Journal of California and Great Basin Anthropology
Vol. 14, No. 1, pp. 72-84 (1992).

Inland Utilization of Marine Fishes by Native Americans along the Central California Coast

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WHEN remains of fishes are excavated from archaeological sites found within the current geographic range of those species, the simplest explanation for their presence is that the fish were caught locally. As examples of local capture, Miller and Smith (1984:61) found nearly all the expected Colorado River species at Stanton's Cave, Grand Canyon, Arizona, and Schulz and Simons (1973:107) found all the large lowland California Central Valley fishes at their Stone Lake site (CA-SAC-145). Fish remains found outside the current geographic range of a species require additional interpretation. Minor environmental fluctuations have been used to explain the presence of normally warm-water marine yellowtail (*Seriola lalandi*) and bonito (*Sarda chiliensis*) as far north as Monterey Bay, California and at Mission La Soledad in Monterey County (Salls 1989:267). A different habitat with stronger stream flow than at present in the headwaters of the Verde River may have been responsible for the presence of razorback sucker (*Xyrauchen texanus*) at ASU site N-4-2 in Arizona (Minckley and Alger 1968:93). The blue sucker (*Cycleptus elongatus*) remains from Rainbow House, Bandelier National Monument, New Mexico suggest the upper Rio Grande River was clearer, larger, and more stable when the fish remains were discarded than has been the case over the past century (Gelbach and Miller 1961:7). The former existence of a huge freshwater lake, Lake Cahuilla (or Lake LeConte), fed by the Colorado River, explains the abundance of native Colorado River fishes in what is now a desert region of the Salton Basin of California (Hubbs and Miller 1948; Gobalet 1992).

Range extensions of now extirpated or extinct fishes can explain the presence of humpback chub (*Gila cypha*) at Catclaw Cave on the lower Colorado River, Mohave County, Arizona (Miller 1955:125); longnose gar (*Lepisosteus osseus*) at Chaco Canyon National Monument, northern New Mexico, and in the upper Rio Grande River (Gehlbach and Miller 1961: 3); thicktail chub (*Gila crassicauda*) at CA-MNT-229 on Elkhorn Slough in the Salinas River of coastal central California (Gobalet 1990a:684), and Sacramento perch (*Archoplites interruptus*) at CA-ALA-483 along Alameda Creek, Alameda County, California (Gobalet 1990b:244).

When appropriate fish habitat is at a considerable distance, trade may account for the occurrence of fishes in archaeological sites. Kelly (1932:97-151 cited in Follett 1980:119) used trade to explain the presence of cui-ui (*Chasmistes cujus*) at Surprise Valley, Modoc County, California, 241 km. from its likely source in the lower Truckee River. Follett (1984:74) noted that hardhead (*Mylopharodon conocephalus*) remains from CA-KER-733 in Antelope Valley, California were found on a major trade route, 64 km. from a likely source at Buena Vista Lake in the southern San Joaquin Valley. If, however, 137 km. was not too great a distance for the Northern Paiute of the Karlo site (CA-LAS-7) to obtain cutthroat trout (*Oncorhynchus clarkii*) or cui-ui from the lower Truckee River (Follett 1980:117, 119), 64 km.

is not an unreasonable distance to import fishes to Antelope Valley.

When exclusively marine fish remains are found inland from their species' natural habitat, it is clear that trade or importation has been undertaken. Dramatic examples of this are remains of marine fishes from the Gulf of Mexico found in archaeological sites in Mexico City (Edmundo Teniente-Nivon, personal communication 1992) and the marine species found in Cuzco in the Inca Empire in Peru. The purpose of this paper is to summarize numerous studies in which marine species have been found at prehistoric Native American archaeological sites inland from their probable location of capture and to discuss the presence of local freshwater fishes exploited at those sites. The geographic range considered is central California from Contra Costa County in the San Francisco Bay area, to Malibu Creek in Los Angeles County (Figs. 1 and 2). Some of these findings have been previously reported only in unreviewed reports not subjected to anonymous evaluation, and thus are not considered published.

