SCREEN SIZE AND THE NEED FOR REINTERPRETATION: A CASE STUDY FROM THE NORTHWEST COAST

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There has been much discussion in the archaeological literature on the utilization of different screen mesh sizes for recovering faunal elements, with many researchers decrying the use of the 6.4 mm (1/4") screen, which allows small elements to fall through the mesh. There has been less discussion on the merits of the data obtained through recovery of smaller elements, specifically, is the "new data" worth the extra time and labor? This paper examines faunal material from three sites from the Northwest coast of Canada. The material has been recovered using either 6.4 mm or 2.8 mm (1/8") mesh screens. The results suggest that elements of herring and other small fish have been greatly underestimated in Northwest coast sites, and that these formed an important part of the coast economy and subsistence. Where salmon, a large fish with often well preserved elements, has been seen as the mainstay of Northwest diet and economy, excavation with small-mesh screens may indicate a much greater importance for herring and other small fish on the coast. For accurate reconstruction of past lifeways, at least on the Northwest coast, screens with mesh 2.8 mm must be used for at least a substantial part of the matrix, in combination with the 6.8 mm mesh.

Key words: screen gauge, fish bones, Northwest coast, sampling, North American prehistory

The question of mesh size for screening archaeological matrix has been the focus of much debate (eg., Butler 1993; Cannon 1999; Clason and Prummel 1977; Gordon 1993; Grayson 1984; James 1997; Lyman 1982; Payne 1972; Rick and Erlandson 2000; Schaffer 1992; Schaffer and Sanchez 1994). Traditionally the 6.4 mm (1/4") and even larger meshes have been used in archaeological excavations, but their utilization has come under attack because of loss of small bone elements through the mesh and consequent loss of faunal data. But how important are these lost data? While much debate focuses on the faunal elements lost and optimal strategies for recovery, there is less discussion about the value of these elements to our overall knowledge of the cultures studied or the reconstruction of the associated environments and animal communities. Several studies have undertaken recovery of fauna with <6.4 mm mesh, and have added the "new" taxa to their lists of resources exploited, and calculated resulting diversity indexes and/or edible meat weights (e.g., Gordon 1993; Rick and Erlandson 2000). Is this additional knowledge worth the considerable time, labor, and cost needed for screening, sorting, and identifying small faunal elements from small-mesh screens?

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In this paper, we analyze fauna from three Northwest coast shell midden sites where either 6.4 mm or 2.8 mm (1/8") mesh screens were utilized. Depending upon which screen size was used, completely divergent faunal results were obtained. These divergent results mean that completely different representations of Northwest coast economy and subsistence can be inferred, depending upon which set of data is consulted. Our study illustrates that, at least in Northwest coast shell middens, accurate subsistence and economic reconstruction is absolutely dependent on recovery of the faunal elements through screens with ≤2.8 mm mesh. We suggest that 50% of the matrix be screened through ≤2.8 mm mesh.

METHODOLOGY

In 1994, 1995, and 1997, the University of Victoria field school under the direction of Don Mitchell, Quentin Mackie, and Becky Wigen began excavating the Kosapsom site (DcRu 4) located on southeastern Vancouver Island along the Gorge waterway in the present-day Victoria area (Fig. 1). The excavation was in part a salvage recovery prior to future construction of a sidewalk. Thirty-eight 1 x 1 m excavation units were randomly and subjectively selected and opened in a strip that more or less followed the shore along the Gorge. Although the deposits were somewhat mixed, there was evidence of three distinct cultural components, each of which concentrated in different areas of the site: Locarno

