Appendix D:
Analysis of the Vertebrate Fauna from Ts'ishaa Village, DfSi-16, Benson Island, B.C.

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Introduction

The vertebrate fauna collected as level samples from five excavation units at DfSi-16, Tsi'ishaa Village, have been identified in whole or in part and are presented as an integrated sample in this report. Earlier reports have detailed the individual units and site areas (Crockford 1999; Frederick 2001, 2002 and 2003). The excavation units provide samples from three different areas of the site: one unit (S14-16 W25-27) from the 1999 trench through the main midden area near the centre of the site; two contiguous units (N2-4 W102-104; N4-6 W102-104) from the 2000 trench through the midden ridges at the western end of the site; and two units (S58-60 W64-66; S62-64 W62-64) from the back terrace area excavated in 2001. Vertebrate fauna from all levels of the back terrace units, odd-numbered levels of the 2000 units and selected levels of the 1999 units were identified.

Methods of Collection

In each area of the site units were excavated using 10 centimeter arbitrary levels (numbered) combined with designation of cultural layers (lettered). All deposits were trowelled and screened through ¼" mesh in the field, with all vertebrate faunal remains retained in the screens or found during excavation bagged for identification. Deposit column and fine screen samples were collected for analysis of small fauna, but this report deals only with the level bag vertebrate fauna.

Methods of Identification

Identifications to the least inclusive taxon possible were made by Gay Frederick (2000 and 2001 samples) and Susan Crockford (1999 samples) using the comparative faunal collection at the Zooarchaeology Laboratory, Department of Anthropology, University of Victoria. Bird, fish, land and sea mammal remains were identified with data recorded directly into a Paradox 35 database. In addition to taxa identification, information on element, element portion, sex, age, size class and modifications was recorded. Confidence codes indicating certainty of identification are used, Code 22 indicating certainty to species (e.g., *Oncorhynchus keta*), Code 21 certainty to at least genus (e.g., *Oncorhynchus sp.* or *Oncorhynchus cf. keta*), Code 20 certainty to family only (e.g., Salmonidae), Code 10 a limited-confidence identification to family (e.g., cf. Salmonidae), Code 11 a best guess and Code 00 indicating a confidence assessment is not applicable (eg.Unidentified Fish).

The faunal data has been quantified using Numbered of Identified Specimens, Number of Specimens and Minimun Number of Individuals. Only the former two measures have been used in integrating the sample. Given the small sample sizes for birds and mammals, these were felt to be the most appropriate measures.

Chronology of Site Areas and Stratigraphic Units

Each of the three areas of the site were occupied at different, sometimes overlapping, time periods and the deposits of both trenches can be broken into major stratigraphic groupings. The oldest deposits at the site are those of the back terrace, with ^{14}C dates of 4470 ± 70 RCYBP to 3000 ± 70 RCYBP. Differences through time within these deposits are seen and described in Frederick 2002 and 2003, but relative to other areas of the site, the fauna are internally consistent and the samples are treated as a unit here. A number of human burials associated with cairns were found in this area of the site.

The deposits of the 1999 trench have an initial occupation date of 1800 ± 60 RCYBP and a second date of 1490 ± 60 RCYBP near the base of cultural Layer C. Layer D, immediately below, is a thin sand layer that appears to cap earlier layers and

the deposits have been divided at this layer for comparative purposes, treating Layers A, B and C as an upper younger unit and Layers D, E, F and G as a lower older unit.

The deposits of the 2000 trench have been divided into three stratigraphic units: an upper one of Layers A and B, relatively horizontal, low shell layers perhaps representing living floors, dating within the past 500 years; a middle one of Layer C, the thick heavy shell dump layer with dates between about 900 RCYBP and 500 RCYBP; and an initial lower unit of Layers D and D*, also heavy shell layers, with an initial ^{14}C date of 1230 ± 90 RCYBP and upper dates around 900 RCYBP. The sequence appears to be continuous, with the two excavation units discussed here cutting through the seaward edge and slope of the middle terrace.

As there are no terminal dates for the upper unit of the 1999 trench, it is not clear how these deposits overlap in time with the lowest layers of the 2000 trench. Otherwise, the tables are laid out in a temporal sequence from the back terrace to upper trench 2000.

Vertebrate Faunal Species Identified

Table 1 lists the taxa identified in the sample, including at least 31 species of birds, 7 species of land mammal, 2 commensal species, 9 species of sea mammal plus whale and 24 species of fish. A brief description of the natural history of each species recovered, including size information, habitat preference, food habits, seasonal movements and also indicating any skeletal identification problems, is presented in Appendix I.

The Identified Sample

A total of 48,962 vertebrate faunal specimens from DfSi-16 was examined. Table 2 lists the Number of Identified Specimens (NISP) for the total identified site level sample and also includes totals for unidentified bone and total Number of Specimens (NSP) for major taxa groupings. Table 3 gives the relative frequencies of NSP for major taxa by site area and stratigraphic unit.

Fish constitute 93% of the vertebrate faunal remains (NSP 45,333) while sea mammals constitute 3% (NSP 1,541) and birds, land mammals and commensal mammals each make up only 1% of the sample Bird NSP 583; Land Mammal NSP 484; Commensal Mammal NSP 296). An additional 1% of the sample (NSP 674) could only be identified as mammal and <1% (NSP 51) could not be identified to a specific taxon (Table 2 and 3). Note that Feature 7A in the 1999 A/B/C stratigraphic unit is excluded from all totals and tables in this report. It was collected as a bulk sample and then screened through smaller mesh than the level samples. Including the counts with the level counts would introduce mesh size bias. Feature 7A included an additional 8616 bones, of which 8506 are anchovy and herring (Crockford 1999). All other feature samples discussed in earlier reports are included in the totals and tables.

It is clear that fish remains are by far the most frequently occurring vertebrate faunal remains by NSP in all areas and time periods at DfSi-16. It is also clear that the dominance of fish is considerably less in the oldest back terrace area (71%) and in the most recent 2000 A/B deposits (65%) than in the other stratigraphic units (91% to 98%). In the back terrace sample, land mammal (6%) and commensal mammal (5%) are more strongly represented than in any other area of the site, while birds (8%) and especially sea mammal (21%) remains are more frequently occurring in the most recent deposits (Table 3).

The dominance of fish remains at over 90% by NSP is especially clear in the 1999 samples and the lower two stratigraphic units of the 2000 trench, despite highly variable total bone sample sizes, ranging from NSP 3,683 to NSP 17,167 (Table 3).

The higher frequency of unidentified mammal in the back terrace sample (9% versus 3% and < 1%) reflects the more fragmentary nature of some of the bone in this area. It is also clear that the 1999 trench deposits contain far less bone than the 2000 trench deposits. A more exact comparison cannot be made at this time as not all level samples in these units were identified, but the depth of deposit is roughly comparable, suggesting a far greater density of bone in the 2000 trench deposits.

The overall pattern, strongly emphasizing fish, is maintained if one looks at only those remains identified to at least family taxonomic level. The differences between the back terrace fauna and the other site areas' fauna is very apparent (Table 4). It is worth noting here that 84% (NISP 294) of the total land mammal sample is from the back terrace area, despite the fact that these deposits produced only 11% by NSP (5345) or 12% by NISP (2356) of the total vertebrate faunal sample. If both land and commensal mammals are counted, that percent rises to 88% (NISP 569). Clearly, these deposits represent a focus of exploitation or activity different from other site areas.

Table 1. DfSi-16 taxa list, taxa identified to at least family, ID confidence code at least 20.

BIRDS	
Loon *sp.*	*Gavia sp.*
Common Loon	*Gavia immer*
Pacific Loon	*Gavia pacifica*
Red-Throated Loon	*Gavia stellata*
Horned Grebe	*Podiceps auritus*
Short-tailed Albatross	*Phoebastria albatrus* formerly *Diomedia albatrus*
Northern Fulmar	*Fulmaris glacialis*
Shearwater *sp.*	*Puffinus sp.*
Sooty Shearwater	*Puffinus griseus*
Pink-footed Shearwater	*Puffinus creatopus*
Flesh-footed (formerly Pale-footed) Shearwater	*Puffinus carneipes*
Short-tailed (formerly Slender-billed) Shearwater	*Puffinus tenuirostris*
Gull *sp.*	*Larus sp.*
Black-legged Kittiwake	*Rissa tridactyla*
Tern *sp.*	*cf. Sterna sp.*
Common Murre	*Uria aalge*
Marbled Murrelet	*Brachyrhamphus marmoratus*
Rhinocerus Auklet	*Cerorhinca monocerata*
Pigeon Guillemot	*Cepphus columba*
Cormorant *sp.*	*Phalacrocorax sp.*
Pelagic Cormorant	*Phalacrocorax pelagicus*
Brandt's Cormorant?	*Phalacrocorax cf. penicillatus*
Goose *sp.*	Anserinae
Goose *sp.*	*Anser sp.*
Goose *sp.* Brant	*Branta bernicla*
Canada Goose	*Branta canadensis*
Duck *sp.*	Anatidae
Diving Duck	*Aythya sp.*
Dabbling Duck	*Anas sp.*
Mallard	*Anas platyrhynchos*
Surf Scoter	*Melanitta perspicillatus*
Bufflehead	*Bucephala albeola*
Bald Eagle	*Halieetus leucocephalus*
Sharp-shinned Hawk	*Accipiter striatus*
Belted Kingfisher	*Ceryle alcyon*
Northwestern Crow	*Corvus caurinus*
Band-tailed Pigeon	*Columba fasciata*
Varied Thrush	*Ixoreus naevius*
LAND MAMMALS	
Mule Deer	*Odocoileus hemionus*
Elk	*Cervus elaphus*
Raccoon	*Procyon lotor*
River Otter	*Lontra canadensis*
Marten	*Martes americana*
Mink	*Mustela vison*
Beaver	*Castor canadensis*

COMMENSAL MAMMALS	
Domestic Dog	*Canis familiaris*
Deer Mouse	*Peromyscus maniculatus*
SEA MAMMALS	
Eared Seal	Otariidae
Fur Seal	*Callorhinus ursinus*
Northern Sealion	*Eumatopias jubata*
California Sealion	*Zalophus californianus*
Harbour Seal	*Phoca vitulina*
Elephant Seal?	*cf. Mirounga angustirostris*
Sea Otter	*Enhydra lutris*
Porpoise/Dolphin *sp.*	Delphinidae/Phocoenidae
Harbour Porpoise	*Phocoena phocoena*
Dall's Porpoise	*Phocoena dalli*
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*
Whale *sp.*	Cetacea
FISH	
Dogfish Shark	*Squalus acanthias*
Ratfish	*Hydrolagus colliei*
Skate *sp.*	*cf. Raja sp.*
Pacific Herring	*Clupea pallasi*
Northern Anchovy	*Engraulis mordax*
Salmon *sp.*	*Oncorhynchus sp.*
Chinook ? Salmon	*Oncorynchus cf. tshawytscha*
Pacific Cod	*Gadus macrocephalus*
Pacific Hake	*Merluccius productus*
Plainfin Midshipman	*Porichthys notatus*
Rockfish *sp.*	*Sebastes sp.*
Lingcod	*Ophiodon elongates*
Greenling *sp.*	*Hexagammos sp.*
Kelp Greenling	*Hexagrammos deccagrammus*
Rock Greenling	*Hexagrammos lagocephalus*
Sculpin *sp.*	Cottidae
Cabezon	*Scorpaenichthys marmoratus*
Red Irish Lord	*Hemilepidotus hemilepidotus*
Irish Lord *sp.*	*Hemilepidotus sp.*
Staghorn Sculpin	*Leptocottus armatus*
Surf Perch *sp.*	Embiotocidae
Pile Perch	*Damalichthys vacca*
Striped Sea Perch	*Embiotica lateralis*
Flatfish *sp.*	Pleuronectiformes
Halibut	*Hippoglossus stenolepis*
Petrale Sole	*Eopsetta jordani*
English Sole	*Parophrys vetulus*
Rock Sole	*Lepidosetta sp.* could be either *L. bilineata* or *L. polyxystra*
Bluefin Tuna	*Thunnus thynnus*

Table 2. DfSi-16, identified site level sample of vertebrate fauna NSP and NISP totals, confidence code of at least 20.

COMMON NAME	SPECIES	SITE TOTAL
BIRDS		
Loon *sp.*	*Gavia sp.*	8
Common Loon	*G. immer*	9
Pacific Loon	*G. pacifica*	6
Red-Throated Loon	*G. stellata*	1
Horned Grebe	*Podiceps auritus*	1
Albatross *sp.*	*Phoebastria sp.*	3
Short-tailed Albatross	*Phoebastria albatrus*	14
Northern Fulmar	*Fulmaris glacialis*	4
Shearwater *sp.*	*Puffinus sp.*	7
Sooty Shearwater	*Puffinus griseus*	19
Pink-footed Shearwater	*Puffinus creatopus*	3
Flesh-footed Shearwater	*Puffinus carneipes*	4
Short-taild Shearwater	*Puffinus tenuirostris*	1
Shearwater/Fulmar	Procellaridae	1
Gull *sp.*	*Larus sp.*	11
Black-legged Kittiwake	*Rissa tridactyla*	7
Tern *sp.*	*cf. Sterna sp.*	3
Common Murre	*Uria aalge*	12
Marbled Murrelet	*Brachyrhamphus marmoratus*	4
Rhinocerus Auklet	*Cerorhina monocerata*	1
Pigeon Guillemot	*Cepphus columba*	1
Cormorant *sp.*	*Phalacrocorax sp.*	11
Pelagic Cormorant	*Phalacrocorax pelagicus*	9
Brandt's Cormorant?	*Phalacrocorax cf. penicillatus*	1
Goose *sp.*	Anserinae	15
Goose *sp.*	*Anser sp.*	28
Goose *sp.* Brant?	*cf. Branta bernicla*	5
Canada Goose	*Branta canadensis*	13
Duck *sp.*	Anatidae	20
Diving Duck	*Aythya sp.*	1
Dabbling Duck	*Anas sp.*	1
Mallard	*Anas platyrhynchos*	10
Surf Scoter	*Melanitta perspicillatus*	1
Bufflehead	*Bucephala albeola*	1
Bald Eagle	*Halieetus leucocephalus*	14
Sharp-shinned Hawk	*Accipiter striatus*	1
Belted Kingfisher	*Ceryle alcyon*	1
Northwestern Crow	*Corvus caurinus*	2
Band-tailed Pigeon	*Columba fasciata*	1
Varied Thrush	*Ixoreus naevius*	1
	TOTAL BIRD NISP	**256**
Unidentified bird		327
	TOTAL BIRD NSP	**583**
FISH		
Dogfish Shark	*Squalus acanthias*	429
Ratfish	*Hydrolagus colliei*	
Skate *sp.*	*cf. Raja sp.*	1
Pacific Herring	*Clupea pallasi*	401
Northern Anchovy	*Engraulis mordax*	328
Salmon *sp.*	*Oncorhynchus sp.*	360
Chinook Salmon?	*Oncorynchus cf. tshawytscha*	5
Pacific Cod	*Gadus macrocephalus*	17
Pacific Hake	*Merluccius productus*	436
Plainfin Midshipman	*Porichthys notatus*	38
Rockfish *sp*	*Sebastes sp.*	14,385
Lingcod	*Ophiodon elongates*	1,448
Greenling *sp.*	*Hexagammos sp.*	1,038
Kelp Greenling	*Hexagrammos deccagrammus*	775

Table 2 Continued.

