

Faunal Analysis: Fish

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Kopperl presents a descriptive summary of the types of fish bones present at OpD and the results of quantitative analyses of those remains. The fish assemblage is dominated by salmonid and herring and is remarkably well preserved. Kopperl suggests that the fish remains from OpD are not sufficient to determine if the shell ridge was a domestic area per se; however, they can be used to investigate the activities associated with topographical features in the shell midden. He notes that differential representation of the major fish taxa across the site may indicate differential disposal of food remains across space.

Fish remains are a major component of the OpD shell midden assemblage, providing a large volume of information on Native American fishing, fish habitat, and midden formation processes. A sample of approximately 25% of the fish bones was analyzed from the six 1 x 2 meter OpD excavation units placed in three distinctive topographic zones in front of, within, and behind a large depression. Of this sample of 15,168 specimens, 9,124 or about 60% were identified to at least the taxonomic level of Order. Of the identified specimens, salmon, herring, and dogfish dominated the assemblage, with smaller numbers of greenling, sculpin, flatfish, and other fish remains also found. The fish bone assemblages recovered from different parts of the OpD midden contain different proportions of salmon, herring, and other identifiable fish taxa, suggesting differential use or disposal patterns occurred across a relatively small area. An appendix showing all results is available on file at the Burke Museum of Natural History and Culture (and see Table 12.1).

METHODS

Sorting and Sampling

Given time and budgetary constraints, the entire fish bone assemblage from OpD could not be ana-

lyzed. The assemblage was sampled in a manner that provided even spatial coverage, addressed the general research interests of the project and yielded adequate samples to make statistically valid inferences about Native American fish utilization at British Camp. Fish bones from the first and every fourth bucket from each excavation level and screen size were separated from the rest of the assemblage for analysis.

Analysis Protocol

Fish remains from the OpD assemblage were identified to the finest taxonomic level possible using personal comparative material of over 150 complete fish skeletons representing all economically important fish taxa found in the Puget Sound and Strait of Georgia region, and numerous skeletons of other species as well. That comparative collection is now housed with the Fish Collection at the School of Aquatic and Fishery Sciences/Burke Museum of Natural and Cultural History. Each bag of fish bones was separated by finest taxonomic identification, skeletal element and element portion, side (if the specimen is from a sided element), presence of diagnostic landmark, and whether the specimen was burned.

Analysis was conducted at the Department of Anthropology at the University of Washington, and at the home laboratory of the author. Each bag of fish bones

Table 12.1 NISP of major fish taxa by unit and facies

Layer	Volume (liters)	Taxa													NISP/ Density per liter	
		Dogfish	Skate	Ratfish	Herring	Salmonid	Smelt	Cod	Surf perch	Mackerel	Rockfish	Greenling	Sculpin	Flatfish	Unid.	
Unit 105 365																
1A	32	1			1	3									7	12 / 0.4
1B	136	25		2	37	44	3				12	3	2	106		234 / 1.7
1C	8	2				6					1			18		27 / 3.4
1D	96	18	1		9	30					7		1	48		114 / 1.2
1G	8													4		4 / 0.5
1H	40	37	1		43	79	1				9		2	139		311 / 7.8
1J	48	55			38	42	1		5		1	8	2	125		277 / 5.8
1K	72	25			33	120	3		2			5		182		370 / 5.1
1L	40	19			25	161	3		2			6	1	1	212	430 / 10.8
1M	24	10			8	23						4	1		68	114 / 4.8
1N	8					8						1				9 / 1.1
1O	80	10			147	68	2				1	15	8	1	259	511 / 6.4
1P	16	2			18	13									9	42 / 2.6
1Q	16	1			83	11						2	1	1	74	173 / 10.8
1R	8	1			21	3						3			17	45 / 5.6
1S	48	13	1		224	100			1			73	6	2	322	742 / 15.5
1T	32	2			80	36	1						4	1	81	205 / 6.4
1U	64	7			11	24						8	2		28	80 / 1.3
1V	32	5			36	9	1					2	19		101	173 / 5.4
1W	32	4			51	17						1	12		77	162 / 5.1
00	80	41		1	453	226	2					10	61	1	794	1589 / 19.9
Unit 107 341																
1A	16	1				1										2 / 0.1
1B	8	10				9			1			1			3	24 / 3.0
1C	40	12				8						1			5	26 / 0.7
1D	8	5			4	6						4	1		12	32 / 4.0
Unit 111 349																
1A	16	1			125	6			2			1	1		50	186 / 11.6
1B	72	11	2		48	20					1	13	3		55	153 / 2.1
1D	8	1			11	1							1		8	22 / 2.8
1E	8				2							1	2		1	6 / 0.8
1G	80	7		1	64	30	1					6	10		110	229 / 2.9
1H	16	3			14	2						3	1		12	35 / 2.2
1I	8	6				3									3	12 / 1.5
1J	24	1			2	8						2			8	21 / 0.9
1K	24	1			6	3						9	5		14	38 / 1.6
1L	24	2			21	14						7	2	1	16	63 / 2.6
1M	32	1			39	19						3	5	1	29	97 / 3.0
1O	8				1	3						10	6		11	31 / 3.9
1P	8	1			3	3						12	6		25	50 / 6.3
1R	8				4	48	1						5		39	97 / 12.1
1S	16	4			17	22						2	5		40	90 / 5.6
1U	16	3			1	15							1		35	55 / 3.4
1W	16	29			3	16						8	6		36	98 / 6.1
1X	8				2	6						1	3		19	31 / 3.9

Table 12.1 NISP of major fish taxa by unit and facies (continued)

Layer	Volume (liters)	Taxa														NISP/ Density per liter	
		Dogfish	Skate	Ratfish	Herring	Salmonid	Smelt	Cod	Surf perch	Mackerel	Rockfish	Greenling	Sculpin	Flatfish	Unid.		
Unit 111 349 (continued)																	
1Y	8											3			10	13 / 1.6	
1Z	8	2			4	26			3		1	33	1	47	117 / 14.6		
2A	24	3		1	31	74				1	9	19		125	263 / 11.0		
2B	8					7					1	1		7	16 / 2.0		
2C	8	5			5	15			2			3		14	44 / 5.5		
2D	32	11			52	58					15	16	1	107	260 / 8.1		
2E	72	26	6		158	132	1			1	21	24	1	322	692 / 9.6		
2F	8	4		1	14	5					2			12	38 / 4.8		
00	136	45		2	348	196				1	1	38	68	2	494	1195 / 8.8	
Unit 121 347																	
1A	24	4									1	1		1	7 / 0.3		
1B	168	24		2	31	88			11		14	15	4	85	274 / 1.6		
1C	32	12			10	38					3	5		29	97 / 3.0		
1D	96	51	1	1	79	116				3	18	15	3	162	449 / 4.7		
1F	8	1			2	3			1		2		3		12 / 1.5		
1G	8				2	4					2	1			9 / 1.1		
1H	16	1			13	8				3		2	1	26	54 / 3.4		
1I	24	2				6			1					1	10 / 0.4		
00	24	1				8									2	11 / 0.5	
Unit 123 347																	
1A	216	80		1	79	402		3	7		5	50	29	3	228	887 / 4.1	
1B	8	2				10						1		3		16 / 2.0	
1C	8	6		1	2	8							1	1	5	24 / 3.0	
1D	8	2			1	2									1	6 / 0.8	
1G	64	12			24	49					12	6		47	150 / 2.3		
1H	40	8		2	7	35					8	5	1	68	134 / 3.4		
1I	24	5			12	36					10			25	88 / 3.7		
Unit 130 352																	
1A	136	141			246	266					2	33	13	2	232	935 / 6.9	
1B	120	171	2		130	354			3		4	45	34	2	415	1160 / 9.7	
1C	40	122			15	103			1		1	12	14		141	409 / 10.2	
1D	24	18			18	37						3	2		16	94 / 3.9	
1E	16	12			4	9									1	26 / 1.6	
1G	40	24			49	82						1	3	1	91	251 / 6.3	
1H	8	2			4	8						1	3			18 / 2.3	
1I	8	7			2	20									23	52 / 6.5	
1K	8					38								4		42 / 5.3	
1L	8										1					1 / 0.1	
00	24	3			5	40					1	1			55	105 / 4.4	

Table 12.2 Number of Identified Fish Specimens (NISP)

