour, but the adult females and pups of the year would still be concentrated at the breeding rookeries. During the winter months individuals of various ages and both sexes might again be available. Although present distributions may differ from past patterns, these animals were probably never a concentrated resource, but were probably seasonally available in small groups and individually year round (Kenyon and Rice 1961; Pike 1958; Pike 1966; Pike and Maxwell 1958; Spalding 1964; Orr and Poulter 1967).

The west coast of Vancouver Island has previously been considered the extreme northern limit of the California Sea Lion, but there are recently reports of a further northward extension. Formerly, only males aged four to ten years would be seen off the west coast and then only during the winter months. After the breeding season many males migrate north of their breeding areas off the coasts of California and Mexico. They tend to haul out at locations used by their cousins the Northern Sea Lion, sometimes intermingling with the larger species (as at Barkley Sound), at other locations maintaining separate groups (Mate 1973:12-17). Their presence in the Hesquiat Harbour area would be confined to sporadic occurrences of male animals in the winter months. They occupy the same coast littoral habitat as the Northern Sea Lion.

The Northern Elephant Seal, the largest of the northern earless seals, breeds on several small islands off the coasts of Mexico and

California, but ranges as far north as Alaska in the winter. It is today rare, but was formerly numerous to the south and regularly reported off the west coast of Vancouver Island in winter. It has been recorded as far as 65 kilometres off shore but also frequents the littoral waters (Cowan and Guiguet n.d.:354-355). At sea they forage alone, feeding in waters 70 to 185 metres deep, while on land they are highly gregarious and slow moving. Pups are born between mid-December and the end of January (Banfield 1974:380-382).

Littoral Mammals:

The Sea Otter was formerly abundant along the west coast of Vancouver Island, but there is no information available on the former locations of breeding areas. This marine mammal eats and often sleeps at sea, and also regularly hauls out on rocky points, or sometimes sand beaches, spits and islets. They favour shallow waters adjacent to the coast or underwater rocky reefs, particularly where kelp beds occur. (Kenyon 1969:57). Sea otters tend to remain in shallow water and are generally within the 55 metre line. They are gregarious and tend to form colonies (Kenyon 1969:57, 64-69). They dive for their food of fish, molluscs, echinoderms and crabs in waters of 10 to 45 metres deep, the majority feeding within 1 kilometre of shore (Kenyon 1969:105, 110; Banfield 1974:345; Cowan and Guiguet n.d.:335). Although there does not appear to be a fixed breeding season, with new born young reported for all seasons, there does appear to be ausummer peak in births (Kenyon 1969:230). The west coast of Vancouver Island was formerly rich in this marine mammal, prior to its near extinction by pelage hunters. Although they are generally close to shore, where underwater reefs provide shallow water feeding conditions even far offshore, they will also be found there. In Hesquiat Harbour the kelp beds along the eastern entrance shoreline and along the outer coast between Boulder Point and Estevan Point would be ideal sea otter habitat.

The Harbour Seal is the marine mammal most commonly seen in B.C. coastal waters. Its habitat is primarily littoral marine, rather than pelagic, and these animals are generally close to shore and in shallow bays and inlets (Cowan and Guiguet n.d.:352). It is essentially non-migratory, although local movements associated with tides, fluctuations in food supplies, seasons and reproduction are documented (Biggs 1969a:2). For much of the day individuals are solitary, dispersed along the shores foraging for food. It is only at the hauling out places, the sand bars, reefs and estuarine mudflats, that they are found in loosely gregarious herds. In favourable locations these groups may be 100 to 150 individuals, but are commonly much smaller, averaging about 30 individuals. They include males and females of all ages.

Pupping takes place on isolated sand bars and reefs, with no harem formation. The pupping season covers an annually predictable period of one and a half to two months, the time of year varying with latitude and becoming progressively earlier as one goes from Puget Sound north to Alaska (Biggs 1969b:450). Although there are no published data specific to the central portion of the west coast of Vancouver Island, records for the areas to the north and south suggest June and July would be the months when most births occur in this area, with a peak of early to mid-July (Biggs 1969a:9; Biggs 1969b:450; Fisher 1952:26-27).

Hesquiat Harbour provides a few good hauling out places for Harbour Seals, including the reefs off Estevan and Homeis Points, the reefs and rocks off Hesquiat Point, and possibly Anton's Spit, although the surrounding waters are too shallow to be ideal. These areas would only be available at low tide. At other times one might expect to see Harbour Seals almost anywhere in the harbour, often close to shore.

Littoral/Forest Edge Mammals:

The River Otter, the Mink and the Raccoon are common in Hesquiat Harbour, and while all three species inhabit the forests, their favoured habitat in this region is the seashore and the immediately adjacent forest fringe. Both river otter and mink favour the streams, beaches and immediately adjacent littoral waters, spending much time in the water and feeding on fish and crustaceans. A family of river otters was a daily sight at the head of Hesquiat Harbour during the summer months of 1973. Mink young are born in April and May, river otters in March and April (Cowan and Guiguet n.d.:320-321, 330-331; Banfield 1974:330, 340).

Raccoons are also common in the harbour, but being primarily nocturnal, are less frequently seen. They are commonly found along forest water course and along the beaches. Young are born from mid-March to mid-April (Banfield 1974:315; Cowan and Guiguet n.d.:298).

Forest Mammals::

Coast Black-tailed Deer is the only large ungulate found in the study area while Black Bear, Cougar and Wolf are the only large forest carnivores. The Marten and a number of small rodents are also present, in undetermined abundance.

The Canada Land Inventory classifies Hesquiat Harbour as Class 4 land with moderate limitations to the production.of ungulates (Land Capability for Wildlife - Ungulates, Map Nootka Sound 92E). No accurate estimate of abundance is available, but deer are certainly not plentiful in the harbour today. Male deer shed their antlers in March, although young animals may carry them through April. The velvet is stripped from the new antlers in August and early September (Cowan and Guiguet n.d.: 368). Fawns are normally born in June, although the range is from March to November (Banfield 1974:390). In the harbour, the meadows to the northwest of Hesquiat Village on Hesquiat Peninsula are known as the best deer hunting territory, although tracks are also seen on the beaches.

Black bears are the most frequently seen today of the large carnivores. In 1976 the head of the harbour supported at least one family of four, and Fisheries records frequently mention black bears at the streams during the fall salmon runs. In the mild Hesquiat area, the large Vancouver Island black bear may be active throughout the winter, but if hibernating from November to April, the young are born in hibernation, usually in January or February (Cowan and Guiguet n.d.:290; Banfield 1974:305-308).

Signs of cougar are common and there is probably more than one territory in the harbour. Cougars range over wide areas and through various habitats, from swamps to dense coniferous forest, in search of food. Apart from the recently (1900's) introduced domestic goats and cows, the only large prey in the harbour is deer. As cougars have no fixed breeding season the young may be born at any time of year (Cowan and Guiguet n.d.: 336) although there are reported to be two peaks of birth, late winter and midsummer (Banfield 1974:347).

Wolves have not been seen here for years, but the tracks of a solitary animal were seen in 1975, while in earlier times-they were certainly more plentiful. Wolves, too, range throughout a variety of habitats, hunting in packs that average four to seven in numbers but can range from two to fourteen (Banfield 1974:290). Pups are born in

April and May (Cowan and Guiguet n.d.:282). The low ungulate population in the harbour is reflected in the relatively low abundance of their principal predators, wolf and cougar, while black bears, with a varied diet, have maintained a higher population in the area. In none of these instances, however, are we talking about an abundant resource.

Although the presence of Marten was not personally confirmed, its range includes Hesquiat Harbour. This animal favours the forest habitat, occasionally feeding along the seashore. The young are born in late March and April (Banfield 1974:316-317; Cowan and Guiguet n.d.:301).

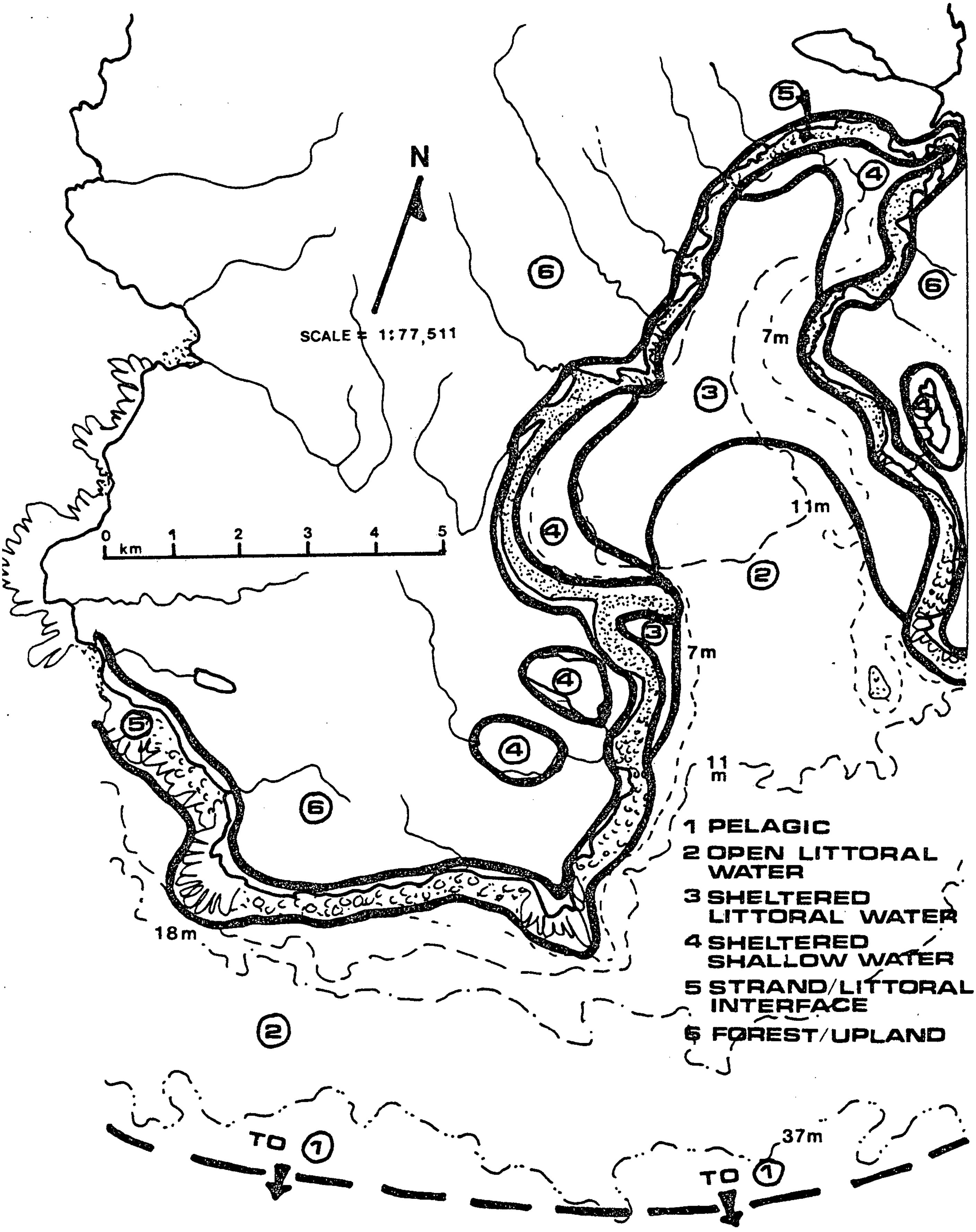
Three of the rodents reported for the area have been identified in the archaeological record, the Townsend's Vole, the American Red Squirrel and possibly the Deer Mouse. The Navigator Shrew wasoalso identified archaeologically and the Short-tailed Weasel seen in 1973. All of these animals are small forest dwellers.

Birds:

Avian resources of the area are diverse, including many different species, from ocean going fliers to forest residents. The species also show variation in seasonal availability, abundance and concentration. The habitats of the inner harbour and those of the outer coast differ in all these factors.

The bird species present in Hesquiat Harbour today and also identified in the archaeological samples can be grouped according to preferred habitat. The following habitat categories indicateethe habitats where the listed species are most likely to be found in greatest abundance, rather than the only habitats in which they will be found. Birds are highly mobile species. Table 3 groups the species identified in the archaeological samples by the habitat categories, while Figure 5

Figure 5. Generalized Distribution of Bird Habitat Categories.



illustrates the present distribution of the habitats in Hesquiat Harbour.

Pelagic: open ocean from about 15 to 200 kilometres offshore, particularly 20 to 40 kilometres offshore.

Open-Littoral Waters: the open, littoral waters, including outer portions of some larger bays and inlets.

Sheltered Littoral Waters: the sheltered littoral waters of bays and inlets.

Sheltered Shallow Waters: the shallow littoral waters of sheltered bays and estuaries, lakes, mudflats, marshes and streams.

Strand/Littoral Interface: the beaches and adjacent littoral waters and forest edge.

Forest/Upland: the forest, including the wooded areas and open meadows within the forest.

Many of these birds vary greatly in size. While bird weights are highly variable, even within a single day, the mean weights presented in Table 4 give a gross measure of relative sizes.

Pelagic Birds:

The pelagic birds are primarily the ocean fliers, rarely coming close to shore in Hesquiat waters. While species such as the albatross are large, most are relatively small birds whose big wingspan belies their actual weight. They include both the Black-footed Albatross (*Diomedea nigripes* Audubon) and the Short-tailed Albatross (*D. albatrus* Pallas), the Northern Fulmar (*Fulmaris glacialis* (Linnaeus)), the Sooty Shearwater (*Puffinus griseus* (Gmelin)), the Northern Phalarope (*Lobipes lobatus* (Linnaeus)), the Parasitic Jaeger (*Stercorarius parasiticus* (Linnaeus)), the Arctic Tern (*Sterna paradisea* Pontopiddan), the Black-Legged Kittiwake (*Rissa tridactyla* (Linnaeus)) and storm petrels (Hydrobatidae).

Open Littoral Water Birds:

The birds in this category are diving, fish eating birds, sometimes

Table 3. Habitat Categories of Birds found in the Hesquiat Harbour Region

	Habitat Categories					
	1	2	3	4	5	6
Taxa	Pelagic	Open Littoral Waters	Sheltered Littoral Waters	Sheltered Shallow Waters	Strand/ Littorall Interface	Forest/ Upland
Albatross, *Diomedea* sp.	X					
Northern Fulmar, *Fulmaris glacialis*	X					
Sooty Shearwater, *Puffinus griseus*	X					
Storm Petrals, Hydrobatidae	X					
Northern Phalarope, *Lobipes lobatus*	X					
Parasitic Jaeger, *Stercorarius parasiticus*	X					
Arctic Tern, *Sterna paradisea*	X					
Black-legged Kittiwake, *Rissa tridactyla*	X					
Arctic Loon, *Gavia arctica*		X				
Western Grebe, *Aechmophorus occidentalis*		X				
Double-crested Cormorant, *Phalacrocorax auritus*		X				
Brandt's Cormorant, *P. penicillatus*		X				
Pelagic Cormorant, *P. pelagicus*		X				
Oldsquaw, Duck, *Clangula hyemalis*		X				
White-winged Scoter, *Melanitta deglandi*		X				
Surf Scoter, *M. perspicillata*		X				
Common Scoter, *Oidemia nigra*		X				
Common Murre, *Uria aalge*		X				
Pigeon Guillemot, *Cepphus columba*		X				
Marbled Murrelet, *Brachyramphus marmoratus*		X				
Cassin's Auklet, *Ptychoramphus aleutica*		X				
Rhinoceros Auklet, *Cerorhinca monocerata*		X				
Tufted Puffin, *Lunda cirrhata*		X				

Table 3. (Continued)

	Habitat Categories					
	1	2	3	4	5	6
Taxa	Pelagic	Open Littoral Waters	Sheltered Littoral Waters	Sheltered Shallow Waters	Strand/ Littoral Interface	Forest/ Upland
Common Loon, *Gavia immer*			X			
Red-throated Loon, *Gavia stellata*			X			
Red-necked Grebe, *Podiceps grisagena*			X			
Horned Grebe, *P. auritus*			X			
Eared Grebe, *P. caspicus*			X			
Greater Scaup, *Aythya marila*			X			
Common Goldeneye, *Bucephala clangula*			X			
Barrow's Goldeneye, *B. islandica*			X			
Bufflehead, *B. albeola*			X			
Common Merganser, *Mergus merganser*			X			
Red-breasted Merganser, *M. serrator*			X			
Whistling Swan, *Olor columbianus*				X		
Canada Goose, *Branta canadensis*				X		
Brant, *B. bernicla*				X		
White-fronted Goose, *Anser albifrons*				X		
Snow Goose, *Chen caerulescens*				X		
Mallard, *Anas platyrhynchos*				X		
Gadwall, *A. strepara*				X		
Blue-winged Teal, *A. discors*				X		
Pintail, *A. acuta*				X		
American Widgeon, *Mareca americana*				X		
Shoveler, *Spatula clypeata*				X		
American Coot, *Fulica americana*				X		
Glaucous-winged Gull, *Larus glaucescens*					X	
Western Gull, *L. occidentalis*					X	
Herring Gull, *L. argentatus*					X	

Table 3. (Continued)

	Habitat Categories					
	1	22	3	4	5	6
Taxa	Pelagic	Open Littoral Waters	Sheltered Littoral Waters	Sheltered Shallow Waters	Strand/ Littoral Interface	Forest/ Upland
California Gull, *L. californicus*					X	
Mew Gull, *L. canus*					X	
Bonaparte's Gull, *L. philadelphia*					X	
Heerman's Gull, *L. heermanni*					X	
Great Blue Heron, *Ardea herodias*					X	
Bald Eagle, *Haliaeetus leucocephalus*					X	
Black Oystercatcher, *Haematopus bachmani*					X	
Greater Yellowlegs, *Totanus melanoleucus*					X	
Sandpipers, *Erolia sp.*					X	
Northwestern Crow, *Corvus caurinus*					X	
Great Horned Owl, *Bubo virginianus*						X
Snowy Owl, *Nyctea scandiaca*						X
Flicker, *Colaptes cafer/auritus*						X
Pileated Woodpecker, *Dryocopus pileatus*						X
Varied Thrush, *Ixoreus naevius*						X
Finches etc, *Fringillidae*						X

seen closer to shore, but more abundant where the large schools of fish are concentrated in deeper water. They include the cormorants, the murres, and some of the grebes, loons and ducks. Those identified in the archaeological sites are: Arctic Loon (*Gavia arctica* (Linnaeus)), Western Grebe (*Aechmophorus occidentalis* (Lawrence)), Double-crested Cormorant (*Phalacrocorax auritus* (Lesson)), Brandt's Cormorant (*P. penicillatus* (Brandt)), Pelagic Cormorant (*P. pelagicus* Pallas), Oldsquaw Duck (*Clangula hyemalis* (Linnaeus)), White-winged Scoter (*Melanitta deglandi* (Bonaparte)), Surf Scoter (M. *perspicillata* (Linnaeus)), Common Scoter (*Oidemia nigra* (Linnaeus)), Common Murre (*Uria aalge* (Pontoppidan)), Pigeon Guillemot (*Cepphus columba* Pallas), Marbled Murrelet (*Brachyramphus marmoratus* (Gmelin)), Cassin's Auklet (*Ptychoramphus aleuticus* (Pallas)), Rhinoceros Auklet (*Cerorhinca monocerata* (Pallas)), and Tufted Puffin (*Lunda cirrhata* (Pallas)).

Sheltered Littoral Water Birds:

The birds in this category are also diving, fish eating birds, but they favour more sheltered waters than their cousins. They are often seen close to shore, and most are migratory. They include Common Loon (*Gavia immer* (Brunnich)), Red-throated Loon (*Gavia stellata* (Pontoppidan)), Red-necked Grebe (*Podiceps grisagena* (Boddaect)), Horned Grebe (*Podiceps auritus* (Linnaeus)), Eared Grebe (*Podiceps caspicus* (Hablizl)), Greater Scaup (*Aythya marila* (Linnaeus)), Common Goldeneye (*Bucephala clangula* (Linnaeus)), Barrow's Goldeneye (*B. islandica* (Gmelin)), Bufflehead (*B. albeola* (Linnaeus)), Common Merganser (*Mergus merganser* Linnaeus) and Red-breasted Merganser (*M. serrator* Linnaeus).

Sheltered Shallow Water Birds:

These birds are the surface feeding and dabbling ducks, geese and swans, whose preferred habitats are the shallow waters over eel grass

Table 4. Weights of Selected Bird Species

Taxa	$\bar{X}$ Weight in Grams	Taxa	$\bar{X}$ Weight in Grams
Common Loon	3330(2425-3677)	Common Goldeneye	1010(692-1452)
Arctic Loon	2000*	Barrow's Goldeneye	939(499-1135)
Red-throated Loon	2000*	Bufflehead	466(332-636)
Western Grebe	656(520-793)	Pintail	969(590-1462)
Red-necked Grebe	450*	Oldsquaw Duck	746(612-999)
Horned Grebe	369(N.A.)	White-winged Scoter	1373(953-1771)
Eared Grebe	350*	Surf Scoter	863(636-1135)
Short-tailed Albatross	2300*	Common Scoter	1068(863-1272)
Black-footed Albatross	2300*	Common Merganser	1430(953-2043)
Northern Fulmar	100*	Red-breasted Merganser	704(590-817)
Sooty Shearwater	100*	Hooded Merganser	704(681-726)
Leach's Petrel	27	Great Blue Heron	2340(1850-3062)
D-C Cormorant	3000*	Bald Eagle	5549(4313-6356)
Brandt's Cormorant	2979	Coot	493(434-551)
Pelagic Cormorant	1463(1250-1850)	Black Oyster-catcher	559(524-577)
Whistling Swan	6208(4072-8244)	Greater Yellowlegs	170
Canada Goose	3882(2134-5676)	Northern Phalarope	6
Brant	1385(1317-1453)	Parasitic Jaeger	500*
White-fronted Goose	2729(2134-2996)	Skua	500*
Snow Goose	2254(1345-3314)	Glaucous-winged Gull	941(717-1120)
Mallard	1039(544-1725)	Western Gull	900*
Gadwall	863(636-1044)	Herring Gull	1018(850-1184)
Blue-winged Teal	397(227-545)	California Gull	700*
Widgeon	817(544-1089)	Bonaparte Gull	300*
Shovellor	647(499-817)	Mew Gull	400*
Greater Scaup	806(726-1362)	Heerman's Gull	510(430-554)
Black-legged Kittiwake	400*	Great Horned Owl	1291(973-1480)

Table 4. (Continued)

Taxa	$\bar{X}$ Weight in Grams	Taxa	$\bar{X}$ Weight in Grams
Arctic Tern	300*	Snowy Owl	1404
Common Murre	978(637-1195)	Flicker	142(108-163)
Pigeon Guillemot	400*	Pileated Woodpecker	950*
Rhinoceros Auklet	500(470-530)	Northwestern Crow	866
Tufted Puffin	703(606-813)	Robin	78(74-82)
Marbled Murrelet	216(206-226)	Varied Thrush	75*
Cassin's Auklet	143		

Measurements in brackets are ranges; all measurements include both male and female individuals; * indicates an estimated weight based on length relative to known weight species that are closely related. Poole 1938; Baldwin and Kendeigh 1938; Bellrose 1976; B.C. Provincial Museum, Archaeology Division records.

beds in sheltered bays and estuaries, shallow lakes, mudflats, marshes and streams. They include: Whistling Swan (*Olor columbianus* (Ord)), Canada Goose (several sub-species) (*Branta canadensis* (Linnaeus)), Brant (*B. bernicla* (Linnaeus)), White-fronted Goose (*Anser albifrons* (Scopoli)), Snow Goose (*Chen caerulescens* (Linnaeus)), Mallard (*Anas platyrhynchos* Linnaeus), Gadwall (*A. strepara* Linnaeus), Blue-winged Teal (*A. discors* Linnaeus), Pintail (*A. acuta* Linnaeus) American Widgeon (*Mareca americana* (Gmelin)), Shoveler (*Spatula clypeata* (Linnaeus)), and American Coot (*Fulica americana* Gmelin). These birds are often found on shore at the waters edge, as well as in the littoral waters.

Strand/Littoral Interface Birds:

These are the beach scavengers and the wading birds who feed on the tidal flats, the gulls and the shorebirds. They include the Glaucous-winged Gull (*Larus glaucescens* Naumann), Western Gull (*L. occidentalis* Audubon), Herring Gull (*L. argentatus* Pontoppidan), California Gull (*L.*

californicus Lawrence), Mew Gull (*L. canus* Linnaeus), Bonaparte's Gull (*L. philadelphia* (Ord)), Heermann's Gull (*L. heermanni* Cassin), Great Blue Heron (*Ardea herodias* Linnaeus) Bald Eagle (*Haliaeetus leucocephalus* (Linnaeus)), Black Oyster-catcher (*Haematopus bachmani* Audubon), Greater Yellowlegs (*Totanus melanoleucus* (Gmelin)), Northwestern Crow (*Corvus caurinus* Baird) and various sandpiper species.

Forest/Upland Birds:

Few forest birds are represented in the samples, although there are many species present in the harbour. Those identified archaeologically include Great Horned Owl (*Bubo virginianus* (Gmelin)), Snowy Owl (*Nyctea scandiaca* (Linnaeus), Flicker (*Colaptes cafer* (Gmelin)), Pileated Woodpecker (*Dryocopus pileatus* (Linnaeus)), Varied Thrush (*Ixoreus naevius* (Gmelin)) and various unidentified small finches or the like.

All of Hesquiat Harbour except the lakes is classified by the B.C. Land Directorate as Class 7 land in capability for waterfowl production, meaning that the limitations of these lands are so severe that waterfowl production is nearly precluded. The lakes are classified as Class 5 (moderately severe) and Class 6 (severe limitations) (The Canada Land Inventory, Land Capability Classification for Wildlife, Map Nootka Sound, 92E, Waterfowl). This classification takes into account the breeding, wintering and migratory stopover potential of an area, and clearly indicates the unsuitability of the Hesquiat Harbour terrain to support large waterfowl populations.

No accurate estimates of seabird populations specific to Hesquiat Harbour are available, but they are certainly more common than waterfowl. Many of both the waterfowl and the seabirds are migratory, only available in Hesquiat Harbour at certain times of year.

The most relevant information on species abundance and seasonal occurrence is that gathered by Hatler, Campbell and Dorst (1978) for Pacific Rim National Park on the west coast of Vancouver Island south of Hesquiat Harbour. Table 5 presents seasonal abundance data from this study (augmented by direct observations in Hesquiat Harbour) for all 63 species of bird identified in the archaeological samples. The birds are grouped into 10 categories of seasonal availability:

1) Present year round in roughly equal abundance
2) Present year round but less common in the summer months
3) Not present (for varying lengths of time in the summer months
4) Only present late fall to very early spring
5) Present year round but more abundant in the fall and spring
6) Only present in fall and spring
7) Only present discontinuously in the spring to early fall months
8) Present year round but more common in the summer months
9) Only present spring through fall
10) Only present summer through fall

As can be seen from Table 5, 36 of the 63 species are potentially available year round. Of these, 17 species are available in roughly constant quantities throughout the year, the remaining 19 in seasonally fluctuating quantities. All other species are only available for restricted portions of the year.

In addition to seasonal fluctuations in occurrence and/or abundance, the availability of the seabirds is affected by their offshore/onshore and short range latitudinal movements related to the occurrence of feed.

Table 5. Seasonal Abundance and Availability of Selected Bird Species in the Hesquiat Harbour Region *

Seasonal Category	Species	Month J F M A M J J A S O N D
1	Surf Scoter	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	Northwestern Crow	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	Bald Eagle	X X X X X X X X X X X X X X X X X
	Black Oystercatcher	X X X X X X X X X X X X X X X X X
	Brandt's Cormorant	X X X X X X X X X X X X X X X X X
	Pelagic Cormorant	X X X X X X X X X X X X X X X X X
	Great Blue Heron	X X X X X X X X X X X X X X X X X
	Common Merganser	X X X X X X X X X X X X X X X X X
	Glaucous-winged Gull	XXXX X X X X X X X X X X X X X X X
	Mew Gull	X X X X X X X X X X X X X X X X X
	Western Gull	----------------------------------
	Herring Gull	----------------------------------
	Pigeon Guillemot	----------------------------------
	Common Scoter	---------------?-?--?------------
	Flicker	----------------------------------
	Pileated Woodpecker	- - - - - - - - - - - -
	Great Horned Owl	- - - - - - - - - - - -
2	Common Loon	X X X X X X XXXX-------XXXX X X X
	Varied Thrush	X X X X X X X------XXXXXXXXX X X X
	Greater Scaup	X X X XXXXX X - - - - X X X X
	Mallard	X X X X X X X-------------X X X X
	Red-breasted Merganser	X X X X X X X - - - - - X X X
	Western Grebe	--------------- - - - - - -------
	Red-necked Grebe	------------ - - - ----------
	Double-crested Cormorant	------------ - - - - --------
	Horned Grebe	------------ - - - - -------
3	Brant	----X XXX X ---- - - - --
	Pintail	------- - - - ----X X X X --
	American Widgeon	XXXXXXXXXXX X - - - X XXXXXXXX
	Common Goldeneye	X X X X X X X- - -X X X

Table 5. (Continued)

Seasonal Category	Species	J	F	M	A	M	J	J	A	S	O	N	D
3 (cont)	Barrow's Goldeneye	--	-	-	-	-	-??		?	? -	-	-	
	Bufflehead	XX	XXX	XXX	XXX	X X	X			X	X XX	XXX	X
	Oldsquaw Duck	--	---	---	---	-				-	- -	---	--
4	American Coot	-	-	--	---	-				--	---	---	-
	Snowy Owl	-	-									---	--
5	White-winged Scoter	X	X X	XX	XX	X X	X	XXX	XXX	XX	X X	X	X
	Bonaparte's Gull	-	--	-	--	---	- -	--	---	- -	--	---	--
	Arctic Loon	X-	---	-X	X X	XXX	X X	XX	X X	XXX	---	---	--
	Canada Goose	--	---	-X	X X	X X	X	-	- -	--X	XX	XX	X
6	Whistling Swan			-	-	--	-				-	-	-
	White-fronted Goose				--	--		---	---	- -	-	-	
	Gadwall				-	- -	-			-	-	-	-
	Shoveler			- -	---	---	--			-	--	---	-
	Snow Goose			-	-						--	---	-
7	Blue-winged Teal						-??	?-	? -	?-?	-		
	Arctic Tern						-?-	--	-	-			
	Northern Phalarope			--	-XX	XXX	X -	X	XX	X X	-	-	
8	Black-legged Kittiwake	--	---	---	---	-X	X X	X	X X	X	---	---	--
	Common Murre	-	-?-	-	-?-	-	X X	XXX	XXX	XXX	-	-?-	-
	Red-throated Loon	--	---	---	-X	X X	X	X X	X	X X	---	---	--
	Marbled Murrelet	-	- -	-X	X	X X	X	X X	X	X X	- -	-	-
	Black-footed Albatross		-	- -	-	- -	-	- -	---	---	- -	---	- -
	Northern Fulmar	-	-	-	-	-	-	-	- -	-	- -	-	- -
9	Greater Yellowlegs			-	--	--	-	---	---	---	--	-	-
	Parasitic Jaeger					- -	-	-	--	---	--		
	Sooty Shearwater		X	X X	X	X X	XX	XXX	X X	X	X X	X	
	Cassin's Auklet		-	- -	-	- -	-	- -	-	- -	-		
	Rhinoceros Auklet				---	---	---	---	---	---	--	-	
	Tufted Puffin					-	--	---	---	---	-		

Table 5. (Continued)

Seasonal Category	Species	J	F	M	A	M	J	J	A	S	O	N	D
								Month					
10	Heermann's Gull						-	-X	X	X	X-	-	
	Skua							-	-	-	-		

KEY: Absent   ; Rare - ---; Present - - -; Uncommon -----;
Common X X X ; Abundant XXXXX

* Extrapolated from Hatler, Campbell and Dorst 1978

No precise data are currently available on these latter movements for the Hesquiat area, although it is known they can be abrupt, unpredictable with present knowledge and of considerable magnitude, with flocks of several thousand Sooty Shearwaters for example, congregating in an area for several days, then disappearing overnight.

A third factor affecting availability from a human predator's point of view is the concentration in which a species occurs. For bird species, this ranges from single individuals through pairs, family groups, small flocks and large flocks of several thousand individuals, and may vary with the season. In general, largest concentrations are at nesting grounds or during migration. At sea, the fully pelagic birds tend to disperse into small groups or individuals, flocking into larger groups when the feed is concentrated or when actually on migration. The murres, auklets and cormorants are usually found in small flocks while the grebes and loons tend to be solitary, in pairs, or in very small groups when not actually migrating. During migration, all the duck and goose species are found in small to very large flocks. At other times they tend to move in pairs or small groups of pairs. The gulls are found in highly variable concentrations when off the nesting grounds, favouring small flocks. Sandpipers congregate in small flocks while the Greater Yellow Legs, the Great Blue Heron and Black Oyster Catcher are solitary or in pairs. Other seastrand and forest birds are generally found in pairs or solitary, except for the crows, which are normally found in small flocks.

Fish:

At least forty different species of fish were identified in the archaeological samples from Hesquiat Harbour, ranging from marine sharks and rockfish to anadromous salmon. Although many more species are available, those present represent a wide range of habitats and a good selection of food fish.of varying sizes. Although most are marine fish, four species of anadromous fish spawn in the Harbour streams and those entering Hesquiat, Hisnit and Village Lakes, including Sockeye (Hesquiat Lake only), Coho and Chum Salmon, and Steelhead. Some marine fish, such as Herring, Sardine and Bluefin Tuna, are also only seasonally available in the harbour.

No accurate data on abundance of individual species, are available specifically for Hesquiat Harbour except for Fisheries records for the salmon and steelhead spawning in the creeks on the east side of the harbour. These records are not direct stream counts, but estimates, often obtained from local residents or from planes. They cannot be regarded as accurate data. They do, however, indicate that salmon resources of the Harbour are not (and probably were not) very extensive.

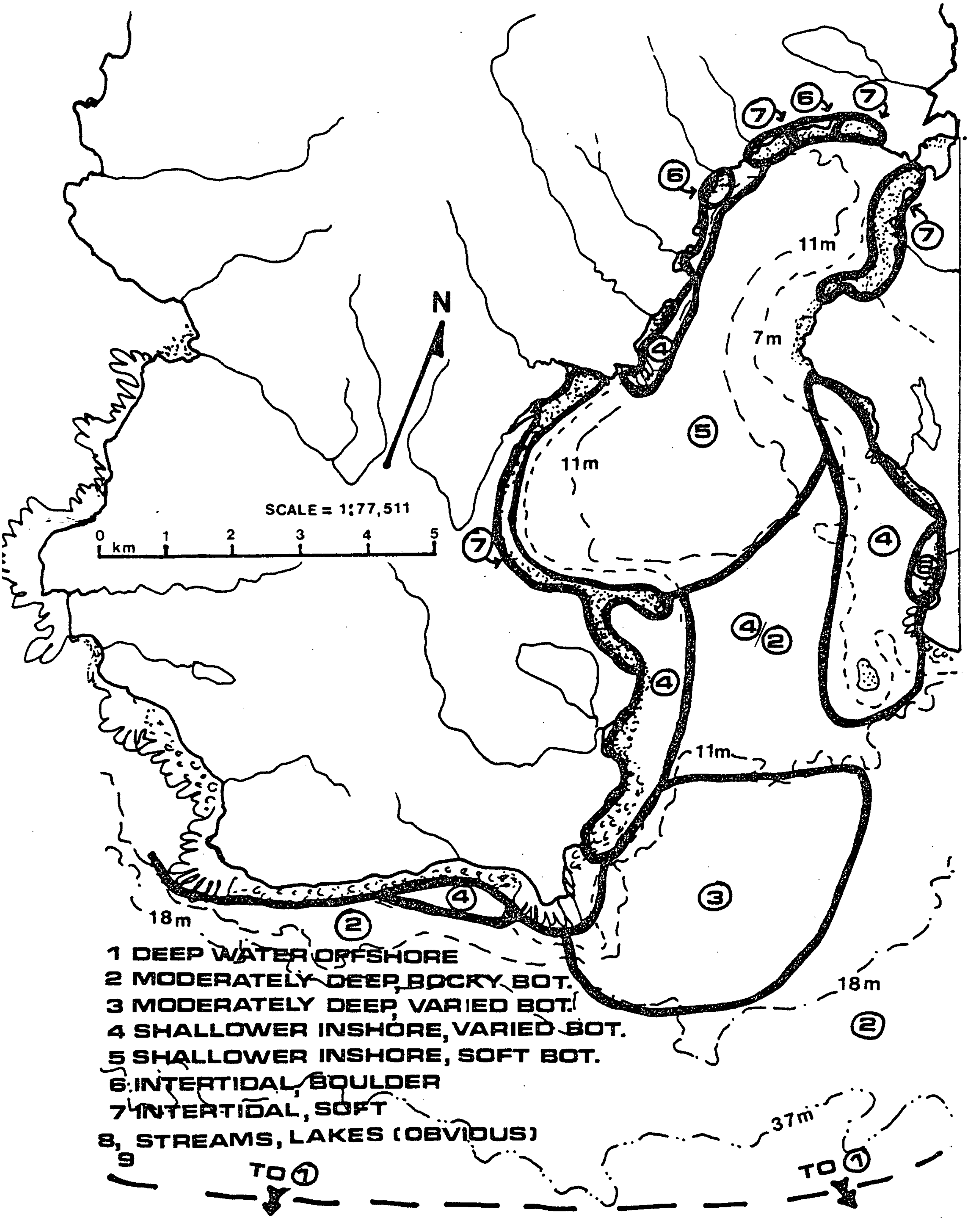
The count estimates record a steady decline in the number of fish entering the streams throughout the period of records. For the years 1944 to 1973, the average annual number of Coho spawning in the eastside streams and Hesquiat Lake drainage is estimated at 1,247 fish, with a range of 50 (1963) to 10,000 (1945) fish. For Chum, the annual average is 2,120 fish and the range 50 (1963) to 20,000 (1946) fish. Sockeye only appear in the records in five of the years since 1968, one year only as fingerlings. It is not clear if sockeye are newly using these spawning grounds or if they were not recorded in earlier years. The range of run size is 30 to 1,000 fish, average 216 fish. Steelhead are recorded as present in the east side streams, but no numerical data are given (Tofino Federal Fisheries Office Records, 1944 - 1973). Local residents indicate that the streams on the north and west sides of Hesquiat Harbour are also Chum and Coho streams, and that the stream draining Village Lake is a good, though small run, Coho stream.

Herring are very abundant in the late winter and early spring when they approach the Harbour beaches to spawn. Although no figures specific to Hesquiat Harbour are available, it is known to local fisherman as one of the best places for herring on the west coast of Vancouver Island. Numerical abundance data are not available for the other species of fish identified in the archaeological record, but dogfish and rockfish are certainly common in the Harbour.

Great variation exists among species in the concentration of occurrence, ranging from the solitary wolf eel to the huge schools of spawning herring.

The fish fauna can be grouped into nine habitat categories as defined below, according to their preferred habitat. These habitats refer to adult populations and do not take into account vertical or local movement

Figure 6. Generalized Distribution of Fish Habitat Categories.



within the categories. Table 6 groups the species identified archaeologically by the habitat categories and indicates season of availability. The present distribution of the habitat categories in the harbour is displayed in Figure 6. Dogfish (Squalus acanthius Linnaeus) and Ratfish (Hydrolagus colliei (Lay and Bennett)) are excluded from the habitat table as they occur in a very wide range of habitats. They are available year round. The habitat categories are:

Deep Water Offshore: the deep, offshore waters of the open coast, over varied bottoms, including offshore reefs and banks, often deeper than 300 metres.

Moderately Deep Water, Rocky Bottom: the moderately deep to deep littoral waters over rocky bottoms. Fish are concentrated above 300 metres, often above 200 metres.

Moderately Deep Water, Varied Bottom: the moderately deep to deep littoral waters over varied bottom.

Shallower Inshore Waters: the shallow waters of bayssand inlets over various substrata.

Shallower Inshore Waters, Soft Bottom: the shallow waters of bays and inlets over muddy sand and gravel bottoms.

Intertidal, Boulder Bottom: the littoral waters of bays and inlets over intertidal zones of boulders and rocks on soft bottom.

Intertidal, Soft Bottom: the shallow littoral waters of bays and inlets over intertidal zones of sand and gravel.

Streams: (self explanatory)

Lakes: (self explanatory)

Deep Water Offshore Fish:

These fish include several species of sharks, as well as a number of flatfish and smaller schooling fish. The west coast of Vancouver Island is the northern limit of the Bluefin Tuna's range, where it occurs infrequently during the summer months. The fish in this category are Longnose Skate (Raja rhina Jordan and Gilbert), Sardine (Sardinops Sagax

Table 6. Seasonal Availability and Habitat Categories of Fish Found in the Hesquiat Harbour Area

	Habitat Categories								
Taxa	1 Deep Water Offshore	2 Mod. Deep Rocky Bottom	3 Mod. Deep Varied Bottom	4 Shallower Inshore Varied Bottom	5 Shallower Inshore Soft Bottom	6 Intertidal Boulder Bottom	7 Intertidal Soft Bottom	8 Streams	9 Lakes
Sharks, Pleurotremata	X								
Longnose Skate, *Raja rhina*	X								
Sardine, *Sardinops sagax*	X(S)								
Northern Anchovy, *Engraulis mordax mordax*	X(S)								
Pacific Hake, *Merluccius productus*	X								
Bluefin Tuna, *Thunnus thynnus*	X(S)								
Sablefish, *Anoplopoma fimbria*	X								
Arrowtooth Flounder, *Atheresthes stomias*	X								
Petrale Sole, *Eopsetta jordani*	X(W)		X(S)						
Flathead Sole, *Hippoglossoides elassodon*	X								
Pacific Halibut, *Hippoglossus stenolepis*	X								
Dover Sole, *Microstomus pacificus*	X								
English Sole, *Parophrys vetulus*	X(W)		X(S)						
Copper Rockfish, *Sebastes caurinus*		X							
Yellowtail Rockfish, *S. flavidus*		X							
Shortbelly Rockfish, *S. jordani*		X							
Quillback Rockfish, *S. maliger*		X							
Black Rockfish, *S. melanops*		X							
Bocaccio, *S. paucispinus*		X							
Canary Rockfish, *S. pinniger*		X							

Table 6. (Continued)

Taxa	Habitat Categories 1 Deep Water Offshore	2 Mod. Deep Rocky Bottom	3 Mod. Deep Varied Bottom	4 Shallower Inshore Varied Bottom	5 Shallower Inshore Soft Bottom	6 Intertidal Boulder Bottom	7 Intertidal Soft Bottom	8 Streams	9 Lakes
Yelloweye Rockfish, *S. ruberrimus*		X							
Rock Greenling, *Hexagrammos lagocephalus*		X							
Lingcod, *Ophiodon elongatus*		X							
Cabezon, *Scorpaenichthys marmoratus*		X							
Big Skate, *Raja binoculata*			XX						
Spring Salmon, *Oncorhynchus tshawytscha*			X(W,SP)						
Plainfin Midshipman, *Porichthys notatus*			X(W)			X(SP)			
Wolf-eel, *Anarrhichthys ocellatus*			X						
Striped Seaperch, *Embiotoca lateralis*				X					
Pile Perch, *Rhacochilus vacca*				X					
Buffalo Sculpin, *Enophrys bison*				X					
Red Irish Lord, *Hemilepidotus hemilepidotus*				X(W)			X(SP)		
Rock Sole, *Lepidosetta bilineata*				X					
Pacific Sanddab, *Citharichthys sordidus*					X				
Starry Flounder, *Platichthys stellatus*					X				
Sand Sole, *Psettichthys melanostictus*					X				
Herring, *Clupea harengus pallasi*						X(SP)			
Steelhead, *Salmo gairdneri*			X(S)	X(S)				X(F)	

Table 6. (Continued)

Taxa	1 Deep Water Offshore	2 Mod. Deep Rocky Bottom	3 Mod. Deep Varied Bottom	4 Shallower Inshore Varied Bottom	5 Shallower Inshore Soft Bottom	6 Intertidal Boulder Bottom	7 Intertidal Soft Bottom	8 Streams	99 Lakes
Chum Salmon, _Oncorhynchus_ _keta_			X(S)	X(S)				X(F)	
Coho Salmon, _O._ _kisutch_			X(S)	X(S)				X(F)	
Sockeye Salmon, _O._ _nerka_			X(S)	X(S)				X(F)	X(F)
Trout, _Salmo_ sp.								X	X

KEY: (W)-Winter; (SP)-Spring; (S)-Summer; (F)-Fall; otherwise year round
d

(Jenyns)), Northern Anchovy (*Engraulis mordax mordax* Girard), Pacific Hake (*Merluccius productus* (Ayres)), Bluefin Tuna (*Thunnus thynnus* (Linnaeus)), Sablefish (*Anoplopoma fimbria* (Pallas)), Arrowtooth Flounder (*Atheresthes stomias* (Jordan and Gilbert)), Petrale Sole (*Eopsetta jordani* (Lockington)), Flathead Sole (*Hippoglossoides elassodon* Jordan and Gilbert), Pacific Halibut (*Hippoglossus stenolepis* Schmidt), Dover Sole (*Microstomus pacificus* (Lockington)), and English Sole (*Parophrys vetulus* Girard). During the summer months, the English and the Petrale Soles move into shallower waters closer to shore.

Moderately Deep Water over Rocky Bottom Fish:

This category includes the rockfish, greenlings and some of the larger sculpins. Species identified are Copper Rockfish (*Sebastes caurinus* Richardson), Yellowtail Rockfish (*Sebastes flavidus* (Ayres)), Shortbelly Rockfish (*Sebastes jordani* (Gilbert)), Quillback Rockfish (*Sebastes maliger* (Jordan and Gilbert)), Black Rockfish (*Sebastes melanops* Girard), Bocaccio (*Sebastes paucispinus* Ayres), Canary Rockfish (*Sebastes pinniger* (Gill)), Yelloweye Rockfish (*Sebastes ruberrimus* (Cramer)), Rock Greenling (*Hexagrammos lagocephalus* (Pallas)), Lingcod (*Ophiodon elongatus* Girard) and Cabezon (*Scorpaenichthys marmoratus* (Ayres)).

Moderately Deep Water Over Varied Bottom Fish:

This is a less well defined category than others. The Big Skate (*Raja binoculata* Girard) and the Wolf Eel (*Anarrhichthys ocellatus* Ayres) are year round residents of these waters, while Petrale and English Soles are found here during the summer months, Spring Salmon (*Oncorhynchus tshawytscha* (Walbaum)) during the late winter and early spring months, and the Plainfin Midshipman (*Porichthys notatus* Girard) through the months when it is not spawning, in the spring and early summer. During the late summer, just prior to entering the streams, the Coho Salmon (Oncorhynchus kisutch (Walbaum)), Chum Salmon (O. keta (Walbaum)), Sockeye Salmon (O. nerka (Walbaum)) and Steelhead (Salmo gairdneri Richardson) are also found in this category.

Shallower Inshore Waters over Varied Bottom Fish:

These waters are the haunts of the sea perches, smaller sculpins and some flatfish. The Chum, Coho and Sockeye Salmon and Steelhead are also found in this habitat while they wait to enter fresh water. Identified in the archaeological sample are Striped Seaperch (Embiotoca lateralis Agassiz), Pile Perch (Rhacochilus vacca (Girard)), Buffalo Sculpin (Enophrys bison (Girard)), and Rock Sole (Lepidosetta bilineata (Ayres)). The Red Irish Lord (Hemilepidotus hemilepidotus (Tilesius)) is also found here except when spawning in the spring.

Shallower Inshore Waters Over Soft Bottom Fish:

Three species of flatfish identified in the archaeological samples inhabit these waters, the Pacific Sanddab (Citharichthys sordidus (Girard)), the Starry Flounder (Platichthys stellatus (Pallas)) and the Sand Sole (Psettichthys melanostictus (Girard).

Intertidal, Boulder Bottom Fish:

A single species, the Plainfin Midshipman, inhabits these areas during the spawning time in spring and early summer. They burrow beneath the boulders, making nests in the soft muddy sand.

Intertidal, Soft Bottom Fish:

This category is also a seasonal category, the intertidal soft beaches used for spring spawning by the Red Irish Lord and the Pacific Herring (<u>Clupea harengus pallasi</u> Valenciennes).

Stream Fish:

The Coho, Sockeye, and Chum Salmon, the Steelhead and trout (<u>Salmo</u> sp.) are found in the streams, the former four species during the spawning season only, in Fall, while otherstrout are year round residents.

Lake Fish:

Sockeye Salmon and trout species will also be found in the lakes, the former only during the fall spawning season, as they wait to enter the tributary spawning streams.

The range of fish species exploited by the inhabitants of Hesquiat Harbour vary greatly in size, from the 33 cm Pacific Herring to the 2.5 m Bluefin Tuna and even larger sharks. To assist in the later analysis of the faunal remains, the fish species were grouped into major weight classes. These groupings are detailed in Table 7 below.

Table 7. SizesClasses of Selected Fish

Size Class	Taxa
< 1 Kg	Pacific Herring, Sardine, Anchovy, Plainfin Midshipman, Striped Seaperch, Pile Perch, Buffalo Sculpin, Sanddab, Flathead Sole, Red Irish Lord
1 Kg -<5 Kg	Pink Salmon, Coho Salmon, Sockeye Salmon, Copper Rockfish, Yellowtail Rockfish, Quillback Rockfish, Black Rockfish, Greenling, Rock Sole, English Sole, Sand Sole, Dover Sole, Petrale Sole, Ratfish, Shortbelly Rockfish
5 Kg -<10 Kg	Dogfish, Arrowtooth Flounder, Starry Flounder, Hake, Bocaccio, Canary Rockfish, Yelloweye Rockfish, Big Skate

Table 7. (Continued)

Size Class	Taxa
10 Kg -<20 Kg	Wolf Eel, Steelhead, Chum Salmon, Longnose Skate, Cabezon, Sablefish
20 Kg -<60 Kg	Spring Salmon, Ling Cod, Halibut (male)
60 Kg - 100 Kg	Bluefin Tuna (maximum 114 Kg), Halibut (female, maximum 216 kg), Sharks

Size estimates are based on Hart 1973 and records of the BCPM Archaeology Division Comparative Skeleton Collection.

Shellfish:

The term shellfish is used here to include intertidal and marine invertebrates with calcareous exoskeletons that are preserved in an archaeological context. This category includes bivalve and univalve molluscs, chitons, sea urchins, crabs and barnacles.

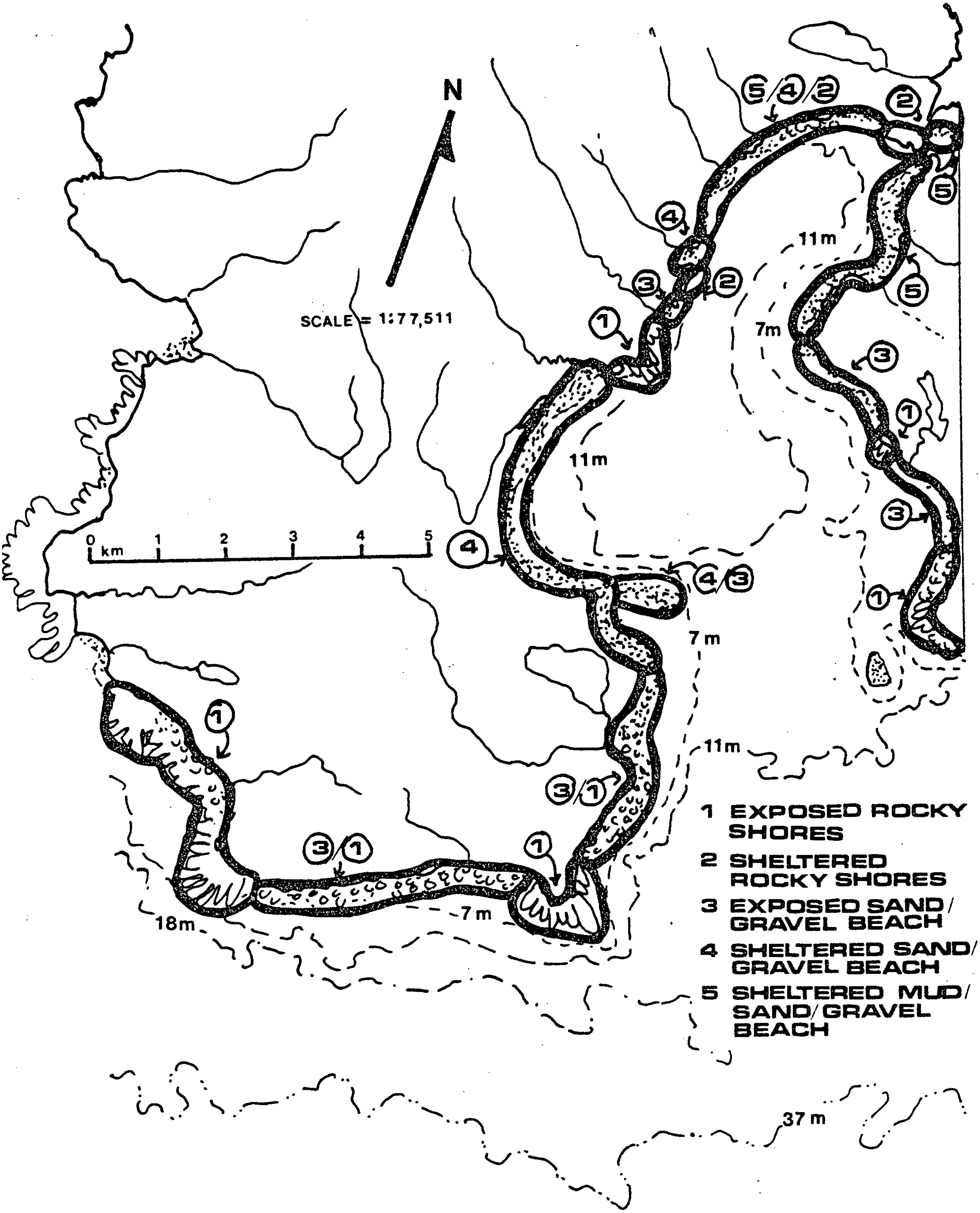
All the shellfish identified in the archaeological record are available year round, although some may be considered unpalatable during their breeding season. Their availability is, however, affected by their vertical placement in the intertidal zone and by seasonal tidal patterns. Many shellfish are adapted to very specific habitats, while others are tolerant of a wider range of conditions.

Regardless of their vertical placement in the intertidal zone, the 34 species of shellfish identified in the archaeological samples from Hesquiat Harbour can be grouped according to their preference for the following habitats:

Exposed Rocky Shores: the rock substratum intertidal zone exposed to heavy (outer coast) wave action; high salinity.

Sheltered Rocky Shores: the rock substratum and boulder beach intertidal zone subject to less wave action; varying degrees of salinity.

Figure 7. Generalized Distribution of Shellfish Habitat Categories.



Exposed Clean Sand/Gravel Beaches: sand or gravel substratum intertidal zone subject to less wave action; varying degrees of salinity.

Sheltered Sand/Gravel Beaches: protected sand or gravel substratum intertidal zone subject to less wave action; varying degrees of salinity.

Sheltered Mud/Sand/Gravel Beaches: protected muddy sand and gravel substratum intertidal zone subject to less wave action; lower salinity.

Table 8 groups the species according to these habitat categories, while the present distribution of the categories in Hesquiat Harbour is displayed in Figure 7.

Exposed Rocky Shores Shellfish:

The exposed rocky shores of Hesquiat Harbour are outer coast habitats. The shellfish found only on these shores are the California Mussel (*Mytilus californianus* (Conrad)), sea urchin species (*Strongylocentrotus* sp.), Northern Abalone (*Haliotis kamschatkana* Jonas), Leafy Hornmouth (*Ceratostoma foliatum* (Gmelin)), Dire Whelk (*Searlesia dira* (Reeve)). The Finger Limpet (*Acmaea digitalis* Eschscholtz), Black Turban (*Tegula funebralis* (A. Adams)), Red Turban (*Astraea gibberosa* (Dillwyn)), Sitka Periwinkle (*Littorina sitkana* Philippi), Eschricht's Bittium (*Bittium eschrichti* (Middendorff)), Hooked Slipper Shell (*Crepidula adunca* Sowerby), Lurid Rock Shell (*Ocenebra lurida* (Middendorff)), Mossy Chiton (*Mopalia muscosa* Gould), Black Katy (*Katherina tunicata* Wood), and the Giant Chiton (*Cryptochiton stelleri* Middendorff) all prefer the more exposed rocky shores, but are also found on less open shores. The Plate Limpet (*Acmaea testudinalis scutum* Eschscholtz), Channeled Dogwinkle (*Thais canaliculata* (Duclos), Emarginate Dogwinkle (*Thais emarginata* Deshayes) and the File Dogwinkle (*Thais lima* (Gmelin) are found equally on both exposed and protected rocky shores.

Table 8. Habitat Categories for Shellfish in the Hesquiat Harbour Region

	Habitat Category				
	1	2	3	4	5
Taxa	Exposed Rocky Shore	Sheltered Rocky Shore	Exposed Clean Sand/Gravel Beaches	Sheltered Sand/Gravel Beaches	Sheltered Mud/Sand/Gravel Beaches
California Mussel, *Mytilus californianus*	X				
Sea Urchin, *Strongylocentrotus* sp.	X				
Northern Abalone, *Haliotis kamschatkana*	X				
Leafy Hornmouth, *Ceratostoma foliatum*	X				
Dire Whelk, *Searlesia dira*	X				
Finger Limpet, *Acmaea digitalis*	XX	X			
Black Turban, *Tegula funebralis*	XX	X			
Red Turban, *Astraea gibberosa*	XX	X			
Sitka Periwinkle, *Littorina sitkana*	XX	X			
Eschricht's Bittium, *Bittium eschrichti*	XX	XX			
Hooked Slipper Shell, *Crepidula adunca*	XX	X			
Lurid Rock Shell, *Ocenebra lurida*	XX	X			
Mossy Chiton, *Mopalia muscosa*	XX	X			
Black Katy, *Katharina tunicata*	XX	X			
Giant Chiton, *Cryptochiton stelleri*	XX	X			
Plate Limpet, *Acaea testudinalis scutum*	X	X			
Channeled Dogwinkle, *Thais canaliculata*	X	X			
Emarginate Dogwinkle, *Thais emarginata*	X	X			
File Dogwinkle, *Thais lima*	X	X			
Bay Mussel, *Mytilus edulis*	X	XX			
Shield Limpet, *Acmaea pelta*	X	XX			
Frilled Dogwinkle, *Thais lamellosa*	X	XX			
Purple-hinged Scallop, *Hinnites multirugosus*	X	XX			

Table 8. (Continued)

	Habitat Category				
	1	2	3	4	5
Taxa	Exposed Rocky Shore	Sheltered Rocky Shore	Exposed Clean Sand/Gravel Beaches	Sheltered Sand/Gravel Beaches	Sheltered Mud/Sand/Gravel Beaches
Pearly Monia, *Pododesmus cepio*		X			
Mask Limpet, *Acmaea persona*		X			
Bodega Clam, *Tellina bodegensis*			XX	XX	
Lewis's Moon Snail, *Polinices lewisii*			XX	X	
Purple Olive, *Olivella biplicata*			XX	X	
Butter Clam, *Saxidomus giganteus*				X	
Sand Macoma, *Macoma secta*				X	
Rose-petal Semele, *Semele rubropicta*				X	
Native Littleneck, *Protothaca staminea*				X	X
Basket Cockle, *Clinocardium nuttalli*					X
Horse Clam, *Tresus capax/nuttalli*					X

KEY: X-Present; XX-More abundant in this category when present in more than one category.

Sheltered Rocky Shores Shellfish:

The Mask Limpet (*Acmaea persona* Eschscholtz) and the Pearly Monia (*Pododesmus cepio* (Gray)) both prefer the sheltered rocky shore habitat. While the Bay Mussel (*Mytilus edulis* Linnaues), Shield Limpet (*Acmaea pelta* Eschscholtz), Frilled Dogwinkle (*Thais lamellosa* (Gmelin)) and the Purple-hinged Scallop (*Hinnites multirugosus* (Gale)) are sometimes found in the more exposed habitats, they too prefer the sheltered rocky shores.

Exposed Clean Sand/Gravel Beaches Shellfish:

The exposed soft substratum beaches are home to few animals. Their clean sands and gravels, virtually free of organic materials, provide little food for shellfish. Only three species found in the samples prefer these beaches, the Bodega Clam (*Tellina bodegensis* Hinds), the Lewis's Moon Snail (*Polinices lewisii* (Gould)), and the Purple Olive snail (*Olivella biplicata* (Sowerby)). All three species are also found less frequently on more sheltered beaches.

Sheltered Sand/Gravel Beaches Shellfish:

In addition to the three species mentioned above, four species of clams prefer this habitat category, the Butter Clam (*Saxidomus giganteus* Deshayes), Sand Macoma (*Macoma secta* (Conrad)), Rose-petal Semele (*Semele rubropicta* Dall), and Native Littleneck (*Protothaca staminea* (Conrad)). The Native Littleneck is equally abundant in more muddy habitats.

Sheltered Mud/Sand/Gravel Beaches Shellfish:

Two species of clams prefer the more muddy habitats of sheltered beaches, the Basket Cockle (*Clinocardium nuttalli* (Conrad)) and the Horse Clam (*Tresus capax/nuttalli* (Conrad)). As mentioned, the Native Littleneck is also found here.

Summary of Faunal Resources

These are the archaeologically exploited animal species and the habitats in which they are most commonly found today, characteristic of the study area. It is a fauna offering a wide variety of food resources to a human population but offering them in varying concentrations throughout the Harbour area and throughout the year.

The shape, topography, geomorphology, location and orientation of

Hesquiat Harbour are such that faunal habitats are unevenly distributed throughout the general harbour region. While the effects of this range and localized distribution of habitats are less noticeable on the local availability of land animal species, they are extremely important in the distribution of intertidal and marine species. The physical and ecological characteristics of the harbour combine to produce two geographical subdivisions of the harbour within which certain of the habitats cluster and within which the associated animals are most likely to be found in greatest quantities and most predictably.

To obtain a general picture of the harbour environment, the faunal habitat categories for birds, fish and mammal can be combined into five major vertebrate habitat categories as follows:

Pelagic: includes mammals Pelagic (1); birds Pelagic (1); and fish Deep Water Offshore (1).

Palagic/Littoral: includes mammals Pelagic/Littoral (2); birds Open Littoral Waters (2); and fish Moderately Deep Waters over Rocky Bottom (2).

Littoral: includes mammals Littoral (3); birds Sheltered Littoral Waters (3) and Sheltered Shallow Waters (4); and fish Moderately Deep Waters over Varied Bottom (3), Shallower Inshore Waters, Varied Bottom (4) and Shallower Inshore Waters, Soft Bottom (5).

Littoral/Forest Edge: includes mammals Littoral/Forest Edge (4); birds Strand/Littoral Interface (5); and fish Intertidal Boulder Bottom (6) and Intertidal Soft Bottom (7).

Streams/Lakes/Forests: includes mammals Forest (5); birds Forest/Upland (6); and fish Streams (8) and Lakes (9).

Similarly, the shellfish habitat categories can be grouped into two major habitat categories defined as follows:

Exposed Shores: includes categories Exposed Rocky Shores (1) and Exposed Clean Sand/Gravel Beaches (3).

Sheltered Shores: includes categories Sheltered Rocky Shores (2), Sheltered Sand/Gravel Beaches (4), and Sheltered Mud/Sand/Gravel Beaches (5).

The general distribution in Hesquiat Harbour of these major habitat categories is mapped in Figures 8 and 9.

The distributions of the combined habitat categories roughly divide the harbour region into two zones, an Inner Harbour Zone, north of Anton's Spit on the west and Rondeau Point on the east, and an Outer Coast Zone south of these two points of land. The transition from one zone to the other is not abrupt, with some sections of Exposed Shores habitat around LeClaire Point, but north of both LeClaire and Rondeau Points, all the habitats are sheltered. Each zone offers a different combination of habitats, as outlined below.

Inner Harbour Zone:

Here the more sheltered harbour waters are quite shallow, ranging from 15 metres on the west to 2 metres on the east. The sea bottom and surrounding beaches are predominantly muddy sand, with some stretches of boulder on sand. The shoreline contains rocky promontaries between the beaches particularly along the western shore. The bordering land is mostly mountain slope, fronted in some areas with old beach ridge flats, with only a small portion of the western shoreline backing onto the flat land of the Peninsula. Seven streams drain the mountain slopes and the zone contains Hesquiat and Rae lakes, and their tributary streams.

This zone contains the following optimal habitat categories:

Mammals: Littoral (3), Littoral/Forest Edge (4) and Forest (5).

Birds: Sheltered Littoral Waters (3), Sheltered Shallow Waters (4), Strand/Littoral Interface (5), Forest/Upland (6).

Figure 8. Generalized Distribution of Combined Vertebrate Habitats.