METHODS AND MATERIALS

The identifications in this study are based on comparative materials in the collection at the Biology Department at California State University, Bakersfield supplemented by skeletons of the arroyo chub (*Gila orcutti*) from the Natural History Museum of Los Angeles County. Camm Swift identified the vertebral centra of shovelnose guitarfish (*Rhinobatos productus*) and shortfin mako (*Isurus oxyrinchus*) from CA-LAN-229. Identification of the shortfin mako tooth was based on a photograph in Huddleston and Barker (1978:25). Illustrations in Eschmeyer et al. (1983:16-18) were used to identify the teeth of the bigeye thresher (*Alopias superciliosus*), sevengill shark (*Notorynchus cepedianus*), and soupfin shark (*Galeorhinus zyopterus*). Illustrations of otoliths in Fitch (1972: 117-118, 1975:469) also were useful. Identifications based solely on published illustrations are tentative. The common and scientific names follow Robins et al. (1991).

Shark centra identified only as "requiem shark" (family Carcharhinidae) are probably leopard shark (*Triakis semifasciata*) but the centra are difficult to distinguish from those of soupfin shark, gray smoothhound (*Mustelus californicus*) or brown smoothhound (*M. henlei*), particularly without x-rays. Distinguishing between vertebrae of jacksmelt (*Atherinopsis californiensis*) and topsmelt (*Atherinops affinis*), family Atherinidae, is time-consuming and was judged not worth the effort for the purpose of this study. This was also true for vertebrae of Pacific herring (*Clupea pallasi*) and North Pacific sardine (*Sardinops sagax caerulus* [Hubbs et al. 1979:6]), family Clupeidae; numerous surfperches, family Embiotocidae; and numerous minnows, family Cyprinidae. The salmon centra recovered at CA-CCO-18 and CA-CCO-309 probably represent the chinook salmon (*Oncorhynchus tshawytscha*) because it is the most common of the five salmon species known to migrate through the Carquinez Strait to the Sacramento or San Joaquin rivers (Hallock and Fry 1967). The specific identifications of rockfishes made by Johnson (1982) and Follett (1963, 1965, 1969, 1973) have been expressed as *Sebastes* sp. to conform to my identifications. Due to the large number of morphologically and ecologically similar species within this genus, it is extremely difficult if not impossible to distinguish between them on the basis of fragmentary vertebrae. This is particularly true because studies on specific and ontogenetic variation of their skeletons are generally lacking. Site locations, dates of occupation, and minimum distance from marine resources are listed in Table 1. The remains were returned to the respective individuals or institutions listed in the Acknowledgements for deposition.