Scientific Name	Common Name	Unit						Total
		105 365	107 341	111 349	121 347	123 347	130 352	
Chondrichthys	Cartilaginous Fish	1						1
<i>Squalus acanthias</i> , c.f.	Spiny Dogfish	278	28	167	96	115	512	1196
<i>Raja</i> sp.	Skate	2		8			2	12
<i>Raja rhina</i> , c.f.	Lognose Skate	1			1			2
<i>Hydrolagus collieri</i>	Spotted Ratfish	5		5	3	4		17
<i>Clupea barangus pallasi</i>	Pacific Herring	1318	4	976	137	125	493	3053
<i>Oncorhynchus</i> sp.	Salmon and Trout	1020	24	740	271	542	1027	3624
<i>Salvelinus malma</i> , c.f.	Dolly Varden	3						3
Osmeridae	Smelt	17		3				20
Gadidae	Codfish					3		3
Embiotocidae	Surfperch	9	1	7	10	5	5	37
<i>Cymatogaster aggregata</i> , c.f.	Shiner Perch						1	1
<i>Embiotoca lateralis</i> , c.f.	Striped Seaperch				2			2
<i>Rhacochilus vacca</i> , c.f.	Pile Perch	1			1	2		4
<i>Scomber japonicus</i> , c.f.	Chub Mackerel			1				1
Scorpaeniformes	Rockfish, Greenlings, Sculpins	6						6
Scorpaenidae	Rockfish	2		4	6	5	9	26
Hexagrammidae	Greenlings	145	4	154	36	76	96	511
<i>Hexagrammos lagocephalus</i> , c.f.	Rock Greenling	3		4	1			8
<i>Hexagrammos stelleri</i> , c.f.	Whitespotted Greenling	15	2	1	1		1	20
<i>Ophiodon elongatus</i> , c.f.	Lingcod	4		6	2	6	5	23
Cottidae	Sculpins	99		201	31	34	60	425
<i>Enophrys bison</i> , c.f.	Buffalo Sculpin	3		6		2	2	13
<i>Hemilepidotus</i> sp., c.f.	Irish Lord	6		1				7
<i>Leptocottus armatus</i>	Pacific Staghorn Sculpin	1		4		1	4	10
<i>Leptocottus armatus</i> , c.f.	Pacific Staghorn Sculpin	20	1	9	8	3	9	50
<i>Scorpaenichthys marmoratus</i> , c.f.	Cabezon			11		1		12
Pleuronectiformes	Flatfish	8		7	8	4	4	31
<i>Hippoglossus stenolepis</i>	Pacific Halibut				1			1
<i>Platichthys stellatus</i> , c.f.	Starry Flounder	4					1	5
Unidentified Fish	Unidentified Fish	2671	20	1655	308	377	1013	6044
Total		5642	84	3970	923	1305	3244	15168

within the sample had an individual catalog number comprised of the unit, stratum, level, bucket, material, and screen-size. After fish bones from each bag were sorted by the characteristics listed above, each group was entered into an Excel spreadsheet, and weighed by quantity.

Fish remains were quantified using NISP, or Number of Identified Specimens, which is the quantity of

all remains identified for each taxon. Each specimen is treated as a single NISP. Other methods of quantification were not used, such as Minimum Number of Individuals (MNI), which is the minimum number of individuals of a particular taxon represented by an aggregate of specimens. Numerous studies have shown that NISP and MNI are highly correlated (e.g., Butler 1987; Grayson 1984). Given the aggregation problems

associated with MNI, NISP was used to quantify taxonomic abundance for this analysis. MNI can be calculated, however, from the information provided in the analysis.

DESCRIPTIVE SUMMARY

This section provides descriptions of each fish taxon identified in the analyzed OpD assemblage, in standard phylogenetic order following Hart (1973). Of the 15,168 specimens analyzed, 9,124 (60.1%) were identified to a finer taxonomic level. Scientific and common names for each taxon followed by a list of the data described in this section are also shown in Table 12.2.

Class Chondrichthyes (cartilaginous fish)

Material: 1 undiff. vertebra.

Total: 1 specimen.

Remarks: This taxonomic Class includes cartilaginous fishes, such as lampreys, sharks, skates, rays, and ratfish. All of these groups are represented on the Northwest Coast, and the remains of some, most notably dogfish and skates, are common in many shell middens in the Straits and Puget Sound region. Miller and Borton (1980) note ten species of shark from seven Families, one species from the electric ray Family, four species from the skate Family, and one species from the chimaerid Family observed in the Straits and Puget Sound region. Of these, only the dogfish, skate, and ratfish are commonly encountered.

Besides teeth and spines, vertebrae of some kinds of cartilaginous fish ossify and therefore may be preserved in archaeological sites. Although almost all specimens identified from the OpD assemblage are identified to a finer taxon than Class, one vertebral specimen is morphologically different from the available dogfish (*S. acanthias*), skate (*Raja* sp.), and ratfish (*H. collieri*) comparative material.

Subclass Elasmobranchii (sharks, rays)

Order Squaliformes

Family Squalidae

c.f. *Squalus acanthias* (Spiny Dogfish)

Material: 1171 undiff. vertebrae, 15 spines, 9 teeth.

Total: 1196 specimens.

Remarks: Dogfish (Figure 12.1) are the most abundant of the seven shark Families and ten shark species found in Puget Sound (Miller and Borton 1980). Interestingly, their modern distribution in the waters surrounding San Juan Island is concentrated in San Juan Channel east of the Island opposite the location of British Camp (Miller and Borton 1980:7.2). Dogfish inhabit both shallow and deep water, feeding on small fish such as herring and smelt. Historically, they were

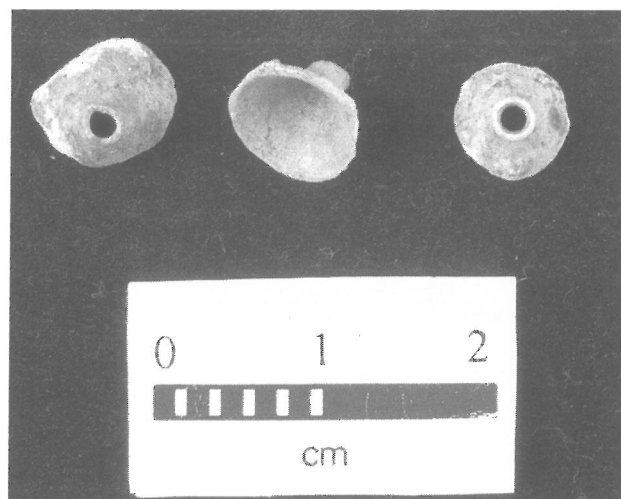


Figure 12.1 Dogfish vertebrae (SAJH 127237).

harvested on a commercial scale for their oil, first used for lamps and as an industrial lubricant and later as a vitamin supplement (Hart 1973:44-46). Spiny dogfish vertebrae have a very distinctive spool-shape, and their teeth and the cross-sections of their spines are distinctive as well, often allowing for species-level identification when encountered.

Order Rajiformes (skates and rays)

Family Rajidae

Raja sp. (Skate)

Material: 1 vertebra, 7 dermal denticles, 4 teeth.

Total: 12 specimens.

Remarks: There are four species of skate found in Puget Sound today, all being shallow bottom-feeders. *Raja binoculata* (big skate) and *Raja rhina* (longnose skate) are by far the most common skate species in the area and have been observed on the eastern shore of San Juan Island near Friday Harbor (Miller and Borton 1980). Ethnographically, skates were caught with spears near-shore by the Lummi (Stern 1934:51). Skate vertebrae and dermal denticles have distinctive morphology that allows them to be identified to the Genus level.

c.f. *Raja rhina* (Longnose Skate)

Material: 2 dermal denticles.

Total: 2 specimens.

Remarks: Dermal denticles are the element from skates that are the most distinctive to species. Several denticle specimens were found in the OpD assemblage that were intact and most closely resembled those of the *Raja rhina* in the comparative collection, which had a well-defined star-shaped base.

Order Chimaeriformes

Family Chimaeridae (Chimeras)

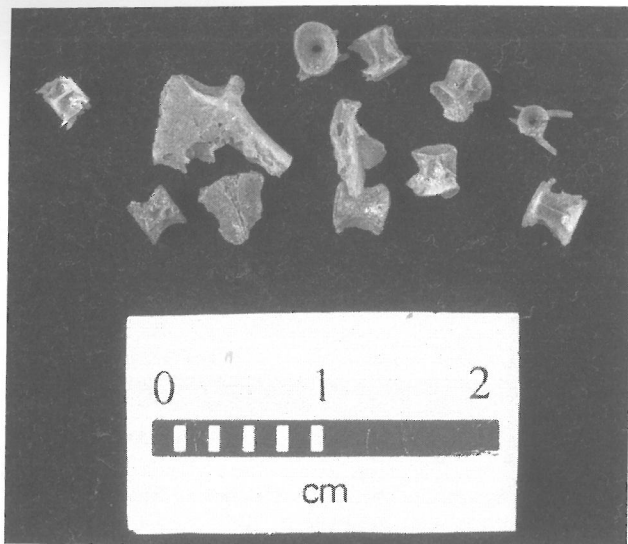


Figure 12.2 Herring specimens (SAJH 127445).

Hydrolagus colliei (Spotted Ratfish)

Material: 10 undiff. teeth, 2 lower teeth, 5 upper medial teeth.

