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ABSTRACT

Analysis of fish remains from the 1970 University of Colorado excavations at Namu, British Columbia, is the basis for a revised assessment of patterns and trends in the site fisheries over the past 2000 years. The results are consistent with overall patterns at the site but show a previously unrecognized trend of early decline and later recovery of the salmon fishery. They also show a period of overall diversification of the fishery when numbers of salmon were at their lowest levels and confirm the use of ratfish as a marginal food resource in times of salmon shortage.

RÉSUMÉ

L'analyse des restes de poisson provenant de la fouille du site de Namu (Colombie-Britannique) menée en 1970 par l'université du Colorado mène à une révision des modèles d'exploitation de l'industrie de la pêche au cours des derniers 2000 ans. Les résultats de l'analyse de ce site sont consistants avec les modèles généraux mais démontrent aussi une tendance, jusqu'alors insoupçonnée, de déclin et puis de renouveau des pêcheries de saumon. Ils démontrent aussi une période de diversification générale des pêcheries quand la population de saumon est en baise, et confirment l'utilisation de la chimère d'Amérique comme ressource comestible bien que marginale en temps de pénurie.

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The faunal remains from the site of Namu, located within traditional Heiltsuk territory on the central coast of British Columbia (Figure 1), have been well published (Cannon 1991, Conover 1978), and the data have provided the basis for wide-ranging interpretations of economic and ecological trends over the course of the last 7000 years of the site's 11,000 year occupation span. Although no faunal remains are preserved in the earlier deposits dating to 9000-5000 BC, grouping of later deposits and their contents by time period (Carlson 1991, 1996) enabled the identification of major faunal trends over the period from 5000 BC to the time of European contact.

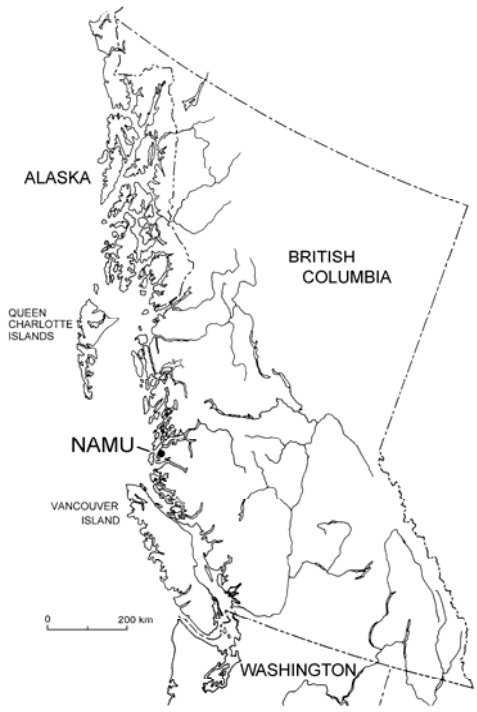

Figure 1: Location of Namu on the Central Coast of British Columbia.

The vertebrate faunal remains recovered during the Simon Fraser University field school excavations conducted by Roy L. Carlson in 1977-78 were identified and reported by Cannon (1991). The mammalian remains recovered from University of Colorado excavations in 1968-70 were identified by Charles Repenning of the US Geological Survey and the avian remains were identified by Howard Savage of the Royal Ontario Museum. These data were reported by Conover (1978). The fish remains from the University of Colorado excavations were reportedly analysed, but the results were never published.

We present the first published account of the fish fauna from the 1970 excavations based on stratigraphically recovered fauna from a single 2x4 m excavation unit, FS 10, described as the Front Trench (Luebbers 1978:20-24) (Figure 2). The significance of these remains is that they represent a part of the site near the foreshore margin of the midden that was not excavated by Simon Fraser University (SFU) in 1977-78. This area contains a 6 m deep midden deposit, which accumulated during a span of ca. 2000 years before European contact.

Although Cannon (1991) defined the focus of faunal resource use for Period 6 for its entire span from AD 1 to European contact, this was based on a much smaller assemblage than was available for earlier periods. Deposits from the last ca. 2000 years of the Namu site occupation, which were very poorly represented in the areas excavated in 1977-78, produced only 567 identified fish remains, compared to totals ranging from 6,417 to 60,882 for earlier periods. Given the small volume, scattered distribution, and relative lack of secure dating of these deposits in the areas excavated by SFU, it was

impossible to know if the recovered fauna were representative of the entire span of this last period of pre-European site occupation.