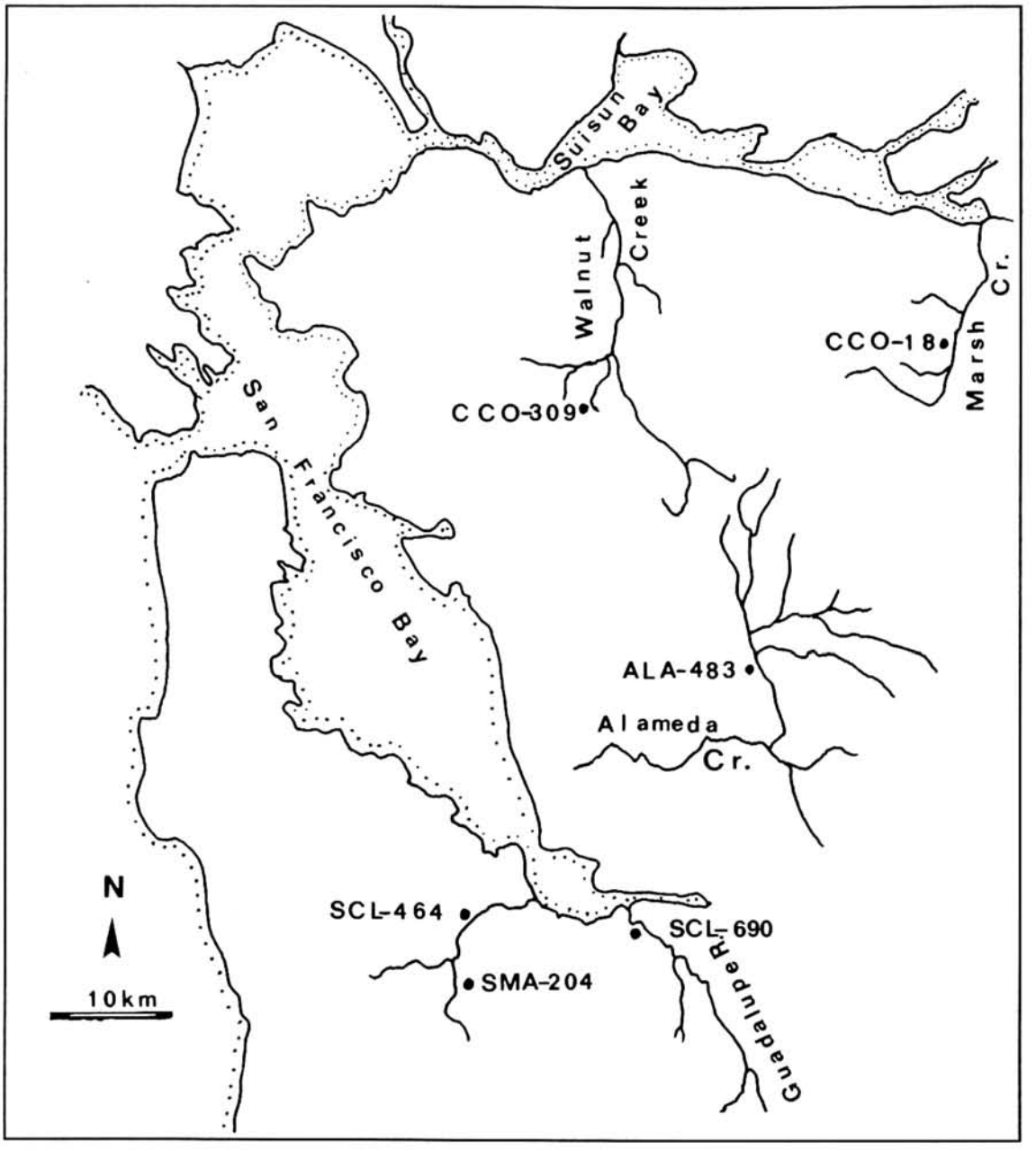

Fig. 1. Locations of the archaeological sites considered in the San Francisco Bay area, California.

RESULTS AND DISCUSSION

The extraordinary feature of all the sites considered here is the presence of marine and euryhaline species that most likely were obtained from estuaries or open sea at some distance from the location of recovery (Tables 2 and 3). The bat ray (*Myliobatis californica*),