Total: 17 specimens.

Remarks: The spotted ratfish is the only member of the order Chimaeriformes found along the Northwest Coast (Hart 1973:65). Identification is therefore made at the species level. The fish often inhabits deep waters but has been known to exhibit seasonal variation in its depth in Puget Sound. This occurs mainly in the spring when the spotted ratfish shows greater abundance in shallower water (Quinn et al. 1980). They have been observed historically off the western shore of San Juan Island, but are more common on the eastern shore (Miller and Borton 1980:11.1). Despite their unpopularity in the modern fishing and culinary community, their remains are sometimes found in abundance in archaeological shell middens and speculated by some archaeologists to be consumed during lean subsistence times (e.g., Cannon 1995). The teeth of the spotted ratfish are distinctive wavy bony plates with vertical ridges perpendicular to the cutting edge.

Class Osteichthys (Bony Fishes)

Order Clupeiformes

Family Clupeidae

Clupea harengus pallasii (Pacific Herring)

Materials: 46 1st vertebrae, 665 thoracic vertebrae, 1895 caudal vertebrae, 15 ultimate vertebrae, 22 angulars, 13 basioccipitals, 14 ceratohyals, 4 cleithra, 16 dentaries, 5 epihyals, 19 exoccipitals, 11 frontals, 10 hyomandibulars, 1 hypohyal, 3 hypurals, 13 maxillae, 1 mesopterygoid, 19 opercles, 2 orbitosphenoids, 2 parietals, 2 postcleithra, 10 posttemporals, 8 prefrontals, 1 premaxilla, 3 preopercles, 161 prootics, 57

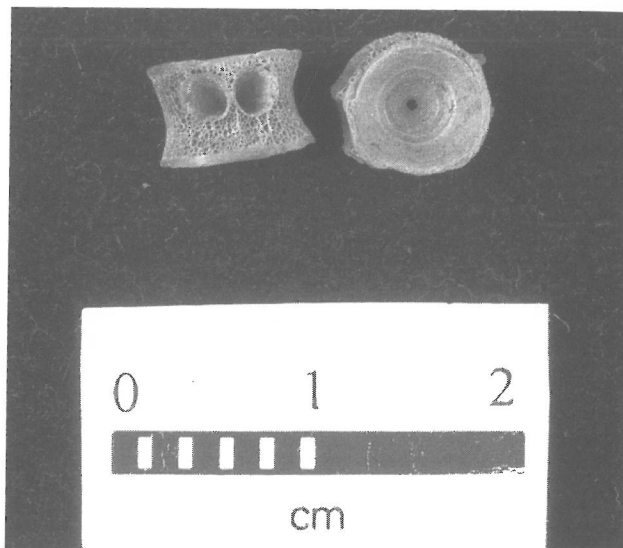


Figure 12.3 Salmon vertebrae (SAJH 127194).

pteroics, 7 quadrates, 13 sphenotics, 6 subopercles, 1 supracleithra, 1 supramaxilla, 6 supraoccipitals, 1 vomer.

Total: 3053 specimens.

Remarks: Herring (Figure 12.2) is one of the most abundant fish taxa in the OpD fish bone assemblage. Two native species from this Family are found in the northeast Pacific: *C. harengus pallasii* (Pacific herring) and *Sardinops sagax* (Pacific sardine) (Hart 1973:94). Herring migrate to shallow water in the late winter to spawn, remaining in protected bays and coves until the early spring (e.g., Hart 1973:96-99). Today the sardine is very rare in Puget Sound and the Straits region, whereas herring are abundant. Miller and Borton (1980:14.2) and Kerwin (2002:60) have reported herring spawning areas clustered around Westcott Bay. The remains found at British Camp OpD are considered Pacific herring.

The Lummi traditionally collected herring eggs by anchoring the top boughs of young cedar trees to ropes submerged in shallow marine water, removing them after sufficient eggs have accumulated and are ready to be dried. Herring attracted other prey as well; during the herring spawn, other animal such as ducks could be netted as they fed on the eggs (Stern 1934:41,50; see also Monks 1987). The presence of herring bones in many archaeological sites in the region attests to the consumption of large quantities of mature herring as well (e.g., Kopperl 2001a).

Order Salmoniformes

Family Salmonidae

Oncorhynchus sp. (Pacific salmon and trout)

Materials: 4 1st vertebrae, 388 thoracic vertebrae, 32 precaudal vertebrae, 357 caudal vertebrae, 2 penultimate vertebrae, 1 ultimate vertebra, 2704 undiff. vertebra

fragments, 23 basipterygia, 5 branchials, 4 branchiostegal rays, 4 ceratobranchials, 2 coracoids, 2 undiff. cranial fragments, 1 dentary, 2 epibranchials, 1 epihyals, 2 epiotics, 17 epurals, 4 exoccipitals, 1 hyomandibular, 2 hypobranchials, 12 hypurals, 1 interopercle, 1 lingual plate, 3 maxillae, 2 mesocoracoids, 1 middle postcleithrum, 2 postcleithra, 3 posttemporals, 1 prootic, 1 pterotic, 1 quadrate, 16 scapulae, 1 supracleithrum, 18 teeth, 1 toothed bone, 1 undiff. fragment, 1 urohyal.

Total: 3624 specimens.

Remarks: The waters of the Straits and Puget Sound region are home to seven species in the genus *Oncorhynchus* (Figure 12.3), two species of *Salvelinus* (*S. malma* – dolly varden; *S. confluentus* – bull trout), and one species of whitefish (*Prosopium williamsoni*) (Miller and Borton 1980). Any of these species might be represented in the OpD assemblage, although the size of the specimens strongly suggests they are the remains of salmon, *Oncorhynchus*. Around San Juan Island, pink (*O. gorbuscha*) and chum (*O. keta*) salmon are found most frequently near Friday Harbor, while sockeye (*O. nerka*) salmon are found off the south shore near Cattle Point. Coho (*O. kisutch*) and chinook (*O. tshawytscha*) are the salmon species that have historically been observed near Westcott Bay (Miller and Borton 1980:16.1-16.7). Aside from anecdotal reports of pink and coho salmon spawning in streams on the larger San Juan Islands, however, most salmonids caught in the archipelago are on their way to spawning areas in larger mainland rivers such as the Fraser and Skagit Rivers (Kerwin 2002).

The vertebrae and many other skeletal elements of salmon and trout are easy to identify because of their morphology (Cannon 1987). Abdominal, precaudal, and caudal vertebrae can be distinguished on the basis of caudal and haemel processes (Butler 1993). Taxonomic discrimination beyond genus level, however, is very difficult to accomplish. Butler (1987) developed a discriminant function analysis that uses a combination of measurements on the 1st vertebrae of salmon to assign a specimen to a particular species group. Only four salmonid 1st vertebrae were found in this assemblage, and identification of all salmonid specimens were limited to the genus level.

Family Salmonidae

c.f. *Salvelinus malma* (Dolly Varden)

Materials: 2 thoracic vertebrae, 1 caudal vertebra.

Total: 3 specimens.

Remarks: Dolly varden have been historically observed along the mainland, as close to San Juan Island as the Skagit River delta (Miller and Borton 1980:16.8). Three salmonid specimens are tentatively identified as *S. malma*. The basis of the identification is the morphological

similarity to comparative dolly varden skeletons, and substantial difference in size between the archaeological specimens and whole vertebrae of all other species within the Salmonid family that are found in the region today.

Family Osmeridae (smelt, eulachon)

Materials: 1 thoracic vertebra, 1 caudal vertebra, 17 dentaries, 1 premaxilla.

Total: 20 specimens.

Remarks: Five species of smelt are found in the Straits and Puget Sound region today. Three of them, surf smelt (*H. pretiosus*), longfin smelt (*S. thaleichthys*), and eulachon (*T. pacificus*) are common to the San Juan archipelago (Miller and Borton 1980:17.1-17.5). Surf smelt may spawn at any time of the year along beaches without heavy surf action (Hart 1973:140). This species of smelt are known to spawn along the more steeply-backed shore of Westcott Bay southwest of OpD (Kerwin 2002). Identification of smelt specimens was made to the Family level, as most of their elements, including vertebrae and jaws, are morphologically similar.

Order Gadiformes

Family Gadidae (codfish)

Material: 3 caudal vertebrae.

Total: 3 specimens.

Remarks: Three species from the Gadid family are found in the Straits and Puget Sound area: Pacific cod (*Gadus macrocephalus*), Pacific tomcod (*Microgadus proximus*), and walleye pollock (*Theragra chalcogramma*). None are commonly found along the west shore of San Juan Island; Pacific cod and Pacific tomcod are more commonly observed in waters off Orcas Island, while walleye pollock are frequently observed as close as Friday Harbor (Miller and Borton 1980:24.1-24.4). The Strait of Georgia is spawning ground for both Pacific cod and walleye pollock, offering a seasonally congregated fish resource in mid-spring (Hart 1973:222-229). Because there is little morphological difference in most elements between species, the Gadid vertebrae specimens in the OpD assemblage were not given a finer taxonomic identification.