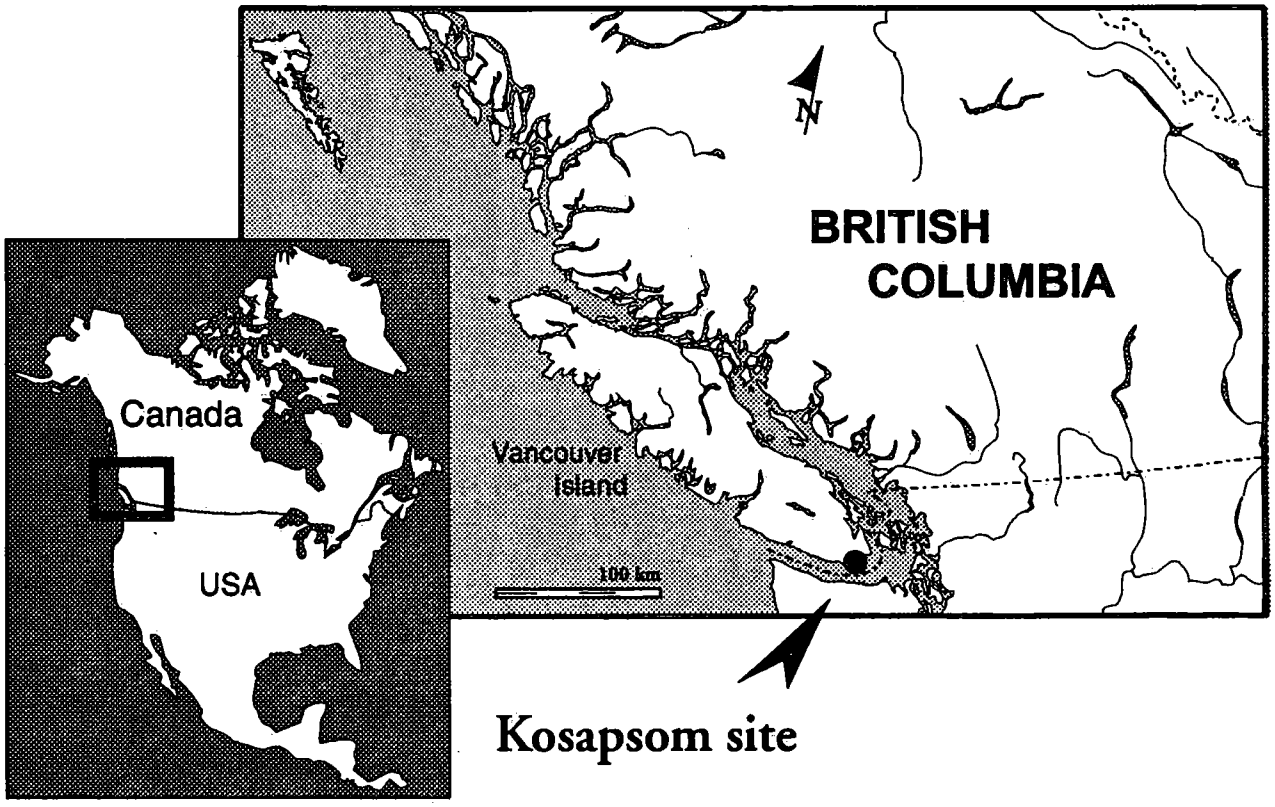

Figure 1. The Kasapsom site, southern Vancouver Island.

Beach Phase, dating from about 3500 to 2500 B.P., Gulf of Georgia Phase, dating from about 1500 B.P. to contact, and Historic, dating from 1855 A.D. to the present.

In the 1994 field season, all material recovered from excavation by 5 cm levels was screened using a 2.8 mm screen. Recovery of the small bones from the screens in the field was so time-consuming that the decision was made to bag the material from the 2.8 mm screens and finish the sorting in the lab. In addition, a 20 x 20 x 5 cm sample was taken from a corner of each excavation unit. Retrieved material was taken to a laboratory at the University of Victoria for sorting. Unfortunately, the time required for sorting the material into the categories of shell and vertebrates was enormous, and after four weeks of full-time work by several students, little of the material had been sorted. With so little material processed, the decision was made to use a 6.4 mm screen for recovery in the new units opened during both the 1995 and 1997 field seasons. The 2.8 mm mesh was used for column samples.

All vertebrate material was identified by one author (KS) and invertebrate material by the other (RW), although the latter is not discussed in this paper. Vertebrate material was identified using both the collections of the Canadian Museum of Nature in Ottawa, and the University of Victoria osteological collections. In this paper we present the results of the Kosapsom faunal analysis, and also compare the results with the fauna from two nearby and reasonably contemporaneous sites, Esquimalt Lagoon (DcRu 2) and Fort Rodd Hill (DcRu 78). These sites are about 3 and 4.5 km, respectively, west of the Kosapsom site on the Gorge waterway.

At Esquimalt Lagoon, fourteen 1 x 2 meter units were excavated and fauna collected by 10 cm levels. Matrix excavated was screened through a 6.4 mm mesh screen. All vertebrate material was identified to element, but bird elements were not identified to taxon (Hanson 1991). At Fort Rodd Hill, five 2 x 2 meter units were excavated, and matrix screened through a 5 mm (1/5") mesh screen. All vertebrate fauna was analyzed (Hanson 1991). Comparisons with the Esquimalt Lagoon and Fort Rodd Hill faunas are based on numbers in Hanson (1991).

RESULTS

To date, a total of 3707 elements have been analyzed from the Gulf of Georgia levels at Kosapsom, from three classes (Table 1). As can be seen in the total numbers,

fish are most abundant, with considerable diversity, while mammals are next in abundance, but with less diversity. Birds were poorly represented, with very little diversity.