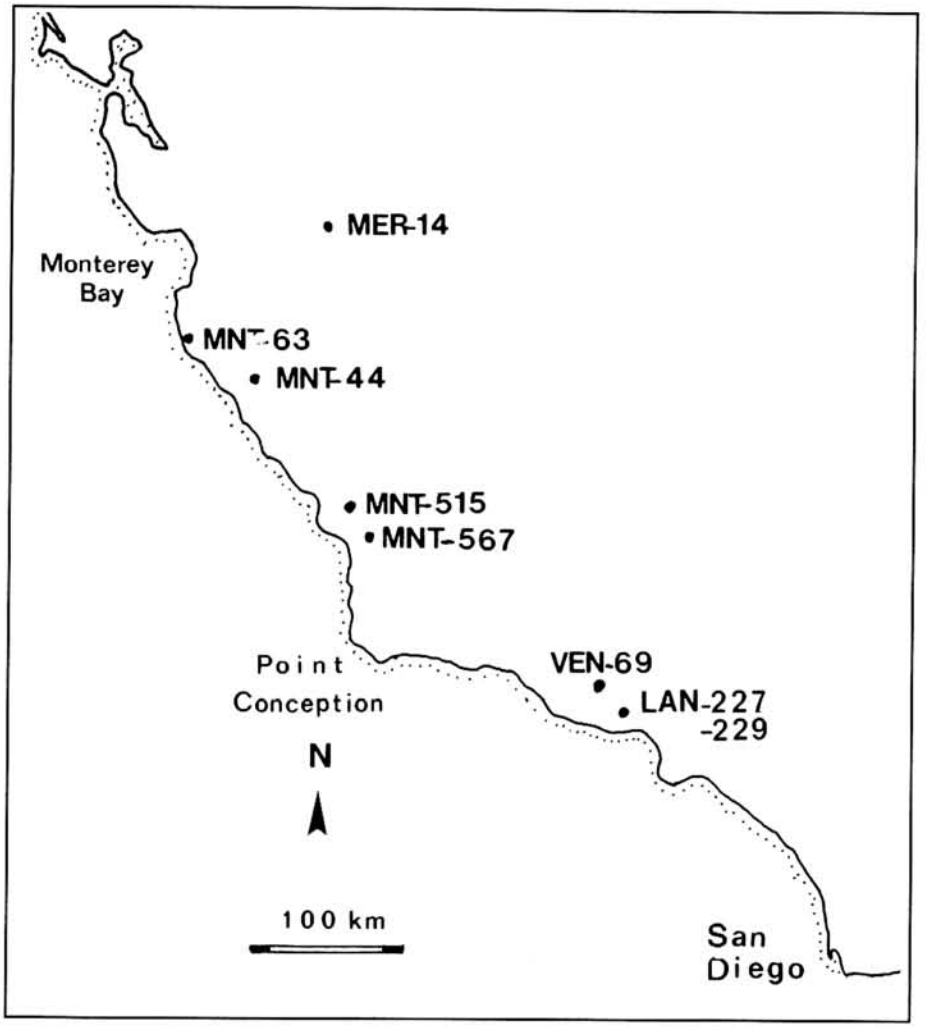

Fig. 2. Locations of the archaeological sites considered in Merced, Monterey, Ventura, and Los Angeles counties, California.

requiem shark, and probably sturgeon (*Acipenser* sp.) were carried a minimum of 13 km. to CA-CCO-18, and approximately 20 km. for the requiem shark, bat ray, sturgeon, atherinids, clupeids, and probably chinook salmon carried to CA-CCO-309. The fishing emphasis at CA-CCO-309 probably was to the north in the Suisun Bay and marsh even though the site is approximately equidistant from Suisun Bay and the San Leandro section of the San Francisco Bay to the west (Table 1, Fig. 1). The marshlands of Suisun Bay and the Sacramento-San Joaquin delta were more extensive and closer to CA-CCO-309 prior to 1850 when marshland reclamation began (see map in Nichols et al. 1986:569), and the lack of hilly terrain to the north would have made movement in that direction easier than to the west. The

