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Implications of Nutritional Potential of Anadromous Fish Resources of the Western Snake River Plain[1]

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THE presence of anadromous fish resources in southwestern Idaho provides a major basis for archaeological interpretations of the prehistory of the western Snake River area (see Butler 1978; Pavesic 1978; Swanson 1965). These interpretations are based on ethnographic accounts (e.g., Steward 1938; Liljeblad 1957; Murphy and Murphy 1960) portraying spring/summer and fall salmon runs as the focal point of an otherwise transhumant pattern emphasizing unspecialized plant resource use. Salmonid resources in southern Idaho in this context have been viewed equal to other regionally important Great Basin resources such as piñon (Pavesic 1978). Clearly, as indicated by fish weirs along the Middle Snake River (Meatte 1982, 1983; Butler 1983), native populations invested considerable energy in exploitation of fish resources. This emphasis, however, stands in contrast to ethnohistoric accounts of Snake River Shoshoni (Frémont 1887; Steward 1938) who depended heavily on supplies of stored salmon during the winter months. These accounts describe starving aboriginal groups awaiting the first spring salmon, a situation inconsistent with the magnitude of the resource and its ethnohistorically documented exploitation. This raises questions regarding the nutritional value of the resource. The purpose of this paper is to evaluate the food potential of salmon for native populations by examining an historic fisheries harvest, calculating its food potential and assessing variables affecting loss of nutritional value.

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ANADROMOUS RESOURCES

Prior to construction of dams and water control systems in the Northwest, anadromous fishes were found as far east in the Snake River as Shoshone Falls, near the modern city of Twin Falls (Evermann 1896, 1897; see also Steward 1938). Anadromous fishes are also known to have migrated into the Owyhee River (Evermann 1896, 1897); the Bruneau River west of Shoshone Falls (Gilbert and Evermann 1894), and into the Jarbidge River, a tributary of the Bruneau, through which they entered northern Nevada (La Rivers and Trelease 1952: 113).

Salmonid runs in southern Idaho occurred three times a year. During March and April the runs were largely of steelhead trout, *Salmo gairdnerii,* called *tahma agai* 'spring salmon' (Steward 1938: 167). The second run, in late spring-early summer, usually began in May or June. It consisted of the chinook salmon, *Oncorhynchus tshawytscha,* locally called *taza agai* 'summer salmon' (Steward 1938: 167). The fall run of salmon, *yuva agai* (Steward 1938: 168), occurred between September and November and was largely chinook (Fulton 1968).

During all runs, fish were acquired by various methods including spearing, trapping, netting, and the use of weirs (e.g., Steward 1938; Liljeblad 1957; Murphy and Murphy 1960). Fishing was sometimes a cooperative effort with coordination relegated to a director (Steward 1938: 167).

ARCHAEOLOGICAL EVIDENCE

Though great importance has been attached to the aboriginal use of anadromous fish resources in southwestern Idaho, little archaeological evidence has been reported to substantiate these interpretations. Only four southern Idaho sites have produced fish remains. While fish remains from three of these sites have been identified to species, only two of the sites are located on the Snake River. Fish remains have been recovered from Shellbach Cave (Shellbach 1967) located on the Snake River south of Boise (Fig. 1). Although they have not yet been positively identified, it is probable that a number of large caudal vertebrae from the site belong to chinook salmon. In addition to fish remains, evidence of fishing equipment was recovered (Shellbach 1967). To the south, evidence of steelhead trout (*Salmo gairdnerii*) was recovered from Nahas Cave (Plew 1980b), located on a secondary tributary of the Owyhee River (Fig. 1). Here, salmon, suckers (Catostomidea), and possible sculpins (Cottidae) occur in deposits dating from ca 4990 B.P. into the late prehistoric period (Plew 1980b: 130). Chinook salmon remains also have been recovered from Deer Creek Cave in northern Nevada (Follett 1963).

Two sites, 10 GG 1 and 10 TF 352, situated on opposite banks of the Snake River approximately 40 miles west of Shoshone Falls, produced the largest assemblage of fish remains recovered archaeologically in southwestern Idaho. Occupation of these sites spans ca. 4000 years (Plew 1981b). Site 10 GG 1 consists of four contemporary components and dates post-A.D. 1200 (Plew 1981b: 68). Site 10 TF 352 contains two separate components, the earliest a Humboldt component dating ca. 4000-700 B.C., and a later Rose Spring-Eastgate component dating ca. A.D. 600-1200 (Plew 1981b: 72-73).