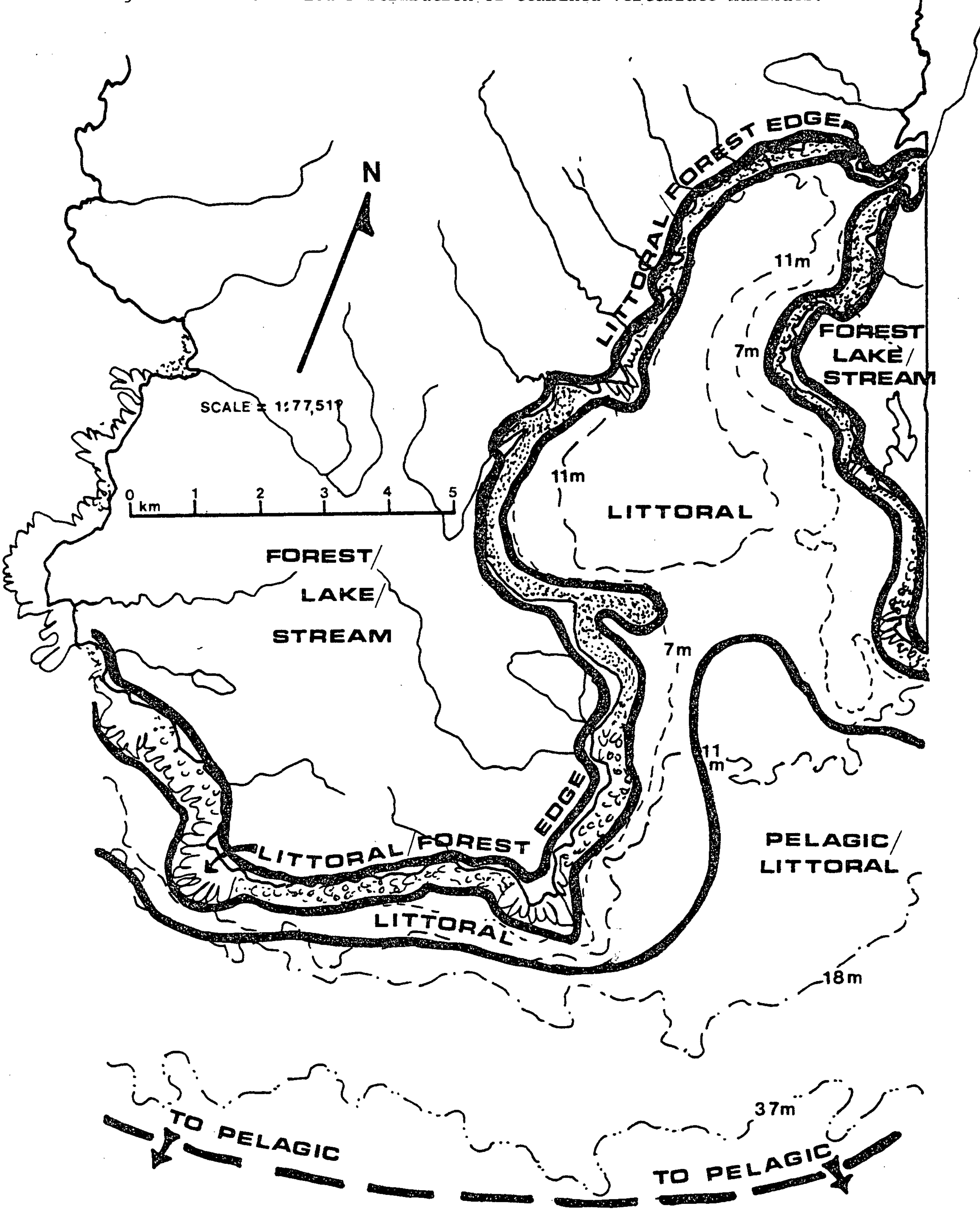
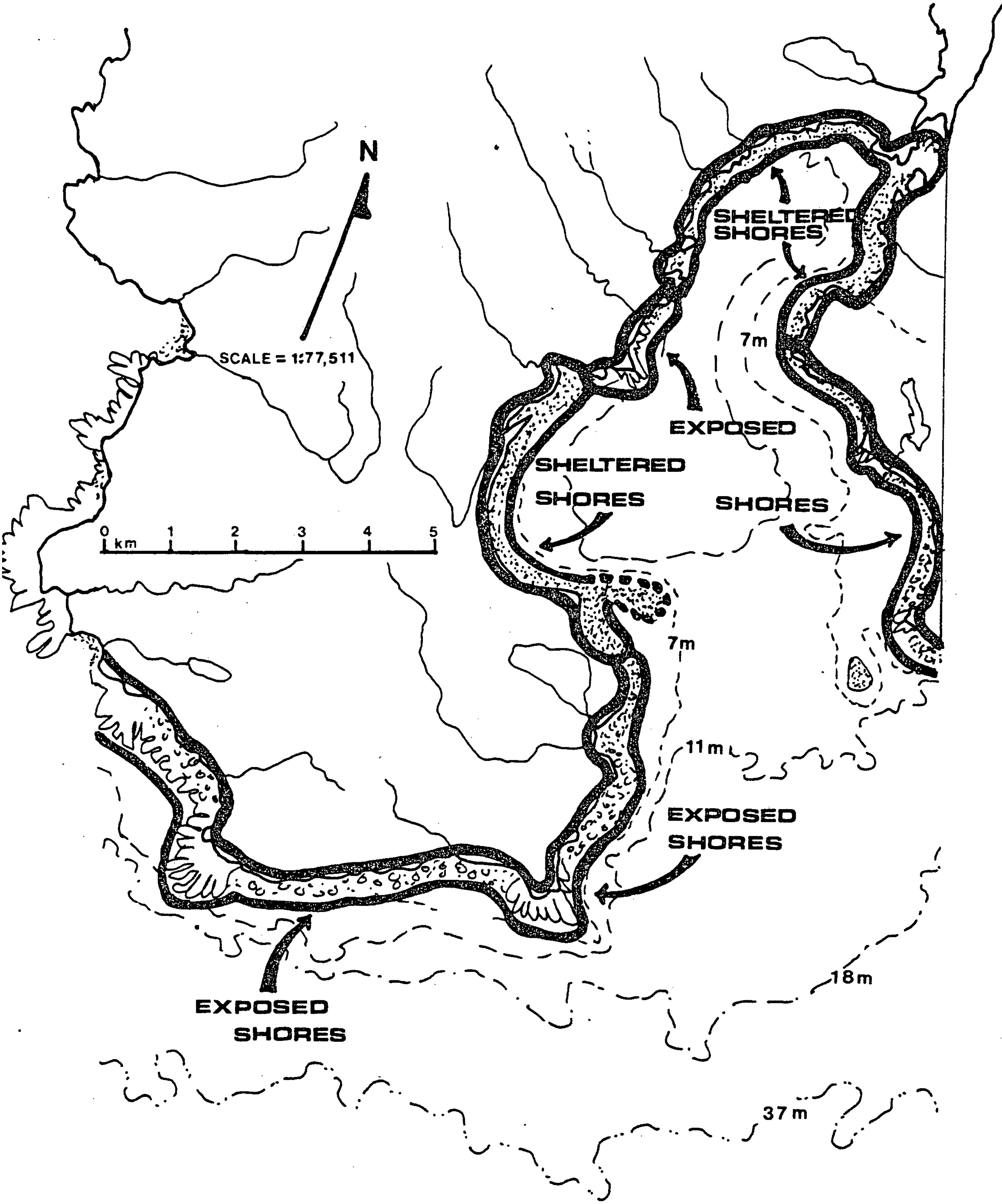


Figure 9. Generalized Distribution of Combined Shellfish Habitat Categories.



Fish: Shallower Inshore Waters, Soft Bottom (5), Intertidal, Boulder Bottom (6), Intertidal, Soft Bottom (7), Streams (8) and Lakes (9).

Shellfish: Sheltered Rocky Shores and Boulder Beaches (2), Sheltered Mud/Sand/Gravel Beaches (4).

In terms of the combined vertebrate habitat categories, the Inner Harbour Zone is characterized by Littoral, Littoral/Forest Edge, and Forest/ Streams Habitat Categories, while in the combined shellfish habitat categories, it is characterized almost exclusively by Sheltered Shores Habitat Category, with but a small area of Exposed Shores around LeClaire Point.

In summary, the Inner Harbour Zone is characterized by sheltered intertidal and shallow water marine habitats with good stretches of sand/ mud/gravel beaches and a predominantly muddy ocean floor. Streams are numerous, there are two lakes, and land habitats are forest and forest edge.

Outer Coast Zone:

As well as the eastern shoreline south of Rondeau Point and the western Shoreline south of Anton's Spit, this zone includes the complex of offshore reefs flanking the peninsula, the full stretch of open water across the harbour mouth and the open ocean areas offshore. The shoreline is predominantly rocky, with many headlands separated by stretches of clean sand and gravel beaches and long exposures of flat bedrock covered with huge boulders. There are few sheltered areas and few streams. Village Lake is included in this Zone. On the west, the land is the low, flat peninsula, on the east, the mountains slopes.

This zone offers the following habitat categories:

Mammals: All habitat categories are available in this zone, but Pelagic (1) and Pelagic/Littoral (2) are optimal here.

Birds: Pelagic (1), Open Littoral Waters (2) are optimal, with some occurrences of Sheltered Shallow Waters (4) around the lake and of Strand/Littoral Interface (5) and Forest/Upland (6) habitats.

Fish: Deep Water, Offshore (1), Moderately Deep Waters, Rocky Bottom (2), and Moderately Deep Water, Varied Bottom (3).

Shellfish: Exposed Rocky Shores (1) and Exposed Clean Sand/Gravel Beaches (3) with much more limited occurrences of more sheltered habitats.

In terms of the combined vertebrate habitat categories, the Outer Coast Zone is characterized by all the habitat categories, but with particularly good access to Pelagic and Pelagic/Littoral Habitat Categories. Combined shellfish habitat categories here are almost exclusively Exposed Shores, with very limited occurrences of sheltered beaches as isolated pockets.

In summary, this zone offers good deep, open water pelagic and pelagic-littoral habitats and rocky exposed intertidal habitats.

As can be seen from this summary of the general characteristics of the two zones, they are quite distinct one from the other as far as faunal resources are concerned. The Inner Harbour Zone has a more limited range of habitats available to it than the Outer Coast Zone, but both offer varied, though distinctly different, resource basis to an inhabiting human population.

PAST ENVIRONMENT

There is as yet a very limited amount of information available on the early Recent and Post Pleistocene environment of the west coast of Vancouver Island, directly relevant to Hesquiat Harbour. As this study is concerned only with the last 2,500 years, no attempt is made to summarize what is known of the immediate post-glacial history of the area. By 2,500 years ago, the west coast of Vancouver Island was probably much as it is today, with earlier successional stages of the existing first growth forest well established and wide area land-sea relationships generally stabilized at about their present levels, although recent evidence suggests continuing uplift (Don Howes, pers. comm.).

As yet there are no reported geological data from the west coast of the island to support or reject this regional pattern extrapolated from other areas. Recent palynological work in Hesquiat Harbour, however, has provided evidence of changes in local topography during the time period under discussion. Whether these data are regionally or only locally relevant is not yet known. It seems best to consider that they record local events until such time as work in adjacent areas allows their interpretation within a broader perspective.

Landforms, Geology and Sea Levels

The major landforms characteristic of Hesquiat Harbour, the Estevan Coastal Plain and the Vancouver Island Mountains, were established well before 2500 years ago. Any changes in the land-sea interface, however, may have affected the areal extent of the plain as represented by Hesquiat Peninsula, as much of this peninsula is less than 46 metres above present mean sea level. Palynological evidence from the swampy Whicknit meadows around Purdon Creek, behind the present village of Hesquiat, indicates that the swamps began to form about 1,000 years ago on the flat gravel deposits overlying the bedrock in this area (Hebda and Rouse 1976). A single pollen core of 46 cm from these swampy meadows provided a basal C^{14} estimate of 1080 ± 100 B.P. (WSU 1588).

A second pollen core from Village Lake with a basal C^{14} estimate of 2760 ± 80 B.P. (I - 1977) records vegetation and micro-faunal changes indicating that the local depositional environment of the core sediments changed from saltwater to brackish to fresh water within the last 2,700 years. The actual change from brackish to fully fresh water, recording the full emergence of Village Lake, is not dated, but occurs approximately 30 cm from the top of the two metre core (Hebda and Rouse 1976:6). This indicates that it is a recent phenomenon, possibly occurring within the last 700 to 500 years.

The bedrock and surficial geology of this area of Hesquiat Peninsula suggest that the event recorded by the Village Lake pollen core involved at least the area now containing the lake, Anton's Spit and the adjacent foreshore. Southwest of this area the bedrock is uplifted in a prominent escarpment.

It is probable that until about A.D. 700 the escarpment itself was the western land boundary to the harbour entrance, bordered by stretches of sand and gravel beaches, while the area now containing the mouth of Purdon Creek, Village Lake and the projecting land northeast of Village Lake would have been under the sea. This area was probably tidal flats and shifting sand bars until about 1,000 to 1,200 A.D. The total area involved is uncertain. The local environment of the Village Lake basin changed from marine or tidal marine to a brackish environment suggesting a lagoon or embayment periodically inundated during highest tides, to a fully fresh water lake surrounded by alluvial marine deposits on which strandline Sitka Spruce forest then Cedar swamp vegetation took hold. Subsequently, or coterminously with the last phases of this phenomenon, Anton's Spit began to build up along the inner edge of Hesquiat Bar. The gradual replacement in the pollen core of saltwater plant species with brackish then fresh water species suggests a continuous, gradual development of the lake basin.

As yet, no clear evidence is available to indicate whether this occurrence is restricted to the Village Lake area and essentially records local topographic changes dependent on spit formation and the blockage of the main lagoon outlet or is more widespread, involving a gradual uplifting of the land relative to the sea throughout the area of Hesquiat Harbour. Hebda and Rouse suggest the latter, calculating a rate of uplift of approximately 1.1 metres per 1,000 years (Hebda and Rouse 1979:129). Archaeological test excavations at DiSo 21, just north of Hesquiat Point and at DiSp 2 at Homeis Cove on the outer coast north of Estevan Point, revealed cultural deposits below the main midden deposits and clearly separated from them by non-cultural sand deposits (Crozier 1977:13). Analysis of the sand samples is not complete, the deposits are not dated and the areas tested too limited to allow definite interpretation. These deposits may represent fluctuations in land-sea interfaces related to widespread occurrences or may represent fluctuating beach ridge deposits associated with local beach development. They do suggest, however, that the land-sea relationships in this region have been fluctuating in the recent past in a complicated pattern either from local tectonic movements, widespread isostatic movements or successional topographic development of a geomorphological nature.

Hydrography

Obviously, no lake habitat was available near Hesquiat prior to about A.D. 1200 and it is probable that Purdon Creek, associated with the development of the swampy meadows, is also a recent phenomenon in its present form. Other streams probably drained into the area now occupied by Village Lake. The lake itself may have been fully established by about 700 to 500 years ago. This time estimate is based on an assumed constant rate of emergence for the lake basin and a constant rate of deposition of sediments in the lake basin. This is obviously an assumption that may or may not be valid. One would expect an increased rate of deposition in the upper portion of the deposits as the outlet of the embayment gradually became closed in. The sediments recorded by the upper thirty centimetres of the pollen core may have built up at a faster rate than the lower sediments relating to a tidal estuary situation and the actual amount of time represented by the 30 centimetres of deposit may be less than 700/500 years.

If the emergence of Village Lake was associated with a local uplift of land, Hesquiat Bar may also have been affected. If so, the waters over the bar may have been deeper initially than at present.

Flora

The two pollen cores from Hesquiat Harbour record local vegetation changes typical of successional developments within a Coastal Western Hemlock Biogeoclimatic Zone.

The 46 cm core from Whicknit Meadows records a local coniferous forest cover dominated by Western Hemlock associated with lesser amounts of Shore Pine (Pinus contorta Douglas), spruce (Picea sp.) and alder (Alnus sp.). Pine and spruce are slightly more prominent in the lowest levels of the core, while alder is more prominent in the upper 10 cm. The core is dominated by high levels of Sweet Gale throughout, with a decrease in the upper 10 cm and the lower 5 cm. Grasses (Graminacea) and sedges (Cyperacea) increase from bottom to top and a number of other herbs and ferns are present. According to Hebda and Rouse,

> "The Whicknit core shows little change in vegetation. ...
> ...Sweet gale, together with hemlock, grasses, sedges and

> ferns seem to have been the major vegetational components throughout the (1,000 year) interval. Near the top of the core the site becomes more open, with a progressive increase in sedges to the present."
>
> (Hebda and Rouse 1976:7)

The two meter core from Village Lake records four depositional zones characterized by differing pollen frequencies and recording the development of Village Lake. The bottom 85 to 90 cm of the core, Zone I, are characterized by tree pollen dominated by hemlock and spruce with some cedar, pine and alder, while the nontree pollen is represented by significant levels of grasses, Goosefoot (Chenopodiacaea) and Ragweed (Ambrosia sp.). This portion of the core relates to the interval when the lake basin was influenced by a marine environment. The next 85 cm of the core, Zone II, record the same tree species, but a much higher frequency of cedar pollen. Nontree pollen is essentially the same. The next 17 cm, Zone III, record tree pollen frequencies essentially the same as Zone II, but in the nontree pollen, the Chenopodiacaea, grasses and ragweed pollen gradually disappear and Yellow Water Lily pollen becomes abundant. In the upper 13 cm, Zone IV, tree pollen remains the same except for the disappearance of cedar pollen (possibly associated with human activity in the area) and further increases are apparent in the levels of Yellow Water Lily pollen and polypody fern spores. In summary, Hebda and Rouse state:

> "The lower part of the Village Lake core indicates the presence of a forest dominated by western hemlock during the early phases of deposition... The high levels of spruce indicate the presence of coastal sitks spruce stands, similar to those typically strung out along and behind sandy beach areas on the west coast of Vancouver Island today. Since there is little cedar pollen in the lowest part of the core, originally there were likely no wet swampy lowlands with cedar stands, such as those presently around the lake. However, the absence of cedar

> pollen may be due to non-preservation in the carbonate rich bottom sediments. There is a smaller number of species recorded in the basal sediments than those immediately above. This suggests that the forest closed in quickly after an initial period when little vegetation grew in the immediate vicinity of the lake."
>
> (Hebda and Rouse 1976:5)

While it is not possible to extrapolate the details from these two cores to the region as a whole, as they record local events, it is obvious that the vegetation changes recorded are within expected ranges for successional developments within a coastal western hemlock forest. No major regional changes in vegetation have occurred. This also indicates that no major climatic changes have occurred within the relevant time period of the past 2,500 years.

Fauna

There is nothing in the available geological and botanical evidence to suggest environmental changes between 2500 B.P. and the present of sufficient magnitude to effect substantial major changes in the fauna of the study area. This is supported by the archaeological evidence of the faunal remains from excavated sites. All species identified in the faunal assemblages can be found in the region today or could have been prior to the historic fur trade period when species such as the Sea Otter, Northern Fur Seal and several species of albatross were almost exterminated. The regional animal resource base, then, was probably little different 2,500 years ago from the present base.

One possible exception to this general picture is the presence at the bottom of the Village Lake pollen core of the estuarine clam the False Mya (_Cryptomya_ _californica_ (Conrad)) which was not recorded for the area during the intertidal beach survey. These animals are quite deep living species, burrowing to a depth of 0.5 m (Quayle 1973), so may well have been missed during the survey, but no dead shells were found either. Whether or not the species is present in the area today, no specimens were identified in the archaeological fauna, suggesting that even though they may have been present in the Harbour during the initial occupation of DiSo 1, they were not being exploited.

The archaeological evidence from Ozette does suggest that the composition of the Northern Fur Seal population available in the area may have been different (Gustafson 1968), and if this means other rookery locations closer to the Hesquiat area, the seasonal availability of these animals may also have been different from the present patterns. Recent changes in the range of the California Sea Lion suggest that they also may have been available in differing patterns of seasonality and population composition.

The land-sea interface or local topographic changes described in the preceding section would have affected the local distribution of some of the species in the study area. It seems probable that prior to the formation of the protective prominence of Anton's Spit, the harbour would have been even more open than it is today. If the changes also involved Hesquiat Bar, the waters over this area of the entrance may also have been deeper. It is possible, then, that the western beaches were even more fully exposed to the open Pacific winds and waves than they are today, perhaps as far north as LeClaire Point, perhaps even further into the Harbour.

One might expect that pelagic littoral mammals and birds now not consistently found in the inside harbour would have been more likely to use the wider, more open waters. Fish species preferring deeper water habitats may also have been more common in the inner harbour, while exposed intertidal habitats along the western shore possibly extended further north into the harbour. Additional habitats associated with the brackish-lagoon-estuary that became Village Lake would have been present in the Outer Coast/Inner Harbour Zone boundary area and mud/sand flats would have been more extensive here as well.

In terms of general faunal distributions, the whole Outer Coast Zone possibly extended further into the harbour, the Inner Harbour Zone may have been restricted to the northeastern part of the Harbour and the transition from Outer Coast habitats to Inner Harbour habitats may have been more gradual along the western shore, until about 1200 to 1400 A.D.

Summary

Throughout the time period represented by the faunal samples from DiSo 1, 9 and 16, the natural environment of Hesquiat Harbour has been much as it is today, with a closely similar flora and fauna, with the exception of local topographic changes relating to the development of Village Lake and Anton's Spit. The vegetation, topographic and hydrographic changes recorded by two pollen cores from Hesquiat Peninsula are summarized by Hebda and Rouse as follows:

> "Until a few thousand years ago, this part of Hesquiat Peninsula was probably under salt water and characterized by shifting sand bars, spits and beaches. Initially the Village Lake basin was a salt water bay with a few streams running into it, which later became a brackish water estuary. As land became uncovered, stands of sitka spruce occupied areas behind sandy beaches, while hemlock forests grew on older mature soils. As more flat land became available, cedar swamps developed near the lake, behind a band of sitka spruce. Very recently the Village Lake basin was cut off from the sea and developed a fresh water flora...small boggy areas such as Whicknit developed on the lowlands."
>
> (Hebda and Rouse 1976:8)

Prior to the development of this land area the harbour mouth was probably more open than today, allowing stronger influence of the open o ocean wind and wave action in the inner harbour areas. Present conditions were possibly established by about 500 years ago.

ETHNOGRAPHY

The area of the west coast of Vancouver Island from approximately Escalante in the north to mid-way between Hesquiat Point and Refuge Cove in the south is considered to be the traditional territory of the Hesquiat speaking peoples, a linguistic and cultural sub-group of the Nootkan ethno-linguistic family. Culturally the Hesquiat people are considered part of the Central Nootkan Tribes (Drucker 1971:4). In pre-contact times, like other Nootkan groups, they had a sophisticated socio-cultural adaptation involving inheritance of rights and privileges validated by the potlatch system and a socio-political division of the population into discrete socio-economic groups whose bilaterally related members were bound together by common residence and economic association with a chiefly family (Drucker 1971:220). Their subsistence economy was based on the hunting of land and sea mammals, gathering of intertidal shellfish and of berries and roots, fowling, and fishing for both marine and anadromous species, with a strong emphasis on marine resources. As among other Nootkan groups, Hesquiat settlement, land use and resource exploitation systems are closely interrelated with aspects of their kinship, socio-political and ownership systems.

General Nootkan Ethnography

Socio-politically the Central Nootkan peoples were divided into non-unilineal kin groups who lived in the same house, associated with partie lineal lines of high ranking individuals (chiefs). These kin groups, or local groups, were named entities associated with particular resources and habitation locations to which they controlled access through exclusive rights of ownership vested in the chiefly line. This unit, unless formally associated with other such units, was independent politically and economically, maintaining a separate winter village and exploiting at the appropriate times the resources of their fishing and gathering places (Drucker 1951:220-221; S. Kenyon 1976).

By virtue of their status, the highest ranking male members of the local group, the family of chiefs, owned rights of access to particular salmon streams, sea fishing places, seal rocks, off-shore halibut banks, lakes, areas of forest, tracts of sea, clam beds and stretches of shoreline. Important among rights of access were salvage rights to that which drifted ashore, such as a dead whale. Not only actual resource locations, but every section of the shoreline was named and owned. While rights of access were exclusive, permission for use of the resource locations could be given to outsiders by the controlling chief. On such occasions a portion of the stuffs obtained would be given to the owning chief. Boundaries between local groups were clearly demarcated and strictly upheld, to the point of warfare (Drucker 1951:333).

Among some Nootkan peoples the local groups were formally bound together into wider territorial units called "tribes" and "confederacies" by Drucker. Im summarizing Nootkan polity, he states:

> "The fundamental Nootkan political unit was a local group centering in a family of chiefs who owned territorial rights, houses and various other privileges. Such a group bore a name, usually that of their "place" (a site at their fishing ground where they "belonged"), or sometimes that of a chief; and had a tradition, firmly believed, of descent from a common ancestor ... Among most Northern Nootkans these local groups were not autonomous. Each was formally

> united with several others by possession of a common winter village, fixed ranking for their assembled chiefs, and often a name. To such a formal union the term "tribe" is applied ... Several such tribes might be bound together into a confederacy."
>
> (Drucker 1951:220)

At the confederacy level of formal association, several tribes shared a summer village and integrated ranking of their chiefs. This type of association was not found south of Nootka Sound.

In a brief discussion Drucker makes the following statements about the polity of the Hesquiat people:

> "Among the Muchalat, and in Hesquiat Harbour, just south of Nootka Sound, there was no tribal organization whatsoever in prehistoric times. There were simply five or six local groups, each independent of the others."
>
> (Drucker 1951:221)

> "...the Hesquiat (hɛckwīʾ ȧth), a modern fusion of several independent local groups of the Hesquiat Harbour region..."
>
> (Drucker 1951:5)

> "The present day group living at Hesquiat Harbour represents a merging within historic times of four or five formerly independent local groups each of whom had their own separate winter villages and seasonal camps and stations."
>
> (Drucker 1951:235)

Drucker deals fairly extensively with the general Nootkan annual r round. Although much of this is not fully applicable to the Hesquiat situation, it is summarized here as a basic description from which the various Hesquiat local groups diverged to a greater or lesser degree. The seasonal use of several different habitation and/or resource exploitation locations within firmly fixed territories over which the owners had exclusive control is common to all Nootkan groups, including the Hesquiat groups. As described by Drucker (1951:36-61) the annual round involved a sequential yearly movement from a sheltered inside winter village, to spring and summer outer coast fishing and sea mammal hunting places, to fall salmon streams, back to the winter village. In Hesquiat Harbour this pattern applied only for those groups with territory that included both outer coast and sheltered inner locations, the groups collectively referred to as the *kīqinath* and even then only partially. Two other local groups, *the maʔapiath* and *ya·qsisath*, controlled territory solely within the inner harbour, and had no direct access to outer coast resources. A fourth, the *homaʔisath*, had no sheltered inner locations, but only exposed outer coast territory, while the fifth, the *haimaiʔisath*, also had very little sheltered area within their territory and were basically outer coast. Thus the general pattern following is not fully applicable to all Hesquiat local groups.

The winter village was the main settlement for the local group, where large wooden houses were constructed and people lived a relatively sedentary life from November to the end of January. Economic activities during this time were sporadic and intended to add variety to the steady diet of dried salmon, herring and cod. Such activities included fishing for red snapper, kelpfish and perch; some deer hunting; the gathering of winter huckleberries; and the collecting of the following invertebrates: horse-clams, cockles, "a medium sized clam", butter clams, razor clams, a large and small pecten, large and small mussels, limpets, small abalones, china slippers, periwinkles, sea anenomes, large barnacles, sea cucumbers, crabs and spider crabs (Drucker 1951:39). According to Drucker, sea snails, "rock borers" and whale barnacles were not eaten although sea snails are certainly found in the archaeological deposits (Drucker 1951:37-39).

The winter village was occupied for a longer portion of the year than any of the other locations. It was here, during the dark, wet winter months that ceremonial activities such as feasts, potlatches and the wolf rituals vividly expressed the complexity and richness of the Nootkan social organization (Drucker 1951:40). The manufacturing of tools, gear and clothing, as well as ceremonial regalia, also took place at the winter villages. As the food procurement was less intensive, people had more time and energy to spend on manufactures. The winter village, then, consisted of the greatest aggregation of people for the longest portion of the year and was a place of consumption, manufacture and ceremonialism more than of economic food production. Many of the foodstuffs procured and preserved during other seasons at other locations were consumed at the winter villages.

In late winters, preserved food stores ran low and the arrival of the herring schools, the first major spring food resource, was eagerly awaited. The groups moved to their fishing stations around February to exploit this important resource (Drucker 1951:40-42). Both the fish and the eggs were dried for later consumption, as well as eaten fresh. The herring were split and dried whole, not filleted. Sea going spring salmon would also be available at this time, and were eaten fresh (Drucker 1951:41-42). Towards the end of the herring season flocks of migratory water fowl appeared and were hunted. The new growth of seaweed was exploited. This was also the time when the migrating female fur seals would be available closest to shore.

Towards the end of April, beginning of May, those local groups with outer coast resource stations moved there to fish for halibut and true cod and to hunt sea mammals. The halibut and cod were sun-dried for winter use, the sea mammals were eaten fresh although the blubber was rendered to oil and stored for later use also. The summer months were the time for picking berries and digging roots, while late summer saw the fishing of perch and the early runs of coho salmon (Drucker 1951: 56-57).

With the arrival of the main coho, chum and sockeye runs in late September and October, individual families moved to their salmon fishing streams and began the short period of intensive exploitation of these important resources. As well as being eaten fresh, the fish were dried and smoked for winter use. The flesh was removed in one piece and dried separately from the backbone, which with head and tail attached, was eaten fresh at the beginning of the season but dried and smoked towards the end of the season. After the end of the salmon runs the people returned to the winter villages (Drucker 1951:58-59).

Other economic activities such as hunting of deer, bear, cougar and small fur bearing animals, were carried out in a more opportunistic fashion consistent with their year round availability, but also taking into account the state of the animal for food, its hide or pelt for leather or clothing and the greater importance of other, only seasonally available resources. The flesh of land mammals was not smoked or dried (Drucker 1951:65).

It is obvious from this brief discussion that there was a continuum of settlement types as far as variety of subsistence activities, length of occupation and size of occupying group is concerned, with the single activity salmon fishing station at one end and the multi-use "winter" village at the other. The amount of time spent at a location and the v variety of activities carried out there obviously varied according to local conditions. Length of occupation probably varied directly with the variety of resources sequentially available from that one location and/or the quantity of a resource and the duration of its availability. While the economic procurement activities carried out from the winter village were probably less important in providing quantities of food, the variety appears greatest of all settlement types. Additionally, many foodstuffs obtained elsewhere were actually consumed at the winter villages. Depending on how the resources were prepared for preserving, these foods may or may not have left concrete evidence of their consumption in deposits associated with winter settlements.

The cooking of meats and fish was simple--roasting, broiling, steaming under mats and stone boiling (Drucker 1951:61). Bones, shells and other refuse were simply tossed outside on the garbage heaps. Smoked and dried fish were hung on racks near the ceilings of the big houses in the smoke of the cooking fires until ready to be packed away in wooden boxes.

The material culture of capture, while also simple, was yet sophisticated in the precise working of wood into many diverse implements. Halibut, other flatfish, cod, rockfish and spring salmon were caught on hand lines trolled from canoes, armed with a variety of composite hooks with bent wood, straight wood or stone shanks and bone barbs (Drucker 1951: 22). Other salmon were taken by harpoon or in traps and weirs in the spawning streams and at the mouths of streams (Drucker 1951:16-18, 19-21). Fir and spruce boughs were set in frames like fences along the beaches, just under water, for the herring to spawn on and the eggs adhering to the boughs collected. The adult fish were taken from canoes with herring rakes armed with bone or wooden teeth and with dipnets (Drucker 1951:23). Perch were caught in tidal beach traps of stone and lattice work while greenlings were caught in submerged woven traps (Drucker 1951:19). Nets other than dipnets were apparently not used for fishing (Drucker 1951:25).

There is very little information on how birds were captured. Ducks and geese were taken at night with nets thrown from the bow of a canoe after the birds had been confused by a light (Drucker 1951:43); with bow and arrow from canoes (Drucker 1951:43); and with submerged traps. These were for taking diving ducks and were armed either with underwater nooses or baited gorge hooks (Drucker 1951:33-34). Eagles were shot, snared with loop snares or grabbed by trickery (Drucker 1951:59).

Deer and black bear were hunted with bow and arrow, spear and deadfall traps (Drucker 1951:32-33). Cougar were also occasionally taken in the traps, as were raccoon (Drucker 1951:61).

The hunting of sea mammals was done with harpoons of various sizes, from canoes also of different sizes for different game. For all the harpoons, the arming heads were toggle heads with bone or wooden barbs and a mussel shell cutting blade. When large animals such as whales and sea lions were hunted, seal skin floats were attached to the heavy cedar harpoon line to create drag and to help buoy up the animal once dead (Drucker 1951:46, 48-55). Harbour seal and porpoise were also harpooned, and harbour seal were also clubbed at their hauling out places if unlucky enough to be stranded far from the water's edge (Drucker 1951:45). Sea otters were taken either with harpoons or with bow and arrow, from canoes (Drucker 1951:46). While Drucker states that fur seal were not hunted aboriginally (1951:46), many fur seal remains are present in the archaeological sites. Presumably they were taken with harpoons as were other sea mammals.

A simple wooden digging stick was used by the women to dig for roots and for clams, and to pry mussels, chitons and sea urchins from the rocks (Drucker 1951:35). The shellfish were collected in open weave cedar baskets.

A much fuller description of the material culture is given by Drucker, but perhaps the most important point is that most of the manufactures were either entirely of plant fibers or at least major portions of composite tools were made from wood. Such materials rarely survive in the archaeological context of a shell midden, thus leaving no direct evidence of the kinds of implements used, other than the bits and pieces that were made from shell or bone or stone. The excavations at Ozette, on the Olympic Peninsula in Washington, where vegetal materials have been preserved, have provided ample evidence of just how much of the material culture is not normally retrieved by archaeologists working with northwest coast shell middens.

Hesquiat Local Group Territories and Settlement and Subsistence Patterns

According to Drucker (1951:235-238), prior to the amalgamation of the independent groups at Hesquiat in the mid-1850's, there were four, possibly five, local groups in the harbour. He lists these as the kiqinȧth, with four houses at their winter place of kīqina (DiSo 2) (Fig. 10), a summer village at hiƛwina (DiSo 21) and fall fishing station at kūkūwah (DiSo 3) and tɛ'amuƛ (no site identified); the haimai'isȧth, with two houses at their winter place of hɛckwī (DiSo 1), a summer place at taƛȧta (DiSp 1) and a cod fishing place at tca'a (Boulder Point); the outer coast hōmīsȧth with five winter houses at hōmīs (DiSp 2); a summer place at hɔhqi (DiSp 4) and unidentified fishing places; the ma'apīȧth, with four houses at their winter village of ma'apī (DiSo 8) and at least three fishing stations, pa'astciƛ (DiSo 6), tsaiya (not identified archaeologically) and ai'īsȧqh (DiSo 25) but no summer place; and the family owning the fishing rights to the stream of yaqhsis (DiSo 14) who were in the process of becoming a separate local group split off from the ma'apīȧth.

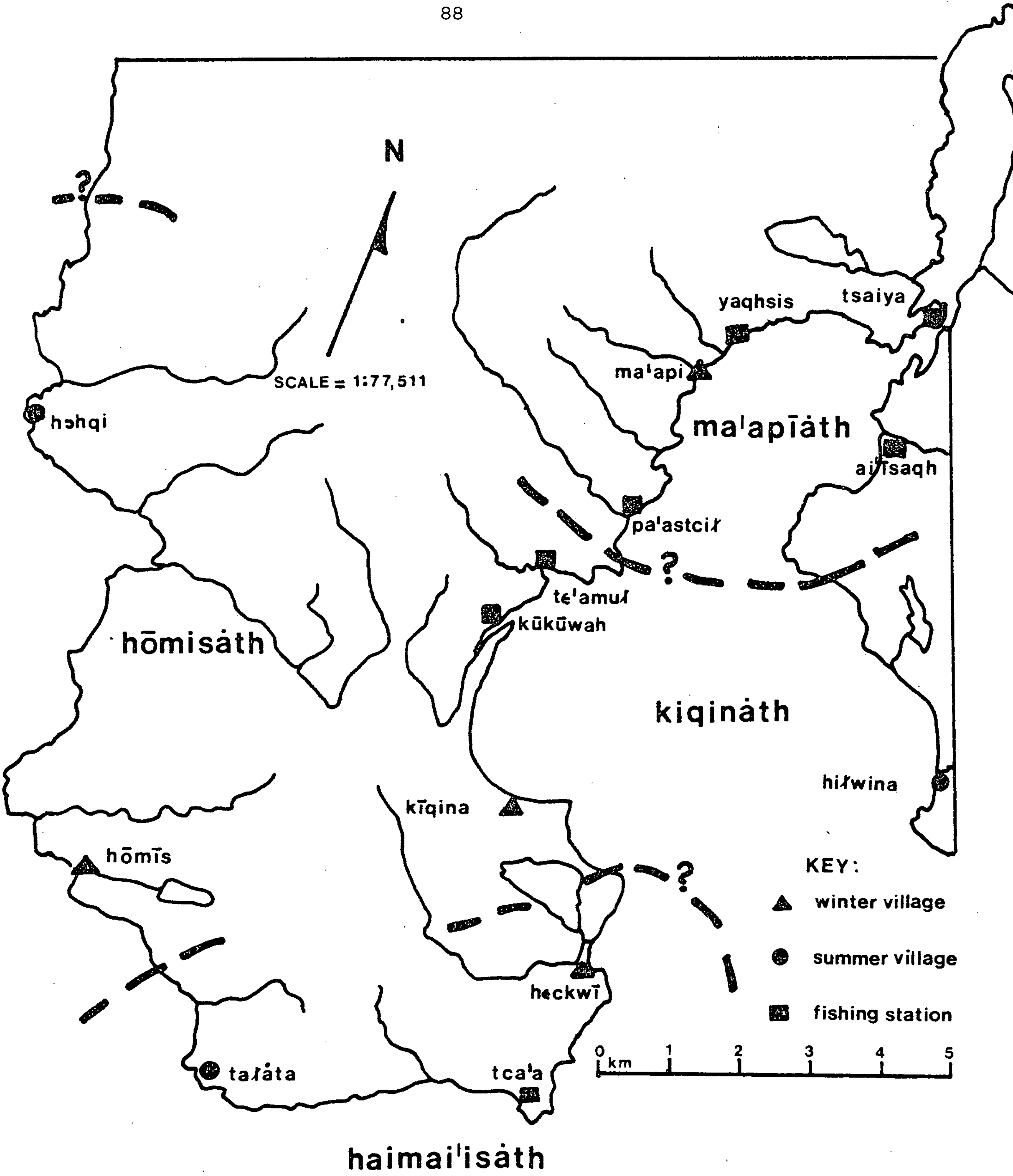


Figure 10. Hesquiat Local Group Territories According to Drucker. Based on Drucker 1951:236.

He notes that in summer the *ma'apīȧth* shared *hiƛwina* with the *kiqinȧth*, but it is uncertain whether or not this is solely a post-amalgamation pattern (Drucker 1951:237). A combination of war and economic advantage seems to have drawn the local groups to amalgamate prior to the establishment of the first Catholic mission on the west coast at Hesquiat in 1875 (Moser 1926), with the *kiqinȧth* maintaining the first four (highest ranking) potlatch seats (Drucker 1951:237).

Information recorded by the Hesquiat elders has modified this picture, especially in the matter of the seasonal and local group affiliation of particular locations in Hesquiat Harbour. This information is still being collected and processed, thus the tentative outline of settlement patterns described here is not entirely clear and is subject to modification in the future. The following descriptions of Hesquiat local groups and territories are based on data recorded by the Hesquiat elders with Barbara Efrat, Andrea Laforet and Larry Paul, between 1973 and 1978. The descriptions of Hesquiat subsistence economy are based on information recorded by the Hesquiat elders and knowledge of the harbour. Translations from Hesquiat were done by Larry Paul and Dora Gallegos.

The settlement pattern described by the elders is more complicated than that described by Drucker, particularly as regards the local group called *kiqinȧth* by Drucker. According to the elders there appear to be twelve named groups with territorial rights to particular resource stations. Six of these groups in the middle territory of the harbour shared a winter village, suggesting either that there was a grouping akin to Drucker's "tribe" in the central area, or that the named groups are in fact families, rather than local groups. This is not yet clear.

By order of territorial affiliation and from north to south to north, starting on the outer coast north of Estevan Point, the groups distinguished by the elders are listed below. Orthography is that used by Laforet and Efrat. Figure 11 shows their locations and territories in the harbour.

1) the *homaʔisath*
2) the *tʔa·ƛa·tʔath*
3) the *ciknuʔath*
4) the *haimaiʔisath*
5) the *kinqoastakaməƛath*
6) the *qʷacʔaštakaməƛath* or *mohatikƛeyath*
7) the *napulyutakeməƛath*
8) the *qeyxƛanistakaməƛath*
9) the *pasciƛath*
10) the *cʔasnoasath*
11) the *maʔapiath*
12) the *yaʔqsisath*

The *homaʔisath* had a small territory on the outer coast, with portions of *haimaiʔisath* territory on either side to the north and to the south. It is not clear if *homaʔisath* territory was always this small, or whether this is a late pattern. Drucker records both Split Cape and Barchester Bay as *homaʔisath* locations (Drucker 1951:236-237). However, the elders record that *haimaiʔisath* territory included *hɔhqui* (Split Cape) and *paʔčista* (Barchester Bay) and as far south as Perex Rocks on the outer coast, was broken by the *homaʔisath* territory, then stretched from Estevan Point around to and including the present village of Hesquiat. Two other independent groups, the *tʔa·ƛa·tʔath* and the *ciknuʔath*, apparently lived year round at Estevan Point and Smokehouse Bay respectively, but were associated with the haimaiʔisath. The ciknuʔath also had fishing rights across the harbour south of Hesquiat Point at a sockeye stream called ti·tapi. These two groups seem to be family groups that functioned independently but it is not clear if they had core chiefly lines and hence fit Drucker's definition of a local group.

The kinqoastakaməƛath, qʷacʔaštakaməƛath/mohatikƛeyath, napulyutakaməƛath, and qeyxƛanistakaməƛath all wintered at hiłwina and had various summer, spring and fall resource stations, separate, along the shores of the central portion of Hesquiat Harbour and south past Hesquiat Point. These are the groups collectively called the kiqɨnȧth by Drucker. The pasciƛath apparently stayed year round at pa·sciƛh but sometimes moved into hiłwina also, and are therefore associated with the other four groups more closely than with any other inner harbour group. Apparently some people stayed year round at hiłwina, but it is not clear if this means some of all the groups or a particular group, nor is it clear who the cʔasnoasath are, if in fact they are a separate group.

The maʔapiath correspond closely to Drucker's description, staying year round at maʔapi, with some people exploiting the resources of the fishing streams across the harbour in summer and fall. Their territory began north of pa·sciƛh, stretched as far as yaʔqsis, then started again south of Hesquiat Lake, and from there continued as far south as somewhere between Rondeau Point and Hisnit Lake. There were at least three chiefs in this group, each with particular rights to portions of the shoreline, streams and harbour waters.

The yaʔqsisath owned the territory from yaʔqsis stream near their year round village, to the eastern entrance of Hesquiat Lake, including Hesquiat Lake and its tributaries.

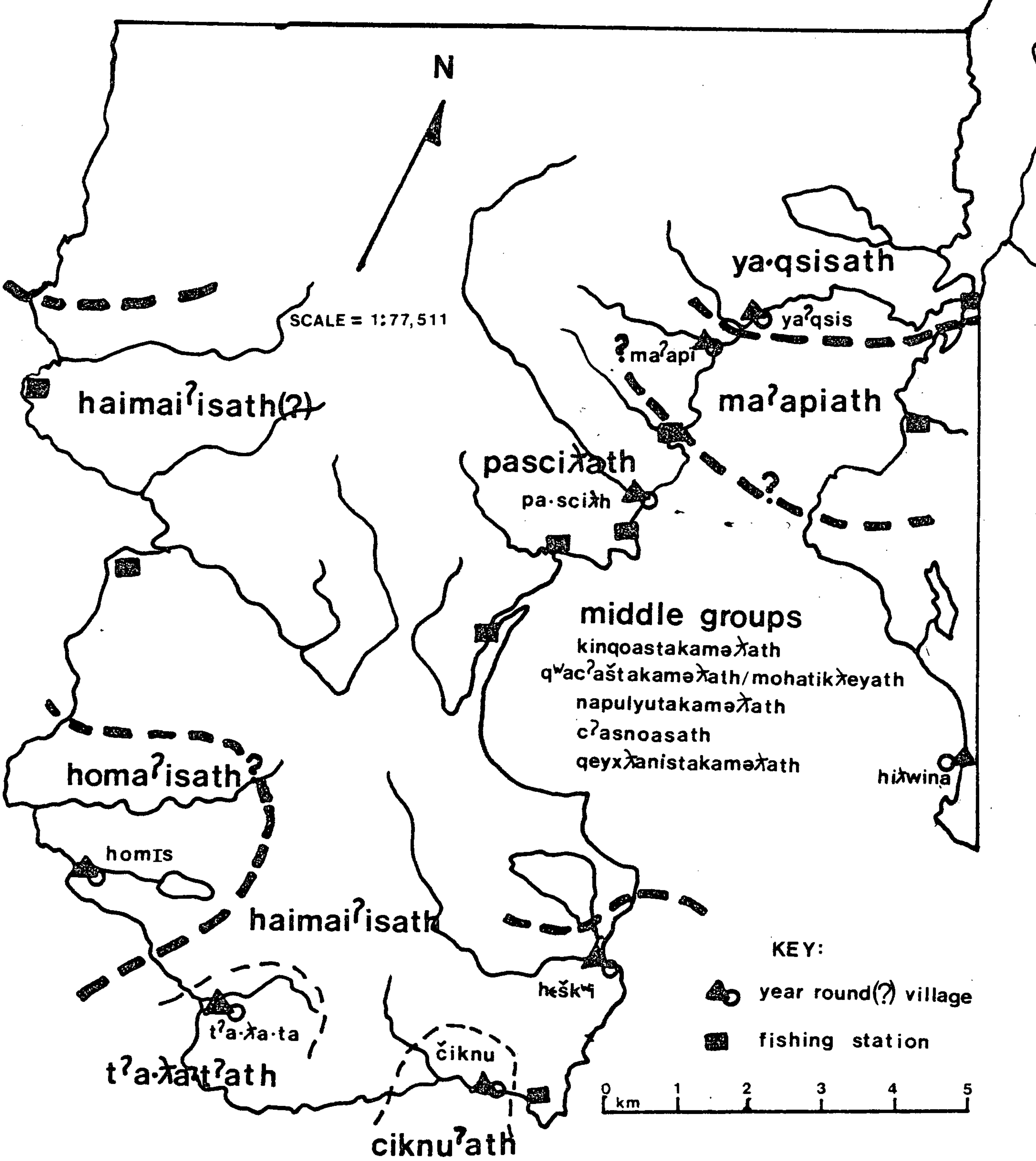


Figure 11. Hesquiat Local Group Territories According to Information Recorded by the Hesquiat Elders.

As far as seasonal movements are concerned, it would seem that the *maʔapiath* and *yaʔqsisath* were essentially sedentary, using the resources of their salmon streams but not actually setting up permanent habitation structures at these locations. Both *maʔapi* and *yaʔqsis* are themselves by salmon streams. After amalgamation of the local groups at Hesquiat, however, these groups did erect houses at the inside fishing stations. Archaeological testing of these fishing stations confirms that they are historical, with no prehistoric deposits. Presumably the controlling factor here was distance.

The middle groups, who wintered at *hiƛwina*, seem to have been more mobile, but it is not clear if they actually had prehistoric structures at Anton's Spit, although there are midden deposits there (DiSo 2). There are no prehistoric structures at their salmon streams.

A similar pattern holds for the *haimaiʔisath* and the *homaʔisath*, there being midden deposits at their designated "winter" villages, but only historic deposits at other resource stations.

Whether the prehistoric structures were but temporary and have left little evidence, or were much removed from the present, up-lifting, shoreline, or were non-existent, is notyyet clear. But it seems certain that permanent house frames at winter, summer and fishing villages, such as those described for the northern Nootkans by Drucker (Drucker 1951:69), did not exist in Hesquiat Harbour. The settlement pattern for each local group seems to have been centered around a single, permanent habitation site (marked by a shell midden). The constellation of resource locations seems to have been exploited from the main location, at least until amalgamation at Hesquiat in the late 1800's. The lack of midden deposits at the northern outside fishing stations suggest that the *haimaiʔisath* use of these locations may be a late pattern and that formerly they were homaʔisath, as haimaiʔisath use would have demanded actual group movement.

Some specific statements about animal resources in Hesquiat Harbour add detail to Drucker's remarks. They are based on information recorded by the Hesquiat elders with Larry Paul, Marilyn Amos and Cathy Amos in 1977.

Harbour seals, sea lions, fur seals and whales were all hunted. Harbour seals could be found on the rocks off homis, off Hesquiat Point and at the head of the harbour in Boat Basin, sometimes even in Hesquiat Lake. They were speared or harpooned (the distinction is not always made) in the water and also clubbed at hauling out places. At these rocks, sharpened sticks might be placed hidden beneath seaweed, where the startled seals heading for the water would impale themselves. The same methods were used for sea lions, but they were not clubbed, just harpooned or speared. These animals were considered dangerous, were scarce, and were hunted less frequently. There were no good places for sea lions at Hesquiat Harbour, the nearest hauling out rocks being at Revel Point by Hot Springs Cove. They were not around in the summer.

Fur seals were hunted far out at sea, although they were a little closer to Hesquiat "when the berries were fully ripe" in early summer. At least four different sizes were distinguished, the largest being found furthest out to sea, so far out that only the tips of the snow capped mountains could be seen. They did not come into Hesquiat Harbour. Gray and humpback whales were harpooned as described by Drucker (1951:48-56). Sea otters were hunted offshore between homis and Hesquiat, with bow and arrow or harpoon.

Land game was hunted with deadfalls, bow and arrow, and spear. River otters were common at Hesquiat Lake stream and the mouth of Purdon Creek, and were especially common in the fall at the salmon streams. Deer were hunted mainly in early fall and winter. They were most plentiful around maʔapi, in the meadows north of Hesquiat Village, at Hesquiat Point, and towards Estevan Point. Bear were available in all areas but were especially plentiful at the salmon streams in fall. Raccoon and mink were caught in deadfall traps set on their trails and were common everywhere.

Wolves were special. They had a special relationship with people and were hunted only for their skins, for the dance regalia of the Wolf Rituals. Cougar were not hunted very much.

Dogs are said to have been relatively recent imports. It is not certain where they came from, but it is said the Moachat people to the north saw them first, and probably got them from the Nimpkish people of the east coast of Vancouver Island. At first there was only one kind. They were used for hunting.

Little information has yet been recorded on fish and birds, but some of the species abundant in the archaeological records are discussed.

Diving birds such as cormorants, scoters and other diving ducks were taken mainly from just inside the harbour. They were caught on baited hooks set several to a hand line, trolled from a canoe. Loons, mergansers, and grebes were also caught this way but were found at the head of the harbour. Canada geese of at least two subspecies and snow geese were netted from canoes in Village Lake, at night, when storms kept the geese from flying. They were also taken on the beach inside Anton's Spit and between Boulder Point and homis, in the spring and fall. Swans only came among the geese in the fall. Brant were common only along the outer beaches and inside Anton's Spit in spring. Other ducks, such as mallards and shovelers, were taken in traps on the beaches, or snared with a hoop on the end of a long pole. Ducks were most abundant in late winter and spring, when the herring were in the harbour prior to spawning. Bow and arrow was also used for birds.

Albatross and shearwaters were seen and shot when people were out fur sealing. Albatross (the Short-tailed Albatross?) formerly also came near to Boulder Point and could be caught there on hook and line at sea. They were sought for their bones for raw material as well as to eat.

Herring were taken with dip-net and rake from the inside harbour waters, and their spawn collected on bough fences from the sandy beaches. They were available in late winter as well as early spring. Dogfish were everywhere. Sea perches were trapped in tidal traps of stone and "wicker", especially between Hesquiat Village and Anton's Spit, where stone alignments are still visible on the beach. They were used mainly for bait.

The Midshipman was eaten bytthe yaʔqsisath and maʔapiath people especially. They were taken from beneath the rocks at low tide during the spring spawning season. They were especially plentiful in Rae Basin at the head of the harbour near the stream mouth from Hesquiat Lake.

Small flatfish were not common, but were sometimes taken inside Anton's Spit in the shallow water. They were speared with a special short spear. Halibut were not found in the inner harbour, only at the offshore banks off Estevan and homis. Here also was the best place for sea cod and large rockfish like the red snapper. The Hesquiat people distinguished at least five different kinds of rockfish. The small ones were found more generally distributed, the large red snapper and another big species only in the deep waters offshore.

Coho salmon were found in most streams in the harbour, but dog salmon only in those of the inner harbour, north of LeClaire and Rondeau Points. Sockeye were scarce and found only in the Hesquiat and Hisnit Lake systems, as were the few steelhead. Pink salmon were also scarce and seen only at the head of the harbour. The outside streams only had coho runs. The spring salmon did not spawn in the harbour streams but were in the inner harbour during winter. Salmon were taken in saltwater with hook and line, in the streams with spears/harpoons and traps and weirs. The remnants of weirs can be seen on the beaches in front of two streams in the inner harbour, and in the stream itself as well for one of the streams.

The beaches at Anton's Spit and inside the harbour were known as good clam beds. Boulder Point was good for mussels, chitons and sea urchins.

According to the Hesquiat elders, territorial boundaries were strictly upheld. One could only hunt or fish or gather in the places of another group with the permission of that group's chief. It is clear from their records that there were differences among the local groups in emphasis on certain resources, and that trade between the inside and outside groups took place, in important resources not generally available. Thus the outside groups traded seal, sea lion and whale oil and blubber to the inside groups, for bear meat and dog salmon, which were more plentiful in these groups' territories.

PREVIOUS ARCHAEOLOGICAL WORK

Although the west coast of Vancouver Island was one of the first areas in British Columbia to see the meeting of native Indian and European cultures, the prehistory of the native cultures has only recently received serious study. There is a rich literature of ethnographic reports and early historical descriptions of the native Nootkan inhabitants' way of life. Speculation concerning the origins and connections of the Nootkan speaking peoples and of their cultural adaptations has been considerable (Borden 1951, 1962; Chard 1956, 1962; Drucker 1943, 1955; Duff 1965; Huntsman 1963; and Swanson 1956). Yet it was not until the 1960's that the first systematic archaeological excavations were carried out in what is known ethnographically as Nootkan territory.

In the summer of 1966 the National Historic Sites Service of the Federal Department of Northern and Indian Affairs funded excavations at the historically famous village of Friendly Cove, or Yuquot, the summer village of Chief Maquinna and the Moachat Confederacy. Directed by William Folan with the assistance of John Dewhirst, the excavations revealed finely stratified cultural shell midden deposits to a depth of five and a half metres, representing at least the past 4,000 years (Dewhirst 1969:232, 239; Folan 1969:217; Folan and Dewhirst 1970).

As yet, only preliminary results of the work are available. The excavators interpret the data as representing an in situ cultural development analytically divisible into four periods based on stratigraphic zones and radio carbon estimates (Dewhirst 1977:12). They interpret the data as indicating cultural stability through time, with a gradual refinement of the initial adaptation and an increasing dependence on marine resources as one nears the historic period (Dewhirst 1977:12; 1978:7, 10, 20).

Artifact technologies are relatively simple, with a very limited chipped stone industry; quantities of sandstone abraders and saws; a developed ground stone industry centering around fish hook shanks and adze blades; a developed ground shell industry using mussel shell for harpoon points and knives; and a strong bone sawing, splitting and grinding industry centering on the production of awls and ulna tools, numerous simple bone points of various sizes, some barbed points and a range of both toggle and tanged harpoon types (Dewhirst 1978:8-15). The simple stone technology and the manufacturing tool assemblages recovered from Yuquot suggest that wood and vegetal materials that have not survived were major components of many tools (Dewhirst 1977:13). This supposition is given greater support by the recent excavations at Ozette on the Olympic Peninsula, a southern Nootkan (Makah) site at which wood and vegetal materials as well as bone and antler, are preserved and have been recovered. A very high percentage of the Ozette artifacts are made of plant materials that would not normally survive in an archaeological context. The antecedents and extra-areal cultural relationships of the Nootkan artifact traditions are not yet apparent.

The faunal remains from Yuquot are as yet unreported in full. Preliminary analyses suggest an increasing use of sea mammal resources as one nears the historic period. Shellfish and fish are major constituents of the faunal remains, birds less abundant (Savage 1973, 1975).

Although there are minor changes in frequencies, the basic tool kit at Yuquot appears to have remained remarkably unchanged until the historic period. Dewhirst says of this "incredible cultural continuity":

> "The Nootkans of today are probably the descendents of the people occupying the West Coast in the Early Period at Yuquot ... The successful cultural patterns of the Early Period have been gradually refined during the past forty centuries to improve the adaptations of the Nootkans to their coastal environment. This process, for the most part, has been one of cultural continuity, with gradual change and some innovations."
>
> (Dewhirst 1978:20)

In 1966 Alan McMillan carried out the second archaeological excavation in Nootkan territory, a small test excavation at Coopte in Nootka Sound, the winter and early spring site of some of the Moachat people who summered at Yuquot (McMillan 1969). Although the excavations were limited, they revealed cultural deposits varying in depth from .5 to 1.5 metres on the first beach terrace and 2.4 metres on the second beach terrace (McMillan 1969:60-62). The artifact assemblage of 273 objects is similar to that from Yuquot. The most common faunal remains are reported to be fish, including salmon, herring, halibut and dogfish. Sea mammal remains, including porpoise, harbour seal and whale, are present, as are deer remains. Bird remains seem to be less common and shellfish remains, though not particularly abundant, include butter clam, native littleneck clam, horse clam, barnacle and both bay and California mussel (McMillan 1969:100-105). As the faunal assemblage is not reported quantitatively it is difficult to assess.

Both the Yuquot and Coopte materials suggest a long <u>in situ</u> development of the Nootkan cultural adaptation described by Drucker in his classic 1951 monograph "The Northern and Central Nootkan Tribes". Site locations and artifact assemblages suggest that the later prehistoric adaptation differed little from the ethnographic pattern in main features of economic orientation. As in the ethnographic pattern, habitation sites probably formed segments of multi-site group settlement patterns that allowed exploitation of both outer coast sea mammal, fish and shellfish resources, and inlet herring spawning beaches, as well as up inlet salmon spawning streams (Dewhirst 1978:19). As these resources are separated seasonally as well as geographically, seasonal shifts of residence were necessary. Thus different exploitative activities were carried out at different seasonally occupied sites. Dewhirst emphasizes this outer/inner, spring and summer/fall and winter adaptive shift utilizing the two major environmental settings of the west coast shoreline as a basic underlying principle of

Nootkan ecological orientation (Dewhirst 1977:11).

Still, the artifact assemblages from outer coast Yuquot and inside Coopte are very similar.

> "Nearly every artifact type found at Coopte is also found at Yuquot. The Coopte material fits nicely into the Late Period (A.D. 800-1790) and the Historic Period (post A.D. 1790) at Yuquot".
>
> (Dewhirst 1978:19)

Dewhirst suggests that this similarity in artifact assemblages, despite the differentiated subsistence activities, is the result of using the same tools for different tasks at the different locations.

> "There are only a few instances, such as whaling, halibut fishing, dentalium fishing, in which specialized portable artifacts were used in only one major environmental setting... It would appear that the Nootkans had essentially one "tool kit" for environmental exploitation in both outside and inside settings".
>
> (Dewhirst 1978:20).

He further suggests that Yuquot is "fairly typical" of the large outer coast midden sites along the west coast of Vancouver Island in Nootkan territory; that the four cultural periods defined at Yuquot, the Early Period (2300 - 1000 B.C.), the Middle Period (1000 B.C. - A.D. 800), the Late Period (A.D. 800 - 1790) and the Historic Period (A.D. 1790 - 1966), will "likely apply to the archaeology of other outside sites"; and that it is only the faunal remains that will indicate the differences in resource utilization at a particular site (Dewhirst 1978:7). Faunal remains will reflect local site to site variation within a regional adaptation to a far greater degree than artifacts.

THE HESQUIAT PROJECT

The archaeological studies resulting in this dissertation were undertaken as part of the Hesquiat Cultural Recovery Project, a multi-disciplinary project initiated and directed by members of the Hesquiat Indian Band, in conjunction with specialists in many different fields from outside the Band (Haggarty 1978:3).

Faced with the increasingly frequent desecration of their ancestors' burial places in their remote territory of Hesquiat Harbour, the Hesquiat people took the initiative. In 1970 they formed a Cultural Committee and charged it with the responsibility for directing the recovery and preservation of information about their past, and making that knowledge a meaningful part of today's way of being Hesquiat. The Cultural Committee approached Donald Abbott at the Archaeology Division, British Columbia Provincial Museum, and requested assistance in the work of preserving their heritage. This first hesitant contact between the Hesquiat Cultural Committee and the Archaeology Division was the beginning of a unique co-operative endeavour that is now in its tenth year of operation.

Since that time, the scope of the project has grown beyond the initial salvage work in archaeology and physical anthropology (Haggarty 1978; Cybulski 1978), to include research in linguistics, ethnography, botany, palynology, dendrochronology, pedology and geomorphology. In addition to academic research, the project encompasses equally important activities ranging from the construction of a Cultural Education Center at Hesquiat Village to house the objects, tapes and books resulting from the project's work; to summer schools for band children to learn their native tongue, at Hesquiat, from the Band elders; to the production of calendars, colouring books and a simple dictionary in the Hesquiat tongue. Central to the project is the assurance that benefits of the project will accrue equally to both the academic specialists who participate in the project and the Hesquiat People. At the core of the assurance is the

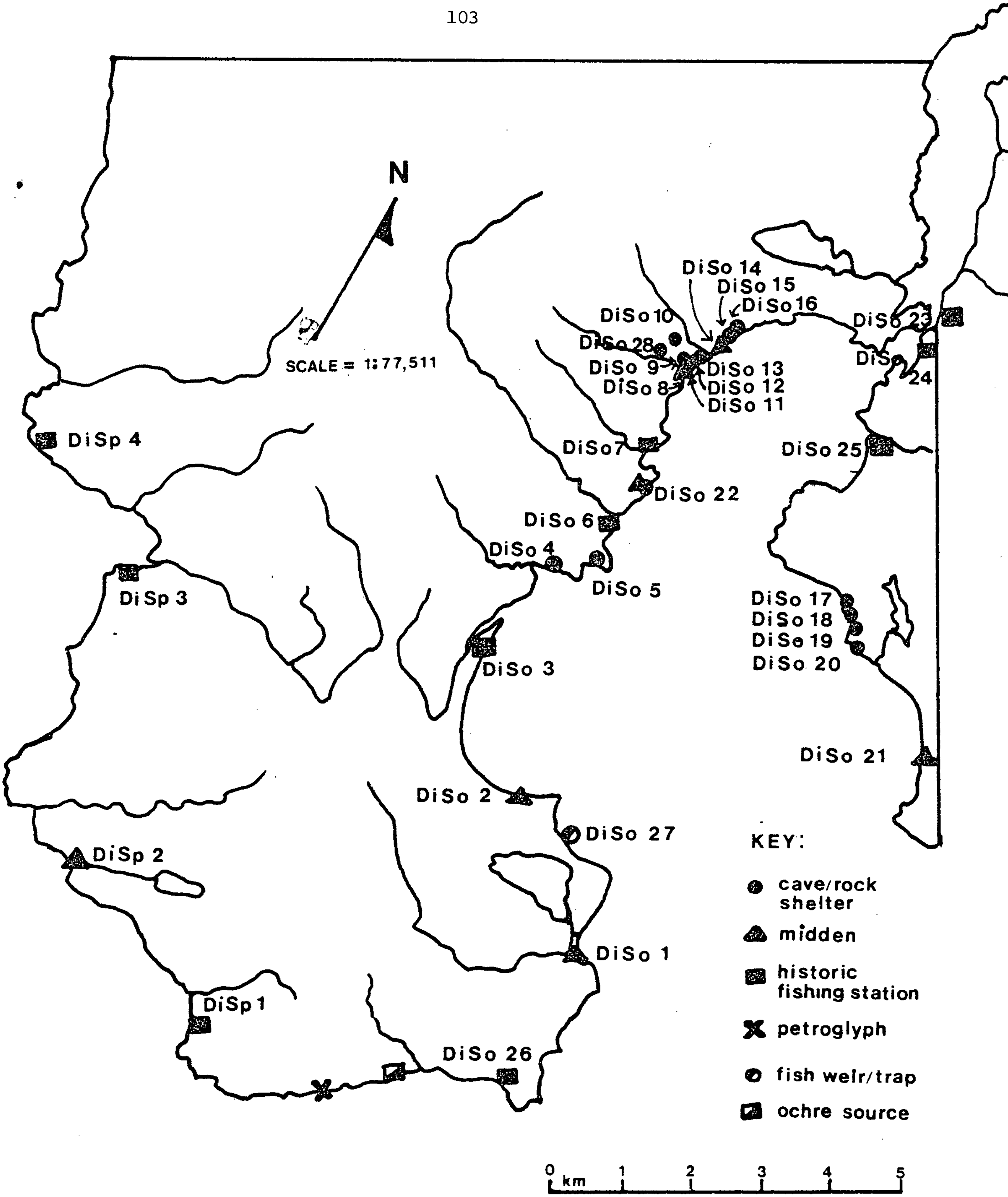


Figure 12. Known Archaeological Sites in Hesquiat Harbour.

growth and maintenance of a warm working relationship between band members and non-band members, based on mutual trust and respect.

The archaeological work began in 1971 under the direction of James Haggarty, who has remained the principal museum staff member associated with the project since that time. The author joined the project in 1973. Between 1971 and 1977 thirty-four archaeological sites were located. They include open midden sites, cave/rock shelter sites with surface burial complexes and/or habitation deposits, fish trap and weir remnants, an ochre site, a petroglyph, and historic fishing stations (Figure 12). Seventeen of the sites have been tested archaeologically and the surface burials from all cave/rock shelter sites systematically removed for reburial in a crypt at Hesquiat Village (Cybulski 1978). The faunal assemblages from three of the sites investigated in 1973 and 1974 under this joint Hesquiat Cultural Committee/British Columbia Provincial Museum project of survey and excavation, Hesquiat Village (DiSo 1), Loon Cave (DiSo 9) and Yaksis Cave (DiSo 16), are the subject of this study.

Chapter III

Statement of Problem

An examination of eight faunal assemblages from three sites in Hesquiat Harbour spanning attime range from at least A.D. 100 to historic times, shows there are major differences among the assemblages, both in species represented and in frequency of occurrence of species. The aim of this study is to determine whether or not the major proportion of the observed variation among the faunal assemblages can be related to the exploitation of animal resources from different habitats.

The small distances between sites, the homogeneity of artifact assemblages, the contemporaneity of at least some of the assemblages, and the linguistic, cultural, and social unity of recent inhabitants of the harbour all suggest the sites represent either temporal or spatial segments of the same regional adaptive system. It is suggested that the main factor contributing to inter-assemblage variability in the archaeological assemblages is the interaction between a land use system of strictly defined and regulated cultural territories and diversity in the geographical distribution of animal resources. Such a land use system is documented ethnographically for Hesquiat Harbour and environmental information confirms that the geographical distribution of animal habitats in the harbour does not provide each of the ethnographic territories with access to the same resource bases.

This interaction results in the cultural creation of different resource bases associated with specific habitation locations in the harbour. Consequently, one would expect differing faunal assemblages in the archaeological sites, for as long as a similar interaction has taken place.

As differing seasonal availability of resources within individual territories is also documented, it is further suggested that some of the variation among the faunal assemblages is attributable to season of exploitation. Changes in the local environment have been recorded for the relevant time period, and also can be expected to contribute to the pattern of interassemblage variation.

GENERAL THEORY

The sources of variation considered here differ from those suggested by Dewhirst for the west coast of Vancouver Island generally (Dewhirst 1978:20). He predicts, in view of a broadly based uniformity of material culture through time and space in the Nootkan cultural area, that artifact assemblages from Nootkan area sites will vary minimally through both time and space, while faunal assemblages will differ according to an outer coast late spring and summer versus an inner coast fall, winter and early spring settlement pattern. He also suggests that faunal assemblages will probably indicate an increasing use of marine resources as one nears the present. These predictions are based on the 4,000 year sequence at Yuquot, to the north of Hesquiat Harbour.

While the inner coast/outer coast shifting residential and exploitation pattern may indeed be an underlying cultural principle of Nootkan ecological orientation, as Dewhirst suggests, it is unlikely to have been so for the local group unallied to other local groups with territories in the different environmental settings, that is, until a tribal or confederacy level of socio-political integration was achieved. MacMillan, following Drucker (1951:228-231), outlines the development of such an integration for the Moachat local groups within recent tribal memory, achieved through the inter-group transfer of territorial rights (McMillan 1969:14). Folan also sees this process of confederation altering the settlement pattern of Nootka Sound from an initial one of independent local groups with year round residence in their own contiguous blocks of territory in a single environmental setting to one of integrated local groups with seasonally shifting residence in discontinuous territories spanning several environmental settings (Folan 1973:13). The local groups' territorial rights were then guaranteed by the socio-political alliances of the tribal and confederacy organizations.