Rock Greenling	*Hexagrammos lagocephalus*	31
Sculpin *sp*.	Cottidae	15
Cabezon	*Scorpaenichthys marmoratus*	292
Red Irish Lord	*Hemilepidotus hemilepidotus*	79
Irish Lord *sp*.	*Hemilepidotus sp*.	4
Staghorn Sculpin	*Leptocottus armatus*	1
Surf Perch *sp*	Embiotocidae	366
Pile Perch	*Damalichthys vacca*	314
Striped Sea Perch	*Embiotica lateralis*	119
Flatfish *sp*.	Pleuronectiformes	154
Halibut	*Hippoglossus stenolepis*	181
Petrale Sole	*Eopsetta jordani*	598
English Sole	*Parophrys vetulus*	2
Rock Sole	*Lepidosetta sp*.	23
Bluefin Tuna	*Thunnus thynnus*	20
	TOTAL FISH NISP	**22,100**
Unidentified fish		23,233
	TOTAL FISH NSP	**45,333**
LAND MAMMALS		
Mule Deer	*Odocoileus hemionus*	45
Elk	*Cervus elaphus*	1
Raccoon	*Procyon lotor*	40
River Otter	*Lontra canadensis*	187
Marten	*Martes americana*	1
Mink	*Mustela vison*	74
Beaver	*Castor canadensis*	3
	TOTAL LAND MAMMAL NISP	**351**
Unidentified land mammal		133
	TOTAL LAND MAMMAL NSP	**484**
COMMENSAL MAMMALS		
Domestic Dog	*Canis familiaris*	294
Deer Mouse	*Peromyscus maniculatus*	2
	TOTAL COMMENSAL MAMMAL NISP	**296**
	TOTAL COMMENSAL MAMMAL NSP	**296**
SEA MAMMALS		
Eared Seal	Otariidae	16
Fur Seal	*Callorhinus ursinus*	250
Northern Sealion	*Eumatopias jubata*	19
California Sealion	*Zalophus californianus*	1
Harbour Seal	*Phoca vitulina*	43
Elephant Seal?	*cf. Mirounga angustirostris*	1
Pinneped	Unspecified Pinnepedia	159
Sea Otter	*Enhydra lutris*	6
Porpoise/Dolphin *sp*.	Delphinidae/Phocoenidae	52
Harbour Porpoise	*Phocoena phocoena*	19
Dall's Porpoise	*Phocoena dalli*	6
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	48
Whale *sp*.	Cetacea	254
	TOTAL SEA MAMMAL NISP	**874**
Unidentified sea mammal		667
	TOTAL SEA MAMMAL NSP	**1,541**
UNDETERMINED MAMMAL	**TOTAL NSP**	**674**
UNDISTINGUISHED BONE	**TOTAL NSP**	**51**
	TOTAL IDENTIFIED BONE NISP	**23,881**
	TOTAL NSP (ALL BONE)	**48,962**

Table 3. DfSi-16, vetebrate fauna major taxa by site area and strata, relative frequency, NSP*.

Strat Unit	Bird (%)	Fish (%)	Sea Mammal (%)	Land Mammal (%)	Comm. Mammal (%)	Unid. Mammal (%)	Unid. Taxa (%)	Total (%)	Total NSP
2000 A/B	8	65	21	2	0	3	<1	**99**	**1,080**
2000 C	2	95	2	<1	<1	<1	<1	**99**	**16,373**
2000 D/D*	<1	98	2	<1	<1	<1	<1	**100**	**17,167**
1999 A/B/C	1	91	5	<1	<1	3	0	**100**	**3,683**
1999 D/E/F/G	1	97	1	1	0	<1	<1	**100**	**5,313**
Back Terrace	1	71	8	6	5	9	<1	**100**	**5,346**
Site %	**1**	**93**	**3**	**1**	**1**	**1**	**<1**	**100**	
Total NSP	**583**	**45,333**	**1,541**	**484**	**296**	**674**	**51**		**48,962**

*Excludes Feature 7A in 1999 A/B/C which contained an additional 8,616 bones, of which 8,506 are anchovy and herring. This feature has been excluded from future tables because it was collected as a bulk sample and then screened through smaller mesh than the level samples. Including the counts with the level counts would introduce mesh size bias. Feature 7A material is excluded from all tables in this report. All other feature samples discussed in earlier reports are included in the totals in this and all subsequent tables.

Table 4. DfSi-16, identified vertebrate fauna. Major taxa by site area and strata, relative frequency, NISP.

Strat. Unit	Bird (%)	Fish (%)	Sea Mammal (%)	Land Mammal (%)	Commensal Mammal (%)	Total (%)	Total NISP
2000 A/B	7	66	26	1	0	**100**	**535**
2000 C	2	95	3	<1	<1	**100**	**7,606**
2000 D/D*	<1	98	2	<1	<1	**100**	**8,659**
1999 A/B/C	1	92	6	<1	1	**100**	**1,754**
1999 D/E/F/G	1	97	1	1	0	**100**	**2,356**
Back Terrace	1	71	8	10	9	**99**	**2,967**
Total %	**1**	**93**	**4**	**1**	**1**	**100**	
Total NISP	**256**	**22,100**	**874**	**351**	**296**		**23,877**

Land Mammals

Of the 484 land mammal specimens, 351 were identified to species, including Coast Deer, Elk, Raccoon, River Otter, Mink, Marten and Beaver (Table 2, 5 and 6). River Otter is the most frequently occurring land mammal at 53% (NISP 187), Mink is next at 21% (NISP 74), then Coast Deer with 13% (NISP 45) and Raccoon with 11% (NISP 40). Beaver is 1% (NISP 3) and Elk and Marten <1% each (NISP 1 each). The samples from all site areas and strata except the back terrace are very small, less then 20 specimens. In contrast, 294 specimens were identified from the back terrace sample. As explained in earlier reports, this high land mammal frequency is primarily the result of the recovery of partial and nearly complete River Otter and Mink skeletons (Frederick 2002, 2003). At least one River Otter skeleton (Feature #19, Level 9, EU S58-60 W 64-66) seems to have been deliberately interred, and the same may be true for three partial mink skeletons. The skeleton of the large male river otter was found in anatomical alignment indicating it had been placed on its back, with a loose circle of fairly large stones surrounding the skeleton.

It may well be that these partial and almost complete otter and mink skeletons, as well as the dog skeletons from this areas (see below) are deliberate burials associated with the human burials in this area of the site. In this regard, it is worth noting that "land" otter and mink are both important figures in southern Northwest Coast mythology.

The sample sizes for the other site areas/strata are so small as to make the percentages meaningless. The restricted number of species represented reflects the island location while the three fragments of beaver teeth and the one fragment of elk rib are clearly imports.

Mule deer are represented by adult, subadult and juvenile individuals. Adult, sub-adult, juvenile and foetal or newborn raccoons are present, and

Table 5. DfSi-16, land mammals, taxa by site area and strata, relative frequency of NISP.

Strat. Unit	Mule Deer (%)	Elk (%)	Raccoon (%)	River Otter (%)	Mink (%)	Marten (%)	Beaver (%)	Total(%)	NISP
2000 A/B	29	0	0	29	43	0	0	**101**	**7**
2000 C	20	10	10	30	20	0	10	**100**	**10**
2000 D/D*	85	0	8	8	0	0	0	**101**	**13**
1999 A/B/C	43	0	0	14	14	14	14	**99**	**7**
1999 D/E/F/G	80	0	0	15	5	0	0	**100**	**20**
Back Terrace	4	0	13	60	23	0	<1	**100**	**294**
Total %	**13**	**<1**	**11**	**53**	**21**	**<1**	**1**	**99**	
Total NSP	**45**	**1**	**40**	**187**	**74**	**1**	**3**		**351**

Table 6. DfSi-16, land and commensal mammals, site area and strata by species, relative frequency of NISP.

Strat. Unit	Muledeer (%)	Elk (%)	Raccoon (%)	River Otter (%)	Mink (%)	Marten (%)	Beaver (%)	Deer Mouse (%)	Dog (%)	Total (%)	NISP
2000 A/B	29	0	0	29	43	0	0	0	0	**101**	**7**
2000 C	18	9	9	27	18	0	9	0	9	**99**	**11**
2000 D/D*	52	0	5	5	0	0	0	0	38	**100**	**21**
1999 A/B/C	16	0	0	5	5	5	5	5	58	**00**	**19**
1999 D/E/F/G	80	0	0	15	5	0	0	0	0	**100**	**20**
Back Terrace	2	0	7	31	12	0	<1	<1	48	**100**	**569**
Site %	**7**	**<1**	**6**	**29**	**11**	**<1**	**<1**	**<1**	**45**	**98**	
Total NISP	**45**	**1**	**40**	**187**	**74**	**1**	**3**	**2**	**294**		**647**

river otters are represented by adults, sub-adults and juveniles. Mink on the other hand, are represented only by adults.

Commensal Mammals

Commensal mammals are represented by the Domestic Dog and the Deer Mouse. It is possible that the deer mouse (NISP 2) is a local forest inhabitant rather than a true commensal. Two hundred and ninety-four dogbones were identified, 274 of these from the back terrace. If included with land mammals, dogs form 48% of the back terrace sample (Table 2 and 6). The back terrace dog sample includes two discrete clusters of bones in anatomical alignment, partial skeletons possibly representing deliberate burials. Also three left mandibles were recovered from the back terrace area that display an interesting pattern of cut marks suggestive of deliberate dispatch of the dogs. The cut marks are short, sharp cuts across the basal border of the horizontal ramus in the area between M1 and the mental foramen (Frederick 2002). Again, the other site areas' sample sizes are too small to provide meaningful relative frequencies for those samples. The sample contains all ages of dogs.

Eighteen (55%) of the 33 skeletal elements of dog that could be compared with Crockford's Type 1 and Type 2 means and ranges for specific measurements, fit within the size range of Crockford's Type 1 small Northwest Coast dog, or are slightly smaller (Appendix II). The larger Type 2 dog is also represented. Eleven measurable elements from the articulated partial rear legs in Unit S58-60 W 64-66 place this individual in the Type 2 size category. The overwhelming concentration of dog remains in the older back terrace area compared to other areas of the site is particularly interesting. It suggests that the inhabitants responsible for these older deposits viewed and treated dogs in a different manner from the later site inhabitants. While the Type 1 specimens clearly represent a small Northwest Coast dog of the type ethnographically associated with the Salish wool dog it is not possible to determine from the structure of the skeletal remains, the nature of the Benson Island dogs' coats. Their size range does however, raise the possibility that these may have been long haired "wool dogs" kept separate and treated differently from other dogs. Their presence could push the known time depth of a small Type 1 dog back beyond 4000 RCYBP on the Northwest Coast.

Sea Mammals

One thousand five hundred and forty-one specimens were identified as sea mammal. Of these, 874 were identified to species, genus or family, including Fur Seal, Northern Sea Lion, California Sea Lion, Harbour Seal, cf. Elephant Seal, Sea otter, Harbour Porpoise, Dall's Porpoise, Pacific White-sided Dolphin and whale (Table 2 and 7). While the whale bones from the excavation units discussed here have not been identified to species, a number of skeletal elements in other units have been at least tentatively identified using DNA analysis. Of these, 13 samples are identified as Humpback Whale and the fourteenth, a complete mandible from the 2000 trench, is identified as Gray Whale (McMillan, pers. comm. 2003). It is likely that the fragmentary whale bones recovered from all areas of the site reflect a similar pattern of concentration on humpback whale.

Of the identified sea mammals, fur seal and whale are the most frequently occurring specimens, each at 29% (NISP 250 and 254 respectively) of the total sample. Unspecified Pinniped is next at 18% (NISP 159). It is likely that most of these fragments are in fact fur seal. No other taxonomic category forms more than 6% of the sample, with Dolphin/Porpoise sp. at 6% (NISP 52), Pacific White-sided Dolphin and Harbour Seal each at 5% (NISP 48 and 43 respectively), Northern Sea Lion and Harbour Porpoise at 2% (NISP 19 for each) and Dall's Porpoise at 1% (NISP 6). Only 6 specimens of Sea Otter were recovered, and a single specimen each of California Sea Lion and probable Elephant Seal were identified (Table 7).

There is a definite increase through time in the relative frequency of fur seal remains, from 13% in the back terrace sample to 49% in the 2000 A/B sample. Of interest is the pattern presented by Cetacea remains. The highest relative frequencies are in the oldest deposits, with 57% in the back terrace and 53% in the 1999 D/E/F/G sample. These patterns are amplified if one groups the data into larger taxonomic groupings of Pinnipeds, Dolphins/Porpoises, Sea Otter and Cetacea (Table 8). The emphasis in the older deposits on Cetacea and Dolphins/Porpoises is clearer, while the general increase in relative frequency of Pinnipeds through time is upheld. It should be pointed out here that the pattern of whale remains may have a great deal to do with the nature of the deposits, the way in which large whale bones enter the archaeological record and the fragmentation patterns of large chunks of whale bone. In other words the high frequency in the older deposits may represent a few large bones that are highly fragmented, rather than an increased frequency of element occurrence. This is an ongoing problem in the quantification of whale bone in Northwest Coast sites. Similarly the low frequency of whale remains in the most recent deposits 2000 A/B may have more to do with the nature of these deposits, potential living floors, than the actual frequency of occurrence of whale remains in deposits of this time period. This becomes clear when one looks at the fauna recovered from units close to the present beach on a lower terrace. Here several

Table 7. DfSi-16, sea mammals, site area and strata by taxa, relative frequency of NISP.