Approximately 700 fish remains were recovered from 10 GG 1 and 10 TF 352. The identified remains suggest heavy salmonid use (see Plew 1981b: 152-156; Huelsbeck 1981). In the case of 10 GG 1, 86% of the remains were identified as salmonid, probably chinook (Plew 1981b: 155). The additional 14% were catostomids and identified nonsalmonids, including the northern squawfish (see Table 1).

Fish remains recovered from southwestern Idaho are compiled in Table 1. Although the number of sites and recovered specimens are few, present archaeological evidence does confirm the regional use of salmonids for at least the last 5000 years.

HARVESTING POTENTIALS: THE HISTORIC LIBERTY MILLET'S FISHERY

Critical to understanding the importance of anadromous fish resources in southwestern Idaho is determination of the relative abundance and efficiency of potential harvests. This is particularly important since few data are available concerning fisheries in southern Idaho. To illustrate these potentials, the fish harvest at the historic Liberty Millet's fishery was examined for the year 1894 (Evermann 1896).

The Liberty Millet's fishery is located just below Upper Salmon Falls, an area considered a major fishery in the regional ethnohistoric literature (e.g., Steward 1938). At the request of Barton Evermann (see Evermann 1896), representative of the U. S. Fish Commission, Millet's fishery was harvested daily during the period September 29 through November 1,