An examination of the ethnographic pattern of settlement and land use in Hesquiat Harbour suggests that Dewhirst's predictions of a dichotomous outer coast summer/inner coast winter settlement pattern, are unlikely to be applicable in the Hesquiat area. The five Hesquiat local groups were not bound politically and economically into a tribe or confederacy (although such changes were beginning to take place and were interrupted by the establishment of Father Brabant's Catholic Mission at Hesquiat Village in 1875) but were independent local groups. Each had their own series of seasonally used resource extraction and habitation locations within clearly defined territorial portions of the wider Hesquiat territory.

As detailed in Chapter II, animal resources are distributed throughout Hesquiat Harbour in a clustered and discontinuous manner, reflecting habitat conditions, just as they are elsewhere on the west coast of Vancouver Island. But local group territories were not necessarily discontinuous and did not necessarily provide direct access to both outer coast and inner coast resources for each local group. On the contrary, four of the five groups held blocks of territory entirely within one of the major environmental settings (see pages 87 to 93).

Given this interaction of socio-political and environmental factors, one would still expect Hesquiat faunal assemblages relating to the ethnographic pattern of land use or ownership to reflect an outer coast/inner coast split in resource extraction and consumption, but this division should occur along local group lines, not within the local group adaptation represented by a series of sites, with the possible exception of those sites relating to the local group occupying the central portion of the harbour, called *kīqinȧth* by Drucker. Until the development of a tribal or confederacy level of socio-political structure that allowed the maintenance of discontinuous territories of exploitation, one would have to expect major differences in the subsistence bases of Nootkan autonomous local groups related to the exploitation of their immediate local environment.

If it is determined that the major source of variation among Hesquiat faunal assemblages is in fact attributable to the exploitation on a year round basis of different habitats that are but portions of the available regional resource base, then culturally restricted access to the total resource base seems the most likely explanation. Such a pattern of inter-assemblage variation would suggest the presence of culturally bounded blocks of exploitation territories within single environmental settings, such as would be associated with the local group level of socio-political organization.

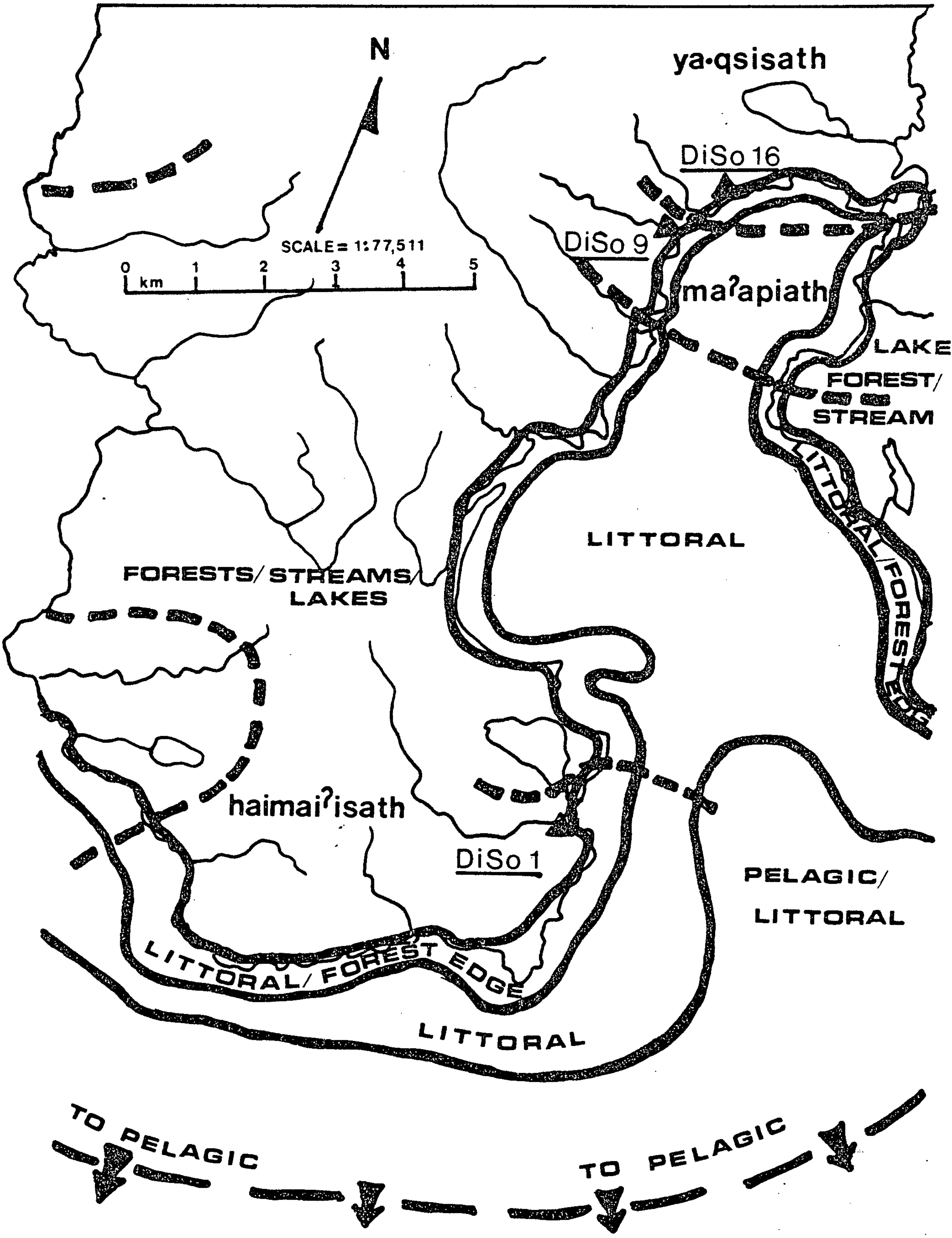
The works of Drucker, Dewhirst, McMillan and Folan suggest that the ethnographically described Nootkan adaptation to the west coast of Vancouver Island may have developed from a settlement pattern closer to that exhibited by the Hesquiat peoples at contact than that exhibited by the Moachat and other northern groups, that is, one of independent local groups. Confirmation of a long time depth for this level of socio-political organization in Hesquiat Harbour would lend support to the theory that the simpler, autonomous local group socio-political structure was the earlier adaptive pattern over a widespread area of the west coast of Vancouver Island.

To determine whether or not the major proportion of observed variation in the faunal assemblages from Hesquiat Harbour can be related to year round exploitation of restricted portions of the harbour territory, the three sites, Hesquiat Village (DiSo 1), Loon Cave (DiSo 9) and Yaksis Cave (DiSo 16), are related to the ethnographic territories and settlement patterns. These are related to the distribution in Hesquiat Harbour of animal species, grouped into Habitat Categories as defined in Chapter II. Using this information predictions of Major Habitat Category emphasis at each site are made, according to the ethnographic pattern of land use and ownership. These expected patterns will be compared with the observed variation in Habitat Category emphasis, and the differences and similarities discussed.

PREDICTED FAUNAL ASSEMBLAGE EMPHASIS

The faunal remains studied were excavated from the three sites DiSo 1, DiSo 9 and DiSo 16 during the 1973 and 1974 field seasons of the Hesquiat Project (Boehm 1974; Haggarty and Boehm 1974; Haggarty and Crozier 1975). DiSo 1 is the traditional "winter" village of the haimaiˀisath local group and the present day village of Hesquiat. DiSo 16 is a small cave site located within yaˀqsis traditional territory and DiSo 9 a larger cave located within maˀapiath territory. The latter two sites were used as burial places during the ethnographic period and thus are not linked as habitation locations to the ethnographic settlement pattern in the harbour. They are, however, clearly within the above mentioned local group territories in the inner harbour. DiSo 1 is on the outer coast, but because of the orientation

Figure 13. Relationship of Hesquiat Local Group Territories, Combined Vertebrate Habitat Categories, and DiSo 1, DiSo 9 and DiSo 16.



of the harbour, is slightly sheltered. Figure 13 locates the three sites in relation to Hesquiat local group territories and combined vertebrate habitat categories in the harbour.

For the purposes of this research, then, we are concerned with the territories, seasonal settlement patterns and resource bases of three Hesquiat local groups, the *haimaiʔisath*, the *maʔapiath* and the *ÿaʔqsisath*. Their territories and seasonal settlement patterns have been outlined above (pages 87-93). The present faunal distributions in Hesquiat Harbour have been described in pages 19 to 64). With this knowledge it is possible to suggest the major patterns one would expect to find in the faunal assemblages of the three sites if the ethnographic patterns have a long time depth in the harbour.

DiSo 1 and haimaiʔisath Territory

Haimaiʔisath territory differs markedly from that of the *maʔapiath* and the *yaʔqsisath*. Their territory is entirely within the Outer Coast Zone, with good access to Pelagic and Pelagic-Littoral marine and unprotected intertidal habitats. They have no chum salmon streams and few coho streams. The outer beaches are not particularly good herring spawning places because of excessive wave action.

DiSo 1 is ethnographically a "winter" season village. One would expect a faunal assemblage relating to this ethnographic usage in this territory to demonstrate an emphasis on deep and moderately deep water sea fish, shellfish, preserved and fresh coho salmon, preserved halibut and cod, and preserved herring. As the summer fishing places of this group are unprotected outer coast stations, one might also expect the herring fishery and some sea mammal hunting to take place from this, the only relatively well sheltered location. Since an important coho stream in *haimaiʔisath* territory is at this location, one might expect the deposits at DiSo 1 to represent the fall season as well. The faunal assemblages might include spring and fall catches of migratory waterfowl obtained in the lake and the meadows behind the village. In short, this "winter" village is so situated as to be habitable year round, at least for portions of the population.

Archaeologically one would expect a wide range of resources to be represented with a definite emphasis on outer coast marine and inter-tidal resources. Using the categories established in Chapter II, one would expect the faunal assemblage to be predominantly from the following Habitat Categories: Mammal - Pelagic (1) and Pelägic-Littoral (2); Bird - Pelagic (1), Open Littoral Waters (2), Sheltered Shallow Waters (läkes and marshes) (3), with lesser frequencies of Strand/Littoral Interface (5) and Forest (6); Fish - Deep Water Offshore (1), Moderately Deep Waters, Rocky Bottom and Varied Bottom (2 & 3), Streams (8) and Lakes (9); and Shellfish - Exposed Rocky Shores (1), Exposed Clean Sand/Gravel Beaches (3) and lesser frequencies of sheltered mud and sand beaches animals although pockets of these habitats are found even on the outer coast. Other categories may well be represented, but these should predominate.

The vertebrate fauna can be grouped into the more inclusive combined habitatecategories and arranged in rank order of expected importance to provide a general picture of the faunal assemblages expected at DiSo 1. This is illustrated in Figure 14C. Pelagic is expected to be most important, followed by Pelagic/Littoral, then Littoral, Streams/Lakes/Forests and finally Littoral/Forest Edge.

DiSo 9 and maʔapiath Territory

Maʔapiath territory is entirely within the Inner Harbour Zone, shel-

A. DiSo 16

PELAGIC	
PELAGIC/LITTORAL	4
LITTORAL/FOREST EDGE	3
LITTORAL	2
STREAMS/LAKES/FOREST	1

B. DiSo 9

PELAGIC	
PELAGIC/LITTORAL	4
LITTORAL/FOREST EDGE	3
STREAMS/LAKES/FOREST	2
LITTORAL	1

C. DiSo 1

PELAGIC	1
PELAGIC/LITTORAL	2
LITTORAL	3
STREAMS/LAKES/FOREST	4
LITTORAL / FOREST EDGE	5

Figure 14. Expected Rank Orders of Importance for Vertebrate Faunal Habitat Categories, Sites DiSo 1, DiSo 9, DiSo 16.

tered, with at least four good salmon streams, but no access to Hesquiat Lake or the open ocean. Beaches are predominantly muddy sand with areas of boulder beach. DiSo 9 articulates with the ethnographic settlement and land use pattern as a burial place. The earlier habitation deposits, if they belong within the <u>maʔapiath</u> settlement tradition, are expected to be year round, as ethnographically the "winter" village of the <u>maʔapiath</u> (DiSo 8) was occupied year round, while the many fishing stations were used but not lived at until historic times, and there is apparently no summer village associated with this local group until after amalgamation. There does not appear to be any advantage to moving about within <u>maʔapiath</u> territory as it is small, relatively homogeneous and entirely within the Inner Harbour. Strictly speaking, the <u>maʔapiath</u> settlement pattern prior to amalgamation would seem to be sedentary, with use of many resource locations from a central habitation location.

One would expect at DiSo 9 a fairly wide range of resources represented in the deposits, but only those available in the sheltered, shallow water marine and intertidal habitats and in streams and forests. Surface feeding ducks and geese should be fairly well represented, as should sheltered mud-sand beach molluscs. One would not expect the sea lions, porpoises and whales to be well represented, although harbour seal and sea otter might well be present. Fur seal might also be present if they are following the herring into Hesquiat Harbour in the spring. These animals should be female and/or foetal. As large sea mammals are not readily available in this zone, one might expect a greater reliance on large land mammals, particularly deer, at this site than at DiSo 1. Herring and salmon should be well represented, particularly chum salmon.

Summarizing, all seasons are expected to be represented and the following Habitat Categories are expected to be emphasized: Mammal - Littoral (3), Littoral/Forest Edge (4) and Forests (5) possible with some Pelagic-Littoral (2) in the form of fur seal; Bird - Sheltered Littoral Waters (3), Sheltered Shallow Waters (4), Strand/Littoral Interface (5), and Forest/Upland (6); Fish - Shallower Inshore Waters (4), Shallower Inshore Waters with Soft Bottom (5), Intertidal, Boulder Bottom (6), Intertidal, Soft Bottom (7), and Streams (8); and Shellfish - Sheltered Rocky Shores and Boulder Beaches (2), Sheltered Sand/Gravel Beaches (4) and Sheltered Mud/Sand/Gravel Beaches (5).

The expected combined vertebrate pattern is illustrated in Figure 14B. It is expected that Littoral resources will rank first in importance, followed by Streams/Lakes/Forests resources, then Littoral/Forest Edge resources, and finally Pelagic/Littoral resources. Pelagic resources are not expected to be represented.

DiSo 16 and yaʔqsisath Territory

Yaʔqsisath territory is even more restricted than maʔapiath territory and also entirely within the Inner Harbour Zone. It does, however, include the sockeye and other salmon resources of the Hesquiat Lake system. Principal resource locations are streams and sheltered shallow water marine and intertidal habitats.

The habitation deposits of DiSo 16 presumably represent an early expression of the yaʔqsisath settlement pattern. The cave is so small as to suggest a single (extended?) family occupation. As at DiSo 9, one might expect year round occupation of this small cave, with a full range of the available resources represented in the faunal assemblage, but as the territory is more restricted, a lesser variety than at DiSo 9. Again, one would not expect to find emphasis on sea mammal resources, but a greater emphasis on deer, salmon, and possibly herring, although this territory includes few stretches of good sandy beach such as that favoured by spawning herring. Much of the beach shoreline is boulder.

The Habitat Categories expected to be predominantly represented are: Mammal - Littoral (3), Littoral-Forest Edge (4) and Forests (5); Bird - Sheltered Littoral Waters (3), Sheltered Shallow Waters and Adjacent Shores (4), Strand/Littoral Interface (5) and Forest/Upland (6); Fish - Shallower Inshore Waters (4), Shallower Inshore Waters, Soft Bottom (5), Intertidal, Boulder Bottom (6), Intertidal, Soft Bottom (7), Streams (8), and Lakes (9); and Shellfish - Sheltered Rocky Shores (2), Sheltered Sand/ Gravel Beaches (4) and Sheltered Mud/Sand/Gravel Beaches (5).

Figure 14A illustrates the expected pattern for the combined vertebrate faunal categories. Streams/Lakes/Forests are expected to rank first in importance, followed by Littoral resources, then Littoral/Forest Edge and finally Pelagic/Littoral. As at DiSo 9, Pelagic resources are not expected to be present.

Summary

These are the expected faunal assemblages given a continuation back through time of the ethnographic settlement and land use systems that prevailed prior to amalgamation of the Hesquiat local groups at Hesquiat Village sometime in the early 1800's. Generally, one would expect the widest range of resources and greatest emphasis on marine pelagic and pelagic littoral resources at DiSo 1, with DiSo 9 and 16 exhibiting similar inner harbour assemblages, but with the DiSo 16 assemblage less varied. One would expect all seasons to be represented at all sites, although the more limited the range of resources exploited the less likely it is that it will be possible to document all seasons. It should be pointed out that this representation of all seasons is a record of the seasons of exploitation, not necessarily the seasons of occupation. Wherever a storage technology is either known or logically presumed to have been in use, the season of occupation must be distinguished from the season of exploitation of animal resources in interpreting faunal assemblages.

These faunal patterns should persist for as long as the people occupying the sites have had direct access to similarly restricted territories and have used the locations during the same seasons. In summary, one would expect to find a particular type of fauna at each site, grouped by the types of habitats that they favour and possibly, to a lesser degree, by the seasons at which they are available. If it is found that the archaeological faunal assemblages from these sites differ primarily in habitat groupings of fauna, then one must conclude that different habitats are being exploited by the occupants of each site. If such is the case, the best explication of such a pattern would seem to be culturally defined territories that associate restricted resource exploitation territories with each habitation location.

Chapter IV

Site Context of the Faunal Assemblages

Bird, fish, mammal and shellfish remains were systematically collected during the excavation of all sites tested in the seven years of archaeological field research undertaken as part of the Hesquiat Project. Partial samples from the excavated samples recovered from DiSo 1 and DiSo 9 and the full sample from DiSo 16, completely excavated, are used here. The sampling and excavation methods by which the faunal samples were recovered varied slightly from site to site, but adhered to three general objectives: the collection of an areally representative sample; the maintenance of cultural stratigraphic provenience; and the collection of control samples to ensure the inter-site comparability of Faunal data.

SITE EXCAVATION METHODS, STRATIGRAPHY AND DATING

DiSo 16 is a small cave site located at the head of Hesquiat Harbour approximately .4 kilometres east of the mouth of yaqsis stream and 1.1 kilometres east of DiSo 9 (Fig. 13). The cave is set back some 10 metres from the present shoreline and approximately 1.5 metres above present high high water level. In outline the interior of the cave is narrow and shallowly bilobate at the back, with a maximum length of 3.5 metres and a maximum width of 2.8 metres (Fig. 15). The dripline marking the entrance overhang angles backwards from west to east so that there are only about five square metres of sheltered area within the cave. The habitation deposits reach a maximum thickness of one metre at the front of the cave. The cave floor slopes unevenly upwards towards the back of the cave and the deposits here are correspondingly shallower. No cultural deposits were located outside the cave although the slope in front was sampled using a power auger.

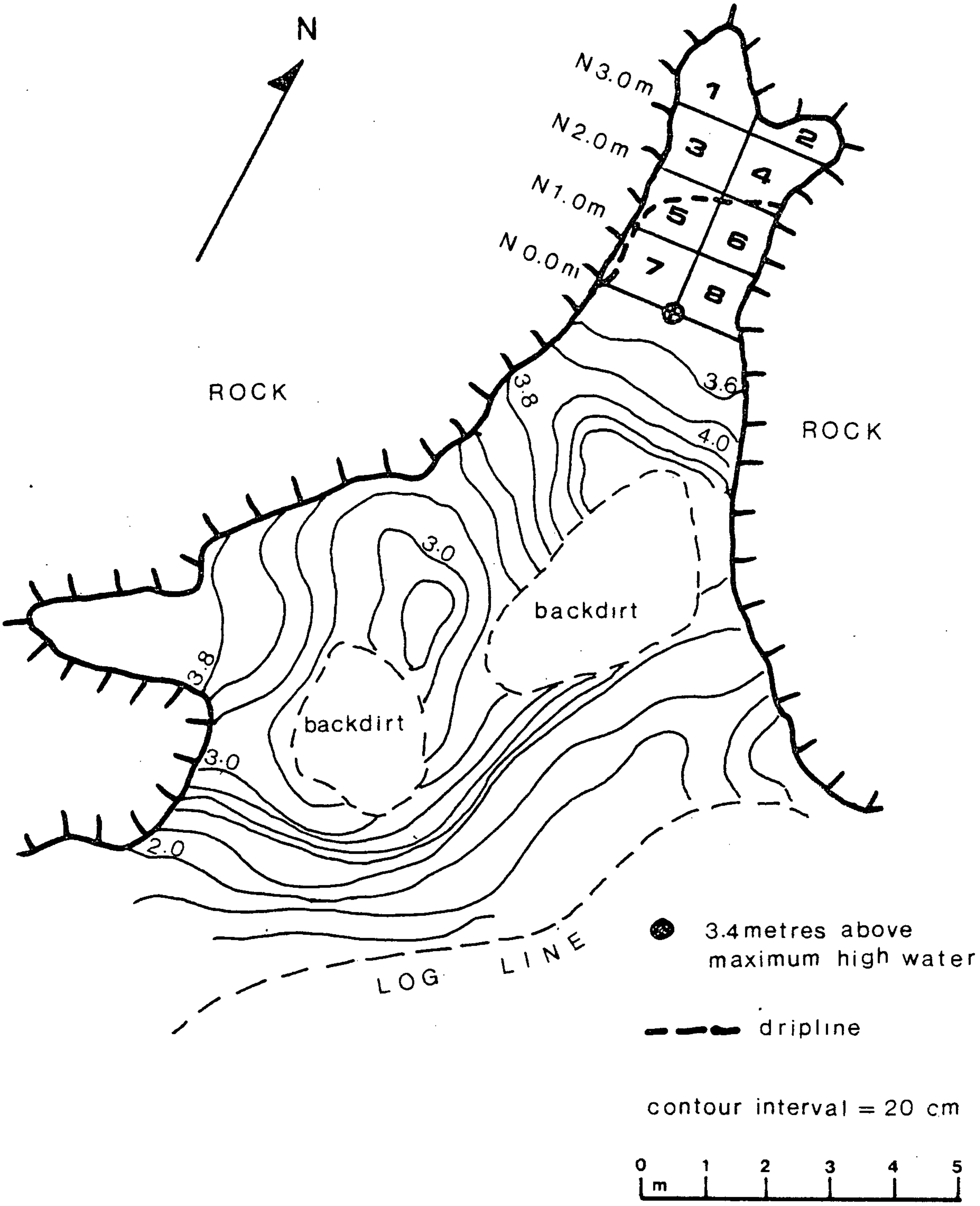


Figure 15. Site Map of Yaksis Cave, DiSo 16.

The deposits at DiSo 16 were completely excavated within a line at right angles to the western edge of the dripline. A one metre square grid was defined inside the cave and deposits removed by trowelling in alternate one metre square units, using a combined system of ten centimetre arbitrary and cultural levels. All material removed was dry screened through 1/4 inch mesh. All vertebrate remains uncovered during excavation or retained in the screens were collected for analysis. Representative samples of molluscan remains were collected, the different species being sampled according to their perceived relative frequency of occurrence in the deposits. Matrix samples of the stratigraphic layers were collected from the excavation unites during excavation. In addition, two 20 cm by 20 cm vertical columns, one in the central area of the cave and the other outside the dripline, were collected in total by combined arbitrary and cultural levels, for matrix analysis. These also serve as control samples for the recovery of small faunal remains and the subjective collection of molluscan remains. The cultural deposits at DiSo 16 were excavated down to the cave floor. The full sample of faunal remains from eight 1 m by 1 m excavation units is discussed here.

The physical stratigraphy of the deposits is relatively simple but is partially complicated by the effects of the angled dripline (Fig. 16). In the areas immediately outside the dripline, an undifferentiated matrix of dark, slightly sandy soil high in organic content and containing scattered charcoal, fire cracked rocks and very occasional pockets of shell, extended from the surface to the cave floor or to the noncultural sands and gravels filling the uneven pockets of the cave floor. In the center of the cave a complex of rock spread hearths was uncovered at 10 cm below the surface, extending down to 50 cm below the surface of the deposits. To the north and west of this hearth complex are concentrated shell lenses underlain by a dark, slightly sandy soil and overlain by a brown humus with scattered shell remains. At the back

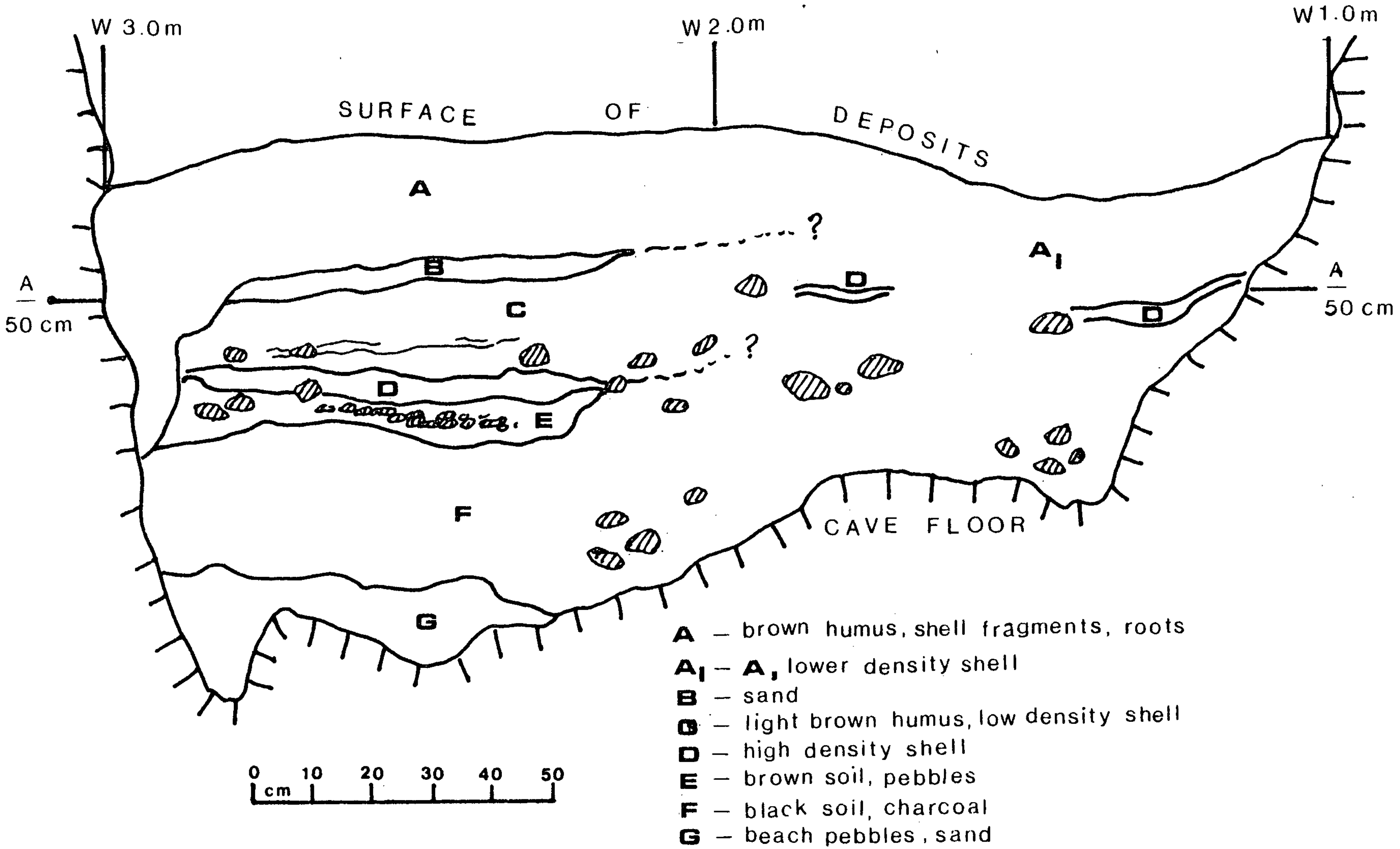


Figure 16. East/West Profile at North 2.0 Metres, Yaksis Cave, DiSo 16.

of the cave in the two small lobes, the concentrated shell lenses lie directly upon the noncultural sand and gravel deposits (Haggarty and Boehm 1974).

Two wood charcoal samples from the site, one associated with the hearth complex and the other from beneath it, returned radiocarbon estimates of A.D. 1375 ± 85 (I-8114) and A.D. 1265 ± 80 (I-8113) respectively. See Table 9 for dendrochronologically corrected ranges for these estimates.

The size of the cave, the depth of the cultural deposits and their relatively simple, continuous nature, and the two radiocarbon estimates, which could be estimates of the same date, all suggest that the deposits at DiSo 16 represent a single short term occupation. The faunal remains are considered a single assemblage representing a short period of occupation in the 12th to 14th Centuries A.D.

DiSo 9 is a larger cave located immediately east of *maʔapi*, the traditional "winter" village of the *maʔapiath* local group, at the head of Hesquiat Harbour (Fig. 13). It is about 1.1 kilometres west of DiSo 16. Like DiSo 16, it is set back from the present shoreline and is 4.2 metres above present high high water. The interior of the cave is long and narrow, being about three metres at its widest point and about twelve metres long. The roof of the cave is low and extremely uneven. Prior to excavation,of the habitation deposits, it was impossible to stand upright in the cave, an obvious reason for its abandonment some time in the eighth century A.D. Much later, probably in the 18th and 19th centuries A.D., the cave was again used, this time as a resting place for the dead. The cave floor slopes upwards towards the back of the cave, so that the earliest occupation layers are thickest at the front of the cave, up to two metres deep, where, beyond the dripline marking the cave entrance they become almost indistinguishable from and grade into the natural soil build up in front of the cave. As at DiSo 16, power auger testing of the slope in front of the cave revealed no cultural debris.

Table 9. Radiocarbon Estimates for Hesquiat Harbour Sitess*

Site	Strat. Unit	Lab. No.	Age of Sample	^{14}C Estimate	Dendrochronology*** Corrected range
DiSo 16	-	I-8113	685 ± 80	AD 1265	AD 1355 - AD 1210
		I-8114	575 ± 85	AD 1375	AD 1420 - AD 1300
DiSo 9	I	GaK-4395	1180 ± 60	AD 770	AD 910 - AD 730
	I	I-8109	1200 ± 85	AD 750	AD 915 - AD 690
	I	I-8111	1285 ± 85	AD 665	AD 820 - AD 620
	II	WSU-1543	1740 ± 60	AD 210	AD 380 - AD 200
	II	I-8110	1790 ± 90	AD 160	AD 350 - AD 140
	II	WSU-1544	1800 ± 70	AD 150	AD 290 - AD 140
	II	I-8112	1810 ± 115	AD 140	AD 355 - AD 95
DiSo 1	II	WSU-2286	520 ± 90	AD 1430	AD 1440 - AD 1340
	III	WSU-2287	520 ± 90	AD 1430	AD 1440 - AD 1340
	III	WSU-2290	540 ± 65	AD 1410	AD 1420 - AD 1345
	IV	WSU-2291	780 ± 90	AD 1230	AD 1330 - AD 1190
	IV	WSU-1542	820 ± 70	AD 1130	AD 1240 - AD 1090
	IV	WSU-2288	1065 ± 70	AD 885	AD 1020 - AD 860
	IV	WSU-2289	1220 ± 65	AD 730	AD 880 - AD 700
?	V/IV	**GaK-4394	2430 ± 200	480 BC	230 BC - 800 BC

*Dates taken from Condrashoff and Abbott 1978.

**This date is seemingly unreliable.

***Ralph, Michael and Han 1973.

DiSo 9 was excavated in 2 m by 1 m units aligned parallel to the long axis of the cave (Fig. 17). A system of combined 5 cm arbitrary and cultural level was used to remove the deposits and to record and collect the data. The deposits were trowelled and dry screened through 2 mm mesh. In 1973 all vertebrate remains uncovered or retained in the screens, and representative samples of molluscan remains, were collected. In 1974 all vertebrate and all whole, umbo and spire fragments of molluscan remains were retained. Matrix samples were collected from each combined arbitrary and cultural level during excavation and five 20 cm by 20 cm columns randomly selected within 2 m segments of the cave midline were collected in total after excavation for control matrix samples.

Approximately fifty per cent of the deposits at DiSo 9 had been excavated by the end of the 1974 season, but the sample from only five of the excavation units, 1, 2, 3, 8 and 10, is reported on here. These five units provide samples from the front, middle and back of the cave deposits and the midline area as well as that adjacent to the eastern cave wall.

The physical stratigraphy of DiSo 9 is both simple and complicated. In the field it was possible to distinguish vertically 23 distinct cultural matrices that could be followed horizontally throughout the cave wherever they occurred. Thus in two metres of vertical deposit there is very fine stratification, but because of the level nature of their deposition these strata can be correlated horizontally from excavation unit to excavation unit throughout the area excavated.

Inside the cave the cultural deposits sit directly on top of the cave floor or the natural sands and gravels originally laid down by wave action (Fig. 18). The lowest cultural levels at the front of the cave can best be characterized as black to brown soil with varying concentrations of sand and gravel, high carbon and ash content, and little scattered shell but a consid-

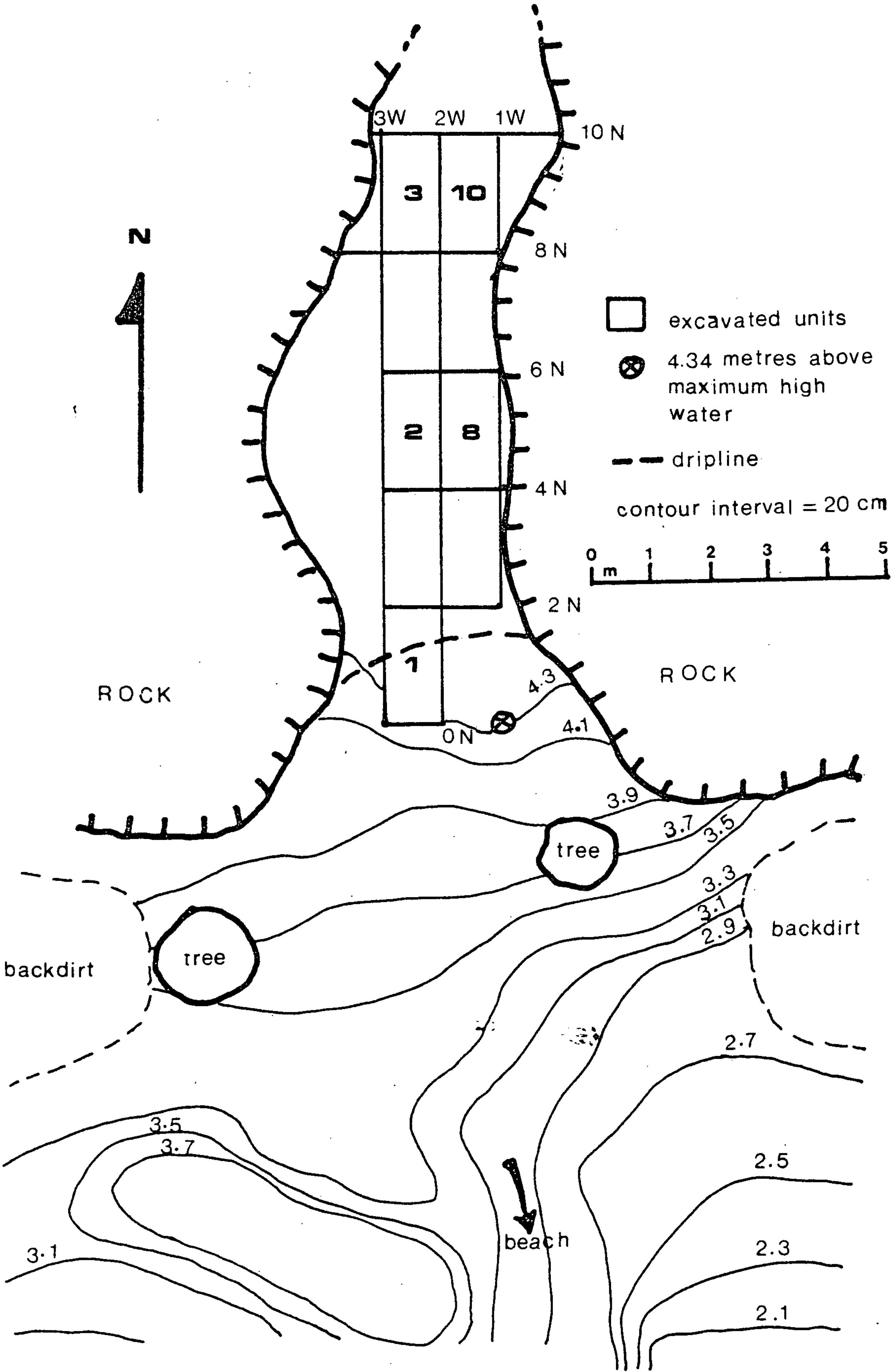


Figure 17. Map of Loon Cave, DiSo 9.

erable number of pockets of concentrated shellfish remains. In these lower deposits almost the entire front and central area of the cave is taken up by a series of large structured hearths associated with extensive ash and charcoal deposits. At the back of the cave are concentrated shell and sand deposits contemporary with the hearth structures. Scattered shell content in the front area increases towards the top of this major stratigraphic unit.

Approximately one metre below the surface of the deposits there occurs a stratigraphic discontinuity. It is marked by a layer of sand that caps the lower deposits, separating them from the upper cultural layers. The sand layer is very thin, about one centimetre thick, at the front of the cave and contains very few faunal remains. It gradually increases in thickness and faunal content towards the back of the cave, where it reaches a maximum thickness of 20 centimetres. In the profiles, the capping effect of the sand layer is clearly visible, the sand filling small depressions and holes in the original surface on which it was deposited.

Above the sand layer lies a series of cultural layers with varying concentration of faunal remains, ash and charcoal, in a dark and sometimes sandy soil. In this upper zone the concentration of shell is visibly greater than in the front and central portions of the lower unit. A series of rock spread hearth complexes associated with ash spreads occurs in the central and frontal portions of the cave in this stratigraphic unit also and shell concentration is again heaviest towards the back of the cave.

The upper surface of the deposits has been somewhat disturbed by the subsequent use of the cave as a burial place and the top ten to twenty centimetres of the deposits contain fragments of cedar bark rope, matting, planks, historic artifacts and a high concentration of decayed wood particles from disintegrated burial boxes, all associated with the surface burial complex.

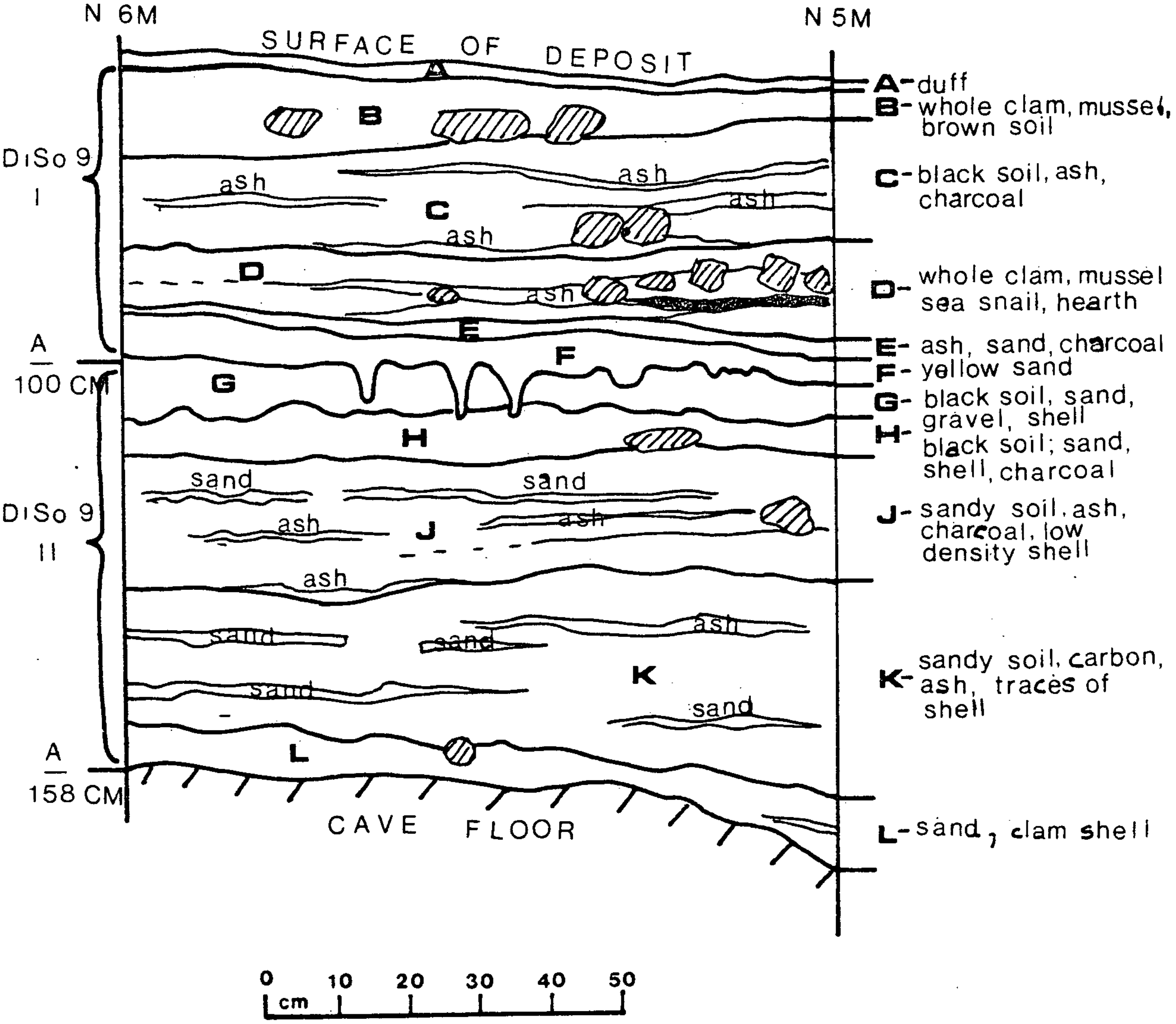


Figure 18. Typical North/South Profile, Loon Cave, DiSo 9.

There is little actual disturbance from digging or mixing of layers, rather materials originally lying on the surface of the habitation deposits have gradually filtered down into the underlying layers.

Seven radiocarbon estimates were obtained for DiSo 9. Three wood charcoal samples associated with rock spread hearths of the upper unit returned estimates of A.D. 750 ± 85 (I-8108), A.D 770 ± 60 (GaK-4395) and A.D. 665 ± 85 (I-8111), while four wood charcoal samples associated with structured hearths from the lower unit returned estimates of A.D. 140 ± 115 (I-8112), A.D. 160 ± 90 (I-8110), A.D. 150 ± 70 (WSU-1544) and A.D. 210 ± 60 (WSU-1543). Dendrochronologically corrected ranges for these estimates are given in Table 9.

The physical stratigraphy and the radiocarbon estimates indicate that the deposits at DiSo 9 should be considered as two stratigraphic units representing two periods of occupation, an early one in the 2nd and 3rd Centuries A.D. and a later one in the 7th and 8th Centuries A.D. The faunal remains are considered to be two assemblages resulting from these two occupations.

DiSo 1 is a large open midden site located on a low sandstone bluff approximately 8 metres above mean sea level on the western shore of the harbour mouth (Fig. 13). The cultural deposits are concentrated in two areas: a high area approximately 40 m by more than 160 metres stretched along the top of the bluff; and a shallow area to the east, at the bottom of the bluff, stretched atop the more recent beach deposits associated with the development of Village Lake and now approximately 1.5 - 2.2 metres above high high water. Both areas were used historically, but the deposits of the low area are very shallow and appear to be entirely historic, while those on top of the bluff reach a depth of about one and a half metres, with historic overlying prehistoric deposits. Only material from the bluff area is discussed here.

Atop the bluff, a 2 m by 2 m grid was established over an area 106 m long by 32 m to 44 m wide in the central portion of the known extent of the midden deposits. Six units within this grid were selected using a table of random numbers, and excavated. The faunal remains from two of these units, 12 and 18, plus remains from a third unit selected from the 1973 southward extension of the grid, unit B, are discussed here. Excavation Unit 12 is 74 metres north of Excavation Unit 18, 86 metres north of Excavation Unit B and 10 metres west of the edge of the bluff. Excavation Units 18 and B are located 12 and 18 metres respectively further back from the seaward edge of the midden than Excavation Unit 12, so that a reasonably wide area is sampled by the three units (Fig. 19).

Deposits were excavated by trowel in combined 10 cm arbitrary and cultural levels and dry screened through 1/4 inch mesh. All vertebrate remains uncovered or retained in the screens were collected for analysis, and representative samples of molluscan remains were retained. As excavation proceeded, deposit samples were obtained from each combined arbitrary and cultural level for matrix analysis and a check on the recovery of small size faunal remains.

In the areas sampled by the three excavation units, the midden deposits range in maximum depth from 1.1 m to 1.6 m. They overly geological deposits of hard packed sand, clay and gravel. Stratigraphically the cultural deposits can be divided on the basis of matrix content and depositional processes into four major stratigraphic units, overlying the basal unit of natural origin. All four of the major cultural stratigraphic units are present in each of the three units reported here (Fig. 20).

Stratigraphic Unit I, varying in thickness from 3 to 40 cm, is a layer of brown humus containing some shell and fire cracked rock, and many historic artifacts. Some areas of this unit are considerably disturbed from the planting of vegetable gardens and historic building activity. In E.U. 12 ,

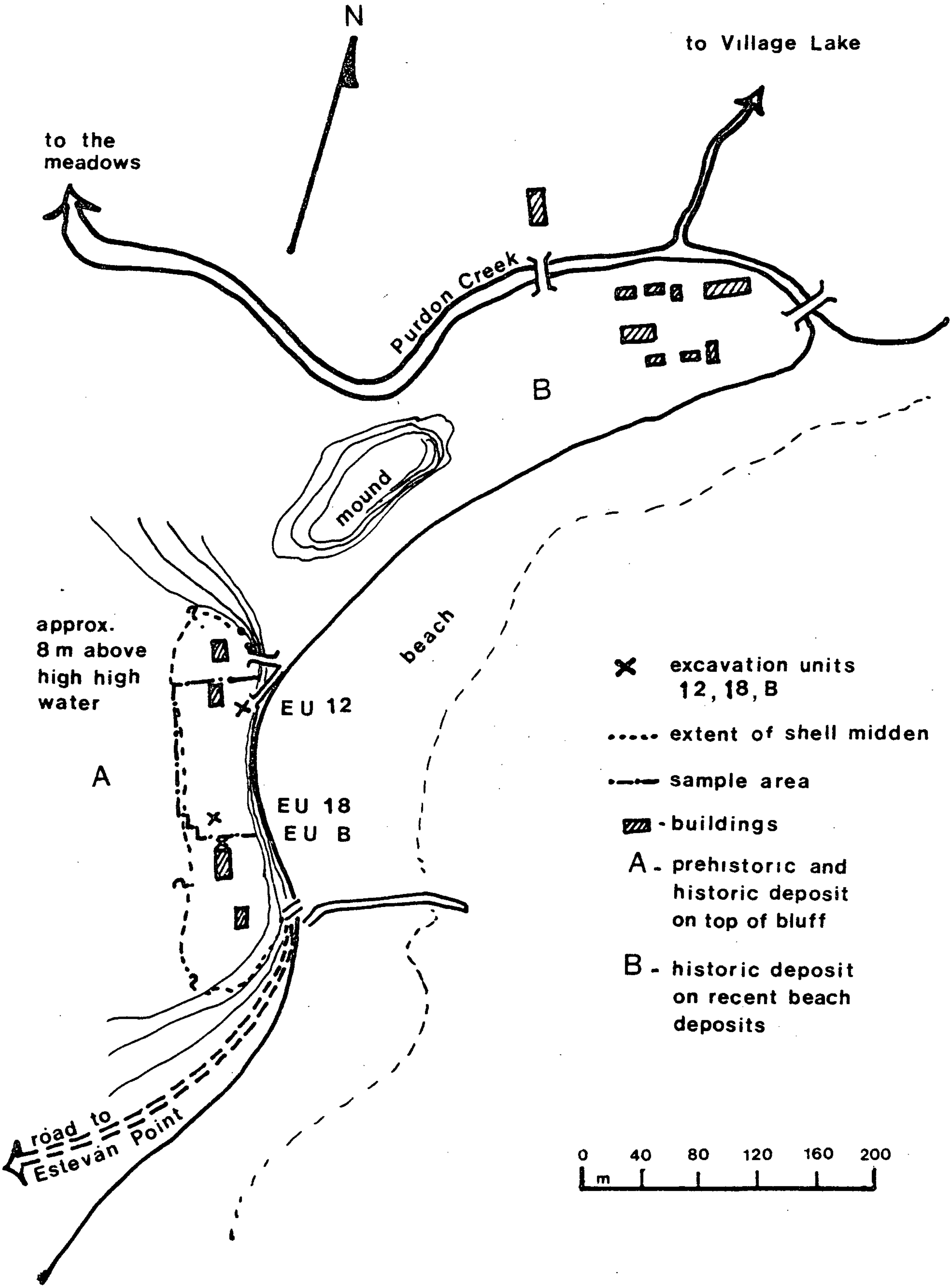


Figure 19. Site Map of Hesquiat Village, DiSo 1.

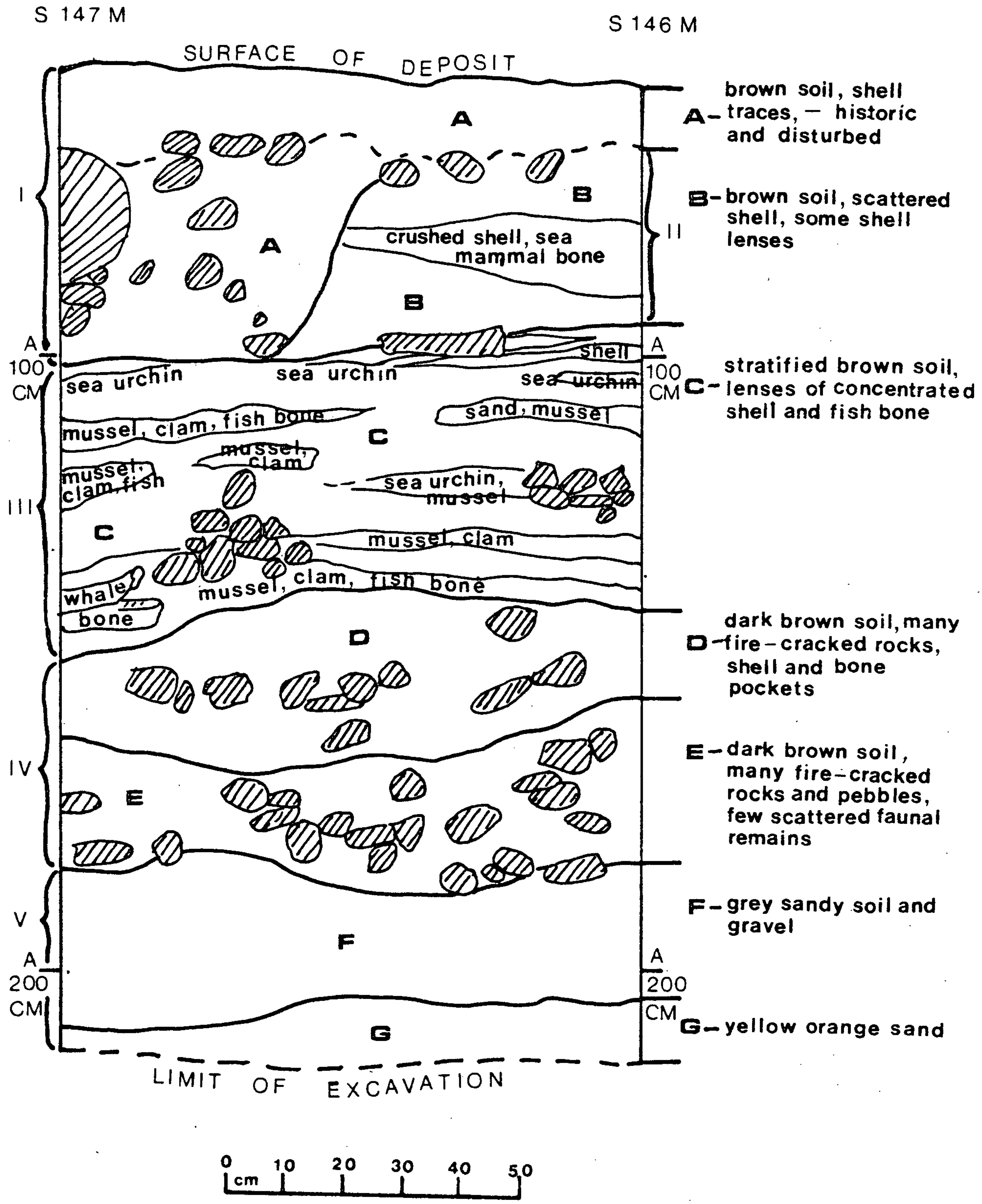


Figure 20. Typical DiSo 1 Profile, Abstracted from Excavation Unit B.

this layer is very disturbed, containing a post hole approximately 20 cm in diameter extending 75 cm down from the surface, and a pit of approximately 80 cm diameter extending 85 cm down from the surface. The fill of these features is mixed and homogeneous and obviously contains both historical and prehistorical material from various levels of the site. The whole of this stratigraphic unit is considered basically historic, but also disturbed.

Stratigraphic Unit II is a major unit of stratified deposits of brown soil, shell lenses and fire cracked rock, containing at least one sand pit hearth feature. It varies in thickness from 7 to 65 cm, and in both E.U. 18 and E.U. 12, much of the unit has been truncated and removed by subsequent occupational activities. In E.U. 18, the separation between the remnant of this unit and the underlying deposits was not clearly perceived during excavation, thus E.U. 18 Unit II levels have had to be lumped with Unit I levels as disturbed. Stratigraphic Unit II, then, only contains faunal remains from Excavation Units 12 and B. A wood charcoal sample from the hearth feature returned a radiocarbon estimate of 520 ± 90 B.P. (WSU-2286).

Stratigraphic Unit III is a finely stratified unit of highly concentrated shell layers, varying in thickness from 3 to 70 cm. It is well represented in E.U. B but is discontinuous in both E.U. 12 and E.U. 18. There are two radiocarbon estimates for this unit, one of 520 ± 90 B.P. (WSU-2289) and one of 540 ± 65 B.P. (WSU-2290).

Stratigraphic Unit IV is a stratified unit of brown sandy soils with low density scattered shell lenses and very heavy concentrations of fire cracked rocks. It also contains varyingly concentrated lenses of vertebrate remains. In the E.U. 18 area, it is the bulk of the midden, being from 80 to 140 cm thick. In the other two units it is less extensive, ranging from 20 to 65 cm in thickness. Radiocarbon estimates on four wood charcoal samples from this unit date it to between 1200 and 700 years ago. These dates are somewhat confusing as two dates, one of 720 ± 90 B.P. (WSU-2291) and one of 1065 ± 70 B.P.

(WSU-2288) both come from middle layers of this unit, while the other two, of 1220 ± 65 B.P. (WSU-2289) and 820 ± 70 B.P. (WSU-1542) both date the initial occupation layer. A fifth estimate of 2430 ± 200 (GaK-4394) on wood charcoal from near the contact of Units IV and V seems out of line. Stratigraphic Unit IV overlies the geological deposits.

Stratigraphic Unit V is the geological unit of semi-consolidated sands, clays, and gravels, arbitrarily ended by the limit of excavation. It is basically sterile, but contains a few pockets of faunal remains that may be intrusive from Unit IV.

While these five major stratigraphic units are distinguished partly on stratigraphic discontinuities, the depositional breaks are not associated with the development of sterile soil horizons. They probably reflect changing types and intensities of occupation, not abandonments and reoccupations of the whole site. The stratigraphic sequence is interpreted as a relatively continuous depositional sequence exhibiting changing patterns of site usage through time.

The physical stratigraphy of DiSo 1 indicates that the faunal remains should be considered five separable assemblages, four cultural and one basically noncultural, within a single more or less continuous depositional sequence. The separation of the faunal remains by Major Stratigraphic Unit allows the examination of changes through time in the faunal record of this major midden site.

ASSOCIATED ARTIFACT ASSEMBLAGES

The samples of prehistoric artifacts from the excavation units that produced the faunal samples are small: 34 artifacts from DiSo 16; 172 from DiSo 9; and 282 from DiSo 1. Bone, antler, stone and shell artifacts were recovered. Full descriptions of the assemblages are still in preparation, but the following brief summary and Table 10 serve to demonstrate the relative simplicity of the assemblages. Figures 21 and 22 illustrate the artifact classes.

Table 10 lists the artifact classes distinguished and illustrates their distribution and actual frequencies in the stratigraphic units used to group the faunal remains. Artifact classes are as defined in Mitchell (1971). Where they differ, they are briefly described at the end of Table 10.

The general characters of all the assemblages are very similar. Chipped stone objects are either absent or extremely rare, and there is no chipping detritus. The few stone artifacts other than abrasive stones, of which there are many, are manufactured by grinding techniques. There are no ground slate points or knives. Instead there are ground California Mussel shell points and knives. Other ground stone artifacts are celts and fishhook shanks.

The majority of the bone and antler artifacts are simple bone points or barbs of varying sizes and styles. Composite toggling harpoon heads are also present in two sizes. Other artifacts include needles, awls, unilaterally barbed fixed points, bipoints, and the deer ulna tools ethnographically described as fish cutting knives. There is support for this functional identification for the archaeological tools as well. Two of the deer ulna tools from the Hesquiat samples were recovered with fish scales adhering to the bone surfaces. Bone artifacts are more common than antler artifacts.

The artifact assemblages, then, are relatively simple. In fact the simplicity of the assemblages suggests that they are remnants of material cultures that used many plant fibres, which have not survived in the archaeological context, in their manufactures. This suggestion is supported by both ethnographic data and the archaeological evidence from the Hesquiat burial complex artifacts, among which are many wooden items.

Table 10. Distribution of Artifacts by Major Stratigraphic Units

Class	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
STONE								
Chipped stone								
Quartz flake/nodule	1						1	2
Chipped-slate knife							1	
Notched stone		1						
Ground Stone								
Fishhook shank*				5	4	3	1	
Celt			2					
Misc. ground stone objects	1		1	1		1		
Pecked and Ground Stone								
Abrasive stones and slabs	5	8	13	27	8	16	62	2
BONE AND ANTLER								
Mammal bone needle		1	3					
Bird bone needle	2	3	1					
Dogfish spine awl?*	1							
Bird bone awl, tiny			7					
Blunt "awl"			1					
Deer ulna tool	1	1	1			1		
Pointed bone object	1	3	1				1	
Bone wedge or chisel bit			1		1		2	
Bird bone handle?*	1							
Sea mammal bone dagger?*							1	
Polished porpoise auditory bulla				1				
Ground carnivore tooth		1						
Unilaterally barbed point				1		2	1	
Composite toggling harpoon valve 6 cm to 13 cm	1	5		2	3	2	2	
Composite toggling harpoon valve 4 cm to < 6 cm				1			2	
Wedge- or conical-based point < 5 cm	1	16	7	4	1	1		
Misc. bone point			2			3	3	
*Angled barb < 3 cm	1			3				
Angled barb 3 - < 5 cm		1	1	7		3		
Angled barb > 5 cm	4	1	2	1				
Straight barb < 5 cm		6	19	5		3	1	
Bone bipoint < 7 cm		5		7	2	7	4	
Point or barb fragments	9	20	6	18	2	4	3	
Bipoint fragments				2				
Misc. worked human bone			1					
Misc. worked antler		3					1	
Misc. worked sea mammal bone		4	1	9	3	3	10	
Misc. worked land mammal bone	2	4	5	3	3	6	2	

Table 10. (Continued)

Class	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
SHELL								
Mussel shell point			1					
Mussel shell knife		2	1					
Mussel shell adze blade		1	4					
Mussel shell knife/adze fragment	1		2					
Shell bead		2						
Dentalium	1	1						
Clam shell scoop?*	1							
Totals	34	89	83	97	27	55	99	4

Artifacts of non-aboriginal manufacture were present in the deposits of DiSo 1-I, probably intrusive into DiSo 1-II and DiSo 1-III, and intrusive from the surface burial complex in DiSo 16 and DiSo 9-I.

*Ground stone fishhook shank: These are cylindrical stone shanks beveled or grooved at one end to receive a bone barb and modified at the opposite end to provide an area for line attachment (Fig. 21 b).

*Dogfish spine awl?: This is a dorsal fin spine from a dogfish which is extremely worn at the tip. The wear is uneven and seems more extensive than the usual wear exhibited naturally by these spines, although it may be just an anomalously worn natural spine.

*Bird bone handle?: This is made from the right tibia of a Pelagic Cormorant (Phalacrocorax pelagicus). The long bone is neatly ground off at right angles to the long axis of the shaft so that the proximal 1/5th has been removed. The distal articular surfaces are unmodified. The result is a naturally socketed shaft approximately 8 cm long with a slightly curved handle (Fig. 22 m).

*Sea mammal bone dagger?: This is a 29.5 cm long by 3.5 cm wide by 1.2 cm thick section of whale rib with a sharply pointed end. It would make a very efficient dagger or bark peeler.

*Angled barbs: These are bone barbs for fishhook shanks, of varying lengths as described (Fig. 22 o-r). The bases are shaped with one straight side and one ground smooth at a 10 to 20 degree angle to the long axis of the shaft.

*Clam shell scoop?: This may also be natural. It is a Basket Cockle shell (Clinocardium nuttallii) with a worn ventral edge that appears artificially modified. As with the dogfish spine, however, it may be naturally worn.

As the samples are very small, comparisons are made with reservations, but a few differences seem noteworthy. Ground stone fishhook shanks, although recovered from the burial complex assemblages at DiSo 9, only occur in the habitation deposits of DiSo 1, even though they are reported from Yuquot as early as 1,000 B.C. (Dewhirst 1978:12). Unilaterally barbed points, not present in these samples at DiSo 9, and DiSo 16, are found in other excavation unit samples at DiSo 9, while stone celts, not present in this sample from DiSo 1, are similarly present in other excavation unit samples at this site. Large toggle harpoon valves, like the fishhook shanks, are also found only in the habitation deposits of DiSo 1, although recovered with the burial complex at DiSo 9. These artifacts are not present at Yuquot until after A.D. 800 (Dewhirst 1978:14). Bone bipoints, angled barbs and abrasive stones are all more common at DiSo 1 in this sample. Wedge- or conical-based points and straight barbs less than 5 cm in length, on the other hand, are more common at DiSo 9. The shell beads and dentalium found at DiSo 9 and DiSo 16 are most probably intrusive from the surface burial complexes at these sites.

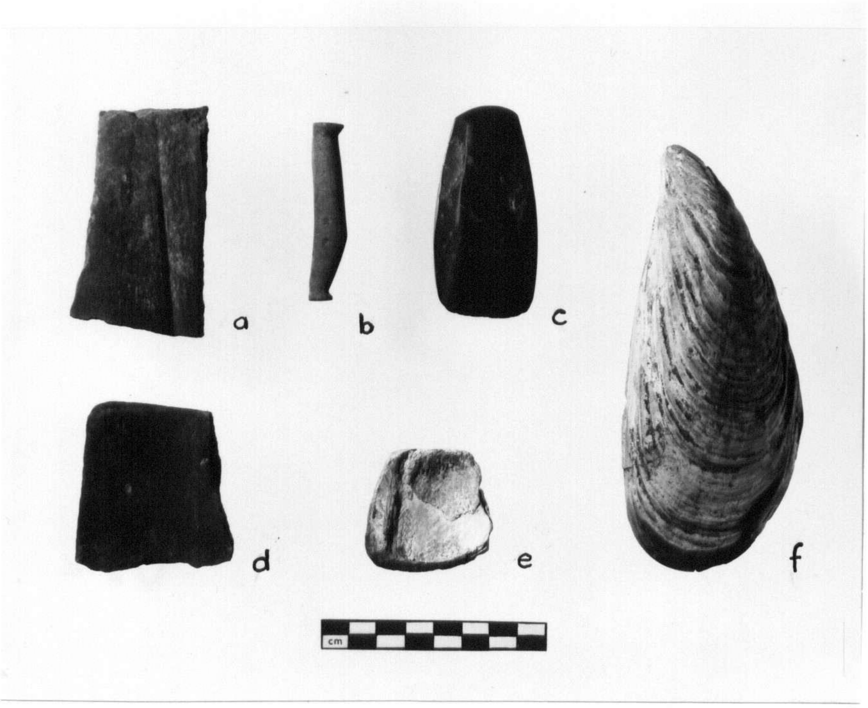


Figure 21. Stone and Shell Artifact Classes

a. abrasive stone, DiSo 1
b. fishhook shank, DiSo 1
c. celt, DiSo 9
d. abrasive stone, DiSo 16
e. California Mussel shell adze blade, DiSo 9
f. California Mussel shell knife, DiSo 9

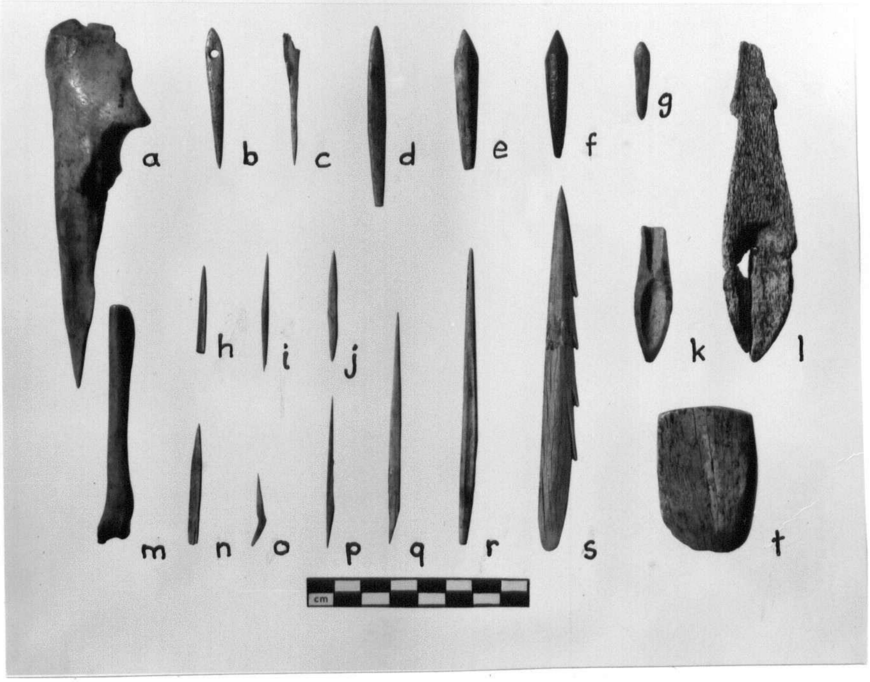


Figure 22. Bone and Antler Artifact Classes

a. deer ulna tool, DiSo 9
b. mammal bone needle, DiSo 9
c. bird bone awl, DiSo 9
d. misc. bone point, DiSo 9
e. conical-based bone point, DiSo 1
f. conical-based bone point, DiSo 9
g. wedge-based bone point, DiSo 9
h. straight barb<5 cm, DiSo 9
k. composite toggling harpoon valve 6 cm, DiSo 9
l. composite toggling harpoon valve >6 cm, DiSo 1
m. bird bone handle?, DiSo 16
n. straight barb 5 cm, DiSo 1
o. angled barb<3 cm, DiSo 16
p. angled barb 3-5 cm, DiSo 1
q,r. angled barbs>5 cm, DiSo 1
s. unilaterally barbed bone point, DiSo 1
t. bone wedge or chisel bit, DiSo 1

These differences will be discussed more fully in Chapter VI, but it is worth noting here that nearly every artifact class found in these Hesquiat samples is present in the Yuquot site at a comparable or earlier time period (Dewhirst 1978:8-17). The similarity of the assemblages is, as predicted by Dewhirst, quite remarkable.