Taxa	2000 A/B (%)	2000 C (%)	2000 D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	NISP
Fur Seal	49	26	38	34	16	13	**29**	**250**
Northern Sea Lion	1	1	1	9	0	3	**2**	**19**
California Sea Lion	0	0	1	0	0	0	**<1**	**1**
Ottarid	4	1	2	1	0	2	**2**	**16**
Harbour Seal	4	7	5	11	6	1	**5**	**43**
Elephant Seal	0	0	0	0	3	0	**<1**	**1**
Pinniped Unspecified	39	16	31	21	0	1	**18**	**159**
Sea Otter	0	1	1	1	0	1	**1**	**6**
Harbour Porpoise	0	2	4	2	19	0	**2**	**19**
Dall's Porporise	0	1	2	1	0	0	**1**	**6**
Pacific W-s Dolphin	0	4	4	0	0	14	**5**	**48**
Porpoise/Dolphin Sp.	0	11	3	2	3	9	**6**	**52**
Cetacea	2	32	8	19	53	57	**29**	**254**
Total %	**99**	**100**	**100**	**101**	**100**	**101**	**101**	
NISP	**138**	**197**	**162**	**101**	**32**	**244**		**874**

Table 8. DfSi-16, sea mammals, major taxa grouping by site area and strata, relative frequency by NISP.

Strat. and Area	Pinnipeds (%)	Dolphins/Porpoises (%)	Sea Otter (%)	Cetacea (%)	Total (%)	NISP
2000 A/B	98	0	0	2	**100**	**138**
2000 C	49	18	1	31	**99**	**194**
2000 D/D*	78	14	1	8	**101**	**162**
1999 A/B/C	75	5	1	19	**100**	**101**
1999 D/E/F/G	25	22	0	53	**100**	**32**
Back Terrace	19	23	1	57	**100**	**244**
Site Total (%)	**56**	**14**	**1**	**29**	**100**	**872**
NISP	**488**	**125**	**6**	**253**		

features of whale bone were uncovered comparable in age to the 2000 A/B sample. Both humpback and grey whale elements are present in Feature 57, located seaward of the units discussed here above a ^{14}C date of 690±60 RCYBP.

The higher frequency of porpoise and dolphin remains in the back terrace area is partially accounted for by the presence in those deposits of two clusters of aligned vertebrae of Pacific White-sided Dolphin, clearly deposited while still articulated. The spines have obviously been chewed by a small carnivore, displaying tooth punctures consistent in size and nature with those that would be made by a puppy. These vertebral column sections may well have been fed to the dogs.

Clearly, there is a focus at DfSi-16, from the initial occupation of the site, on fur seals, dolphins and porpoises and whales. Taking adults of these species would require considerable hunting skill and the use of efficient watercraft. While actual hunting of whales cannot be proven for the earlier deposits, it is proven for the later deposits at DfSi-16.

Although not discussed in this particular sample, a partial humpback whale skull with a California mussel shell harpoon blade imbedded in the occipital bone was recovered from Feature 57 in the 2000 trench, above the date of 690±60 RCYBP (McMillan and St. Claire 2001:39–40). Sea otters were apparently not a focus of exploitation at this site.

Additionally, the presence in these samples of fur seals of all age groups and both sexes, including newborn and still nursing infants, clearly demonstrates the presence in the general Barkley Sound area of fur seal pupping grounds well outside the known pupping range of the present fur seal population, indicating a local, non-migratory population in the nearby area (Crockford, Frederick and Wigen 2002). New born and/or young juvenile animals are recorded from all site areas/straigraphic units except 2000 A/B. In this sample, although no definitely nursing pups are recorded, both juvenile and adult individuals are present. The presence of newborn fur seals also confirms the presence of the site inhabitants on Benson Island during the summer months and hunting of these animals on the pupping grounds. Today, the Northern Fur Seal pupping season in the Bering Sea is narrowly constrained between early June and mid-July. It is possible that it may have been slightly longer and earlier in the more southerly, warmer waters off the west coast of Vancouver Island.

Birds

A small sample of bird remains was recovered from the DfSi-16 site. Of the 583 bird specimens examined, 256 were identified to species or genus (Table 2). At least 33 species of birds are present (Table 1). Grouping the species into larger taxonomic categories displays some patterns, even in this small sample (Table 9). In the site as a whole, geese are the most frequently occurring birds at 24% (NISP 61), followed by shearwaters and the Northern Fulmar at 16% (NISP 39) then ducks at 13% (NISP 34). Loons and grebes; albatross; alcids; cormorants; gulls, terns and kittiwakes; and eagles and hawks each form between 6% and 9% of the sample, while crows and other small forest birds each make up 1% of the sample. The earlier deposits at the site display less focus on geese and ducks, and a slightly greater emphasis on the pelagic species such as albatross and shearwaters and the diving birds such as cormorants and alcids. The sample sizes are, however, very small, so these apparent patterns may be unreliable. Birds do not appear to have been a major focus of exploitation.

None of the samples are large enough to show reliable patterns of skeletal elements represented.

Table 9. DfSi-16, identified birds, taxa by site area and strata, relative frequency of NISP.

TAXA	2000 A/B (%)	2000 C (%)	2000 D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	NISP
Loons and Grebes	6	12	0	10	5	14	**9**	**25**
Albatross	18	0	10	14	25	3	**7**	**17**
N. Fulmar, Shearwaters	0	16	10	38	25	10	**16**	**39**
Alcids	5	7	20	0	25	0	**7**	**18**
Cormorants	11	4	0	0	0	38	**8**	**21**
Gulls, Terns, Kittiwakes	8	9	10	5	20	0	**8**	**21**
Geese	24	31	30	14	0	10	**24**	**61**
Ducks	8	18	10	19	0	3	**13**	**34**
Eagles, Hawks	18	2	10	0	0	14	**6**	**15**
Crow	3	0	0	0	0	3	**1**	**2**
Small Forest Birds	0	2	0	0	0	3	**1**	**3**
Total %	**101**	**101**	**100**	**100**	**100**	**98**	**100**	
NISP	**38**	**138**	**10**	**21**	**20**	**29**		**256**

The presence of migratory birds allows some inferences to be made regarding season of exploitation and presumably occupation. Preferred habitats also allow some inferences to be made regarding where hunting may have been taking place. These topics are discussed below in the sections on Season of Exploitation and Habitats Exploited.

Fish

Fish remains form by far the greatest proportion of the faunal remains at DfSi-16, in all areas of the site. Of the 45,333 fish bones examined 22,100 were identified to species, genus or family (Table 2 and 10). For the site as a whole, Rockfish species are overwhelmingly the most frequently occurring taxon at 65% (NISP 14,385). The next most frequently occurring taxon is Greenlings at only 8% (NISP 1,844) followed by Lingcod at 7% (NISP 1,448), Surf Perches at 4% (NISP 799) and Petrale Sole at 3% (NISP 598). All other fish taxa are 2% or less of the site sample. While rockfish dominate in all areas and stratigraphic units of the site, there are some differences between the earliest back terrace deposits, the main midden trenches, and the most recent deposits of trench 2000 A/B. In the back terrace sample, there is a more broadscale distribution of emphasis, with rockfish (31%), Greenlings (23%) and Lingcod (13%) more evenly emphasized, and dogfish (9%), surfperches (6%) and anchovy (6%) more frequently occurring. At the same time, there is a lower or nonexistent emphasis on smaller flatfishes and offshore fishes such as Halibut, Bluefin Tuna, Pacific Cod and Pacific Hake.

In the middle and lower layers of the 2000 trench, the emphasis is very strongly on rockfish, while in the 1999 trench, the lower layers show a strong emphasis on rockfish but also more emphasis on lingcod as well. The higher frequency of herring and anchovy in the upper layers of the 1999 trench is undoubtedly related to the presence of Feature 7A (the 8000 plus anchovy and herring bones) in layer A. There is also a stronger emphasis on surf perches in these upper layers (Table 10).

The upper unit of the 2000 trench is distinguished from all other site areas and stratigraphic units by the much higher percentage of salmon remains. In all other areas and strata, salmon are 3% or less of the fish sample by NISP. In the 2000 A/B sample, salmon form 27% of the identified fish remains. This may represent a shift in exploitation strategy, a different season of occupation, or may simply reflect the different nature of these deposits as living floors rather than dump areas.

The most clearly marked pattern in the fish remains is the steady increase in rockfish percentages until the 2000 A/B sample. It is also clear that rockfish, greenling, surf perches and lingcod together are the most important of the larger fish resources for all areas except 2000 A/B . Together, they account for 84 % of the total site fish sample, and between 72 % (1999 A/B/C) and 91% (2000 C) of the different site area/ stratigraphic unit samples. Even with the strong emphasis on salmon in the 2000 A/B sample, these four taxa form 53% of that sample. All other species occur in much lower frequencies and sporadically. One must always keep in mind the under-representation of herring and anchovy in these level samples. While not well

Table 10. DfSi-6, fish taxa by site area and strata, relative frequency by NISP.

TAXA	2000 A/B (%)	2000 C (%)	2000 D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	NISP
Herring*	5	<1	1	13	<1	3	**2**	**401**
Anchovy*	0	<1	0	7	<1	6	**1**	**328**
Salmon	27	1	1	1	2	3	**2**	**365**
Surfperch	2	3	3	10	1	6	**4**	**799**
Cabezon	3	1	1	1	1	3	**1**	**292**
Other Sculpin	2	<1	<1	<1	<1	<1	**<1**	**99**
Lingcod	10	3	3	3	29	13	**7**	**1,448**
Greenling Sp.	14	4	8	10	7	23	**8**	**1,844**
Rockfish	27	81	70	49	48	31	**65**	**14,385**
Dogfish	1	1	1	1	2	9	**2**	**429**
Ratfish	1	1	1	2	1	1	**1**	**240**
Halibut	0	<1	<1	1	4	1	**1**	**181**
Petrale Sole	5	4	4	<1	<1	<1	**3**	**598**
Other Flatfish	1	1	1	<1	<1	<1	**1**	**179**
Pacific Cod	0	0	<1	0	<1	0	**<1**	**17**
Pacific Hake	1	1	4	<1	2	0	**2**	**436**
Bluefintuna	0	<1	<1	0	<1	0	**<1**	**20**
Plainfin Midshipman	<1	<1	<1	<1	<1	<1	**<1**	**38**
Other	0	0	0	<1	0	0	**<1**	**1**
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**	
NISP	**352**	**7,260**	**8,466**	**1,613**	**2,284**	**2,125**		**22,100**

*Herring and Anchovy are greatly under-represented in the level samples, especially as Feature 7A in the 1999 A/B/C unit is excluded from this table. The more than 8000 bones of herring and anchovy concentrated in that feature alone, indicates both the degree to which level samples do not reflect these species' frequency of occurrence and also the patchy and concentrated nature of their deposition in the site. A much better estimation of their presence and importance in the site fish fauna will be obtained from the column sample data presently being analysed by Iain McKechnie.

represented in the level samples, these species are clearly of considerable importance. A much better estimation of their presence will be obtained from the column sample data.

Also of some interest are the patterns exhibited when size categories are examined for rockfish and lingcod. Those specimens that were sufficiently complete and variable by size to be assigned to a size category were tabulated for both these taxa. Note that only the sample from Unit N 4-6 W 102-104 was analysed for the 2000 trench for these comparisons. The rockfish data show an increase in the frequency of smaller individuals from the older deposits through Layer C of the 2000 trench (Table 11). The sample from Layer A/B of the 2000 trench is much too small (NISP 3) to be meaningful. This increasing exploitation of smaller rockfish through time is accompanied by a decreasing frequency of medium sized individuals rather than a marked decrease in large and very large individuals, although the latter size category also declines slightly in frequency through time. This pattern may reflect heavy predation on the local rockfish population resulting in the availability of fewer and fewer large and medium sized fish. It might also reflect changing fishing techniques and/or exploitation of different ecological niches, shifting from the exploitation of deeper waters where the larger individuals are more abundant, to shallower, more protected habitats where the smaller individuals are more abundant.

The pattern for lingcod is less distinct and the sample sizes are smaller, but the data do suggest an increasing exploitation of large and very large lingcod through time (Table 12). In the back terrace sample, there is a roughly equal split between bones of medium sized and larger individuals. Through time, the percentage of medium individuals in the sample decreases while the percentage of larger individuals increases. Again, the sample for 2000 A/B is too small to be reliable (NISP 12). The pattern displayed by the back terrace sample is more typical of the catch one would expect if these fish are being taken in late winter to early spring during the lingcod spawning season, when the large females, the medium sized males and the

Table 11. DfSi-16, rockfish size category by site area and strata, relative frequency of NISP

Size Category	2000* A/B (%)	2000* C (%)	2000* D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	Site NISP
Extra Small/Very Small/ Small	66	85	87	78	61	58	**78**	**2,368**
Medium/Medium-Large	0	13	10	19	33	37	**18**	**546**
Large/Very Large/ Extra Large	33	2	3	3	6	5	**4**	**110**
Total %	**99**	**100**	**100**	**100**	**100**	**100**	**100**	
NISP	**3**	**701**	**1,359**	**121**	**194**	**646**		**3,024**

* Unit N4-6 W102-104 only.

Table 12. DfSi-16, lingcod size category by site area and strata, relative frequency of NISP.

Size Category	2000* A/B (%)	2000* C (%)	2000* D/D* (%)	1999 A/B/C (%)	1999 D/E/F/G (%)	Back Terrace (%)	Total Site (%)	Site NISP
Extra Small/ Very Small/ Small	0	0	0	0	0	4	**2**	**15**
Medium/ Medium- Large	83	15	20	11	30	45	**35**	**234**
Large/Very Large/Extra Large	17	85	80	89	70	51	**63**	**420**
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**	
NISP	**12**	**55**	**69**	**64**	**106**	**363**		**669**

* Unit N4-6 W102-104 only

smaller juveniles are all to be found in the shallow lower intertidal waters. The higher percentage of bones of large and very large individuals, which by their size are presumed to be female, in the younger stratigraphic units may indicate a different pattern of exploitation of the deeper rocky inshore waters during late spring through early fall, when the large females are to found concentrated in these habitats.