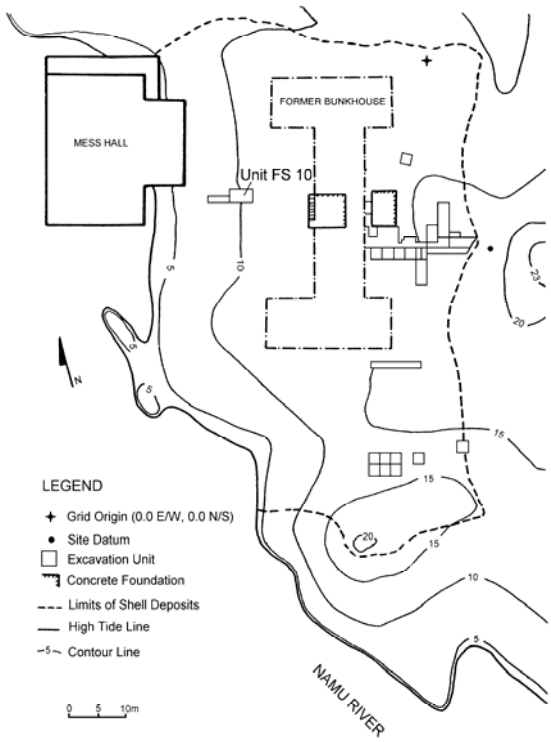

Figure 2: Location of Excavation Unit FS 10.

The identified fish remains from the Period 6 deposits in Unit FS 10 bring the total from that period to 12,214. With these new data we can establish the nature of the later fisheries with much greater clarity and certainty. The data fill in a missing piece in the otherwise extensively reported Namu faunal assemblage. The last phase of pre-contact occupation, after ca. AD 1000, was also described as a period of distinct changes in the nature of the midden and its contents. Deposits dating to this period were characterized by a distinctive pattern of discrete unmixed shell lenses, series of thin horizontal strata, hearth features, and an overall decline in artifacts and mammalian faunal remains (Conover 1978:98). Data on the fish remains provide a further basis for determining whether these characteristics represent a change in the overall pattern of site use or are more a function of site formation and the relatively short time depth of the most recent deposits.

Excavation, Recovery and Identification

Luebbers (1978:22) describes the excavation of the deep FS 10 trench, which attempted to follow major stratigraphic divisions as these were observed in the course of excavation. There was close but not perfect correspondence between strata observed in the field (FS 10.1-17) and those assigned to the deposits on the basis of profile and column sample analysis after the excavation (FSC 1-15) (Figure 3).

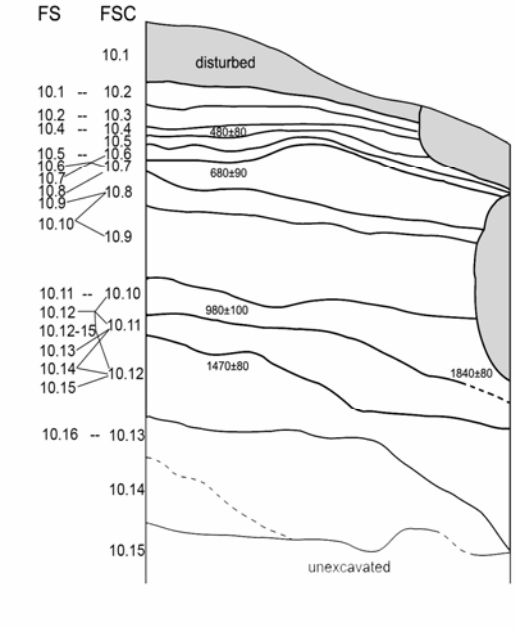

Figure 3: Stratigraphic Profile of Unit FS 10 (after Luebbers 1978:24).

The layers shown in Figure 3 are those assigned following the excavation. The faunal samples are provenienced according to Field Strata 1-16. The correspondence, derived from Luebbers's (1978:20) Figure 14, between the field strata designations and the layers defined after the excavations is shown in the right hand column on Figure 3 and in the second column in Table 1. The lack of one to one correspondence between the strata designations is somewhat confusing, but we use the field proveniences of the fauna in our analyses and subsequent discussions. Their rough correspondence with the stratigraphic divisions assigned later provides an adequate coarse-grained temporal sequence for the interpretation of faunal trends over the last 2000 years.