When the faunal analysis is sorted by screen size, however, two very different pictures of the fauna emerge (Fig. 2). In the fauna recovered using 2.8 mm mesh, fish is clearly the dominant class, comprising 75.8% of the total number of elements, compared to less than half (32%) recovered in the 6.4 mm mesh. A similar reversal occurs with mammalian elements, comprising only 19.6% of the 2.8 mm assemblage, but a much higher 62.1% in the 6.4 mm assemblage. Birds were about equally, but poorly, represented in both assemblages.

Diversity and abundance also differ between screen-mesh sizes, particularly with fish taxa (Figs. 3, 4). Thirteen different genera/families of fish were recovered with the 2.8 mm screen, while the assemblage recovered from the 6.4 mm screen contains only 10 genera/families. In addition, the abundance differs markedly between assemblages, with herring dominating the 2.8 mm fauna at 72.4%, but comprising a mere 5.3% of the total in the 6.4 mm mesh assemblage (Fig. 3). A similar reversal occurs with salmon, which comprise 53.6% of the larger 6.4 mm mesh assemblage, but only 16.1% of the smaller 2.8 mm fauna. Among the less numerous fish taxa (Fig. 4), dogfish, lingcod, and flatfish are most common in the 2.8 mm screen, while dogfish, surfperch, and sculpin dominate the 6.4 mm fauna.

An analysis of the estimated total lengths of the fish recovered in each screen size shows more dissimilarities (Fig. 5), with a clear peak for smaller-sized fish recovered in the 2.8 mm screen, and a dominance of larger-sized fish in the 6.4 mm assemblage.

Mammalian taxa also show dramatic differences between the two screen mesh sizes (Fig. 6), with dogs, rodents (including beaver), and deer predominating in the 6.4 mm assemblage, but rodents, sea otters, and dogs/deer predominating in the 2.8 mm assemblage. There are three taxa that are only represented in one or the other size group.

Comparison of the fish fauna of Kosapsom, sorted by screen size (6.4 mm and 2.8 mm meshes), with the fish fauna of Fort Rodd Hill, screened through 5 mm mesh, and Esquimalt Lagoon, screened through 6.4 mm mesh (Fig. 7), shows that salmon predominates in the sites utilizing the larger screen meshes. In contrast, herring overwhemingly predominates in the Kosapsom levels screened with 2.8 mm mesh.

Trends are not as distinct when examining fish taxa other than salmon and herring (Fig. 8), but, in general, the sites using the 6.4 mm mesh screen had poor or no representation of the smaller fishes, including surfperch, sculpins, sticklebacks, and anchovies. When we compared mammals between the three sites (not graphed), we found no discernable pattern in the elements recovered. The smallest elements, those of rodents, were equally represented in all sites, regardless of screen mesh used. Birds were not compared among sites, as few bird elements have been recovered at Kosapsom, and birds were not identified beyond class in the Esquimalt Lagoon assemblage.

Table 1. Numbers and percentages of faunal elements recovered from Gulf of Georgia levels at Kosapsom.

	no.	percent
Fish		
Squalus acanthias (dogfish)	41	4.5
Raja sp. (ray)	1	0.1
Clupea harengus (herring)	580	64.3
Engraulis mordax (anchovy)	3	0.3
Oncorhynchus sp. (salmon)	187	20.8
Gadus macrocephalus (Pacific cod)	8	0.9
Gasterosteus aculeatus (3-spine stickleback)	10	1.1
Embiotocidae (surfperch)	18	2.0
Sebastes sp. (rockfish)	2	0.2
Ophiodon elongatus (lingcod)	16	1.8
Hexagrammidae (greenling)	2	0.2
Cottidae (sculpin)	12	1.3
Hippoglossus stenolepis (Pacific halibut)	1	0.1
Pleuronectiformes (flatfish)	22	2.4
Mammals		
Rodentia (rodents)	8	24.2
Canidae (dogs or wolves; mainly dogs)	10	30.3
Enhydra lutris (sea otter)	4	12.1
Mustelids (otters, minks etc.)	2	6.1
Odocoileus hemionus (deer)	3	9.1
Cervidae (deer, elk, etc.)	6	18.2
Birds		
Anatidae (ducks, geese, etc.)	3	42.9
Laridae (gulls)	4	57.1

DISCUSSION

Kosapsom

The faunal data retrieved from the 6.4 mm screens and from the 2.8 mm screens present very different pictures of subsistence and economy at Kosapsom. If only the results from the 6.4 mm screen are used, mammals are twice as common in the site refuse as