Order Perciformes

Family Embiotocidae (surfperch)

Material: 2 1st vertebrae, 11 thoracic vertebrae, 8 precaudal vertebrae, 9 caudal vertebrae, 1 basioccipital, 1 ceratohyal, 1 lower pharyngeal plate, 1 undiff. pharyngeal plate fragment, 2 pharyngeal teeth, 1 upper pharyngeal plate.

Total: 37 specimens.

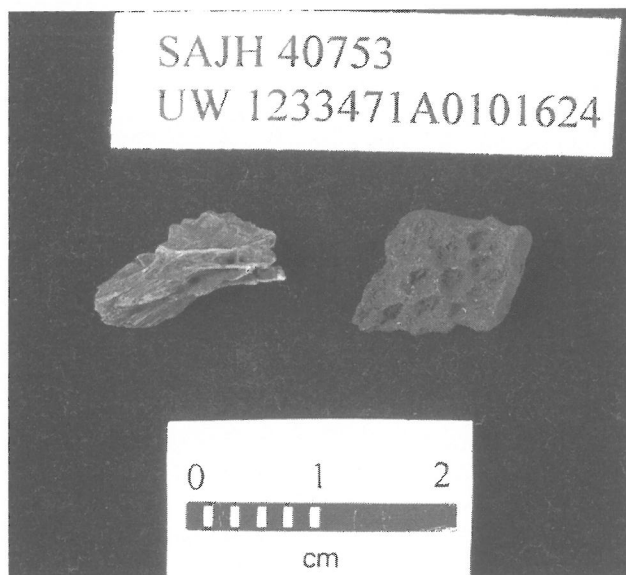


Figure 12.4 Perch specimens (SAJH 40753).

Remarks: There are six species of surfperch that inhabit the Straits and Puget Sound region today. Four species, *B. frenatus* (kelp perch), *C. aggregata* (shiner perch), *E. lateralis* (striped seaperch), and *R. vacca* (pile perch) have been observed in the vicinity of Westcott Bay and the western shore of San Juan Island (Miller and Borton 1980:36.1-36.6). These relatively small fish can be found year-round in a variety of near-shore marine habitats, including sandy beaches, eelgrass and kelp beds, and rocky reefs (Lamb and Edgell 1986:59). Although many of their elements are quite distinct to taxonomic Family, especially their toothed pharyngeal plates, most of their vertebrae and individual pharyngeal teeth are morphologically similar. These elements and fragments of others were therefore identified to Family level (Figure 12.4).

c.f. *Cymatogaster aggregata* (Shiner Perch)

Material: 1 lower pharyngeal plate.

Total: 1 specimen.

Remarks: Shiner perch are the smallest species of surfperch in the region, rarely reaching 6 inches in length. Mature shiner perch inhabit deeper water in the winter months, and move closer to shore during the summer, where they are often found feeding near mussel and barnacle clusters on reefs and wharves (Hart 1973:305). The archaeological specimen was identified as shiner perch based on morphology and size.

c.f. *Embiotoca lateralis* (Striped Seaperch)

Material: 1 1st vertebra, 1 angular.

Total: 2 specimens.

Remarks: Striped seaperch congregate in the summer along shallow, rocky shores (Lamb and Edgell

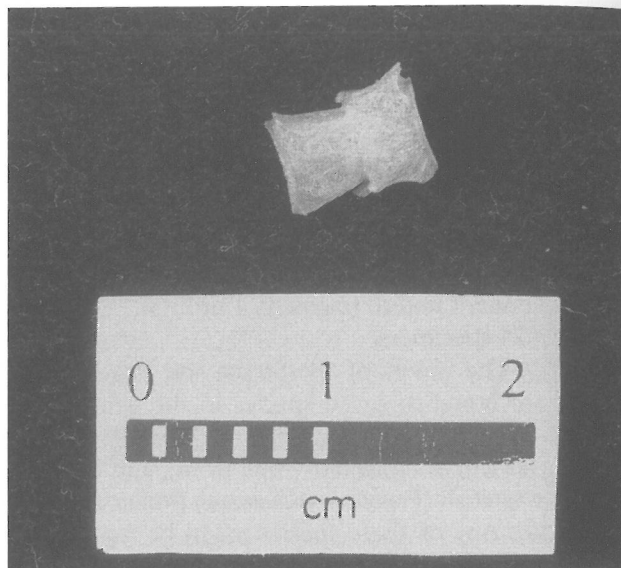


Figure 12.5 Mackerel vertebra (SAJH 127461).

1986:60). These archaeological specimens were identified as striped seaperch based on morphology.

c.f. *Rhacochilus vacca* (Pile Perch)

Material: 1 frontal, 3 lower pharyngeal plates.

Total: 4 specimens.

Remarks: Pile perch are found most commonly during the summer months in shallow water such as that of Westcott Bay (Lamb and Edgell 1986:61; Miller and Borton 1980:36.6). Their toothed pharyngeal plates are larger relative to other species of surfperch, reflecting a dietary focus on mussels as opposed to smaller invertebrates (Hart 1973:313). The OpD specimens were identified tentatively as pile perch given their fragmentary condition.

Family Scombridae (Mackerels and Tuna)

c.f. *Scomber japonicus* (Pacific Chub Mackerel)

Material: 1 undiff. vertebra.

Total: 1 specimen.

Remarks: Specimens from the Scombrid family are unusual in archaeological assemblages in the Straits and Puget Sound. Isolated specimens of bluefin tuna (*T. thynnus*) have been found occasionally in sites in more open coastal settings (e.g., Cannon 1991; McMillan 1979; Samuels 1994:79). Two species have been recorded live in modern waters of the region: the Pacific bonito (*Sarda chiliensis*) has been observed several in times in central Puget Sound, and the Pacific chub mackerel (*Scomber japonicus*) which has been observed once in Possession Sound near Everett (Miller and Borton 1980:49.1-49.2). The bonito is the larger of the two species. Both species spawn off the coast of California well to the south. Mackerel (Figure 12.5)

are known to be highly migratory and range across much of the Pacific. Although uncommon in the area today in any age category, large numbers of immature mackerel were reported in the Strait of Georgia in 1940 (Hart 1973:373-376). Their presence in the Pacific Northwest in recent years is associated with El Niño years (Lamb and Edgell 1986). Based on size of the specimen, it was tentatively identified as chub mackerel.

Order Scorpaeniformes (Rockfish, Greenlings, Sculpins)

Material: 2 thoracic vertebrae, 2 caudal vertebrae, 1 epibranchial, 1 exoccipital.

Total: 6 specimens.

Remarks: Species of Scorpaeniformes are diverse, and comprise the greatest number of fish species of any Order within the Straits and Puget Sound region (Miller and Borton 1980). The constituent Families, including rockfish, greenling, and sculpins, are characterized by large heads and mouths relative to the remainder of their bodies. Most elements are distinctive to at least family, if not a finer taxon. Smaller or more highly fragment specimens that exhibit typical morphological characteristics of Scorpaeniformes, however, sometimes could not be identified to a particular family, and therefore placed in this general category.

Family Scorpaenidae (Rockfish)

Material: 1 thoracic vertebra, 7 precaudal vertebrae, 5 caudal vertebrae, 1 undiff. vertebra, 1 interopercle, 1 parasphenoid, 1 posttemporal, 3 premaxillae, 1 prootic, 2 pterygiophores, 1 radial, 1 retroarticular, 1 spine.

Total: 26 specimens.

Remarks: Numerous species of rockfish (Figure 12.6) inhabit the waters of the Straits and Puget Sound region, and include two taxonomic genera: *Sebastes* and *Sebastolobus*. Rockfish are highly adaptable and inhabit a variety of marine habitats, including rocky shorelines and deep open water (Hart 1973:388-454; Love et al. 2002). Rockfish inhabit both near-shore and open water at a variety of depths, feeding on crustaceans and smaller fish. Of the 27 species that have been observed in the modern waters of the Straits and Puget Sound region, six have been recorded along the northwest shore of San Juan Island near Westcott Bay: the copper rockfish (*S. caurinus*), rosethorn rockfish (*S. helvomaculatus*), quillback rockfish (*S. maliger*), black rockfish (*S. melanops*), china rockfish (*S. nebulosus*), and the canary rockfish (*S. pinniger*). Despite the great diversity of rockfish in the region, their skeletal elements have yet to be systematically differentiated by zooarchaeologists, and specimens in this assemblage were identified to Family level.



Figure 12.6 Rockfish vertebra (SAJH 127494).