SUMMARY

The faunal remains discussed in this study are considered to be eight distinct assemblages from the stratigraphic units defined as follows:

1. DiSo 16 : dating to the 13th and 14th Centuries A.D.
2. DiSo 9-I : the upper deposits and the sand layer at DiSo 9, dating to the 7th and 8th Centuries A.D.
3. DiSo 9-II : the lower deposits at DiSo 9, dating to the 2nd and 3rd Centuries A.D.
4. DiSo 1-I : the upper historic and disturbed layers at DiSo 1, dating primarily to the historic period from the late 1700's to the present.
5. DiSo 1-II : the upper, low density shell layers at DiSo 1, dating to the 1400's A.D., representing the latter part of the prehistoric record and comparable to the ethnographic "present".
6. DiSo 1-III : the heavy shell layers at DiSo 1, also dated to the 1400's A.D.
7. DiSo 1-IV : the fire-cracked rock, cobble and faunal layers dated to between 700 A.D. and about 1250 A.D., (but possibly beginning as early as 400 B.C. in some areas of the site?)
8. DiSo 1-V : the essentially sterile geological deposits underlying the cultural midden deposits, containing a few faunal remains that may have originated from DiSo 1-IV.

The faunal assemblages are associated with similar artifact assemblages differing slightly in relative frequencies of particular artifact classes, but obviously part of the same regional technological tradition.

Chapter V

Faunal Assemblages

The faunal assemblages of each of the three sites include mammal, bird, fish and shellfish remains. A total of 49,770 skeletal elements were recovered from the three sites and identified to Family or more specific taxa. Of these, 5,061 elements are mammal, 6,913 are bird and 37,796 are fish. 135,777.4 grams of shellfish remains were retained for analysis.

METHOD OF IDENTIFICATION

All faunal remains were identified by the author or assistants trained and supervised by the author. The comparative skeletal collections in the Vertebrate Zoology Division and the Archaeology Division of the British Columbia Provincial Museum, Victoria, were used for identification. Use was also made of the fish skeleton collection of the Zoology Department of the University of British Columbia, Vancouver, and of the descriptive illustrated key devised by Dr. N.J. Wilimovsky, Institute of Animal Resource Ecology at the University of B.C., and his students, during their identification of the fish remains from the Yuquot excavations. No attempt was made to identify ribs, rays and spines of fish other than the first interhaemal and first interneural spines and the dorsal spines of dogfish, ratfish and skates. All elements of mammal remains were identified if complete enough to retain critical morphological features. No attempt was made to identify bird ribs. All shellfish remains retained during excavation were analysed. Where there is doubt, identifications are conservative.

Four age categories are used for mammals, augmented where possible by more specific ages derived from patterns of dental eruption and wear or established ages of epiphyseal union. These four categories are:

1. Adult: element is full size, with epiphyses fully fused and articular facets and muscle ridges developed.
2. Sub-Adult: element is full size or nearly so, but ephiphyses are not fully joined, articular facets and muscle ridges developed. With sea mammals, the criterion of epiphyseal union is less useful than for land mammals, as they retain unfused epiphyses of many elements well into adulthood. Thus many sea mammal elements have had to be classified as either adult or sub-adult. The sub-adult category is not used for rodents, raccoon or the small mustelids as it is roughly equivalent to the Juvenile category for these animals.
3. Juvenile: element is less than adult size, still retains the juvenile cortex, epiphyses are unfused, and muscle attachments still developing. The category roughly corresponds to animals in their first year of life.
4. New Born/Foetal: element is of very small size, morphological features and articular surfaces still forming, juvenile cortex evident and epiphyses absent. The lack of comparative material, particularly for sea mammals, of definitely new born or definitely foetal ages has necessitated combining these age groupings. This is especially so for sea mammals, as unlike most land mammals, they are precocious. The northern fur seal, for example, sheds its deciduous teeth *in utero*.

Sex distinctions for mammals are based primarily on well-established sexual dimorphism augmented where possible by direct evidence such as antler formation and baccula. No attempt was made to age or sex birds and fish.

METHODS OF QUANTIFICATION

The faunal remains are quantified using major stratigraphic units (defined above Pages 130 to 131) as the unit of quantification. Skeletal element count and minimum number of individuals represented (MNI) for vertebrates and weight of remains for shellfish, are used as the units of measurement. The calculation of skeletal element count is conservative, in that two non-overlapping fragments of the same element of a species, recovered from different levels within a major stratigraphic unit, are considered to represent one element. Size, age and sex distinctions are taken into account wherever possible.

For DiSo 9 and DiSo 16, MNI is calculated on the total site (DiSo 16) or major stratigraphic unit (DiSo 9) sample for each distinguished taxon, disregarding intra-site or intra-unit horizontal and vertical divisions. For DiSo 1, where widely separated, randomly selected units were excavated, MNI is calculated on the excavation unit major stratigraphic unit sample for each distinguished taxon, with site major stratigraphic unit totals being the sum of individual excavation unit totals. Vertical intra-stratigraphic unit divisions are disregarded. As with element count, age, sex, and size distinctions are taken into account wherever possible.

Shellfish remains are reported in grams of remains by site or major stratigraphic unit. This method of measurement has problems, over-representing the larger, heavier-shelled species, but as two different collection methods were used for shellfish remains it was felt to be a more representative unit of measurement in this case than element count or MNI.

DESCRIPTION AND COMPARISON

Given the number of species identified, many of which are present in very low frequencies, a comparison of the faunal assemblages at the species level can be confusing. Comparison at the zoological Family level serves to elucidate the major differences and similarities among the eight assemblages. The comparisons are presented in bar graphs. Detailed discussions of each assemblage follow the general comparisons, but the specific data are reported in Appendix A. Here, raw and relative frequencies of occurrence for each identified taxon of each faunal assemblage are presented in tabular form. Only remains identified to species, genus or Family are included in the total counts for percentage purposes, but less specifically identified remains are also reported. Unless specifically identified, cetacean and delphinid remains are not included in the percentage counts, and although technically a delphinid, the killer whale is quantified under cetacean because of the size of its elements. Both skeletal element count and MNI relative frequencies are reported in Appendix A, but throughout Chapters V and VI element count alone is generally used to compare assemblages. Where there are marked differences between the results of these two methods of quantification, this is noted.

DiSo 16 Assemblages

A total of 286 mammal, 516 bird and 3188 identifiable fish bones or bone fragments was recovered from the small cave DiSo 16. This is an average of 831 bones or bone fragments larger than 6 mm per cubic metre of deposit, a high concentration of remains that probably reflects the confined nature of the occupation and deposition area. A total representative sample weight of 5,338.2 grams of shellfish remains were recovered. The remains were concentrated in the back and western half of the cave and in the upper fifty centimetres of deposit.

DiSo 9 Assemblages

A total count of 785 mammal, 2,626 bird and 19,285 identifiable fish remains and 114,791.5 grams of shellfish remains were collected from excavation units 1, 2, 3, 8 and 10 at DiSo 9. This is an average of 1,513 bones larger than 2 mm per cubic metre of deposit, a very high concentration of faunal remains. Except for bird remains, the remains are fairly equally divided between Stratigraphic Units I and II.

Stratigraphic Unit:I:

This unit contains 53 per cent of the mammal, 73 per cent of the bird and 43 per cent of the fish remains by bone count and 45 per cent of the shellfish remains by weight. Horizontally, these remains increase in concentration towards the back of the cave.

Stratigraphic Unit II:

This unit contains 47 per cent of the mammal remains, 27 per cent of the bird remains and 57 per cent of the fish remains by bone count, while 55 per cent of the shellfish remains by weight are from this unit. This seems anomalous as the front portions of these lower levels of the cave deposits are visually nearly shell-free, but results from the concentrated shell lenses at the back of the cave in these layers.

DiSo 1 Assemblages

A total of 3,990 mammal(17 per cent), 3,772 bird(16 percent) and 15,323 identifiable fish(66 per cent) bones were recovered from Excavation Units 12, 18 and B at DiSo 1, for a total vertebrate sample of 23,085 bones. This is an average of 1,282 bones larger than 6 mm per cubic metre. The distribution of vertebrate fauna among the Major Stratigraphic Units is illustrated in Table 11. Stratigraphic Units III and IV contained a greater proportion of the remains. As expected, Unit II contains a relatively lower proportion of the remains, partly a result of the small volume of deposit represented by this unit. Unit V, being primarily non-cultural, contains a very small proportion of the total sample, and that primarily fish. The lower proportion of remains

Table 11. Percentage of Bone by Stratigraphic Unit of DiSo 1 and Type of Bone

Stratigraphic Units	Taxa			
	Mammal	Bird	Fish	All Bone
I	28	37	12	19
II	23	7	17	16
III	19	40	40	36
IV	30	15	25	24
V	1	1	6	5
N	3,990	3,772	15,325	23,085

All columns total 100%

in Unit I is perhaps partially explained by the nature of the deposits, historic and disturbed. In relation to sample size and distribution, I Unit I contains a surprisingly high proportion of the bird remains and Units I and II high proportions of the mammal remains, while Unit II contains a relatively low proportion of the bird and III a low proportion of the mammal remains.

15,722.9 grams of shellfish remains were retained for analysis from the three excavation units. Stratigraphic Unit I contained 10.7 percent, Unit II 2.2 percent, Unit III 61.2 percent, Unit IV 25.8 percent and Unit V 0.1 percent of the shellfish remains by weight.

The numbers of mammal, bird and fish bone elements and the weight of shellfish remains recovered from each Stratigraphic Unit at DiSo 1 are illustrated in Table 12.

Table 12. Numbers of Bone Elements and Weights of Shell Recovered from Stratigraphic Units at DiSo 1

Stratigraphic Unit	Weight of Shell	Mammal Bone	Bird Bone	Fish Bone	Total Bone
I	1,681.5 g	1,117(26)*	1,386(32)	1,853(42)	4,356
II	342.1	897(24)	276(8)	2,527(68)	3,700
III	4,061.7	763(9)	1,516(18)	6,081(73)	8,360
IV	4,061.7	1,190(21)	565(10)	3,865(69)	5,620
V	9.7	23(2)	29(3)	947(95)	1,049

* Figures in brackets are percentages of the total bone element count for the Stratigraphic Unit

Vertebrate Fauna

In all assemblages, fish remains are the most frequently occurring vertebrate remains, varying from 42 percent to 95 percent of the vertebrate remains by element count. In the assemblages of DiSo 16, DiSo 9-I and DiSo 9-II and DiSo 1-I, III and V, bird remains are more common than mammal remains by bone count, while in assemblages DiSo 1-II and IV the reverse is true. Table 13 presents these relative frequencies.

Table 13. Percentage Distribution of Vertebrate Bone by Major Taxa, in Site Assemblages

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	III	I	II	III	IV	V
Mammal	7	4	3	26	24	9	21	2
Bird	13	18	6	32	8	18	10	3
Fish	80	78	91	42	68	73	69	95
N	3,990	10,703	11,993	4,355	3,700	8,360	5,620	1,049

All columns total 100%

Mammal Remains:

A further breakdown of mammal remains into land and sea mammal, reveals that by both bone count and MNI, the DiSo 16 assemblage is heavily weighted towards land mammal remains, while all DiSo 1 assemblages are equally heavily weighted towards sea mammal remains. Both DiSo 9 assemblages have a more equable split between land and sea mammals, with sea mammals slightly predominant. Table 14 and 15 illustrate these patterns.

Table 14. Relative Frequencies of Land and Sea Mammal Remains, All Assemblages, Bone Count

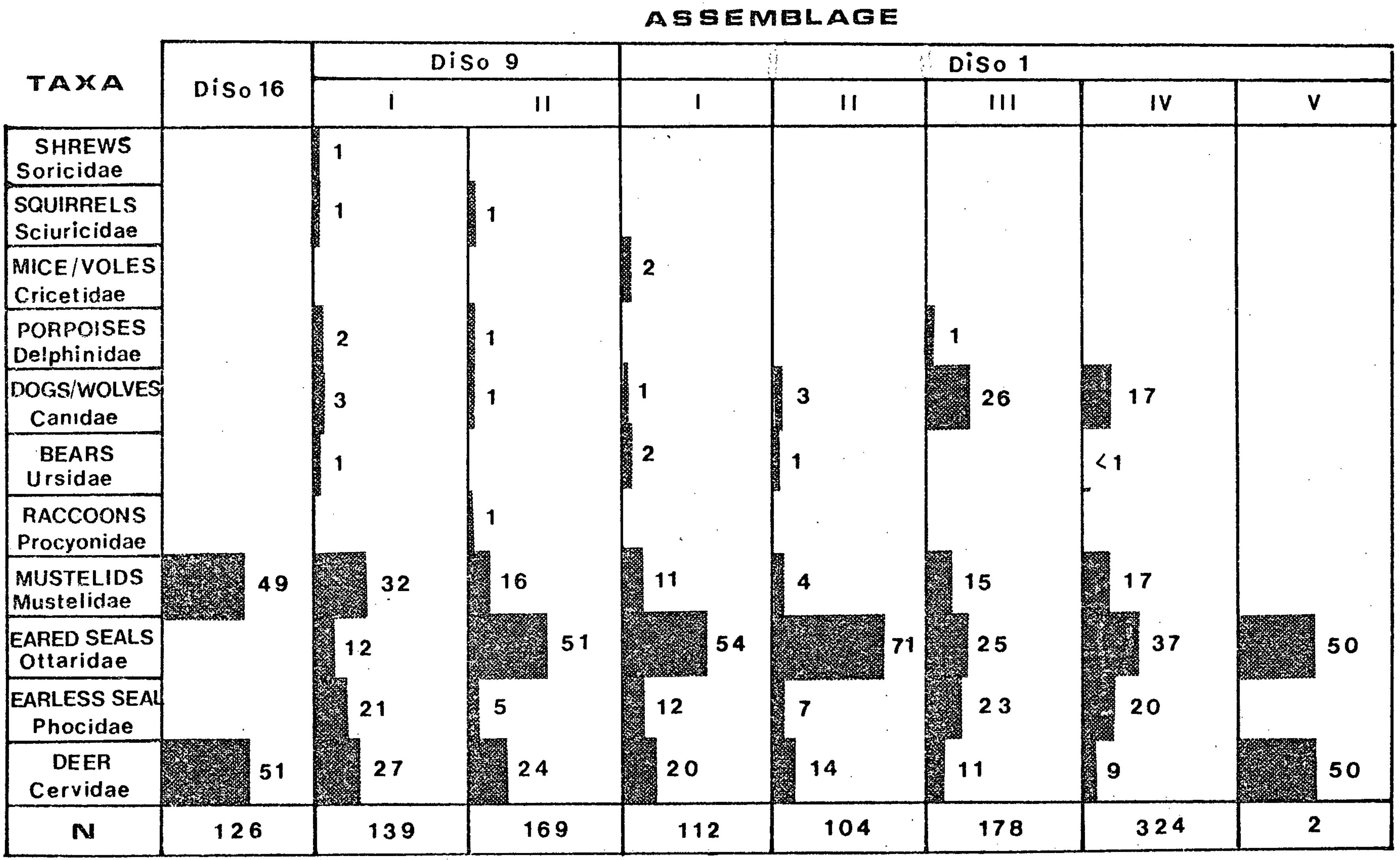
Taxa	Assemblages							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Sea Mammal	3	36	39	81	84	68	84	74
Land Mammal	97	41	32	11	7	16	10	13
Undetermined Mammal	-	23	29	8	9	16	6	13
N	286	416	369	1117	8897	763	1190	23

All columns total 100%

Table 15. Relative Frequencies of Land and Sea Mammal Remains, All All Assemblages, MNI

Taxa	Assemblages							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Sea Mammal	11	58	70	72	70	83	84	75
Land Mammal	89	42	30	28	30	17	16	25
MNI	9	26	23	39	23	47	57	4

All columns total 100%



Columns total 100%
Skeletal Element Count

Figure 23. Relative Frequencies of Mammal Remains.

Figure 23 compares the mammal remains of all assemblages at the Family taxonomic level. It is apparent that the major differences among the assemblages are the shifts in highest frequency from deer (Cervidae) and mustelids (Mustelidae) at DiSo 16 and DiSo 9-I to the eared seals (Ottaridae) at DiSo 9-II and all DiSo 1 assemblages. This shift in focus from land to sea mammals is actually sharper than it looks, as the mustelids at DiSo 16 are River Otter while those of the other assemblages are primarily Sea Otter. This shift is even more dramatically illustrated in Table 16, which includes non-specifically identified whale and dolphin (Cetacea) and seals, sea lions and/or sea otter (Pinnepedia, Pinnepedia/*E. lutris*) remains in the sample (see also Tables 30-32, Appendix A).

Table 16. Relative Frequencies of Mammal Remains Including Non-Specifically Identified Sea Mammals, Bone Count

Taxa	Assemblages							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Shrews, Insectivora	- -	1	-	-	-	-	-	-
Rodents, Rodentia	- -	1	1	1	-	-	-	-
Whales and Dolphins, Cetacea	5 5	5	3	40	31	31	51	39
Seals and Sea Lions, Pinnepidia	--	344	56	29	20	23	24	56
Small Sea Mammal, Pinnepedia/*E. lutris*	-	8	1	23	44	24	9	-
Carvinores, Carnivora	47	29	17	3	2	18	14	-
Deer, Artiodactyla	48	22	23	5	4	5	3	6
N	133	172	181	492	413	417	848	18

All columns total 100%

The assemblages of the three sites, then, are decidedly different each from the others in the emphasis on sea mammals and land mammals. There is a strong emphasis on all kinds of sea mammals in all the DiSo 1 assemblages; a strong emphasis on seals and sea lions (Pinnepedia) at DiSo 9 but little emphasis on whales and dolphins (Cetacea); and very little emphasis on sea mammals at DiSo 16. Emphases do differ among assemblages of the same site but major differences seem to be between sites.

DiSo 16:

Of the 286 mammal bones recovered from DiSo 16, 99 (34.6 percent) were identified to species, 7 (2.4 percent) to order and 27 (9.4 percent) to probable species. 153 bone fragments (53.3 percent) were not identifiable beyond the classification land mammal. 46.5 percent of the sample, then, was identified. Of the total sample, including both specifically identified and unidentified fragments, 97 percent by bone count and 89 percent by MNI are land mammal, 3 percent by bone count and 11 percent by MNI are sea mammal. Deer, River Otter and Mink and an unidentified whale species are present. Table 39, page 291, , Appendix A, presents the raw and relative frequencies by skeletal element count and MNI for identified mammal remains.

Of the two deer represented, one is a large animal, probably male, the other a smaller animal more than 14 months old. The River Otters include one sub-adult, one juvenile, two very young juveniles and one new born or foetal animal. In addition, 27 bones or bone fragments of a very young juvenile and a new born or foetal animal that are probably River Otter were recovered. All these bones could be part of the positively identified individual otters. The single Mink is an adult, probably male.

Whale is represented by six fragments of rib and one miscellaneous fragment, all of which could be from the same individual. The six rib fragments come from the same excavation unit within the top 10 centimeters of deposit. No other sea mammal remains were recovered.

The 153 fragments classifiable only to land mammal include fragments of long bone shaft, rib, skull, vertebrae and unidentifiable fragments. The majority are probably deer. Many of the long bone fragments are splintersdexhibiting spiral fractures.

The small sample of mammal remains suggests limited use of land game resources and no use of sea mammal resources. The whale bone rib fragments are more likely to be imported raw material than food refuse. The major mammal resource is clearly deer. All species identified are today available in the immediate site area.

DiSo 9-I:

416 mammal bone or bone fragments were recovered from this upper stratigraphic unit at DiSo 9. Of these, 139 bones (33.4 percent) representing at least 25 individuals were identified to species or genus, 31 (7.5 percent) to family and two (1 percent) to order. The remaining 244 fragments (58.7 percent) were not identifiable with certainty beyond the classification sea, land or indeterminate mammal. Of the total sample, including both specifically and not specifically identified remains, 36 percent by count are sea mammal, 41 percent land mammal and 23 percent indeterminate.

Twelve species of mammal are present, plus unspecifically identified whale, porpoise and pinniped remains. Table 43, Appendix A, presents these data by bone count and MNI. By both methods, Sea Otter is the most frequently occurring species (29.5 percent/20 percent), followed closely by Coast Deer (27.3 percent/16 percent). Harbour Seal and Northern Fur Seal are both also well represented, with Northern Fur Seal more strongly represented by MNI (10.8 percent/16 percent) and Harbour Seal by bone count (20.9 percent/12 percent). These four species together comprise 88.5 percent by bone count and 64 percent by MNI of the sample identified to species. All other species are much less strongly represented.

Of the individual Sea Otters, two are adult (one male and one female), one adult or sub-adult, and two juvenile, one of these 5 to 6 months old. The Deer are one adult, two sub-adults of less than 34 months and 12 to 14 months old and one juvenile of no more than 6 months old. Of the three Harbour Seals, two are adult (one male) and the third juvenile. One of the four Northern Fur Seals is adult (male?), one a sub-adult male of 5 to 7 years, one a juvenile (male) of about 13 weeks old and one newborn or foetal. One of the two dogs(?) is adult, one sub-adult, and the Mink and the Red Squirrel are juvenile individuals. The River Otter is an adult female and the California Sea Lion an adult male. Both the Navigator Shrew and the Harbour Porpoise are adults. The identification of Black Bear is uncertain, being based on a single distal portion of a right metacarpal or metatarsal.

The major mammal resources in this assemblage, then, are Sea Otter, Deer, Harbour Seal and Northern Fur Seal, by bone count.

DiSo 9-II:

369 mammal bones were recovered from the DiSo 9-II layers. 169 bones 45.8 percent) representing a minimum of 22 individuals, were identified to species or genus, 9 (2.4 percent) to family and 3 (1l percent) to order. The remaining 188 fragments (50.9 percent) were not identifiable beyond land, sea or indeterminate mammal. Of both specifically identified and non-specifically identified remains, 144 bones (39 percent) are sea mammal, 117 (31.7 percent) land mammal and 108 (29.3 percent) indeterminate mammal.

Nine species of mammal are present, plus unspecifically identified whale, porpoise and pinneped remains (Table 47, Appendix A). Northern Fur Seal is the most frequently occurring mammal, both by bone count, 85 bones (50.3 percent) and MNI, seven individuals (31.8 percent). Deer and Sea Otter are the next most frequently occurring species, with Deer more strongly represented by count (24.3 per cent/13.6 percent) and Sea Otter by MNI (15.9 percent/18.2 percent). Harbour Seal is the only other mammal representing more than five percent of the sample, with nine bones

(5.3 percent) representing two individuals (9.1 percent). All other species are less than two percent by bone count. The cetaceans and delphinids are not strongly represented, although either Harbour or Dall's Porpoise was identified. Northern Fur Seal, Deer and Sea Otter together comprise 90.5 percent by bone count and 63.6 percent by MNI of the specifically identified sample.

> Of the 7 Northern Fur Seals, two are adults (one female, one male), one is a sub-adult (male), one a juvenile and three are new born or foetal. The two Harbour Seals are one adult and one sub-adult female. The four Sea Otters are two adults (one female?, one male?), one juvenile and one new born or foetal. The single Northern Sea Lion is an adult female and the Raccoons are one adult and one juvenile. Of the three Deer, two are adult (one female?), and the third is a sub-adult of no more than 29 months old. The Dog is an adult.

The main mammal resources for this assemblage are Northern Fur Seal, Deer and Sea Otter.

DiSo 1-I:

Of the 1,117 mammal bones recovered from DiSo 1-I, 112 (10.0 percent) were identified to species or genus and 380 (34 percent) to Order. A further 625 fragments (56 percent) were not classifiable beyond the categories land, sea or indeterminate mammal. Of these, 94 (15 percent) are land mammal, 439 (70 percent) sea mammal and 92 (15 percent) mammal, general. Of the total sample, including both specifically and not specifically identified remains, 81 percent by bone count are sea mammal, 11 pe percent land mammal and 8 percent indeterminate.

At least ten species of mammal are present, plus unspecifically identified whale, porpoise and pinneped remains. Table 51, Appendix A, presents bone counts and MNI for these species. Northern Fur Seal remains are the most frequently occurring (34.9 percent/26.5). Deer (19.6 percent/

8.8 percent), Harbour Seal (11.6 percent/11.8 percent) and Northern Sea Lion (11.6 percent/14.7 percent) are also strongly represented. Other species are present in frequencies of less than ten percent, most less than two percent of the identified sample. Northern Fur Seal, Northern Sea Lion, Harbour Seal and Deer together comprise 77.6 percent by bone count and 61.8 percent by MNI of the identified sample.

> Of the nine Northern Fur Seals, three are adult females, one adult male, two sub-adult or adult males, and three juveniles, at least one of which is male. The northern Sea Lions are two adult males, one sub-adult or adult male and two juveniles. Of the two California Sea Lions, one is an adult male, the other a juvenile. The four Harbour Seals are three adults (at least one male) and a juvenile of undetermined sex. One of the Sea Otters is adult, the second juvenile and the third probably adult or sub-adult. The three Deer are one adult, one sub-adult and one either adult or sub-adult. The two Black Bear are an adult and a sub-adult or adult, while the Dog? is an adult, possibly female. The remaining individuals are either adult or of undetermined age.

In this assemblage from DiSo 1 the most important mammal resources are Northern Fur Seal, Deer, Harbour Seal and Northern Sea Lion. Whale remains, not specifically identified, are also common.

DiSo 1-II:

Of the 897 mammal bone and bone fragments recovered from DiSo 1-II, 104 (12 percent) were identified to species or genus and 309 (34 percent) to order. The remaining 484 fragments (54 percent) were not classifiable beyond the categories land, sea and undetermined mammal. Of these, 362 (75 percent) are sea mammal bone, 39 (8 percent) land mammal and 83 (17 percent) undetermined mammal. Of the total sample of 897 bones, 84 percent are sea mammal, 7 percent land mammal and nine percent undetermined.

Eight species of mammal are recorded for this unit, with the 104 bones representing a minimum of 18 individuals (Table 55, Appendix A).

Unspecified whale, porpoise and pinniped remains are also present. Northern Fur Seal remains are by far the most frequently occurring elements (69.2 percent/33.3 percent). Deer is the second most frequently occurring mammal (14.1 percent/16.7 percent), while Harbour Seal, at 6.7 percent and 16.7 percent is the only other species occurring in bone count frequencies above five percent. As the MNI total is so low, these relative frequencies are distorted.

> Of the six Northern Fur Seals, one is an adult female, two are sub-adult or adult (one male and one female), one is a sub-adult (Male?), one juvenile male, and one a new born or foetal individual. The three Harbour Seals include an adult male, an adult or sub-adult and a juvenile of undetermined sex. Both the single Northern Sea Lion and the single Sea Otter are adult males. The three Deer include one adult, one juvenile and one new born or foetal individuals, all of undetermined sex. The Mink is adult, the Black Bear sub-adult (male?) and the Dogs? a sub-adult and a newborn or foetal individual. Although not counted in the MNI totals, one of the Delphinidae is a juvenile animal.

In this small assemblage, Northern Fur Seal is clearly the most important resource, with Deer and Harbour Seal also important.

DiSo 1-III:

Of the 763 mammal bones or bone fragments recovered from DiSo 1-III, 178 (23.3 percent) were identified to genus or species, 239 (31.3 percent) to order and 346 (45.33 percent) to gross category only. Of the latter, 57 fragments (16.5 percent) are land mammal, 168 (49 percent) sea mammal and the remaining 121 fragments (35 percent) unspecified mammal. 67.8 percent of the total mammal sample is sea mammal bone or bone fragment 16.4 percent land mammal and 15.9 percent unspecified mammal. Table 59 Appendix A, presents bone counts and MNI for the mammal remains.

At least 41 individuals from nine species of mammal are represented. Northern Fur Seal and Harbour Seal are the two most frequently occurring species, with the former comprising 17.4 percent by bone count or 26.8 percent by MNI and the latter 21.9 percent by bone count or 19.5 percent by MNI, of the identified sample. Sea Otter (14.0 percent/17.1 percent) and Deer (10.7 percent/12.2 percent) are also well represented. Although dog is well represented by bone count (25.2 percent), the forty-five identified elements are all from a single large individual. Northern Sea Lion, Mink, Killer Whale and possibly Northern Elephant Seal are also present, although the identification of the last, based on a single phalanx, is not positive. Unidentified whale and porpoise and pinniped are also present.

> Of the element Northern Fur Seals, there are two adult males, two adult females, one adult or sub-adult of undetermined sex, one sub-adult male, one sub-adult or juvenile (male?), one juvenile male, two juveniles of undetermined sex, and one new born or foetal animal. All three Northern Sea Lions are adult males. The two California Sea Lions are a sub-adult and an individual of greater than juvenile age. The Northern Elephant Seal would be an adult (female?). Eight Harbour Seals include three adults, one male and two of undetermined sex, two sub-adults of undetermined sex and three juveniles of undetermined sex. The Sea Otters are three adults, one male, one female and one of undetermined sex; two sub-adults of undetermined sex; two juveniles, one male and the other of undetermined sex. The Deer include two adults, one sub-adult and one juvenile, all of undetermined sex. The Dog is a juvenile, the <u>Canis</u> sp. of undetermined sex and sub-adult age, and both the Mink and the Killer Whale are adults. One of the unidentified Delphinidae is a juvenile.

Northern Fur Seal, Harbour Seal, Sea Otter and Deer are again the most important mammal resources in this assemblage, disregarding the unidentified whale remains.

DiSo 1-IV:

324 (27.2 percent) of the 1,190 mammal bones were identified to species or genus and 524 (44 percent) to order. An additional 342 (29 percent) fragments were classified only according to gross category. Of these, 40 (12 percent) are land mammal, 235 (69 percent) sea mammal and 67 (19 per-

cent) undetermined mammal. Of the total mammal samples of 1,190 bones and bone fragments, 83.9 percent are sea mammal, 10.4 percent are land mammal and 5.6 percent undetermined.

Eight specifically identified mammal species are present, the 324 bones representing at least 48 individuals (Table 63, Appendix A). Unidentified whale, porpoise and pinniped remains are also present. Northern Fur Seal is the most frequently occurring species (26.5 percent/31.3 percent). Harbour Seal (20.4/18.8 percent), Sea Otter (17.0 percent/12.5 percent) and Dog (17.0 percent/6.3 percent) are also strongly represented.

> The fifteen Northern Fur Seals include two adult males and three adult females, two adult or sub-adult males and one adult or sub-adult female, one sub-adult male and one sub-adult female, one sub-adult or juvenile male and two sub-adults or juveniles of undetermined sex, and two juveniles, one possibly male. The Northern Sea Lions are two adult males, one adult or sub-adult male, and one adult or sub-adult female. The five California Sea Lions include two adult or sub-adult males, one sub-adult male and two juveniles of undetermined sex. Of the nine Harbour Seals, four are adult males and one an adult of undetermined sex, two are juvenile, one male, and two are new born or foetal of undetermined sex. The six Sea Otters include two adult males, two adult or sub-adult males, one sub-adult or juvenile of undetermined sex, and one new born or foetal of undetermined sex. The Deer are an adult male, three adults or sub-adults of undetermined sex and one juvenile of undetermined sex. The Dogs? include two juveniles and one sub-adult or adult, all of undetermined sex. The Black Bear is an adult.

DiSo 1-V:

Only 2 (9 percent) of the 23 mammal bones recovered from DiSo 1-V were identified to species, one Northern Fur Seal and the other Deer. 16 bones (70 percent) were identified to order. Of these, six fragments are unidentified whale (Cetacea), 1 is unidentified Porpoise (Delphinidae) and 9 are unidentified seal or sea lion (Pinnipedia). An additional 5 fragments (21 percent) were only classifiable as land mammal (2 fragments) and undetermined mammal (3 fragments) (Table 67, Appendix A).

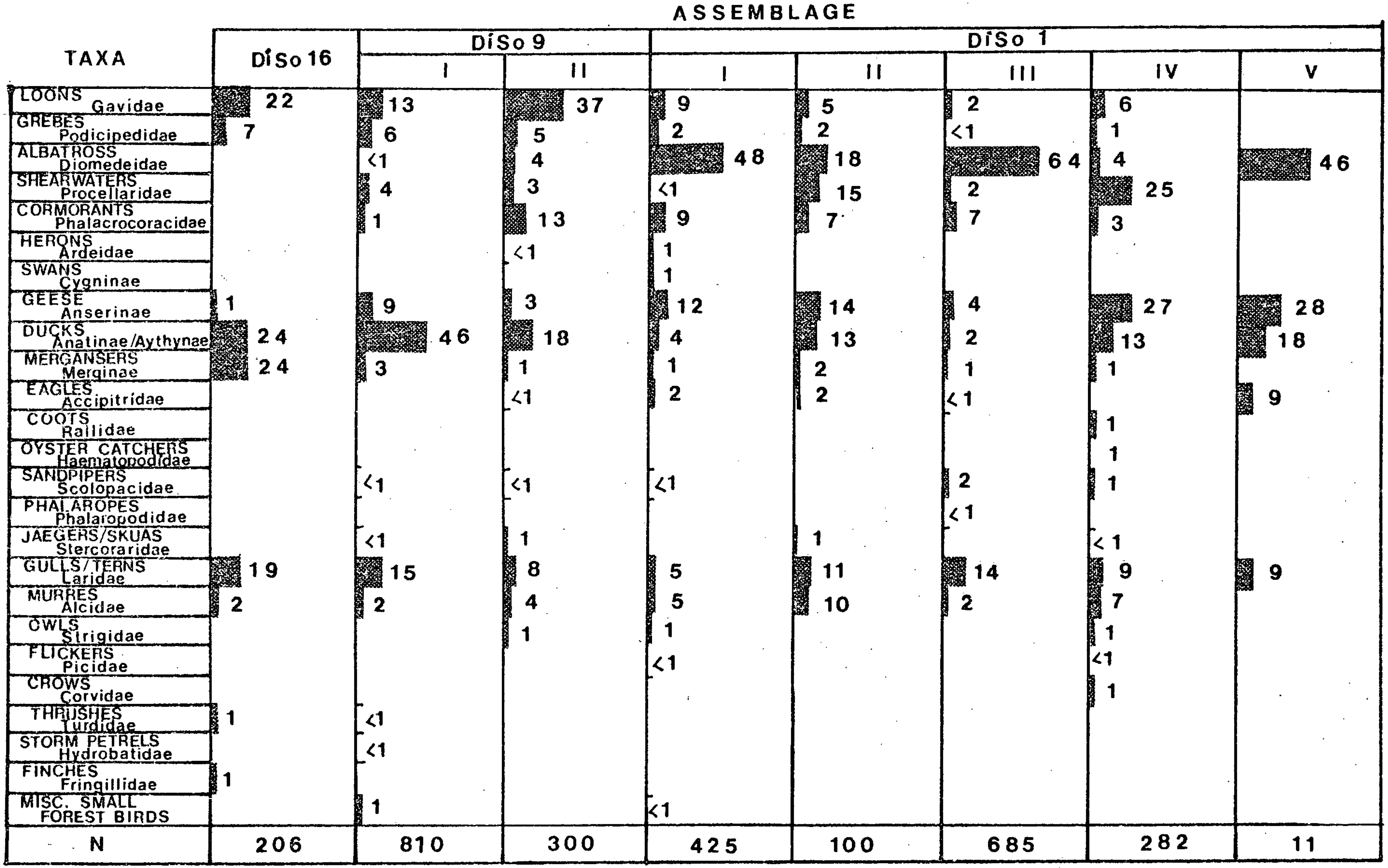
The Northern Fur Seal is an adult of undetermined sex, the Deer a sub-adult, also of undetermined sex.

Summary of Mammal Remains:

The mammal remains clearly separate the assemblages along site lines. All DiSo 1 assemblages are similar and strongly weighted towards the sea mammals, emphasizing particularly eared seals (Otaridae) and whales and porpoises (Cetacea), but also including the earless seals (Phocidae) and the Sea Otter (E. lutris). The DiSo 16 assemblage is distinctly different, being almost exclusively deer (Cervidae) and mustelid (Mustelidae), with no eared or earless seals and no Sea Otter. The two DiSo 9 assemblages most closely resemble each other, but differ also. In the emphasis on eared and earless seals DiSo 9-II resembles the DiSo 1 assemblages but displays a stronger emphasis on land mammals, particularly deer. DiSo 9-I differs from DiSo 9-II in having a stronger emphasis on the mustelids ((mostly Sea Otter), earless seals, and deer as contrasted to the eared seals.

Birds:

As with the mammal remains, the bird remains from these Hesquiat Harbour assemblages tend to differ more markedly among sites than within sites. In many of the Families represented, frequency of occurrence groups the DiSo 1 assemblages together, clearly differentiated from the DiSo 16 assemblage, with DiSo 9 assemblages in an intermediate position, but with DiSo 9-I tending to be more like DiSo 16 and DiSo 9-II more like the DiSo 1 assemblages. Although there is more intra-site variation at DiSo 1 in the bird frequencies than in the mammal frequencies, it is still less than the inter-site variation. All bird bone identified was from adult



TAXA	DíSo 16	DíSo 9 I	DíSo 9 II	DíSo 1 I	DíSo 1 II	DíSo 1 III	DíSo 1 IV	DíSo 1 V
LOONS Gavidae	22	13	37	9	5	2	6	
GREBES Podicipedidae	7	6	5	2	2	<1	1	
ALBATROSS Diomedeidae		<1	4	48	18	64	4	46
SHEARWATERS Procellaridae		4	3	<1	15	2	25	
CORMORANTS Phalacrocoracidae		1	13	9	7	7	3	
HERONS Ardeidae			<1	1				
SWANS Cygninae				1				
GEESE Anserinae	1	9	3	12	14	4	27	28
DUCKS Anatinae/Aythynae	24	46	18	4	13	2	13	18
MERGANSERS Merginae	24	3	1	1	2	1	1	
EAGLES Accipitridae			<1	2	2	<1		9
COOTS Rallidae							1	
OYSTER CATCHERS Haematopodidae							1	
SANDPIPERS Scolopacidae		<1	<1	<1		2	1	
PHALAROPES Phalaropodidae						<1		
JAEGERS/SKUAS Stercoraridae		<1	1		1		<1	
GULLS/TERNS Laridae	19	15	8	5	11	14	9	9
MURRES Alcidae	2	2	4	5	10	2	7	
OWLS Strigidae			1	1			1	
FLICKERS Picidae				<1			<1	
CROWS Corvidae							1	
THRUSHES Turdidae	1	<1						
STORM PETRELS Hydrobatidae		<1						
FINCHES Fringillidae	1							
MISC. SMALL FOREST BIRDS		1		<1				
N	206	810	300	425	100	685	282	11

Columns total 100%
Skeletal Element Count

Figure 24. Relative Frequencies of Bird Remains.

animals and no medullary bone growth (Rick 1975; 1979:4) was noted in broken elements. Figure 24 illustrates the relative frequencies by skeletal element count for taxonomic Family groupings for all assemblages (See also Tables 33 and 34 in Appendix A).

The inter-assemblage differences are particularly marked in the Families or sub-Families loons (Gavidae), grebes (Podicipedidae), albatrosses (Diomedeidae), geese (Anserinae), dabbling and diving ducks (Anatinae/ Aythynae), mergansers (Merginae) and murres (Alcidae).

Differences are also apparent in comparing the species frequencies among the assemblages. These differences are discussed below with detailed data presented in Tables 40, 44, 48, 52, 56, 60, 64 and 68 in Appendix A.

DiSo 16:

Of the 516 bird bones recovered from DiSo 16, 206 bones (39.9 percent) were identified to family, genus or species. A further 109 fragments (21.1 percent) were identifiable as to skeletal element, but were not sufficiently complete to assign with confidence to meaningful taxonomic categories. 201 fragments (39 percent) were not identifiable, being long bone shaft fragments, ribs and miscellaneous fragments.

The identified elements represent at least seventeen different species of loons, grebes, gulls, ducks, geese, the kittywake, the common murre, thrushes and finches. Loons, ducks and gulls are the most frequently occurring species in the sample, together making up 89 percent by bone count and 77 percent by MNI of the identified sample.

Ducks and geese together make up 48.4 percent by bone count and 42.9 percent by MNI of the specifically identified sample. Only 2 of these 100 bones are goose. Within the ducks (Anatidae), the mergansers (Merginae) are the most strongly represented, with 49 bones representing a minimum of

5 individuals comprising 23.8 percent of the total identified sample. Diving ducks (Aythynae) are well represented, particularly by the scoters (Melanitta sp.), with 26 bones (13 percent) representing 7 individuals (19.5 percent), while dabbling ducks (Anatinae) are poorly represented by two specifically identified bones. The strong representation of the mergansers and scoters may be partially accountable to the fact that their bones are more easily recognized, but even if one assumes that all non-specifically identified duck remains were from dabbling ducks, scoters and mergansers are still 80 percent of the duck sample. Mergansers along are 64 percent of the total duck sample.

Loons are well represented, with 46 elements (22.3 percent) representing six individuals (17.7 percent) recovered. Both Arctic and Red-throated Loon are present. Gulls (including the kittiwake) are also well represented, with 40 elements (19.3 percent) representing seven individuals (20 percent), while grebes are less common, with 14 elements (6.8 percent) representing at least four individuals (11.4 percent). The Common Murre is present but not common, and the Varied Thrush and the unidentified finch species probably represent residents of the site area accidentally introduced to the cultural sample.

DiSo 9-I:

Of the 1,925 bird bones recovered from the upper unit of DiSo 9, 810 (42 percent) were identified to species, genus of family, while 219 bones (11 percent) could be identified to element but not to a meaningful taxonomic category. A further 900 miscellaneous fragments (47 percent), mainly ribs and long bone shaft slivers, could not be identified. The 810 bones identified are 78 percent of the identifiable sample and represent a minimum of 64 individual animals from at least 34 different species.

Ducks and geese (Anatidae), loons (Gavidae) and gulls (Laridae) are most strongly represented. Together, ducks and geese contribute 467 bones (57.7 percent) representing 29 individuals (45.4 percent) to the total sample. Of these, 71 bones (15 percent) are goose, primarily Canada Goose, 25 (5.4 percent) are merganser, either Common or Red-breasted, and the remaining 369 (79 percent) are diving or dabbling ducks. Of these, 161 (43.6 percent) are identified to species or genus, the majority (76 percent) being scoter.

At least three species of gull are present, the Glaucous-winged, Heerman's and Bonaparte's. Most of the 74 gull bones identifiable only to genus are probably also Glaucous-winged gull. Gulls are 14.7 percent by bone count and 12.5 percent by MNI of the identified sample. All three species of loon are represented, the Arctic Loon especially strongly, comprising 12.8 percent by bone count and 12.5 percent by MNI of the sample. Grebes are well represented, particularly the Red-necked Grebe, and the Sooty Shearwater is also a frequently occurring species. All other species occur in frequencies of less than two percent, most less than one percent.

DiSo 9-II:

701 bird bones were recovered from the lower unit at DiSo 9. Of these, 300 (42.7 percent) were identified to species, genus or family, 81 (11.6 percent) to skeletal element only and 320 (45.6 percent) were unidentifiable ribs, long bone slivers and miscellaneous fragments. The 300 bones identified are 79 percent of the identifiable sample and represent a minimum of 42 individuals from at least 24 different species.

The loons (Gavidae), ducks and geese (Anatidae), cormorants ((Phalacrocoracidae) and gulls (Laridae) are the most frequently occurring groups. Grebes (Podicepedidae) and alcids (Alcidae) are also well represented. Common, Arctic and Red-throated Loons represent 37 percent by bone count and 14.3 percent by MNI of the sample, with Red-throated Loon contributing most to the total(28.3 percent/7.1 percent).

The Anatidae contribute 68 bones (22.6 percent) representing at least 9 individuals (21.4 percent) to the total sample. Few of these are specifically identified, but Canada Goose and White-winged Scoter are the most frequently occurring of the remains identified to species.

All three species of cormorant are present, together contributing 38 bones (12.7 percent) from at least 6 (14.3 percent) individuals. Brandt's Cormorant is the most frequently occurring of the three species. Only Glaucous-winged Gull was specifically identified, but 24 bones (8 percent) representing at least five individuals (11.9 percent) were identified at least to gull. While grebes do not contribute greatly to the bone count, with four bones of Western Grebe, nine of Red-necked Grebe and one of Eared Grebe forming 4.6 percent of the total count, by MNI they represent 11.9 percent of the sample, with Red-necked Grebe most prominent (7.1 percent). The Common Murre, a species of albatross (either Black-footed or Short-tailed Albatross), the Sooty Shearwater are present at frequencies of more than two percent by either bone count or MNI. All other species are present at very low frequencies.

Together, loons, ducks, geese, cormorants and gulls make up 80.6 percent by bone count and 66.7 percent by MNI of the sample.

DiSo 1-I:

Of the 1,385 bird bones recovered from the disturbed and historic layers of DiSo 1, 425 (30.6 percent) were identified to species, genus or family. A further 171 (12.3 percent) were identified to element but not taxa, while the remaining 790 (57 percent) are unidentifiable fragments of long bone shafts, ribs and miscellaneous fragments. The 425 bones identified are 71 percent of the identifiable sample of 596 bones and represent a minimum of 72 individuals from at least 35 species.

By bone count, albatross are by far the most frequently occurring species (at least two different species are present) with 205 bones (48.2 percent). This may be partially a reflection of the fact that even each phalanx of the Diomedeidae is identifiable, thus biasing the bone count in favour of the albatross to some extent, but this does not explain the high frequencies at DiSo 1 and low frequencies at DiSo 9 and DiSo 16. By MNI Albatross are still important, ranking second, but the frequency is considerably lower at 12.5 percent. Although only one skeleton of the Black-footed Albatross (Diomedea nigripes) was available for comparative purposes, it appears that at least two species of albatross are represented, one of which may be the Black-footed while the other may be the Short-tailed Albatross (Diomedea albatrus). A proportion of the specimens are considerably larger and more robust than the others, and while this might be sexual dimorphism, slight morphological differences suggest that more than one species is involved. Without a more complete range of comparative material for study, the differences are impossible to evaluate at this point.

Geese (12.0 percent/15.3 percent), loons (8.9 percent/11.1 percent) and cormorants (8.9 percent/6.9 percent) are well represented by both bone count and MNI. Four different species of goose are present, Canada Goose, Brandt, White-fronted Goose and Snow Goose, and three species of loon, Common, Arctic and Red-throated are present. The Arctic Loon is particularly well represented (4.9 percent/4.1 percent). All three species of cormorant are also present, with Pelagic strongly represented at 6.8 percent by bone count.

The grebes, gulls and alcids are all well represented by MNI, less so by bone count. Three species of grebe, four species of gullsplus the Black-legged Kittiwake, and three species of alcid are represented, with Common Murre, Glaucous-winged Gull and Horned Grebe occurring most frequently.

Ducks are not as well represented (4.0 percent/6.9 percent) with only three species specifically identified. Other birds occur in frequencies of less than one or two percent.

DiSo 1-II:

100 (36 percent) of the 276 bird bones from DiSo 1-II were identified to species, genus or family. A further 35 fragments (13 percent) were identified to element but not species, while an additional 141 fragments (51 percent) are unidentifiable long bone shaft, rib and miscellaneous fragments. The 100 bones identified are 74 percent of the identifiable sample, representing a minimum of 32 individuals from at least 23 species.

By both bone count and MNI, Albatross (18 percent/9.4 percent) is the most frequently occurring species. The Sooty Shearwater is also a commonly occurring species (13.0 percent/6.3 percent). As groups, the geese, ducks, gulls and alcids are also well represented, although no one species is particularly prevalent. Neither the Arctic Loon nor the Red-necked Grebe are present in this unit and only the Brandt's Cormorant is present.

DiSo 1-III:

1,516 bird bones and bone fragments were recovered from Stratigraphic Unit III. 685 (45.2 percent) were identified to species, genus or family.

130 (8.6 percent) were identifiable to element but not to a meaningful taxa with available comparative material and 701 (46.2 percent) were unidentifiable long bone shaft, rib and miscellaneous fragments. The 685 bones identified are 84 percent of the identifiable sample. They represent a minimum of 75 individuals from at least 30 species.

Albatross is the most frequently occurring species, particularly by bone count, with 438 elements (63.9 percent) from at least 14 (18.9 percent) individuals. The only other species occurring at a high frequency is Glaucous-winged Gull, with 71 bones (10.4 percent) from 11 (14.9 percent) individuals. As a group, the cormorants are quite strongly represented by bone count, but are more strongly represented by MNI, with MNI group frequencies of 10.8 percent, 6.8 percent and 8.1 percent respectively. All other species are present in frequencies of less than two percent by bone count. While not numerically significant, shore birds are more strongly represented in this unit.

DiSo 1-IV:

Of the 565 bird bones recovered, 282 (50 percent) were identified to species, genus or family, 92 (16 percent) to element but not to taxa, and 191 (34 percent) were unidentifiable rib, long bone and shaft and miscellaneous fragments. 75 percent of the identifiable elements were identified. They represent a minimum of 72 individuals of at least 34 species.

Sooty Shearwater (34.8 percent/13.9 percent), Canada Goose (19.1 percent/9.7 percent) and Common Murre (6.4 percent/6.9 percent) are the most frequently occurring species. As groups, the geese (26.6 percent/ 15.3 percent), shearwaters (24.5 percent/15.3 percent) ducks (13.4 percent/ 13.9 percent), gulls (8.5 percent/13.9 percent) and alcids (7.4 percent/

8.3 percent) are most common. Although not numerically important, Albatross, loons, Northern Fulmar, American Coot, Black Oystercatcher, Snowy Owl and Northwestern Crow are present. The identification of Pileated Woodpecker, although certainly possible for the area, is uncertain.

DiSo 1-V:

11 (38 percent) of the 29 bird bones were identified to species, genus or family. Another 7 (24 percent) were identified only to element while the remaining 11 (38 percent) were unidentifiable fragments. The 11 identified bones, from at least 5 individuals, are 61 percent of the identifiable sample. White-fronted Goose, Shoveler, Bald Eagle and Western Gull are all represented by one bone and one individual each. Albatross is represented by 5 bones and one individual. The relative frequencies are based on such small samples as to be meaningless.

Summary of Bird Remains:

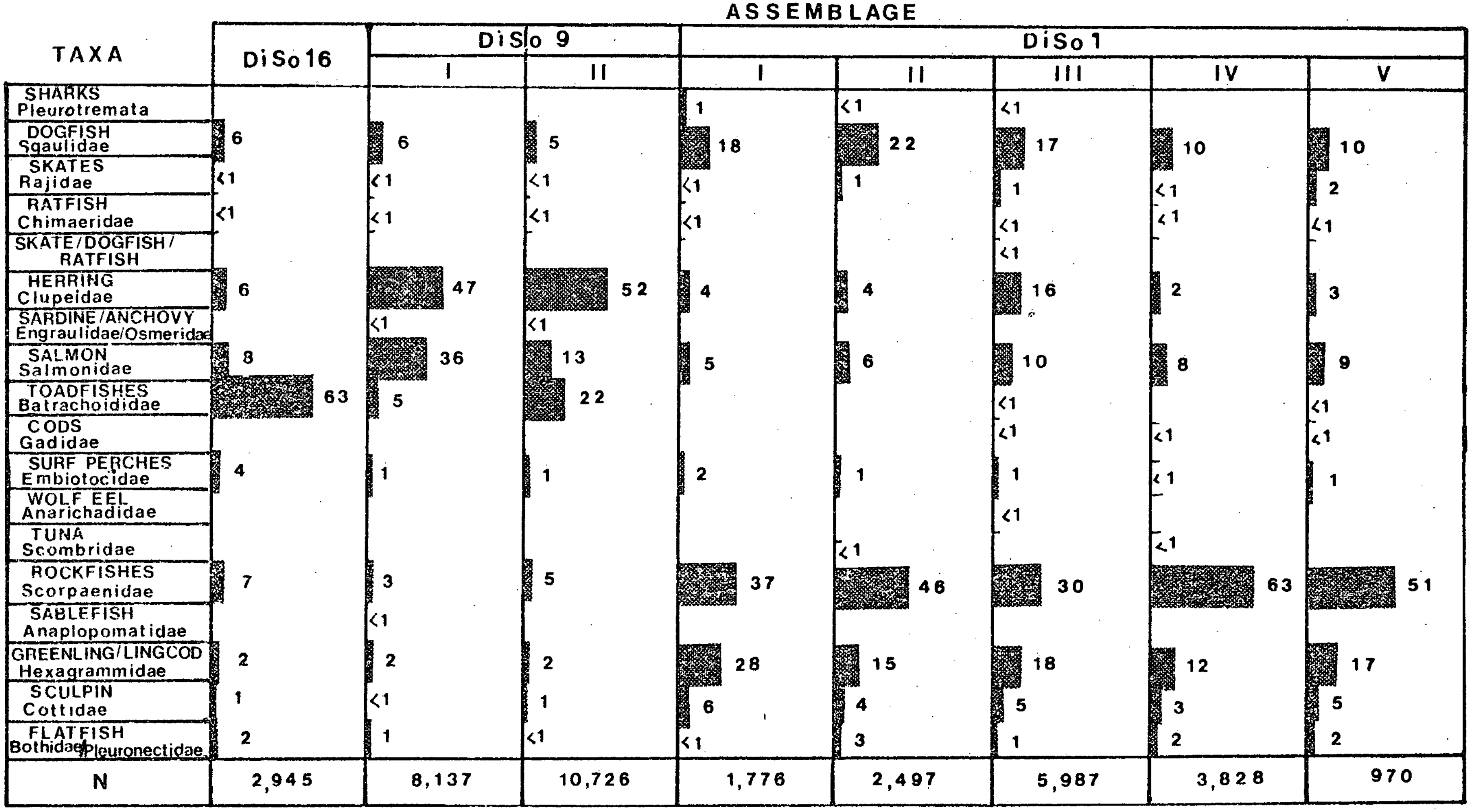
Although the large number of bird species represented in the faunal remains suggests for all assemblages an extensive use of bird resources, emphasis on certain groups are apparent for each assemblages. In the DiSo 16 assemblage the loons (Gavidae), dabbling and diving ducks (Anatinae/Aytynae), mergansers (Merginae) and gulls (Laridae) are the most prevalent. In the DiSo 9-I assemblage, the dabbling and diving ducks, loons, gulls and geese (Anserinae) predominate, while in the DiSo 9-II assemblage it is the loons, cormorants (Phalacrocoracidae), dabbling and diving ducks and gulls. In the DiSo 1-I assemblage the albatrosses (Diomedidae), geese and loons are the most frequently occurring groups. In DiSo 1-II, it is the shearwaters (Procellaridae), albatrosses, geese, dabbling and diving ducks and gulls, and in DiSo V, the albatrosses.

Fish:

As with the bird and mammal remains, the major differences among the fish faunal assemblages group DiSo 16 and DiSo 9 together on the one hand and all DiSo 1 assemblages on the other. The main shifts are higher frequencies of herring (Clupeidae), salmon (Salmonidae) and toadfishes (Batrichoididae) in the former and higher frequencies of all cartilagenous fishes (Pleurotremata, Rajidae, Squalidae and Chimaeridae), true cods (Gadidae), rockfish (Scorpaenidae), greenlings and ling cod (Hexagrammidae) and sculpins (Cottidae) in the latter. Figure 25 illustrates the relative frequencies by skeletal element count for taxonomic Families of fish fauna for all assemblages. Detailed data are presented in Tables 35 to 37, Appendix A.

The differences among the DiSo 16 and DiSo 9-I and DiSo 9-II assemblages are perhaps more marked for fish than for other fauna. At DiSo 16 the toadfishes (Batrachoididae) especially, and the surfperches (Embiotocidae) and rockfish (Scorpaenidae) are more frequently occurring, while in the DiSo 9 assemblages herring (Clupeidae) and salmon (Salmonidae) are most frequently occurring. There is also a definite shift in emphasis from DiSo 9-II to DiSo 9-I from earlier high frequencies of herring and toadfishes to later high frequencies of herring and salmon. Within the DiSo 1 assemblages, DiSo 1-III stands out as having higher frequencies of herring and salmon and lower frequencies of rockfish than the other DiSo 1 assemblages. It should be remembered that the lower frequencies of herring at DiSo 16 and DiSo 1 may be partially attributable to sample recovery techniques.

Because samples from DiSo 9 were recovered using 2 mm mesh screen, while those from DiSo 1 and DiSo 16 were recovered using 6 mm screening,



TAXA	ASSEMBLAGE							
	DiSo16	DiSo 9		DiSo1				
		I	II	I	II	III	IV	V
SHARKS Pleurotremata				1	<1	<1		
DOGFISH Sqaulidae	6	6	5	18	22	17	10	10
SKATES Rajidae	<1	<1	<1	<1	1	1	<1	2
RATFISH Chimaeridae	<1	<1	<1	<1		<1	<1	<1
SKATE/DOGFISH/RATFISH						<1		
HERRING Clupeidae	6	47	52	4	4	16	2	3
SARDINE/ANCHOVY Engraulidae/Osmeridae		<1	<1					
SALMON Salmonidae	8	36	13	5	6	10	8	9
TOADFISHES Batrachoididae	63	5	22			<1		<1
CODS Gadidae						<1	<1	<1
SURF PERCHES Embiotocidae	4	1	1	2	1	1	<1	1
WOLF EEL Anarichadidae						<1		
TUNA Scombridae					<1		<1	
ROCKFISHES Scorpaenidae	7	3	5	37	46	30	63	51
SABLEFISH Anaplopomatidae		<1						
GREENLING/LINGCOD Hexagrammidae	2	2	2	28	15	18	12	17
SCULPIN Cottidae	1	<1	1	6	4	5	3	5
FLATFISH Bothidae/Pleuronectidae	2	1	<1	<1	3	1	2	2
N	2,945	8,137	10,726	1,776	2,497	5,987	3,828	970

Columns total 100%
Skeletal Element Count

Figure 25. Relative Frequencies of Fish Remains.

it is certain that the smaller boned fish such as herring, anchovy and sardine are under represented in the samples from the latter two sites. Table 17 compares the recovery of herring bones from standard sized matrix samples collected from all strata of each site, using 6 mm and 2 mm mesh. Assemblages DiSo 16, DiSo 1-IV and DiSo 1-V have a lower average frequency of herring bones in the deposit samples than do assemblages DiSo 9-I and DiSo 9-II. The level samples of these assemblages, then, are probably not too badly skewed, but may still underrepresent herring. Assemblages DiSo 1-I and DiSo 1-II have an average frequency of herring bones comparable to the DiSo 9 assemblages. Herring are definitely badly underrepresented in the level samples from these assemblages. The most highly affected is assemblage DiSo 1-III which has an average frequency of herring bones in deposit samples three times greater than the DiSo 9 assemblages. In the level samples from these deposits, herring is obviously grossly underrepresented.

Because of this biasing factor, the fish remains were also graphed excluding the very small boned fishes, herring, anchovy and sardine, from the sample. Figure 26 presents these data. While intra-assemblage frequencies are obviously affected, the differences in relative frequencies are less important as far as inter-assemblages comparisons are concerned, as the rank orders of importance for the different families within assemblages remains the same. In fact, the inter-assemblage differences are intensified. Of course, if the matrix sample data are applicable to the levels in total, then the projected relative frequencies of herring remains in the DiSo 1 assemblages would make herring by far the most frequently occurring species, consequently decreasing the relative frequencies of the currently predominant rockfish, greenlings and dogfish.

Table 17. Average Number of Herring Bones Recovered from Standard Size Matrix Samples Using 6 mm and 2 mm Mesh Screens

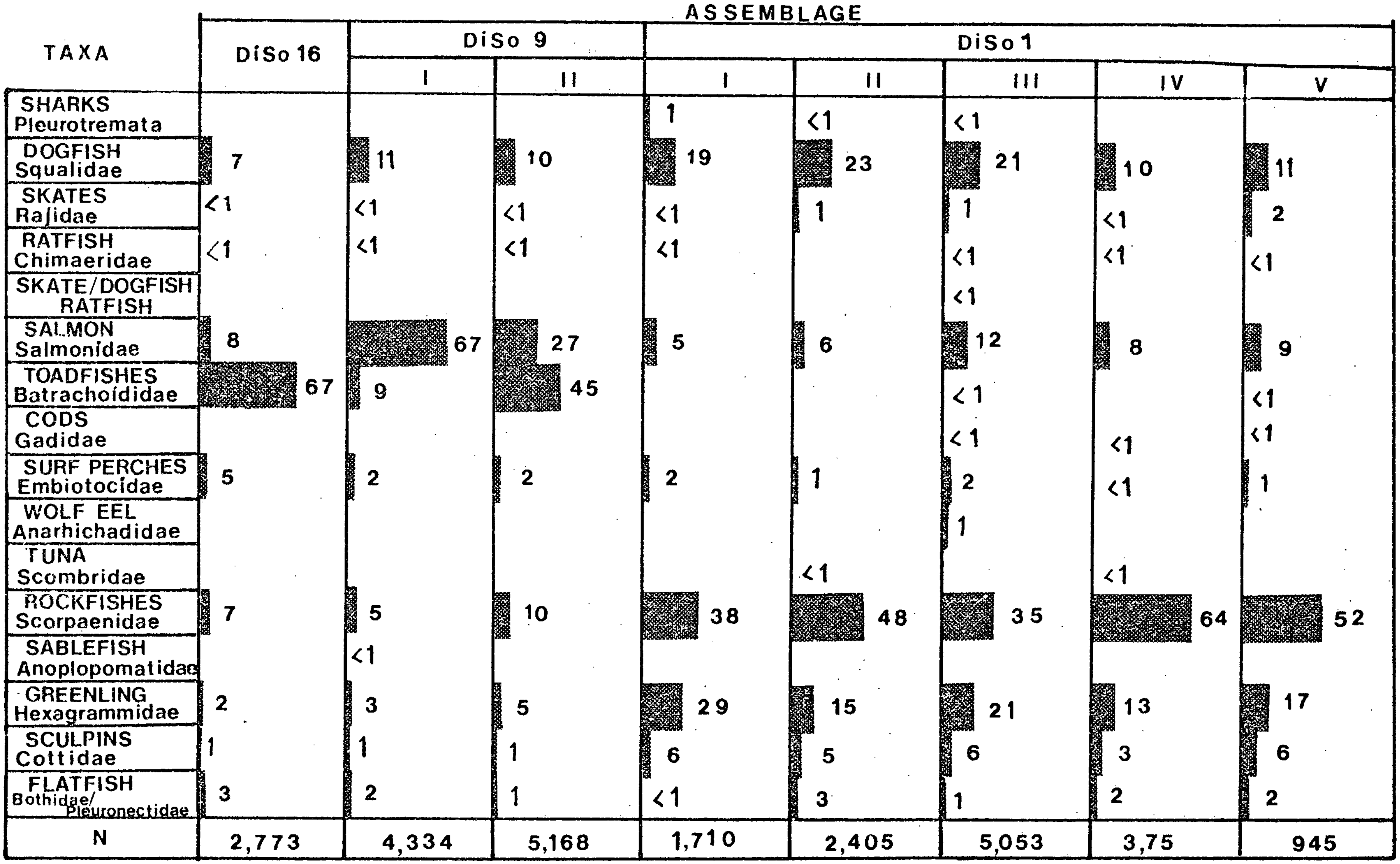
Assemblage	No. of Samples	$\bar{X}$ Number of Bones Recovered 6 mm Screen	$\bar{X}$ Number of Bones Recovered 2 mm Screen	% Frequency of Herring Bones in Level Samples
DiSo 16	12	0.0	9.5 (0 - 32)*	6
DiSo 9-I	22	0.1	23.0 (0 - 113)	47
DiSo 9-II	41	0.0	20.0 (0.- 72)	52
DiSo 1-I	7	0.0	28.0 (2 - 81)	4
DiSo 1-II	9	0.0	29.0 (0 - 108)	4
DiSo 1-III	17	0.7	60.0 (0 - 148)	16
DiSo 1-IV	23	<0.1	6.5 (0 - 20)	2
DiSo 1-V	7	0.0	0.1 (0 - 1)	3

* Range for number of bones recovered from the 2 mm mesh screen

Thus the actual frequencies may not be as extremely different among assemblages as the graphs (Fig. 25 and 26) would suggest, but the pattern of variation remains. Individual assemblages are discussed below (See Tables 41, 45, 49, 53, 57, 61, 65 and 69 in Appendix A).

DiSo 16:

Of the 3,188 identifiable fish bones from DiSo 16, 2,014 (94.5 percent) were identified to species, genus or family. The remaining 174 bones (5.5 percent) could not be identified with certainty using the available comparative collections. Many of these are probably elements of surf perches and sculpins not represented in the comparative collection, while others are of fish not represented in the identified sample. Totally unidentifiable fragments, ribs, fin rays and spines were not counted, simply weighed. By weight, 63 percent of the total fish bone weight of 2,706.1 grams was identified.



TAXA	ASSEMBLAGE							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
SHARKS Pleurotremata				1	<1	<1		
DOGFISH Squalidae	7	11	10	19	23	21	10	11
SKATES Rajidae	<1	<1	<1	<1	1	1	<1	2
RATFISH Chimaeridae	<1	<1	<1	<1		<1	<1	<1
SKATE/DOGFISH RATFISH						<1		
SALMON Salmonidae	8	67	27	5	6	12	8	9
TOADFISHES Batrachoididae	67	9	45			<1		<1
CODS Gadidae						<1	<1	<1
SURF PERCHES Embiotocidae	5	2	2	2	1	2	<1	1
WOLF EEL Anarhichadidae						1		
TUNA Scombridae					<1		<1	
ROCKFISHES Scorpaenidae	7	5	10	38	48	35	64	52
SABLEFISH Anoplopomatidae		<1						
GREENLING Hexagrammidae	2	3	5	29	15	21	13	17
SCULPINS Cottidae	1	1	1	6	5	6	3	6
FLATFISH Bothidae/Pleuronectidae	3	2	1	<1	3	1	2	2
N	2,773	4,334	5,168	1,710	2,405	5,053	3,75	945

Columns total 100%
Skeletal Element Count

Figure 26. Relative Frequencies of Fish Remains Excluding Herring, Anchovy and Sardine.

At least eighteen different species of fish are represented in the sample, including cartilagenous fishes, clupeids, salmonids, toad fishes, surf perches, rockfish, hexagrammids, sculpins and flatfish. A single species, the little Plainfin Midshipman, is by far the most frequently occurring fish in the sample, comprising 61.7 percent by bone count and 72.6 percent by MNI of the identified sample. Dogfish, salmon, herring and rockfish each comprise between five and ten percent by bone count and/or MNI of the identified sample, while all other species are present in frequencies of less than five percent, most less than one percent.

DiSo 9-I:

8,166 (98 percent) of the 8,362 identifiable fish bones from this stratigraphic unit were identified to species, genus or family. The remaining 196 bones could not be identified with certainty. An additional 613.8 grams of ribs, fin rays and miscellaneous fragments also remains unidentified, forming 40 percent by weight of the recovered sample of 1,528.4 grams of bone.

A minimum of 313 individuals from at least 22 different species are represented by the identified remains. Herring is by far the most frequently occurring species. It is represented by 3,795 elements and 132 individuals, forming 46.5 percent and 42.3 percent respectively of the identified sample. Salmon are also well represented, all species together forming 35.7 percent by count and 26.9 percent by MNI. Except for the Plainfin Midshipman, Dogfish, rockfishes and surf perches are the only other fishes occurring at more than one percent frequency. The Midshipman is strongly represented by MNI at 13.5 percent, but by bone count is only 4.5 percent. The different species are all represented by a wide range of skeletal elements including both vertebral and facial elements.