The entire excavated matrix was screened by water under pressure directed through two screens. The finest mesh was 2 mm. Although this screen should have retained a large quantity of herring bones, it is clear that these were not recovered in representative numbers. Auger sampling undertaken in 1994 (Cannon 2000) showed that herring were numerous in all areas of the Namu midden (Table 2). A combination of insufficient time for the recovery of these numerous small remains, poor visibility among the large quantities of fine shell fragments, and destruction and loss of small bones because of the strong water pressure was likely responsible for the poor recovery of herring. We could also expect these factors to have affected recovery of the small bones of other fish, such as greenling. As similar considerations affected the field recovery of fish bones in 1977-78, we can only assume that the recovery of fish remains was comparable to that from the water-screened portions of the SFU excavations.

We gained access to the FS 10 fish fauna collection fortuitously. It was among other materials from the University of Colorado excavations that had been sent to be archived at the Department of Archaeology at SFU, and were included in a shipment of Namu fauna from SFU to McMaster University. The remains were still in their original field collection bags with the provenience information written on the outside. Not all of the strata recorded for Unit FS 10 were represented among the bags of fish remains. There were no bags for Field Strata 3, 8, 12, or 17, and we presume that either these have gone missing in the years since 1970 or materials assigned to these strata were incorporated into contiguous assemblages. Field Strata 3 and 8 appear to have been very thin and only tentatively identified. Field Stratum 3 did not produce any mammalian faunal remains (Hester and Nelson 1978:124). Field Strata 8 and 12 did produce substantial mammalian assemblages, and presumably fish as well, but these were not available for study and are presumed lost. Field Stratum 17 is not listed in the analysis of mammal remains, and it is likely that materials from this layer were incorporated into those collected as part of Field Stratum 16.

Stratigraphic control in the recovery of fauna appears to have been reasonably well maintained, but the lack of complete correspondence between field and assigned stratigraphic designations means that there is considerable temporal overlap among some of the individual

faunal assemblages. The difficulty in assigning materials to individual strata was also clearly recognized in the field, since one bag included material from Strata 12-15. Layers below Field Stratum 17 were not excavated due to the presence of groundwater (Luebbers 1978:30). Stratum 1 deposits reportedly contained materials dating from the early 20th century, but we include the fish from this stratum in our totals for Period 6.

Luebbers provides a total of five radiocarbon dates from the Front Trench. The earliest is 1840±80 radiocarbon years bp for Field Stratum 11, but this overlies Assigned Stratum 12 from which a column sample yielded a date of 1470±80 rybp. Luebbers (1978:62-64) was unable to account for this discrepancy, but suggested stratigraphic mixing in the excavation. He suggested the later date could apply to Field Stratum 10 and the earlier date to Field Stratum 12, although a two sigma calibration of the two dates brings them to within thirty years of one another at around AD 400. These and the other dates from this unit (Figure 3) have been used to suggest more or less continuous deposition in this area of the site from ca. 2000 years ago up until the time of European contact. Although there are no dates from the lowest stratum in Unit FS 10, Luebbers (1978:30) noted the overlap in dates between the upper layers at the rear of the site and the lower layers in FS 10 at around 1900 rybp and noted their similarities in texture, content, and morphology. Our attribution of all the material from this unit to the last 2000 years of site occupation is based on the observations of Luebbers, but we acknowledge the possibility that material from the earliest excavated layer, Field Stratum 16, may date somewhat earlier than this.

Nadia Densmore identified the FS 10 fish remains under the supervision of Aubrey Cannon, using the comparative collection of the McMaster University Fisheries Archaeology Research Centre. The comparative collection is equal in breadth to the collection used by Cannon in 1977-78 in the identification of the fauna from the SFU excavations. As in the earlier analysis, the identifications in Table 1 are reported at the family level for the cods (Gadidae), flatfish (Pleuronectidae), greenlings (Hexagrammidae), skates (Rajidae), and sculpins (Cottidae); the genus level for salmon (*Oncorhynchus*) and rockfish (*Sebastes*); and the species level for ratfish (*Hydrolagus colliei*), dogfish (*Squalus acanthias*), herring (*Clupea harengus pallasii*), and sablefish (*Anoplopoma fimbria*). Other clearly identifiable species were observed within families (e.g. occasional halibut among the Pleuronectidae and lingcod among the Hexagrammidae), but no systematic effort was made to identify species of flatfish, cod, or greenling. The level of identifications reported in Table 1 are the same as those reported by Cannon (1991). Table 1 also shows a category of potentially identifiable but unidentified elements. In most cases these are small fragments of elements, for which taxonomic identification was uncertain or which were eroded or otherwise difficult to identify to element. In a small number of cases these are clearly identifiable elements of taxa that were not available in the comparative collection. Again, we report this category to remain consistent with Cannon's (1991) original report.