Family Hexagrammidae (Greenlings)

Material: 7 1st vertebrae, 82 thoracic vertebrae, 35 precaudal vertebrae, 258 caudal vertebrae, 2 penultimate vertebrae, 4 ultimate vertebrae, 2 angulars, 1 basibranchial, 1 basiptyergium, 1 branchial, 1 ceratohyal, 1 cleithrum, 7 dentaries, 2 ectopterygoids, 2 epibranchials, 12 epihyals, 3 epiotics, 1 ethmoid, 3 exoccipitals, 1 frontal, 2 hyomandibulars, 2 undiff. hypohyals, 3 lower hypohyal, 2 upper hypohyals, 1 interopercle, 1 lachrymal, 6 maxillae, 1 mesopterygoid, 5 opercles, 5 palatines, 2 parashpenoids, 1 parietal, 6 posttemporals, 2 prefrontals, 7 premaxillae, 1 preopercle, 2 prootics, 5 pterotics, 10 quadrates, 9 radials, 1 retroarticular, 1 sphenotic, 2 suborbitals, 3 supracleithra, 1 symplectic, 1 urohyal, 3 vomers.

Total: 511 specimens.

Remarks: The greenling Family is represented in the Straits and Puget Sound region by six species (Miller and Borton 1980:54.1-54.6). Like other Families within the Order Scorpaeniformes, they inhabit a variety of near-shore and open water marine settings and can be caught near land throughout the year (Lamb and Edgell 1986:125). One exception is the lingcod (*O. elongatus*), which voraciously feeds on forage fish such as herring and sand lance and often follows its prey into deeper waters (Hart 1973:468-469). Because comparative skeletal material used for this analysis included four of the six greenling species, most specimens were identified only to Family level.

c.f. *Hexagrammos lagocephalus* (Rock Greenling)

Material: 1 basioccipital, 1 hyomandibular, 3 posttemporals, 1 prefrontal, 1 quadrate, 1 supracleithrum.

Total: 8 specimens.

Remarks: The rock greenling has been observed occa-

sionally throughout the region, including Friday Harbor and False Bay (Miller and Borton 1980:54.2). They are known to be solitary and elusive to catch (Lamb and Edgell 1986:128). Specimens identified as c.f. *H. lagocephalus* were identical to the comparative skeletal material of this species, but those identifications remain tentative.

c.f. *Hexagrammos stelleri* (Whitespotted Greenling)

Material: 2 1st vertebrae, 1 angular, 2 dentaries, 4 hyomandibulars, 1 maxilla, 1 opercle, 2 palatines, 4 premaxillae, 2 quadrates, 1 vomer.

Total: 20 specimens.

Remarks: The white-spotted greenling, unlike the other smaller members of the same genus, is abundant throughout the San Juan archipelago (Miller and Borton 1980:54.3). This species favors shallow sandy subtidal areas with eelgrass or other plants adjacent to rocky outcroppings, where they congregate and are relatively easily caught (Lamb and Edgell 1986:127). Specimens identified as c.f. *H. stelleri* were identical to the comparative skeletal material of this species, but those identifications remain tentative.

c.f. *Ophiodon elongatus* (Lingcod)

Material: 1 thoracic vertebra, 4 precaudal vertebrae, 12 caudal vertebrae, 1 undiff. vertebra, 1 basioccipital, 1 ceratohyal, 1 ectopterygoid, 1 epihyal, 1 premaxilla.

Total: 23 specimens.

Remarks: Lingcod are the largest members of the greenling family, and is abundant throughout the San Juan archipelago (Miller and Borton 1980:54.4). Although this species can be found in deeper waters in pursuit of forage fish, it may also be caught in shallows, where spawning occurs from December to March. Hart (1973:468) notes that individual lingcod exhibit two patterns of behavior: some are almost completely sedentary once matured, while others migrate to different depths and habitats throughout their lives. Although identifications of lingcod specimens are tentative, their larger size than other greenling specimens make their identifications somewhat more secure.

Family Cottidae (Sculpins)

Material: 12 1st vertebrae, 87 thoracic vertebrae, 6 precaudal vertebrae, 183 caudal vertebrae, 1 penultimate vertebrae, 6 ultimate vertebrae, 8 angulars, 8 basioccipitals, 1 basipterygium, 1 ceratobranchial, 8 ceratohyals, 1 cleithrum, 5 misc. cranium fragments, 14 dentaries, 1 ectopterygoid, 1 epihyal, 5 exoccipital, 1 frontal, 6 hyomandibulars, 1 hypural, 2 lachrymals, 4 maxillae, 6 opercles, 3 palatines, 1 parasphenoid, 5 parietals, 5 pharyngeal plates, 6 pharyngobranchials, 5 posttemporals,

8 premaxillae, 4 preopercles, 12 quadrates, 1 scapula, 3 toothed bone fragments, 1 urohyal, 3 vomers.

Total: 425 specimens.

Remarks: A total of 36 sculpin species have been observed in the Puget Sound and Straits region in modern times (Miller and Borton 1980). These species are highly variable in size, salinity tolerance, habitat preference, and behavior (Hart 1973:472-546). Although most sculpin elements are not identifiable beyond the family level, some are distinctive to genus and others are identifiable to species based on texture, size, or unique landmarks in the case of some cranial bones such as the preopercle.

c.f. *Enophrys bison* (Buffalo Sculpin)

Material: 8 misc. cranium fragments, 1 dentary, 1 palatine, 1 premaxilla, 2 preopercles.

Total: 13 specimens.

Remarks: The buffalo sculpin is a medium-sized sculpin that does not grow longer than about 14 inches. Abundant along most of the shore of San Juan Island (Miller and Borton 1980:55.13), this species tends to be solitary and inhabits shallow water year-round amongst plant growth that aids in camouflage (Hart 1973:499-500; Lamb and Edgell 1986:165). Tentative identification was made on specimens based upon the distinctive morphology of toothed bones and the preopercle, and the surface texture of cranial bones.

c.f. *Hemilepidotus* sp. (Irish Lord)

Material: 1 epihyal, 1 ethmoid, 1 mesopterygoid, 1 parasphenoid, 1 premaxilla, 1 quadrate, 1 symplectic.

Total: 7 specimens.

Remarks: Two species of the medium-sized Irish Lord genus inhabit the Puget Sound and Straits region, the red Irish Lord (*H. hemilepidotus*), and the brown Irish Lord (*H. spinosus*), although the brown Irish Lord has been observed only rarely (Miller and Borton 1980:55.15-55.16). Irish Lord are voracious eaters and prefer a variety of shallow habitats to feed while being relatively sedentary (Hart 1973:502-505; Lamb and Edgell 1986:166-167). Tentative identification was made based upon the distinctive morphology of cranial bones.

* *Leptocottus armatus* (Pacific Staghorn Sculpin)

Material: 10 preopercle spines.

Total: 10 specimens.

Remarks: The Pacific staghorn sculpin is a common species of medium-sized sculpin that can be found from shallow to moderate depths across the Pacific Northwest. They prefer silt- or mud-bottomed near-shore subtidal areas, however, as well as estuaries and lower portions of coastal streams (Hart 1973:518-519;

Lamb and Edgell 1986:168). They have been observed in abundance in Garrison Bay, Friday Harbor, Griffin Bay, and False Bay (Miller and Borton 1980:55.22). Identification of specimens to this species was based upon their distinctive antler-shaped preopercle spine.

c.f. *Leptocottus armatus* (Pacific Staghorn Sculpin)

Material: 2 1st vertebrae, 4 angulars, 2 basioccipitals, 7 ceratohyals, 1 cleithrum, 3 dentaries, 2 frontals, 4 hyomandibulars, 1 interopercle, 7 opercles, 1 parietal, 4 posttemporals, 3 premaxillae, 4 preopercles, 3 quadrates, 1 scapula, 1 vomer.

Total: 50 specimens.

Remarks: Aside from the spine of the preopercle, other elements and portions of elements are distinct enough to make tentative identifications to the species-level, including the 1st vertebrae which exhibit morphology and texture different from other taxa of sculpin.

c.f. *Scorpaenichthys marmoratus* (Cabezon)

Material: 11 caudal vertebrae, 1 frontal.

Total: 12 specimens.

Remarks: The cabezon is largest sculpin species inhabiting Puget Sound and the Straits. Although they are most commonly found at moderate depths, adult cabezon often swim into very shallow water in pursuit of prey or to spawn, which occurs January through March (Hart 1973:540-541). They have been observed in shallow bays throughout the San Juan archipelago, including Garrison Bay (Miller and Borton 1980:55.33). Tentative identification of this species was based upon size and morphology of vertebrae, and size and texture of the one frontal specimen found in the assemblage.

Order Pleuronectiformes (Flatfish)

Material: 2 thoracic vertebrae, 2 precaudal vertebrae, 20 caudal vertebrae, 1 basipterygium, 1 hyomandibular, 1 interhaemel spine, 1 premaxilla, 1 pterotic, 1 quadrate, 1 vomer.