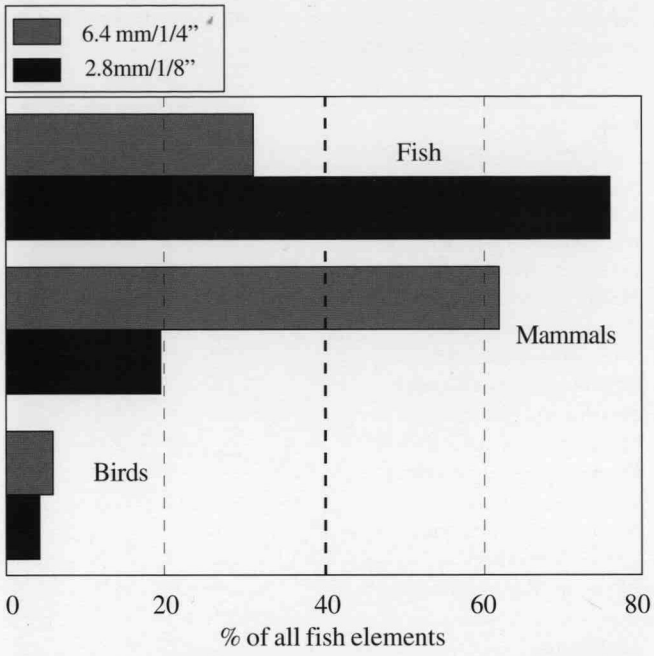

Figure 2. Percentages of each class, of all elements, by screen size at Kosapsom.

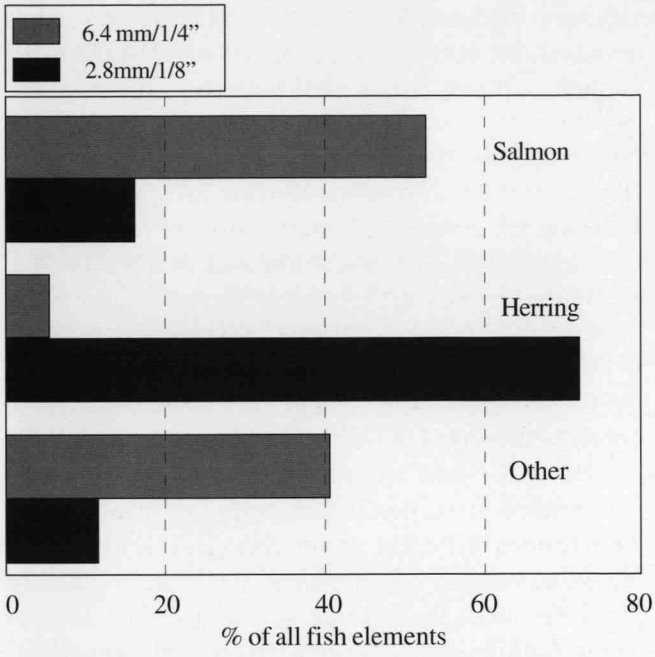

Figure 3. Percentages of salmon and herring elements, of all fish elements, by screen size at Kosapsom.