Field Stratum	Defined Stratum	Rajidae	*Squalus acanthias*	*Hydrolagus colliei*	*Clupea harengus pallasii*	*Oncohynchus*	Gadidae	*Sebastes*	*Anoplopoma fimbria*	Hexagrammidae	Cottidae	Pleuronectidae	Non-id
10.1	10.2	0	28	20	0	930 (77.37)	72	78	8	61	0	5	140
10.2	10.3	1	18	0	7	749 (80.19)	39	62	21	31	0	6	79
10.4	10.4	0	7	5	1	695 (92.54)	7	11	13	9	0	3	37
10.5	10.6	0	2	2	0	483 (97.38)	3	5	0	1	0	0	9
10.6	10.6-7	0	1	12	0	739 (95.60)	10	5	0	3	0	3	15
10.7	10.6-7	1	4	16	0	1659 (97.30)	7	5	10	3	0	0	26
10.9	10.8	0	4	68	7	369 (75.15)	9	15	3	13	0	3	31
10.10	10.8-9	0	1	2	0	256 (54.93)	4	192	1	7	0	3	15
10.11	10.10	0	72	173	26	1653 (67.28)	269	5	80	160	0	19	344
10.12-15	10.10-12	0	1	7	0	181 (88.29)	8	5	0	1	0	2	4
10.13	10.11	1	7	40	0	1444 (86.42)	18	128	3	22	0	8	121
10.14	10.11-12	0	3	8	0	258 (88.97)	2	13	2	3	0	1	12
10.15	10.12	0	0	2	0	82 (92.13)	3	1	0	1	0	0	95
10.16	10.13	0	0	0	0	116 (100.0)	0	0	0	0	0	0	0

Table 1: Representation of identified fish taxa in excavation Unit FS 10 by stratum (values are NISP, except for *Oncorhynchus*, which includes NISP and the percentage of all identified fish specimens).

Site Area	Years Excavated	Auger Samples[1]	Sample Volume (l)	Herring NISP	Herring NISP/Litre
Rivermouth	1978, 1994	C, D, E, F	32.0	1331	41.6
Central	1968-70, 1977	G, H	11.5	298	25.9
Front	1970	I, J	19.2	769	40.0

[1] See Cannon (2000: Figure 2) for locations of excavation units and auger samples.

Table 2: Frequency and density of herring remains in auger samples collected in 1994 from locations adjacent to areas of excavation at Namu.

Our objective is to supplement, for comparative purposes, the data relating to the latest period of site occupation. We concluded there was little value in achieving a finer level of identification and reporting for this latest period without undertaking a similar level of analysis and reporting for the entire 1977-78 fish fauna. Although potentially interesting, even in isolation, finer resolution in fish identification for this one unit did not warrant the extra investment of time and expense.

Interpretations

Stratigraphic Variability within Unit FS 10

We took advantage of the stratigraphic resolution and associated dates available for the Front Trench to look at the potential for variation and trends within the fishing economy over the past 2000 years. Accepting the potential for errors in the assignment of fauna to particular strata and taking into account the issue of the inverted dates for Field Strata 11 and 15, the overall patterns seem quite clear. Generally, the fauna from each stratum are consistent with respect to the main emphases of the site fisheries. Salmon predominate in all strata, but vary between 55 and 100% of the fish remains. The general pattern through time suggests that the decline of the salmon fishery, which began ca. 2000 BC and is attributed to periodic failure of the pink salmon fishery (Cannon and Yang 2006), continued through the first 1000 years of Period 6, following which the proportions of salmon rebounded to levels (92-97%) comparable to those observed in Periods 3 and 4 (97%). Further ancient DNA analysis is now underway to determine if this recovery in the salmon fishery is attributable specifically to the recovery of the pink salmon fishery. If so, further dating will be undertaken to refine the temporal resolution of the disruption and apparent recovery of the fishery.