Total: 31 specimens.

Remarks: Two taxonomic Families of the Order Pleuronectiformes are found in the Puget Sound and Straits region: 13 species of right-eyed flounders (Pleuronectidae) and two species of left-eyed flounders (Bothidae) (Miller and Borton 1980). Flatfish are distinguished by their flattened bodies and asymmetrical crania in which their eyes migrate as juveniles to either their left or right side. Adult flatfish species vary greatly in size and depth preference, but all are normally bottom-dwellers (Hart 1973:595). Despite morphological characteristics that distinguish flatfish skeletal specimens from other taxonomic orders of fish — most notably lateral projections of the vertebral centrum — many specimens in

this assemblage could not be identified to a finer taxonomic level.

Family Pleuronectidae (Right-Eyed Flounders)

Hippoglossus stenolepis (Pacific Halibut)

Material: 1 thoracic vertebra.

Total: 1 specimen.

Remarks: The halibut is the largest species of flatfish in the Pacific Ocean, often attaining lengths exceeding 6 feet. Although halibut live and spawn in deep to moderate depths (>275 meters), juveniles mature in shallower water (Hart 1973:614-615). Halibut are rarely observed in the San Juan archipelago and Strait of Georgia, instead being seen and caught in deeper waters of the Strait of Juan de Fuca and the Puget Sound (Miller and Borton 1980:59.5). Identification of the one vertebra specimen in the assemblage was based upon centrum morphology and size.

c.f. *Platichthys stellatus* (Starry Flounder)

Material: 3 caudal vertebrae, 1 dermal denticle, 1 premaxilla.

Total: 5 specimens.

Remarks: The starry flounder is a medium-sized (less than 36 inches in length) flatfish that inhabits a variety of depths and habitats, including estuaries and lower courses of freshwater streams, and despite belonging to the family of right-eyed flounders may become right- or left-eyed upon maturity. They spawn between February and April, but may be found in shallow water during the rest of the year as well (Hart 1973:631-632; Lamb and Edgell 1986:204). Starry flounder are abundant throughout the San Juan archipelago, and have been observed in Garrison Bay (Miller and Borton 1980:59.11). Identification of the vertebrae and premaxilla specimens were based upon morphology, and the star-shaped dermal denticle is distinctive to the starry flounder (Hart 1973:632).

Unidentified Fish

Material: 2 thoracic vertebrae, 5 caudal vertebrae, 30 undiff. vertebrae, 1 cleithrum, 1 epibranchial, 1 exoccipital, 1 hypural, 6 toothed bone fragments, 2779 misc. ray or spine fragments, 3218 unidentified fragments.

Total: 6044 specimens.

Remarks: In most cases, specimens of a known element could be further identified, but for some specimens, most notably vertebra fragments, this was not possible. The majority of unidentified fish specimens, however, were very small fragments from undetermined elements or ray or spine fragments that would not likely be identified to a finer taxonomic level even if the ray or spine were intact.

RESULTS AND DISCUSSION

In terms of overall relative taxonomic abundance, the identified OpD fish bone assemblage is dominated by salmonids (40%) and herring (33%), with lesser quantities of dogfish (13%), greenlings (6%), sculpins (5%), and eight other major taxonomic kinds of fish (3%). Elements from the entire fish skeleton are represented at the site by most taxa of bony fishes with a sample size greater than a few specimens. For example, salmonid remains are predominantly vertebrae and vertebral fragments; however cranial fragments, teeth, and bones of the pelvic and pectoral girdle are also represented. This indicates both salmon heads and bodies were discarded at OpD. The herring, greenling, and sculpin bones are represented by most cranial elements as well as vertebrae and post-cranial elements. This analysis has also shed light on taphonomic processes affecting the OpD fish bones, variability of those remains within the OpD deposits, and similarities and differences between this assemblage and others across the region.

Taphonomy

The OpD fish bone assemblage is well preserved, which is expected of faunal remains in alkaline shell midden deposits such as this (Stein 1992). Fish bones of varying density are represented, from vertebrae and teeth of larger fish to very delicate cranial elements of smaller fish. Factors such as bone density, degree of burning, and ground-water saturated depositional environments are known to structure the survivorship of fish remains (Butler and Chatters 1994; Lubinski 1996; Pegg 1999).

Burned fish bones are present in small numbers in the assemblage, and were recorded during analysis as being either charred or calcined. Color is the most commonly used characteristic for identifying thermal alteration of bone, although numerous chemical processes unrelated to burning can have a similar effect on the structure of bone (Lyman 1994; Shipman et al. 1984). The most effective means of identification of burned bone and the temperature range in which a specimen has been burned is by scanning-electron microscopic examination of the specimen's crystal-line structure (e.g., McCutcheon 1992). Because the procedure was not practical for this analysis, it was assumed that specimens exhibiting blackening, whitening, or a combination of the two underwent some form of thermal alteration. Blackened specimens were identified as "charred", and are assumed to have been carbonized at a relatively low temperature. Whitened specimens that also exhibited a brittle, chalky texture

were identified as "calcined", and are assumed to have been heated to higher temperatures in which much of the organic material within the mineral structure of the bone has been removed.

A total of 299 specimens, or about 2%, of the entire analyzed assemblage of 15,168 fish specimens were either charred or calcined. Of these burned bones, 202 were charred and 97 were calcined. The specimens are distributed randomly across the excavation units and facies in proportion to the total numbers of fish bones in each aggregation. By taxon, the specimens are also distributed in proportion to the total assemblage with the greatest number of burned specimens from salmonids, herring, dogfish, and greenling. Burned fish bones within the OpD assemblage suggest either cooking, heat smoking or drying, or disposal of fish in fire at British Camp, although their small numbers and random distribution throughout the assemblage preclude more detailed inferences.

Differential survivorship of bone fragments may also be attributed to the bone density of particular elements of fish taxa deposited at British Camp. Butler and Chatters (1994) measured bone densities of salmon elements, noting that in general post-cranial elements such as vertebrae are much denser than cranial elements. Therefore, inferences about salmon processing based on presence or absence of cranial elements in an assemblage may be inaccurate. The salmonid remains in the OpD assemblage are dominated by vertebrae, however less dense elements such as the coracoid, basipterygium, and exoccipital are also represented. Also, vertebrae are the element most easily identifiable to taxon in highly fragmented assemblages such as that of OpD. The presence throughout the units and facies of salmonid cranial elements, as well as abundant cranial specimens of herring, suggests that bone density has not played a substantial role in survivorship.

The OpD fish bones are highly fragmented, despite the apparently minor role of differential bone density and burning in structuring the assemblage. The screen-size distribution of the fish bone assemblage reflects degree of fragmentation as well as abundance of small-bodied fish. The mesh sizes of screens used during excavation of OpD were as fine as 1/8". Although very small fragments of fish bone pass through mesh of this size (e.g., Cannon 2000), the screens used at OpD were small enough to retain the bones of fish such as smelt, herring, and shiner perch that were ethnohistorically some of the smallest economically important fish taxa used in the Straits region. Of the four screen-size fractions (1", 1/2", 1/4", and 1/8"), the majority of specimens were from the 1/8-inch fraction. In all six units analyzed, abundance within screen-size fractions