DiSo 9-II:

10,923 identifiable fish bones were recovered from the lower stratigraphic unit of DiSo 9. Of these, 10,760 (98.5 percent) were identified to species, genus or family. A further amount of 388.5 grams of ribs, fin rays, spines and miscellaneous fragments remain unidentified, representing 33 percent by weight of the total recovered sample of 1,177.7 grams.

A minimum of 331 individuals from at least 22 different species are represented by the identified sample.

Herring, represented by 5,513 bones (51.2 percent) and 115 individuals (34.7 percent) is by far the most frequently occurring species. Plainfin Midshipman is also well represented, with 2,313 bones (21.5 percent) and 100 individuals (30.2 percent). At least three species of salmon, Chum, Coho and Spring are present, and all salmon remains together number 1399 (13.2 percent) from at least 42 (12.4 percent) individuals. Apart from these, only Dogfish and all rockfish species together contribute more than four percent to the bone count. Together, Herring, Midshipman and salmon account for 86.2 percent by count and 77.5 percent by MNI of the identified fish sample. These species are all represented by a wide range of skeletal elements, including facial, appendicular and vertebral elements.

DiSo 1-I:

1,853 identifiable fish bones were recovered from this stratigraphic unit. Of these, 1,780 (96 percent) were identified to species, genus or family. The remaining 73 bones (4 percent) were identifiable to element but could not be identified with certainty using the available comparative material. A further 335.1 grams of ribs, fin rays, spines and miscellaneous fragments were considered unidentifiable. This is 35 percent of the total fish sample of 960.9 grams. A minimum of 142 individuals from at least 20 species are represented.

Rockfish, Dogfish, greenlings, Lingcod and Cabezon are the most frequently occurring fishes. Although specifically identified rockfish are not so frequent, this is an effect of the identification process rather than the sample variation. All rockfish taken together are represented by 654 bones (36.7 percent) and 39 individuals (27.2 percent). Dogfish are particularly strongly represented considering that only their vertebral centra and dorsal spines are preserved, and consequently their elements have a smaller chance than other species of occurring in the sample to start with. Their 321 elements (18 percent) represent 31 individuals (21.8 percent). Greenlings are well represented by each unit of measurement (17.3 percent/14.8 percent) while Lingcod are well represented by bone count (10.1 percent) but less well represented by MNI (5.6 percent). All other species are present in frequencies of less than five percent. Rockfish, Dogfish, greenlings and Lingcod make up 82.1 percent by bone count and 69.6 percent by MNI of the identified sample. Eight shark vertebrae were recovered. Salmon are not well represented.

DiSo 1-II:

2,527 identifiable fish bones were recovered from Stratigraphic Unit II. Of these, 2,509 (99.3 percent) were identified to species, genus or family. A further 18 bones (0.7 percent) were not identified, although identifiable. 673.2 grams of ribs, fin rays and miscellaneous fragments comprising 40 percent of the total fish sample weight of 1,666.0 grams, were considered unidentifiable. At least 24 different species of fish are represented by a minimum of 134 individuals.

Rockfish species are by far the most frequently occurring fish, their 1,142 elements (45.4 percent) representing 43 (32.0)percent) individuals. Dogfish is the only other species or group of species also strongly represented, with 545 elements (21.7 percent) from at least 28 individuals (20.9 percent). The only other species occurring in frequencies of more than two or three percent are Lingcod (7.9 percent/8.2 percent) and greenlings (6.7 percent/8.2 percent). Of note, though not numerically important, is the presence of shark and Bluefin Tuna. The west coast of Vancouver Island would be the north of the Bluefin's range in the summer time and one would not expect to find them close to shore but well out to sea. Rockfish, Dogfish, greenlings and Lingcod account for 81.7 percent by bone count and 69.3 percent by MNI of the identified sample.

DiSo 1-III:

Of the 6,081 identifiable fish bones recovered from this stratigraphic unit 5,672 (98 percent) were identified to species, genus or family. A further 109 bones (2 percent) could not be identified with certainty, while 858.1 grams of ribs, fin rays, spines and miscellaneous fragments were considered unidentifiable. The identifiable sample is 72 percent by weight of the total excavated fish sample weight of 3,087.8 grams. A minimum of 396 individual fish from at least 33 different species is represented.

Rockfish, Dogfish, Greenlings, Herring and Lingcod are the most frequently occurring species. By bone count, rockfish rank first (29.8 percent/13.8 percent), by MNI Herring rank first (15.6 percent/31.1 percent). All species of salmon combined are also quite strongly represented (10.4 percent/2.8 percent). Although not numerically important, a wider range of cartilagenous fishes other than Dogfish are present, including shark, Ratfish and two species of skate. Hake, Sardine and Wolf Eel are also present. Together, Dogfish, Herring, rockfish, greenlings, Lingcod and salmon make up 91.2 percent by bone count and 82.1 percent by MNI of the identified sample.

DiSo 1-IV:

3,835 (99 percent) of the 3,865 identifiable fish bones recovered were identified to species, genus or family. The remaining 30 elements were not identified. 847.2 grams of ribs, fin rays, spines and miscellaneous fragments, 29 percent by weight of the total fish sample of 2,874.9 grams, were considered unidentifiable. The identified sample includes a minimum of 237 individuals from at least 27 species.

Rockfish (62.8 percent/42.6 percent) are the most common group, including at least six different species. Dogfish (9.8 percent/22.5 percent) and Lingcod (10.0 percent/8.3 percent) are also well represented. At least three species of salmon are present, together contributing 8.2 percent by bone count and 3.3 percent by MNI to the sample totals. Although not numerically important, Hake and Bluefin Tuna are present, plus a variety of both the sculpins and the flatfish. Rockfish, Dogfish and Lingcod together make up 82.6 percent by count and 74.4 percent by MNI of the identified sample.

DiSo 1-V:

Fish form by far the largest portion of the vertebrate sample from this unit. Of the 997 bones recovered, 969 (97 percent) were identified to species, genus or family, while 28 elements (3 percent) could not be identified. An additional weight of 275.8 grams of ribs, spines and fins rays and miscellaneous fragments were considered unidentifiable. The identified sample is 62 percent by weight of the total fish sample of 718.6 grams. A minimum of 53 individuals from at least 23 species is present.

Rockfish (50.8 percent/28.3 percent) are the most frequently occurring group of fish, Dogfish (10.3 percent/22.6 percent) and Lingcod (11.1 percent/7.5 percent) the most frequently occurring individual species. Salmon are reasonably well represented (9.0 percent/3.8 percent), as are greenlings (5.5 percent/7.5 percent) and Cabezon (4.8 percent/3.8 percent).

Summary of Fish Remains:

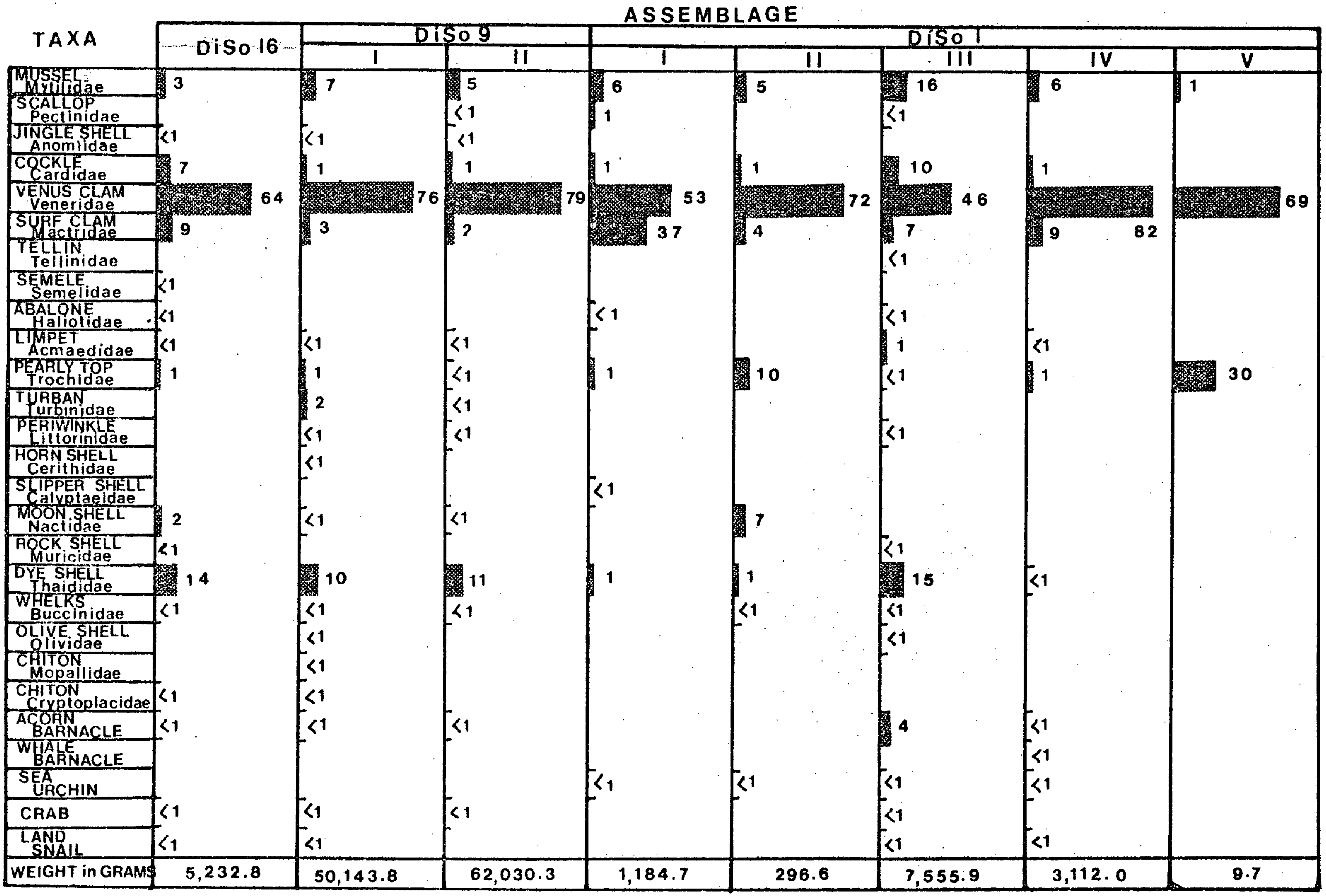
The fish remains clearly differentiate the DiSo 1 assemblages from the other three, with rockfish (Scorpaenidae), greenlings and Lingcod (Hexagrammidae) and Dogfish (Squalidae) being the most frequently occurring Families. It is noteworthy that in DiSo 1-III there is a higher frequency of herring remains than in all the other DiSo 1 assemblages. At DiSo 16, the toadfishes (Batrachoididae) are by far the most predominant remains, while in both DiSo 9 assemblages herring (Clupeidae) are predominant with salmon (Salmonidae) next in importance, particularly in DiSo 9-I. The toadfishes are also strongly represented in DiSo 9-II. Taking into account the sample recovery factors, it should be considered that salmon and toadfish are the most prevalent families at DiSo 9, keeping in mind that herring were probably the single most frequently occurring species in all assemblages.

Shellfish

Because shellfish remains were quantified by weight of remains, problems arise in comparing assemblages at the taxonomic family level. The heavier species comprise such high proportions of the sample that variations within families of lighter shelled, smaller species are obscured. However, it is obvious that certain families are being much more heavily exploited than others. The high incidence of clam remains in all assemblages is a real factor, not simply a sampling factor.

Over thirty species of clams, mussels, sea snails, limpets, chitons and sea urchin were identified in these assemblages. Relative frequencies by weight of remains for the Family taxonomic level, for all assemblages, are graphed in Figure 27 (see also Table 38, Appendix A). Because of the disproportionate amount of weight represented by clam shells relative to other mollusc shells, inter-assemblage variation is limited at this level of classificaiton. DiSo 16, DiSo 9-I and DiSo 9-II show higher frequencies of dog winkles (Thaididae); DiSo 1-I shows a much higher frequency of surf clams (Mactridae); and DiSo 1-III displays higher frequencies than other DiSo 1 assemblages of mussels (Mytylidae), cockles (Cardidae), dogwinkles (Thaidae), and acorn barnacles, but all assemblages are heavily weighted towards the Venus clams (Veneridae). The last family includes the species Native Littleneck (Protothaca staminea) and Butter Clam (Saxidomus giganteus), ethnographically the major food clams. In all assemblages these two species together are by far the most frequently occurring shellfish remains, varying from 46.4 percent to 82.3 percent of the remains by weight.

The comparison of more inclusive categories, also including non-specifically identified remains, retains a similar pattern. Clams are by far the most frequently occurring remains in all assemblages, while mussels occur in higher frequency in DiSo 1-III and sea snails in lower frequencies in DiSo 1-I and DiSo 1-IV. All other groups occur in frequencies of less than one percent in all assemblages. Table 18 presents these groupings.



TAXA	ASSEMBLAGE							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
MUSSEL Mytilidae	3	7	5	6	5	16	6	1
SCALLOP Pectinidae			<1	1		<1		
JINGLE SHELL Anomiidae	<1	<1	<1					
COCKLE Cardidae	7	1	1	1	1	10	1	
VENUS CLAM Veneridae	64	76	79	53	72	46	82	69
SURF CLAM Mactridae	9	3	2	37	4	7	9	
TELLIN Tellinidae						<1		
SEMELE Semelidae	<1							
ABALONE Haliotidae	<1			<1		<1		
LIMPET Acmaedidae	<1	<1	<1			1	<1	
PEARLY TOP Trochidae	1	1	<1	1	10	<1	1	30
TURBAN Turbinidae		2	<1					
PERIWINKLE Littorinidae		<1	<1			<1		
HORN SHELL Cerithidae		<1						
SLIPPER SHELL Calyptaeidae				<1				
MOON SHELL Nactidae	2	<1	<1		7			
ROCK SHELL Muricidae	<1					<1		
DYE SHELL Thaididae	14	10	11	1	1	15	<1	
WHELKS Buccinidae	<1	<1	<1		<1	<1		
OLIVE SHELL Olividae		<1				<1		
CHITON Mopallidae		<1						
CHITON Cryptoplacidae	<1	<1						
ACORN BARNACLE	<1	<1	<1			4	<1	
WHALE BARNACLE							<1	
SEA URCHIN				<1	<1	<1	<1	
CRAB	<1	<1	<1			<1		
LAND SNAIL	<1	<1				<1	<1	
WEIGHT in GRAMS	5,232.8	50,143.8	62,030.3	1,184.7	296.6	7,555.9	3,112.0	9.7

Columns total 100%
Weight of remains

Figure 27. Relative Frequencies of Shellfish Remains.

Table 18. Major Groupings of Shellfish Remains Including Non-specifically Identified Remains, Relative Frequencies by Weight in Grams, All Assemblages

Groupings	Assemblages							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Mussels	3.0	6.8	5.3	4.0	4.4	12.4	4.8	1.0
Clams,Oysters, Scallops	80.1	77.9	81.8	94.0	79.3	70.9	93.9	69.1
Sea Snails	16.4	12.5	10.9	1.2	15.8	12.0	0.9	29.9
Limpets	0.1	0.2	0.4	0.1	-	0.5	0.1	-
Chitons	0.2	0.1	-	0.1	-	0.1	0.1	-
Barnacles	0.1	0.4	0.4	0.2	0.1	4.1	0.2	-
Other	0.2	0.1	0.1	0.3	0.1	0.1	0.1	-
Unidentified Shell	0.1	2.2	1.2	0.1	0.2	0.1	0.1	-
Weight	5,345.3	51,860.2	62,934.9	1,681.8	343.1	9,540.5	4,061.9	9.7

All Columns total 100%

For the shellfish, variations at the species level within major categories are most revealing. These data for specifically identified clams, mussels, sea snails and limpets are presented in Tables 19, 20, 21 and 22. While the butter clam (<u>Saxidomus giganteus</u>) is the most frequently occurring species of clam in all the assemblages, the Native Littleneck Clam (<u>Protothaca staminea</u>) has much higher frequencies in the DiSo 16 and both DiSo 9 assemblages, while the Horse Clam (<u>Tresus</u> sp.) is more abundant in the DiSo 1 assemblages.

Table 19. Relative Frequencies by Weight of Remains within Major Classes, Clam/Oyster/Scallop Species

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IVV	VV
Native Littleneck, *Protothaca staminea*	36	34	29	7	9	18	13	-
Butter Clam, *Saxidomus giganteus*	44	62	67	51	85	54	76	100
Horse Clam, *Tresus* sp.	11	3	3	41	6	12	10	-
Basket Cockle, *Clinocardium nuttalli*	9	1	1	1	1	16	1	-
Purple-hinged Scallop, *Hinnites multirugosus*	-	-	<1	1	-	<1	-	-
Rock Oyster, *Pododesmus cepio*	<1	<1	<1	-	-	-	-	-
Rose Petal Semele, *Semele rubropicta*	1	-	-	-	-	-	-	-
Sand Clam, *Macoma secta*	-	-	-	-	-	1	-	-
Bodega Clam, *Tellina bodegensis*	-	-	-	-	-	1	-	-
Weight in Grams of All Clams	4,174.6	39,863.2	51,314.9	1,090.7	228.6	4,868.0	2,873.7	6.7

All columns total 100%

Inaall the assemblages, the California Mussel, *Mytilus californianus*, is by far the most frequently occurring mussel species. It is only in the DiSo 16 and DiSo 9 assemblages, however, that the Bay Mussel, *Mytilus edulis*, occurs in relatively high frequencies. At DiSo 1 it is either absent or less than one percent by weight. The DiSo 1-V sample is too small to be meaningful (Table 20).

Table 20. Relative Frequencies by Weight of Remains within Major Class, Mussel species

Taxa	Assemblages							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
California Mussel, <u>Mytilus</u> <u>californianus</u>	63	64	89	100	100	99	100	-
Bay Mussel, <u>Mytilus</u> <u>edulis</u>	37	36	11	-	-	1	-	100
Weight in Grams of all Mussel	158.9	3,507.7	3,356.7	67.9	15.1	1,166.2	195.0	0.1

All columns total 100%

Among the sea snail remains, there is a clear difference between the DiSo 16 and the DiSo 9 assemblages on the one hand, and the DiSo 1 assemblages on the other (Table 21). In the former assemblages, the Frilled Dogwinkle (<u>Thais</u> <u>lamellosa</u>) is by far the most frequently occurring species, while in the latter there is a much higher incidence of the Black Turban (<u>Tegula</u> <u>funebralis</u>). The assemblage DiSo 1-III, however, unlike the other DiSo 1 assemblages, has a very high frequency of Frilled Dogwinkles. The Red Turban, (<u>Astraea</u> <u>gibberosa</u>) occurs only in the DiSo 9 assemblages.

Differences among the assemblages are also apparent in the Limpet species frequencies (Table 22). Except in DiSo 1-III, limpets are either absent from the DiSo 1 samples or present in very low frequencies. At DiSo 1-III, the most commonly occurring species is Mask Limpet (<u>Acmaea</u> <u>persona</u>) with the Plate Limpet (<u>A</u>. <u>t</u>. <u>scutum</u>), also well represented. At DiSo 16, the Shield Limpet (<u>Acmaea</u> <u>pelta</u>) forms 85% of the sample, while at both DiSo 9 assemblages the Mask Limpet comprises more than 80 percent of the sample.

Table 21. Relative Frequencies by Weight of Remains within Major Class, Sea Snail Species

Assemblages

Taxa	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Frilled Dog Winkle *Thais lamellosa*	83	80	94	51	5	97	16	-
Emarginate Winkle *T. emarginata*	<1	<1	<1	3	-	1	-	-
File Dogwinkle *T. lima*	-	-	-	-	-	<1	-	-
Channeled Dogwinkle *T. canaliculata*	-	-	-	-	-	1	-	-
Black Turban *Tegula funebralis*	3	6	1	46	56	1	84	100
Dire Whelk *Searlesia dira*	1	1	1	-	1	1	-	-
Leafy Hornmouth *Ceratastoma foliata*	1	-	-	-	-	-	-	-
Lewis' Moon Snail *Polynices lewisii*	12	1	1	-	39	-	-	-
Purple Olive *Olivella biplicata*	-	1	-	-	-	1	-	-
Eschricht's Bittium *Bittium eschrichti*	-	1	-	-	-	-	-	-
Periwinkle *Littorina* sp.	-	1	1	-	-	1	-	-
Rock Shell *Ocenebra* sp.	-	-	-	-	-	1	-	-
Red Turban *Astraea gibberosa*	-	12	3	-	-	-	-	-
Weight in Grams of all Sea Snail	874.5	6,461.5	6,867.5	20.3	52.4	1,139.2	35.3	2.9

All columns total 100%

Table 22. Relative Frequencies by Weight of Remains within Major Class, Limpet Species

Taxa	Assemblages							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Shield Limpet _Acmaea pelta_	85	3	7	-	-	9	-	-
Finger Limpet _A. digitalis_	5	4	7	-	-	1	-	-
Mask Limpet _A. persona_	10	93	86	-	-	64	100	-
Plate Limpet _A. testudinalis scutum_	-	-	1	-	-	25	-	-
Weight in Grams of all Limpet Remains	4.1	91.9	241.0	0.0	0.0	36.2	0.4	0.0

All columns total 100%

The relative frequencies by weight of remains for all species identified in each assemblage are given in Tables 42, 46, 50, 54, 58, 62, 66 and 70 in Appendix A. The individual assemblages are discussed below in detail.

DiSo 16:

Of the 5,338.2 grams of shellfish remains retained for analysis from DiSo 16, 5,232.8 grams (98 percent) were identified. At least 21 different species of bivalve and univalve molluscs, barnacles, chitons and crab are present. Clams are the most frequently occurring shellfish remains by weight (79.8 percent). Sea snails are the next most prevalent category (16.9 percent). Mussels are poorly represented (3 percent), while all other types of remains each contribute less than one percent of the identified sample weight. Only four species of clams and the Frilled Dogwinkle occur in relatively high concentrations.

Native Littleneck and Butter clams together comprise 63.9 percent of the sample, while Frilled Dogwinkle comprises 14 percent and Basket Cockle and Horse Clam are also well represented. All other species occur at frequencies of less than two percent of the sample weight.

Among the clams, Native Littleneck and Butter Clam are the most frequently occurring species, together comprising 80.0 percent of the clam sample. Among limpets, the Shield Limpet occurs most frequently, 85.4 percent, while the California Mussel is more common than the Bay Mussel at 63.4 percent, and the Frilled Dogwinkle is by far the most frequently occurring sea snail at 83.3 percent. None of the barnacle was specifically identified.

All species except the California Mussel and possibly the Northern Abalone, the Rose-petal Semele and the Leafy Hornmouth can today be found in the immediate vicinity of the site and all species are present in Hesquiat Harbour today.

DiSo 9-I:

51,856.6 grams of shellfish remains were retained for analysis from this stratigraphic unit. Of these, 50,143.8 grams (96.7 percent) were identified to species or genus, representing at least 26 species of bivalve and univalve molluscs, barnacles, chitons, crab and land snail. (Table 46 presents these data). Clams (here including oysters and scallops) are the most frequently occurring remains, forming 79.5 percent by weight of the identified sample. Sea snails comprise 12.8 percent and mussels 7.0 percent. All other groupings are less than one percent by weight of the sample. Only two clam species, Native Littleneck and Butter Clam, and one sea snail, the Frilled Dogwinkle, are present in quantity, with the two clam species alone comprising 76.1 percent of the total sample weight.

Within major categories, Butter Clam is the most frequently occurring species at 61.7 percent of all clam remains, followed by Native Littleneck at 34.1 percent. California Mussel comprises 64.5 percent of all mussel remains, while the Mask Limpet is 92.9 percent of all limpets and the Frilled Dogwinkle is 79.9 percent, followed by the Red Turban at 11.9 percent, of the sea snail sample. Balanus cariosus is the only specifically identified barnacle. Although chitons are not numerically abundant, three different species are represented.

All the species except the California Mussel are probably available in the immediate site area today, although direct observations of living Red Turban and Eschricht's Bittium are lacking. All species are certainly available in Hesquiat Harbour.

DiSo 9-II:

62,934.9 grams of shellfish remains were retained for analysis from this unit. Of this sample, 62,030.3 grams were identified, representing 21 species of bivalve and univalve molluscs, barnacles, and crab (Table 50 presents these data).

Clams are the most frequently occurring group (82.7 percent). Sea snails are well represented (11.2 percent), mussels less frequently occurring (5.4 percent). Limpets, barnacles and crab are poorly represented (0.3 percent, 0.4 percent and 0.1 percent respectively). Only Butter Clam, Native Littleneck and the Frilled Dogwinkle occur in quantity (23.9 percent, 55.7 percent and 10.5 percent respectively), together comprising 90.1 percent of the remains by weight. While not numerically abundant, the Red Turban sea snail occurs only in DiSo 9 deposits.

Within major groupings, Butter Clam is the most frequently occurring clam species at 67.4 percent of all clam remains, with Native Littleneck next at 28.9 percent. California Mussel represents 89.1 percent of all mussel, the Mask Limpet 85.8 percent of all limpets and the Frilled Dogwinkle 94.0 percent of all sea snails. *Balanus cariosus* is the only specifically identified barnacle.

DiSo 1-I:

A total weight of 1,681.5 grams of shellfish remains was retained for analysis from DiSo 1-I layers. Of this, 1,184.7 grams (70.5 percent) were identified to species or genus. An additional 494.9 grams were identified to class and the remaining 1.9 grams were considered unidentifiable (Table 54 presents these data).

Clams identified to species comprise 91.1 percent of the sample. Mussels contribute another 5.7 percent, while all other taxa are one percent or less of the identified sample. Butter clam and Horse Clam (*T. capax* and *T. nuttalli* combined) are the most frequently occurring species, with Native Littleneck being much less abundant.

Butter Clam is 50.7 percent of the clam weight, with Horse Clam 40.5 percent. All the mussel is California Mussel, while Frilled Dogwinkle at 51.2 percent and Black Turban at 45.8 percent are the most frequently occurring of all sea snails. There are no specifically identified limpets or barnacles.

DiSo 1-II:

A total weight of 343.1 grams of shellfish remains was recovered from this stratigraphic unit. Of this, 296.6 grams (86 percent) were identified to species or genus, 45.7 grams (13 percent) to major class and 0.8 grams (1 percent) were considered unidentifiable. The 296.6 grams identified include ten different species of bivalve and univalve molluscs and echinoderms. Barnacles are represented in the non-specifically identified sample. Clam is 76.9 percent of the identified sample, mussel 5.1 percent, sea snail 17.6 percent, and sea urchin 0.2 percent (Table 58).

Butter Clam is the most frequently occurring species, providing 65.5 percent of the identified sample weight and 85 percent of the total clam sample weight (Table 58). No other species is more than ten percent of the sample weight. The mussel is all California Mussel and the Black Turban sea snail is the most frequently occurring sea snail, comprising 55.7 percent of all sea snail, with Lewis's Moon Snail second at 38.5 percent. This latter is obviously a reflection of the large size and weight of the Lewis's Moon Snail's shell, rather than a reflection of many individuals in the sample. There are no specifically identified limpets or barnacles.

DiSo 1-III:

Of the 9,626.9 grams of shellfish remains retained for analysis, 7,555.9 grams (78.5 percent) were identified to species, genus or family. An additional 2,070.6 grams (21.5 percent) were identified to major class, while the remaining 0.4 grams (less than one percent) were considered unidentifiable. At least 29 different species are present (Table 62).

Native Littleneck (11.6 percent), Butter Clam (34.8 percent), Basket Cockle (10.4 percent), California Mussel (15.4 percent) and Frilled Dogwinkle (14.6 percent) are the most frequently occurring species by weight. Clams (including scallops) comprise 64.4 percent, mussels 15.6 percent, sea snails 15.2 percent, limpets 0.4 percent, barnacles 4.3 percent and other 0.1 percent of the specifically identified sample. The relatively high percentage of mussel distinguishes this DiSo 1 assemblage from all other DiSo 1 assemblages.

Within clams, Butter Clam is the most frequently occurring species, with 54 percent of the total clam weight. Ninety-nine percent of all the mussel is California Mussel; 64 percent of the limpet is Mask Limpet; 97 percent of the sea snail is Frilled Dogwinkle and 99.9 percent of the barnacle is Balanus cariosus. The high percentage of Frilled Dogwinkle is also different from the other DiSo 1 assemblages.

DiSo 1-IV:

Of the 4,061.7 grams of shellfish remains analyzed, 3,112 grams (77 percent) were identified to genus or species, 947 grams (23 percent) to major class and 2.7 grams (less than one percent) were considered unidentifiable. Of the identifiedssample, clam is 92.4 percent, mussel 6.5 percent, sea snail 1.2 percent, limpets and barnacles less than one percent and sea urchin and land snail one percent each. Only Butter Clam is present in considerable quantity (70.4 percent) (Table 66 gives these data).

Within the major groupings of identified shellfish remains, 76.2 percent by weight of the clam is Butter Clam; all limpets are the Mask Limpet; all mussel is California Mussel; and Black Turban is the most frequently occurring (84.1 percent) of the sea snails (Table 70). Although not numerically abundant the presence in this unit of a specimen of the whale barnacle, Coronula sp., is of great significance. Barnacles of the genus Coronula are found primarily on the Humpback Whale. One species is only found on this whale, the other has been recorded once on a Sperm Whale, but otherwise is only known to occur on the Humpback (Cornwall

1970:51-55). This then is positive, although indirect, evidence that at least one of the whales whose remains were deposited in this stratigraphic unit was a Humpback Whale.

DiSo 1-V:

Only 9.7 grams of shellfish remains were recovered from this unit. 6.7 grams (69.1 percent) are Butter Clam, 2.9 grams (29.9 percent) Black Turban sea snail and 0.1 grams (1 percent) Bay Mussel.

Shellfish Remains Summary:

In all assemblages, clams are the most frequently occurring shellfish remains by weight, followed by sea snails, then mussels. The relative frequencies of clam, mussel, limpet and sea snail species within major groupings generally differentiates DiSo 16 from the two DiSo 9 assemblages and these three from all the DiSo 1 assemblages. There are higher frequencies of Native Littleneck Clam, Bay Mussel, Frilled Dogwinkle in the DiSo 16 and DiSo 9 assemblages, although the percentage of Bay Mussel in DiSo 9-II is considerably lower than that in DiSo 9-I. Both DiSo 9 assemblages are distinguished from the DiSo 16 assemblage by having lower frequencies of Horse Clam and Basket Cockle and higher frequencies of Butter Clam, and higher frequencies of Mask as opposed to Shield Limpets.

While four of the DiSo 1 assemblages are distinguished from the DiSo 16 and DiSo 9 assemblages by higher frequencies of Black Turban sea snails, DiSo 1-III differs in having much higher frequencies of the Frilled Dogwinkle, as do the DiSo 16 and DiSo 19 assemblages. The DiSo 1-III assemblage is different from the other DiSo 1 assemblages in other respects also: mussels (Mytilidae) and cockles (Cardidae) form higher percentages of the identified species; limpets are also more abundant; Native Littleneck clams are more abundant. DiSo 1-I has a higher frequency of Horse Clam than the other DiSo 1 assemblages.

The DiSo 9 assemblages differ from all other assemblages in containing the sea snail,the Red Turban, not found in any other assemblage.

Assemblage Summaries

For all the major taxa, each assemblage can be characterized by those groups of species most abundantly represented in the faunal remains using skeletel element count and shell weight. These emphases are presented for each assemblage in simple pie diagrams illustrating major emphases in mammal, bird, fish, clam, sea snail and limpet remains. As California Mussel is the most abundantly represented of the mussels in all assemblages, it has not been diagrammed.

DiSo 16:

The most abundantly represented skeletal elements in the DiSo 16 assemblage are Deer and River Otter among the mammals; ducks, mergansers, gulls and loons among the birds; Plainfin Midshipman among the fish; and Butter Clam, Native Littleneck, Frilled Dogwinkle and Shield Limpets among the shellfish classes.

All of the resources are ones commonly found in the immediate site area today and indicate exploitation of the forest, intertidal and littoral habitats. The California Mussel is not found in the site locale today.

DiSo 9:

In clams, sea snails, limpets and fish, the two DiSo 9 assemblages are very similar, but they differ in their emphasis on various bird and mammal families.

DiSo 9-I:

The major emphases in this assemblage are on Deer, mustelids, and earless seals among the mammals; ducks among the birds; herring and salmon among the fish; and Butter Clam, Native Littleneck Clam, Frilled Dogwinkles, and Mask Limpets among the shellfish classes.

Major emphases are on resources available today in the immediate site locale, but California Mussel, Red Turban sea snail, eared seals and shearwaters are not commonly found near the site today.

DiSo 9-II:

This assemblage emphasizes eared seals and Deer among the mammals; loons and ducks among the birds; herring and Plainfin Midshipman among the fish; and ButterClams, Native Littlenecks, Frilled Dogwinkle and Mask Limpets among the shellfish classes.

Most resources are available today in the immediate site locale, but the California Mussel, Red Turban, eared seals, albatross and shearwaters are not.

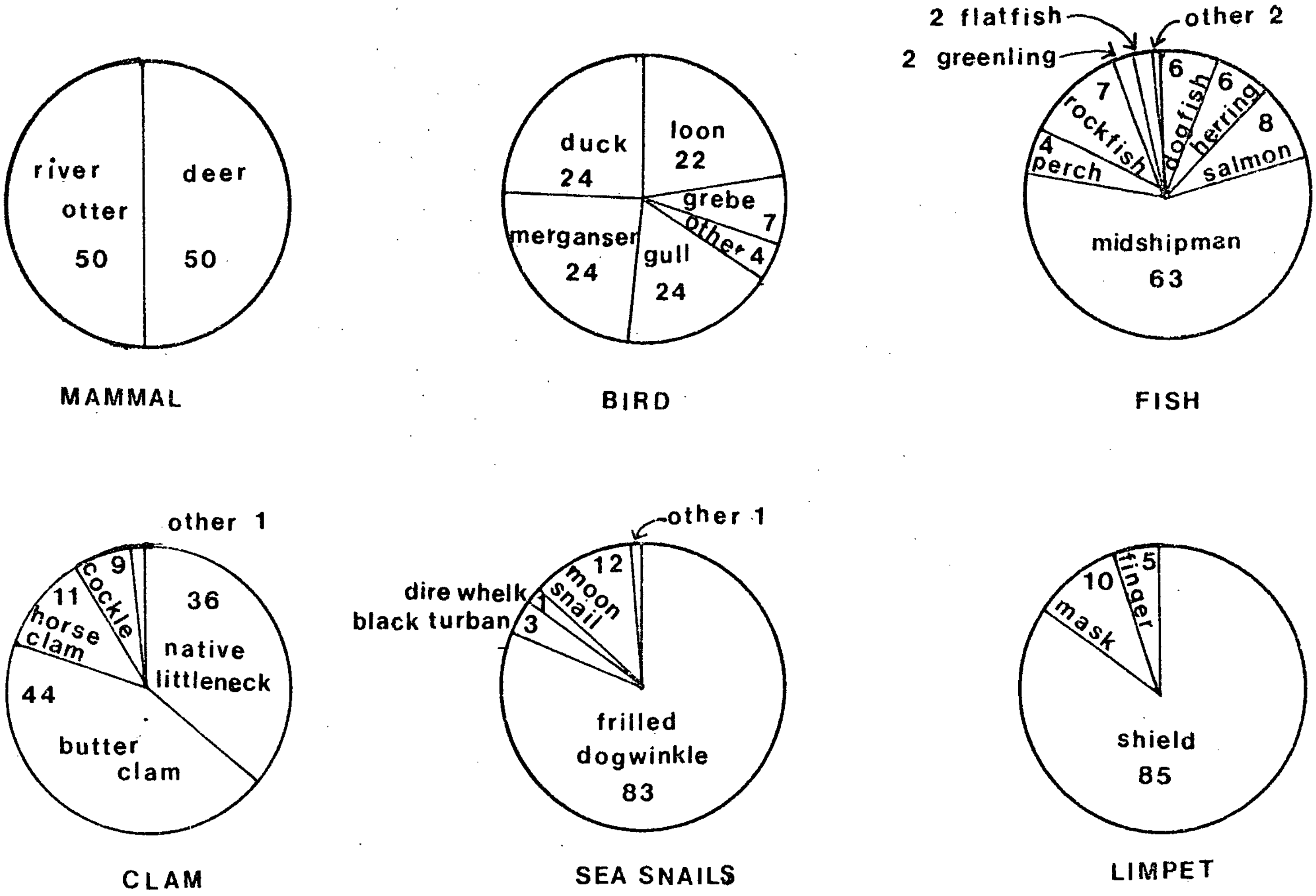
DiSo 1:

The later four DiSo 1 assemblages are all very similar, although DiSo 1-III differs somewhat. The DiSo 1-V assemblage is very small relative to the other samples and tends to differ, but is still more like the other DiSo 1 assemblages than like the DiSo 16 or DiSo 9 assemblages.

In all DiSo 1 assemblages, rockfish, Dogfish and greenling are the most abundant remains among the fish; eared seals, earless seals and either Deer or mustelids are the most abundant of the mammal remains; and Butter Clam, Horse Clam and Native Littleneck, Black Turban and Frilled Dogwinkle the most abundant among the shellfish classes, although DiSo 1-III differs in having no Black Turban sea snail.

The assemblages differ most in their emphasis on particular bird families. While Albatross are the most frequently occurring remains in the DiSo 1-I, DiSo 1-II, DiSo 1-III and DiSo 1-V assemblages, they are much less abundant in the DiSo 1-II assemblage, and form only 4 percent of the DiSo 1-IV assemblage. Both DiSo 1-II and DiSo 1-IV have more varied bird assemblages with shearwaters, geese, ducks and gulls remains also relatively abundant. The assemblages are, however, more similar to each other than to the DiSo 9 and DiSo 16 assemblages.

In all DiSo 1 assemblages, the fauna represented are such as would be found today in the immediate and off-shore site locale.



'Figure 28. DiSo 16, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count or Shell weight.

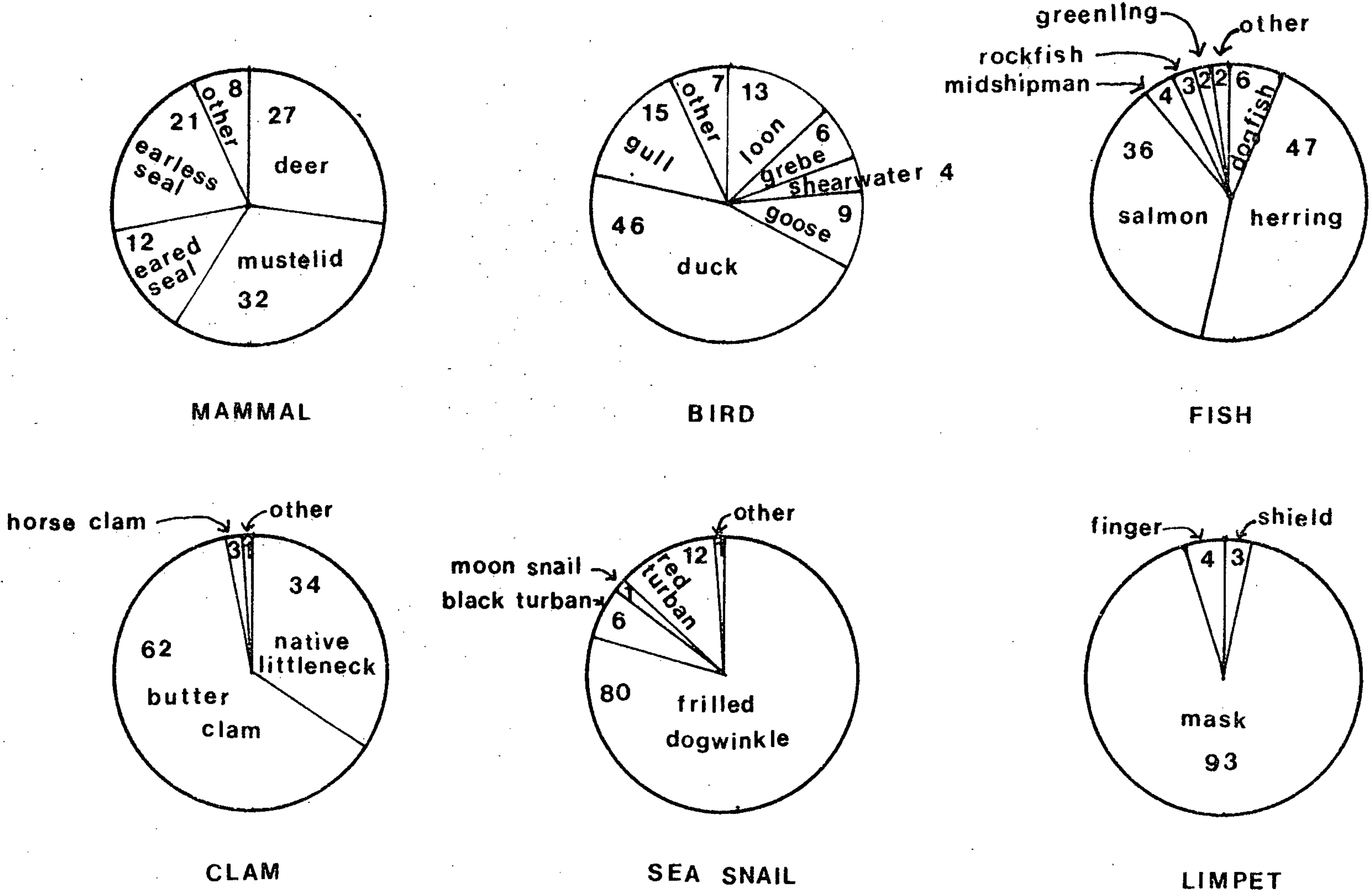
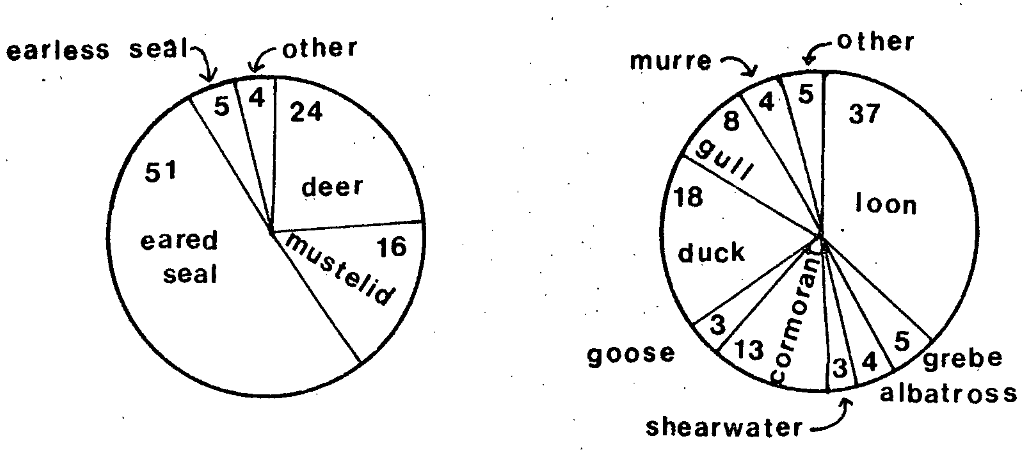
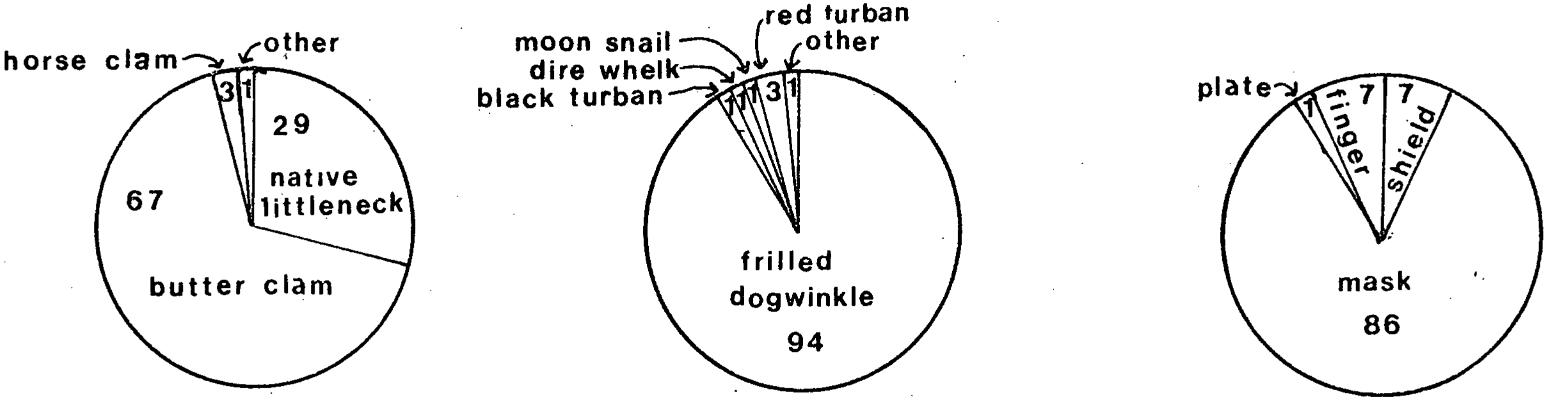


Figure 29. DiSo 9-I, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count or Shell Weight.



MAMMAL BIRD FISH



CLAM SEA SNAIL LIMPET

Figure 30. DiSo 9-II, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count or Shell Weight.

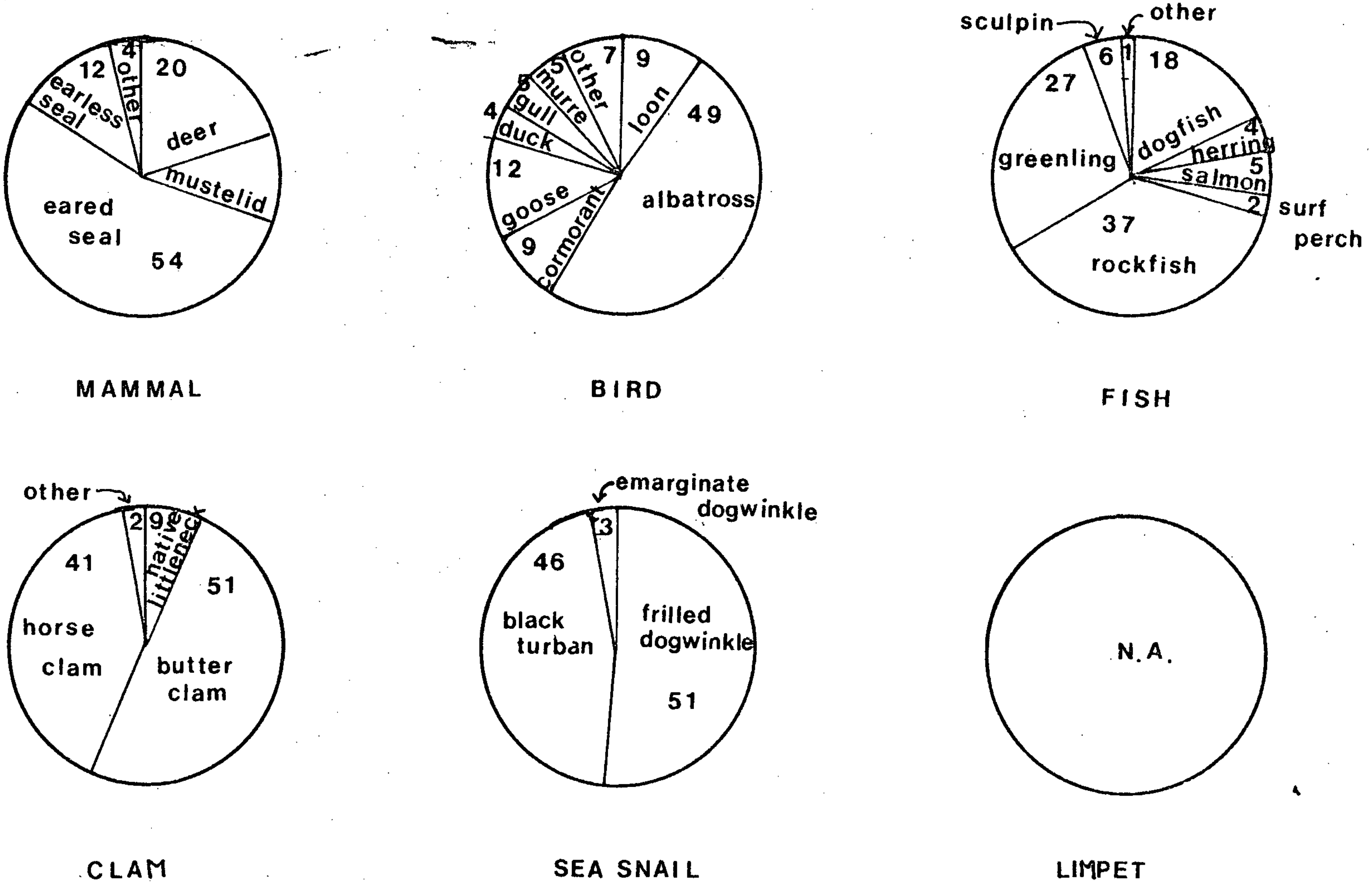


Figure 31. DiSo 1-I, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count and Shell Weight.

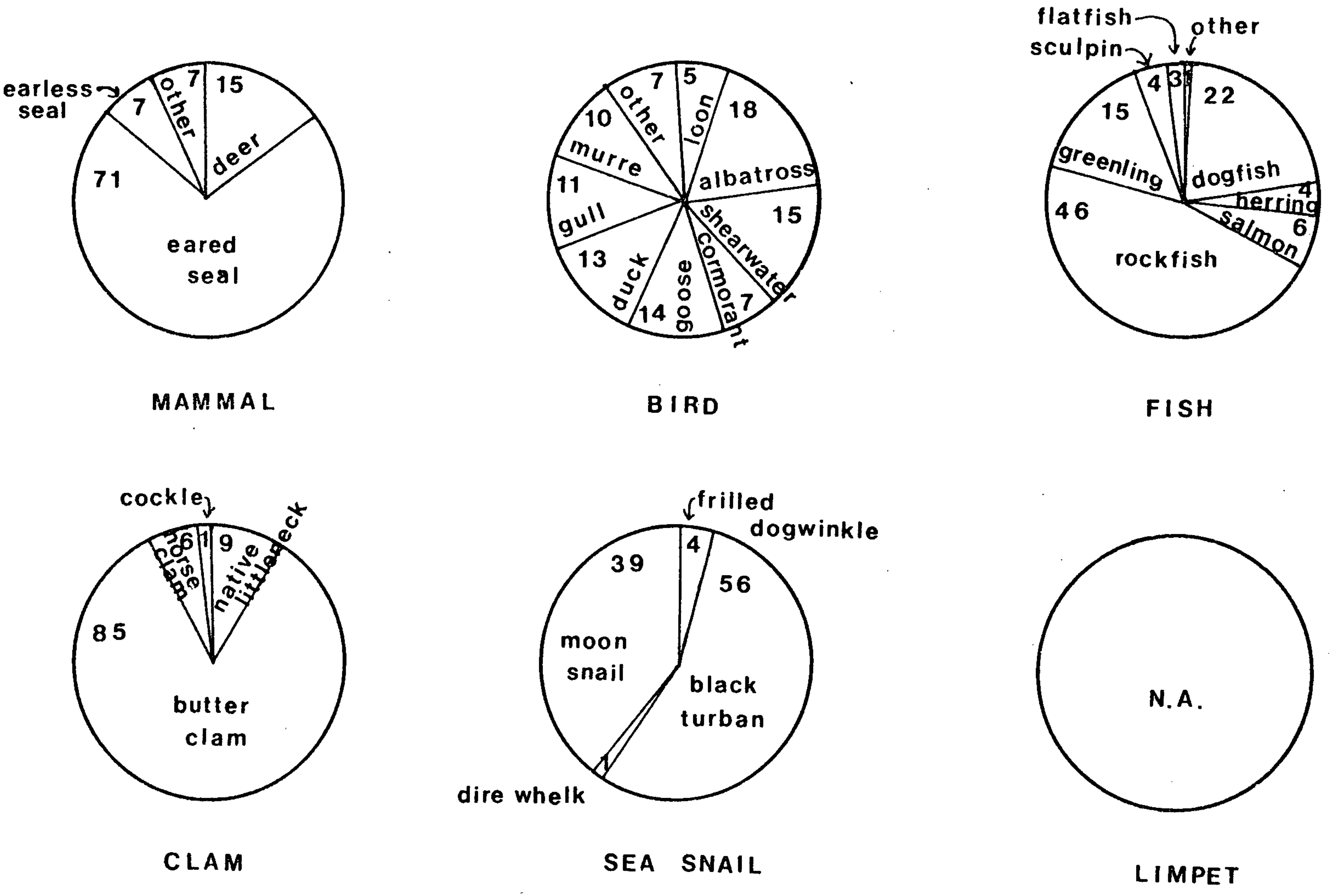
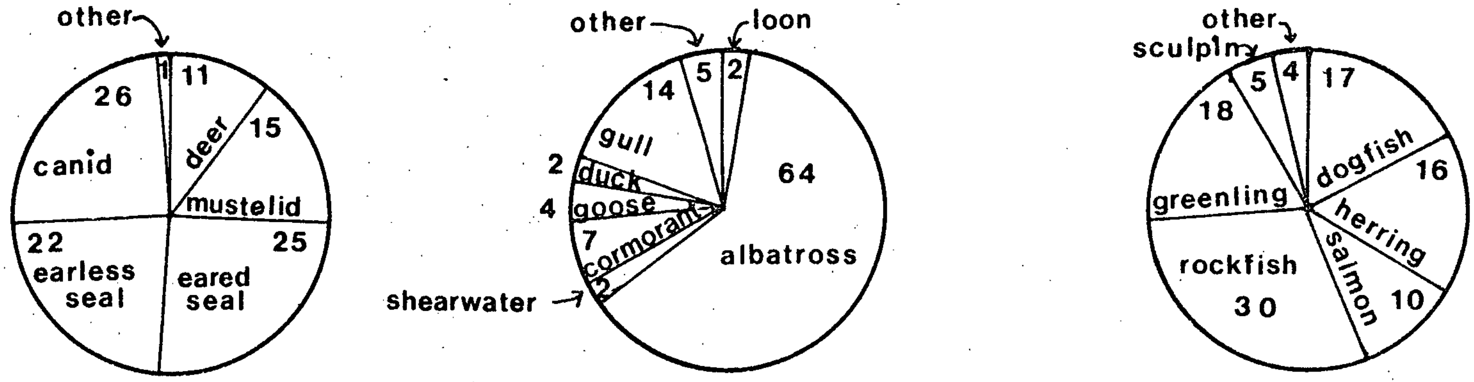


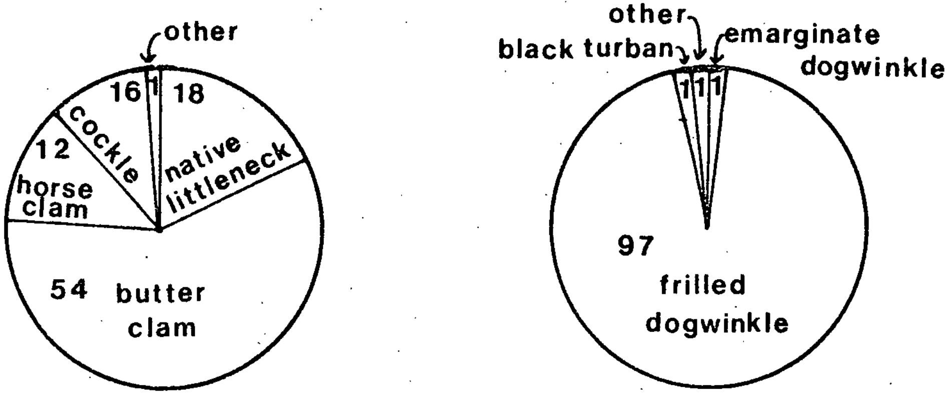
Figure 32. DiSo 1-II, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count or Shell Weight.

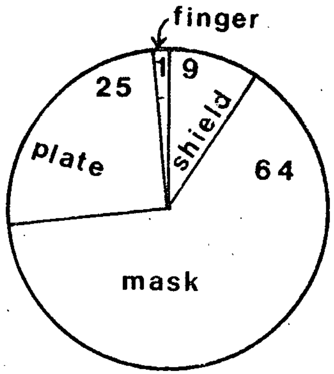


MAMMAL

BIRD

FISH





CLAM

SEA SNAIL

LIMPET

Figure 33. DiSo 1-III, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count and Shell Weight.

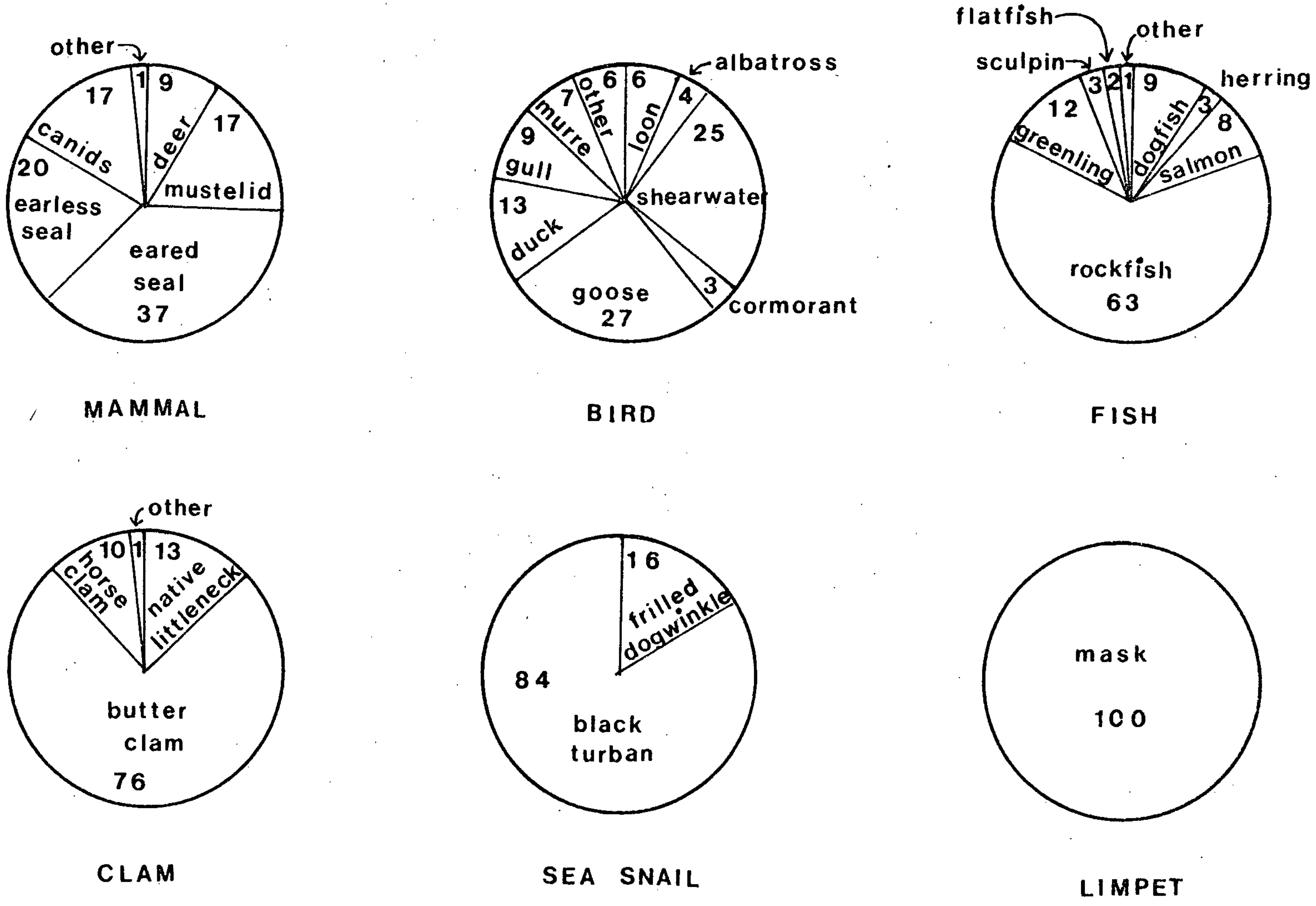


Figure 34. DiSo 1-IV, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count and Shell Weight.

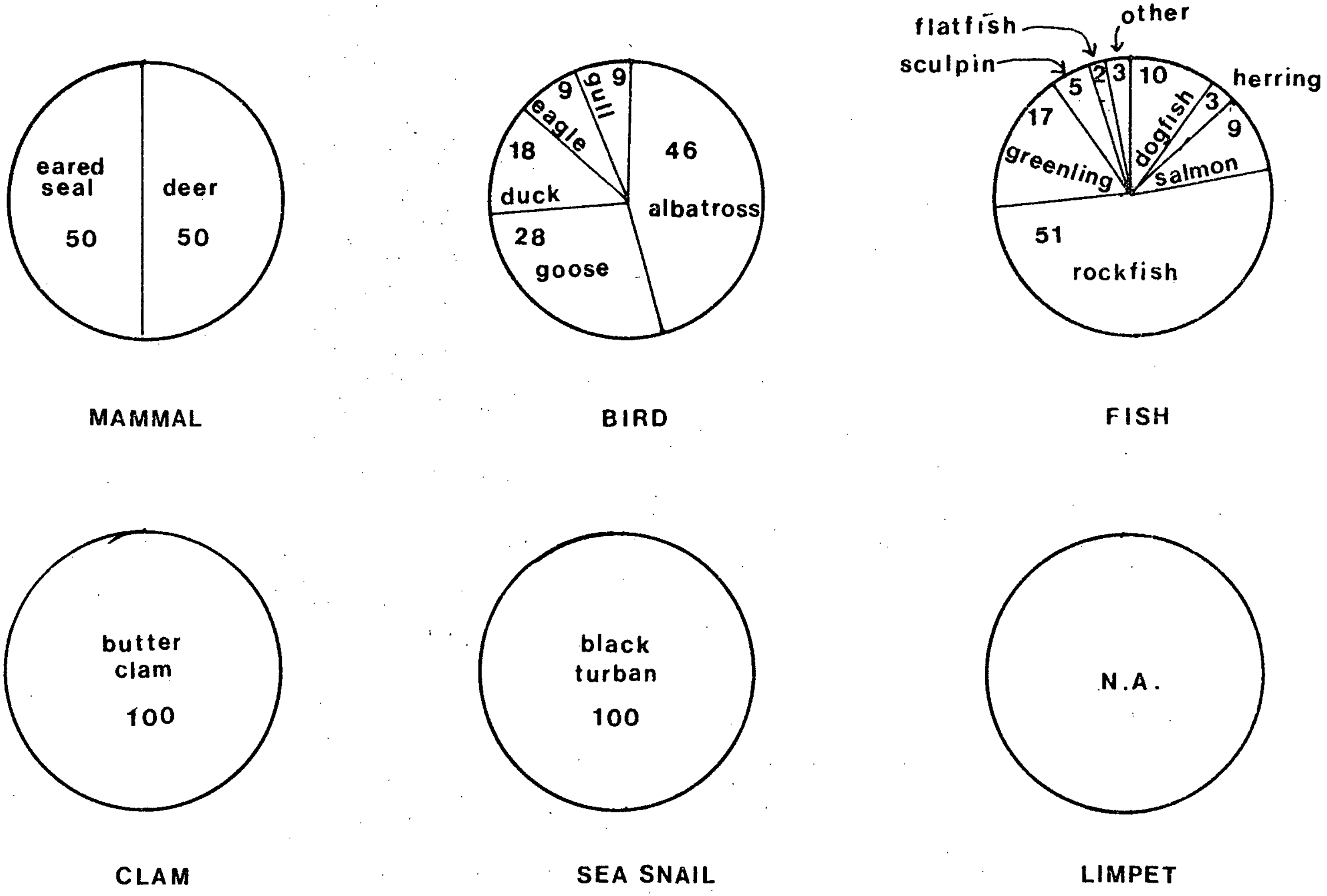


Figure 35. DiSo 1-V, Relative Frequencies of Faunal Remains within Major Taxonomic Classes, Skeletal Element Count and Shell Weight.

Chapter VI

Interpretation

In Chapter V the differences and similarities among the eight faunal assemblages were illustrated. In addition to preservation and sampling factors there appear to be four possible sources of variation that might account for the patterns of inter-assemblage difference: diachronic change in the regional or local resource base; diachronic change in the material culture; differences in season of exploitation; and synchronic variation in the habitats exploited from each site.

It was established in Chapter II that there are today both seasonal and locational variations in the availability of animal species in Hesquiat Harbour. Habitat categories were defined for birds, fish, mammals and shellfish, grouping animal species according to habitat preference and the present general distributions of these habitats in Hesquiat Harbour were mapped. Five more inclusive categories, grouping all vertebrate fauna, were devised from the detailed information. The five major vertebrate habitat categories were defined as: Pelagic, Pelagic/Littoral, Littoral, Littoral/Forest Edge and Forest/Streams/ Lakes. Shellfish were similarly grouped into two major habitat categories of Exposed Shores and Sheltered Shores.

The present distribution of these major habitat categories was used to predict the type of faunal assemblage one would expect to find at each of the three sites under discussion, if the faunal assemblages were obtained from the immediate site area and if the local environment had not changed significantly (Chapter III). It was also established in Chapter II that while major changes in the regional resource base are unlikely, there have been local geomorphological changes in the relevant time period of the last 2,000 years that may have resulted in distributional shifts of certain species in Hesquiat Harbour.

The artifact assemblages from the sites were presented in Chapter IV, and it was seen that there is little variation among the assemblages. Certain differences, however, were observed, and require discussion in relation to both synchronic and diachronic variation.

Before examining the patterning observed in the faunal data in relation to these environmental and cultural factors, the effects of sample collection techniques and the possibility of differential preservation on the comparability of the samples are considered.

SAMPLING FACTORS

It has been explained that the deposits at DiSo 1 and DiSo 16 were screened through 6 mm mesh while those of DiSo 9 were screened through 2 mm mesh. The effect of this on the recovery of small fish remains was illustrated in Table 17. Other bird, fish and mammal remains considered here are not of a size to be affected significantly. The low frequencies of herring in the DiSo 16 and DiSo 1 assemblages must at present be regarded as sample error. The control soil sample fauna suggest that herring remains were in fact much more frequent in the DiSo 1 deposits than the level samples indicate. They suggest that they were also more frequent in the DiSo 16 deposits, but the discrepancy at this site between level and soil sample counts would appear to be less.

The type of faunal samples obtained from DiSo 1 also differ from those of DiSo 9 and DiSo 16, the latter being recovered from block deposit samples and the former from scattered, randomly selected excavation units. While the large sample sizes and replication of patterns among excavation units at all of the sites indicates that the samples from all three sites are representative of the variation contained in each site, the calculation of MNI is affected (Grayson 1973:433). Because the DiSo 1 Stratigraphic Unit MNI counts are summations of MNI estimations based on smaller excavation unit samples, these figures are probably inflated, especially where a species is represented by few bone elements. The smaller samples recovered from DiSo 1 Stratigraphic Units II and V also tend to inflate the figures for these units (Grayson 1978).