The early strata in Unit FS 10 that show relatively low numbers of salmon remains also show relatively high numbers of ratfish. The clear inverse relationship between salmon and ratfish in this unit mirrors that documented in other parts of the site, and adds support to the conclusion that increased use of this marginal fish resource represents an effort to compensate for failures of the staple salmon fishery (Cannon 1995). A range of other fish are also abundant in strata lacking in salmon (see below), but the low food value of ratfish and its proportionately greater abundance in all deposits that lack salmon is the basis for describing this particular species as a marginal resource of last resort. Evidently, it was only appreciably valued at times when there was a need to compensate for a shortage of salmon.

The results of auger sampling in 1994 from the vicinity of the Front Trench show that small fish remains such as herring, greenling, and anchovy are under-represented in the fish recovered from the 1970 excavation (Cannon 2000). This is especially the case for herring (Table 2). Analysis of bulk samples in 1978 showed that this pattern of biased recovery against the bones of small fish occurred during the 1977-78 excavation (Fawcett 1991).

Within the framework of faunal recovery in 1970 and 1977-78, and apart from the major fluctuation in the numbers of

salmon and ratfish over time, the fish from Unit FS 10 show remarkable consistency both between strata and overall, in relation to the fish recovered from other parts of the site. The one major exception is Field Stratum 11, dated to ca. AD 500-1000, which contained an exceptionally large number of cod, sablefish, greenling, and rockfish bones in addition to the large number of ratfish. In some respects, this diversity is a continuation of a pattern evident in Period 5 deposits, when salmon begin to show an overall decline, though this is difficult to verify on the basis of percentage figures given that the percentage representation of other fish would necessarily increase as the percentage of salmon declined. What is unusual about the Stratum FS 10.11 fish remains is the very large numbers of fish other than salmon and the completely unprecedented numbers of sablefish, which is never more than an occasionally occurring species at any other time. This stratum also contained an unusually large number of unidentified fish remains, which is probably a further indication of species diversity.

If the fish remains in Field Stratum 11 represent diversification of the fishing economy in response to failures in the salmon fishery, it is difficult to understand why the pattern was not sustained in subsequent periods when numbers of salmon remained relatively low. It may have been the observation of fish bones from this stratum that led Hester (1978:102) to suggest that this period saw the peak in the local fishing economy. We can only speculate that the diversity of fish from this stratum represents a short-lived response to periodic salmon failure, perhaps its worst period, but apparently this diversification of fishing was not sustained over the long term.

A Revised Assessment of the Period 6 Fisheries

Table 3 shows the revised NISP and percentage representation figures for the Namu fish fauna based on the materials recovered from excavations in various areas of the site in 1977-78 (Cannon 1991:18) and from Unit FS 10 in 1970. The total number of identified fish from Period 6 is now comparable to that for other periods from the last 7000 years of the site's occupation.

The picture that emerges from the late period fisheries based on these revised figures is not radically different in most respects from patterns observed in other periods or that evident from the small numbers of fish remains recovered in 1977-78, although there are some important differences. The percentage of salmon in Period 6 is well below the peak levels exhibited in Periods 3 and 4, and is still the lowest overall percentage of any period, consistent with earlier interpretations that Periods 5 and 6 represented times of at least periodic shortfall in salmon production. The difference is that salmon only represented 67.0% of the 567 fish remains originally reported for this period. The revised percentage of 81.8% is a much more modest decline and is also consistent with the results of auger sampling that showed a less dramatic decline in salmon in the Period 6 deposits (Cannon 2000).