Rockfish, greenlings, lingcod, surfperches, cabezon and other sculpins, petrale sole, other smaller flatfish, hake, Pacific cod, herring, anchovy and plainfin midshipman are each represented by a wide range of skeletal elements in all areas of the site where they occur. Both cranial and post-cranial elements are also identified for halibut and bluefin tuna, although there is a preponderance of vertebrae for these two species. Dogfish and ratfish, as expected, are represented by vertebrae for the former and teeth for the latter. In marked contrast to this general pattern of skeletal elements representing whole fish, salmon are represented only by postcranial elements, 98 % vertebrae and 2% elements such as those associated with the tail structure or the pectoral fin. This pattern excluding cranial elements is not the result of salmon cranial elements not being identified or surviving deposition and recovery. They are readily identified and equally as durable as, for example, small flatfish cranial elements. The pattern of exclusive representation by post-cranial elements strongly suggests that the salmon at DfSi-16 were consumed as preserved fish. In turn, this suggests that they are river-caught fish obtained off island, as there are no salmon spawning streams on Benson Island. The other alternative is a net fishery of sea fish congregating prior to entering the spawning streams flowing into Barkley Sound and Alberni Inlet.

Season of Exploitation

We are able to establish the season of resource exploitation for these deposits in terms of seasons definitely represented, using the data compiled in Appendix A. The presence of certain bird or fish species with restricted seasonal occurrences in the Barkley Sound area and the presence of very young mammals allow us to state season of exploitation for some resources with considerable confidence. However, establishing the presence of people on the site during those time periods, does not preclude their presence in other times with much less clear seasonal markers. The most

frequently occurring species, rockfish, greenlings, lingcod and surf perches, are available year round and provide few clues as to their season of capture.

Back Terrace Deposits

The back terrace deposits contain several clear markers for summer occupation. These include the presence of albatross which are only in this area in summer, and the presence of very young raccoon, juvenile river otter and nursing age fur seal pups. The presence of two fulmar bones might suggest winter occupation, but while winter is when fulmar are most abundantly present in this area, they are also present at other times of the year. The few other birds found in the back terrace sample could all be taken at any time of year, although cormorants, loons and geese are more plentiful during the spring and fall migrations.

Herring are available inshore in great quantities in the spring during February through May spawning times, but could be obtained in lesser quantities at any time. Anchovy, while likely only sporadically available, would be most abundantly available in inshore waters from spring through the July and August spawning season, another summer marker. As mentioned above, the pattern of lingcod individual sizes represented suggests a late fall to early spring fishery, if the fish are all being caught in the same habitat area. There are no salmon streams on Benson Island, so the few salmon remains present must represent sea caught fish which could be taken anytime or river caught fish from off island. As mentioned above, all salmon remains are post-cranial elements, suggesting preserved fish. If one assumes the use of preserved salmon primarily during the winter season, the low frequency of salmon remains might also argue against a full winter occupation. Petrale sole and halibut are most accessible (in shallower waters) during spring and summer. Taken together, seasonal markers indicate at least spring and summer occupation of the back terrace, with summer most clearly marked. The fulmar, lingcod and presumably preserved salmon might indicate winter, but this is equivocal.

1999 Trench Deposits

The summer season is also definitely indicated for all the 1999 deposits, both the older and the more recent layers. It is similarly marked by the presence of albatross, shearwaters, terns, very young fur seal and anchovy. In addition, the presence of bluefin tuna in the older deposits is a strong summer marker, while the concentrated anchovy remains in Feature 7A are a strong summer marker for the upper layers. As for the back terrace area, herring likely mark spring. Petrale sole and halibut also support occupation during the spring and summer.

There is some possibility that winter occupation is also indicated, but it is weak. The Pacific cod in the lower layers might indicate a late winter/early spring exploitation, when cod move into shallower water. They could, however, equally represent individuals taken at other times of year with deep gear. The brant in the upper layers suggest a winter season of occupation, as they are rare off the west coast at any other time of year, but all other clear markers focus on spring and summer. Again, the low frequency of salmon remains argues against a winter occupation.

2000 C and 2000 D/D Deposits*

The summer season is also indicated for the 2000 D/D* and 2000 C layers, but there is a suggestion of a more extended season of occupation in these deposits. Summer is marked by the presence in both stratigraphic units of shearwaters, very young fur seal and bluefin tuna. Additionally, anchovy is present in the 2000 C deposits and albatross in 2000 D/D* deposits. Herring is present in both, marking spring, and petrale sole and halibut in both also suggest spring and summer exploitation. The presence of whale bone that is likely grey or humpback also suggests exploitation in the spring and summer. But in both 2000 C and 2000 D/D* there is a much stronger focus on migratory geese, suggesting a stronger spring and possibly fall focus as well. Additionally, brant is present in both stratigraphic units, suggesting winter exploitation as it is rare at any other time on the west coast. In 2000 C, the presence of fulmars also suggests winter, when they are most abundant on the west coast, while the presence of California sea lion in 2000 D/D* also supports winter occupation as these animals are present in northern waters in the winter months only. Finally, the presence in 2000 C deposits of sharp-shinned hawk also suggests a more extended period of occupation as they are not present in this area in the summer. This suggestion of winter or at least late fall occupation is somewhat contradicted by the continuing low frequency of salmon, if one assumes abundant salmon remains would be the result of

preserved and imported river caught fish, rather than sea caught fish, as suggested by the skeletal element representation. Regardless of whether the salmon are river or sea caught, the low frequency of salmon remains reflects a real lack of focus on this resource. In general, the faunal remains from these two stratigraphic units, 2000 C and 2000 D/D*, suggest a wider season of occupation than the more spring/summer focused occupation of earlier deposits.

2000 A/B

This stratigraphic unit differs in comparison to other areas of the site in the presence of a much higher frequency of salmon remains, and an increased focus on fur seals. It is important also to remember the humpback and grey whale remains from this time period at the site, although they are not well represented in these excavation units. The presence of albatross and rhinoceros auklet mark the summer season of exploitation, while herring suggests spring exploitation. While no newborn or definitely still nursing fur seals are recorded for this time period, there are many juvenile fur seal bones as well as adult remains. This population structure may represent culling of the fur seal herd in late summer and autumn. The higher frequency of fur seal remains may also indicate hunting of the migratory animals moving north in spring as well. In other words, the later inhabitants of the site may well be exploiting both the local and the migratory fur seal populations. The presence of petrale sole also supports a spring and summer presence. The identification of both humpback and grey whale for this time period at the site suggests that these animals were being hunted when most abundant, during their spring northward migrations, but it is important to note that individuals of both species do linger all summer long off the coast of Vancouver Island.

In addition to these spring and summer markers, the 2000 A/B sample also contains a much higher relative frequency of salmon remains that likely do represent preserved and stored salmon being consumed in the winter, as the skeletal elements represented are all postcranial. They likely represent preserved river caught fish from off island. Also present in this sample is bufflehead duck, which has not been recorded off the west coast of the island in summer, but can be found there in fall through spring. Taken together, the seasonal indicators from this time period suggest a more seasonally extended period of occupation, with winter occupation included.

Habitats Exploited

It is clear from the faunal remains that from the first occupation of the site, the focus of exploitation activities has been on the marine and marine foreshore environments. Fur seals, dolphin/porpoise and whale remains are present in the earliest layers of the back terrace area, and continue to be present throughout the sequence. This indicates exploitation of the nearshore marine habitat on a sustained basis and likely included excursions well offshore also. The presence of albatross, fulmars, shearwaters and halibut throughout the sequence supports this at least occasional offshore focus, as may the sporadic occurrence of bluefin tuna, although ethnographic accounts report this species was taken in late summer and early fall in inshore waters (Crockford 1997b:20).

It is equally clear that the great majority of fish were obtained from the inshore marine habitat, especially the areas of relatively shallow water over rocky substrate that support kelp beds. Here would be found the rockfish, greenlings and surf perches that form the bulk of the faunal remains throughout the sequence. Clearly herring are also being exploited, likely during the spring spawning season when they congregate in great numbers in the shallow waters of sheltered bays and inlets in Barkley Sound. Also attracted inshore to feed on these concentrations of herring, would be a whole series of fish, sea mammals and birds, at which times they too would be particularly vulnerable to hunting by humans. This includes the hake, lingcod and petrale sole identified in the Ts'ishaa faunal samples. The spawning herring concentrations also attract humpback whales, Pacific white-sided dolphins, sea lions, harbour seals and fur seals, feeding on both the herring themselves and the larger fish as well. Loons, especially the Pacific loon, and cormorants, especially the pelagic cormorant, surf scoters and common murres all gather in larger numbers than usual to feed on spawning herring. The gulls and eagles are also attracted. It might well be that these species were taken most frequently by Ts'ishaa Village inhabitants during the spring season when all would be available inshore in predictable, concentrated locations. A similar but less regular pattern could be inferred for anchovy during the summer months.

Summary

In general, the faunal remains from Ts'ishaa Village present a picture of exploitation of local, nearshore habitats, with a clear focus on marine fish and mammals. The few land mammal remains present are what one would expect, if the site inhabitants had direct access only to the Benson Island fauna, and the great majority of the land mammal remains are in fact small fur bearers. Most of these river otters, mink and raccoon may not even have been intended as food, but may well be associated with the burials in the back terrace. Although a considerable number of species are represented by the 256 specifically identifed bird remains, like the land mammals, they form a small proportion of the faunal sample and are clearly not a major focus of exploitation at only 1% of the specifically identified sample. Those species present generally indicate exploitation of the nearshore marine habitat, with some exploitation of the offshore marine waters. Sea mammals are clearly more important in the food economy than land mammals, with fur seals and whales being the most important. Although sea mammals form only 4% of the specifically identified faunal remains by NISP, it is important to remember that these 872 bones represent some very large individual animals which would have provided considerable quantities of meat and fat. In reality, sea mammals may have been as important a food source as fish. Of special note, is the presence in the Ts'ishaa Village fur seal sample of newborn and young juvenile individuals, confirming the presence in prehistoric times of a non-migratory population of fur seals in the Barkley Sound region.

There is clear evidence of a spring and summer occupation at Ts'ishaa Village in all time periods, and the suggestion of a more extended stay in the middle and later layers of the site, probably including a winter presence in the most recent deposits.

Although there are clearly fluctuations in emphasis on particular species through time and space at Ts'ishaa Village, with the greatest differences being between the back terrace, the most recent layers, and the central layers of the site, there is also clearly some continuity at the site in terms of species exploited. At all time periods, rockfish are the most frequently occurring fish remains and fur seals the most important pinniped. Perhaps the greatest shift occurs in the more recent layers with the increased emphasis on salmon, fur seal and probably whale. The much greater frequency of small land mammals and dogs in the oldest, backridge area of the site, also sets this area apart. The dogs are of particular interest as the oldest deposits at the site include representatives of the small Type 1 westcoast dog, ethnographically associated with the south coast wool dog.

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Appendix I: Vertebrate Fauna Seasonal Availability and Habitat Summaries

This appendix contains a brief description of the natural history of each species recovered in the Ts'ishaa Village deposits, including size information, habitat preferences, migratory patterns, food habits and reproductive behaviour. Skeletal identification problems are also discussed.

FISH

Order Squaliformes

Family Squalidae

Squalus acanthias **Spiny Dogfish.** The spiny dogfish is a small to medium-sized shark found commonly in B. C. waters whose cartilaginous vertebrae and a few other elements often survive in archaeological sites. Teeth and the two sharp dorsal spines are also frequently recovered. Dogfish are found in schools formed of similarly sized individuals, sometimes of the same sex (Jensen 1965:530). They occupy a variety of habitats in both shallow and deep water. There is some seasonal migration, but this appears to be poorly understood and may relate to a complicated combination of water temperatures and food availability (ibid:530–532). Dogfish eat a wide variety of prey, from fish to crabs, and predate heavily on schooling fish such as herring, capelin and anchovy. Dogfish are a good source of oil and Vitamin A (from the liver) (Hart 1973:46), and the skin can be tanned to produce a "sandpaper". The flesh is also quite edible.

Order Chimaeriformes

Family Chimaeridae

Hydrolagus colliei **Ratfish.** Ratfish are a common cartilaginous fish that can reach a length of 38 inches. They are bottom feeders that prey on various small fishes as well as clams. In this species a single distinctive dorsal spine and six very unique teeth are the only elements that will be found in an archaeological site. Ratfish are found in shallow and very deep water, both inshore and offshore (Eschmeyer et. al. 1983: 59). Egg cases may be laid in the intertidal zone during the late summer and early fall (Hart 1973:67), although the seasonal information is conflicting (see Eschmeyer 1983: 59). Similar to dogfish, ratfish livers are a source of very high quality oil.

Order Clupeiformes

Family Clupeidae

Clupea pallasi **Pacific herring.** Herring are a small schooling fish found commonly and in high numbers on the Pacific coast. They are concentrated in large numbers in shallow inshore waters during the spawning season, February through April/May, but may move inshore well in advance of actual spawning, as early as September/October. They are also present in smaller numbers in inshore and offshore waters at all times, and as many other fish species also do, herring migrate to the surface at night and return to greater depths during the day. Herring spawn in the intertidal zone, laying eggs on seaweed, eelgrass and any other available material (Hart 1973:97). At this time, herring attract a wide variety of predators into shallow inshore waters (such as larger fish, sea birds and marine mammals), making these animals easier prey for First Nations hunters. Both herring and herring eggs were harvested ethnographically in great quantities and preserved for later consumption, but the fish were also taken in all seasons as bait for the hook and line fishery of species such as salmon, cod, lingcod and rockfish (Stewart 1977). Herring were reportedly harvested during the spring spawning period in large numbers, with rakes, nets or tidal traps (Stewart 1977). They have a high oil content and were particularly relished as a fresh fish in the early spring (Drucker 1951: 41) but were also dried for later consumption. Herring were not cleaned prior to preparation and the bones were not removed (Drucker 1951: 65). Herring were thus an important resource not only due to their own food value, but also because of the roe fishery and the other animals which the herring attracted to the accessible inshore habitat.