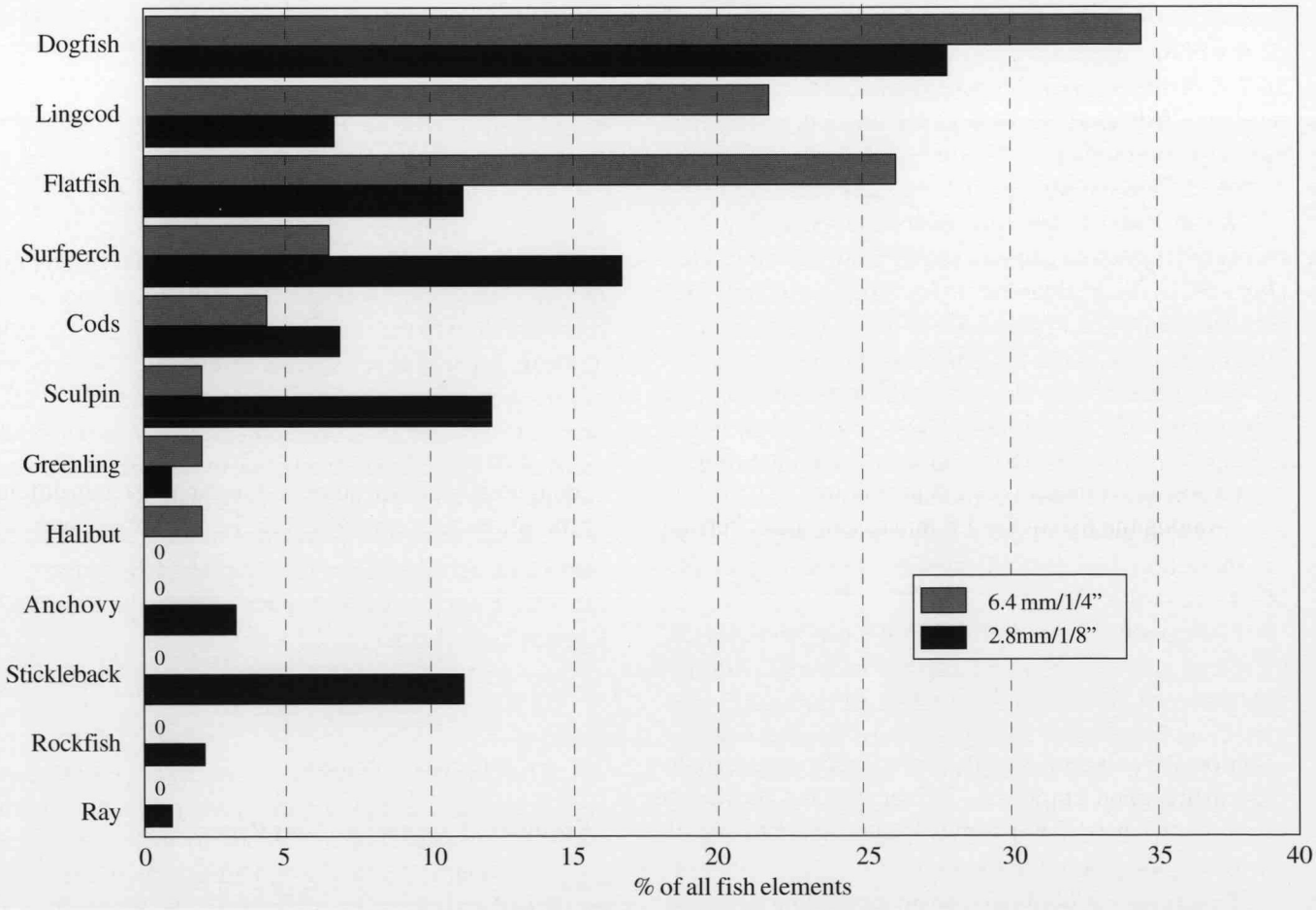

Figure 4. Percentages of "other" fish elements by screen size at Kosapsom.

fish, and, among fish, salmon predominate, with almost 60% of the remains, followed by dogfish, lingcod, and flatfish. The mammals represented were primarily dogs or wolves, but size suggests mainly dogs, which ethnohistoric accounts suggest were kept as pets, not usually for food (e.g., Drucker 1963). Next most important at the site were rodents, which, other than beavers, may have been site intruders, as the Coast Salish did not consume smaller rodents (Suttles 1974), followed in abundance by deer. Deer are very common today on Vancouver Island, and were likely common in Kosapsom times as well. They were hunted for food and their hides for clothing, and bone and antler were used for tools and personal ornaments (e.g., Stewart 1987). Salmon, the dominant fish represented in the 6.4 mm screenings, can achieve a total length of 147 cm (Hart 1980) and were probably caught on spawning runs up rivers and streams. Dogfish, caught for food and for their skin, used for woodworking, can grow to about 130 cm (Hart 1980). Lingcod, a large greenling (up to 152 cm TL), is a valued food fish caught in shallow bottom waters. Flatfish, a diversified group, are well known food fish, ranging from 50 to 267 cm, depending on species (Hart 1980).

If only elements retrieved from the 2.8 mm screen are examined, a completely different picture emerges of Kosapsom subsistence and economy from that from the 6.4 mm assemblage: fish elements outnumber mammalian elements by almost 4 to 1; among fish, herring elements outnumber salmon, again almost 4 to 1. Among mammals, rodents are most numerous, again possibly intruders into the site. Sea otter elements, the next most abundant, surprisingly are completely absent from the 6.4 mm screen elements. Whether a rare inclusion, or only represented by small elements (teeth), the sea otter was valued for food, fur, and teeth for ornaments (Stewart 1987). Dog and deer are next most abundant, but are not well represented in the 2.8 mm fauna.