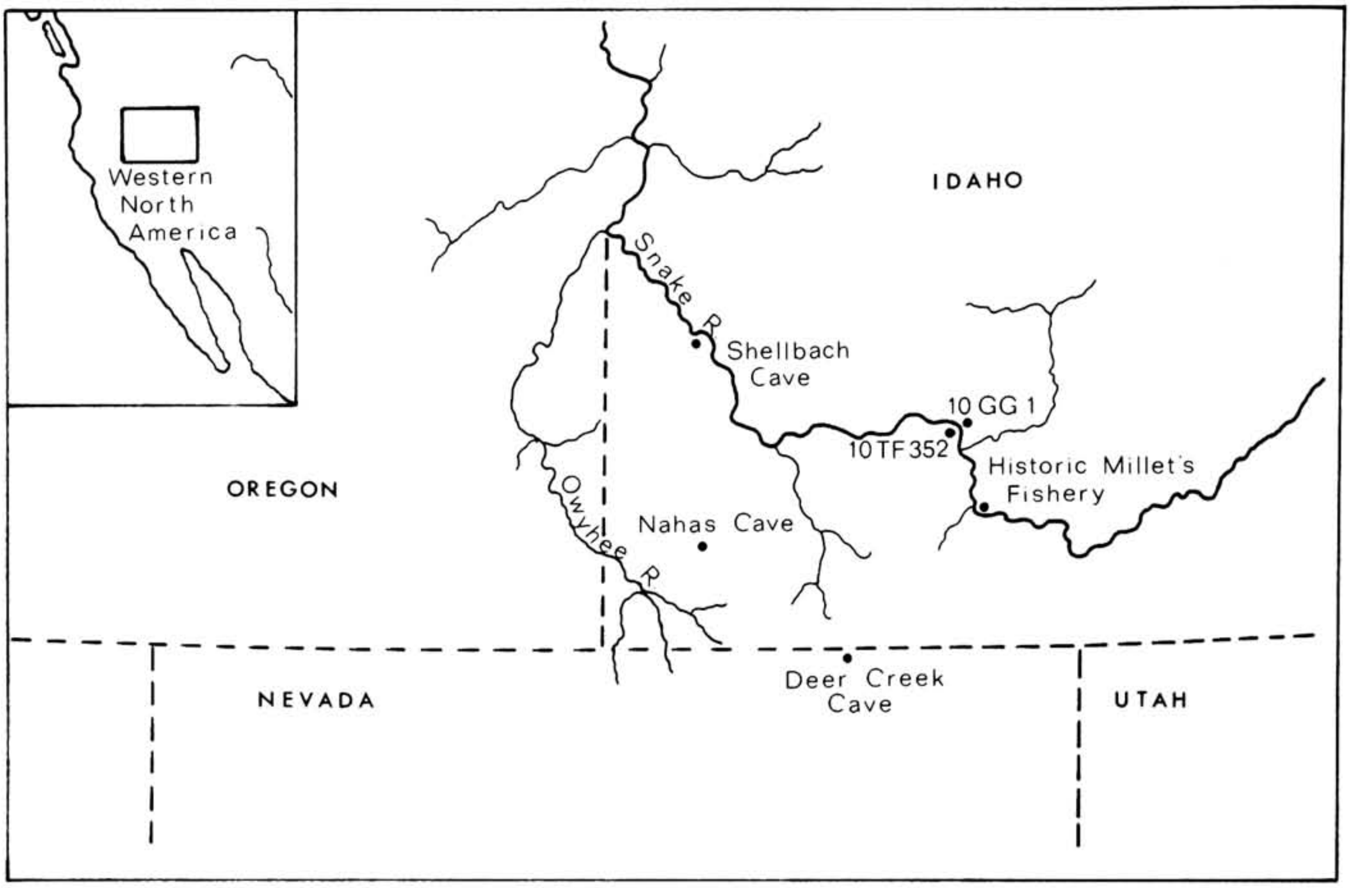

Fig. 1. Location of sites containing fish remains discussed in the text.

Table 1
IDAHO ARCHAEOLOGICAL SITES CONTAINING FISH REMAINS

Site	Number of Specimens	Number of Individuals	Species Represented	Associated Radiocarbon Dates	References
Nahas Cave	11	11	*Catostomus columbianus* *Cottus bairdii* *Salmo gairdnerii*	350 ± 70 B.P. (TX-3635)[1] 1100 ± 80 B.P. (TX-3642) 1410 ± 200 B.P. (TX-3643) 2990 ± 70 B.P. (TX-3636) 5990 ± 170 B.P. (TX-3644)	Plew 1981a
10 GG 1	528	?	*Oncorhynchus tshawytsha* *Ptychocheilus oregonensis* *Mylocheilus caurinus* Unidentified catostomid/ cyprinid remains	250 ± 110 B.P. (RL-1501)[2] 300 ± 110 B.P. (RL-1498) 500 ± 100 B.P. (RL-1503) 900 ± 140 B.P. (RL-1502) 1140 ± 120 B.P. (RL-1500)	Plew 1981b
10 TF 352	75	?	Unidentified salmonid/ catostomid remains		Plew 1981b
Shellbach Cave	?	?	Possible chinook salmon		

[1]Radiocarbon determinations by the Radiocarbon Laboratory, University of Texas, Austin.

[2]Radiocarbon determinations by Radiocarbon Limited, Lampasas, Texas.

1894, excepting a four-day period between October 6 and October 10. The harvest was conducted by two men using a small boat and a seine 300 feet long, 14 feet deep in the center, and 10 feet deep at the wings. They harvested a spawning bed 14-20 feet deep and 325 feet long (Evermann 1896: 265). The results of this harvest are contained in Table 2. The total weight of each day's harvest has been calculated and shows the most prolific harvest occurring during middle and late October. Weight range for the salmon, most of which were males, is 2.5-39 pounds, with the average near 15 pounds per fish. Though the time spent in each day's harvest is not documented for the controlled harvest reported by Evermann (1896), Millet reported having caught as many as 200 fish in a single haul (Evermann 1896: 265). In this context, it is noteworthy that native peoples used seines and reed boats in fashion comparable to that described by Evermann (1896; see also Frémont 1887: 249-252; Steward 1943).

NUTRITIONAL POTENTIALS

As noted, ethnohistoric accounts frequently characterize Snake River Shoshoni as impoverished groups struggling to survive winter months. The availability of salmon as a major resource appears to contradict such ethnographic accounts in view of the food value of salmon. Table 3 shows the food value of raw and smoked salmon (USDA Handbook No. 8; see also Burton 1976). Though most local salmon was dried, these figures do demonstrate relative values. Caloric values were calculated for smoked salmon since various factors may affect the overall energy value. Based on figures given in Table 3, an average smoked salmon (15 pounds) would possess a caloric value of 6804. The caloric value for the Millet's fishery harvest of 13,023 pounds is 5,907,233 calories. Aboriginally, this would have provided a significant resource base. Using minimum daily nutritional

Table 2

WEIGHT SUMMARY OF CHINOOK SALMON CATCH AT LIBERTY MILLET'S FISHERY, UPPER SALMON FALLS, IDAHO SEPTEMBER 29 TO NOVEMBER 1, 1894