Herring bones, while small, are quite distinctive and can be identified readily even in quite fragmented condition. Only some of the larger elements (e.g. dentary), bones from particularly large individuals and vertebrae with intact neural and haemal spines are apt to be retained in 1/4" screens. The bulk of herring remains present in archaeological deposits are collected in 1/8" screens. Thus if the relative abundance of herring in a site is to be successfully assessed, screening of deposits with 1/8" mesh is essential. Alternatively, representative bulk column samples that are screened in the lab can also be used.

Engraulis mordax **Northern anchovy.** The anchovy is a small schooling fish (maximum reported

length to about 8 inches (20 cm) in Canadian waters). Anchovies have been reported as occasionally abundant on the west coast of Vancouver Island since historic times. The preferred water temperature appears to be 14.5 and 18.5°C, which may account for their sporadic occurrence in B.C. waters. They often occur now in mixed schools along with juvenile sardine (pilchard) and/or mackerel. Anchovy move inshore during the spring and spawn in the evening in the upper water layers during July and August, when the water is warmest. Normal diurnal migration brings anchovies to the surface at night from their usual day-time position on the bottom. (Hart 1973:104–105). Their bones, both vertebrae and cranial elements, are distinctive and easily distinguishable from herring and smelts.

Order Salmoniformes

Family Salmonidae

***Oncorhynchus* sp. Salmons, Steelhead and Trouts.** Unfortunately, it is often not possible to identify the skeletal elements of members of this family specifically, therefore it is necessary to consider all members briefly. Most members of the genus are anadromous, spawning in fresh water but living most of their lives in marine waters.

***Oncorhynchus gorbuscha* Pink or Humpback Salmon.** Pinks average 1–2.5 kg in weight. Spawning takes place every other year, with some rivers having a run every year and others having a run on alternate years only (Heard 1991:121). Spawning tends to take place in the lower reaches of the rivers, sometimes even in areas of marine incursion (ibid:122). Coastal migration at the beginning of the spawning season starts in late summer, while the migration into the rivers begins approximately in late August and September.

***Oncorhynchus keta* Chum or Dog Salmon.** Chum are the second largest of the salmons, reaching as much as 15 kg (Hart 1973:112), averaging 4.5 to 6.8 kg (Eschmeyer et al. 1983:76). They spawn in both the lower and upper reaches of streams and rivers (Salo 1991:238). The timing of the spawning run is very broad, "beginning in early September and continuing in some streams as late as March" (ibid.). Male chum salmon develop very enlarged teeth during the spawning period (Hart 1973:112).

***Oncorhynchus kisutch* Coho or Silver Salmon.** Coho average 2.7 to 5.4 kg, with a maximum recorded weight of 14 kg (Hart 1973:116). They spawn in both small tributaries of large rivers and small coastal streams (Sandercock 1991:404). Coho spawn between November and January most commonly, but there is variation which can widen the period to November through March (ibid:409–410).

***Oncorhynchus nerka* Sockeye Salmon.** Sockeye salmon are usually about 2.3 to 3.6 kg with a maximum weight of 6.8 kg (Eschmeyer et al 1983:77). Sockeye spawn in lakes (Burgner 1991:5) and therefore are somewhat more restricted in the rivers they can use than the other species of salmon. They spawn during the late summer and early fall, but the exact timing of their entry into the rivers is variable depending on how far they have to travel up the river to the spawning area and the specific characteristics of the spawning area (usually related to water temperature) (Burgner 1991:18).

***Oncorhynchus tshawytscha* Chinook or King Salmon.** The Chinook salmon is the largest of the genus, averaging 4.5 to 6.8 kg and reaching as much as 60 kg (Eschmeyer et al.1983:78). Chinook spawn in both large rivers and small coastal streams (Healey 1991:316). The timing of the spawning runs is extremely complex, apparently as a result of the presence of two races or populations of Chinook which have different life cycles and spawning times. Some Chinook enter the rivers during the spring and early summer, while others enter during summer and fall (ibid:319). Not all rivers and streams have both runs present. The effect of this is that there are some Chinook running into the rivers at all times of the year.

***Oncorhynchus clarki* Coastal Cutthroat Trout.** Cutthroat trout range in size from 0.7–1.8 kg, although some individuals may reach 7.8 kg (Hart 1973:127). Some cutthroat are permanent residents in fresh water and others are anadromous. Cutthroats spawn in small streams, usually in February and March (ibid:128).

***Oncorhynchus mykiss* Steelhead or Rainbow Trout.** This species includes fish with two distinctive lifestyles. The rainbow trout is exclusively a fresh water resident, living in streams, rivers and lakes (Page and Burr 1991:55). The size of rainbow trout is variable depending upon where they are living, but the record appears to be 37 pounds

(Scott and Crossman 1973:189). The steelhead is anadromous, living for at least some period of their life in salt water. Steelhead spawn in coastal streams and rivers. There appear to be two populations; those that spawn in summer and those that spawn in winter (Hart 1973:129). Their size is variable, but most are under 4.5 kg (Eschmeyer et al. 1983:79) with a maximum of perhaps 19 kg (Hart 1973: 129).

Order Gadiformes

Family Gadidae True cods
Most members of this family are distinctive skeletally and present no identification problems. However, the Pacific cod (Gadus macrocephalus) and walleye pollock (Theragra chalcogramma) are quite similar. Some of their bones are distinctive to species but not all, and fragments are often not diagnostic. Pollock were not identified in the Ts'ishaa sample.

Gadus macrocephalus **Pacific or Gray Cod.** The Pacific cod is a schooling fish that reaches at least 1 meter in length. They are generally considered a deep water species but they do migrate seasonally. Cod move into comparatively shallow water in late winter and spring, where they congregate to spawn, and disperse to greater depths in the fall to feed (Hart 1973:223). Regardless of the depth of water they occupy, Pacific cod are bottom feeders that consume a variety of invertebrates, small schooling fish (such as herring, sandlance and pollock) and small flatfishes.

Merluccius productus **Pacific Hake.** The hake is a medium-sized cod that can reach lengths of up to 1 metre, although most are smaller. Hake are an abundant schooling fish in this area although they are not utilized commercially. They constitute an important food source for larger predatory fishes such as lingcod and dogfish (Hart 1973: 226) and marine mammals (Eschmeyer et al. 1983: 99). Hake normally prefer moderate depths but do come into shallower bays and inlets to feed, especially at night. They are one of a number of herring predators and would probably be attracted to inshore areas by the presence of spawning fish. They can be taken on hook and line or trawling.

Order Scorpaeniformes

Family Scorpaenidae
Sebastes sp. **Rockfishes.** This genus has about 32 species that might be present in southern B.C. waters. It is usually not possible to identify skeletal elements to species. Rockfish are variable in size; a few attain maximum lengths of about 1 metre, but the majority are 30–61 cm in length (Hart 1973). Several species may form group assemblages that occupy a certain specific habitat and thus may be caught together (Nagtegaal 1983). They feed on a number of other fishes and invertebrates, both on the bottom and in mid-water (Philips 1964). Rockfish live in a wide variety of habitats, such as rocky areas, kelp beds and areas of soft bottom, from shallow water to 457 m (Eschmeyer et al.1983:132). However, in general the smaller and younger individuals usually occupy shallower, more protected habitats while larger individuals are more often found in deeper waters.

Family Hexagrammidae
This family consists of several genera including the greenlings, lingcod and combfish. The lingcod skeletal elements are quite morphologically distinct from the other members of this family. However, the remaining genera are often difficult to distinguish from each other and are generally lumped under the category "greenling" for quantification purposes. Some elements are quite distinctive however, and so the species identity of certain elements from an archaeological assemblage can often be determined

Hexagrammos sp. **Greenlings.** Greenlings are medium sized fish, usually under 61 cm in length (Eschmeyer et al. 1983:155). The species most likely to be present in the site area are the kelp greenling (*Hexagrammos decagrammus*), whitespotted greenling (*Hexagrammos stelleri*) and rock greenling (*Hexagrammos lagocephalus*). Greenlings are typically found in rocky areas in relatively shallow water, although the kelp and whitespotted greenlings can be found in kelp beds or sandy areas. There are no recorded seasonal movements. Both kelp and rock greenling were specifically identified in the Ts'ishaa samples.

Ophiodon elongatus **Lingcod.** Lingcod are the largest of the Hexagrammids, reaching maximum lengths of up to 1.5 metres (5 ft.) and weights of up to 45 kg. Its preferred habitat is rocky intertidal areas down to 40 fathoms or more, much the same habitat as the cabezon. Females are larger than males (up to 5 ft/70 lbs for females vs max. 32 in/22 lbs for males) and they tend to occupy progressively deeper and deeper water as

they get larger. Small fish (less than 20 inches) usually occupy shallow water areas over sandy rather than rocky bottoms, likely a response to the cannibalistic tendencies of larger fish (Miller & Geibel 1973). Lingcod are aggressive predatory fish which feed on a variety of other fish such as herring, flatfish, rockfish, cods and smaller lingcod (Hart 1973: 468) and are taken readily on hook and line. Native strategies also included a wooden lure made specifically to entice fish to the surface where it could be speared (Stewart 1977). Lingcod spawn between November and March, usually in rocky subtidal and lower intertidal waters. Males mature at a much smaller size (18–29 inches) than females (27.5–30 inches).

Male lingcod guard the large masses of eggs which the females lay under rocks and in crevices, and thus medium sized males, large females and small immature lingcod of both sexes are all present in the intertidal zone during late winter-early spring. Large and very large fish are more often encountered at other times of the year in deeper waters over reefs (Cass et al. 1990; Miller & Geiber 1973). This size disparity between males and females and the apparent segregation by sex between habitats has important implications for interpreting archaeological lingcod remains. An assemblage representing only large and very large individuals probably indicates a fishery concentrated over deep rocky inshore waters between late spring and early fall. An assemblage representing small to very large individuals however most likely reflects a late fall-early spring fishery concentrated in intertidal waters over both sandy and rocky bottoms.

Family Cottidae

Sculpin sp. **(undetermined).** Sculpins are a large family of fishes with many species (including a few freshwater types) present in B.C waters. Most of the species are skeletally distinctive and only a few bones, or fragmented ones, are not identifiable to species. There are many small to very small tidepool species and a few larger, intertidal ones. Several commonly occurring intertidal sculpin species are often represented in archaeological assemblages from our area and life history details of these are discussed individually below.

Hemilepidotus hemilepidotus **Red Irish Lord.** The Red Irish Lord can reach lengths of about 50 cm., although the average size is closer to 25 or 30 cm. It is relatively common in inshore rocky habitat and intertidal areas and can be caught on hook and line (Eschmeyer 1983). Spawning occurs in intertidal waters during March in southern B.C. (Hart 1973: 503).

Scorpaenichthys marmoratus **Cabezon.** Cabezon are the largest of the local sculpins, reaching a length of 76 cm and a weight of 14 kg (Hart 1973:541). Cabezon spawn in shallow to intertidal waters from January through March. O'Connell reports cabezon are found only on hard bottoms, not on sand or mud (1953:25), in shallow to moderately deep water (up to 50 fathoms), with larger individuals being the deepest dwelling. As for lingcod, during the spawning season both small juveniles and large mature fish occur together in rocky intertidal areas. Cabezon eat a variety of invertebrates and small fish, such as sculpins, rockfish and flatfish.

Leptocottus armatus **Pacific Staghorn Sculpin.** The Staghorn Sculpin is one of the larger sculpins and can reach a length of 46 cm. It is very abundant in British Columbia in the intertidal area and at moderate depths. It prefers sandy, silty or muddy bottoms, often burying itself in the substrate so that only the eyes are showing. It is one of the few sculpins that will take bait and is regularly caught by hook and line (Eschmeyer et al. 1983:175; Hart 1973:518; Lamb and Edgell 1986:168).

Order Perciformes

Family Embiotocidae Surf perches

The surfperch family has a large number of members, three of which are common schooling fish in inshore B.C. waters. Although all perch bones cannot be identified to species, some elements (such as the inferior pharyngeals) are quite diagnostic. To make identification matters difficult, perch are viviparous (live- bearing) and the young of the two larger species approach the size of small individuals of the third (much smaller) species. All perch elements recovered archaeologically are therefore usually quantified together at the family level, although the exact species composition of each assemblage may vary. Only Striped Sea Perch and Pile Perch have been specifically identified in the Ts'ishaa Village sample.

Cymatogaster aggregata **Shiner Perch.** The shiner perch is the smallest of our local species, reaching a maximum length of only 6 inches (15 cm), with females larger than males. Adults feed on mussels and barnacles. Shiners are especially

common during the summer in shallow, inshore waters, moving to depths of up to 40 fathoms in the fall (Hart 1973:304–305).

Embiotoca lateralis **Striped Seaperch.** This perch reaches a length of 38 cm and small schools inhabit shallow waters in rocky areas and kelp beds (Eschmeyer et al. 1983:229). They feed on worms, mussels, crustaceans and herring eggs. They are strongly territorial and available year round.

Damalichthys vacca **Pile Perch.** The pile perch lives in small schools and reaches a maximum length of 44 cm. It is found in shallow water around rocks and kelp beds, where they feed on mussels (Eschmeyer et al. 1983:228). Like the striped seaperch, they are very territorial and show little seasonal movement (Hart 1973:312–313).

Family Scombridae

Thunnus thynnus **Bluefin Tuna.** The Bluefin Tuna is a sporadic visitor to the west coast of the island in the summer months. This huge fish, reaching sizes of over 7 feet in length and weighing more than 250 pounds, is a fast swimming open ocean fish that must have taken great skill to capture (Hart 1973:379). It is likely that it was taken opportunistically during sea mammal hunting expeditions, as nothing but a large harpoon would have enabled aboriginal hunters to dispatch fish of this size and speed. Bluefin feed on small schooling fish such as anchovy. The periodic movement of both species into waters off the west coast may be related to northward movements of warmer waters associated with El Nino events.

Order Pleuronectiformes Flatfishes (flounders) Right-eyed and Left-eyed

There are many species in this order found in southern British Columbia. Flatfish skeletons are easily identifiable to order, however, it is not as easy to make identifications to the species level. Frequently, the mouth parts are quite distinctive while vertebrae are less easily identified to species. Some species however, such as halibut, arrowtooth flounder and curlfin sole, are distinct in almost all elements. The result of this is that there is always a large flatfish category that could potentially include members of both the Bothidae (left-eyed) and Pleuronectidae (right-eyed) families. Consequently, flatfish are usually quantified at the order level, except for the few species which are entirely distinct (such as halibut). The few elements that are identifiable to species make it possible to discuss the utilization of specific habitats and associated fishing technology. Life history details of species identified in the DfSi-16 samples are discussed below.