Among the fish in the 2.8 mm assemblage, herring, not salmon, is by far best represented, comprising 70.1% of all fish, mammal, and bird elements identifiable to order or lower. Herring generally grow to a maximum length of 25 cm in British Columbia (Hart 1980) and have been much prized in historic times for food and oil (Hart 1980). Northwest coast cultures so revered herring, along with salmon and eulachon, that they performed annual rituals to ensure good catches (Drucker 1963). The Gorge waterway, where Kosapsom is located, has historically been a herring fishery, and is fished today for herring. Herring spawn in late winter, most heavily in March (Hart

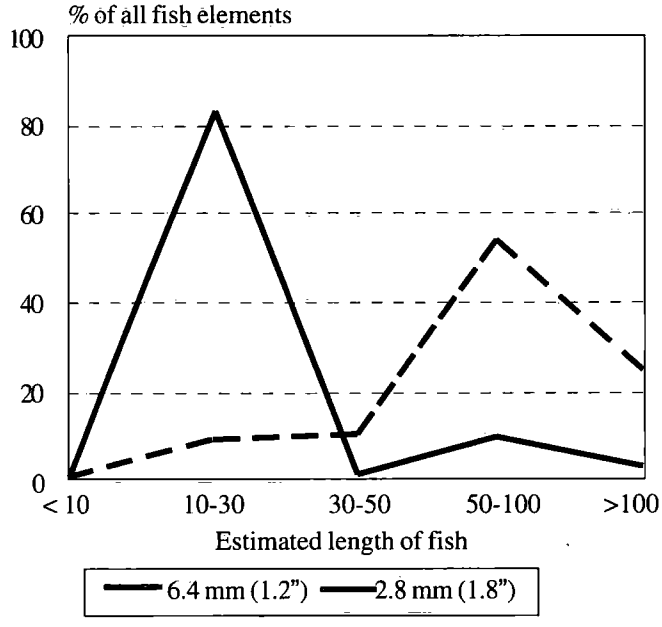

Figure 5. Estimated length of fish by screen size at Kosapsom.

1980). After herring and salmon, dogfish is best represented in the 2.8 mm screening, followed by surfperch, sticklebacks, and sculpins, the majority being smaller fish of <30 cm total length.

Based on different screen sizes, in the 6.4 mm assemblage, Kosapsom inhabitants were mammal hunters and salmon eaters, while in the 2.8 mm assemblage, inhabitants consumed mainly herring, with smaller amounts of salmon, rarely consuming mammals. We asked, why such discrepancies? One scenario might be that, because the remains derive from different squares, but the same cultural levels, the creators of the 6.4 mm faunal assemblage were indeed primarily mammal and salmon eaters, while the 2.8 mm fauna reflected different preferences. This seems highly unlikely, however, because the squares were all located in the same area, often contiguous with each other, and such consistently different proportions are unlikely given the contemporaneity and proximity of the squares to each other.

A far more reasonable explanation is the obvious one: that the larger, 6.4 mm screen allowed most of the smaller fish bones, particularly the herring elements, to drop through. The smaller, 2.8 mm mesh screen retrieved a more representative proportion of the fauna in the levels, particularly herring.

Esquimalt Lagoon and Fort Rodd Hill

When the Kosapsom fauna are compared with the Esquimalt Lagoon and Fort Rodd Hill site faunas, all