Table 1
LOCATION, TIME OF OCCUPATION, AND DISTANCE TO MARINE RESOURCES OF SITES DISCUSSED IN TEXT

Site CA-	Location	Date of Occupation	Minimum Distance (km.) from Saltwater
CCO-18	John Marsh State Historic Park, W. of Brentwood, Contra Costa Co.	A.D. 1000-1500 (G. Farris, pers. comm. 1992)	13
CC0-309	Tice Valley, Rossmore,Walnut Creek, Contra Costa Co.	A.D. 1400-1500 (J. Bard, pers. comm. 1992)	20
SMA-204	Jasper Ridge, Stanford, San Mateo Co.	A.D. 1010-1060 (B. Bocek, pers. comm. 1992)	10
SCL-464	San Franciscito Creek, N. of Stanford, Santa Clara Co.	1200 B.C.-A.D. 1550 (B. Bocek, pers. comm. 1992)	6
SCL-690	San Jose, 0.3 km. from Guadalupe River, Santa Clara Co.	A.D. 700-1300 (J. Hall, pers. comm. 1992)	10
MER-14	San Luis Creek, Pacheco Pass Road, 16 km. W. of Los Banos, Merced Co.	A.D. 300-700 (Follet 1983:105)	80
MNT-44	Church Rockshelter, Church Creek, Arroyo Seco drainage, Santa Lucia Range, Monterey Co.	A.D. 500 (Follett 1973:10, 11)	29
MNT-515	Nacimiento River drainage, Fort Hunter Liggett, Monterey Co.	A.D. 1300-1500 (B. Wickstrom, pers. comm. 1992)	13
MNT-567	Gabilan Creek, Fort Hunter Liggett, Monterey Co.	before A.D. 1300 (B. Wickstrom, pers. comm. 1992)	16
VEN-69	Conejo Rockshelter, 8 km. NNW of Thousand Oaks, Ventura Co.	protohistoric/historic (Follett 1965:81)	24
LAN-227	Century Ranch, Union of Las Virgenes and Triunfo creeks, Malibu Canyon, Los Angeles Co.	A.D. 500-1300 (Follet 1969:132)	10.5
LAN-229	Century Ranch, Las Virgenes Creek, Malibu Canyon, Los Angeles Co.	A.D. 1550-1800 (Follett 1963: 228, 1969:132)	10.5

freshwater species also probably were obtained from the north because year-round flow was unlikely in Tice Creek by the site. CA-CCO-18 was undoubtedly much closer to bay and delta marshland resources during its occupation than is currently the situation with levee-restricted water flow.

The presence of jaw parts (pterygoid, maxilla) of sturgeon at CA-CCO-309 suggests that these parts with poor nutritive value were hauled intact with the fish even though they could easily have been removed to decrease the carrying weight. This would suggest they were caught and hauled inland fresh, with little preparation. The sturgeon jaws may have provided a convenient handle for hauling these large, slippery fish with potentially injurious scutes (enlarged spiny scales). Though head musculature is minimal in sturgeons, the jaw muscles may have been a delicacy for the

Table 2
NUMBER OF FISH ELEMENTS RECOVERED FROM NINE ARCHAEOLOGICAL SITES IN CONTRA COSTA, SAN MATEO, SANTA CLARA, MERCED, AND MONTEREY COUNTIES

	CCO-18	CCO-309	SMA-204	SCL-464	SCL-690	MER-14[a]	MNT-44[b]	MNT-55	MNT-567
MARINE OR EURYHALINE SPECIES[c]									
Requiem shark	1	1	--	--	1	--	--	--	--
Bat ray	1	2	--	--	--	--	--	--	--
Longjaw mudsucker	--	--	--	4	--	--	--	--	--
Northern anchovy	--	--	--	1	--	--	--	--	--
Rockfish	--	--	--	--	1	--	1	--	4
Pile perch	--	--	--	--	--	--	2	--	--
Cabezon	--	--	--	--	--	--	4	1	1
Rock prickleback	--	--	--	--	--	--	1	--	--
Sturgeon (white or green)	24	71	--	--	--	--	--	--	--
Atherinidae	--	16	5	641[d]	--	--	--	--	--
Topsmelt	--	--	--	10	--	--	--	--	--
Jacksmelt	--	--	--	--	--	15	--	--	--
Clupeidae	--	89	--	--	--	--	--	--	--
Pacific herring	--	1	--	--	2	--	--	--	--
Pacific sardine	--	--	--	--	1	--	--	--	--
Steelhead	--	--	--	--	3	--	8	--	--
Chinook salmon	1	2	--	--	--	--	--	--	--
FRESHWATER SPECIES[c]									
Sacramento perch	137	16	--	--	--	--	--	--	--
Sacramento sucker	10	80	--	--	15	--	--	--	--
Cyprinidae	197	101	--	--	12	--	--	--	--
Thicktail chub	14	--	--	--	--	--	--	--	--
Hitch	2	--	--	--	2	--	--	--	--
Hardhead	1	--	--	--	--	--	--	--	--
Sacramento blackfish	4	--	--	--	--	--	--	--	--
Splittail	3	1	--	--	10	--	--	--	--
Sacramento squawfish	15	--	--	--	--	--	--	--	--

[a] Follet 1983
[b] Follet 1973
[c] names follow Robins et al. (1991)
[d] includes 584 scales.