It was for these reasons that skeletal element count was used as the primary unit of measurement for comparative purposes, while MNI percentages were placed in the appendix. While the use of skeletal element count introduces its own problems of sample comparability, it was felt these could be identified and noted. For example, the bone count for albatross, as mentioned on page 156 may be inflated relative to some less easily identified species, but as the objective is to compare patterns among assemblages, this does not introduce a factor that biases one sample and not another. It is equally applicable to all the assemblages. Thus the percentage figures given may be inflated in relation to actual relative importance of this species, but the inflation factor applies equally to all assemblages and does not distort the interassemblage comparisons.

Further, the sample sizes used, particularly for fish remains, are large enough that low frequencies of certain species are felt to reflect an actual low frequency rather than a sampling error. In most instances, the skeletal element count percentages and the MNI percentages are closely similar. Where they differ markedly, which is the case where a high proportion of the identified elements of a species come from a single individual (eg. Canis sp. remains in assemblage DiSo 1-III), this has been noted.

Apart from these individual instances of possibly distorted samples, it appears that the only variation among assemblages that can be attributed at least in part to sample error are the differences in frequency of herring remains. While other sampling factors as yet unidentified may be biasing results, the patterns identified appear to be too consistent and too integrated to result from sample error.

PRESERVATION FACTORS

Identifiable preservation factors do not appear to be responsible for the observed pattern of variation. Preservation of bone and shell at all three sites was good. Although layers without heavy concentrations of shell did produce lower frequencies of vertebrate remains, the bone from these layers is generally as well preserved as that from the heavy shell layers. The lower frequencies probably result from horizontal clustering of remains and/or lower intensity of occupation rather than differential preservation of faunal remains.

Calcium and pH values of the deposits indicate little difference in these properties among stratigraphic units at a site (Table 23). pH values do differ among sites, but in all cases except DiSo 9-II, DiSo 1-III and DiSo 1-IV, the ranges overlap. The pH ranges of each of these three stratigraphic units overlap with all other stratigraphic unit ranges except DiSo 16, which despite the shell content, has an acidic soil environment. Calcium ppm at this site are also a little lower than at other sites. At both DiSo 16 and DiSo 9, outside the cave dripline both

Table 23. Calcium ppm and pH Ranges of Matrix Samples from all Stratigraphic Units. *

	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
pH	5.0-6.6	5.6-8.2	7.1-8.6	6.3-7.1	6.6-7.5	7.0-8.0	6.9-7.7	6.6-7.2
Calcium ppm	410-430	430-470	420-470	430-480	430-480	4430-480	430-450	400-450

* (Crozier n.d.)

pH and calcium ppm drop markedly. At DiSo 16 pH ranges from 4.1 to 6.1 and calcium ppm from 0 to 175 in the lower 50 cm, and from 250 to 410 ppm in the upper 30 cm. At DiSo 9, pH ranges from 3.8 to 6.1 outside the dripline, while calcium ppm fluctuate between 10 and 450, increasing gradually towards the top of the deposits. This suggests some lateral movement of calcium in the upper portions of the deposits, while the low calcium ppm in the lower deposits suggest there never was a high concentration of calcium (i.e. shell) in the entrance to the cave. Possibly calcium derived from shell deposits inside the cave has moved right through these deposits to be redeposited further down slope. At DiSo 1, lowest pH values are in DiSo 1-I and DiSo 1-V, the topsoil/disturbed/historic layer and the primarily geological layer, as would be expected. Both are slightly acidic, but neither varies more than 30 ppm in calcium concentration from the heavy shell units. Calcium ppm hardly vary among all stratigraphic units (Crozier, n.d.).

As these values represent the present chemical environment of the deposits, they do not necessarily indicate the chemical environment throughout the period of deposition nor the time period since deposition.

One would certainly expect the later deposition of heavy shell layers to affect the calcium content and the pH of layers previously deposited, thus masking the original environment of deposition for the earlier layers.

While noncultural transformation processes, Schiffer's "n-transforms" (Schiffer 1976:15), have undoubtedly contributed to the observed variation, our understanding of their interactions within a site is very incomplete. While we may know that an acid soil destroys bone, we do not yet know the addition of shell, in what quantities and over what period of time, required to create a soil environment sufficiently basic to begin preserving bone and shell. Nor do we clearly understand the interrelations of the various chemical reactions taking place in soils of mixed natural and cultural origin, to which new and varied materials are constantly being added. In sites as complex as shell middens, soil acidity values cannot be interpreted as confirmation of poor or good soil preservation throughout the life of the deposits. A basic soil containing few bones is not necessarily confirmation of an initial low frequency of bone. The soil may originally have been acidic. Such values measure the current state of acidity within a continually changing soil system, now perhaps influenced only by natural soil forming processes, but formerly influenced by the interaction of both natural and cultural processes.

The observed pattern of interassemblage variation in these faunal samples cannot be related logically to any identified preservation factors. It is likely that preservation is now poorer in the lower layers of DiSo 1 than it is in the upper layers, as the lower layers are subject to the influence of a fluctuating water table, while those of the upper deposits are not, but the influence of this appears to be minimal as far as amount and hardness of bone recovered. If differential preservation were a factor here, one would expect differences among these DiSo 1 assemblages, where one finds instead strong similarities.

Further, the differences among the assemblages of different sites are ones of frequency, rarely presence and absence. In fact, the differences among sites argue against major preservation factors affecting the samples. It seems illogical to suppose that deposits such as DiSo 9, preserving quantities of fragile herring bones, fish scales, mussel periostracae and snail operculae, would fail to preserve quantities of strong, hard rockfish bones if they had been present. Instead, the higher quantities of rockfish remains are found at DiSo 1. Nor do these high frequencies result solely from recovery techniques biasing the sample against small remains. There is an absolute higher frequency of rockfish remains at DiSo 1 than at DiSo 9 even though the latter site has a larger sample of fish remains. This is true even if herring remains are excluded from the samples.

At DiSo 1 one might logically expect poorer preservation as a result of greater movement of ground water through the deposits promoting chemical deterioration; greater physical compaction and weight of deposits promoting higher incidences of mechanical fracture; and higher incidence of post-depositional disturbance, all factors that can contribute to degradation of bone and shell. That these factors cannot be held responsible for lower frequencies of fragile remains such as herring and salmon at DiSo 1, is attested by the abundance of herring bones in the DiSo 1 matrix samples and the good preservation of those salmon bones recovered.

Similarly, sea mammal bone is equally well preserved, when present, in the DiSo 9 deposits as in the DiSo 1 deposits where it is so much more abundant.

In short, the observed pattern of interassemblage variation cannot logically be related to interassemblage differences in preservation. Although the control data needed to test such suggestions, ie. chemical tests on the degradation of specific animal remains in specific environments of deposition over known and varying lengths of time, are not currently available, the patterns observed appear too consistent yet apparently unrelated to identified factors of preservation, to be the result of differential preservation.

DIACHRONIC VARIATION IN MATERIAL CULTURE

The introduction of new items of material culture into the procurement technology can result in the exploitation of food resources formerly unused or a more efficient exploitation of ones already being harvested. This does not appear to be the case with the Hesquiat samples. While it is impossible to say that the technology of food procurement has not changed through time in Hesquiat Harbour, it is possible to demonstrate that the material items of food procurement systems preserved in the sites do not differ significantly in methods of manufacture or concept, in a manner which could explain the observed differences in faunal assemblages.

Figure 36 presents the uncalibrated radiocarbon estimates for the assemblages plotted as the mid-points of their ranges to two sigma factors. DiSo 9-II is the only assemblages that does not overlap at least partially with one or more other assemblages. (The estimate for DiSo 1-V cannot be considered reliable.) Thus a fairly continuous temporal sequence with considerable periods of contemporaneity is suggested.

This contemporaneity of several of the assemblages argues against the association of faunal differences with diachronic change in material culture, inasmuch as some of the major differences among the artifact assemblages cross cut temporal distinctions. Bone needles, for example, are found in the earliest assemblage, DiSo 9-II and in a much later assemblage, DiSo 16, but not in the temporally intervening assemblages of DiSo 1. While the small artifact samples from all the assemblages dictates that caution should be used in considering sample absences as real absences, the fact remains that the demonstrated interassemblage variation in occurrence of bone needles does not reflect changing technology through time.

There do not appear to be any major differences in the artifact assemblages that could explain the differences among the faunal assemblages on the basis of differing technological knowledge of a particular method of manufacture or class of artifacts (See Table 10 in Chapter IV, page 135 , for complete artifact distributions). Except for objects of non-aboriginal materials, few of the differences observed appear to correlate with the age of the sample.

The differences that do occur are most marked between sites, rather than assemblages. Table 24 illustrates the relative frequencies of selected artifact classes. It is apparent from this table that a number of the differences are such as one would expect if different kinds of resource extraction activities were being carried out at the different sites.

It is noteworthy that stone fishhook shanks occur in four of the five DiSo 1 assemblages but at neither DiSo 16 nor DiSo 9 habitations deposits. (A single shank was associated with the surface burial complex

Figure 36. Comparison of Radiocarbon Estimates from Three Hesquiat Harbour Sites.

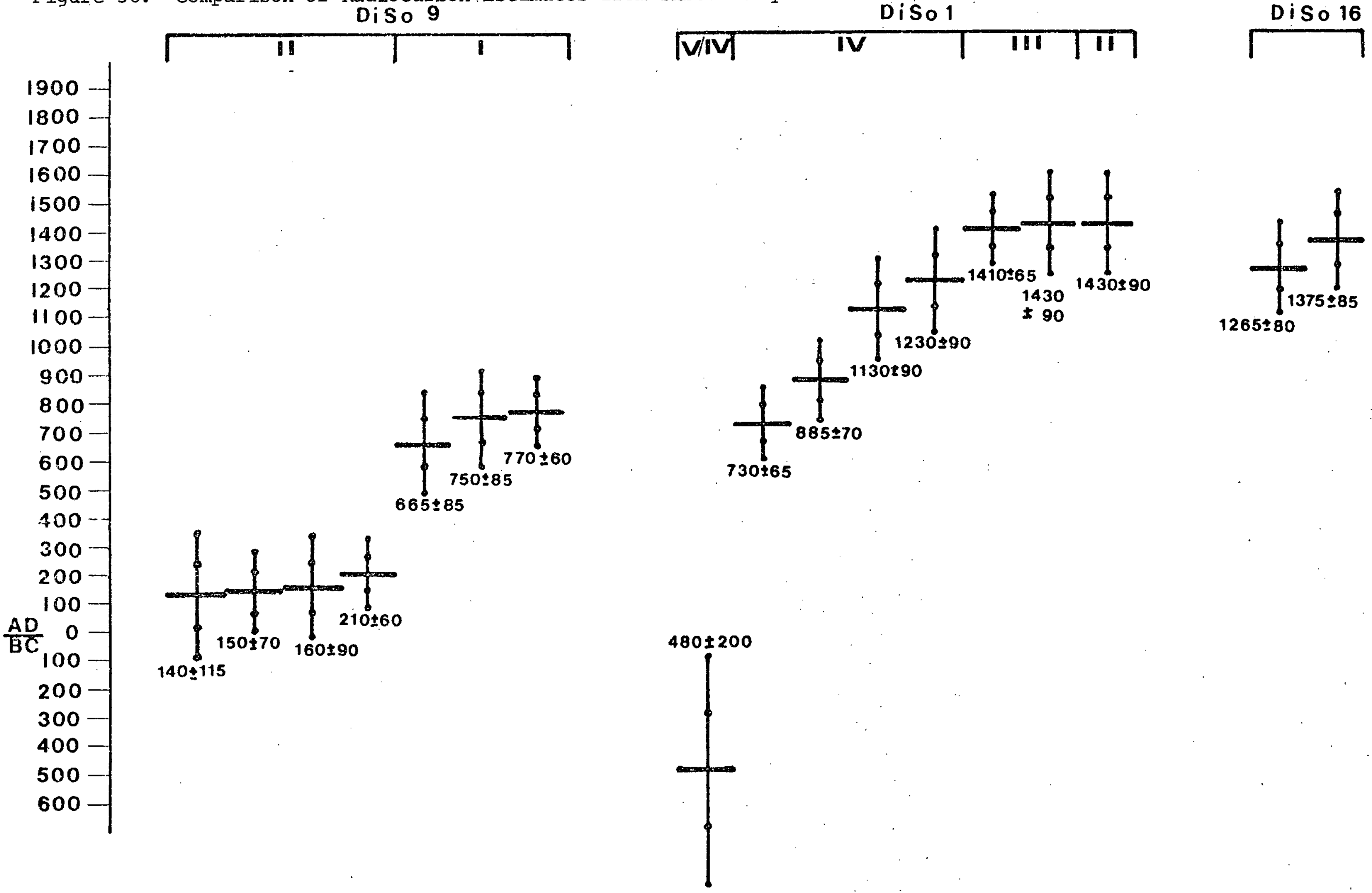


Table 24. Relative Frequencies of Selected Artifact Classes by Site.

Artifact Class	Site DiSo 16	 DiSo 9	 DiSo 1
Abrasive stones or slabs	31	18	58
Grd. stone fishhook shanks	-	-	6
Bone needles	13	7	-
Bird bone awls	-	6	-
Deer ulna tools	6	2	1
Unilaterally barbed points	-	-	2
Small toggle harpoon valves	6	4	5
Large toggle harpoon valves	-	-	1
Harpoon points <5 cm	6	20	3
Other bone points	-	2	3
Angled bone barbs	31	4	7
Straight bone barbs <5 cm	-	22	5
Bone bipoints	-	4	10
Mussel shell point	-	1	-
Mussel shell knife	-	3	-
Mussel shell knife/adze frags.	6	6	-
Columns total 100% N	15	114	200

at DiSo 9.) Although these shanks were reportedly also made of wood, which might not have survived in the archaeological context, it seems unlikely that the use of stone would be restricted to DiSo 1. These artifacts are reported to be "cod" fish, spring salmon and more recently dogfish hook shanks (Drucker 1951:22). The faunal remains at DiSo 1 tend to support this, with rockfish ("rock cod", "black cod") and dogfish being abundant in DiSo 1 assemblages, but less abundant in the DiSo 16 and DiSo 9 assemblages.

A similar correspondance of faunal remains and artifact classes occurs in the DiSo 9 assemblages. In both these assemblages herring are abundant faunal remains. Ethnographically herring were fished with dipnets and with the herring rake, a device like a paddle with small, sharp bone points set along one edge (Drucker 1951:23). The straight bone barbs $<$5 cm in length are precisely the kind of point required. They have a much higher frequency at DiSo 9 than at DiSo 16 or DiSo 1, just as do herring remains. While this may be partially an artifact of sample error, the fact that the straight barbs that do occur in DiSo 1 were recovered from DiSo 1-III, also the assemblage with the most herring of all the DiSo 1 assemblages, supports the association of artifact class and faunal remain class. Deer ulna tools, traditionally used to split herring for drying, occur in all three sites.

Other correspondences suggest an association of small toggle harpoon arming points such as those ethnographically described as salmon harpoon points (Drucker 1951:21) and the higher frequencies of salmon remains at DiSo 9 and DiSo 16. Mussel shell knives, traditionally used in the preparation of salmon, occur at DiSo 9 and possibly DiSo 16 but not DiSo 1.

The presence of large toggle harpoon valves such as those reportedly used for sealions, seals and porpoises (Drucker 1951:26) at DiSo 1 but not DiSo 9 or DiSo 16 habitation deposits corroborates the faunal evidence of higher frequencies of large sea mammal remains at DiSo 1. The higher frequencies of bone bipoints, reportedly used as gorge hooks for diving ducks (Drucker 1951:34), at DiSo 1 is not supported by higher frequencies at that site of duck remains. On the contrary, duck remains are more abundant at the other two sites. Perhaps such points were also used for small sea fish such as greenlings and the smaller rockfish. Abrasive stones are much more common at DiSo 1 than at the other two sites, perhaps reflecting the larger size and more permanent nature of this site.

While other artifact classes do not necessarily occur in all assemblages, (eg. needles, bird bone awls, bone wedges) the differences do not appear to be related to linear diachronic change in material culture. In short, those differences apparent among the assemblages appear to group along spatial, rather than temporal lines, and appear to be related to the kinds of activities carried out at each site, rather than differences in technological adaptation.

As mentioned in Chapter IV, at Yuquot, just 25 kilometres north of Hesquiat, fishhook shanks and unilaterally and bilaterally barbed harpoons presumably used for sea mammals are part of the Middle Period artifact assemblage dated from about 1000 B.C. to A.D. 800, as are small toggle harpoons, bone bipoints, and unilaterally barbed fixed points (Dewhirst 1978:10-15). It is interesting that at Yuquot the larger toggling harpoons do not appear in the archaeological record until the Late Period, A.D. 800 to A.D. 1790, roughly the time period spanned by the Hesquiat Village DiSo 1 deposits, where these are also found.

It would seem that the range of artifact classes present at Hesquiat, with the possible exception of larger toggling harpoons, was already present at Yuquot prior to the initial occupation of DiSo.9. This is further support for the association of faunal differences among the sites with differences in activities rather than change in material culture.

ENVIRONMENTAL CHANGE

There is no evidence to suggest that the kinds of differences among the faunal assemblages can be explained by change in the regional resource base. Nor is there environmental evidence of such regional change in animal populations. There is, however, evidence of local geomorphological changes that must have affected the availability of certain marine and intertidal species in the Harbour. As these changes are not yet clearly understood it is difficult to determine the exact effects, but certain variations in faunal frequencies may reflect such changes.

Apart from introducing a lake where before there were tidal mudflats and an embayment, the development of Village Lake basin and the adjacent Anton's Spit must have affected surrounding beaches and created a more sheltered habitat north of the spit. Hebda and Rouse (1979:129) suggest that Hesquiat Peninsula has uplifted 3 metres relative to mean sea level during the last 2,700 years. Such a difference in the land-sea relationship would place the Village Lake area of Hesquiat Peninsula beneath shallow seas. By the time DiSo 9 was first occupied about A.D. 100 these shallow seas were probably already becoming extensive tidal flats, but there would still have been a greater open ocean influence in the Harbour at that time. It was not until approximately 1000 years ago, after the abandonment of DiSo 9, that the peat bogs began to form in the marshy meadows on the peninsula north of Hesquiat Village. And it was probably not until 700 to 500 years ago that the Village Lake basin was completely cut off from salt water influence by a combination of uplift and spit development. New geological evidence from old strand lines and caves in the harbour supports the recency of this continuing uplift (Don Howes, pers. comm.).

While the Village Lake area was still an embayment flanked to the south and east by building beach ridges and developing tidal flats, there must have been extensive areas of sand and muddy sand in this region, and good stretches of sheltered sandy beaches. These would have provided excellent habitat for clams and good substrata for spawning herring. The timing for the closure of Village Lake embayment is estimated to be around A.D. 1200 to A.D. 1400, the approximate time period of the end of DiSo 1-IV deposits and the time of the DiSo 1-III deposits.

There is a marked increase in abundance of clam remains in DiSo 1-III over their frequency in DiSo 1-IV. This may well reflect utilization of more extensive muddy sand clam flats in the area now occupied by Village Lake and earlier, during much of DiSo 1-IV times, occupied by the sea. The decrease in clam shell frequency in the DiSo 1-II deposits may reflect the full development of the lake basin and concomittant reduction in the tidal flats area.

The higher frequency of herring remains in DiSo 1-III relative to other DiSo 1 assemblages may also be related to these geomorphological developments, there being a relatively short period of time when the area beaches were suitable for herring spawning. The higher frequency of Frilled Dogwinkle sea snail in DiSo 1-III layers, a sea snail favouring a more sheltered habitat, may also be related to these changes, as may the higher relative frequency of Native Littleneck Clam and Basket Cockle, species favouring muddy sand habitats, as compared to other DiSo 1 assemblages.

The occurrence in both DiSo 9 assemblages of quantities of Mytilus californianus suggest either that this species now occupies a reduced range in the harbour compared to earlier times or that the inhabitants of the site had access to a wider territory of exploitation than the inner harbour. Prior to full emergence of Anton's Spit and the adjacent areas, restricting both wave action and incurrent fresh water dispersal patterns, salinity and wave action within Hesquiat Harbour may have been sufficient to provide more suitable habitat for M. californianus. It seems unlikely, however, that the inner harbour was ever an optimal habitat for this species during the time period represented by these assemblages. In this regard it is worth noting that the M. californianus valves recovered from DiSo 9 are relatively small, seldom exceeding 10 cm in length. Cultural management of the beds might also result in the small size.

The presence in both DiSo 9 assemblages of Red Turban sea snails (Astraea gibberosa), which prefer an exposed rocky shore, also suggests either a more open habitat in earlier times or a wider territory of exploitation. The occurrence of sea lion and fur seal remains in these assemblages might also indicate a more open harbour, or a wider exploitation territory. The higher frequency of Eared Seal remains than might have been expected is particularly marked for the older DiSo 9-II assemblage. This assemblage also contains small amounts of Albatross, Shearwater and Murre bones, species more commonly found in the Pelagic and Pelagic Littoral environments now found along the outer coast rather than in the inner harbour. In contrast, the clam remains emphasize Frilled Dogwinkle and Native Littleneck Clam, as would be expected from the present environment of the site. Taken together, these indications suggest that during the occupation of DiSo 9 the inner harbour was subject to more influence from the open ocean, but that some of the fauna was also being exploited from habitats that even so, one would not expect to find in that inner harbour. This suggests a wider territory of exploitation as well, particularly for DiSo 9-II.

There is evidence then of considerable change in the local environment during the time period covered by the assemblages. There are indications in the DiSo 1 assemblages of changes associated with the development of the Village Lake basin, and in the DiSo 9 assemblages of a greater availability of open coast animals in what is today a more sheltered harbour. There are also suggestions in the DiSo 9 assemblages, particularly DiSo 9-II, that these faunal assemblages may have been deposited by inhabitants with access to a wider territory of exploitation than just the inner harbour.

SEASON OF EXPLOITATION

The seasonal movement patterns of migratory birds and mammals are often used by archaeologists as evidence for season of exploitation. It is sometimes overlooked that zoological summaries of these patterns generally refer to the patterns of most commonly observed behaviour, the normal behaviour of adult breeding animals. Others using these data tend to attribute a rigidity to the patterns not claimed by zoologists.

The migration of the grey whale is a case in point. Their north-south movements between the summer feeding grounds in the arctic and the winter breeding bays of Baja California are well established. But a few grey whales can be sighted off the west coast of Vancouver Island in almost any month of the year. Similarly the behaviour of non-breeding birds may differ from the species' general pattern.

Patterns of growth and development of the bones and teeth are equally fraught with sources of potential error. While the actual sequence of tooth eruption or long bone epiphyseal union may be well established for the species, the ages at which each stage commences and/or finishes are affected by such things as population density and quantity and quality of feed. Even if the exact age of the archaeological specimen can be established by such methods as counts of annual growth rings in the teeth, the problem of associating the established age with a calendar date remains. The birth period of species covers at least several weeks, sometimes several months, thereby introducing a seasonal plus or minus factor of some weeks.

The use of bivalve mollusc shell growth layers is potentially the most accurate of the available techniques, but as yet is still experimental (Ham and Irvine 1975). For most areas of the west coast control samples of species obtained under known habitat conditions are yet to be obtained. In addition, accuracy in identifying winter check marks (ie. assigning the year's "day 1") in archaeological specimens is often difficult. Nor has an association of these check marks with specific weeks or months yet been clearly established for different areas of the west coast. These points do not even consider the problem of applying present day zoological data to past environments.

It is well to remember in attributing season of exploitation to archaeological faunal assemblages using zoological data, that in most instances we are dealing with the most probable, not the undisputed season of exploitation. The following discussion and data presentation deals with just such probabilities for the Hesquiat assemblages. The assignment of seasonality is based on the information given in Chapter II.

Mammals

The sample size of mammal remains that can be used as season markers is too small to compare assemblages using relative frequencies. Instead, the data are illustrated in a presence/absence table (Table 25). A problem arises in using Fur Seal remains for seasonality markers because it was not possible to distinguish between new born and late term foetal remains. It is my opinion that the size of the remains classified as new born/foetal indicates they are in fact foetal, but this opinion is as yet unsupported by comparative material. If foetal, they indicate an early spring season, if new born, a summer season. For this reason they are classed here as spring/summer.

At DiSo 16 only the spring season is clearly marked. In DiSo 9-I layers all seasons are suggested: spring/summer, fall/winter and definitely winter. In DiSo 9-II layers fall/winter and spring/summer are represented. Fall and winter are represented in the DiSo 1-I layers; all seasons are represented in DiSo 1-II and DiSo 1-III layers, while in the DiSo 1-IV assemblage summer and fall/winter are represented. There are no season markers among the mammal remains from DiSo 1-V.

Table 25. Seasons Represented in the Mammal Fauna of All Assemblages, Presence of Known Age or Migratory Mammals.

Season Represented	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Spring	River Otter < 3 Months	Newborn/ Foetal Fur Seal	Newborn/ Foetal Fur Seal		Newborn/ Foetal Fur Seal	Newborn/ Foetal Fur Seal		
Summer		Deer < 6 Months					Newborn/ Foetal Harbour Seal	
Fall		Juvenile Fur Seal	Juvenile Fur Seal & Raccoon	Juvenile Fur Seal & Harbour Seal	Juvenile Fur Seal & Harbour Seal	Juvenile Fur Seal & Harbour Seal	Juvenile Fur Seal & Harbour Seal	
Winter		Adult ♂ California Sea Lion		Juvenile Northern Sea Lion		Adult Northern Elephant Seal	Juvenile Northern Sea Lion	

Birds

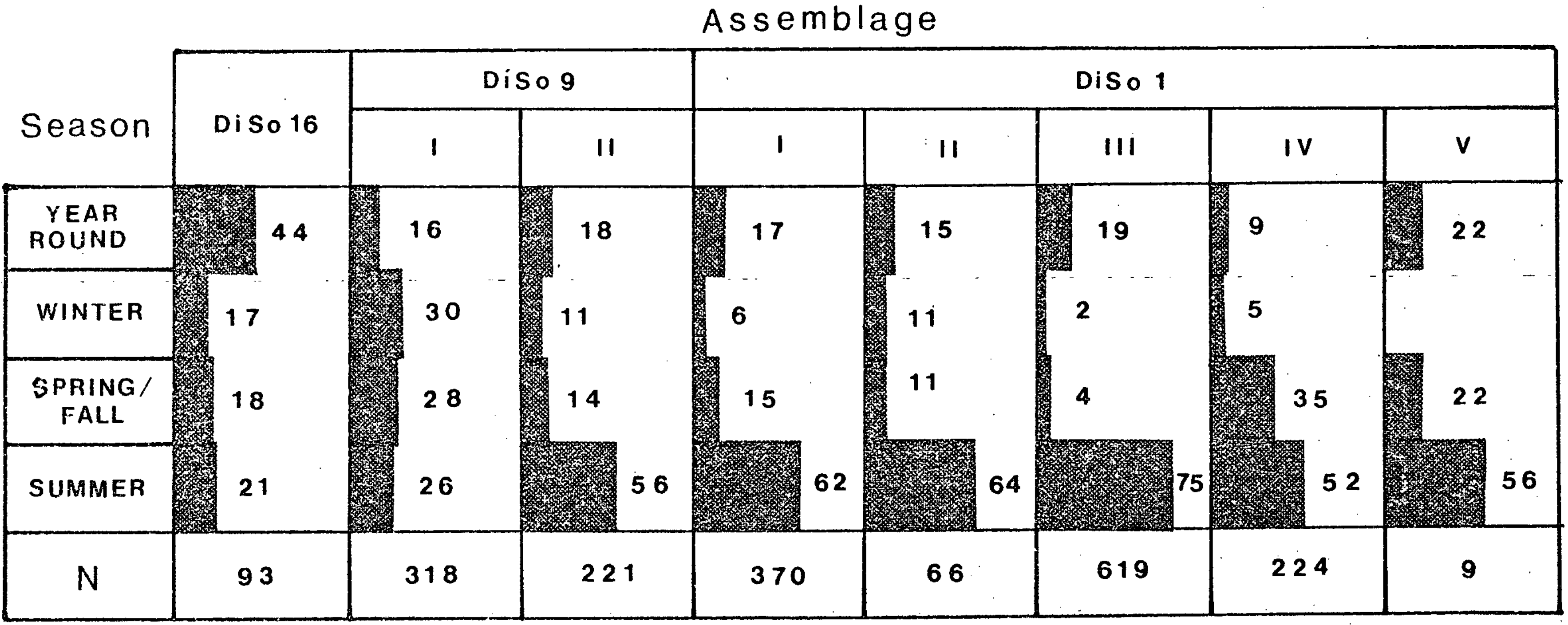
Using the seasonal categories defined in Chapter II, the bird remains from each assemblage were grouped by both bone count and MNI into four categories, Present Year Round (1); Suggesting Winter (2,3,4); Suggesting Spring and/or Fall (5,6) and Suggesting Summer (7,8,9,10). These broad groupings were used to reflect the times of year when the species in question were most likely to be present in their greatest abundance and hence most likely to have been exploited. The results are graphed in Figure 37. (Tables 71 and 72 in Appendix A display the detailed data.)

All four seasonal categories are represented in each assemblage except DiSo 1-V, with a very small sample of 9 bones and 5 individuals. Differences in emphasis, however, are apparent. In all other DiSo 1 assemblages, the category Suggesting Summer accounts for between 52 percent and 75 percent by bone count (42 percent and 43 percent by MNI).

Using bone count, this category also accounts for 56 percent of the bird remains from DiSo 9-II, but using MNI this is reduced to 25 percent. In this case Winter is equally well represented.

In the DiSo 9-I assemblage the three categories Winter, Spring/Fall and Summer are roughly equally emphasized whether using MNI or bone count. The same pattern holds for the DiSo 16 assemblage, but here Year Round is the most emphasized category.

The bird remains, then, suggest a strong emphasis at DiSo 1 of the summer exploitation of birds, while at both other sites the exploitation of birds is more extensively spread throughout the year.



Assemblage

Season	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
YEAR ROUND	44	16	18	17	15	19	9	22
WINTER	17	30	11	6	11	2	5	
SPRING/ FALL	18	28	14	15	11	4	35	22
SUMMER	21	26	56	62	64	75	52	56
N	93	318	221	370	66	619	224	9

Columns total 100%

Figure 37. Season of Availability, Avifauna of all Assemblages, Relative Frequency by Skeletal Element Count.

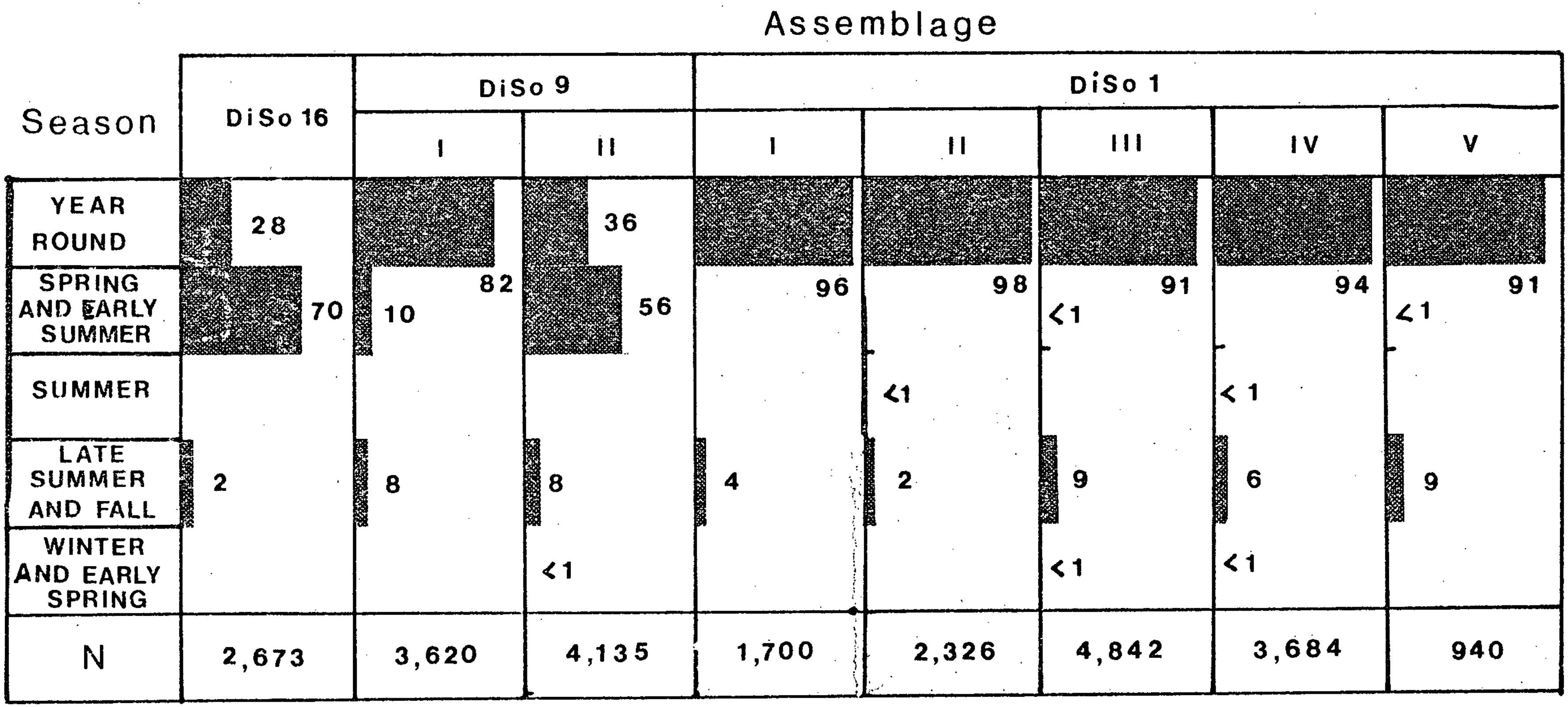
Fish

Few of the fish species can be used as season markers. The possibility of including herring in the relative frequency comparisons is precluded by the differences in sample recovery techniques among the assemblages. Bluefin tuna and salmon can be used, the tuna only being available in summer, coho, chum/dog, and sockeye salmon in late summer and fall, and spring salmon in winter and early spring. Plainfin Midshipman are available in spring and early summer when they are in the intertidal zone for spawning.

The availability of herring in large schools close to shore is restricted to late February through March off the west coast of Vancouver Island. As herring occur in all the assemblages, this season of exploitation is confirmed for all assemblages.

Figure 38 compares fish assemblages according to season of availability with the small fishes herring (Clupeidae), anchovies (Engraulidae) and sardines (Osmeridae) excluded from the sample. (Tables 73 and 74 in Appendix A present the detailed data.) The majority of fish in all the DiSo 1 assemblages are available year round, whether measured by skeletal element count or MNI. By skeletal element count a similar pattern is exhibited by the DiSo 9-I assemblage, but by MNI this pattern is more diffuse with Spring also marked by a high frequency. In the DiSo 16 assemblage, approximately three-quarters of the remains are in the category Spring/Early Summer by both methods of measurement. In the DiSo 9-II assemblage, just over half the remains are in that category, with almost 40 percent in the category Year Round.

The category Fall is not strongly represented in any assemblage. It should be noted here that unspecifically identified salmon remains



Season	DiSo 16	DiSo 9 I	DiSo 9 II	DiSo 1 I	DiSo 1 II	DiSo 1 III	DiSo 1 IV	DiSo 1 V
YEAR ROUND	28	82	36	96	98	91	94	91
SPRING AND EARLY SUMMER	70	10	56			<1		<1
SUMMER					<1		<1	
LATE SUMMER AND FALL	2	8	8	4	2	9	6	9
WINTER AND EARLY SPRING			<1			<1	<1	
N	2,673	3,620	4,135	1,700	2,326	4,842	3,684	940

Assemblage

Herring, anchovy and sardine excluded from the sample.
Early spring is actually represented in all assemblages, by herring (see page 227)
Columns total 100%

Figure 38. Season of Availability, Fish Fauna of All Assemblages, Relative Frequency by Skeletal Element Count.

could not be included in these calculations, thus Fall is underrepresented in all assemblages to some degree. The strength of representation for Spring/Early Summer at DiSo 9 and DiSo 16 is the more surprising in that it represents only one species, the Plainfin Midshipman.

Molluscs

It had been my intention to obtain season of death estimates for selected valves of Native Littleneck and Butter Clam from all sites to determine the seasons of major collection of these two species. Two factors prevented the completion of this study: the number of valves suitable for seasonality studies available from DiSo 1 was too small to be reliable; and after the DiSo 9 and DiSo 16 samples were measured, aged and cross-sectioned, it was found that they differ significantly in size/age correlation from the only comparative biological growth statistics available for estimating average annual amount of growth per age class (Fraser and Smith 1928). In all age classes the average size of the archaeological samples from Hesquiat is smaller than that of the comparable Fraser and Smith samples, often by more than 10 mm (Table 26). This is logical, as all 32 of the beaches sampled in the Fraser and Smith studies were east coast of Vancouver Island, while the archaeological specimens are west coast. While the samples of archaeological valves are sufficient to demonstrate the discrepancy, they are not sufficiently large to construct a reliable table of age correlated mean breadth growths using the archaeological samples themselves. Only 136 valves of Native Littleneck and 122 valves of Butter Clam were aged and measured with sufficient certainty to use in this fashion. When

Table 26. Comparison of Growth Statistics by Age for East Coast Vancouver Island Clams, (based on Fraser and Smith 1928, biological samples from 32 beaches between Victoria and Nanaimo) and West Coast Vancouver Island Clams (based on archaeological specimens from Hesquiat Harbour, dating between A.D. 100 and A.D. 700).

Protothaca staminea Native Littleneck

Age	East Coast Breadth Range	$\bar{X}$ Breadth	West Coast Breadth Range	$\bar{X}$ Breadth
2	19.3-29.2 mm	23.1 mm	15.6-25.9 mm	20.6 mm
3	27.2-39.5 mm	32.0 mm	19.8-30.9 mm	24.2 mm
4	32.6-45.7 mm	38.8 mm	23.1-31.5 mm	27.6 mm
5	38.6-49.9 mm	43.5 mm	24.9-36.9 mm	29.9 mm
6	40.2-53.8 mm	47.1 mm	26.0-45.2 mm	33.5 mm
7	43.6-55.6 mm	50.2 mm	31.5-45.2 mm	35.8 mm

(Fraser and Smith sample for age classes 1 year to 10 years, N=2975)

(Archaeological sample from DiSo 9, N=136)

Saxidomus giganteus Butter Clam

Age	East Coast Breadth Range	$\bar{X}$ Breadth	West Coast Breadth Range	$\bar{X}$ Breadth
2	20.2-28.8 mm	24.5 mm	19.1-25.4 mm	22.2 mm
3	29.4-39.1 mm	34.0 mm	21.7-29.2 mm	26.5 mm
4	35.6-49.7 mm	42.2 mm	25.6-40.0 mm	32.5 mm
5	41.3-57.8 mm	48.7 mm	29.1-42.6 mm	34.4 mm
6	45.3-64.5 mm	54.3 mm	29.7-43.3 mm	37.5 mm
7	48.9-70.5 mm	58.9 mm	37.0-50.1 mm	43.5 mm
8	52.1-75.5 mm	62.9 mm	37.4-53.3 mm	45.9 mm
9	55.1-78.0 mm	66.2 mm	37.2-52.0 mm	43.7 mm
10	57.6-78.5 mm	67.6 mm	44.6-69.6 mm	55.9 mm
11	59.0-78.2 mm	69.0 mm	51.5-61.6 mm	56.6 mm

(Fraser and Smith sample for age classes 1 year to 16 years, N=2523)

(Archaeological sample from DiSo 9, N=122) spread over seven and eleven age classes respectively, these numbers gave results that while consistent, were not deemed inclusive enough to be reliable. As individual specimens often exceed the mean breadth growth increments for appropriate age classes, it was not possible to assign seasonal categories to halves or quarters of predicted growths, the method used by Keen (1979).

The same problem prevented the development of a growth curve from which to assess the proportion of yearly growth achieved, a preferable method of determining sub-annual growth increments. While it would be possible to increase the sample size in each age class by measuring the amount of growth for each year of each specimen and construct a growth curve that could be used predictively, time did not permit returning to the specimens for these data. As the other faunal data indicate that each assemblage contains vertebrate remains from all seasons, and the clam remains are those which differ least among assemblages in frequency of occurrence, the additional shellfish data were not felt essential to the central topic of the study.

A few comments regarding the Butter and Native Littleneck clams from DiSo 9 and DiSo 16, however, can be made. Clams displaying no growth after the last winter check ring were not recorded. My subjective impression, based on the archaeological growth statistics, is that the majority of the valves in both samples display a small to moderate amount of growth after the last winter check ring. This suggests for both DiSo 16 and DiSo 9 (both assemblages), that gathering of these molluscs took place primarily in late spring and summer, confirming the representation of these seasons in these assemblages. Also the clams from DiSo 9-II tend to be older and larger than those from DiSo 9-I

Table 27. Seasons Represented in the Vertebrate Faunal Assemblages.*

Assemblage		Spring	Summer	Fall	Winter	Year Round
				Season		
DiSo 16	M	XXXXXXXXXXX				
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
	F	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXX			XXXXXXXXXXXX
DiSo 9-I	M	XXXXXXXXXXXXXXX		XXXXXXXXXXXXXXXXX		
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
	F	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXX			XXXXXXXXXXXX
DiSo 9-II	M	XXXXXXXXX		XXXXXXXXXXXXXXXXX		
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
	F	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXX		TRACE	XXXXXXXXXXXX
DiSo 1-I	M			XXXXXXXXXXXXXXXXX		
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
	F	XXXXXXXXXXX	XXXXXXXXXXXXXXXX			XXXXXXXXXXXX
DiSo 1-II	M	XXXXXXXXX		XXXXXXXXXXXXXXXXX		
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
	F	XXXXXXXXXXX	XXXXXXXXXXXXXXXX			XXXXXXXXXXXX
DiSo 1-III	M	XXXXXXXXX		XXXXXXXXXXXXXXXXX		
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
	F	XXXXXXXXXXX	XXXXXXXXXXXXXXXX		TRACE	XXXXXXXXXXXX
DiSo 1-IV	M	XXXXXXXXXXXX		XXXXXXXXXXXXXXXXX		
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
	F	XXXXXXXXXXX	XXXXXXXXXXXXXXXX		TRACE	XXXXXXXXXXXX
DiSo 1-V	M					
	B	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				XXXXXXXXXXXX
	F	XXXXXXXXXXX	XXXXXXXXXXXXXXXX			XXXXXXXXXXXX

*Herring remains, representing spring, are considered present in all assemblages. M = Mammal, B = Bird, F = Fish.

and DiSo 16, perhaps suggesting the influence of extensive exploitation on the inner harbour shellfish beds.

Summary

As predicted in Chapter III, all seasons are represented in all assemblages, except in DiSo 1-V, in which winter is not represented. This is likely a factor of sample size. Table 27 summarizes the vertebrate data.

No assemblage is represented by a single season only. This indicates that while there are differences in seasonal emphases among the assemblages, the data do not support the idea that any assemblage is the result of a very restricted seasonal occupation. Thus the assemblages are likely to represent either year round occupations or winter occupations augmented by preserved food. The faunal remains themselves support the former interpretation, in that they contain the bones of animals from all seasons that are unlikely to have been left in the meat, and hence could have been transported, if that meat was preserved. Examples of this are the sea mammal remains, all the bird remains and large fish such as tuna. Further, no species is represented only by anatomical portions, rather than the remains of whole animals, as might mark preserved foods. While food storage patterns may be influencing these data, there is no unequivocal evidence from the faunal remains to indicate so. Rather, the assemblages suggest a variety of species being taken at different times throughout the year, thus the idea that they represent but part of the seasonal round must be rejected. The impression of all assemblages is that of a range of hunting, fowling, fishing and gathering activities being carried out with different species being exploited as seasonally available.

The seasonal variation among the assemblages appears to be the result of the exploitation of different seasonally available resources, rather than of different restricted seasons of occupation.

HABITATS EXPLOITED

It is a thesis of this study that although the Hesquiat faunal assemblages are at least partially contemporary, they represent separate exploitations of faunal resources within differing, culturally bounded, territorial units of the same regional cultural adaptation. It is contended that the different habitats contained within these discrete territorial units and exploited by the site inhabitants, are the major factor contributing to interassemblage differences in faunal remains. The territorial units are drawn by socio-cultural boundaries limiting access to resource locations to particular groups of people associated with specific habitation sites. Thus the groups effectively exploit, and are adapted to, differing sub-regional resource bases.

The types of faunal assemblages one would expect at each site, provided that the ethnographic system of land use and/or ownership was already in operation, and given a relatively stable environment, were described in Chapter III (pages 21 to 64). We have seen that some of the variation detailed in Chapter V can be attributed to seasonal variation in availability of resources, to sample error, and to a changing local environment. It remains to determine whether or not the faunal assemblages differ markedly among themselves in the exploitation of different Habitat Categories as defined in Chapter II (pages 19 to 64) and compare the results with those expected.

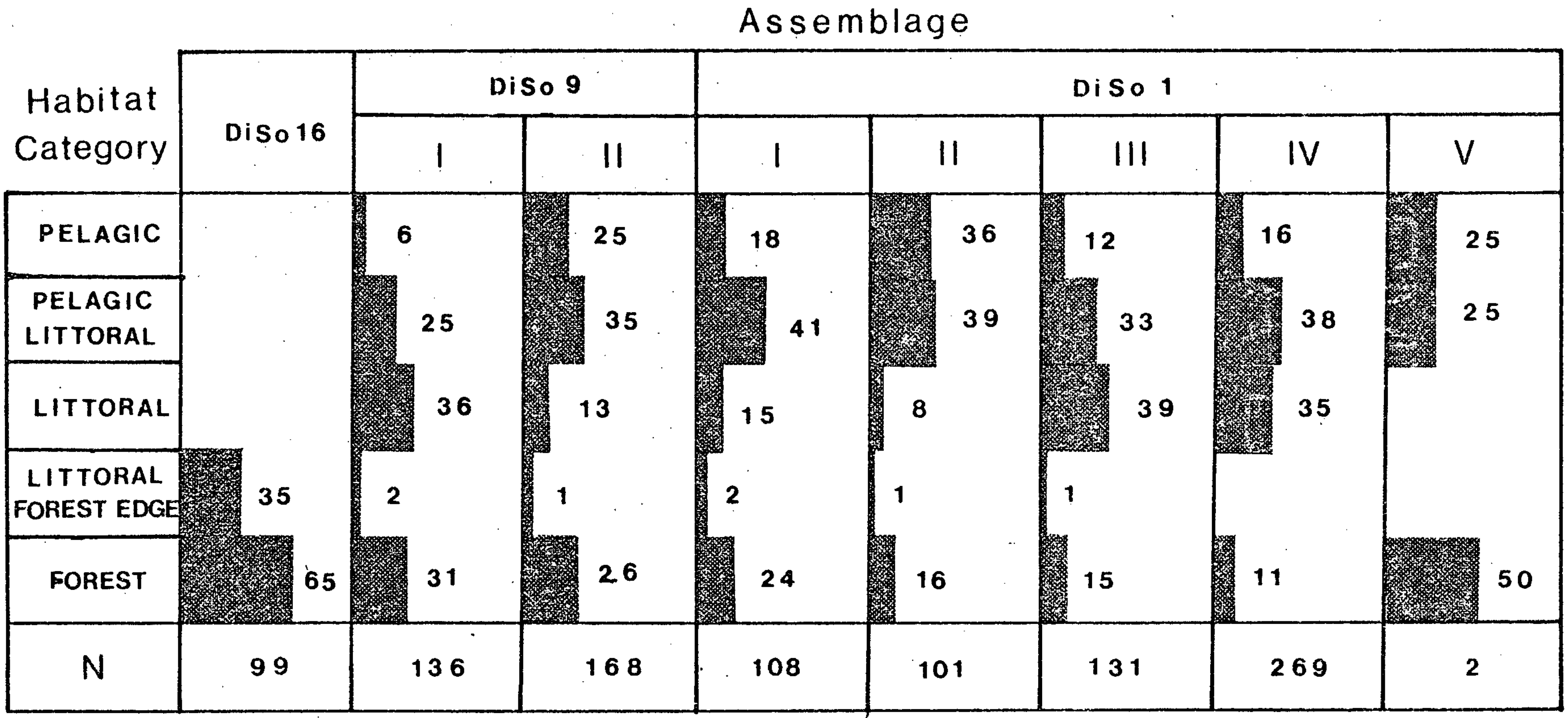
It was predicted that at DiSo 1, the assemblages would rank the Pelagic and Pelagic/Littoral/combined vertebrate habitat categories first and second in importance, followed by Littoral, then Streams/Lakes/Forests, and finally Littoral/Forest Edge. At DiSo 16, Streams/Lakes/Forests was expected to rank first in importance, followed by Littoral, then Littoral/Forest Edge, then Pelagic/Littoral fourth. The Pelagic category was not expected to be represented at either DiSo 16 or DiSo 9. At DiSo 9, it was predicted that the category Littoral would rank first in importance, followed by Streams/Lakes/Forests, then Littoral/Forest Edge, then Pelagic/Littoral. It was also predicted that the DiSo 16 assemblage would be less varied than the DiSo 9 assemblage, although both would be similar. Emphases on Exposed Shores shellfish species at DiSo 1 and Sheltered Shores species at both DiSo 9 and DiSo 16 also were predicted.

Vertebrate Fauna

Using the definitions presented in Chapter II, the vertebrate faunal remains of all assemblages were grouped according to the species' preferred habitat, within the major groupings of bird, fish and mammal taxa. The results provided by skeletal element count are presented in Figures 38 to 41 (see also Tables 75 to 81 in Appendix A). As one would expect, fish and bird species more sharply differentiate among the assemblages than mammals, but in all three vertebrate cases the pattern is clear and similar. These patterns are displayed in Figures 39, 40 and 41. Tables 75 to 81 in Appendix A give the figures for both skeletal element count and MNI.

For the mammals (Figure 39), the DiSo 16 assemblage is exclusively within two categories, Littoral/Forest Edge and Forest. The DiSo 9-I assemblage is different, with approximately equally strong representation in Forest Littoral, and Pelagic-Littoral categories, but also some representation in Pelagic and Littoral/Forest Edge categories. DiSo 9-II appears to be grouped with the DiSo 1 assemblages in emphasizing the categories Pelagic and Pelagic-Littoral most strongly. It should be noted that the DiSo 9-II Pelagic category is exclusively Northern Fur Seal, which may also have been taken in the Pelagic-Littoral environment. Because it is not possible to determine exactly where these animals were being taken, their numbers are equally split between these two categories in all assemblages where they occur. If bone count is used, there also appears to be a slight shift with DiSo 1 assemblages from earlier to more recent, from Littoral to Pelagic categories. It should also be noted that the category Pelagic at DiSo 1 is underrepresented in all assemblages, as the graph does not take into account the quantities of non-specifically identified whale and porpoise (Cetacea) remains recovered from these deposits. MNI frequencies do not differ appreciably from the skeletal element count figures.

The pattern for bird remains, using skeletal element count, more clearly separates the DiSo 1 assemblages from the two DiSo 9 assemblages, and all these from DiSo 16 (Figure 40). At DiSo 16 there is a clear emphasis on Open Littoral Water and Sheltered Littoral Waters avifauna. At DiSo 9, while these two categories are also the most strongly emphasized, both assemblages display a stronger emphasis on the former category and Pelagic avifauna occur more frequently. DiSo 9-II differs from DiSo 9-I in having a higher percentage of remains from Sheltered Littoral



Habitat Category	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
PELAGIC		6	25	18	36	12	16	25
PELAGIC LITTORAL		25	35	41	39	33	38	25
LITTORAL		36	13	15	8	39	35	
LITTORAL FOREST EDGE	35	2	1	2	1	1		
FOREST	65	31	26	24	16	15	11	50
N	99	136	168	108	101	131	269	2

Columns total 100%

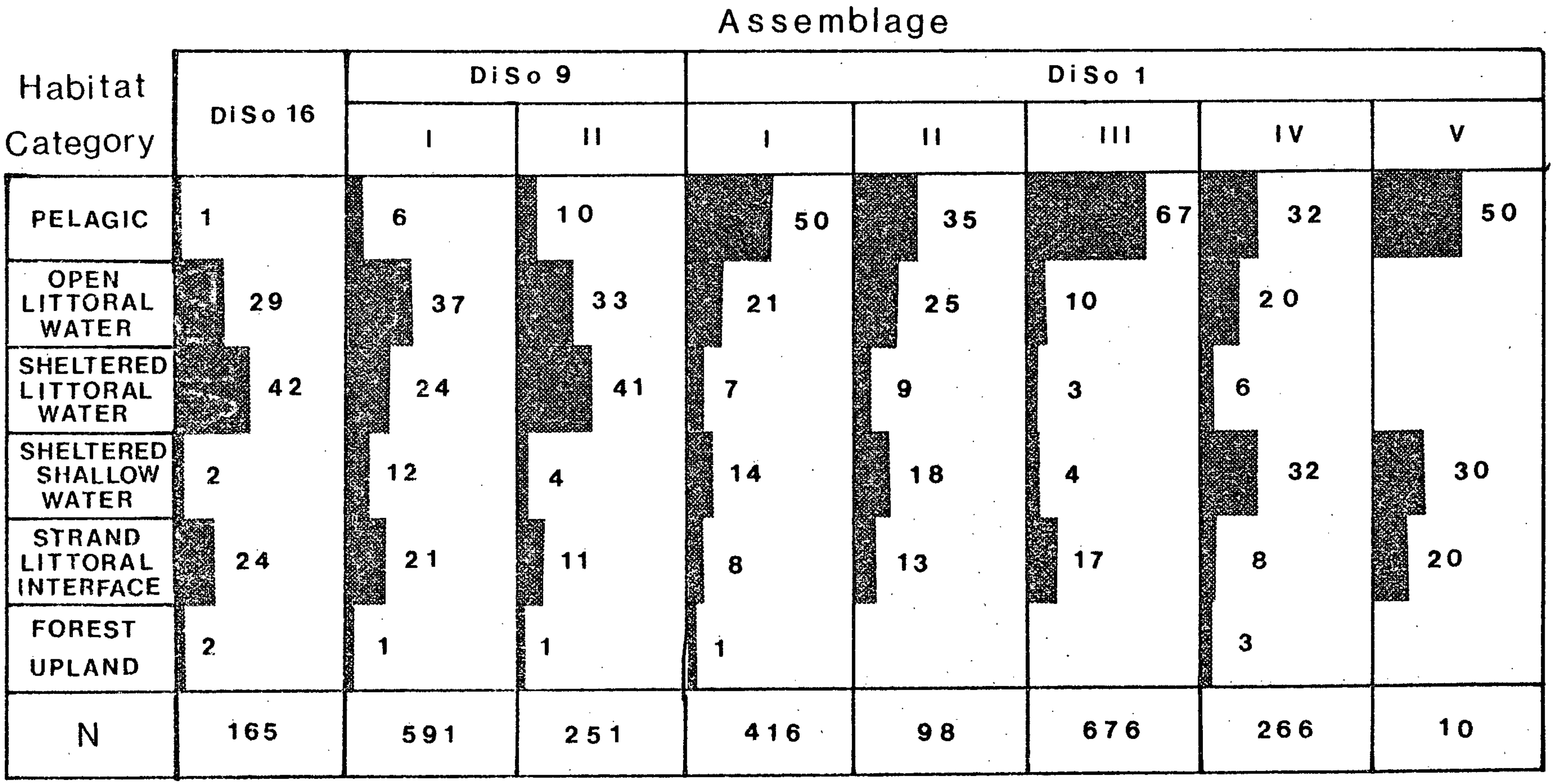
Canis familiaris is excluded.

Figure 39. Relative Frequency of Identified Mammal Remains, Habitat Category by Assemblage, Skeletal Element Count.

Waters species, and a lower percentage of remains from Strand/Littoral Interface species. In all DiSo 1 assemblages the Pelagic avifauna are much more strongly represented, Open Littoral Water avifauna are favoured, and those frequenting Sheltered, Shallow Water habitats are well represented. This latter category includes water meadows, lakes and tidal flats, some of which would be available in the Village Lake area both before and after the full development of the lake basin. In all assemblages the Strand/Littoral Interface avifauna are frequently occurring species.

Fish remains, with herring included in the sample, group the assemblages as clearly as do the avifauna (Figure 41). DiSo 16 is separated from both DiSo 9 assemblages, while all of these assemblages are separated from the DiSo 1 assemblages. At DiSo 16, 70 to 80 percent of the fish remains (Tables 79 and 80) are in two categories, Moderately Deep Water Over Varied Bottom, and Intertidal Over Boulder Bottom. No other assemblage emphasizes these categories so strongly. Both DiSo 9 assemblages strongly emphasize the category Intertidal with Soft Bottom, with a lesser emphasis on the category Moderately Deep Water over Varied Bottom. These two assemblages also more strongly emphasize the category Streams than do other assemblages. At DiSo 1, all assemblages display a heavy emphasis on the single category Moderately Deep Water Over Rocky Bottom. In DiSo 1-III, there is also an emphasis on the category Intertidal with Soft Bottom.

If herring, anchovy and sardine are excluded from the sample to compensate for differing recovery techniques (Figure 42), assemblages are still grouped in the same fashion, but both DiSo 9 assemblages display a greatly increased emphasis in the category Moderately Deep Water



Habitat Category	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
PELAGIC	1	6	10	50	35	67	32	50
OPEN LITTORAL WATER	29	37	33	21	25	10	20	
SHELTERED LITTORAL WATER	42	24	41	7	9	3	6	
SHELTERED SHALLOW WATER	2	12	4	14	18	4	32	30
STRAND LITTORAL INTERFACE	24	21	11	8	13	17	8	20
FOREST UPLAND	2	1	1	1			3	
N	165	591	251	416	98	676	266	10

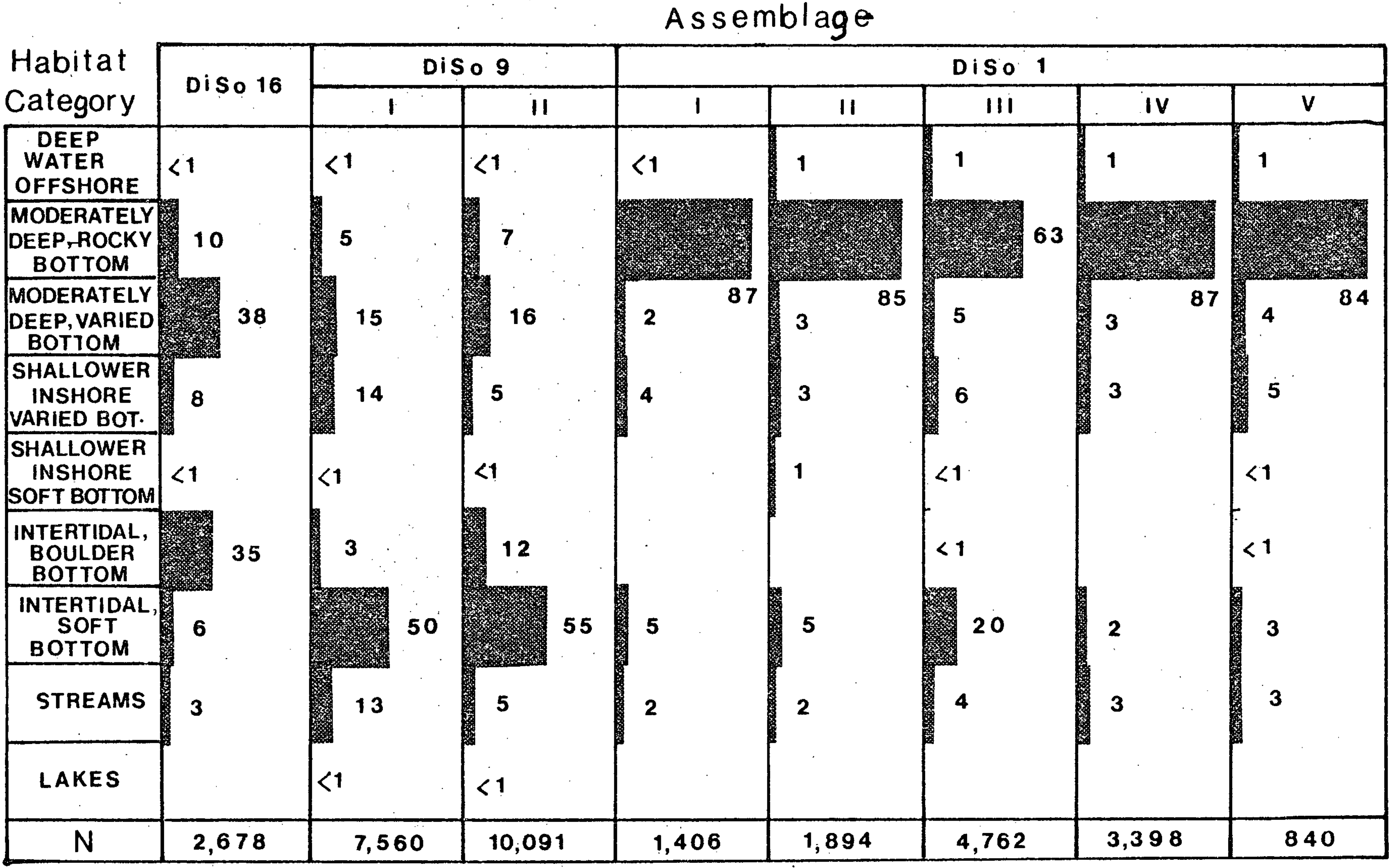
Columns total 100%

Figure 40. Relative Frequency of Identified Bird Remains, Habitat Category by Assemblage, Skeletal Element Count.

Over Varied Bottom and less increases in the categories Shallower Inshore Waters Over Varied Bottom, and Streams. Other assemblage emphases remain the same, except for DiSo 1-III, where the removal of herring decreases the frequency of category 7 and increases category 2.

For DiSo 16 and DiSo 1, these findings fit well with the exploitation from each site of the immediate site environment. The DiSo 9 data suggest a more complicated pattern. To further clarify the picture, the total specifically identified vertebrate sample, excluding herring, anchovy, sardine, dogfish, ratfish and <u>Canis</u> sp., was grouped under the more inclusive Major Habitat Categories (see Chapter II, page 65) of Pelagic, Pelagic-Littoral, Littoral, Littoral/Forest Edge, and Streams/Lakes/Forests, using skeletal element count. The percentages, displayed in Figure 43, are obtained by combining the percentages for bird, fish and mammal categories and standardizing them on a base of 300, rather than returning to individual sample skeletal element counts. This was done to compensate for vastly differing sample sizes between fish remains and other vertebrate remains.

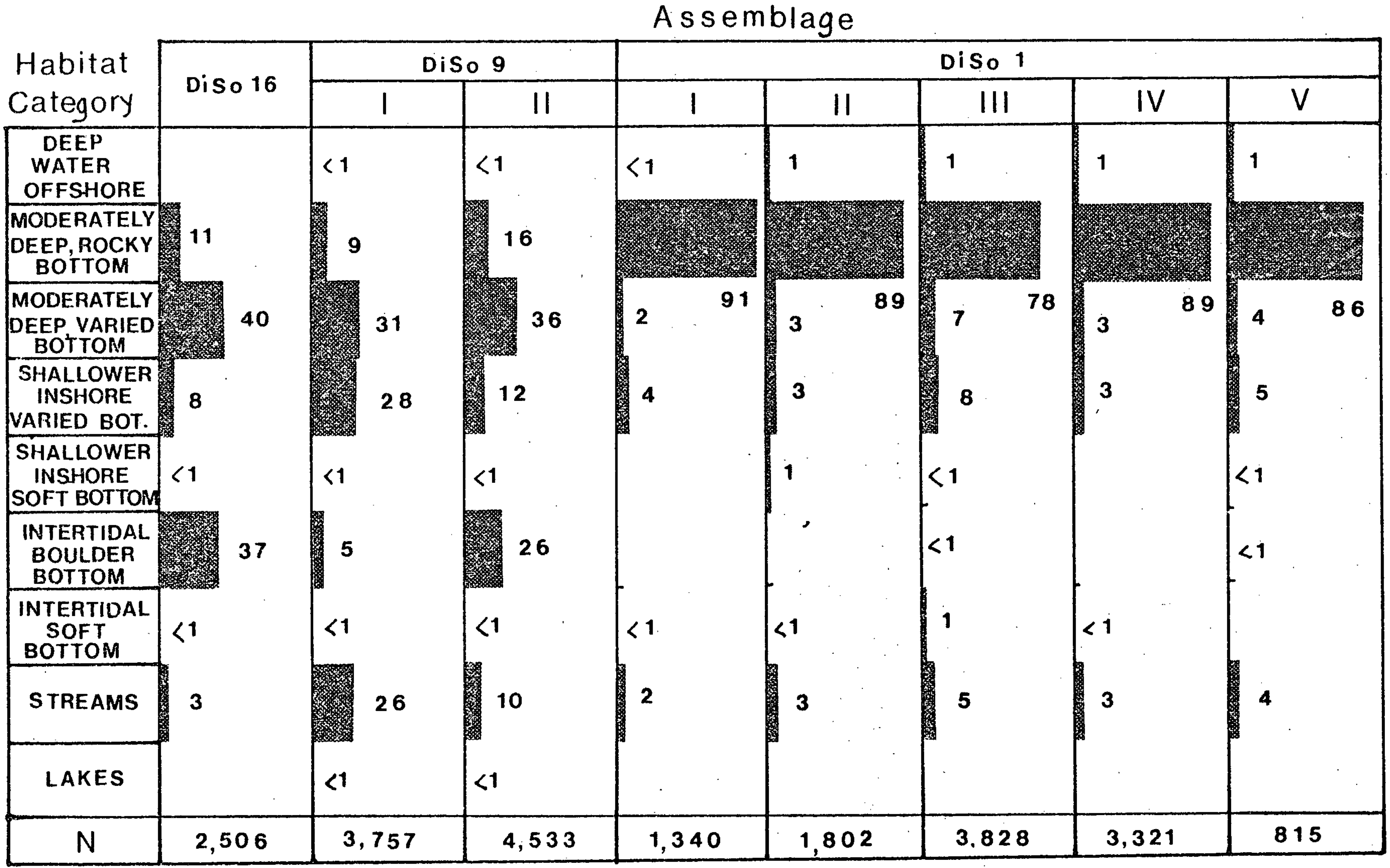
All DiSo 1 assemblages are grouped together, with between 55 and 75 percent of their vertebrate faunal remains occurring in the Pelagic/Littoral and Pelagic categories. Major emphasis in both DiSo 9 assemblages is the category Littoral, comprising 44 percent at DiSo 9-I and 35 percent at DiSo 9-II. In DiSo 9-I a further 27 percent is made up of the category Streams/Lakes/Forests. In both DiSo 9 assemblages the frequencies in the category Pelagic/Littoral are considerably less than in the DiSo 1 assemblages but higher than that of the DiSo 16 assemblage. A larger proportion of the DiSo 9-II assemblage than of the DiSo 9-I assemblage is in the Pelagic and Pelagic/Littoral categories.



Columns total 100%

Dogfish and Ratfish are excluded. Where species occur in more than one category, the number of bones is divided equally among the categories.

Figure 41. Relative Frequencies of Identified Fish, Habitat Category by Assemblage, Skeletal Element Count.