Family Pleuronectidae

Eopsetta jordani **Petrale sole.** The Petrale sole is a deep-spawning species and thus has a seasonal migration pattern which is the reverse of most fish. It disperses to relatively shallow inshore waters (31–60 fathoms) in spring (March-April) after congregating for winter spawning (Nov-Feb) at depths of 140–250 fathoms (DiDonato & Pasquale 1970). One of the main spawning grounds is Esteban Deep off the central west coast of Vancouver Island. The Petrale sole can attain lengths of up to 70 centimetres (Hart 1973:608) and prey include sandlance, herring, invertebrates and small bottom

Hippoglossus stenolepis **Halibut.** The Pacific halibut is an extremely sexually dimorphic flatfish species, with females reaching almost 3 metres (over 200 kg) while males seldom exceed 1.2 metres (50 kg) (Hart 1973:614–616). Halibut, like petrale sole, are deep-water winter spawners. The spawning season runs from November through January at depths of 150 to 225 fathoms (275–412 m). Relatively small, immature fish (average 16 kg) are found between 30 and 225 fathoms and this size are generally available year-round. Mature fish (8–16 years for females, younger for males) make extensive migrations between their relatively shallow feeding grounds and deeper spawning areas. These bottom-dwelling fish are caught on specialized hooks that are size-dependent: large hooks can be taken only by large fish (Stewart 1977). Hook size thus effectively restricts the catch to this species and the few other flounders which attain a relatively large size (starry flounder and petrale sole). Halibut have distinctive skeletal elements, which permits their archaeological remains to be quantified separately from other species.

Lepidosetta sp. **Rock Sole.** Two species of Rock sole that have only recently been distinguished are found off the west coast of Vancouver Island. The skeletal differences between the northern species, *L. polyxystra* and the southern one *L. bilineata,* are not yet clearly defined. Both species inhabit the inshore waters of the continental shelf over sandy bottoms. The southern rock sole can be found to depths of 200 fathoms (339 metres) while the northern rock sole inhabits slightly shallower

depths to 150 fathoms (246 metres), but both species are usually found at shallow depths between 20 and 30 fathoms (37 and 55 metres). In summer, the fish move into shallower depths. The southern rock sole reaches lengths up to 58 centimetres while the northern one is slightly larger, reaching lengths of 69 centimetres. (Hart 1973:621; Mecklenburg et al. 2002:837–838).

Parophrys vetulus **English Sole.** The English sole is a common medium sized flatfish reaching lengths of 57 centimetres. Juvenile fish are found in shallow water but as they grow they move into increasingly deeper waters, to 300 fathoms (550 metres). There is also a spring movement into shallower waters and a return to deeper waters in winter. Most fish are concentrated at less than 70 fathoms (128 metres), where they feed on small molluscs, marine worms, small crabs and shrimp (Hart 1973:628; Lamb and Edgell 1986:206).

Order Batrachoidiformes

Family Batrachoididae

Porichthys notatus **Plainfin Midshipman.** This fish is a common resident of the west coast of Vancouver Island from the intertidal zone to depths of 145 fathoms (265 metres). They spawn in the spring in shallow water or in the intertidal zone, scooping out the sand beneath rocks and attaching the eggs to the rock surface. The male guards the eggs until the young emerge, and would be vulnerable to capture during this time. Midshipmen are also known as "singing fish" for the humming, grunting sound that they make with their gasbladders. They reach lengths to 38 centimetres (Hart 1973:207).

MAMMALS

Order Rodentia

Family Castoridae

Castor canadensis Beaver. The beaver is Vancouver Island's largest rodent, although the Island subspecies (C. c. leucodontus), at about 18 lbs, is considerably smaller than the Rocky Mountain subspecies which can reach almost 100 lbs (McTaggart-Cowan & Guiget 1965;174). Beavers occupy slow-moving streams and lakes of all sizes, where lodges of tree branches are built. Young are born from late April to early July and the lodge usually houses a family composed of a pair of adults with the young of the year and of the previous year. Two-year olds leave the lodge at midsummer and often travel far from water in search of a new suitable lodge location (ibid. 170–173). These two years olds are probably more vulnerable to predation than the very young or fully adult individuals.

Family Cricetidae

Peromyscus maniculatus **Deer Mouse.** The little Deer Mouse is the only native mouse in the study region. It is classified here as a commensal species, as it frequently enters human habitations and takes up at least seasonal residence during the winter. It is omnivorous, feeding on a wide variety of seeds, nuts, fruits, insects, and even small crabs and limpets along the seashore and can be seen at any time of year McTaggart-Cowan and Guiguet 1965:177).

Order Artiodactyla

Family Cervidae Elk and Deer

Two members of this family occur on Vancouver Island, the blacktail deer (which is a coastal subspecies of the mule deer) and the elk. While the mule deer overlaps in distribution with the white-tailed deer in the interior of the province, on the coast any prehistoric deer is unlikely to be anything other than blacktail. In terms of geographic distribution, the coast black tail and the mule deer overlap only in a narrow range well inland from most coastal archaeological sites. However no attempt is made to distinguish these regional subspecies, as such distinctions are probably not taxonomically valid as applied to most skeletal elements; identification made to subspecific level is based on geographic range only, not skeletal difference.

In addition, many fragments which probably can be attributed to deer are in fact not species-distinctive. In these cases, the category of medium ungulate is used, because if these remains were encountered in areas where species such as goat and sheep occur it would not be possible to identify such fragments to species. The same is true to some extent for elk. However, for elk the main problem is distinguishing fragments of it from cow in historic levels. A very large ungulate category exists to quantify these ambiguous elk/cow elements.

Antler fragments recovered archaeologically often cannot be identified to species, unless relatively large, unaltered chunks are found. All male cervids possess antlers and in coastal sites either

deer or elk could be the source of antler used for tools and decorative items.

Cervus elaphus **Elk.** Elk are the largest land mammals that were available to coastal First Nations people; males weigh up to 800 lbs. and females close to 500 lbs., with calves weighing about 40 lbs at birth (McTaggart-Cowan & Guiget 1965:358). They prefer a "parkland" type habitat, where mixed conifer/deciduous forests are interspersed with grasslands, and feed largely on grasses, shrubs and deciduous trees. Elk can be solitary but generally travel in small herds consisting of a bull and 4 to 20 cows. Calves are born in mid to late spring and twins often occur.

Odocoileus hemionus columbianus **Coast blacktail deer (mule deer).** The blacktail deer is a subspecies of the mule deer, a common coastal ungulate whose size varies considerably with habitat and forage type. Semi-dwarf races occur on coastal islands and large Vancouver Island specimens on the west coast and northern regions. Adult males may weigh from 110 to 250 lbs.; females, 70–140 lbs. Fawns (twins or triplets) are approximately 3–6 lbs at birth, with most born during the spring (although this can be quite variable). Many deer migrate to higher elevations during the summer months and descend to the coastal areas in the fall (McTaggart-Cowan and Guiget 1965:366–369).

Order Carnivora

Family Procyonidae

Procyon lotor **Raccoon.** The raccoon is a medium-sized nocturnal carnivore, occupying diverse habitats and foraging on a wide variety of foods. This omnivorous diet includes intertidal fish and invertebrates, small mammals and reptiles, birds and bird eggs. Raccoons on the coast forage almost exclusively on the beach, where they would have been easily accessible to native hunters. Young are born in the spring, usually a litter of 1 to 8. The Vancouver Island subspecies is generally smaller (to about 12 lbs) than the mainland subspecies which can reach weights of up to 22 lbs (McTaggart-Cowan & Guiget 1965).

Family Mustelidae

Enhydra lutris **Sea otter.** The sea otter is the largest of the mustelids. Size ranges from 50 to 80 lbs (McTaggart-Cowan & Guiguet 1965), with males usually larger than females. Their thick dense fur was likely always an attractive commodity. Pups are often born in the spring, although birth can occur at any season due to delayed implantation. Young usually remain with their mothers for the first year. The sea otter is exclusively marine and lives among offshore kelp beds. It consumes shellfish, crabs, sea urchins and fish (Nicherson 1984). Their bones are quite distinct from the river otter, as are the flattened molar teeth.

Mustela vison **Mink.** This medium-sized mustelid is semi-aquatic and occupies areas close to fresh or sea water. Like the raccoon, mink on the coast forage almost exclusively on the beach, eating intertidal invertebrates and fish, and thus would have been easily accessible prey for native hunters. Young are born from April to June. Males are larger than females (3 lbs. vs about 1.5 lbs) and the Vancouver Island subspecies is larger on average than the mainland subspecies (McTaggart-Cowan & Guiguet 1965).

Martes americana **Marten.** The marten is a fairly common but solitary resident in the coniferous forests of study area. Mice are their main food, but they also take voles, small birds, squirrels, hares and rabbits and even berries and insects. They will also forage along the seashore, taking crustaceans. Small litters of one to four young are born in late March and April. Juveniles reach adult size by about three and a half months old, but do not breed until two years old. Being curious animals, they are relatively easily trapped (Banfield 1974:315; McTaggart-Cowan and Guiguet 1965:300).

Lontra canadensis **River Otter.** The River Otter is a common and abundant mustelid along the west coast of Vancouver Island. In coastal areas they forage along the seashore, taking many different species of fish from the inshore waters and also eating crustaceans and small birds. The young, one to five, are born in March and April. Except for the Sea Otter, they are the largest of the mustelids, with adult males weighing up to 30 pounds and measuring more than four feet in length (Banfield 1978:341; McTaggart-Cowan and Guiguet 1965:330;).

Order Cetacea

Family undetermined Whales

Fragmented whalebone is often recovered in archaeological sites and is impossible to identify to species; only nearly complete elements and large chunks of skull can be more precisely identified

(Huelsbeck and Fisken 1983). Many species of toothed and baleen whale frequented B.C. waters in prehistoric times. Of these the ones most likely to be found off the west coast of Vancouver Island would be the gray whale and the humpback, now much reduced in numbers from their former abundance. The killer whale is also a common resident in Barkley Sound. Their population also may have been much higher prehistorically. In addition to these species, west coast waters previously attracted blue, fin, minke, sei, and right whales, although they are no longer of common occurrence (Huelsbeck 1983; Huelsbeck and Wessen 1994; Leatherwood et al. 1988; McTaggart-Cowan & Guiguet 1965). Several smaller species are less common, such as the beaked and pilot whales, and while few details of their distribution or habits are known (Leatherwood et al. 1988), they may also have been subject to native hunting activities.

Active hunting of whales is a specialized activity requiring unique equipment and skilled hunters, but occasional beached carcasses could be scavenged for bone and baleen by groups which did not normally actively pursue whales. Thus small amounts of whalebone recovered archaeologically does not necessarily indicate that active whaling was practiced by any prehistoric group. DNA analysis of a number of whale bone specimens recovered from the Ts'ishaa Village deposits has confirmed the presence of both grey whale and humpback in the faunal samples. A mandible from the 2000 trench has been identified as grey whale, while the other specimens, including ones from the backridge and the 2000 trench deposits, are humpback whale.

Family Eschrichtidae
Eschrichtius robustus **Grey Whale.** The grey whale is one of the larger baleen whales, reaching lengths of up to 50 feet (15 metres) and weighing about 36.4 tons. The females are larger than the males. They are bottom feeders in relatively shallow waters over the continental shelf, commonly staying within six miles of the shore. They do not normally dive beyond 15 to 25 fathoms (75 –135 feet). They follow a regular migratory pattern between the northern summer feeding grounds in the Chukchi and Bering Seas and their wintering and calving grounds in the shallow lagoons of Baja California. The relatively slow moving northward annual migration passes the Barkley Sound area in April and early May, while the much more rapid southward migration passes Vancouver Island in December. During these times the whales are close inshore (Banfield 1978:270–272). While peak population densities off the west coast of the island are during the migration periods, some solitary animals linger along the west coast of Vancouver Island during the summer months as well (Banfield 1978:270; Letherwood et al. 1988; 72). This species was hunted almost to extinction in the early historic period but is now recovering in numbers.

Family Balaenopteridae
Megaptera novaeangliae **Humpback Whale.** The humpback whale is of similar size to the gray whale, reaching lengths of 48 feet (14.3 metres) and weighing up to about 44 tons. As with gray whales, the females are larger than the males. In their arctic summer grounds they feed primarily on krill but they also feed on small schooling fish such as herring and capelin. Like the grey whale, they follow a migratory pattern between summering grounds in arctic waters and wintering grounds in more temperate seas off the west coast of Mexico. They pass northwards along the west coast of Vancouver Island in May and June, returning southward again in October and November. Some humpbacks remain to summer along the island's western shores. There are reports that there may once have been a resident population of humpbacks in Barkley Sound/ Alberni Inlet. They are a slow swimming whale, remaining close to shore and often entering bays and estuaries and are consequently vulnerable to human predation (Banfield 1978:279; Leatherwood et al. 1988:39–50). The west coast population levels were also reduced drastically by early historic overhunting.

Family Delphinidae Porpoises including:
Phocoena phocoena **Harbour Porpoise**
Phocoenoides dalli **Dall's Porpoise**
Lagenorhynchus obliquidens **Pacific White-sided Dolphin.** Several species of porpoises and dolphins occur in B.C. coastal waters, but much of the archaeological skeletal material cannot be assigned to any one species because of its fragmentary nature. However, most intact elements, including vertebrae and ribs, can be identified to species. The Pacific white-sided dolphin (up to 2.2 metres) and the Dall's (up to 2.0 metres) are slightly larger than the Harbour porpoise, which attains a length of up to 1.8 metres (Leatherwood et al. 1988). All are reasonably common on the west coast of Vancouver Island, where they feed on squid and small schooling fish such as herring (Balcomb & Balcomb 1982).

Dall's porpoise are somewhat more abundant

offshore than inshore at most times of the year (Everitt et al. 1979). Whitesided dolphins appear to be more common (and to be found in larger groups) in protected inside waters during the winter and move to outside waters during the summer (ibid.). The harbour porpoise is currently a year-round resident species in inshore waters, being especially common in more protected waters. Harbour porpoises are noticeably more shy of human contact than the other two species and are reported to be quite difficult to approach by boat (ibid.; Leatherwood et al. 1988). Porpoises of all kinds are elusive prey despite their relative abundance and active procurement involves specialized hunting strategies.