Date	Males	Females	
October 2	176.25	20.00	
October 3	32.50		
October 4	128.00		
October 5	155.75		
October 6	93.00		
October 10	201.75		
October 11	281.00	34.00	
October 12	158.50	42.00	
October 13	287.00	80.50	
October 14	712.00	88.00	
October 15	324.50	70.00	
October 16	552.25	178.00	
October 17	451.50	88.00	
October 18	437.00	125.25	
October 19	1,003.00	342.50	
October 20	1,153.50	213.75	
October 22	906.25	117.00	
October 23	1,387.00	967.25	
October 24	148.24	12.00	
October 25	360.00	175.25	
October 26	417.00	149.75	
October 27	495.75	130.50	
October 31	149.00	105.50	
November 1	93.50		
TOTAL	10,104.25 lbs	2,919.25 lbs	13,023.50 lbs

Table 3

COMPOSITION OF SALMON PER 100-GRAM UNIT[1]

	Raw Salmon (Chinook-King)	Smoked Salmon
Caloric Value	222.00	176.0
Protein	19.10	21.6
Fat	15.60	9.3
Ash	1.10	9.4
Calcium	0	14.0
Phosphorus	301.00	245.0
Iron	0	0
Sodium	45.00	0
Potassium	399.00	0
Vitamin A	310.00	0
Thiamine	0.10	0
Riboflavin	0.23	0
Niacin	0	0

[1] From Watt and Merrill, 1963, The Composition of Foods. USDA *Agricultural Handbook* No. 8.

requirements (National Research Council, Food and Nutrition Board 1973) and assuming a resource base comparable to the Millet's fishery harvest, it is possible to calculate resource potential for winter use. A fish harvest comparable to Millet's fishery would easily provide, at 2200 calories per day for adult males (National Research Council, Food and Nutrition Board 1973), the needs of ca. 30 persons for 90 days, equivalent to the critical mid-December to mid-March period. Though minimum daily nutritional requirements for other elements would not be met by salmon use, these could have been easily met through cached foodstuffs and foods acquired during winter months.

This does not, however, explain the apparent food shortages experienced by many native groups during the winter period. Though few researchers (e.g., Schalk 1977) have considered the importance of variables affecting the aboriginal importance of anadromous fish resources, these variables must be taken into account. Among these variables are fluctuations in annual and semiannual fish populations entering the Snake River; the duration of or length of runs; productivity of fishing technology and the nature and efficiency of preparation and storage (cf. Schalk 1977). With regard to the nutritional values of anadromous resources, questions regarding the efficiency of preparation and storage and calculation of caloric values are extremely important. The majority of the salmon harvested aboriginally on the Snake River in southwestern Idaho appear to have been prepared for storage by drying (e.g., Frémont 1887; Steward 1938). Caloric values available for salmon have been calculated for raw and smoked salmon (see Table 3). Although the effects of the processes of drying and smoking on the nutritional value of salmon have been largely ignored, Cutting (1962) suggests that drying does not substantially alter the nutritive value. Smoked salmon, however, suffers losses of vitamins A, B-1, Niacin, and Pantothenic acid, while retaining much of its caloric value (Cutting 1962; Taarland et al. 1958). This, however, is of limited importance in southern Idaho where most fish were dried (Steward 1938).

Table 4
ENERGY EXPENDITURES OF STUART AND CHILKO LAKES SOCKEYE SALMON[1]

	Stuart Lake Sockeye		Chilko Lake Sockeye	
	Males	Females	Males	Females
Fat Loss	91%	96%	77.6%	91.4%
Protein Loss	31%	53%	42 %	61 %
Total Caloric Expenditures	1398	1644	1293	1903

[1] From Idler and Clemens (1959).

An additional problem of significance to consideration of the importance of nutritional values of salmon on the western Snake River Plain, are energy expenditures of salmonids during spawning migrations (Idler and Clemens 1959; Kukucz 1962). Idler and Clemens (1959) documented significant energy losses in sockeye salmon migrating up the Fraser River to Stuart and Chilko lakes, British Columbia. The Stuart Lake migration totaled 635 miles while the Chilko Lake migration was a shorter 370 miles. During these runs, the salmon suffered significant energy losses (see Table 4). Stuart Lake sockeye expended 91-96% of their fat reserves compared with 77.6-91.4% of the fat reserves of Chilko Lake salmon. In addition, protein losses for Stuart Lake salmon amounted to 31% for males and 53% for females (Idler and Clemens 1959). Kukucz (1962: 76) also observed fat and protein loss in sea trout (*Salmo trutta*) undertaking a 1000 kilometer migration in the Vistula River. Fat loss during the spawning migration was 80-85%, while protein loss amounted to approximately 15% of premigration values. Overall weight was substantially decreased (Kukucz 1962: 76). These runs approximate the length of the spawning migration of salmonids into the upper Snake River in southwestern Idaho. Clearly, the significant losses in fat and protein noted by Idler and Clemens (1959) suggest that nutritional values of southern Idaho salmon may have been substantially less than suggested by the magnitude of historic fisheries' harvests and caloric values calculated for salmon from Pacific fisheries (cf. Watt and Merrill 1963). Further, native harvests appear to have been consistently smaller than commercial fisheries' harvests (Hewes 1973).