	Period 2 5-4000BC		Period 3 4-3000BC		Period 4 3-2000BC		Period 5 2000BC- AD1		Period 6 AD1-Contact		Period 6 + Unit FS 10	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Rajidae	1	0.02	0	0.00	5	0.001	3	0.03	0	0.00	3	0.02
Squalus acanthias	74	1.15	37	0.21	49	0.08	73	0.65	17	3.00	165	1.35
Hydrolagus colliei	59	0.92	70	0.39	76	0.12	254	2.26	69	12.17	424	3.47
Clupea harengus pallasii	28	0.44	33	0.19	366	0.60	48	0.43	0	0.00	41	0.34
Oncorhynchus sp.	5720	89.17	17272	97.15	58940	96.82	9509	84.77	380	67.00	9994	81.82
Gadidae	81	1.26	54	0.30	296	0.49	86	0.77	45	7.93	496	4.06
Sebastes sp.	318	4.96	210	1.18	755	1.24	815	7.27	41	7.23	566	4.63
Anoplopoma fimbria	4	0.06	16	0.09	19	0.03	48	0.43	1	0.18	142	1.16
Hexagrammidae	79	1.23	28	0.16	172	0.28	215	1.92	5	0.88	320	2.62
Cottidae	3	0.05	1	0.01	15	0.02	19	0.17	0	0.00	0	0.00
Pleuronectidae	48	0.75	58	0.33	185	0.30	147	1.31	9	1.59	62	0.52
Unidentified	53		73		64		110		18		946	
Total Identified	**6417**		**17782**		**60882**		**11222**		**567**		**12214**	

Table 3: Representation of fish taxa as total NISP and percentage of identified fish by time period.

A larger sample would be expected to moderate extremes in variation, but the stratum by stratum comparison also allows us to determine that Period 6 includes deposits with the lowest numbers of salmon, possibly indicating the period of greatest crisis in the salmon fishery, and deposits with salmon in numbers comparable to their peak in earlier periods, suggesting overall recovery of the fishery by the latter half of Period 6. The small volume of Period 6 deposits excavated in 1977-78 and the small number of fish reported from those excavations were not sufficient to show this pattern.

The addition of data from Unit FS 10 also makes it possible to characterize fisheries other than salmon as generally comparable to those in place throughout the last 7000 years. The range and relative emphasis on different categories of fish are remarkably similar in all periods. The major exceptions in Period 6 are the numbers of ratfish, rockfish, and greenling, which are comparable to their high levels in Period 5, and the exceptionally large numbers of cod and sablefish, which can be attributed entirely to the unusually large numbers of their remains in Stratum FS 10.11. Herring, which is completely under-represented in the figures in Table 3, would have been numerically predominant in all periods of site occupation (Cannon 2000). Based on the results of auger sampling, it appears that the intensity of the herring fishery remained consistent throughout the past 7000 years.

It is difficult to find support in the fish fauna for any interpretation that would posit a shift in the pattern of site use during the last 1000 years. In contrast to observed distinctions in strata, features, artifacts, and mammalian faunal remains (Conover 1978:98), our data show consistency among most fisheries over the past 2000 years. Fisheries are also generally comparable with those from

other periods, especially following the apparent recovery of the salmon fishery. It seems more likely that apparent distinctions in strata and features and in the density of fauna and artifacts are a function of the recent accumulation of the later site deposits. It is possible that greater compaction over time would have obscured the particular stratigraphic and feature characteristics observed in the upper portions of Unit FS 10 and resulted in a greater density of both fauna and artifacts.

Conclusions

The fish remains from Unit FS 10 have provided a larger and more representative sample of fish from the last 2000 years of the Namu site occupation, which is consistent with the diversity and emphasis of local fisheries throughout the last 7000 years. Although these included a wide range of taxa typical of Northwest Coast sites, the emphasis among larger fish was clearly on salmon in all periods. Herring, which were under-represented in the recovered remains, were numerically predominant in all periods. In comparison to herring and salmon, all other fish would have to be described as relatively minor components of the overall subsistence economy, though potentially of more or less importance at different times of year or in relation to periodic shortages of subsistence staples.

The larger sample of identified fish from Period 6 confirms the continued decline in salmon, but not to the extent suggested in earlier analysis. The revised data show continuing decline from Period 5 to the lowest percentages of salmon in any period in the lower strata of Unit FS 10, followed by recovery of the salmon fishery after ca. AD 1000 to the peak levels observed in Periods 3 and 4 (4-2000 BC). The fish remains from Period 6 also confirm consistent use of marginal resources such as ratfish to compensate for salmon shortages, and indicate efforts to diversify the local fishery by increasing emphasis on rockfish, cod, sablefish, and greenling, particularly during the period of the FS 10.11 deposits.

Despite problems in controlling for the recovery of fish remains in 1970 and concerns about the integrity of the samples in the decades since the excavation, the data we have been able to derive from this assemblage represent an additional dimension of information on the history of fisheries at the Namu site. These new data provide the first full picture of the last 2000 years as well as the basis for a more balanced overview of the 7000-year history of fishing at Namu.

Acknowledgments

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