Table 3
NUMBER OF FISH ELEMENTS RECOVERED FROM THREE ARCHAEOLOGICAL SITES IN VENTURA AND WESTERN LOS ANGELES COUNTIES

	LAN-229 (Gobalet 1990d)	LAN-229 (Johnson 1982)[a]	LAN-229 (Follett 1969)	LAN-227 (Follett 1963)	VEN-69 (Follet 1965)
MARINE SPECIES[b]					
Bigeye thresher	1	--	--	--	--
Elasomobranch	78	--	--	--	--
Leopard shark	9	x	66	6	7
Soupfin shark	12	x	--	7	5
Great white shark	--	--	--	--	2
Shortfin mako	3	x	2	4	9
Spiny dogfish	1	x	--	--	--
Sevengill shark	1	x	--	--	--
Blue shark	1	x	--	1	--
Bat ray	36	x	15	--	4
Skate	1	--	--	--	--
Pacific angel shark	62	x	63	5	27
Shovelnose guitarfish	10	x	67	15	27
Horn shark	--	x	--	--	--
Smoothhound	--	x	--	--	--
Swell shark	--	x	--	--	--
Thornback	--	x	--	--	--
Narrowtooth shark	--	--	1	--	--
Clupeidae	1,652	x	--	--	--
Pacific herring	5	--	--	--	--
Pacific sardine	10	x	2	--	16
Northern anchovy	226	x	x	--	--
Jacksmelt	3	x	--	--	--
White seabass	1	x	2	1	--
White croaker	13	x	--	--	1
California corbina	5	--	--	--	--
Black croaker	--	--	1	--	--
Sciaenidae	1	x	--	--	--
Señorita	31	x	--	--	--
California sheephead	7	x	1	5	--
Kelp bass	--	--	--	5	--
Serranidae	1	--	--	--	--
Skipjack tuna	1	--	4	2	--

[a] numbers not available in Johnson (1982); "x" indicates presence
[b] names follow Robins et al. (1991)

Table 3 (Continued)
NUMBER OF FISH ELEMENTS RECOVERED FROM THREE ARCHAEOLOGICAL SITES IN VENTURA AND WESTERN LOS ANGELES COUNTIES

	LAN-229 (Gobalet 1990d)	LAN-229 (Johnson 1982)[a]	LAN-229 (Follett 1969)	LAN-227 (Follett 1963)	VEN-69 (Follet 1965)
MARINE SPECIES[b]					
Skipjack tuna	1	--	4	2	--
Pacific bonito	4	x	--	18	--
Chub mackerel	26	x	13	2	6
Scombridae	3	x	--	--	--
Albacore	1	x	12	44	--
Jack mackerel	9	--	4	--	--
Yellowtail	1	--	7	19	--
Pacific barracuda	7	x	10	2	3
Shiner perch	1	--	--	--	--
Rubberlip seaperch	--	x	--	--	1
Pile perch	--	x	--	--	--
Embiotocidae	2	x	--	--	--
California opaleye	--	--	--	--	1
Lingcod	3	--	--	--	--
Rockfishes	44	x	9	29	4
California halibut	4	x	13	11	--
Pleuronectiformes (flatfishes)	1	x	--	--	--
FRESHWATER SPECIES[b]					
Arroyo chub	9	--	--	--	--
Steelhead	2	x	--	--	--

[a] numbers not available in Johnson (1982); "x" indicates presence
[b] names follow Robins et al. (1991)

Native Americans, as is the case for cabrilla (fam. Serranidae) for Mexican fishermen in the Sea of Cortez (Lloyd Findley, personal communication 1992) and by Russians for raw salmon jaw muscles in Siberia.