CONCLUSIONS

This paper has described archaeological occurrences of salmon in southwestern Idaho, the historic Millet's fishery harvest of 1894, and variables affecting the nutritional potential of comparable aboriginal harvests. These form the basis for the following conclusions:

(1) Archaeological evidence suggests use of salmonids in southwestern Idaho during the last 5000 years.

(2) Salmon, while a prolific and easily extractable resource, were probably never harvested in quantities comparable to productivity of historic/modern commercial fisheries.

(3) Variables including techniques of preparation (e.g., drying and smoking), and, in particular, energy expenditures during spawning migrations, may substantially alter the nutritive value of salmon, thereby reducing the food potential of fish taken at the end of spawning migrations.

(4) Although the abundance of salmon and its importance to the aboriginal economy of the Snake River Shoshoni are unquestioned, the resource should be viewed with scrutiny insofar as considerations of nutritional potential cannot be based upon simple calculations of raw catch weight and nutritional values calculated for salmon taken from Pacific fisheries. Further, ethnohistoric accounts may more correctly reflect the abundance of the resource than its quality. This paper does not question the importance of fishing or the time and energy expended in the exploitation of salmon by native peoples of the region. It does note possible nutritional deficiencies in the resource which are not implied by its abundance and the technology used to extract it. Finally, archaeological interpretations of southwestern Idaho prehistory that emphasize salmon fishing should place no greater emphasis on the archaeological and ethnohistoric records than they do on the biological and environmental variables affecting salmon resources.

NOTES

1. An earlier version of this paper was presented at the 36th Annual Northwest Anthropological Conference, Boise, Idaho, in a symposium entitled "Native Fishing on the Western Snake River Plain: Research and Perspective."

REFERENCES

Burton, Benjamin T.
1976 Human Nutrition. Third edition. New York: McGraw-Hill.

Butler, B. Robert
1978 A Guide to Understanding Idaho Archaeology: The Upper Snake and Salmon River Country (third edition). Boise: Idaho State Preservation Office.

1983 Southern Idaho Fisheries: The Fremont Connection. Paper presented at the 36th Annual Northwest Anthropological Conference, Boise.

Cutting, C. L.
1962 Influence of Drying, Salting and Smoking on Nutritive Value of Fish. In: Fish in Nutrition, Erich Heen and Rudolf Kruezer eds., pp. 161-179. London: Fishing News.

Evermann, Barton W.
1896 A Preliminary Report Upon Salmon Investigations in Idaho in 1894. Washington, D.C.: Bulletin of the U. S. Fish Commission 15: 253-284.

1897 A Report Upon Salmon Investigations in the Headwaters of the Columbia River and in the State of Idaho in 1895. Washington, D.C.: Bulletin of the U. S. Fish Commission 16: 151-202.

Follett, W. I.
1963 Fish Remains from Deer Creek Cave, Elko County, Nevada. In: Deer Creek Cave, Elko County, Nevada, by Mary Elizabeth Shutler and Richard Shutler, Jr., pp. 31-32. Nevada State Museum Anthropological Papers No. 11.

Frémont, John C.
1887 Memoirs of My Life, Including in the Narrative Five Journeys of Western Exploration During the Years 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1853, 1854. Chicago.

Fulton, Leonard A.
1968 Spawning Areas and Abundance of Chinook Salmon (*Oncorhynchus tshawytsha*) in the Columbia River Basin – Past and Present. Washington, D.C.: U. S. Fish and Wildlife Service Special Report No. 571.

Gilbert, Charles H., and Barton W. Evermann
1894 A Report Upon Investigations in the Columbia River Basin With Description of Four New Species of Fishes. Washington, D.C.: Bulletin of the U. S. Fish Commission 14: 169-207.