Order Pinnipedia

Family Otariidae Eared Seals

Three species of eared seal occur in B.C. coastal waters: *Callorhinus ursinus* (Northern fur seal), *Eumetopias jubatus* (Steller's or Northern sea lion) and *Zalophus californianus* (California sea lion). They all display strong sexual dimorphism, with females considerably smaller than males. Skeletal elements of these three can sometimes be difficult to distinguish, especially for fragmented or juvenile specimens. All species consume squid, octopus, rockfish and ratfish, as well as schooling fish such as herring, hake and sandlance.

***Eumatopias jubata* Steller's (Northern) Sea Lion.** Only Steller's sea lion currently breeds in B.C. waters (on a few isolated offshore rocky islets, such as the Scott Islands at the north end of Vancouver Island) and thus may be encountered all year long (Bigg 1985; Olesiuk and Bigg 1988). Mature males and breeding-age females are on the breeding rookeries during the summer available only to local hunters at that time. At other times of the year they are more widely dispersed and therefore more widely available. Hauling out places are located on the north eastern side of Benson Island today. Adult males are enormous, reaching 3.2 m in length and weighing 1,000 kg or more (Everitt et al. 1979). Adult females are only about 2 m long and weigh about 300 kg.

***Callorhinus ursinus* Northern Fur Seal.** Fur seals now enter B.C. waters only during their annual migration to and from their rookeries on the Pribilof Islands in Alaska (Olesiuk and Bigg 1988), although the Ts'ishaa Village archaeological data , as well as archaeological data from Hesquiat Harbour and the Ozette site on the Olympic Peninsula indicate that the pattern was different prehistorically (Calvert 1980; Crockford, Frederick and Wigen 2002; Gustafson 1968, 1975; Lyman 1994). Currently, adult breeding males remain in Alaska year-round, while females and juveniles migrate as far south as California. Pregnant females begin to pass through B.C. waters in early April, followed successively by mature but non-pregnant females, immature males, then immature females (2–4 yrs) (Trites and Bigg 1996). Breeding males stake out territories on the Alaskan rookeries and collect harems of pregnant females. Pups are born in June and July and mating occurs soon after (there is delayed implantation of the fertilized ovum in this species). About late October through November, all animals except the bulls begin their southward migration, passing through B.C. waters again during January and February (Manzer and McTaggart-Cowan 1956). A few immature animals may remain off the B.C. coast during winter and spring rather than migrate further south (Olesiuk and Bigg 1988).

The presence of very young juvenile individuals, under four months of age and therefore still nursing rookery animals, in the Ts'ishaa archaeological data shows that there was also a local non-migratory population of fur seals in the Barkley Sound region in earlier times. Undoubtedly local non-migratory west coast Vancouver Island population numbers were swelled by the annual northward migration of the larger Pribiloff herds in the spring.

Fur seals were once extremely abundant along the B.C. coast but a concerted slaughter by Russians and Europeans hunters on the northern breeding rookeries late in the 18th and early 19th century decimated the fur seal population. An international treaty signed early in the 20th century protected the animals on the breeding grounds, but pregnant females were still permitted to be taken during the pelagic hunt by aboriginal hunters for another 30 years (Everitt et al. 1979). Such devastation of the population may well have resulted in changes to both total range and migratory behaviour of this species and modern distribution patterns cannot be reliably used to interpret the prehistoric aboriginal harvest. More research on the age and sex composition, and seasonal distribution, of prehistoric fur seal populations off the B.C. coast is sorely needed.

Adult male fur seals are about the size of female Steller's sealion (2.5m/280 kg). Female fur seals are considerably smaller and weigh only 30–50 kg (ca. 1.7 m long). This discrepancy in size between

the two makes it relatively easy to distinguish the sex of adult skeletal material, although in contrast to land mammal species, epiphyseal fusion of most elements does not take place until well after sexual maturity is reached (Trites and Bigg 1996). Thus "mature" adult status (i.e. breeding age) is most difficult to determine. Canine teeth, particularly the upper ones, can be reliably used to determine age by counting the prominent growth ridges (Scheffer 1950; Schiavini et al. 1992; Trites, pers. comm., U.B.C. Fisheries Centre, Vancouver).

Zalpohus californianus **California Sea Lion.** While not as numerous as the previous two species, male California sea lions often winter in B.C. after leaving California rookeries at the end of the summer (McTaggart Cowan & Guiget 1965). Males attain a length of about 2.5 m and weigh up to 365 kg (about the size of male fur seals), while females are only about 1.6 m and 115 kg (Everitt et al. 1979).

Family Phocidae

Phoca vitulina **Harbour seal.** The harbour seal is a common resident in B.C. waters, occurring most often in nearshore areas such as shallow bays, inlets and estuaries; they occasionally enter fresh water. Seals haul out on islands, exposed reefs, sandbars and mudflats to rest and to give birth. Pups are generally born in late May or June (Olesiuk and Bigg 1988). Harbour seals are very eclectic in their food habits but prey largely on schooling fish such as herring and hake, although a number of other fish and invertebrates are taken as well (Bigg et.al. 1990). Although generally distributed in small groups, harbour seals do congregate seasonally in areas of high food availability, such as river mouths during salmon spawning periods and in shallow bays where spawning herring concentrate (ibid.).

Harbour seals are not as sexually dimorphic as fur seals and sea lions and thus it is difficult to determine the sex of individuals from their skeletal elements. Males can weigh up to 300 lbs., with females being somewhat smaller (McTaggart-Cowan & Guiget 1965).

Mirounga anustirostris **Northern Elephant Seal.** The Northern Elephant Seal is a very large Phocid, adult males weighing up to 2½ tons and measuring to 16 feet in length. They take their name from the male's long inflatable snout. Females are considerably smaller. They are comparatively rare today off the west coast of the island but were likely more common before the southern centers of population were decimated by hunting in the early historic period. Individual males are reported regularly but sporadically in the study area, individuals having been reported in both September and April (Banfield 1974:380; McTaggart-Cowan and Guiguet 1965:353).

BIRDS

Order Gaviiformes

Family Gaviidae

Gavia sp. **Loons.** The three loon species which occur in coastal B.C. areas, the Red-throated, the Pacific and the Common loon, were all identified at Ts'ishaa Village. Generally, whole skeletal elements of these species are distinguishable, but fragmentary material is less distinctive. All three occupy similar habitats, where they are proficient divers, but there are slight differences in breeding and resident population distributions. All three species breed and nest on fresh water lakes.

Gavia stellata **Red-throated Loon.** The red-throated loon is a fairly common resident in the Barkley Sound area, with a breeding population recorded for Nitinat Lake. Locally it is very abundant in the spring as migrant birds swell the overwintering populations. This loon breeds in small coastal lakes in May through August and forages on the ocean (Campbell et. al.1990(I):158). It prefers shallow inshore areas, where it feeds on small schooling fish such as sandlance and herring and some invertebrates (Angell and Bascomb 1982).

The red-throated is the smallest of the three local loons and is often distinguishable from the others skeletally on this basis, although there is some overlap with the Pacific loon, especially for fragmented material.

Gavia pacifica **Pacific Loon.** The Pacific loon is an abundant spring and autumn migrant on the B.C. coast, with much smaller winter and summer population of non-breeding birds on the west coast of the island. Large numbers of Pacific loons congregate in herring spawning areas in the spring (Campbell et.al. 1990(I):160), made up of winter residents and northward migrating birds. Breeding areas are in the Yukon. This loon is generally slightly larger than the red-throated loon.

Gavia immer **Common Loon.** The Common loon is the largest of the three species found on the west

coast of the island. In the Barkley Sound region non-breeding birds are present all year, with flock numbers increased by northward migrations of breeding birds in spring (mid-March through June) and southward migrations in the fall (late August through November).

A breeding population is recorded for the Barkley Sound area (Campbell et al. 1990(I):162).

Order Podicipediformes

Family Podicipedidae Grebes. Four species of grebes are commonly found off the west coast of Vancouver Island, but only one was identified in the birds from Ts'ishaa Village, the Horned Grebe.

Podiceps auritus **Horned Grebe.** Although the Horned grebe is not a coastal breeder, non-breeding birds can be seen widely distributed along the west coast of the island throughout the year with increased populations recorded during spring and fall migrations of breeding birds. The species is common along the coast in winter, with Clayoquot Sound just north of Barkley Sound recorded as an important wintering area (Campbell et al. 1990(I):168). It favours inshore marine waters, feeding on crustaceans and small fishes (Godfrey 1979:16).

Order Pelecaniformes

Family Phalacrocoracidae Cormorants. There are three species of cormorants which occur in coastal B.C., one of which is markedly larger than the other two. Non-breeding individuals of all three species are found year round in the Barkley Sound area, but only the Brandt's and the Pelagic breed in the area. All are efficient divers that feed on fish but local abundance varies somewhat between species. Skeletal elements of the Double-crested can usually be distinguished on the basis of its larger size, but it is often difficult to distinguish elements from the Brandt's and Pelagic, especially fragments, phalanges and vertebrae.

Phalacrocorax auritus **Double-crested Cormorant.** The Double-crested cormorant is uncommon on the west coast of Vancouver Island but non-breeding individuals are recorded from Barkley Sound. The population is increased in spring and fall by migrating breeders (Campbell et al.1990(I):216–18). This is the largest of the cormorants and feeds on a variety of small fish, preferring foraging areas near estuaries and quiet bays (Angell & Bascomb 1982). It often roosts with both Pelagic and Brandt's cormorants on islets, floating logs and dead trees and in summer is primarily a bottom feeder, eating gunnels, surf perches , pricklebacks and sand lance (Campbell et al. 1990(I):218).

Phalacrocorax pelagicus **Pelagic Cormorant.** The Pelagic cormorant is a common resident on the west coast of the island, breeding throughout its range on the B.C. coast. It prefers inshore waters in rocky coast areas where it is an efficient bottom-feeder, taking such prey as sandlance, gunnels and shrimp. Herring are also taken however, and large numbers of Pelagic cormorants congregate to feed at herring spawning sites during the spring (Campbell et.al. 1990:228).

Phalacrocorax penicillatus **Brandt's Cormorant.** Brandt's is a less abundant cormorant species, resident in the Barkley Sound area year round, with breeding colonies recorded for Long Beach and Barkley Sound. The species avoids fresh or brackish waters and is more likely to be found in bays and narrows with strong currents and rocky shorelines (Campbell et al. 1990(I):224).

Order Anseriformes

Family Anatidae Geese

Branta canadensis **Canada Goose.** Non-breeding Canada geese are resident year round off the west coast of the island but no breeding areas are recorded in Barkley Sound. Coastal populations are largest in October and November and again in April when local populations are swollen by migrant breeders (Campbell et al.1990(I):278). They are the largest of the geese which occur in B.C. and skeletal elements are often easily distinguished based on size, making fragmentary elements identifiable which might not be possible for other species. Canada geese forage on mudflats, along salt marshes and in estuaries for reeds, eelgrass and other vegetation (Angell & Bascomb 1982). The sub-species most likely to be found on the west coast of the Island are the Vancouver Canada Goose *B. c. fulva* and the larger Dusky Canada Goose *B. c. occidentalis* (Campbell et. Al. 1990(I):280–282)

Branta bernicla **Brant.** The Brant is a small goose that was formerly a very abundant winter visitant to the west coast and an abundant spring migrant.

It breeds in the arctic and is rare off the coast in summer and autumn. Non-breeding birds are today rarely seen and it was likely never very abundant in the Barkley Sound region, the main migration corridors being along the east coast of the island or well off shore (Campbell et al. 1990(I):274).

Anser sp. **cf. Greater White-fronted Goose.** The Greater White-fronted goose was formerly a very abundant offshore transient during spring and fall migrations. There are both spring and fall records from Barkley Sound. This species nests in the Yukon River delta and winter in California, but a few non-breeding birds are recorded along the coast in both summer and winter (Campbell et al. 1990(I):262).

Order Anseriformes

Family Anatidae Duck sp.(undetermined)
A number of species of ducks, classified into several different genera, occur in B.C. waters. With a few exceptions, these species are often difficult to distinguish skeletally, depending on the element and its completeness. It is often possible to distinguish between some Diving Ducks (*Aythya sp*.) and some Dabbling Ducks (*Anas sp*.). Otherwise, size categories can be used to group duck remains. The few remains which can be identified to species give an indication of habitat utilization and seasonality of procurement.

The deposits reported on here contain three species of positively identified duck, Surf Scoter *Melanitta perspicillatus* , Bufflehead *Bucephala albeola*, and Mallard *Anas platyrhynchus*. Some other remains were determined to be dabbling (surface-feeding) ducks and some were diving ducks, although all three size categories of "ducks" were recognized (small, medium and large). Ducks are poor seasonal indicators on the southern B.C. coast, as many are residents as well as common fall/spring migrants (Campbell et al. 1990(I)).

Anas platyryhchus **Mallard.** The Mallard is common and present year round in Barkley Sound with both breeding and wintering populations. A dabbling duck, it forages in tidal marshes, estuaries and shallow water bays (Campbell et al. 1990(I): 290).

Bucephala albeola **Bufflehead.** The Bufflehead is a small diving duck that is a common migrant and winter visitant along the coast, but breeds primarily in the B.C. interior. It has been recorded in Barkley sound from September through May. It feeds in protected bays and estuaries in some numbers and large concentrations have been observed feeding on spawning herring shoals in late winter and early spring (Campbell et al. 1990(I):358)

Melanitta perspicillatus **Surf Scoter.** The Surf scoter is one of the most common ducks on the west coast of Vancouver Island, where large rafts of birds are commonly seen in both open and protected shallow waters. Very large concentrations feed on the spawning herring in spring. Although they do not breed in Barkley Sound, Surf Scoters are common there year round (Campbell 1990(I):340).

Order Charadriiformes

Family Alcidae Murres and Auklets
Cepphus columba **Pigeon Guillemot.** These small alcids are locally common to abundant resident breeders along the west coast of Vancouver Island (Campbell et al., 1990(II): 302; Godfrey 1979). It especially favours rocky coastlines, where it inhabits the nearshore zone and is regularly found in bays, inlets, surge narrows, coves and harbours.