Habitat Category	DiSo 16	DiSo 9 I	DiSo 9 II	DiSo 1 I	DiSo 1 II	DiSo 1 III	DiSo 1 IV	DiSo 1 V
DEEP WATER OFFSHORE		<1	<1	<1	1	1	1	1
MODERATELY DEEP, ROCKY BOTTOM	11	9	16	91	89	78	89	86
MODERATELY DEEP VARIED BOTTOM	40	31	36	2	3	7	3	4
SHALLOWER INSHORE VARIED BOT.	8	28	12	4	3	8	3	5
SHALLOWER INSHORE SOFT BOTTOM	<1	<1	<1		1	<1		<1
INTERTIDAL BOULDER BOTTOM	37	5	26			<1		<1
INTERTIDAL SOFT BOTTOM	<1	<1	<1	<1	<1	1	<1	
STREAMS	3	26	10	2	3	5	3	4
LAKES		<1	<1					
N	2,506	3,757	4,533	1,340	1,802	3,828	3,321	815

Columns total 100%

Dogfish and Ratfish excluded.

Figure 42. Relative Frequency of Fish Excluding Sardine, Anchovy and Herring, Habitat Category by Assemblage, Skeletal Element Count.

The groupings Littoral and Littoral/Forest Edge comprise 31 and 32 percent respectively of the DiSo 16 sample. Of interest are the higher frequencies at DiSo 9 and DiSo 16 in the category Streams/Lakes/ Forests, reflecting in part the higher frequencies of salmon in these assemblages (see also Tables 82 and 83, Appendix A).

These calculations suggest a strong association between the DiSo 1 assemblages and the Pelagic and Pelagic/Littoral habitats, while both DiSo 9 assemblages are associated with the Pelagic/Littoral and Littoral categories, and the DiSo 16 assemblage is associated with Littoral, Littoral/Forest Edge, and Streams/Lakes/Forests habitats.

A further measure of these associations was made by using weight of animals represented. This was done to examine the possibility that while a higher frequency of individuals was being taken from a particular habitat, it did not represent a higher proportion of meat. The calculations were designed to provide at least a gross measure of relative importance of the habitat categories for each assemblage in producing vertebrate meat, rather than to arrive at accurate statistics of useable meat represented. Such measures are so fraught with potential error as to be highly suspect (Smith, B.D. 1975:101; Lyman 1979:537-538; Stewart and Stahl 1977). Accordingly, mean live weights of species or groups of species were used, not useable meat ratios such as those suggested by White (1953) or Lyman (1979:539).

In Chapter II, weight classes for fish were given (Table 7); mean weights and ranges of weights for male and female adult mammals were given (Table 2); and mean weights and ranges for female and male birds combined were given (Table 4). To calculate the body weight represented

Combined Vertebrate Habitat Category	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
PELAGIC	1	4	12	23	24	27	16	18
PELAGIC LITTORAL	13	24	28	51	51	40	49	37
LITTORAL	31	44	35	14	14	20	26	21
LITTORAL FOREST EDGE	32	9	13	3	5	6	3	26
STREAM LAKE FOREST	23	27	12	9	6	7	6	18
N	2,770	4,484	4,952	1,864	2,001	4,635	3,766	827

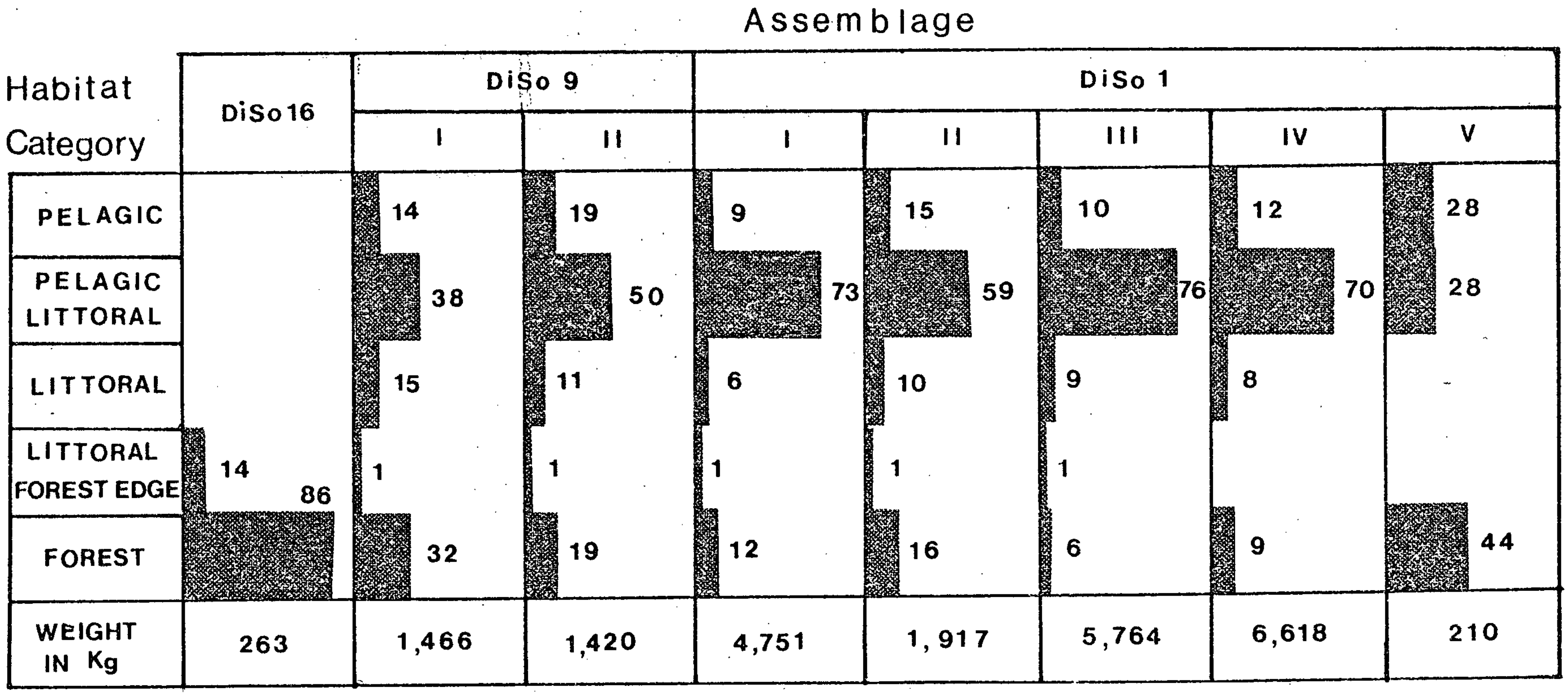
Columns total 100%
Excludes herring, anchovy, dogfish, ratfish and dog.

Figure 43. Relative Frequency of Bird, Fish and Mammal Remains, Habitat Category by Assemblage, Skeletal Element Count.

for a habitat category in the archaeological fish samples, assemblage MNI's for fish species were multiplied by the mean of the appropriate fish weight class. All halibut were taken to be female. For mammals, adult male and female means were used for adult individuals of known sex; the mean of male and female means for adult and sub-adult individuals of unknown sex; half of this mean for juveniles; and half again for newborn/foetal individuals. For birds, a single species mean was used. Figures 44, 45, and 46 present the results of these calculations. (See also Tables 85 to 87 in Appendix A.) It is obvious that while percentages certainly differ from those of skeletal element relative frequencies, the overall pattern of interassemblage variation, and the association of each assemblage with particular habitat categories remains essentially the same.

The pattern is equally clear if bird, fish and mammal weights are added together in the more inclusive Major Habitat Categories and percentages calculated for each category based on the total assemblage weight. This compensates for the proportion of weight contributed to the total by each major taxon, a compensatory measure necessary, as birds contribute only one to five percent of the total weight (Table 84, Appendix A). The results of these calculations are displayed in Figure 47 (see also Table 88, Appendix A).

As with the individual major taxa percentages, the combined vertebrate faunal weight percentages show the same strong association between DiSo 1 assemblages and Pelagic and Pelagic/Littoral habitats; between DiSo 9 assemblages and Pelagic/Littoral and Littoral habitats; and between DiSo 16 and Littoral and Streams/Lakes/Forests habitats. The differences between DiSo 9-I and DiSo 9-II assemblages are also



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Canis familiaris and Orcinus orca excluded.

Figure 44. Relative Frequency of Mammal Remains, Habitat Category by Assemblage, Animal Weight.

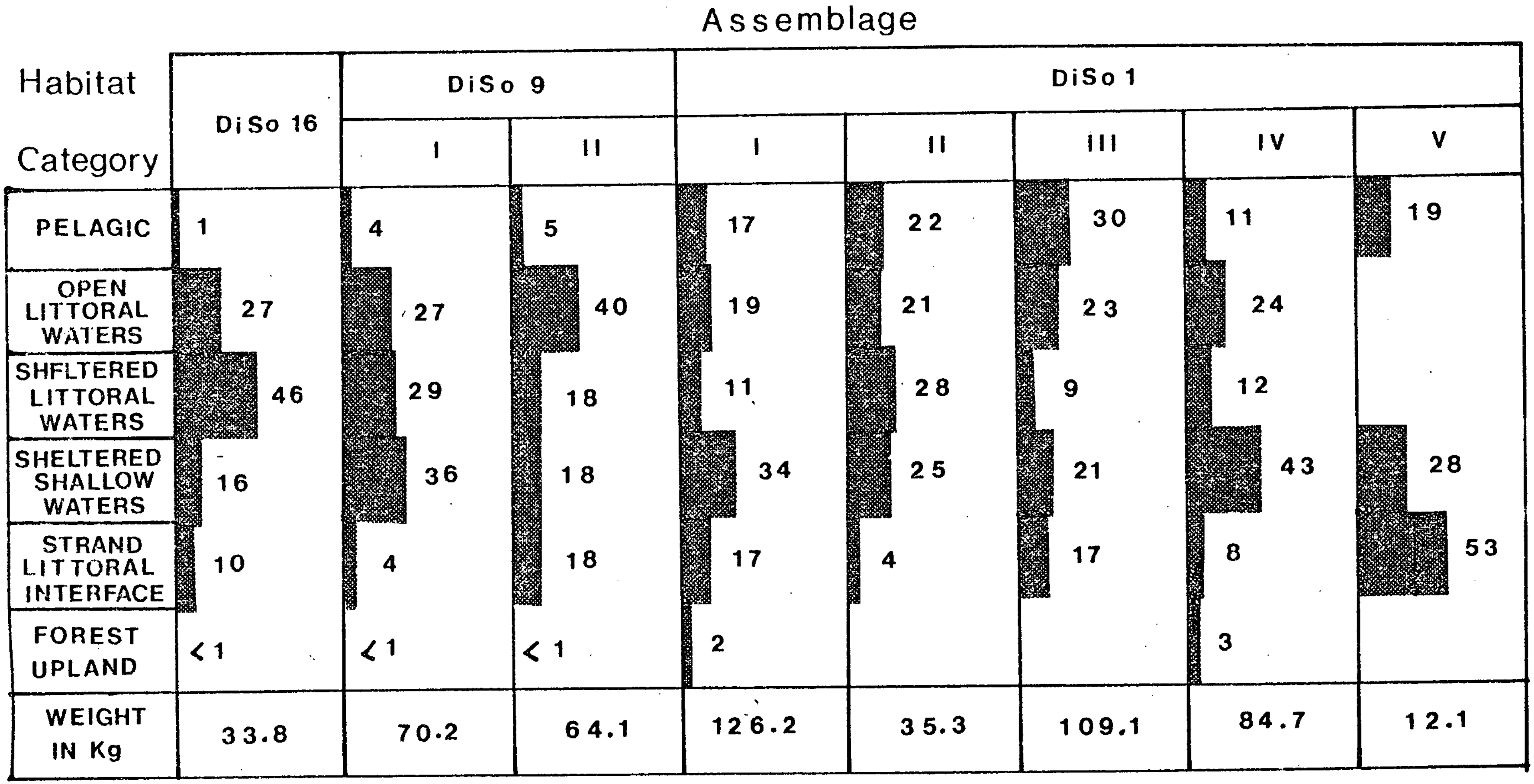

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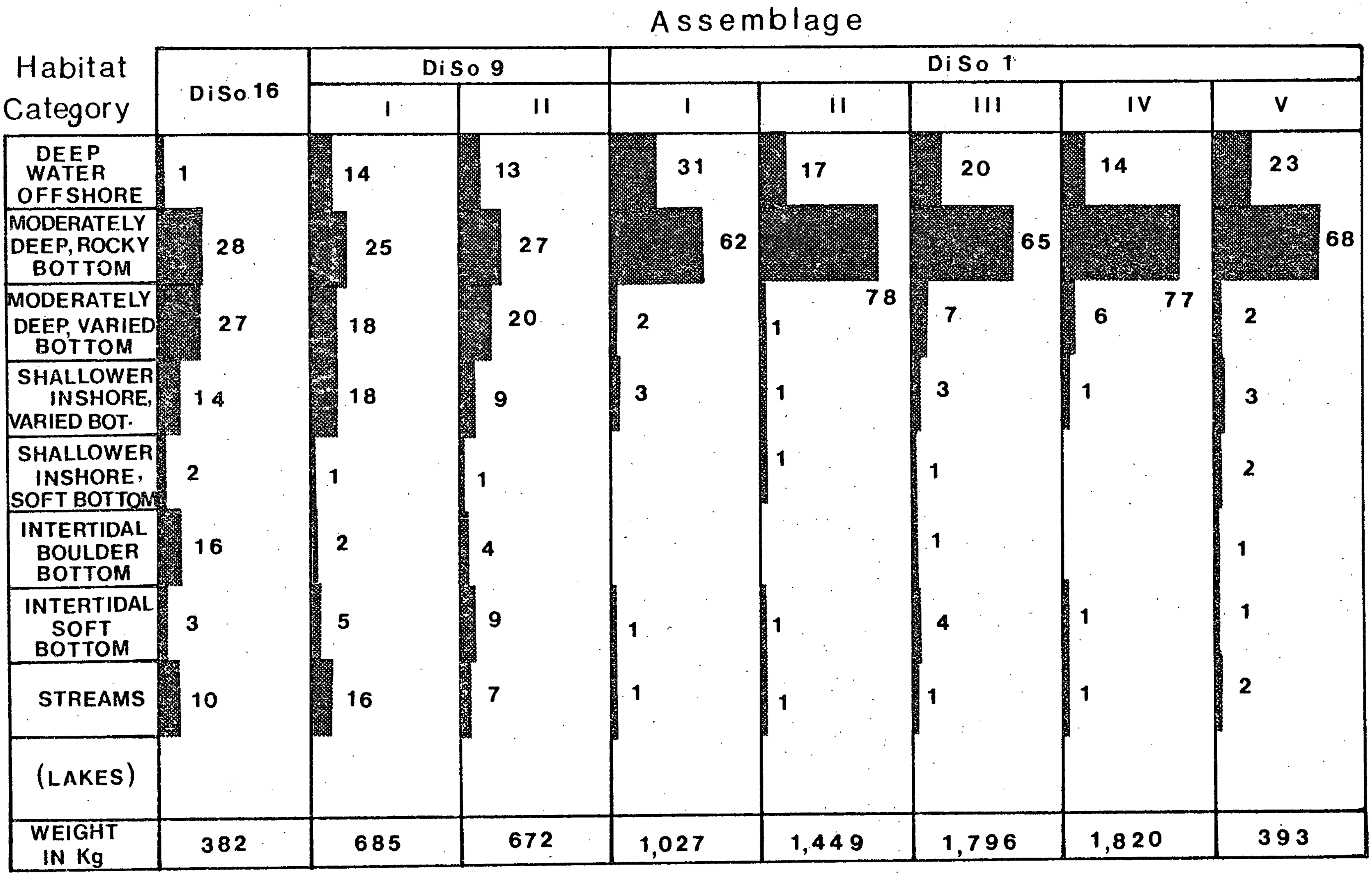
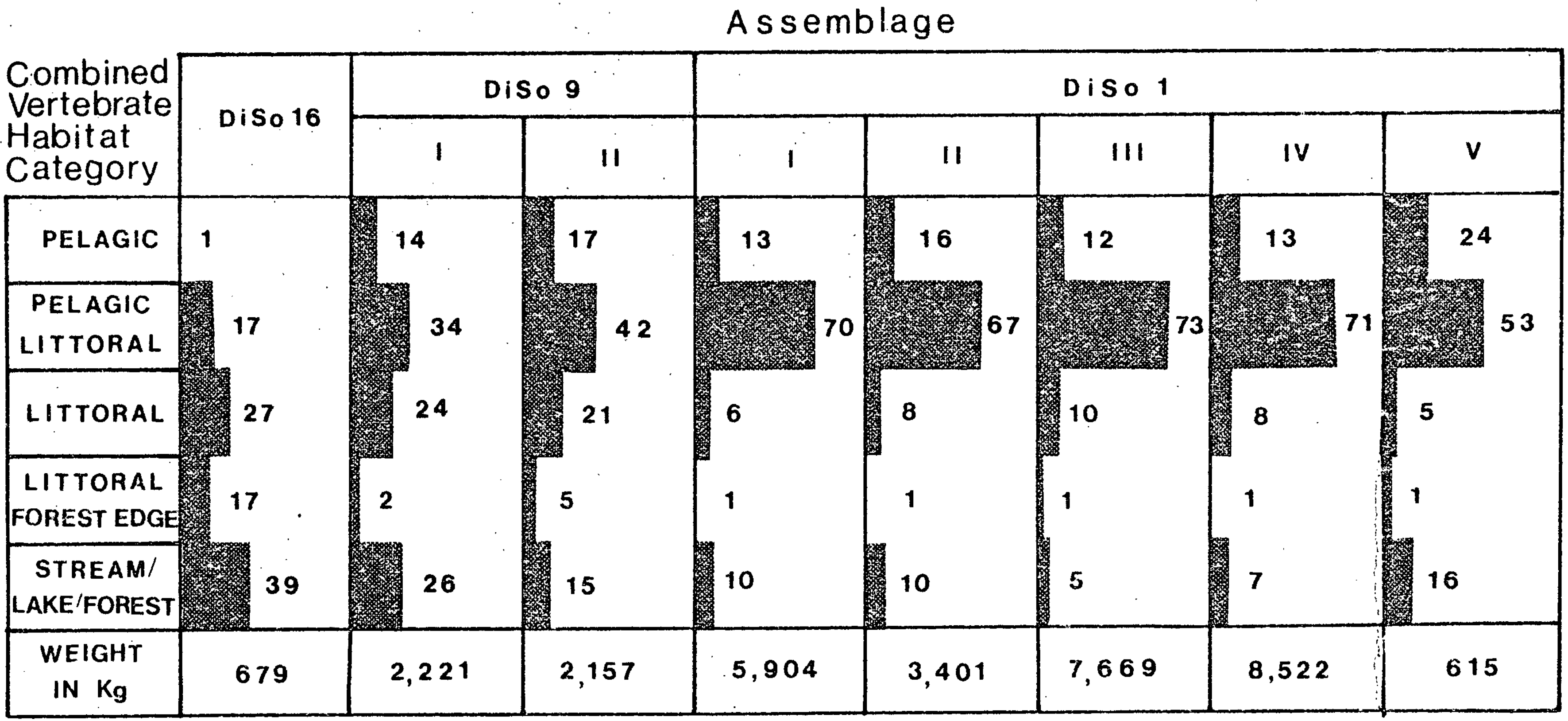
Figure 45. Relative Frequency of Bird Remains, Habitat Category by Assemblage, Animal Weight.



Columns total 100%. Dogfish and Ratfish excluded.

Figure 46. Relative Frequency of Fish Remains, Habitat Category by Assemblage, Animal Weight.



	Assemblage							
Combined Vertebrate Habitat Category	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
PELAGIC	1	14	17	13	16	12	13	24
PELAGIC LITTORAL	17	34	42	70	67	73	71	53
LITTORAL	27	24	21	6	8	10	8	5
LITTORAL FOREST EDGE	17	2	5	1	1	1	1	1
STREAM/ LAKE/FOREST	39	26	15	10	10	5	7	16
WEIGHT IN Kg	679	2,221	2,157	5,904	3,401	7,669	8,522	615

Columns total 100%
Excludes Dogfish, Ratfish and Dog.

Figure 47. Relative Frequency of Bird, Fish and Mammal Remains, Combined Habitat Category by Assemblage, Animal Weight.

clearly illustrated, with the latter displaying a stronger association with Pelagic/Littoral and Pelagic habitats while DiSo 9-I shows a stronger association with Streams/Lakes/Forests habitats.

Summary of Vertebrate Patterns

There can be no doubt that the inhabitants of DiSo 1, throughout its occupation, were obtaining the majority of their vertebrate resources from Pelagic and Pelagic/Littoral habitats. The percentages range from 74 to 85 percent by animal weight and from 55 to 75 percent by skeletal element count. Again, the reader is reminded that these percentages do not include whale remains, as no reasonable method of quantifying these remains was devised. If such remains were included, undoubtedly these two categories in DiSo 1 assemblages would be even more strongly emphasized.

Those who deposited the DiSo 9 assemblages were exploiting the Pelagic/Littoral and Littoral habitats most heavily, obtaining between 58 and 63 percent, by animal weight, or between 63 and 68 percent, by skeletal element count, of their faunal resources from these two habitat categories. They were also exploiting the Streams/Lakes/Forests habitats more intensively, with 15 to 26 percent (by weight) or 12 to 27 percent (by element count) of the vertebrates taken from these habitats. DiSo 9-I emphasized these habitats more than DiSo 9-II, while the latter emphasized the Pelagic and Pelagic/Littoral habitats more strongly.

The people who deposited the DiSo 16 assemblage clearly emphasized Littoral, Littoral/Forest Edge and Streams/Lakes/Forests habitats, with limited use of animals more commonly found in the Pelagic/Littoral environments, but little or no exploitation of the Pelagic habitat.

Shellfish Fauna

The pattern of shellfish exploitation is not as clear, as there were in all assemblages strong emphases on two main species of clam, Native Littleneck and Butter Clam, inhabitants of sheltered, muddy sand and gravel beaches. Pockets of such habitat are found nearly everywhere in Hesquiat Harbour, even in little, relatively sheltered bays on the outer coast as well as in the more obviously suitable inner harbour. It has been remarked that DiSo 9 and DiSo 16 assemblages all contain higher proportions than DiSo 1 assemblages of Native Littleneck, a species that favours a slightly more sheltered, muddy sand, habitat than Butter Clam. There are also a few other indications that shellfish in the DiSo 1 assemblages were obtained primarily from the outer coast habitats, while those of DiSo 9 and DiSo 16 assemblages were obtained more frequently from sheltered shores.

DiSo 1 was the only site at which sea urchin test and spine fragments were consistently noted, although not collected for quantitative analysis. Chitons are also more frequent in the DiSo 1 assemblages. Bay mussel, preferring sheltered rocky shores and tolerating less saline water conditions, was recovered from DiSo 9 and DiSo 16 assemblages, but occurred rarely in the DiSo 1 assemblages. At DiSo 16 and DiSo 9-I it is 24 percent of the mussel sample, at DiSo 9-II, 7 percent (Table 28). The remainder of these samples is California Mussel, a species not found inside the harbour today.

While the very high relative frequency of California Mussel at DiSo 9 might be explained as the result of resource exploitation in a more extensive territory than the inner harbour, as is possibly suggested by the vertebrate sample from this site, the high frequency at DiSo 16 is not paralleled by such vertebrate evidence. As there is a change from DiSo 9-II to DiSo 9-I, from less Bay Mussel to more Bay Mussel, a trend continued by the DiSo 16 sample, it would seem that perhaps gradual environmental change as discussed on pages 218 to 221 , resulting in a habitat less and less favourable for California Mussel, is the best explanation of this archaeological pattern and present day distributions. The increase in relative frequency of Native Littleneck Clam from DiSo 9-II to DiSo 9-I also may support this interpretation.

Table 28. Major Habitat Categories for Shellfish, All Assemblages, Relative Frequency by Weight in Grams.

	Habitat Categories					
Assemblage	Clams		Mussels		Sea Snails	
	Exposed (1,3)	Sheltered (2,4,5)	Exposed (1,3)	Sheltered (2,4,5)	Exposed (1,3)	Sheltered (2,4,5)
DiSo 16	-	100	76	24	39	61
DiSo 9-I	-	100	77	24	52	48
DiSo 9-II	<1	99.9	93	7	36	64
DiSo 1-I	<1	99.9	100	-	49	51
DiSo 1-II	-	100	100	-	65	35
DiSo 1-III	<1	99.9	99	1	35	65
DiSo 1-IV	-	100	100	-	61	39
DiSo 1-V	-	100	-	100*	66	34

Rows total 100% within categories of clam, mussel and sea snail.
*This percentage is unreliable as based on a sample of only 0.1 g.

The frequencies of sea snails also tend to distinguish the DiSo 1 assemblages from the DiSo 16 and DiSo 9 assemblages, although the pattern is certainly not marked. The latter assemblages tend to have slightly higher frequencies of species favouring more sheltered shores, while DiSo 1 assemblages have slightly greater abundances of species favouring more open habitats (Table 28). Sample sizes of limpets are not sufficient to present reliable patterns.

If the percentages of all classes of shellfish are combined for the two major habitat categories Exposed Shores and Sheltered Shores, the resulting pattern generally distinguishes DiSo 1 assemblages, favouring Exposed Shores species, from the DiSo 9 and DiSo 16 assemblages, favouring Sheltered Shores species, but the pattern is not sufficiently marked to be statistically significant (Table 29).

Table 29. Combined Shellfish Habitat Categories by Assemblage, Relative Frequency by Weight in Grams within Faunal Classes.

Assemblage	Habitat Categories	
	Exposed Shores	Sheltered Shores
DiSo 16	39	61
DiSo 9-I	45	55
DiSo 9-II	41	59
DiSo 1-I	50	50
DiSo 1-II	58	42
DiSo 1-III	42	58
DiSo 1-IV	56	44
DiSo 1-V	33	67

All rows total 100%. DiSo 1-V is a very small sample.

The DiSo 1-III assemblage stands out from the other DiSo 1 assemblages in having higher frequencies of Sheltered Shore species. This probably reflects the development of sheltered tidal flats and little embayments associated with the development of the Village Lake basin and associated land mass. The sample of shellfish from DiSo 1-V is much too small to be reliable.

Summary of Shellfish Patterns

Although the pattern of association between assemblages and habitat categories is not as strongly marked for shellfish fauna as for vertebrate fauna, it does follow the expected pattern, with DiSo 1 assemblages favouring more exposed habitat species than the DiSo 9 and DiSo 16 assemblages. In all assemblages, however, the emphasis on clam species favouring sheltered habitats far outweighs the minor patterns of sea snail, limpet and mussel variation. This is a clear case of a major food resource being exploited wherever and whenever it can be obtained. It also reflects the more discontinuous distribution of small areas of habitat suitable for clams throughout the Hesquiat Harbour area (see Figure 7). The changes in frequency between DiSo 9-II and DiSo 9-I do support the suggestion of a gradually changing inner harbour environment that is becoming more sheltered through time with the development of the Anton's Spit area. This geomorphological change is also seemingly reflected in the DiSo 1-III assemblage, which would be roughly contemporary with the final stages of development of the Village Lake basin cut-off.

DISCUSSION OF RESULTS

On the basis of the patterns of variation illustrated in this chapter, it is possible to say that the predictions of assemblage/habitat associations are confirmed. These associations explain a major proportion of the interassemblage variation in faunal remains.

Seasonal variations, while present, do not satisfactorily explain the patterns of variation. As predicted, all seasons are represented in all assemblages, thus negating the possibility that the assemblage differences result from differing, restricted seasons of exploitation. The different assemblages do display differing emphases in season of exploitation, but these relate to the seasonal availability of particular species, rather than total assemblage emphasis on a particular limited portion of the year.

At DiSo 9-I, for example, both spring and fall are strongly represented by fish (herring and salmon), while mammal and bird remains indicate exploitation throughout the year as well. The seasonal variation observed is best considered resulting from the exploitation of different seasonally available resources, rather than from different, restricted seasons of occupation. In other words, the seasonal variation is dependent on the habitats being exploited, rather than vice versa. The only possible exception to this is DiSo 9-II, whose faunal assemblages suggest a more intensive use of Pelagic and Pelagic/Littoral resources during the spring (fur seal) and summer (birds) months. This seasonal pattern supports the interpretation that this assemblage represents exploitation from a wider territory than that of the inner harbour alone.

Similarly, differences in artifact assemblages relevant to food procurement were found to be dependent on the differing activities being carried out at the different sites. Changes in material culture, whether in artifact manufacturing technology or knowledge of particular artifact classes, were not established. The artifact assemblages from all three sites were found to be very similar, and probably little different from those reported for the Yuquot site Middle and Late Periods.

Sample error and differential preservation were not found to be important factors in the interassemblage variation, except for the differences in frequency of herring, anchovy and sardine remains attributable at least in major part to differing sample recovery techniques. These sample differences are taken into account in the interpretations.

The observed Assemblage/Habitat Category associations are compared with the hypothetical predicted results for the three sites in Figure 48. This figure displays the predicted rank order of importance of Combined Vertebrate Habitat Categories, plus the observed relative frequencies for the categories by skeletal element count and by animal weight. As all five assemblages at DiSo 1 are very similar, mean frequencies for the site are used. The DiSo 9 assemblages display sufficient differences to justify maintaining their separation. Differences between the predicted pattern of rank order and the observed frequencies of Skeletal element counts, animal weights, and the mean of these two percentages, were compared by calculating Spearman's rank order correlation r_s, using the formula $r_s = 1 - \frac{6\sum_{i=1}^{N} D_i^2}{N(N^2-1)}$ as defined in Blalock (1960:317). Both DiSo 1 and DiSo 16 display strong positive correlations with the predicted rank

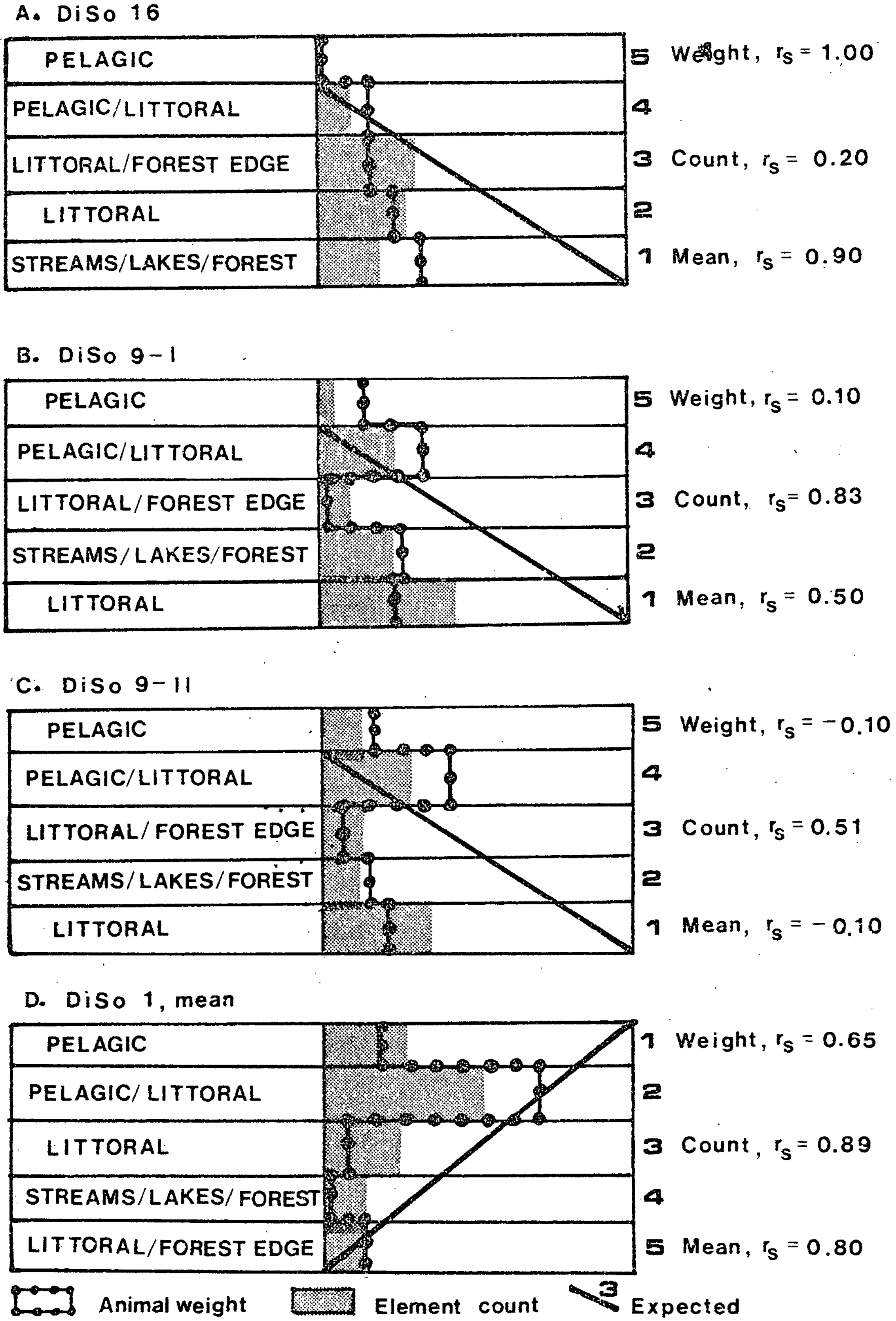


Figure 48. Expected Rank Order of Importance for Vertebrate Faunal Habitat Categories, Compared with Observed Relative Frequencies, DiSo 16, DiSo 9, and DiSo 1.

orders. DiSo 9-I shows a fairly strong positive correlation while DiSo 9-II displays a weak negative correlation.

As predicted, all DiSo 1 assemblages emphasize Pelagic and Pelagic/Littoral categories. They differ from the predicted model in that the Pelagic/Littoral rather than the Pelagic category is most strongly represented. This is partially explained by the greater number of more readily available species in the Pelagic/Littoral category as opposed to the Pelagic category. It must, however, be remembered that no whale and very few porpoise remains are included in these calculations. Thus the results should be interpreted in the light of Table 16 (page 155) which clearly illustrates percentages ranging from 31 to 51 for Cetacean remains relative to other orders, for the DiSo 1 assemblages. When this is considered, the Pelagic category is seen to be as strongly, if not more strongly, emphasized in these assemblages than is the Pelagic/Littoral category, although it has not been quantitatively demonstrated. For animal weight, the correlation with the expected pattern of rank order is r_s=0.65, a reasonably strong positive correlation, but not as strong as that for skeletal element count, which has a r_s of 0.89. The mean of the two percentages provides a strong positive correlation, with r_s=0.80.

Minor differences between the DiSo 1-III assemblage and other DiSo 1 assemblages appear to be attributable to local environmental changes contingent on the development of the Village Lake land area. While these differences are most noticeable in the fish remains, the composite vertebrate sample pattern is clearly similar to other DiSo 1 assemblages.

Shellfish also display a slightly greater emphasis on exposed shore species in DiSo 1 assemblages than in other assemblages, as was predicted. The differences are not as marked because in all assemblages, clams are the most abundantly occurring shellfish. The higher frequency of mussel shell in the DiSo 1-III assemblage relative to other DiSo 1 assemblages is difficult to explain, but might result from isolated areas of rocky outcrop being in the intertidal zone in areas now part of the land mass of the Village Lake-Anton's Spit area. Such pockets of rocky shores might have been suitable areas for expanded mussel colonization.

The DiSo 9 assemblages both differ from the predicted models, especially the older DiSo 9-II assemblage, in their stronger than expected emphasis on the Pelagic and Pelagic/Littoral categories. They do, however, as predicted, display stronger emphases on the habitat categories Littoral and Streams/Lakes/Forests, than do the DiSo 1 assemblages. The DiSo 9-I pattern is closer to the expected pattern of rank order than the DiSo 9-II pattern. For DiSo 9-I, rank order of animal weight provides an r_s of 0.10, a weak positive association, but skeletal element count provides a much stronger positive association of $r_s=0.83$. The mean of count and weight produces a moderately strong positive correlation with the predicted rank order of habitat categories of $r_s=0.50$. At DiSo 9-II, however, animal weight displays a weak negative correlation of $r_s=0.10$ with the predicted rank order of habitat category emphasis, while count is moderately strongly positively associated with the predicted order, with $r_s=0.51$. The mean percentages are weakly negatively correlated with the predicted rank order, with $r_s=0.10$.

The unexpectedly high frequencies in the Pelagic and Pelagic/Littoral categories can be interpreted in two ways: as the result of environmental change, or as the result of a wider territory of exploitation associated with the site.

We have seen that the inner harbour was a less sheltered environment, subject to greater open ocean influence, during the time period represented by the DiSo 9 assemblages. Animals commonly found in the Pelagic/Littoral habitat, such as fur seals, sea lions, open water diving birds and fish preferring deeper waters, might have frequented the inner harbour region more often then, than at present. The suggestion of a local environment gradually changing from more open to more sheltered is supported by a similar reflection in the frequency changes from DiSo 9-II to DiSo 9-I, with its less strongly Pelagic and Pelagic/Littoral fauna.

The same result, however, could be expected if the occupants of DiSo 9 had unrestricted access to the total regional resource base of the harbour area. This would explain the higher than expected frequency of Pelagic fauna, still not satisfactorily explained by environmental change. It is noteworthy that there appears to be an emphasis in DiSo 9-II on the spring and summer exploitation of Pelagic resources, consistent with differing seasonal uses of the different available habitats. While it is still not known if DiSo 9 is the oldest permanent habitation site in the harbour, older sites would be considerably removed from the present shoreline, and it seems likely that it is the oldest site articulating with the recent ecological configuration of the harbour. Thus it may well have had clear access to all the harbour resources during the time period represented by the DiSo 9-II deposits.

During the time period of DiSo 9-I, however, a contemporary habitation site was established in at least one other location in the harbour, at DiSo 1, where a similar time period is represented by the early deposits of DiSo 1-IV. As would be expected if the harbour territory was now divided among two groups, DiSo 1 controlling the outer harbour and its resources and DiSo 9 controlling the inner harbour and its resources, there are differences between the DiSo 9-II and DiSo 9-I faunal assemblages. These include a decrease in emphasis in the latter assemblage on the habitat categories Pelagic and Pelagic/Littoral and a corresponding increase in emphasis on the habitat categories Littoral and Streams/Lakes/Forests. These shifts are most noticeable in the bird and mammal remains, but are perhaps also reflected in the increased frequency of salmon remains in DiSo 9-I relative to DiSo 9-II.

Shellfish remains are rather ambiguous, in that while the presence in both assemblages of California Mussel, not found today in the inner harbour,[6] indicates a less sheltered environment, the high frequency in both assemblages of Frilled Dogwinkle sea snail rather than Black Turban sea snail, suggests a relatively sheltered intertidal environment throughout. Again, a wider territory of exploitation may be the answer.

It seems most likely that both these factors, local environmental change and wider territory of exploitation, are responsible for the manner in which the DiSo 9 assemblages differ from the expected emphases. It may in fact be that DiSo 9-I and the early layers of DiSo 1-IV record an A.D. 700 population split and an early division of the harbour into culturally bounded sub-regional exploitation units.

The DiSo 16 assemblage fits well with the predictive model, showing major emphases on the habitat categories Littoral, Littoral/Forest Edge, and Streams/Lakes/Forests. There is a higher frequency than expected in the Pelagic/Littoral category. This too may reflect the above mentioned environmental changes as it is the result of higher than expected frequencies in the fish category Moderately Deep Water over Rocky Bottom and the bird category Open Littoral Waters. While the rank order based on skeletal element count is only weakly positively associated with the predicted rank order, with r_s=0.02, animal weight rank order is perfectly positively correlated with the predicted order, r_s being 1.00. The mean of the two percentages provides a rank ordering that is strongly positively correlated with the predicted rank order of habitat category emphasis with r_s=0.90. Shellfish also fit the predicted model, but as at DiSo 9, there is a greater quantity of California Mussel than expected, probably resulting from the environmental changes discussed.

Summary

In summary, the faunal assemblages from DiSo 1, DiSo 9 and Diso 16 differ from each other most markedly in the groups of fauna being exploited and these groupings are clearly related to the habitat categories in which the species are most likely to be found. As predicted, all seasons are represented in each assemblage, although there are differing seasonal emphases according to the availability of the animals being taken. Sample error was found to be at least partially responsible for the low frequencies of herring in DiSo 1 and DiSo 16 assemblages, but the latter site probably exploited few herring as well. Differential preservation was not found to be a problem, nor was material culture change through time found to be an important factor in faunal differences.

It has been determined, then, that the major proportion of the observed interassemblage variation in the faunal remains from these Hesquiat Harbour sites is attributable to differing emphases on the exploitation of different major habitats in the harbour area. It was shown in Chapter II that these habitats are associated with particular geographical areas in Hesquiat Harbour. In Chapter III, it was suggested that if the faunal assemblages differed most strongly in habitat category emphases, the most likely explanation was restricted social access for each sites' inhabitants to the regional resource base, that is, the presence of socio-culturally bounded territories of exploitation associated with each site. Using ethnographic information derived from the more recent Hesquiat settlement and site use patterns and the association of habitat categories with geographical areas in Hesquiat Harbour, models were developed for each site predicting the habitat category emphases one would expect, if the ethnographic system had a time depth comparable to that of the sites.

The faunal assemblage associations with Habitat Categories basically agree with the predicted models. Rank orders of Habitat Category emphases at both DiSo 1 and DiSo 16 are strongly positively correlated with the predicted pattern, using Spearman's rank order correlation as the statistical measure. The rank orders of habitat category emphases for both DiSo 9 assemblages, however, differ from the predicted patterns, especially for DiSo 9-II. These differences are primarily consistent with identified local environmental changes, thus the most likely explanation of faunal assemblage differences is considered to be restricted socio-cultural access to differing, sub-regional resource bases.

It is, however, probable that the occupants of DiSo 9 initially had access to a wider territory of exploitation, and thus a wider range of resources than is now found in the immediate site area. It is suggested that the contemporary assemblages DiSo 9-I and DiSo 1-IV may represent an early cultural division of the harbour into smaller territories of exploitation.

Chapter VII

Conclusions

The proposition examined in this study is that among the prehistoric hunter-gatherers of Hesquiat Harbour on the west coast of Vancouver Island, the geographical area exploited, and hence animal resource selection, was controlled by cultural patterns of land use that limited local groups to specific tracts of territory. This proposition was based on the belief that the manner in which a society organizes and maintains access to its animal resources is an important influence on the selection of those resources.

The specific thesis was developed from a consideration of the known ethnographic adaptive system for the area and from archaeological indications at Yuquot, 25 kilometres to the north, of long term cultural continuity and in situ development of the Nootkan adaptive system. Environmental data indicated that a specific tract of land in this area does not necessarily contain all the major habitats found in the region as a whole. It was therefore suggested that the interaction of such a land use system with the environmental diversity would result in differing intra-regional emphases on particular groups of animal resources, prehistorically as well as ethnographically. It was considered that if this interaction had time depth, it would be indirectly observable in archaeological faunal assemblages from the region as interassemblage diversity in emphases on animals from different habitats.

The demonstration of such diversity among the Hesquiat Harbour faunal assemblages would support the theory that there was a subregional level of resource specialization, which would suggest distinct exploitation territories association with the archaeological sites. If faunal assemblages were also shown to be year round in origin, yet the distinctiveness of the assemblages maintained, this could be interpreted as the result of contemporary autonomous production and consumption units operating in discrete territories.

On the basis of the results displayed and discussed in Chapter VI, it can be said that the approach used in this analysis of faunal assemblages from Hesquiat Harbour was successful. Examination of the ethnographic adaptation to Hesquiat Harbour and of the present and past natural environments of the harbour, led to a specific proposition relating cultural land use patterns that channeled the selection of resources, with a specific pattern of diversity among archaeological faunal assemblages from the region. A detailed description of the natural environment and the grouping of animals into habitat categories associated with specific areas of the regional harbour environment, made it possible to predict the types of faunal assemblages one would expect to find at the three sites, DiSo 1, DiSo 9 and DiSo 16, if their animal resources had been obtained from restricted areas of the harbour, as they would have been under the ethnographic system. Analysis of the faunal assemblages in terms of the same habitat categories demonstrated that the major proportion of interassemblage variation could indeed be attributed to differences in emphases on the exploitation of particular habitats.

It was found that at DiSo 1 and DiSo 16, the actual habitat emphases in the faunal assemblages are statistically positively correlated with the predicted emphases based on the ethnographic model. Where actual habitat emphases differ, as in the DiSo 9 assemblages, it is possible to relate the differences logically to known changes in the local environment associated with continuing post-Pleistocene uplift and shoreline development. It was also possible to suggest that the oldest well-dated assemblage, DiSo 9-II, dated to about A.D. 100/200, had unrestricted access to the regional resource base, as would be expected if it represents the sole group occupying the harbour at that time. Subsequent faunal assemblages contained more restricted faunal groupings emphasizing particular habitats available in the site locales. It was also determined that neither restricted seasonal occupation nor change in material culture through time were satisfactory explanations of the observed interassemblage variation on their own, as all seasons were represented in all assemblages, despite differing seasonal emphases, and artifact assemblages differed little through time.

Thus the data demonstrate a pattern of interassemblage variation among the Hesquiat faunal assemblages that suggests the presence in Hesquiat Harbour prehistorically as well as ethnographically, of blocks of exploitation territory within single environmental settings, associated year round with particular habitation locations. It is considered that the best explanation for these site-habitat-season associations is that derived from an ethnographic model in which several autonomous socio-economic units of production and consumption operate within clearly defined and strictly maintained territories. This analysis has supported strongly the presence of differing local group adaptations to local faunal resources in different territorial units of the same regional adaptation.

It was also suggested in Chapter III that this pattern of variation among faunal assemblages was the kind most likely to be associated on the west coast of Vancouver Island with the autonomous, local group level of socio-political organization. While perhaps still speculative, it would seem that this analysis lends support to the theory that this simpler, autonomous local group socio-political structure was the earlier adaptive pattern for the west coast of Vancouver Island, and present in Hesquiat Harbour at least 1,200 years ago.

Taking note of the ethnographic system of controlling access to resources and determining how it might interact with a particular environment allowed a more meaningful and integrated interpretation of the Hesquiat faunal assemblages. This could be a fruitful approach in any region where there is known environmental diversity and ethnographically recorded cultural systems in which control of resources and access to resource locations were highly developed systems of group and land management integral to the regional adaptive system. This analysis has shown that the "cultural" natural environment, defined primarily by socio-cultural organizational principles, is a very real factor influencing regional faunal assemblage patterning on the Northwest Coast.

Finally, the regional approach to Northwest Coast faunal analysis has proved especially rewarding. It is, moreover, an approach that avoids the pitfalls of extrapolating from a single site to a region, in an area known for its environmental diversity and celebrated for its elaborate and highly sophisticated cultural systems of resource management.

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Appendix A

FAUNAL TABLES

Table 30. Mammal Remains, Family by Assemblage, Relative Frequency by Skeletal Element Count

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Shrews, Soricidae	-	0.7	-	-	-	-	-	-
Squirrels, Sciuridae	-	1.4	1.2	-	-	-	-	-
Mice, Cricetidae	-	-	-	1.8	-	-	-	-
Porpoises, Delphinidae	-	2.2	0.6	-	-	0.6	-	-
Dogs/Wolves, Canidae	-	2.9	0.6	0.9	2.9	26.4	16.9	-
Bears, Ursidae	-	0.7	-	1.8	1.0	-	0.3	-
Raccoons, Procyonidae	-	-	1.2	-	-	-	-	-
Mustelids, Mustelidae	49.2	31.7	16.0	10.7	3.8	14.6	16.9	-
Eared Seals, Ottaridae	-	12.2	50.9	53.6	71.2	25.3	26.7	50.0
Earless Seals, Phocidae	-	20.8	5.3	11.6	6.7	22.5	20.4	-
Deer, Cervidae	50.8	27.3	24.3	19.6	14.4	10.7	8.6	50.0
	All columns total 100%							
N	1126	139	169	112	104	178	324	2

Table 31. Mammal Remains, Family by Assemblage, Relative Frequency by MNI

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Shrews, Soricidae	-	4.0	-	-	-	-	-	-
Squirrels, Sciuridae	-	4.0	4.5	-	-	-	-	-
Mice, Cricetidae	-	-	-	5.9	-	-	-	-
Porpoises, Delphinidae	-	4.0	4.5	-	-	2.4	-	-
Dogs/Wolves, Canidae	-	8.0	4.5	2.9	11.1	4.9	6.3	-
Bears, Ursidae	-	4.0	-	5.9	5.6	-	2.1	-
Raccoons, Procyonidae	-	9.1	-	-	-	-	-	-
Mustelids, Mustelidae	75.0	28.0	18.2	17.6	11.1	19.5	12.5	-
Eared Seals, Ottaridae	-	20.0	36.4	47.1	38.9	39.0	50.0	50.0
Earless Seals, Phocidae	-	12.0	9.1	11.8	16.7	21.9	18.8	-
Deer, Cervidae	25.0	16.0	13.6	8.8	16.7	12.2	10.4	50.0
	All columns total 100%							
N	8	25	22	34	18	41	48	2

Table 32. Mammal Remains, Including Non-specifically Identified Remains, Relative Frequencies by MNI

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Shrews, Insectivora	-	3.8	-	-	-	-	-	-
Rodents, Rodentia	-	3.8	4.3	5.1	-	-	-	-
Whales, Cetacea	11.1	7.7	8.7	12.3	21.7	14.9	15.8	50.0
Carnivores, Carnivora	66.6	38.5	30.4	23.1	21.7	21.3	17.5	-
Seals/Sea Lions, Pinnipedia	-	30.8	43.5	51.2	43.5	53.2	57.9	25.0
Deer, Artiodactyla	22.2	15.4	13.00	7.7	13.0	10.6	8.8	25.0

All columns total 100%

N	9	26	23	39	23	47	57	4

Table 33. Bird Remains, Family by Assemblage, Relative Frequency by Skeletal Element Count

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Loons, Gavidae	22.3	12.8	37.0	8.9	5.0	2.2	6.4	-
Grebes, Podicipedidae	6.8	6.4	4.7	2.4	2.0	0.1	1.1	-
Albatross, Diomedeidae	-	0.4	4.3	48.2	18.0	63.9	3.5	45.5
Shearwaters, Procellaridae	--	4.0	3.0	0.2	15.0	1.9	24.5	-
Cormorants, Phalacrocoracidae	-	0.7	12.7	8.9	7.0	6.6	3.2	-
Herons, Ardeidae	-	-	0.3	0.9	-	-	-	-
Swans, Cygninae	-	-	-	0.5	-	-	-	-
Geese, Anserinae	1.0	8.8	3.0	12.0	14.0	3.6	26.6	28.2
Ducks, Anatinae/Aythynae	23.8	45.8	18.3	4.0	13.0	2.2	13.4	18.2
Mergansers, Merginae	23.8	3.1	1.3	1.2	2.0	1.2	0.7	-
Eagles, Accipitridae	-	-	0.3	2.1	2.0	0.4	-	9.1
Coots, Rallidae	-	-	-	-	-	-	0.7	-
Oystercatcher, Haematopodidae	-	-	-	-	-	-	0.4	-
Sandpipers, Scolopacidae	-	0.2	0.3	0.2	-	1.9	0.7	-
Phalaropes, Phalaropodidae	-	-	-	-	-	0.1	-	-
Jaegers/Skuas, Stercoraridae	-	0.1	1.0	-	1.0	[illegible]	0.4	-
Gulls, Laridae	19.4	14.7	8.3	4.9	11.0	14.3	8.5	9.1
Murres, Alcidae	1.5	2.2	4.3	4.5	10.0	1.5	7.4	-
Owls, Strigidae	-	--	1.0	0.5	-	-	1.4	-
Woodpeckers, Picidae	-	-	-	0.2	-	-	0.4	-

Table 33. (Continued)

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Crows, Corvidae	-	-	-	-	-	--	0.7	-
Thrushes, Turdidae	1.0	0.1	-	-	-	-	-	-
Storm Petrels, Hydrobatidae	-	0.1	-	-	-	-	-	-
Finches etc. Fringillidae	0.5	-	-	-	-	-	-	-
Misc. Small Forest Bird	-	0.5	-	0.2	-	-	-	-
	All columns total 100%							
N	206	810	300	425	100	685	282	11

Table 34. Bird Remains, Family by Assemblage, Relative Frequency by MNI

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Loons, Gavidae	16.7	12.5	14.3	11.1	9.4	5.4	8.3	-
Grebes, Podicipedidae	11.1	9.4	11.9	6.9	6.3	1.4	2.8	-
Albatross, Diomedeidae	-	1.6	2.4	12.5	9.4	18.9	4.2	20.0
Shearwaters, Procellaridae	-	4.7	2.4	1.4	9.4	5.4	15.3	-

Table 34. (Continued)

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Herons, Ardeidae	-	-	2.4	2.8	-	-	-	-
Swans, Cygninae	-	-	-	1.4	-	-	-	-
Geese, Anserinae	2.8	12.5	9.5	15.3	12.5	10.8	15.3	20.0
Ducks, Anatinae/Aythynae	27.8	26.6	9.5	6.9	18.8	6.8	13.9	20.0
Mergansers, Merginae	13.9	6.3	2.4	2.8	3.1	4.1	1.4	--
Eagles, Accipitridae	-	-	2.4	2.8	3.1	1.4	-	20.0
Coots, Rallidae	-	-	-	-	-	--	1.4	-
Oystercatchers, Haematopodidae	-	-	-	-	-	-	1.4	-
Sandpipers, Scolopacidae	-	1.6	2.4	1.4	-	4.1	1.4	-
Phalaropes, Phalaropodidae	-	-	-	-	-	1.4	-	-
Jaegers/Skuas, Stercoraridae	-	1.6	2.4	-	3.1	--	11.4	-
Gulls, Laridae	19.4	12.5	14.3	12.5	12.5	22.9	13.9	20.0
Murres, Alcidae	2.8	4.7	4.8	9.7	9.4	8.1	8.3	-
Owls, Strigidae	-	-	2.4	2.8	-	-	1.4	-
Woodpeckers, Picidae	-	-	-	1.4	-	-	1.4	-
Crows, Corvidae	-	-	-	-	-	-	1.4	-
Thrushes, Turdidae	2.8	1.6	-	-	-	-	-	-
Storm Petrels, Hydrobatidae	-	1.6	-	-	-	-	-	-
Finches etc., Fringillidae	2.8	-	-	-	-	-	-	-
Misc. Small Forest Bird	-	-	-	1.4	-	-	-	-
	All columns total 100%							
N	36	64	42	72	32	75	72	5

Table 35. Fish-Remains, Family by Assemblage, Relative Frequency by Skeletal Element Count

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Sharks, Pleurotremata	-	-	-	0.5	0.1	0.2	-	-
Dogfish, Squalidae	6.2	5.6	4.9	18.1	21.8	17.4	9.8	10.3
Skates, Rajidae	0.1	0.1	0.1	0.2	0.7	0.7	0.2	1.5
Ratfish, Chimaeridae	0.1	0.1	0.1	0.2	-	0.1	0.2	0.1
Skate/Dogfish/Ratfish	-	-	-	-	-	0.3	-	-
Herring, Clupeidae	5.8	46.7	51.5	3.7	3.7	15.6	2.0	2.6
Sardine/Anchovy, Engraulidae/Osmeridae	-	0.1	0.4	-	-	-	-	-
Salmon/Trout, Salmonidae	7.8	35.9	13.3	4.7	5.6	10.4	8.0	9.1
Toadfishes, Batrachoididae	63.1	4.5	21.6	-	-	0.1	0	0.2
Cods, Gadidae	-	-	-	-	-	0.1	0.1	0.2
Surf Perches, Embiotocidae	4.4	1.2	0.8	2.0	0.8	1.4	0.2	1.1
Wolf Eel, Anarhichadidae	-	-	-	-	-	0.4	-	-
Tunas, Scombridae	-	-	-	-	0.1	-	0.1	-
Rockfishes, Scorpaenidae	6.9	2.6	4.6	36.8	45.7	29.7	62.9	50.9
Sablefish, Anoplopomatidae	-	0.1	-	-	-	-	-	-
Greenlings/Lingcod, Hexagrammidae	2.2	1.6	2.3	27.5	14.6	17.9	12.3	16.6
Sculpins, Cottidae	0.9	0.4	0.5	6.1	4.3	5.1	2.6	5.4
Flatfish, Pleuronectidae/ Bothidae	2.4	1.1	0.3	0.3	2.6	0.9	1.6	2.0

All columns total 100%

N	2,945	8,137	10,726	1,776	2,497	5,987	3,828	970

Table 36. Fish Remains Excluding Anchovy, Herring and Sardine, Family by Assemblage, Relative Frequency by Skeletal Element Count

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Sharks, Pleurotremata	-	-	-	0.5	0.1	0.2	-	-
Dogfish, Squalidae	6.6	10.5	10.1	18.8	22.7	20.7	10.0	10.6
Skates, Rajidae	0.1	0.1	0.1	0.2	0.7	0.8	0.2	1.6
Ratfish, Chimaeridae	0.1	0.3	0.2	0.2	-	0.1	0.2	0.1
Skate/Ratfish etc, Squalidae/Rajidae/ Chimaeridae	-	-	-	-	-	0.4	-	-
Salmon/Trout, Salmonidae	8.3	67.4	27.2	24.9	5.8	12.3	8.2	9.3
Toadfishes Batrachoididae	67.0	8.5	44.7	-	-	0.1	-	0.2
Cods, Gadidae	-	-	-	-	-	0.1	0.1	0.2
Surf Perches, Embiotocidae	4.7	2.3	1.7	2.1	0.9	1.6	0.2	1.22
Wolf Eel, Anarhichadidae	-	-	-	-	-	0.5	-	-
Tunas, Scombridae	-	-	-	-	0.1	-	0.1	-
Rockfishes, Scorpaenidae	7.4	4.9	9.6	38.2	47.5	35.1	64.2	52.3
Sablefish, Anoplopomatidae	-	0.1	-	-	-	-	-	-
Greenling/Lingcod, Hexagrammidae	2.3	3.1	4488	28.5	15.2	21.2	12.6	17.0
Sculpins, Cottidae	1.0	0.8	1.0	6.3	4.5	6.0	2.7	5.5
Flatfishes, Bothidae/ Pleuronectidae	2.6	2.1	0.7	0.3	2.7	1.0	1.7	2.0
	All columns total 100%							
N	2,773	4,334	5,168	1,710	2,405	5,053	3,751	945

Table 37. Fish Remains, Family by Assemblage
Relative Frequencies by MNI

Taxa	Assemblages							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Sharks, Pleurotremata	-	-	-	1.4	0.8	0.3	-	-
Dogfish, Squalidae	4.2	2.2	2.4	22.3	21.4	15.5	22.8	22.2
Skates, Rajidae	0.3	0.3	0.3	1.4	0.8	0.8	0.4	1.9
Ratfish, Chimaeridae	0.3	1.0	1.2	2.2	-	0.8	1.7	1.9
Herring, Clupeidae	7.2	42.8	35.5	3.6	2.3	31.1	3.8	5.6
Sardine/Anchovy, Engraulidae/Osmeridae	-	0.3	2.4	-	-	-	-	-
Salmon/Trout, Salmonidae	2.7	26.8	12.4	4.3	6.9	2.8	3.4	3.7
Toadfishes, Batrachoididae	72.8	13.4	30.3	-	-	0.3	-	1.9
Cods, Gadidae	-	-	-	-	-	0.3	0.4	1.9
Surf Perches, Embiotocidae	5.4	3.5	3.9	6.5	4.6	4.3	1.3	7.4
Wolf Eel, Anarhichadidae	-	-	-	-	-	0.3	-	-
Tunas, Scombridae	-	-	-	-	0.8	-	0.4	-
Rockfishes, Scorpaenidae	2.7	2.6	4.5	28.1	32.8	13.8	43.0	25.9
Sablefish, Anaplopomatidae	-	0.3	-	-	-	-	-	-
Greenlings/Lingcod, Hexagrammidae	1.8	1.9	3.3	20.9	16.8	18.5	11.4	14.8
Sculpins, Cottidae	1.2	1.9	1.8	6.5	6.9	8.5	7.2	5.6
Flatfishes, Bothidae/Pleuronectidae	1.5	2.9	1.8	2.9	6.1	3.0	4.2	7.4
	All columns total 100%							
N	335	313	330	139	131	399	237	54

Table 38. Shellfish Remains, Family by Assemblage,
Relative Frequency by Weight of Remains

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Mussels, Mytilidae	3.0	7.0	5.4	5.7	5.1	15.6	6.3	1.0
Scallops, Pectinidae	-	-	0.2	1.0	-	1.0	-	-
Jingle Shells, Anomiidae	0.1	0.1	0.1	-	-	-	-	-
Cockles, Cardidae	7.3	0.7	0.6	0.5	0.5	10.4	0.6	-
Venus Clams, Veneridae	63.8	76.1	79.0	53.3	72.4	46.4	82.3	69.1
Surf Clams, Mactridae	8.5	2.6	2.3	37.3	4.2	7.4	9.4	-
Tellins, Tellinidae	-	-	-	-	-	0.1	-	-
Semeles, Semelidae	0.1	-	-	-	-	-	-	-
Abalone, Haliotidae	0.1	-	-	0.4	-	0.1	-	-
Limpets, Acmaedidae	0.1	0.2	0.4	-	-	0.5	0.1	-
Pearly Top Shells, Trochidae	0.5	0.8	0.1	0.8	9.8	0.2	1.0	29.9
Turbans, Turbinidae	-	1.5	0.4	-	-	-	-	-
Periwinkles, Littorinidae	-	0.1	0.1	-	-	0.1	-	-
Horn Shells, Cerithidae	-	0.1	-	-	-	-	-	-
Slipper Shells, Calyptaeidae	-	-	-	0.1	-	-	-	-
Moon Shells, Naticidae	1.9	0.1	0.1	-	6.8	-	-	-
Rock Shells, Muricidae	0.1	-	-	-	-	0.1	-	-
Dye Shells, Thaididae	14.0	10.3	10.5	0.9	0.8	14.7	0.2	-
Whelks, Buccinidae	0.2	0.1	0.1	-	0.2	0.1	-	-
Olive Shells, Olividae	-	0.1	-	-	-	0.1	-	-

Table 38. (Continued)

Taxa	Assemblage							
	DiSo 16	DiSo 9		DiSo 1				
		I	II	I	II	III	IV	V
Chitons, Mopallidae	-	0.1	-	-	-	-	-	-
Chitons, Cryptoplacidae	0.2	0.1	-	-	-	-	-	-
Acorn Barnacles	0.1	0.4	0.4	-	-	4.3	0.1	-
Whale Barnacles	-	-	-	-	-	-	0.1	-
Sea Urchins	-	-	-	0.1	0.2	0.1	0.1	-
Crabs	0.1	0.1	0.1	-	-	0.1	-	-
Land Snails	0.1	0.1	-	-	-	0.1	0.1	-
	All columns total 100%							
Weight in Grams	5,232.8	50,143.8	62,030.3	1,184.7	296.6	7,555.9	3,112.0	9.7

Table 39. DiSo 16, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Deer, <u>Odocoileus hemionus</u>	64	50.8	2	25.0
River Otter, <u>Lontra canadensis</u>	33	26.2	5	62.5
River Otter?	27?	21.4	-	-
Mink, <u>Mustela vison</u>	2	1.6	1	12.5
Total	126	100.0	8	100.0
Unidentified Whale, Cetacea	(7)		(1)	

Table 40. DiSo 16, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%%
Loon, Gavia sp.	4	1.9	1	2.8
Arctic/Red-throated Loon, G. artica/stellata	16	7.8	-	-
Arctic Loon, G. arctica	12	5.8	2	5.6
Red-throated Loon, G. stellata	14	6.8	3	8.3
Western Grebe, Aechmophorus occidentalis	7	3.4	1	2.8
Red-necked Grebe, Podiceps grisagena	6	2.9	2	5.6
Eared/Horned Grebe, P. caspicus/auritus	1	0.5	1	2.8
Goose, Anserinae	1	0.5	-	-
Canada Goose, Branta canadensis	1.	0.5	1	2.8
Duck, Anatinae/Aythynae	20	10.0	1	2.8
Pintail (?), Anas acuta ?	1	0.5	1	2.8
Blue-winged Teal (?), Anas discors ?	1	0.5	1	2.8
Scaup, Aythya sp.	1	0.5	1	2.8
Scoter, Melanitta sp.	14	6.8	3	8.3
White-winged Scoter, M. deglandi	4	1.9	1	2.8
Common Scoter, Oidemia nigra	8	3.8	2	5.6
Merganser, Mergus sp.	46	22.3	3	5.6
Common Merganser, M. Merganser	3	1.4	2	5.6
Gull, Larus sp.	9	4.3	1	2.8
Glaucous-winged Gull, L. glaucescens	28	13.6	3	8.3
Mew Gull, L. canus	2	0.9	2	5.6
Black-legged Kittiwake, Rissa tridactyla	11	0.5	1	2.8
Common Murre, Uria aalge	3	1.4	1	2.8
Varied Thrush, Ixoreus naevius	2	0.9	1	2.8
Finch etc., Fringillidae	1	0.5	1	2.8
Total	206	99.6%	36	100.0%

Table 41. DiSo 16, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Dogfish, *Squalus acanthias*	182	6.0	14	4.2
Skate, *Raja* sp.	1	<0.1	1	0.3
Ratfish, *Hydrolagus colliei*	1	<0.1	1	0.3
Herring, *Clupea harengus*	171	5.7	23	6.8
Pacific Sardine, *Sardinops sagax*	1	<0.1	1	0.3
Salmon, *Oncorhynchus* sp.	169	5.6	2	0.6
Chum Salmon, *O. keta*	62	2.1	7	2.1
Plainfin Midshipman, *Porichthys notatus*	1,859	61.7	244	72.6
Surf Perch, Embiotocidae	87	2.9	-	-
Striped Seaperch, *Embiotoca lateralis*	15	0.5	7	2.1
Pile Perch, *Rhacochilus vacca*	98	3.3	12	3.6
Rockfish, *Sebastes* sp.	191	6.3	8	2.4
Yelloweye Rockfish, *S. ruberrimus*	13	0.4	1	0.3
Ling Cod, *Ophiodon elongatus*	10	0.3	1	0.3
Greenling, *Hexagrammos* sp.	55	1.8	5	1.5
Sculpin, Cottidae	6	0.2	-	-
Buffalo Sculpin, *Enophrys bison*	2	0.1	1	0.3
Red Irish Lord, *Hemilepidotus hemilepidotus*	7	0.2	2	0.6
Cabezon, *Scorpaenichthys marmoratus*	12	0.4	1	0.3
Flatfish, Bottidae/Pleuronectidae	60	2.0	2	0.6
Rock Sole, *Lepidosetta bilineata*	6	0.2	1	0.3
English Sole, *Parophrys vetulus*	1	0.1	1	0.3
Starry Flounder, *Platichthys stellatus*	5	0.2	1	0.3
Total	3,014	100.0%	336	100.0%

Table 42. DiSo 16, Shellfish Remains, Weight of Remains

Taxa	Weight in Grams	
	Raw	Relative
Native Littleneck, Protothaca staminea	1,506.0	28.8
Butter Clam, Saxidomus giganteus	1,834.6	35.1
Basket Cockle, Clinocardium nuttalli	381.4	7.3
Horse Clam, Tresus sp.	78.4	1.5
Horse Clam, T. capax	273.1	5.2
Horse Clam, T. nuttalli	92.8	1.8
Rose-petal Semele, Semele rubropicta	4.4	0.1
Pearly Monia, Pododesmus cepio	3.9	0.1
California Mussel, Mytilus californianus	100.8	1.9
Bay Mussel, M. edulis	58.1	1.1
Frilled Dogwinkle, Thais lamellosa	728.3	14.0
Emarginate Dogwinkle, T. emarginata	3.1	0.1
Black Turban, Tegula funebralis	26.3	0.6
Dire Whelk, Searlesia dira	10.7	0.2
Leafy Hornmouth, Ceratostoma foliatum	4.4	0.1
Lewis's Moon Snail, Polinices lewisii	101.7	1.9
Shield Limpet, Acmaea pelta	3.5	0.1
Finger Limpet, A. digitalis	0.2	<0.1
Mask Limpet, A. persona	0.4	<0.1
Northern Abalone, Haliotis kamtschatkana	6.3	<0.1
Butterfly Chiton, Cryptochiton stelleri	8.2	0.2
Barnacle, Balanus spp.	4.0	0.1
Crab, Cancer sp.	0.1	<0.1
Total	55,232.8 grams	100.3%