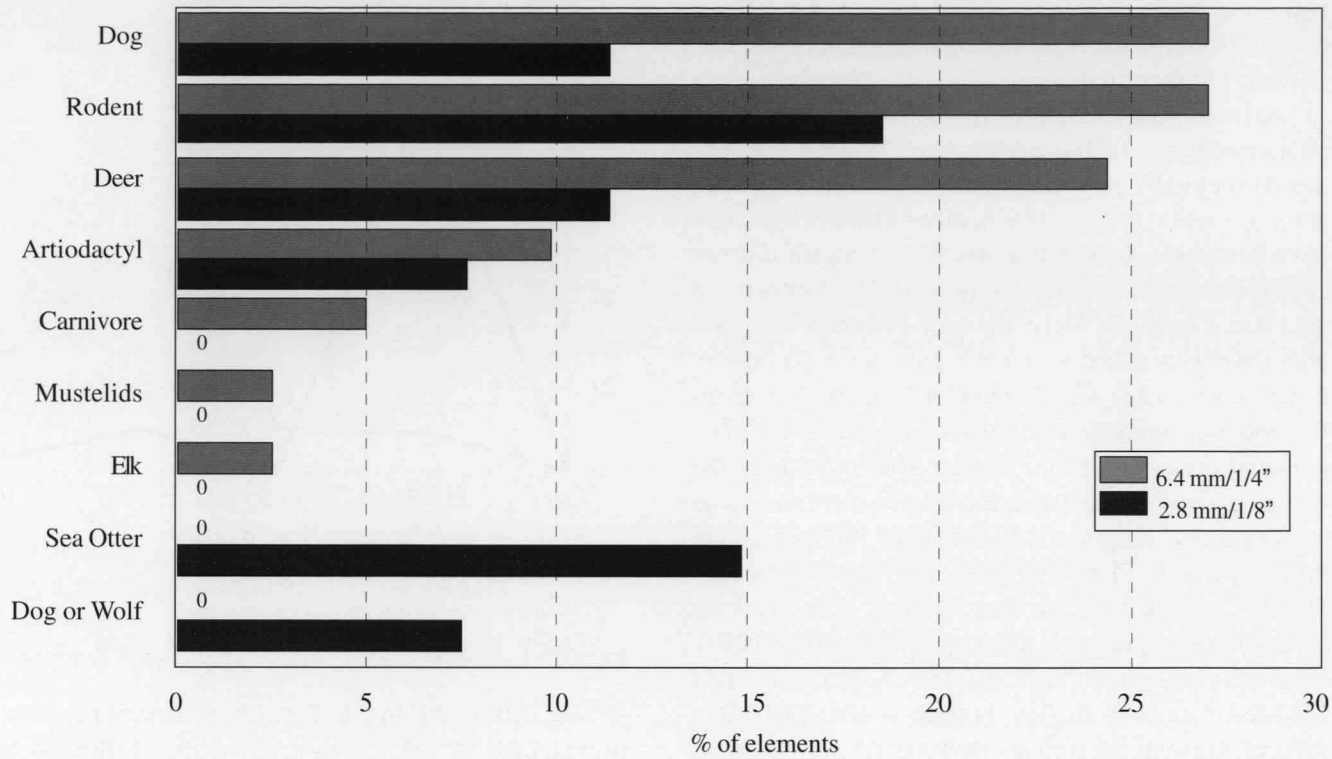

Figure 6. Percentages of mammalian elements by screen size at Kosapsom.

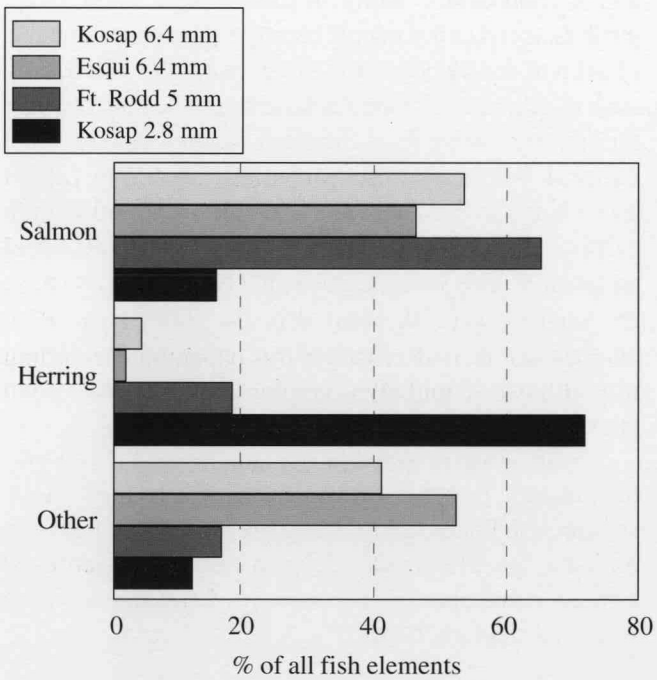

Figure 7. Percentage of salmon, herring, and other fish elements at Kosapsom, Equimalt Lagoon, and Fort Rodd Hill, with screen size.

located less than 5 km from each other, clear differences exist in the fish exploited. The Esquimalt Lagoon and Fort Rodd Hill inhabitants procured salmon and herring in similar proportions to that of the 6.4 mm fish fauna at Kosapsom, while the smaller-mesh fauna from Kosapsom show salmon and herring in reversed proportions, perhaps the result of cultural differences between the sites, but given the sites' proximity and the similarity of results in sizes of screen meshes, it seems that mesh size is the important variable. Further, the coastal area, including Esquimalt Lagoon, is a well known spawning area for herring in both historic and modern times. It would be highly unusual if herring were not also exploited in prehistoric times, given its value among the historic Coast Salish (e.g., Suttles 1974) and its ease of procurement when spawning (e.g., Drucker 1963). The low proportions of herring at the Fort Rodd Hill site and, especially, the Esquimalt Lagoon site seem best explained by the use of the 6.4 and 5 mm meshes.

Changing Interpretations of Subsistence and Economy on the Northwest Coast

The primary purpose of archaeological excavation, recovery, and analysis is to reconstruct past lifeways. A

long-standing view of the prehistoric Northwest coast cultures has been their overwhelming reliance on salmon, a view derived from historic ethnographies and archaeological reports. The often large size and distinctiveness of salmon bones, in particular vertebrae, have enhanced their preservation in archaeological sites, while remains of smaller or less robust fish either have not been preserved or are less visible. When only larger-mesh screens are used, it is predictable that salmon remains dominate to the near-exclusion of all but the largest of other fish species.