Uria aalge **Common Murre.** This large fish eating alcid is a very common resident on the B.C. coast, preferring protected waters off straits, inlets, bays and channels. It can be very abundant in winter. Breeding colonies on rocky islets are recorded for Barkley Sound, as well as year round residency (Campbell et al, 1990(II):294). Like the ducks mentioned above, large flocks are attracted by shoals of spawning herring.

Brachyrhamphus marmoratus **Marbled Murrelet.** This little alcid is a common resident along the west coast of the island. Although no nests have yet been recorded, it is thought to breed throughout its coastal range. It is believed to nest on tree branches in old growth forest. It inhabits both protected and exposed coastal waters within 2 kilometres of land (Campbell et al. 1990(II): 308).

Cerorhinca moncerata **Rhinoceros Auklet.** The Rhinoceros Auklet is one of a number of medium sized alcids that are found along the west coast of the island. This species is common from spring through autumn, breeding in Barkley Sound and nesting in burrows. It is much less commonly seen on the coast in winter. It prefers feeding in open waters rather than within bays and estuaries,

especially favouring areas of upwelling (Campbell et al.1990(II): 326).

Family Laridae

Larus sp. **Gulls.** The bones of the various gull species are very similar and thus difficult, if not impossible, to tell apart. No attempt has been made to determine species, although distinct size classes are obvious.

The most common small sized gull on the southern west coast of Vancouver Island is Bonaparte's Gull *L. philadelphia* which is present year round, although it does not breed in Barkley Sound. Non-breeding individuals of Franklin's Gull *L. pipixan* have also been found here in the summer, although this species is not common and Sabine's gull *Xema sabini* has been rarely recorded off Barkley Sound between March and November.

The Mew Gull *Larus canus* is by far the most common medium-sized gull found on the west coast of Vancouver Island, where it is present year round, with breeding colonies recorded just north and south of Barkley Sound. The Ring-billed Gull *L. delawarensis* has been recorded but is much less common, and Hermann's Gull *L. heermanni* is recorded as a June through November visitor to the region.

Of the larger gulls found in the study area, by far the most common is the Glaucous-wing gull *Larus glaucescens*. It is a resident of the coast, breeding in Barkley Sound. Non-breeding individuals of Western *L. occidentalis*, Herring *L. argentatus* and California gull *L. californicus* have also been recorded throughout the year on the west coast of the island. Thayer's gull *L. thayeri* has also been recorded in the region between September and February, while the Glaucous gull *L. hyperboreus* is a rare winter visitor, but has also been recorded in Barkley Sound between June and August (Campbell et al. 1990 (II): 228–273).

Rissa tridactyla **Black-legged Kitti-wake.** This small pelagic gull is an abundant offshore migrant in spring and autumn with some abundant summer populations and much lower winter populations. They have been recorded year round in Barkley Sound. Although pelagic, they are often found roosting on rocky headlands and islets in company with other gulls (Campbell et al. 1990 (II): 274).

Sterna sp. **Terns.** Three species of terns are found in the region of Barkley Sound, the Common *S. hirundo,* the Caspian *S. caspia* and the Arctic *S. paradisea*. None are common visitors to the Barkley Sound region, with the Caspian and Common terns recorded there in June through August and the Arctic observed in June through November. None are present between December through February (Campbell et al. 1990 (II):278–287).

Order Falconiformes

Family Accipitridae Eagles & Hawks

Haliaeetus leucocephalus **Bald eagle.** The bald eagle is a common west coast fish hawk The bald eagle feeds mainly on fish and is seldom far from water (Scott 1983:184). Numbers of bald eagles commonly congregate around salmon streams at spawning times and where herring balls and congregations of surface feeding fish occur. Most but not all of the skeletal elements can be distinguished from those of the Golden Eagle and can be identified to species. The bald eagle is a common seashore resident of the Barkley Sound area, with numbers particularly high in spring and summer (Campbell et al. 1990 (II): 14–19).

Accipiter striatus **Sharp-shinned Hawk.** This medium-sized hawk is a common spring and autumn migrant throughout B.C. In Barkley Sound, it has been recorded between September and February, but is not known to breed in the area (Campbell et al. 1990 (II): 24).

Order Procellariformes

Family Diomedeidae Albatrosses

Phoebastria albatrus **Short-tailed Albatross.** The short-tailed is the largest of the three north Pacific albatrosses (the other two being the Laysan's, *P. immutabilis* and the Black-footed, *P. nigripes*) and their bones are distinctive on size alone from these other two (Robertson and Nunn 1997). All albatrosses are strictly pelagic, marine birds who may spend up to five years at sea and do not usually breed until about 15 year of age. The short-tailed was formerly the most abundant albatross in the north Pacific but populations were decimated by feather-hunters on their remote island nesting grounds during the 1800's. Until that time, short-taileds were regular, common summer visitors to the west coast of B.C. (Campbell et al. 1990(I): 375). There are now a few hundred breeding pairs of this species but they are still considered endangered.

Albatross are gliding rather than "flapping" birds and depend on updrafts of air over water to stay aloft. Flat calm seas prevent these birds from flying and at these times they raft, often in groups,

on the ocean surface. Under such conditions, albatrosses have to flap their extremely long wings to get airborn. This procedure often requires a run of several hundred metres before the birds actually get into the air, which would have made them especially vulnerable to predation by aboriginal hunters (Ackerman 1990). Short-tailed albatross are a commonly occurring bird in many archaeological sites from the west coast of Vancouver Island and the Juan de Fuca Strait (Calvert 1980; Crockford et al., 1997).

Family Procellaridae

Puffinus sp. **Shearwaters.** Shearwaters are gull-sized, strictly marine birds that resemble small albatrosses. They are common non-breeding summer visitors to offshore waters of the north Pacific and often occur in mixed flocks of related species. The sooty shearwater (*P. griseus*) is by far the most common and the most inclined to come close to shore, but can occur with (and is easily confused with), several closely related species: the pink-footed shearwater (*P. creatopus*); the short-tailed shearwater (*P. tenuirostris*); and the flesh-footed shearwater (*P. carneipes*). Also present off the west coast of the island, but rare, are the Black-vented Shearwater *P. opisthomelas* and Buller's Shearwater *P. bulleri*. None of the shearwaters except the Sooty Shearwater have been recorded near Barkley Sound between December and February, and the Sooty Shearwater is much more common between March and November, especially May through October (Campbell et al. 1990 (I): 188–199; Godfrey 1979).

Fulmarus glacialis **Northern fulmar.** The Northern Fulmar is a common offshore visitor in winter, fairly common at other times of year and can be locally abundant, especially in areas of upwelling or other kinds of turbulence (Campbell et al., 1990 (I):186). Storm-killed birds are frequently encountered on beaches during winter months.

Order Columbiformes

Family Columbidae

Columba fasciata **Band-tailed Pigeon.** The Band-tailed Pigeon is a fairly common resident on the southern B.C. coast, with spring and fall migrations swelling local populations. They are flocking birds, frequenting both deciduous and coniferous forests, preferring the forest edges and open clearings. In the Barkley Sound region they have been recorded today from March through November, but there are also breeding records from the Clayoquot Sound region (Campbell 1990 (II): 342).

Order Passeriformes

Family Corvidae

Corvus caurinus **Northwestern Crow.** The large Northwestern Crow is a common resident on the west coast of Vancouver Island, where it is often seen foraging along the seashore. It has been recorded in Barkley Sound at all seasons of the year (Campbell et al. 1990 (III):228).

Family Muscicapidae

Ixoreus naevius **Varied Thrush.** The Varied Thrush is a fairly common forest bird on the west coast of the island, with populations slightly elevated by migrants in the spring. It has been recorded in the Barkley Sound region year round. It thrives in both old growth and second growth coniferous forests and also forages along sandy beaches near the upper tideline for small invertebrates (Campbell et al.1990(III): 422).

Order Coraciiformes

Family Alcedinidae

Ceryle alcyon **Belted Kingfisher.** Although not that common, the kingfisher is a resident bird in the Barkley Sound area, both wintering and breeding here. It is often seen perched above a stretch of clear water waiting for the movement of an unlucky fish, when it will suddenly plunge headfirst into the water and emerge with a fish in its beak. Its nests are burrows in steep sandy banks (Campbell et al. 1990 (II):418). Belted Kingfishers were observed on Benson Island in 2001 by the senior author.

The information provided above was used to assess the season of exploitation and occupation suggested by the faunal remains from the three Ts'ishaa Village site areas, and to explore which coastal habitats were most frequently utilized.

Appendix II: Measurements of dog bones from Tsi'shaa Village, DfSi-16

Forty-one adult dog specimens from the Ts'ishaa Village site were complete enough to provide at least one measurement. The measurements are as named and described in Von den Driesch 1976. They are presented below by excavation unit, layer and level, and compared where possible with the mean and ranges of each measurement for Crockford's Type 1 small Northwest Coast Dog (Crockford 1997).

Table I. Measurements of dog bones from the back terrace of Tsi'shaa Village, DfSi-16. (Forty adult bones from the backridge area were sufficiently complete to provide at least one measurement each.)

Unit	Layer	Level	Element		Measurement (mm)	Type 1 Mean (mm)	Type 1 Range (mm)
S 62-64	**A**	2	Left mandible	#11	31.69	37.00	36.2–37.7
W 62-64				#12	26.75	32.4	28.8–35.1
				#14	21.47	20.5	18.1–22.2
				#17	19.08	20.3	16.7–24.0
				#19	21.85	21.4	18.2–25.0
				#20	17.38	18.1	15.6–21.6
		3	Left talus	GL	19.10	23.1	21.4–24.2
		4	Left humerus*	GLC	115.06	not measured	
				Bd	23.71	29.2	26.8–33.3
S 62-64	**B**	2	Left mandible	#11	36.77	37.0	36.2–37.
W 62-64				#14	19.80	20.5	18.1–22.2
			Left MC I	GL	17.86	not measured	
				Bd	5.17	not measured	
		3	Left MT V	Gbp	8.77	not measured	
			Axis vertebra	LCDe	35.89	41.0	36.9–44.0
				LAPa	37.15	44.4	38.2–47.4
				H	27.80	32.5	29.0–35.4
			Thor. Vert. #3	BPtr	27.83	not measured	
				BF(cr)	16.03	not measured	
				HF(cr)	9.25	not measured	
		4	Left scapula	SLC	23.19	23.4	18.7–26.1
			Left mandible	#13L	18.29	not measured	
				#13B	6.38	not measured	
S 62-64	**C**	7	Left Femur*	Bp	26.74	35.5	31.0–38.3
W 62-64				DC	13.10	17.4	15.5–19.3
				SD	9.52	12.1	10.6–13.6
S 62-64	**D**	5	Left innominate	GBA	20.73	not measured	
W 62-64			Right MT V	GBp	11.45	not measured	
		7	Left PM4 Up.	GB	8.16	not measured	
				L	15.25	not measured	
				B	5.90	not measured	
			Left Radius	Bd	20.10	21.1	17.0–24.9
			Left Radius	Bp	14.91	16.2	14.4–18.3
				SD	10.08	10.7	9.6–12.7
				Bd	20.81	21.1	17.0–24.9
				GL	125.62	136.0	123.0 –141.0
			Right MCII	GL	46.33	45.9	37.3–49.3
				GBd	7.81	6.2	5.0–7.6
						(Type 2 = 7.5	6.7–8.2)
		8	Left Tibia	SD	12.65	(Type 2 = 11.0	10.0–12.6)
				Bd	23.91	(Type 2 = 22.9	21.5–25.6)
S 58-60	**D**	6	Left MC IV	GL	52.47	53.8	44.8–58.2
W64-66				Bd	8.06	6.7	5.6–7.6
		8	Right Ulna	DPA	19.71	22.4	20.0–24.9
		8	**SW Corner**	**(one individual)**			
			Left Tibia	Bd	21.75	20.3	17.9–21.9
			Left Talus	GL	25.10	23.1	21.4–24.2
			Right Talus	GL	25.18	23.1	21.4–24.2
			L. Calcaneus	GL	43.64	38.4	34.9–40.7
			R. Calcaneus	GL	42.78	38.4	34.9–40.7

Table I. Continued.

Unit	Layer	Level	Element		Measurement (mm)	Type 1 Mean (mm)	Type 1 Range (mm)
			Left MT II	GL	57.80	55.2	49.2–58.2
				Bd	7.96	7.1	6.3–7.9
			Right MT II	GL	58.79	55.2	49.2–58.2
				Bd	8.06	7.1	6.3–7.9
			Left MT III	GL	64.57	63.1	55.5–67.0
				Bd	8.06	7.2	6.4–7.9
			Right MT III	GL	65.09	63.1	55.5–67.0
				Bd	8.22	7.2	6.4–7.9
			Left MT IV	GL	67.12	65.0	57.6–68.6
				Bd	7.59	7.0	6.1–7.9
			Right MT V	GL	60.16	55.7	48.5–58.6
				Bd	7.65	7.1	6.4–8.0
S 58-60	**D**	9	Left Radius	Bp	14.84	16.2	14.4–18.3
W64-66		10	Right MT IV	GL	71.94	65	57.6–68.6
				Bd	8.955	7.0	6.1–7.9
			Right Tibia	Bd	22.76	20.3	17.9–21.9
		10	Left Scapula	SLC	21.73	23.4	18.7 –26.1
				BG	14.73	16.9	13.7–19.2
				GLP	24.92	27.1	22.9–31.2
		11	Lumbar 6	PL	24.26	24.0	22.4–24.8
				HFcd	11.35	11.7	10.4–12.6
	E	10	Left Radius	Bp	14.42	16.2	14.4–18.3
			Right Ulna	SDO	18.92	19.4	17.0–21.6
				DPA	22.14	22.4	20.0–24.9
			R. Mandible	# 11	38.47	37.0	36.2–37.7
				# 12	33.83	32.4	28.8–35.1
				# 20	18.55	18.1	15.6–21.6
			R. Lower M 1	L	22.57	(not given)	
				B	8.75		

(* marrow cavity infilled with cancellous bone)

Table II. Measurements of dog bones from other areas of Tsi'shaa Village, DfSi-16* 2000 Trench. Only one of the nine dog specimens from the 2000 trench could be measured.

Unit	Layer	Level	Element		Measurement (mm)	Type 1 Mean (mm)	Type1 Range (mm)
N 2-4 W 102-104	D	7	Right MT III	GL	64.5	63.1	55.5–67.0

*None of the 11 dog bones from the 1999 trench were sufficiently complete to measure.