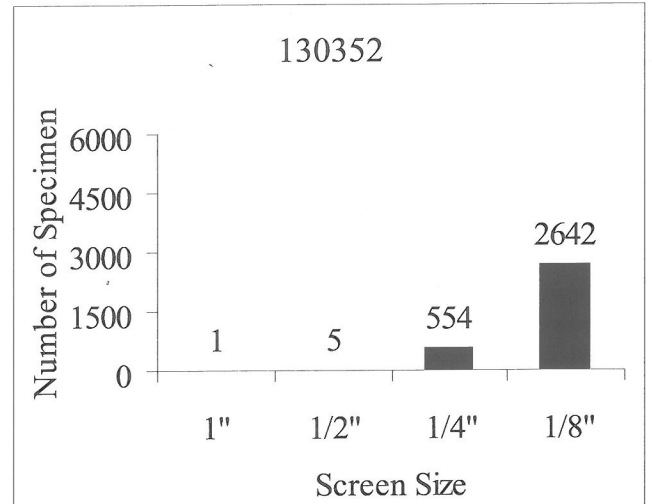
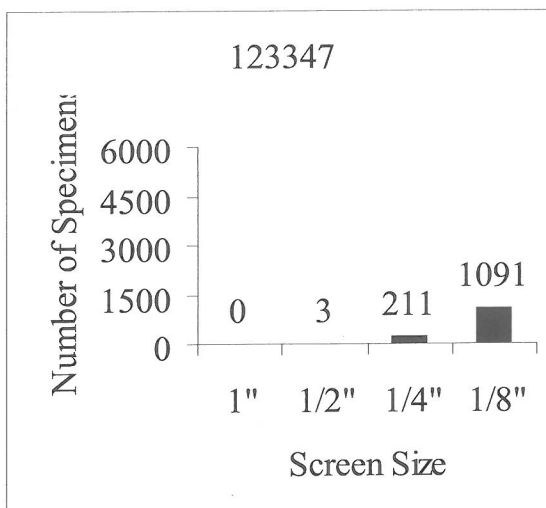
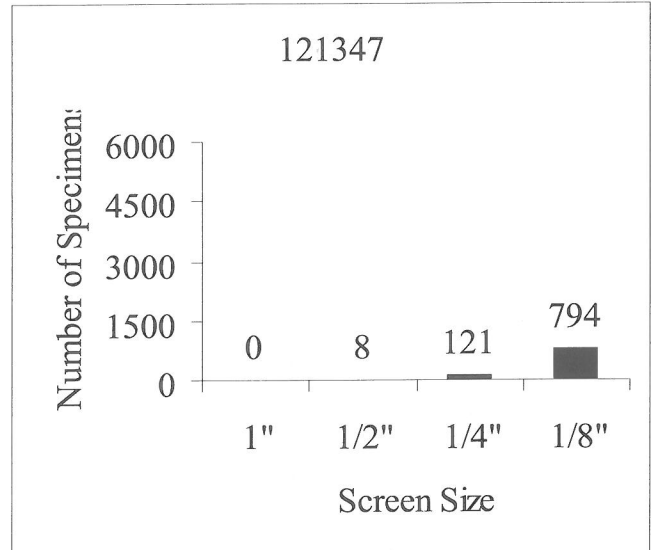
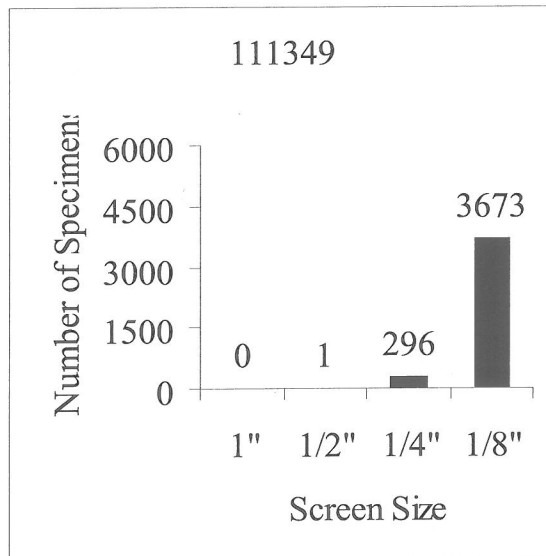
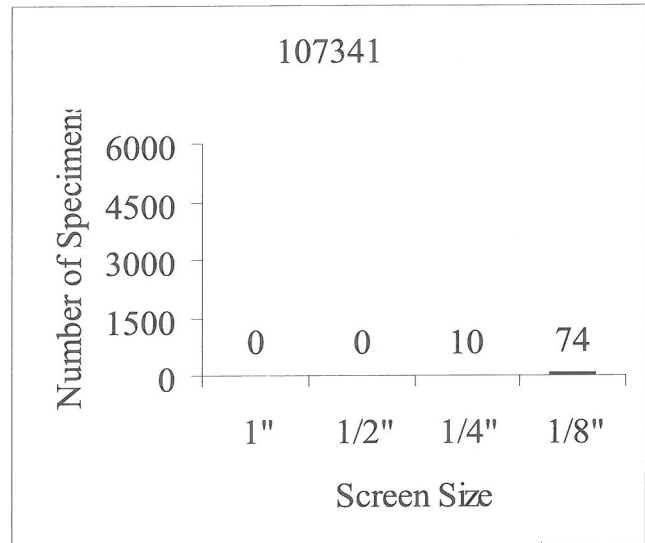
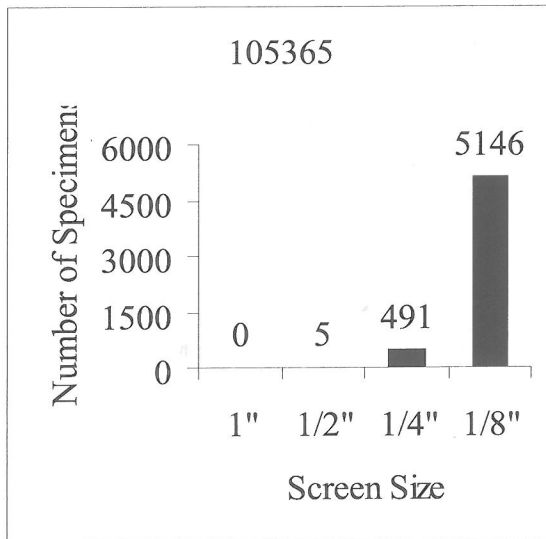


Figure 12.7 Screen-size distribution of fish remains in six Op D excavation units.

Table 12.3 Number of Identified Fish Specimens (NISP) observed/expected/residuals in different areas of OpD

Unit	Salmonid	Herring	Other Identified Fish
Ridge Units (107-/105-/111-)	1787 / 2129.3 / -342.3	2298 / 1792.3 / +505.7	1265 / 1428.4 / -163.4
Depression Units (121-/123-)	813 / 614.1 / +198.9	262 / 516.9 / -254.9	468 / 412.0 / +56.0
Ridge-Front Unit (130-)	1027 / 887.9 / +139.1	493 / 747.4 / -254.4	711 / 595.7 / +115.3

$\chi^2=544.837$ $p(df=4)<0.001$ * Shaded boxes indicate fewer NISP than expected; unshaded boxes indicate greater NISP than expected.

increases geometrically as screen size decreases (Figure 12.7). The one 1" specimen is a rockfish precaudal vertebra, and the ½" specimens are from various elements of large-bodied fish: salmon, lingcod, rockfish, halibut, and cabezon.

Because OpD represents deposition of a large amount of material over relatively brief time span between about 1,000 and 2,000 radiocarbon years BP, comparison of fish remains across space by excavation unit may more informative than comparison through time by facies. One of the most distinctive aspects of OpD is its topography forming a ridge of shell midden around a square depression open towards Garrison Bay. Unit 107 341, 105 365 and 111 349 were placed behind and near the crest of the topographic ridge, units 121 347 and 123 347 were placed within the square depression, and unit 130 352 was placed slightly in front of the depression between its breach and Garrison Bay.

Relative taxonomic abundances of certain fish taxa are expected to differ between excavation units if the distinct topographic divisions of OpD were functionally different. Do the three major taxonomic groups represented at the site (salmonids, herring, and other identifiable fish) have the same distribution across space? A chi-squared analysis of their abundances within the three spatial zones (Units 107-/105-/111-; Units 121-/123-; and Unit 130-) is shown as a contingency table (Table 12.3). The chi-squared value is highly significant, reflecting a substantial difference in fish taxonomic composition between the three zones. Based on the residuals, also given in Table 12.3, the fish bone assemblage from the ridge of shell midden surrounding the depression consisted of a greater abundance of herring than expected. The assemblage from the units within the depression contained a greater abundance of salmonid and other identified fish remains and fewer herring than expected. Likewise, the unit placed in front of the depression opening contained more salmonid and other fish and fewer herring than expected. Although other hypotheses may explain the differences in relative taxonomic abundance across the site, such as differential preservation conditions, this gives some support to

other lines of evidence that may be present for differential disposal of food remains across space.

Fish remains from the OpA portion of the British Camp site were analyzed by Brian Pegg (1999) and provide data from another part of the site. Unlike OpD, which is set back several meters from the wave-cut bank of Garrison Bay, OpA is adjacent to the high-tide line and wave-cut bank. The effects of ground-water saturation of the shell midden deposits of OpA were the focus of geoarchaeological research by Stein (1992) and later examined specific to the vertebrate faunal remains by Pegg (1999). His research supported the hypothesis that the fish bone assemblage at OpA was structured in part by ground-water saturation, which isn't apparent in the OpD deposits. Of 20,293 analyzed specimens, almost 20,000 were fish bones and 70% of those were identified to a finer taxonomic level. By far the majority of identified fish specimens were of herring, followed distantly by salmonids, dogfish, surfperch, sculpins, rockfish, flatfish, and other fish taxa. Although the two most abundant taxa in the OpA and OpD assemblages are the same, herring and salmonids, the majority of the OpA assemblage is herring and the OpD assemblage is much more even between these two taxa. Aside from a lack of greenlings in the OpA assemblage, the assemblages are very similar in terms of taxonomic presence and relative abundance. Unlike OpD, change over time of the abundance of particular OpA taxa was examined by facies corresponding with depth, although no particular diachronic patterns in the fish remains were noted (Pegg 1999:66-67). Rather, changes in fragmentation of salmonid vertebrae and bone density of fish specimens with depth suggest differential post-depositional weathering.