While salmon was certainly a valued food fish and, indeed, a staple among Northwest coast cultural groups, reliance on it may not have been as complete as was once thought, particularly in areas where other resources were easy or easier to procure. In a point relevant to this paper, Hart (1980:111) notes that pink salmon (*Oncorhyncus gorbuscha*), the most abundant salmon in British Columbia, spawn in a "very great number of coastal streams and in all the major rivers with the exception of those along the southeast part of Vancouver Island," where Kosapsom, Esquimalt Lagoon, and Fort Rodd Hill are located. Other less abundant salmonid species spawn up the coastal rivers of southeastern Vancouver Island, so alternate resources were probably utilized.

Because most archaeologists face time and labor constraints, this study does not advocate that screens with mesh ≤2.8 mm be used for all archaeological matrices. We recommend, however, that more than a column sample must be screened through small meshes. For recognition of small fish, we suggest that 50% of the matrix be screened through 6.8 mm and 50% through ≤2.8 mm mesh.

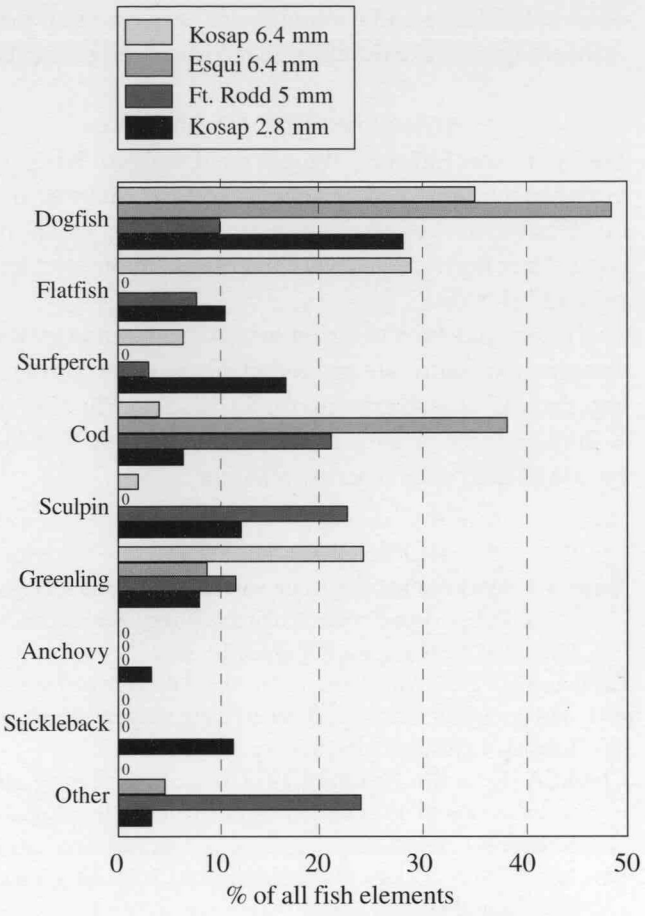

Figure 8. Percentage of "other" fish elements at Kosapsom, Equimalt Lagoon, and Fort Rodd Hill, with screen size.

CONCLUSIONS

The Kosapsom data highlight the differences in data from faunal assemblages depending on screen size used in excavations. We believe that the importance of small fish may be highly underestimated in archaeological reports from the Northwest coast because of faunal recovery strategies, both in past excavations where matrix was not screened, thus small elements were lost, or in more recent excavations where 6.4 mm screens have been used and, again, small elements have fallen through. Screening matrices through ≤2.8 mm mesh will certainly increase recovery and awareness of small faunal elements. Use of still smaller meshes, e.g., 1.4 mm (1/16") screens is even more preferable (Stewart et al. in press), because considerable numbers of herring vertebrae fall through the 2.8 mm screens. Although increased time and labor is involved, the data support a more accurate reconstruction of coastal subsistence and economy.

The importance of herring to Northwest coast peoples has been discussed in this paper, but, according to both historic and ethnographic records, other small fish, including eulachon, anchovy, smelt, and pilchard, were highly valued. Being similar in size to herring, their elements are only recovered in small-mesh screens. Because several of these taxa are localized or only seasonally available, certain cultural groups on the coast had access to them, while others did not. Some of these fish were valuable, for example, eulachon for its oil. Those groups with access to such fish could profit handsomely from trade. Use of fine-mesh screens and recovery of small elements could contribute an entirely new set of data to be used for interpretation of Northwest

coast subsistence and economy, and it is essential that archaeologists make the effort to recover small elements.

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