Hewes, Gordon W.
1973 Indian Fisheries Productivity in Pre-contact Times in the Pacific Salmon Area. Northwest Anthropological Research Notes 7(2): 133-155.

Huelsbeck, David R.
1981 Fish Remains from 10 GG 1 and 10 TF 352. In: Archaeological Test Excavations at Four Prehistoric Sites in the Western Snake River Canyon Near Bliss, Idaho, by Mark G. Plew, pp. 271-284. Boise: Idaho Archaeological Consultants Project Reports No. 5.

Idler, D. R., and W. A. Clemens
1959 The Energy Expenditures of Fraser River Sockeye Salmon During the Spawning Migration to Chilko and Stuart Lakes. International Pacific Salmon Fisheries Commission Progress Reports No. 6.

Kukucz, J. T.
1962 Effects of Biological Factors (Sex, Seasonal Races, Spawning Migrations) on Fat, Protein and Water, their Distribution in Sea-Trout. In: Fish in Nutrition, E. Heen and R. Kreuzer, eds., p. 76. London: Fishing News.

LaRivers, Ira, and T. J. Trelease
1952 An Annotated Checklist of the Fishes of Nevada. California Fish and Game 38(3): 226-240.

Liljeblad, Sven
1957 Indian Peoples of Idaho. Manuscript on file at the Idaho State College Museum, Pocatello.

Meatte, Daniel S.
1982 An Air-Photo Recording of Aboriginal Fish Weirs and Barrages Along the Middle Snake River: Preliminary Report 1982. Paper Presented at the 18th Great Basin Anthropological Conference, Reno.

1983 Distribution and Variation of Native Fishing on the Western Snake River Plain. Paper presented at the 36th Annual Northwest Anthropological Conference, Boise.

Murphy, Robert F., and Yolanda Murphy
1960 Shoshone-Bannock Subsistence and Society. University of California Anthropological Records 16: 229-338.

National Research Council Food and Nutrition Board
1973 Recommended Dietary Allowances. Eighth ed. Washington: National Academy of Sciences.

Pavesic, Max G.
1978 Ethnohistory and Cultural Ecology: A Study of Shoshonean Salmon Fishing. Paper presented at the 31st Annual Northwest Anthropological Association Meetings, Pullman, Washington.

Pavesic, Max G., and Daniel S. Meatte
1980 Archaeological Test Excavations at the National Fish Hatchery Locality, Hagerman Valley, Idaho. Boise State University Archaeological Reports No. 8.

Plew, Mark G.
1980a Archaeological Excavations at Big Foot Bar, Snake River Birds of Prey Natural Area, Idaho. Boise: Idaho Archaeological Consultants Project Reports No. 2.

1980b Fish Remains From Nahas Cave: Archaeological Evidence of Anadromous Fishes in

Southwestern Idaho. Journal of California and Great Basin Anthropology 2: 129-132.

1981a A Preliminary Report on Archaeological Excavations at Nahas Cave. Idaho Archaeologist 4: 1-7.

1981b Archaeological Test Excavations at Four Prehistoric Sites in the Western Snake Canyon Near Bliss, Idaho. Boise: Idaho Archaeological Consultants Project Reports No. 5.

Schalk, Randall B.
1977 The Structure of an Anadromous Fish Resource. In: For Theory Building in Archaeology, Lewis R. Binford, ed., pp. 207-249. New York: Academic Press.

Shellbach, Louis
1967 The Excavation of Cave No. 1, Southwestern Idaho. Tebiwa 10(2): 63-72.

Steward, Julian H.
1938 Basin-Plateau Aboriginal Socio-Political Groups. Washington, D.C.: Bureau of American Ethnology Bulletin No. 120.

1943 Culture Element Distributions: XXIII, Northern and Gosiute Shoshoni. University of California Anthropological Records 8(3): 263-392.

Swanson, Earl H., Jr.
1965 Archaeological Explorations in Southwestern Idaho. American Antiquity 31: 24-37.

Taarland, T., E. Mathiesen, E. Ousthaso, and O. R. Braekkan
1958 Nutritional Values and Vitamins of Norwegian Fish and Fish Products. Tidsskr, Hermetikind 44: 405.

Watt, Bernice K., and Annabel L. Merrill
1963 Composition of Foods. Washington, D.C.: United States Department of Agriculture, Agricultural Handbook No. 8.