Inter-Site Variability

Comparison of the OpD fish bone assemblage with others in the Puget Sound and Strait of Georgia region is difficult because of differential excavation and analytical methods between archaeological sites. Basic comparisons, however, do show some variability that may reflect similarities and differences in fishing behav-

Table 12.4 Selected Strait of Georgia and Puget Sound shell midden sites with analyzed fish bone assemblages

Site and Site Type	Finest Screen Size	NISP	# Taxa Identified	Dominant Taxa	Reference
British Camp, Op D (45-SJ-24) Large Residential, Coastal	1/8"	15168	31	Salmonid, Herring	This Report
British Camp, Op A (45-SJ-24) Large Residential, Coastal	1/8"	19582	16	Herring, Salmonid	Pegg 1999
Deep Bay (DiSe-7) Large Residential, Coastal	1/8"	?	4	Herring, Dogfish, Salmonid	Monks 1977, 1987
Pender Canal (DeRt-1) Large Residential, Coastal	1 mm	6822	37	Surfperch, Herring, Rockfish	Hanson 1991, 1995
Tsawwassen (DgRs-2) Large Residential, Coastal	2 mm	1326	11	Flatfish, Salmonid, Herring	Kusmer 1994
Cama Beach (45-IS-2) Large Residential, Coastal	1/8"	77528	41	Flatfish, Sculpin, Salmonid, Surfperch	Kopperl 2001b, Wigen 2002, Schalk and Nelson 2010
West Point (45-KI-428/429) Large Residential, Coastal	1/8"	27025	39	Salmonid, Flatfish, Sculpin	Wigen 1995
Old Man House (45-KP-2) Large Residential, Coastal	?	1239	13	Herring, Salmonid, Flatfish	Schalk and Rhode 1985
Burton Acres (45-KI-437) Camp/Processing, Coastal	1/8"	8826	21	Herring	Kopperl 2001a
Harbour Pointe (45-SN-93) Camp/Processing, Bluff-top	1/8"	11	1	Flatfish	Kopperl 2005
Fort Rodd Hill (DeRu-78) Camp/Processing, Coastal	1/8"	1286	21	Salmonid, Herring	Mitchell 1981

ior and availability of particular kinds of fish in local habitats.

Table 12.4 lists shell midden sites in the region from which the fish bones have been analyzed and reported, and whose data were available for this analysis. The sample size in most cases is the result of project constraints, although a few of the assemblages come from fine-screen samples of large volumes of midden and yet contained very few fish remains (e.g., Harbour Pointe). Likewise, the overall taxonomic richness of each assemblage in many cases is a product of comparative collection availability. Some patterns do emerge, however, that highlight fishing patterns at these midden sites. Fish remains from sites interpreted to be large residential occupations, when sampled using fine-mesh screens, consistently show large abundances of herring and salmon relative to other taxa. In addition to herring and salmon, some assemblages reflect intensive use of other kinds of fish, such as surfperch at Pender Canal (DeRt-1), flatfish at Tsawwassen (DgRs-2), and sculpin

at Cama Beach (45-IS-2).

Shell midden sites interpreted as more specialized resource procurement and processing camps are more variable in terms of taxonomic richness and dominant taxa. The Fort Rodd Hill (DeRu-78) and Burton Acres (45-KI-437) sites are inferred as seasonal or specialized-use camps, yet contain fish bone assemblages with taxonomic richness well within the range found at larger sites interpreted as more permanent settlement sites. The Harbour Pointe site (45-SN-93), on the other hand, is a spatially extensive bluff-top site with abundant shellfish yet very sparse vertebrate faunal remains, including only 11 flatfish bones in 32 one square-meter excavation units.

CONCLUSIONS

Analysis of the OpD fish bones provides a means of quantifying fish use and disposal of fish remains at the British Camp site. Fish remains are quite abundant in the OpD shell midden deposits. A roughly 25% sam-

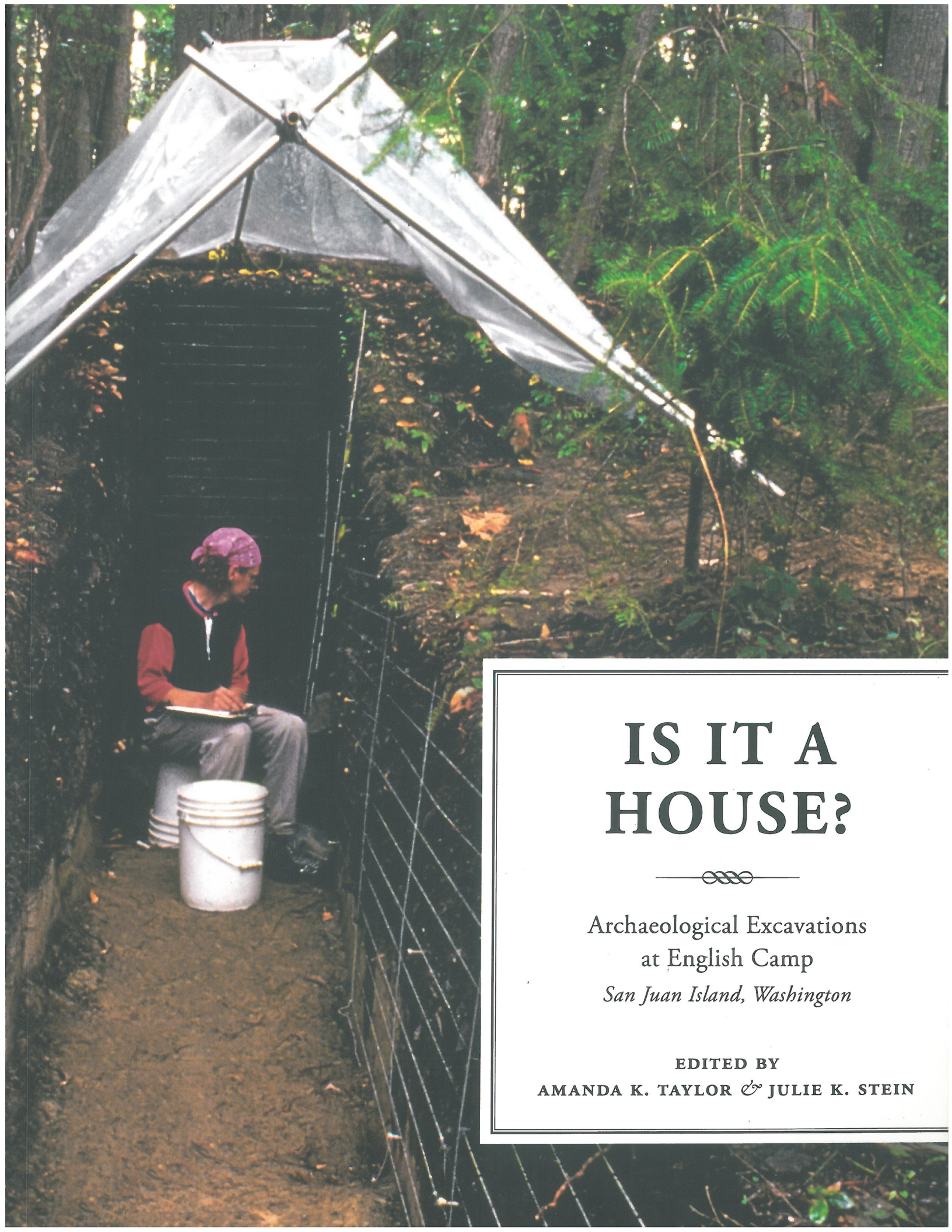
ple of all fish bones collected from six one-meter by two-meter excavation units yielded 15,168 specimens, of which 9,124 or 60.1% were identified to one of 31 taxonomic categories of fish. Most of the identified remains are from salmonids and herring, with dogfish, greenling, and sculpin also abundant. The screen-size distribution of the remains reflects both a high degree of fragmentation and the presence of small-bodied fish. Although much of the assemblage, including most of the salmonid bones, was highly fragmented, most of the specimens were not burned.

The OpD assemblage shows variability in the distribution of fish taxa within the site and shows similarities and differences to other shell middens in the region. Within the OpD portion of British Camp, herring comprised a greater proportion of the fish taxa than expected in the shell midden ridge surrounding the large square depression, while within and front of the depression a greater proportion of salmonid remains than expected were found. Although taphonomic or post-depositional process may account for this variability, differential disposal of fish taxa across this portion of the site may also be an explanation. A previously completed analysis of fish remains from OpA, to the south of OpD within British Camp, generally shows a similar taxonomic dominance by herring and salmonids, although relative abundance of fish at OpA is much more heavily skewed towards herring. These two taxa dominant most other coastal shell middens in the Puget Sound and Strait of Georgia region, although both larger occupation sites and those inferred to be more specialized processing camps often contain one or more other taxa such as flatfish or sculpin that were apparently targeted in large numbers as well.


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EDITED BY
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