Table 43. DiSo 9-I, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%%
Harbour Porpoise, Phocoena vomerina	3	2.2	1	4
Northern Fur Seal, Callorhinus ursinus	15	10.8	4	16
California Sea Lion, Zalophus californianus	2	1.4	1	4
Harbour Seal, Phoca vitulina	29	20.9	3	12
Sea Otter, Enhydra lutris	41	29.5	5	20
Deer, Odocoileus hemionus	38	27.5	4	16
Dog (?), Canis familiaris ?	4	2.9	2	8
Black Bear (?), Ursus americanus?	1	0.7	1	4
River Otter, Lontra canadensis	2	1.4	1	4
Mink, Mustela vison	1	0.7	1	4
American Red Squirrel, Tamiasciurus hudsonicus	2	1.4	1	4
Navigator Shrew, Sorex palustris	1	0.7	1	4
Total	139	99.9%	25	100.0%
Unidentified Whale, Cetacea	(2)		(1)	
Unidentified Porpoise, Delphinidae	(4)			
Unidentified Seal/Sea Lion, Pinnipedia	(13)			
Unidentified Small Sea Mammal, Pinnipedia/Enhydra lutris	(14)			

Table 44. DiSo 9-I, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Arctic/Red-throated Loon, *Gavia stellata/arctica*	9	1.1	-	-
Arctic Loon, *G. arctica*	54	6.7	4	6.3
Red-throated Loon, *G. stellata*	28	3.5	2	3.2
Common Loon, *G. immer*	13	1.6	2	3.2
Western Grebe, *Aechmophorus occidentalis*	10	1.2	2	3.2
Red-necked Grebe, *Podiceps grisagena*	22	2.7	2	3.2
Eared/Horned Grebe, *P. caspicus/auritus*	15	1.9	1	1.6
Horned Grebe, *P. auritus*	5	0.6	1	1.6
Albatross, *Diomedea* spp.	3	0.4	1	1.6
Sooty Shearwater, *Puffinus griseus*	32	4.0	3	4.8
Storm Petrel sp., Hydrobatidae	1	0.1	1	1.6
Double-crested/Brandt's Cormorant, *Phalocrocorax auritus/penicillatus*	1	0.1	-	-
Pelagic Cormorant, *P. pelagicus*	4	0.5	1	1.6
Brandt's Cormorant, *P. penicillatus*	1	0.1	1	1.6
Goose, Anserinae	39	4.8	-	-
Canada Goose, *Branta canadensis*	20	2.5	4	6.3
Brant, *B. bernicla*	7	0.9	2	3.2
White-fronted Goose, *Anser albifrons*	3	0.4	1	1.6
Snow Goose, *Chen caerulescens*	2	0.2	1	1.6
Duck, Anatinae/Aythyinae	210	25.9	-	-
Mallard, *Anas platyrhynchos*	1	0.1	1	1.6
Shoveler, *Spatula clypeata*	1	0.1	1	1.6

Table 44. (Continued)

Taxa	Count		MNI	
	Raw	%	Raw	%
Greater Scaup, *Aythya marila*	22	2.7	3	4.8
Goldeneye sp., *Bucephala* sp.	5	0.6	-	--
Barrow's Goldeneye, *B. islandica*	2	0.2	1	1.6
Bufflehead, *B. albeola*	2	0.2	1	1.6
Oldsquaw, *Clangula hyemalis*	6	0.7	1	1.6
Scoter, *Melanitta* sp.	115	14.2	7	11.1
White-winged Scoter, *M. deglandi*	2	0.2	1	1.6
Surf Scoter, *M. perspicillata*	5	0.6	1	1.6
Merganser, *Mergus* sp.	16	2.0	-	-
Common Merganser, *M. merganser*	5	0.6	2	3.2
Red-breasted Merganser, *M. serrator*	4	0.5	2	3.2
Sandpiper, *Erolia* sp.	2	0.2	1	1.6
Jeager or Skua, Stercoraridae sp.	1	0.1	1	1.6
Gull, *Larus* spp.	74	9.1	4	6.3
Glaucous-winged Gull, *L. glaucescens*	37	4.6	2	3.2
Heermasn's Gull, *L. heermani*	1	0.1	1	1.6
Bonaparte's Gull, *L. philadelphia*	7	0.9	1	1.6
Common Murre, *Uria aalge*	12	1.5	2	4.8
Marbled Murrelet, *Brachyramphus marmoratus*	6	0.7	1	1.6
Varied Thrush, *Ixoreus naevius*	1	0.1	1	1.6
Finches etc., Fringillidae	4	0.5	-	-
Total	810	100.0%	64	100.0%

Table 45. DiSo 9-I, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Dogfish, *Squalus acanthias*	455	5.6	7	2.2
Skate, *Raja* sp.	6	0.1	1	0.3
Ratfish, *Hydrolagus colliei*	12	0.1	3	1.0
Herring, *Clupea harengus*	3,796	46.5	132	42.3
Pacific Sardine, *Sardinops sagax*	2	<0.1	2	0.6
Anchovy (?), Engraulidae	5	0.1	1	0.3
Salmon, *Oncorhynchus* spp.	2,643	32.4	79	25.3
Chum Salmon, *O. keta*	256	3.1	4	1.3
Coho Salmon, *O. kisutch*	5	0.1	1	0.3
Coho/Sockeye Salmon, *O. kisutch/nerka*	11	0.1	-	-
Salmon/Trout, Salmonidae	4	0.1	-	-
Plainfin Midshipman, *Porichthys notatus*	369	4.5	42	13.5
Surf Perch, Embiotocidae	51	0.6	1	0.3
Striped Sea Perch, *Embiotoca lateralis*	1	<0.1	1	0.3
Pile Perch, *Rhacochilus vacca*	75	0.9	8	2.6
Rockfish sp., *Sebastes* spp.	211	2.6	7	2.2
Yelloweye Rockfish, *S. ruberrimus*	2	<0.1	1	0.3
Sablefish, *Anoplopoma fimbria*	1	<0.1	1	0.1
Lingcod, *Ophiodon elongatus*	64	0.8	3	1.0
Greenling, *Hexagrammos* spp.	68	0.8	2	0.6
Rock Greenling, *H. lagocephalus*	2	<0.1	1	0.3
Sculpin, Cottidae	19	0.2	3	1.0
Buffalo Sculpin, *Enophrys bison*	2	<0.1	1	0.3
Red Irish Lord, *Hemilepidotus hemilepidotus*	8	0.1	1	0.3
Cabezon, *Scorpaenichthys marmoratus*	6	0.1	1	0.3
Flatfish, Pleuronectidae/Bothidae	77	0.9	1	0.3
Pacific Halibut, *Hippoglossus stenolepis*	1	<0.1	1	0.3
Rock Sole, *Lepidosetta bilineata*	3	<0.1	1	0.3
Petrale Sole, *Eopsetta jordani*	2	<0.1	1	0.3
Starry Flounder, *Platichthys stellatus*	9	0.1	1	0.3
Total	8,166	99.8%	312	99.7%

Table 46. DiSo 9-I, Shellfish Remains, Weight of Remains

Taxa	Weight in Grams	
	Raw	Relative
Native Littleneck, *Protothaca staminea*	13,576.9	27.1
Butter Clam, *Saxidomus giganteus*	24,581.4	49.0
Basket Cockle, *Clinocardium nuttalli*	359.2	0.7
Horse Clam, *Tresus* spp.	348.5	0.7
Horse Clam, *T. capax*	905.4	1.8
Horse Clam, *T. nuttalli*	57.7	0.1
Pearly Monia, *Pododesmus cepio*	34.1	0.1
Mussel, *Mytilus* sp.	1.3	<0.1
California Mussel, *M. californianus*	2,261.3	4.5
Bay Mussel, *M. edulis*	1,246.4	2.5
Frilled Dogwinkle, *Thais lamellosa*	5,164.9	10.3
Emarginate Dogwinkle, *T. emarginata*	3.0	<0.1
Black Turban, *Tegula funebralis*	413.1	0.8
Dire Whelk, *Searlesia dira*	38.2	0.1
Lewis's Moon Snail, *Polinices lewisii*	63.3	0.1
Purple Olive, *Olivella biplicata*	1.6	<0.1
Eschricht's Bittium, *Bittium eschrichti*	0.1	<0.1
Periwinkle, *Littorina* sp.	9.2	<0.1
Red Turban, *Astraea gibberosa*	768.1	1.5
Shield Limpet, *Acmaea pelta*	2.5	<0.1
Finger Limpet, *A. digitalis*	4.0	<0.1
Mask Limpet, *A. persona*	84.6	0.2
Butterfly Chiton, *Cryptochiton stelleri*	10.6	<0.1
Black Katy, *Katherina tunicata*	5.8	<0.1
Mossy Chiton, *Mopalia muscosa*	3.1	<0.1
Barnacle spp., *Balanus* spp.	0.4	<0.1
Barnacle, *B. cariosus*	193.2	0.4
Crab, *Cancer* sp.	5.7	<0.1
Land Snail	0.2	<0.1
Total	50,143.8 grams	100.0%

Table 47. DiSo 9-II, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Harbour/Dall's Porpoise, *Phocoena vomerina/Phocoenoides dalli*	1	0.6	1	4.5
Northern Fur Seal, *Callorhinus ursinus*	85	50.3	7	31.8
Northern Sea Lion, *Eumatopias jubata*	1	0.6	1	4.5
Harbour Seal, *Phoca vitulina*	9	5.3	2	9.1
Sea Otter, *Enhydra lutris*	27	15.3	4	18.2
Deer, *Odocoileus hemionus*	41	24.3	3	13.6
Dog, *Canis familiaris*	1	0.6	1	4.5
Raccoon, *Procyon lotor*	2	1.2	2	9.1
Small Rodent, *Microtus/Peromyscus*	2	1.2	1	4.5
Total	169	100.0%	22	99.8%
Unidentified Whale, Catacea	(3)		(1)	
Unidentified Porpoise, Delphinidae	(1)			
Unidentified Seal/Sea Lion, Pinnipedia	(7)			
Unidentified Small Sea Mammal, Pinnipedia/ *Enhydra lutris*	(1)			

Table 48. DiSo 9-II, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Arctic/Red-throated Loon, *Gavia arctica/ stellata*	9	3.0	1	2.4
Arctic Loon, *G. arctica*	13	4.3	1	2.4
Red-throated Loon, *G. stellata*	85	28.3	3	7.1
Common Loon, *Gavia immer*	4	1.3	1	2.4
Western Grebe, *Aecmophorus occidentalis*	4	1.3	1	2.4
Red-necked Grebe, *Podiceps grisagena*	9	3.0	3	7.1
Horned Grebe, *P. auritus*	1	0.3	1	2.4
Albatross, *Diomedea* spp.	13	4.3	1	2.4
Sooty Shearwater, *Puffinus griseus*	9	3.0	1	2.4
Double-crested/Brandt's Cormorant, *Phalacrocorax auritus/penicillatus*	2	0.7	-	-
Pelagic Cormorant, *P. pelagicus*	10	3.3	2	4.8
Brandt's Cormorant, *P. penicillatus*	20	6.7	3	7.1
Double-crested Cormorant, *P. auritus*	6	2.0	2	4.8
Great Blue Heron, *Ardea herodias*	1	0.3	1	2.4
Goose, Anserinae	1	0.3	1	2.4
Canada Goose, *Branta canadensis*	8	2.77	3	7.2
Duck, Anatinae/Aythyinae	40	13.3	-	-
Greater Scaup, *Aythya marila*	1	0.3	1	2.4
Scoter, *Melanitta* spp.	1	0.3	-	-
White-winged Scoter, *M. deglandi*	11	3.7	2	4.8
Surf Scoter, *M. perspicillata*	2	0.7	1	2.4
Merganser, *Mergus* spp.	4	1.3	1	2.4
Bald Eagle, *Haliaeetus leucocephalus*	1	0.3	1	2.4
Sandpiper, Scolopacidae	1	0.3	1	2.4
Parasitic Jaeger, *Stercorarius parasiticus*	3	1.0	1	2.4
Gull, *Larus* spp.	18	6.0	1	2.4
Glaucous-winged Gull, *L. glaucescens*	6	2.0	4	9.5
Black-legged Kittiwake, *Rissa tridactyla*	1	0.3	1	2.4
Common Murre, *Uria aalge*	13	4.3	2	4.8
Owl, Strigidae	3	1.0	1	2.4
Total	300	100.0%	42	100.0%%

Table 49. DiSo 9-II, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Dogfish, *Squalus acanthias*	524	4.9	88	2.4
Skate, *Raja* sp.	1	<0.1	1	0.3
Ratfish, *Hydrolagus colliei*	9	0.1	4	1.2
Herring, *Clupea harengus*	5,513	51.2	115	34.7
Pacific Sardine, *Sardinops sagax*	6	0.1	2	0.6
Anchovy (?), Engraulidae	39	0.4	8	2.4
Salmon, *Oncorhynchus* spp.	1,061	9.8	35	10.6
Chum Salmon, *O. keta*	326	3.0	4	1.2
Coho Salmon, *O. kisutch*	8	0.1	1	0.3
Coho/Sockeye Salmon, *O. kisutch/nerka*	2	<0.1	-	-
Spring Salmon, *O. tshawytscha*	2	<0.1	1	0.3
Salmon/Trout, Salmonidae	6	0.1	-	-
Plainfin Midshipman, *Porichthys notatus*	2,312	21.5	100	30.2
Surf Perch, Embiotocidae	61	0.6	-	-
Striped Sea Perch, *Embiotoca lateralis*	4	<0.1	44	1.2
Pile Perch, *Rhacochilus vacca*	559	0.5	10	3.0
Rockfish, *Sebastes* spp.	484	4.5	13	3.9
Yelloweye Rockfish, *S. ruberrimus*	11	0.1	2	0.6
Lingcod, *Ophiodon elongatus*	77	0.7	2	0.6
Greenling, *Hexagrammos* spp.	169	1.6	9	2.7
Sculpin, Cottidae	44	0.4	3	0.9
Buffalo Sculpin, *Enophrys bison*	1	<0.1	1	0.3
Red Irish Lord, *Hemilepidotus hemilepidotus*	2	<0.1	1	0.3
Cabezon, *Scorpaenichthys marmoratus*	3	<0.1	1	0.3
Flatfish, Pleuronectidae/Bothidae	30	0.3	3	0.9
Pacific Halibut, *Hippoglossus stenolepis*	1	<0.1	1	0.3
Rock Sole, *Lepidosetta bilineata*	1	<0.1	1	0.3
Starry Flounder, *Platichthys stellatus*	4	<0.1	1	0.3
Total	10,760	100.0%	331	99.8%

Table 50. DiSo 9-II, Shellfish Remains, Weight of Remains

Taxa	Weight in Grams	
	Raw	Relative
Native Littleneck, *Protothaca staminea*	14,815.7	23.9
Butter Clam, *Saxidomus giganteus*	34,570.6	55.7
Basket Cockle, *Clinocardium nuttalli*	373.8	0.6
Horse Clam, *Tresus* spp.	196.2	0.3
Horse Clam, *T. capax*	1,181.5	1.9
Horse Clam, *T. nuttalli*	61.5	0.1
Purple-hinged Rock Scallop, *Hinnites multirugosus*	104.9	0.2
Pearly Monia, *Pododesmus cepio*	10.7	<0.1
Mussel, *Mytilus* spp.	1.1	<0.1
California Mussel, *M. californianus*	2,991.3	4.8
Bay Mussel, *M. edulis*	365.4	0.6
Frilled Dogwinkle, *Thais lamellosa*	6,486.0	10.5
Emarginate Dogwinkle, *T. emarginata*	4.9	<0.1
Black Turban, *Tegula funebralis*	57.6	0.1
Dire Whelk, *Searlesia dira*	55.5	0.1
Lewis's Moon Snail, *Polinices lewisii*	41.7	0.1
Periwinkle, *Littorina* spp.	0.2	<0.1
Red Turban, *Astraea gibberosa*	221.6	0.4
Shield Limpet, *Acmaea pelta*	16.3	<0.1
Finger Limpet, *A. digitalis*	16.1	<0.1
Mask Limpet, *A. persona*	206.7	0.3
Palte Limpet, *A. testudinalis scutum*	1.9	<0.1
Barnacle, *Balanus* sp.	1.0	<0.1
Barnacle, *Balanus cariosus*	247.5	0.4
Crab, *Cancer* sp.	0.6	<0.1
Total	62,030.3 grams	100.1%

Table 51. DiSo 1-I, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Northern Fur Seal, *Callorhinus ursinus*	39	34.8	9	26.5
Northern Sea Lion, *Eumatopias jubata*	13	11.6	5	14.7
California Sea Lion, *Zalophus californianus*	8	7.1	2	5.9
Harbour Seal, *Phoca vitulina*	13	11.6	4	11.8
Sea Otter, *Enhydra lutris*	7	6.3	3	8.8
Deer, *Odocoileus hemionus*	22	19.6	3	8.8
Dog (?), *Canis familiaris* ?	1	0.9	1	2.9
Black Bear, *Ursus americanus*	2	1.8	2	5.9
Mustelid, *Martes*/*Mustela* sp.	3	2.7	2	5.9
Mink, *Mustela vison*	2	1.8	1	2.9
Vole, *Microtus* sp.	2	1.8	2	5.9
Total	112	100.0%	34	99.9%
Unidentified Whale, Cetacea	(162)		(2)	
Unidentified Porpoise, Delphinidae	(37)		(3)	
Unidentified Seal/Sea Lion, Pinnipedia	(70)			
Unidentified Small Sea Mammal, Pinnipedia/*E. lutris*	(111)			

Table 52. DiSo 1-I, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Loon, *Gavia* sp.	1	0.2	-	-
Arctic/Red-throated Loon, *G. arctica/ stellata*	1	0.2	-	-
Arctic Loon, *G. arctica*	21	4.9	3	4.1
Red-throated Loon, *G. stellata*	12	2.8	3	4.1
Common Loon, *G. immer*	3	0.7	2	2.8
Western Grebe, *Aecmophorus occidentalis*	2	0.5	1	1.4
Red-necked Grebe, *Podiceps grisagena*	3	0.7	2	2.8
Horned Grebe, *P. auritus*	5	1.2	2	2.8
Albatross, *Diomedea* spp.	205	48.3	9	12.5
Sooty Shearwater, *Puffinus griseus*	1	0.2	1	1.4
Cormorant, *Phalacrocorax* sp.	1	0.2	-	-
Double-crested/Brandt's Cormorant, *P. auritus/penicillatus*	1 1	0.2	-	-
Pelagic Cormorant, *P. pelagicus*	29	6.8	2	2.8
Brandt's Cormorant, *P. penicillatus*	2	0.5	2	2.8
Double-crested Cormorant, *P. auritus*	5	1.2	1	1.4
Great Blue Heron, *Ardea herodias*	4	0.9	2	2.8
Swan, *Olor* sp.	1	0.2	-	-
Whistling Swan, *O. columbianus*	1	0.2	1	1.4
Goose, Anserinae	16	3.8	-	-
Canada Goose, *Branta canadensis*	7	1.7	3	4.1
Brant, *B. bernicla*	4	0.9	2	2.8
White-fronted Goose, *Anser albifrons*	16	3.8	3	4.1
Snow Goose, *Chen caerulescens*	8	1.9	3	4.1
Duck, Anatinae/Aythyinae	7	1.7	-	-
Gadwall (?), *Anas strepera* ?	2	0.5	1	1.4
Shoveler, *Spatula clypeata*	1	0.2	1	1.4
Scoter, *Melanitta* sp.	6	1.4	2	2.8
Surf Scoter, *M. perspicillata*	1	0.2	1	1.4
Merganser, *Mergus* sp.	3	0.7	1	1.4

Table 52. (Continued)

Taxa	Count		MNI	
	Raw	%	Raw	%
Common Merganser, *M. merganser*	2	0.5	1	1.4
Bald Eagle, *Haliaeetus leucocephalus*	9	2.1	2	2.8
Sandpiper, *Scolopacidae*	1	0.2	1	1.4
Gull, *Larus* spp.	3	0.7	1	1.4
Glaucous-winged Gull, *L. glaucescens*	12	2.8	3	4.1
Western Gull, *L. occidentalis*	1	0.2	1	1.4
Herring Gull, *L. argentatus*	1	0.2	1	1.4
Heerman's Gull, *L. heermani*	2	0.5	1	1.4
Black-legged Kittiwake, *Rissa tridactyla*	2	0.5	2	2.8
Murre, *Alcidae*	3	0.7	1	1.4
Common Murre, *Uria aalge*	14	3.3	4	5.6
Cassin's Auklet, *Ptychoramphus aleutica*	1	0.2	1	1.4
Rhinoceros Auklet, *Cerorhinca monocerata*	1	0.2	1	1.4
Snowy Owl, *Nyctea scandiaca*	1	0.2	1	1.4
Great Horned Owl, *Bubo virginianus*	1	0.2	1	1.4
Flicker, *Colaptes cafer/auritus*	1	0.2	1	1.4
Finch etc., Fringillidae	1	0.2	1	1.4
Total	425	100.0%	72	100.0%

Table 53. DiSo 1-I, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Shark sp., Pleurotremata	8	0.4	2	1.4
Dogfish, *Squalus acanthias*	321	18.0	31	21.8
Skate, *Raja* sp.	4	0.2	2	1.4
Ratfish, *Hydrolagus colliei*	3	0.2	3	2.1
Herring, *Clupea harengus*	66	3.7	5	3.5
Salmon, *Onchorhynchus* spp.	14	0.8	-	-
Chum Salmon, *O. keta*	16	0.9	3	2.1
Sockeye/Coho Salmon, *O. nerka/kisutch*	53	3.0	3	2.1
Surf Perch, Emiotocidae	11	0.6	-	-
Striped Sea Perch, *Embiotoca lateralis*	14	0.8	5	3.5
Pile Perch, *Rhacochilus vacca*	15	0.8	7	4.9
Rockfish, *Sabastes* spp.	604	33.9	26	18.3
Yelloweye Rockfish, *S. ruberrimus*	36	2.0	6	4.2
Yellowtail Rockfish, *S. flavidus*	5	0.3	2	1.4
Black Rockfish, *S. melanops*	6	0.3	3	2.1
Canary Rockfish, *S. pinniger*	3	0.2	2	1.4
Lingcod, *Ophiodon elongatus*	180	10.1	8	5.6
Greenling, *Hexagrammos* spp.	308	17.3	21	14.8
Sculpin, Cottidae	20	1.1	2	1.4
Buffalo Sculpin, *Enophrys bison*	1	0.1	1	0.7
Red Irish Lord, *Hemilepidotus hemilepidotus*	3 3	0.2	11	0.7
Cabezon, *Scorpaenichthys marmoratus*	84	4.7	5	3.5
Flatfish, Pleuronectida/Bothidae	1	0.1	1	0.7
Halibut, *Hippoglossus stenolepis*	3	0.2	2	1.4
Rock Sole, *Lepidosetta bilineata*	1	0.1	1	0.7
Total	1,780	100.0%	142	100.0%

Table 54. DiSo 1-I, Shellfish Remains, Weight of Remains

Taxa	Weight in Grams	
	Raw	Relative
Native Littleneck, *Protothaca staminea*	78.7	6.6
Butter Clam, *Saxidomus giganteus*	553.0	46.7
Basket Cockle, *Clinocardium nuttalli*	5.8	0.5
Horse Clam, *Tresus* sp.	269.7	22.8
Horse Clam, *Tresus capax*	93.3	7.9
Horse Clam, *Tresus nuttalli*	78.7	6.6
Purple-hinged Rock Scallop, *Hinnites multirugosis*	11.5	1.0
California Mussel, *Mytilus californianus*	67.9	5.7
Frilled Dogwinkle, *Thais lamellosa*	10.4	0.9
Emarginate Dogwinkle, *T. emarginata*	0.6	0.1
Black Turban, *Tegula funebralis*	9.3	0.8
Hooked Slipper Shell, *Crepidula adunca*	0.1	<0.1
Northern Abalone, *Haliotis kamtschatkana*	5.2	0.4
Sea Urchin, *Strongylocentrotus* spp.	0.5	<0.1
Total	1,184.7 grams	100.0%

Table 55. DiSo 1-II, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Northern Fur Seal, *Callorhinus ursinus*	72	69.2	6	33.3
Northern Sea Lion, *Eumatopias jubata*	2	1.9	1	5.6
Harbour Seal, *Phoca vitulina*	7	6.7	3	16.7
Sea Otter, *Enhydra lutris*	3	2.9	1	5.6
Deer, *Odocoileus hemionus*	15	14.4	3	16.7
Dog (?), *Canis familiaris* ?	3	2.9	2	11.1
Black Bear, *Ursus americanus*	1	1.0	1	5.6
Mink, *Mustela vison*	1	1.0	1	5.6
Total	104	100.0%	18	100.3%
Unidentified Whale, Cetacea	(91)		(2)	
Unidentified Porpoise, Delphinidae	(36)		(3)	
Unidentified Seal/Sea Lion, Pinnipedia	(2)			
Small Sea Mammal, Pinnipedia/*E. lutris*	(180)			

Table 56. DiSo 1-II, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Red-throated Loon, _Gavia stellata_	3	3.0	2	6.3
Common Loon, _G. immer_	2	2.0	1	3.1
Western Grebe, _Aecmophorus occidentalis_	1	1.0	1	3.1
Horned Grebe, _Podiceps auritus_	1	1.0	1	3.1
Albatross, _Diomedea_ spp.	18	18.0	3	9.4
Shearwater, _Puffinus_ sp.	2	2.0	1	3.1
Sooty Shearwater, _P. griseus_	13	13.0	2	6.3
Cormorant, _Phalacrocorax_ sp.	3	3.0	-	-
Brandt's Cormorant, _P. penicillatus_	4	4.0	1	3.1
Goose, Anserinae	8	8.0	1	3.1
Canada Goose, _Branta canadensis_	1	1.0	1	3.1
White-fronted Goose, _Anser albifrons_	3	3.0	1	3.1
Snow Goose, _Chen caerulescens_	2	2.0	1	3.1
Duck, Anatinae/Aythyinae	2	2.0	1	3.1
Dabbling Duck, _Anas_ sp.	44	4.0	1	3.1
Greater Scaup, _Aythya marila_	1	1.0	1	3.1
Oldsquaw, _Clangula hyemalis_	3	3.0	2	6.2
Scoter, _Melanitta_ sp.	2	2.0	1	3.1
White-winged Scoter, _M. deglandi_	1	1.0	1	3.1
Common Merganser, _Mergus merganser_	2	2.0	1	3.1
Eagle, Buteoninae	2	2.0	1	3.1
Parasitic Jaeger, _Stercorarius parasiticus_	1	1.0	1	3.1
Gull, _Larus_ sp.	6	6.0	2	6.3
Glaucous-winged Gull, _L. glaucescens_	4	4.0	1	3.1
Heerman's Gull, _L. heermanni_	1	1.0	1	3.1
Common Murre, _Uria aalge_	6	6.0	1	3.1
Murrelet/Auklet, Alcidae (small)	4	4.0	2	6.3
Total	100	100.0%	32	100.0%

Table 57. DiSo 1-II, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Shark, Pleurotremata	1	<0.1	1	0.7
Dogfish, *Squalus acanthias*	545	21.7	28	20.7
Skate, *Raja* sp.	17	0.7	1	0.7
Herring, *Clupea harengus*	92	3.7	3	2.2
Salmon, *Oncorhynchus* spp.	91	3.6	7	5.2
Chum Salmon, *O. keta*	41	1.6	1	0.7
Sockeye/Coho Salmon, *O. nerka/kisutch*	7	0.3	1	0.7
Surf Perch, Embiotocidae	16	0.6	-	-
Striped Sea Perch, *Embiotoca lateralis*	9	0.4	6	4.2
Pile Perch, *Rhacochilus vacca*	8	0.3	3	2.2
Bluefin Tuna, *Thunnus thynnus*	1	<0.1	1	0.7
Rockfish, *Sebastes* spp.	1,075	42.8	31	23.1
Yelloweye Rockfish, *S. ruberrimus*	48	1.9	6	4.5
Yellowtail Rockfish, *S. flavidus*	8	0.3	2	1.5
Quillback Rockfish, *S. maliger*	8	0.3	2	1.5
Copper Rockfish, *S. caurinus*	2	0.1	1	0.7
Black Rockfish, *S. melanops*	1	<0.1	1	0.7
Lingcod, *Ophiodon elongatus*	197	7.9	11	8.2
Greenling, *Hexagrammos* spp.	168	6.7	11	8.2
Sculpin, Cottidae	2	0.1	1	0.7
Buffalo Sculpin, *Enophrys bison*	1	<0.1	1	0.7
Red Irish Lord, *Hemilepidotus hemilepidotus*	3	0.1	2	1.5
Cabezon, *Scorpaenichthys marmoratus*	102	4.1	5	3.7
Flatfish, Pleuronectidae/Bothidae	27	1.1	2	1.5
Halibut, *Hippoglossus stenolepis*	3	0.1	1	0.7
Petrale Sole, *Eopsetta jordani*	14	0.6	1	0.7
English Sole, *Parophrys vetulus*	7	0.3	1	0.7
Starry Flounder, *Platichthys stellatus*	7	0.3	2	1.5
Sand Sole, *Psettichthys melanostictus*	8	0.3	1	0.7
Total	2,509	100.0%	134	100.5%

Table 58. DiSo 1-II, Shellfish Remains, Weight of Remains

Taxa	Weight in Grams	
	Raw	Relative
Native Littleneck, Protothaca staminea	20.2	6.8
Butter Clam, Saxidomus giganteus	194.4	65.5
Basket Cockle, Clinocardium nuttalli	1.4	0.4
Horse Clam, Tresus spp.	12.6	4.2
California Mussel, Mytilus californianus	15.1	5.1
Frilled Dogwinkle, Thais lamellosa	2.5	0.8
Black Turban, Tegula funebralis	29.2	9.8
Dire Whelk, Searlesia dira	00.5	0.2
Lewis's Moon Snail, Polinices lewisii	20.2	6.8
Sea Urchin, Strongylocentrotus spp.	0.5	0.2
Total	296.9 grams	99.8%

Table 59. DiSo 1-III, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Killer Whale, Orcinus orca	1	0.6	1	2.4
Northern Fur Seal, Callorhinus ursinus	31	17.4	11	26.8
Northern Sea Lion, Eumatopias jubata	12	6.7	3	7.3
California Sea Lion, Zalophus californianus	2	1.1	2	4.9
Northern Elephant Seal (?), Mirounga angustirostris ?	1	0.6	1	2.4

Table 59. (Continued)

Taxa	Count		MNI	
	Raw	%	Raw	%
Sea Otter, *Enhydra lutris*	25	14.0	7	17.1
Deer, *Odocoileus hemionus*	19	10.7	5	12.2
Dog, *Canis familiaris*	45	25.2	1	2.4
Dog or Wolf, *Canis* sp.	2	1.1	1	2.4
Mink, *Mustela vison*	1	0.6	1	2.4
Total	178	99.9%	41	99.8%
Unidentified Whale, Cetacea	(90)		(3)=	
Unidentified Porpoise, Delphinidae	(39)		(4)	
Seal/Sea Lion, Pinnipedia	(10)			
Small Sea Mammal, Pinnipedia/*E. lutris*	(99)			
Unidentified Carnivore, Carnivora	(1)			

Table 60. DiSo 1-III, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Arctic/Red-throated Loon, Gavia arctica/ stellata *Gavia arctica/stellata*	1	0.1	-	-
Arctic Loon, *G. arctica*	6	0.8	2	2.7
Red-throated Loon, *G. stellata*	1	0.1	1	1.4
Common Loon, *G. immer*	7	1.0	1	1.4
Red-necked Grebe, *Podiceps grisagena*	1	0.1	1	1.4
Albatross, *Diomedea* spp.	438	63.9	14	18.9
Northern Fulmar, *Fulmaris glacialis*	1	0.1	1	1.4
Shearwater, *Puffinus* sp.	1	0.1	1	1.4
Sooty Shearwater, *P. griseus*	11	1.6	2	2.7

Table 60. (Continued)

Taxa	Count		MNI	
	Raw	%	Raw	%
Double-crested/Brandt's Cormorant, *Phalacrocorax auritus/penicillatus*	6	0.9	2	2.7
Brandt's/Pelagic Cormorant, *P. penicillatus/pelagicus*	5	0.7	-	-
Palagic Cormorant, *P. pelagicus*	19	2.8	3	4.1
Brandt's Cormorant, *P. penicillatus*	15	2.2	2	2.7
Goose, Anserinae	2	0.3	-	-
Canada Goose, *Branta canadensis*	11	1.6	4	5.4
Brant, *Branta bernicla*	2	0.3	2	2.7
White-fronted Goose, *Anser albifrons*	5	0.7	-	-
Snow Goose, *Chen caerulescens*	1	1.0	1	1.4
Goose, *Branta* sp.	2	0.3	-	-
Duck, Anatinae/Aythyinae	8	1.2	1	1.4
Greater Scaup, *Aythya marila*	1	0.1	1	1.4
Bufflehead, *Bucephala albeola*	2	0.3	1	1.4
Scoter, *Melanitta* sp.	2	0.3	1	1.4
White-winged Scoter, *M. deglandi*	2	0.3	1	1.4
Merganser, *Mergus* sp.	6	0.8	1	1.4
Common Merganser, *M. merganser*	2	0.3	2	2.7
Bald Eagle, *Haliaeetus leucocephalus*	3	0.4	1	1.4
Sandpiper, Scolopacidae	4	0.5	-	-
Sandpiper, *Erolia* sp.	6	0.9	2	2.7
Greater Yellowlegs, *Totanus melanoleucus*	3	0.4	1	1.4
Northern Phalarope, *Lobipes lobatus*	1	0.1	1	1.4
Gull, *Larus* spp.	21	3.1	2	2.7
Glaucous-winged Gull, *L. glaucescens*	71	10.4	11	14.9
Western Gull, *L. occidentalis*	3	0.4	2	2.7
Heerman's Gull, *L. heermanni*	1	0.1	1	1.4
Black-legged Kittiwake, *Rissa tridactyla*	2	0.3	1	1.4
Murre, Alcidae	1	0.1	-	-
Common Murre, *Uria aalge*	5	0.7	2	2.7
Marbled Murrelet, *Brachyramphos marmoratus*	1	0.1	1	1.4
Cassin's Auklet, *Ptychoramphus aleutica*	2	0.3	2	2.7
Pigeon Guillemot, *Cepphus columba*	1	0.1	1	1.4
Total	685	100.0%	75	100.0%

Table 61. DiSo 1-III, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Shark, Pleurotremata	11	0.2	1	0.3
Dogfish, *Squalus acanthias*	1,044	17.5	62	15.7
Skate, *Raja* sp.	26	0.4	1	0.3
Longnose Skate, *R. rhina*	1	<0.1	1	0.3
Big Skate, *R. binoculata*	13	0.2	1	0.3
Ratfish, *Hydrolagus colliei*	7	0.1	3	0.8
Skate/Dogfish/Ratfish, Squalidae/ Rajidae/Chimaeridae	18	0.3	-	-
Herring, *Clupea harengus*	933	15.6	123	31.1
Pacific Sardine, *Sardinops sagax*	1	<0.1	1	0.3
Salmon, *Oncorhynchus* sp.	196	3.3	1	0.3
Chum Salmon, *O. keta*	164	2.8	4	1.0
Sockeye/Coho Salmon, *O. nerka/kisutch*	259	4.3	4	1.0
Spring Salmon, *O. tshawytscha*	2	<0.1	2	0.5
Plainfin Midshipman, *Porichthys notatus*	2	<0.1	1	0.3
Hake, *Merluccius productus*	4	0.1	1	0.3
Surf Perch, Embiotocidae	41	0.7	-	-
Striped Sea Perch, *Embiotoca lateralis*	8	0.1	4	1.0
Pile Perch, *Rhacochilus vacca*	17	0.3	10	2.5
Wolf Eel, *Anarrhichthys ocellatus*	25	0.4	1	0.3
Rockfish, *Sebastes* spp.	1,625	27.2	34	8.6
Yelloweye Rockfish, *S. ruberrimus*	95	1.6	8	2.0
Yellowtail Rockfish, *S. flavidus*	23	0.4	3	0.8
Quillback Rockfish, *S. maliger*	13	0.2	3	0.8
Bocaccio, *S. paucispinus*	3	0.1	1	0.3

Table 61. (Continued)

Taxa	Count		MNI	
	Raw	%	Raw	%
Copper Rockfish, *S. caurinus*	6	0.1	2	0.5
Black Rockfish, *S. melanops*	5	0.1	2	0.5
Canary Rockfish, *S. pinniger*	6	0.1	2	0.5
Lingcod, *Ophiodon elongatus*	372	6.2	14	3.5
Greenling, *Hexagrammos* spp.	697	11.7	60	15.2
Sculpin, Cottidae	85	1.4	8	2.0
Buffalo Sculpin, *Enophrys bison*	11	0.2	6	1.5
Red Irish Lord, *Hemilepidotus hemilepidotus*	52	0.9	9	2.3
Cabezon, *Scorpaenichthys marmoratus*	155	2.6	11	2.8
Flatfish, Pleuronectidae/Bothidae	22	0.4	2	0.5
Halibut, *Hippoglossus stenolepis*	21	0.4	3	0.8
Rock Sole, *Lepidosetta bilineata*	2	<0.1	2	0.5
Petrale Sole, *Eopsetta jordani*	4	0.1	2	0.5
Arrowtooth Flounder, *Atheresthes stomias*	1	<0.1	1	0.3
Dover Sole, *Microstomus pacificus*	1	<0.1	1	0.3
Pacific Sanddab, *Citharichthys sordidus*	1	<0.1	1	0.3
Total	5,972	100.0%	396	100.8%

Table 62. DiSo 1-III, Shellfish Remains, Weight of Remains

Taxa	Weight in Grams	
	Raw	Relative
Native Littleneck, *Protothaca staminea*	880.0	11.6
Butter Clam, *Saxidomus giganteus*	2,632.9	34.8
Basket Cockle, *Clinocardium nuttalli*	782.4	10.4
Horse Clam, *Tresus* spp.	242.9	3.2
Horse Clam, *T. capax*	90.3	1.2
Horse Clam, *T. nutalli*	225.2	3.0
Sand Clam, *Macoma secta*	6.6	0.1
Bodega Clam, *Tellina bodegensis*	0.3	<0.1
Purple-hinged Rock Scallop, *Hinnites multirugosus*	7.4	0.1
Mussel, *Mytilus* spp.	14.0	0.2
California Mussel, *M. californianus*	1,162.7	15.4
Bay Mussel, *M. edulis*	3.5	<0.1
Frilled Dogwinkle, *Thais lamellosa*	1,100.8	14.6
Emarginate Dogwinkle, *T. emarginata*	10.6	0.1
File Dogwinkle, *T. lima*	2.1	<0.1
Channeled Dogwinkle, *T. canaliculata*	0.7	<0.1
Black Turban, *Tegula funebralis*	15.5	0.2
Dire Whelk, *Searlesia dira*	4.9	0.1
Purple Olive, *Olivella biplicata*	3.9	0.1
Sitka Periwinkle, *Littorina sitkana*	0.6	<0.1
Lurid Rock Shell (?), *Ocenebra lurida* ?	0.1	<0.1
Sheild Limpet, *Acmaea pelta*	3.2	<0.1
Finger Limpet, *A. digitalis*	0.5	<0.1
Mask Limpet, *A. persona*	23.3	0.3
Plate Limpet, *A. testudinalis scutum*	9.2	0.1
Northern Abalone, *Haliotis kamtschatkana*	2.1	<0.1
Barnacle, *Balanus* spp.	121.0	1.6
Barnacle, *B. cariosus*	202.6	2.7
Whale Barnacle, *B. hesperius*	0.1	<0.1
Sea Urchin, *Strongylocentrotus* spp.	3.2	<0.1
Crab, *Cancer* sp.	0.1	<0.1
Land Snail	0.8	<0.1
Total	7,555.9 grams	100.0%

Table 63. DiSo 1-IV, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Northern Fur Seal, <u>Callorhinus</u> <u>ursinus</u>	86	26.5	15	31.3
Northern Sea Lion, <u>Eumatopias</u> <u>jubata</u>	14	4.3	4	8.3
California Sea Lion, <u>Zalophus</u> <u>californianus</u>	19	5.9	5	10.4
Harbour Seal, <u>Phoca</u> <u>vitulina</u>	66	20.4	9	18.8
Sea Otter, <u>Enhydra</u> <u>lutris</u>	55	17.0	6	12.5
Deer, <u>Odocoileus</u> <u>hemionus</u>	28	88.66	5	10.4
Dog (?), <u>Canis</u> <u>familiaris</u>	55	17.0	3	6.3
Black Bear, <u>Ursus</u> <u>americanus</u>	1	0.3	1	2.1
Total	324	100.0%	48	100.1%
Unidentified Whale, Cetacea	(291)		(4)	
Unidentified Whale, Cetacea	(140)		(5)	
Seal/Sea Lion, Pinnipedia	(20)			
Small Sea Mammal, Pinnipedia/<u>E.</u> <u>lutris</u>	(73)			

Table 64. DiSo 1-IV, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Arctic/Red-throated Loon, *Gavia arctica/stellata*	1	0.4	-	--
Red-throated Loon, *G. stellata*	8	2.8	2	2.8
Arctic Loon, *G. arctica*	8	0.4	1	1.4
Common Loon, *G. immer*	1	0.4	1	1.4
Eared/Horned Grebe, *Podiceps caspicus/ auritus*	2	0.7	1	1.4
Eared Grebe, *P. caspicus*	1	0.4	1	1.4
Albatross, *Diomedea* spp.	10	3.5	3	4.2
Northern Fulmar, *Fulmaris glacialis*	1	0.4	1	1.4
Shearwater, *Puffinus* sp.	1	0.4	-	-
Sooty Shearwater, *P. griseus*	67	23.8	10	13.9
Cormorant, *Phalacrocorax* spp.	5	1.8	3	4.2
Double-crested/Brandt's Cormorant, *P. auritus/penicillatus*	1	0.4	-	-
Pelagic Cormorant, *P. pelagicus*	2	0.7	1	1.4
Double-crested Cormorant, *P. auritus*	1	0.4	1	1.4
Goose, Anserinae	16	5.7	1	1.4
Canada Goose, *Branta canadensis*	54	19.1	7	9.7
White-fronted Goose, *Anser albifrons*	3	1.1	1	1.4
Snow Goose, *Chen caerulescens*	2	0.7	2	2.8
Duck, Anatinae/Aythyinae	15	5.3	-	-
Dabbling Duck, *Anas* sp.	5	1.8	2	2.8
American Widgeon, *Mareca americana*	1	0.4	1	1.4
Shoveler, *Spatula clypeata*	1	0.4	1	1.4
Bufflehead, *Bucephala albeola*	1	0.4	1	1.4

Table 64. (Continued)

Taxa	Count		MNI	
	Raw	%	Raw	%
White-winged Scoter, *Melanitta deglandi*	9	3.2	2	2.8
Surf Scoter, *M. perspicillata*	1	0.4	1	1.4
Common Scoter, *Oidemia nigra*	4	1.4	1	1.4
Common Merganser, *Mergus merganser*	2	0.7	1	1.4
American Coot, *Fulica americana*	2	0.7	1	1.4
Black Oystercatcher, *Haematopus bachmani*	1	0.4	1	1.4
Greater Yellowlegs, *Totanus melanoleucus*	2	0.7	1	1.4
Jaeger/Skua, Stercoraridae	1	0.4	1	1.4
Gull, *Larus* spp.	9	3.2	1	1.4
Glaucous-winged Gull, *L. glaucescens*	5	1.8	3	4.2
Herring Gull, *L. argentatus*	1	.4	1	1.4
Heermann's Gull, *L. heermanni*	3	1.1	2	2.8
Black-legged Kittiwake, *Rissa tridactyla*	3	1.1	2	2.8
Arctic Tern (?), *Sterna paradisea* ?	3	1.1	2	2.8
Murre, Alcidae	2	0.7	-	-
Common Murre, *Uria aalge*	18	6.4	5	6.9
Tufted Puffin, *Lundha cirrhata*	1	0.4	1	1.4
Snowy Owl, *Nyctea scandiaca*	4	1.4	1	1.4
Pileated Woodpecker (?), *Dryocopus pileatus*?	1	0.4	1	1.4
Northwestern Crow, *Corvus caurinus*	2	0.7	1	1.4
Total	282	100.8%	72	100.0%

Table 65. DiSo 1-IV, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Dogfish, *Squalus acanthias*	375	9.8	54	22.5
Skate, *Raja* sp.	7	0.2	1	0.4
Ratfish, *Hydrolagus colliei*	8	0.2	44	1.7
Herring, *Clupea harengus*	77	2.0	9	3.8
Salmon, *Oncorhynchus* spp.	74	2.0	-	-
Chum Salmon, *O. keta*	47	1.2	3	1.3
Coho Salmon, *O. kisutch*	1	<0.1	1	0.4
Sockeye/Coho Salmon, *O. nerka/kisutch*	179	4.7	2	0.8
Spring Salmon, *O. tshawytscha*	5	0.2	2	0.8
Hake, *Merluccius productus*	2	0.1	1	0.4
Surf Perch, Embiotocidae	4	0.1	1	0.4
Striped Sea Perch, *Embiotoca lateralis*	3	0.1	2	0.8
Pile Perch, *Rhacochilus vacca*	7	0.2	3	1.3
Bluefin Tuna, *Thunnus thynnus*	2	0.1	1	0.4
Rockfish, *Sebastes* spp.	2,228	58.1	69	28.8
Yelloweye Rockfish, *S. ruberrimus*	103	2.7	10	4.2
Yellowtail Rockfish, *S. flavidus*	23	0.6	7	2.9
Quillback Rockfish, *S. maliger*	34	0.9	8	3.3
Copper Rockfish, *S. caurinus*	13	0.3	3	1.3
Black Rockfish, *S. melanops*	5	0.1	3	1.3
Canary Rockfish, *S. pinniger*	4	0.1	2	0.8
Lingcod, *Ophiodon elongatus*	384	10.0	20	8.3
Greenling, *Hexagrammos* spp.	87	2.3	7	2.9
Sculpin, Cottidae	2	0.1	1	0.4
Buffalo Sculpin, *Enophrys bison*	2	0.1	1	0.4
Red Irish Lord, *Hemilepidotus hemilepidotus*	4	0.1	3	1.3
Cabezon, *Scorpaenichthys marmoratus*	92	2.4	12	5.0
Flatfish, Pleuronectidae/Bothidae	34	0.9	2	0.8
Halibut, *Hippoglossus stenolepis*	15	0.4	2	0.8
Flathead Sole, *Hippoglossoides elassodon*	1	<0.1	1	0.4
Rock Sole, *Lepidosetta bilineata*	1	<0.1	1	0.4
Petrale Sole, *Eopsetta jordani*	11	0.3	3	1.3
English Sole, *Parophrys vetulus*	1	<0.1	1	0.4
Total	3,835	100.3%	240	100.0%

Table 66. DiSo 1-IV, Shellfish Remains, Weight of Remains

Taxa	Weight of Remains	
	Raw	Relative
Native Littleneck, *Protothaca staminea*	370.3	11.9
Butter Clam, *Saxidomus giganteus*	2,190.0	70.4
Basket Cockle, *Clinocardium nuttalli*	19.1	0.6
Horse Clam, *Tresus* spp.	173.4	5.6
Horse Clam, *T. capax*	30.4	1.0
Horse Clam, *T. nuttalli*	89.6	2.9
Mussel, *Mytilus* spp.	1.4	0.1
California Mussel, *M. californianus*	195.0	6.3
Frilled Dogwinkle, *Thais lamellosa*	5.6	0.2
Black Turban, *Tegula funebralis*	29.7	1.0
Mask Limpet, *Acmaea persona*	0.4	<0.1
Whale Barnacle, *Coronula* sp.	0.8	<0.1
Acorn Barnacle, *Balanus* spp.	0.2	<0.1
Sea Urchin, *Strongylocentrotus* spp.	3.6	0.1
Land Snail	1.6	0.1
Total	3,112.0 grams	1100.0%

Table 67. DiSo 1-V, Mammal Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Northern Ful Seal, *Callorhinus ursinus*	1	50	1	50
Deer, *Odocoileus hemionus*	1	50	1	50
Total	2	100%	2	100%
Unidentified Whale, Cetacea	(6)		(1)	
Unidentified Porpoise, Delphinidae	(1)		(1)	
Seal/Sea Lion, Pinnipedia	(9)			

Table 68. DiSo 1-V, Bird Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Albatross, *Diomedea* spp.	5	45.5	1	20
Goose, Anserinae	1	9.1	-	-
White-fronted Goose, *Anser albifrons*	1	9.1	1	20
Duck, Anatinae/Aythyinae	1	9.1	-	-
Shoveler, *Spatula clypeata*	1	9.1	1	20
Bald Eagle, *Haliaeetus leucocephalus*	1	9.11	1	20
Western Gull, *Larus occidentalis*	1	9.1	1	20
Total	11	100.1%	5	100%

Table 69. DiSo 1-V, Fish Remains, Skeletal Element Count and MNI

Taxa	Count		MNI	
	Raw	%	Raw	%
Dogfish, *Squalus acanthias*	100	10.3	12	22.6
Skate, *Raja* sp.	15	1.5	1	1.9
Ratfish, *Hydrolagus colliei*	1	0.1	1	1.9
Herring, *Clupea harengus*	25	2.6	3	5.7
Salmon, *Oncorhynchus* spp.	5	0.5	-	-
Chum Salmon, *O. keta*	14	1.4	1	1.9
Sockeye, Coho Salmon, *O. nerka/kisutch*	69	7.1	1	1.9
Plainfin Midshipman, *Porichthys notatus*	2	0.2	1	1.9
Hake, *Merluccius productus*	2	0.2	1	1.9
Surf Perch, *Embiotocidae*	7	0.7	-	-
Striped Sea Perch, *Embiotoca lateralis*	1	0.1	1	1.9
Pile Perch, *Rhacochilus vacca*	3	0.3	3	5.7
Rockfish, *Sebastes* spp.	425	43.8	1	1.9
Yelloweye Rockfish, *S. ruberrimus*	31	3.2	2	3.8
Yellowtail Rockfish, *S. flavidus*	16	1.6	4	7.5
Quillback Rockfish, *S. maliger*	10	1.0	4	7.5
Bocaccio, *S. paucispinnis*	3	0.3	1	1.9

Table 69. (Continued)

Taxa	Count		MNI	
	Raw	%	Raw	%
Copper Rockfish, *S. caurinus*	6	0.6	1	1.9
Canary Rockfish, *S. pinniger*	3	0.3	1	1.9
Lingcod, *Ophiodon elongatus*	108	11.1	4	7.5
Greenling, *Hexagrammos* spp.	53	5.5	4	7.5
Sculpin, Cottidae	5	0.1	1	1.9
Cabezon, *Scorpaenichthys marmoratus*	47	4.8	2	3.8
Flatfish, Pleuronectidae/Bothidae	6	0.6	-	-
Halibut, *Hippoglossus stenolepis*	8	0.8	1	1.9
Rock Sole, *Lepidosetta bilineata*	1	0.1	1	1.9
Petrale Sole, *Eopsetta jordani*	1	0.1	1	1.9
Starry Flounder, *Platichthys stellatus*	3	0.3	1	1.9
Total	969	99.6%	53	100.2%

Table 70. DiSo 1-V, Shellfish Remains, Weight of Remains

Taxa	Weight in Grams	
	Raw	Relative
Butter Clam, *Saxidomus giganteus*	6.7	69.1
Black Turban, *Tegula funebralis*	2.9	29.9
Bay Mussel, *Mytilus edulis*	0.1	1.0
Total	9.7 grams	100.0%

Table 71. Bird Remains, Season of Availability by Assemblage, Relative Frequency by Skeletal Element Count

Assemblage	N	Season			
		Year Round (1)	Winter (2,3,4)	Spring/Fall (5,6)	Summer (7,8,9,10)
DiSo 16	93	44	17	18	21
DiSo 9-I	318	16	30	28	26
DiSo 9-II	221	18	11	14	56
DiSo 1-I	370	17	6	15	62
DiSo 1-II	66	15	11	11	64
DiSo 1-III	619	19	2	4	75
DiSo 1-IV	224	9	5	35	52
DiSo 1-V	9	22	0	22	56

All rows total 100%

Table 72. Bird Remains, Season of Availability by Assemblage, Relative Frequency by MNI

Assemblage	N	Season			
		Year Round (1)	Winter (2,3,4)	Spring/Fall (5,6)	Summer (7,8,9,10)
DiSo 16	24	38	21	17	25
DiSo 9-I	49	14	339	27	20
DiSo 9-II	36	33	25	17	25
DiSo 1-I	74	22	15	20	43
DiSo 1-II	24	13	29	17	42
DiSo 1-III	64	34	8	14	42
DiSo 1-IV	63	18	12	27	43
DiSo 1-V	5	40	0	40	20

All rows total 100%

Table 73. Fish Remains, Season of Availability by Assemblage, Relative Frequency by Skeletal Element Count

Assemblage	N	Season				
		Year Round	Early Summer and Spring	Summer	Late Summer and Fall	Winter and Early Spring
DiSo 16	2,673	28	70	-	2	-
DiSo 9-I	3,620	82	10	-	8	-
DiSo 9-II	4,135	36	56	-	8	<1
DiSo 1-I	1,700	96	-	-	4	-
DiSo 1-II	2,326	98	-	<1	2	-
DiSo 1-III	4,842	91	<1	-	9	<1
DiSo 1-IV	3,684	94	-	<1	6	<1
DiSo 1-V	940	91	<1	-	9	-

All rows total 100%
Herring, anchovy and sardine excluded

Table 74. Fish Remains, Season of Availability by Assemblage, Relative Frequency by MNI

Assemblage	N	Season				
		Year Round	Early Summer and Spring	Summer	Late Summer and Fall	Winter and Early Spring
DiSo 16	310	19	79	-	2	-
DiSo 9-I	98	52	43	-	5	-
DiSo 9-II	171	38	58	-	3	<1
DiSo 1-I	137	96	-	-	4	-
DiSo 1-II	124	98	-	<1	1	-
DiSo 1-III	271	96	<1	-	3	1
DiSo 1-IV	231	96	-	<1	3	1
DiSo 1-V	51	94	2	-	4	~~1~~

All rows total 100%
Herring, anchovy and sardine are excluded

Table 75. Mammal Remains, Habitat Category by Assemblage, Relative Frequency by Skeletal Element Count

Assemblage	N	HabitateCategory 1 Pelagic	2 Pelagic Littoral	3 Littoral	4 Littoral/ Forest Edge	5 Forest
DiSo 16	99	~~99~~	-	-	35	65
DiSo 9-I	136	6	25	36	2	31
DiSo 9-II	168	25	35	13	1	26
DiSo 1-I	108	18	41	15	2	24
DiSo 1-II	101	36	39	8	1	16
DiSo 1-III	131	12	33	39	1	15
DiSo 1-IV	269	16	38	35	-	11
DiSo 1-V	2	25	25	-	-	50

All rows total 100%
* _Canis familiaris_ is not included

Table 76. Mammal Remains, HabitateCategory by Assemblage, Relative Frequency of MNI

Assemblage	N	HabitateCategory 1 Pelagic	2 Pelagic Littoral	3 Littoral	4 Littoral/ Forest Edge	5 Forest
DiSo 16	8	-	-	-	75	25
DiSo 9-I	23	9	28	24	9	30
DiSo 9-II	21	17	36	19	9	19
DiSo 1-I	31	14	42	18	3	23
DiSo 1-II	17	18	29	24	6	24
DiSo 1-III	39	15	40	29	3	13
DiSo 1-IV	44	17	42	27	-	14
DiSo 1-V	2	25	25	-	-	50

All rows total 100%
Canis familiaris is not included

Table 77. Bird Remains, Habitat Category by Assemblage, Relative Frequency by Skeletal Element Count

Assemblage	N	Habitat Category 1 Pelagic	2 Open Littoral Waters	3 Sheltered Littoral Waters	4 Sheltered Shallow Waters	5 Strand Littoral Interface	6 Forest/ Upland
DiSo 16	165	1	29	42	2	24	2
DiSo 9-I	591	6	37	24	12	21	1
DiSo 9-II	251	10	33	41	4	11	1
DiSo 1-I	416	50	21	7	14	8	1
DiSo 1-II	98	35	25	9	18	13	-
DiSo 1-III	676	67	10	3	4	17	-
DiSo 1-IV	266	32	20	6	32	8	3
DiSo 1-V	10	50	-	-	30	20	-

All rows total 100%

Table 78. Bird Remains, Habitat Category by Assemblage, Relative Frequency by MNI

Assemblage	N	Habitat Category 1 Pelagic	2 Open Littoral Waters	3 Sheltered Littoral Waters	4 Sheltered Shallow Waters	5 Strand Littoral Interface	6 Forest/ Upland
DiSo 16	33	3	30	33	9	18	6
DiSo 9-I	64	9	33	27	16	14	2
DiSo 9-II	41	10	34	24	10	20	2
DiSo 1-I	72	17	26	15	19	17	6
DiSo 1-II	32	22	28	19	16	16	-
DiSo 1-III	74	28	23	11	11	27	-
DiSo 1-IV	72	25	25	10	24	13	4
DiSo 1-V	5	20	-	-	40	40	-

All rows total 100%

Table 79. Fish Remains, Habitat Category by Assemblage, Relative Frequency of Skeletal Element Count

		Habitat Category								
Assemblage	N	1 Deep Water Offshore	2 Mod. Deep Rocky Bottom	3 Mod. Deep Varied Bottom	4 Shallower Inshore Var. Bot.	5 Shallower Inshore Soft Bot.	6 Intertidal Boulder Bottom	7 Intertidal Soft Bottom	8 Streams	9 Lakes
DiSo 16	2,678	<1	10	38	8	<1	35	6	3	-
DiSo 9-I	7,560	<1	5	15	14	<1	3	50	13	<1
DiSo 9-II	10,091	<1	7	16	5	<1	12	55	5	<1
DiSo 1-I	1,406	<1	87	2	4	-	-	5	2	-
DiSo 1-II	1,894	1	85	3	3	1	-	5	22	-
DiSo 1-III	4,762	1	62	5	6	<1	<1	20	4	-
DiSo 1-IV	3,398	1	87	3	3	-	-	2	3	-
DiSo 1-V	840	1	84	4	5	<1	<1	3	3	-

*Dogfish and Ratfish are excluded; where the species occurs frequently in more than one habitat category, the number of bones is divided equally among the categories.

All rows total 100%

Table 80. Fish Remains, Habitat Category by Assemblage, Relative Frequency of Skeletal Element Count Excluding Herring, Sardine and Anchovy

Assemblage	N	Habitat Category 1 Deep Water Offshore	2 Mod. Deep Rocky Bottom	3 Mod. Deep Varied Bottom	4 Shallower Inshore Var. Bot.	5 Shallower Inshore Var. Bot.	6 Intertidal Boulder Bottom	7 Intertidal Soft Bottom	8 Streams	9 Lakes
DiSo 16	2,506	-	11	40	8	<1	37	<1	3	-
DiSo 9-I	3,757	<1	9	31	28	<1	5	<1	26	<1
DiSo 9-II	4,533	<1	16	36	12	<1	26	<1	10	<1
DiSo 1-I	1,340	<1	91	2	4	-	-	<1	2	-
DiSo 1-II	1,802	1	89	3	3	1	-	<1	33	-
DiSo 1-III	3,828	1	78	7	8	<1	<1	1	5	-
DiSo 1-IV	3,321	1	89	33	3	-	-	<1	3	-
DiSo 1-V	815	1	86	4	5	<1	<1	-	4	-

All rows total 100%
Dogfish and Ratfish are not included

Table 81. Fish Remains, Habitat Category by Assemblage, Relative Frequency of MNI

Assemblage	N	Habitat Category 1 Deep Water Offshore	2 Mod. Deep Rocky Bottom	3 Mod. Deep Varied Bottom	4 Shallower Inshore Var. Bot.	5 Shallower Inshore Var. Bot.	6 Intertidal Boulder Bottom	7 Intertidal Soft Bottom	8 Streams	9 Lakes
DiSo 16	312	<1	5	40	6	<1	39	8	1	-
DiSo 9-I	290	2	5	17	13	<1	7	46	10	<1
DiSo 9-II	306	4	9	21	8	<1	16	38	4	<1
DiSo 1-I	94	2	78	2	11	-	-	5	2	-
DiSo 1-II	93	2	76	3	8	3	-	4	3	-
DiSo 1-III	313	3	45	3	8	<1	-	41	1	-
DiSo 1-IV	172	4	83	3	4	-	-	5	1	-
DiSo 1-V	38	5	63	5	12	3	3	8	2	-

* Dogfish and Ratfish are excluded; where species occur in more than one category, the number of bones is divided equally among categories.

All rows total 100%

Table 82. Habitat Category by Assemblage, Relative Frequency by Skeletal Element Count of Bird, Fish and Mammal Fauna

Assemblage		Habitat Category					N
		1 Pelagic	2 Pelagic Littoral	3 Littoral	4 Littoral Forest Edge	5 Streams Lakes/Forests	
	M	1	22	3	4	5	
	B	1	2	3,4	5	6	
	F	1	2	3,4,5	6,7	8,9	
DiSo 16		1	13	31	32	23	2,770
DiSo 9-I		4	24	44	9	27	4,484
DiSo 9-II		12	28	35	13	12	4,952
DiSo 1-I		23	51	14	3	9	1,864
DiSo 1-II		24	51	14	5	6	2,001
DiSo 1-III		27	40	20	6	7	4,635
DiSo 1-IV		16	49	26	3	6	3,766
DiSo 1-VV		18	37	21	26	18	827

All rows total 100%
Excludes herring, sardine, anchovy, dogfish, ratfish and dog

Table 83. Habitat Category by Assemblage, Relative Frequency by MNI, Bird, Fish and Mammal

				Habitat Category			
Assemblage		1 Pelagic	2 Pelagic/ Littoral	3 Littoral	4 Littoral/ Forest Edge	5 Streams/ Lakes/Forests	N
	M	1	2	3	4	5	
	B	1	2	3,4	5	6	
	F	1	2	3,4,5	6,7	8,9	
DiSo 16		1	12	29	47	11	353
DiSo 9-I		7	22	32	25	14	377
DiSo 9-II		10	26	27	28	8	368
DiSo 1-I		11	49	22	8	10	197
DiSo 1-II		14	44	24	9	9	142
DiSo 1-III		15	36	21	24	5	426
DiSo 1-IV		15	50	23	6	6	288
DiSo 1-V		17	29	23	17	17	45

All rows total 100%
Dogfish, Ratfish and Dog are excluded

Table 84. Percentage of Animal Weight Contributed by Mammal, Bird and Fish Species

Assemblage	Mammal	Bird	Fish	Total Weight
DiSo 16	39	5	56	679 Kg.
DiSo 9-I	66	3	31	2,221
DiSo 9-II	66	3	31	2,156
DiSo 1-I	80	2	17	5,904
DiSo 1-II	56	1	43	3,401
DiSo 1-III	75	1	23	7,669
DiSo 1-IV	78	1	21	8,522
DiSo 1-V	34	2	64	615

All rows total 100%

Table 85. Mammal Remains, Habitat Category by Assemblage, Relative Frequency by Animal Weight

Assemblage	1 Pelagic	2 Pelagic Littoral	3 Littoral	4 Littoral Forest Edge	5 Streams Lakes/Forestss	Weight (Kg)
DiSo 16	-	-	-	14	86	263
DiSo 9-I	14	38	15	1	32	1,466
DiSo 9-II	19	50	11	1	19	1,420
DiSo 1-I	9	73	6	1	12	4,751
DiSo 1-II	15	59	10	1	16	1,917
DiSo 1-III	10	76	9	1	6	5,764
DiSo 1-IV	12	70	8	-	9	6,618
DiSo 1-V	28	28	-	-	44	210

All rows total 100%
<u>Canis</u> sp. and <u>Orcinus</u> <u>orca</u> excluded from sample

Table 86. Bird Remains, Habitat Category by Assemblage, Relative Frequency by Animal Weight

Assemblage	Habitat Category 1 Pelagic	2 Open Littoral Waters	3 Sheltered Littoral Waters	4 Sheltered Shallow Waters	5 Strand Littoral Interface	6 Forest/ Upland	Weight (Kg)
DiSo 16	1	27	46	16	10	<1	33.8
DiSo 9-I	4	27	29	36	4	<1	70.2
DiSo 9-II	5	40	18	18	18	<1	64.1
DiSo 1-I	17	19	11	34	17	2	126.2
DiSo 1-II	22	21	28	25	4	-	35.3
DiSo 1-III	30	23	9	21	17	-	109.1
DiSo 1-III	11	24	12	43	8	3	84.7
DiSo 1-V	19	-	-	28	53	-	12.1

All rows total 100%

Table 87. Fish Remains, Habitat Category by Assemblage, Relative Frequency by Animal Weight

	Habitat Category									
Assemblage	1	22	3	4	5	6	7	8	9	Weight in Kg
	Deep Water Offshore	Mod. Deep Rocky Bottom	Mod. Deep Varied Bottom	Shallower Inshore Varied Bot.	Shallower Inshore Soft Bot.	Intertidal Boulder Bottom	Intertidal Soft Bottom	Streams	Lakes	
DiSo 16	1	28	27	14	2	16	3	10	--	382
DiSo 9-I	14	25	18	18	1	2	5	16	-	685
DiSo 9-II	13	27	20	9	1	4	9	7	-	672
DiSo 1-I	31	62	2	3	-	-	1	1	-	1,027
DiSo 1-III	20	65	7	3	1	1	4	1	-	1,796
DiSo 1-IV	14	77	6	1	-	-	1	1	-	1,820
DiSo 1-V	23	68	22	3	2	1	1	2	-	393

All rows total 100%
Dogfish and Ratfish are not included

Table 88. Habitat Category by Assemblage, Relative Frequency of Animal Weights, Bird, Fish and Mammal Remains

Assemblage		Habitat Category					Weight in Kg
		1 Pelagic	2 Pelagic/ Littoral	3 Littoral	4 Littoral Forest Edge	5 Streams/ Lakes/Forests	
	M	1	2	3	4	5	
	B	1	2	3,4	5	6	
	F	1	2	3,4,5	6,7	8,9	
DiSo 16		<1	17	27	17	39	679
DiSo 9-I		14	34	24	2	26	2,221
DiSo 9-II		17	42	21	5	15	2,157
DiSo 1-I		13	70	6	<1	10	5,904
DiSo 1-II		16	67	8	<1	10	3,401
DiSo 1-III		12	73	10	1	5	7,669
DiSo 1-IV		13	71	8	<1	7	8,522
DiSo 1-V		24	53	5	1	16	615

All rows total 100%
Excludes dogfish, ratfish and Canis sp.