The five atherinid elements, all scales, found at CA-SMA-204 (Table 2) probably were hauled the 10 km. from San Francisco Bay. This trip might have been much longer, however, since *Mytilus* (mussel) shell found at the site could only have come from the Pacific coast on the opposite side of the coastal mountain range (Barbara Bocek, personal communication 1992). Five hundred eighty-four of the 641 atherinid elements recovered at CA-SCL-64 (Table 2), 6 km. from the bay, consisted of scales that were found along with the remains of other small marine and euryhaline fishes: topsmelt, northern anchovy (*Engraulis mordax*), and longjaw mudsucker (*Gillichthys mirabilis*). Requiem shark, rockfish (doubtful identification), Pacific herring, and Pacific sardine would have been hauled at least 6 km. from southern San Francisco Bay to CA-SCL-690 (Table 2).

The 15 jacksmelt scales (Table 2) identified by Follett (1983:106) from a Yokuts site (CA-MER-14) likely were transported from Elkhorn Slough on Monterey Bay a distance of 80 km.! If this fish was a trade item, it may have been exchanged for obsidian, the only apparent trade item identified at CA-MNT-229 on Elkhorn Slough (Dietz et al. 1988).

Monterey County archaeological sites CA-MNT-44, -515, and -567 are located in the coastal mountains 13 km. to 29 km. from the ocean (Table 1, Fig. 2) and their fish remains suggest regular access to the rocky inshore resources of rockfishes, cabezon (*Scorpaenichthys marmoratus*), pile perch (*Rhacochilus vacca*), and rock prickleback (*Xiphister mucosus*). These are common species in central California coastal middens (e.g., Gobalet 1981). Sites CA-MNT-515 and -567 both contain shell of marine origin, including *Mytilus* wrapped in kelp (Brian Wickstrom, personal communication 1992). Considerable nonnutritive material apparently was hauled over great distance. The shells may have been used for ornamentation as well as being superb packages for transport. There is no way of knowing absolutely from these limited remains whether or not the fishes were eviscerated to reduce weight for transport but fresh fish probably were transported regularly.

The steelhead (*Oncorhynchus mykiss*) remains found at CA-MNT-44 may have been obtained from local tributaries of the Salinas River rather than coastal streams because steelhead ascended the Salinas River to spawn (Follett 1972:11). However, steelhead have been documented at CA-MNT-63 (Fig. 2) on the Big Sur River in Andrew Molera State Park (Gobalet 1990c) and those from CA-MNT-44 may have been obtained from such a location.

The three inland sites in Ventura and Los Angeles counties (Table 3, Fig. 2) have a species diversity and abundance of marine fish remains unparalleled at inland sites to the north (Table 2). The CA-VEN-69 site, located 16 km. inland from Mugu Lagoon, contains a minimum of 14 marine species (Table 3; Follett 1965). Site CA-LAN-227, located in a interior valley along Malibu Creek 10.5 km. upstream from the mouth of Malibu Canyon, contains a minimum of 17 marine species (Table 3; Follett 1963). A surprising minimum number of 42 species of marine fishes have been identified from the Century Ranch site (CA-LAN-229), where the recovery and evaluation of fish remains has been extensive (Table 3; Follett 1969; Johnson 1982; Gobalet 1990d). A combination of aboriginal utilization of watercraft to exploit a broader range of marine resources (Follett 1965, 1969), apparently better preservation of remains, excavation techniques utilizing mesh of 1/16-in. and smaller, and microscopic evaluation, probably all account for the superior recovery and identifications. Because jaw removal probably would be part of the cleaning process, particularly if the fishes were filleted, the hundreds of small elasmobranch teeth recovered from CA-LAN-229 suggest that fishes were hauled whole from the coast. Weight reduction again does not appear to have been a major concern. Coastal shell was also found at CA-LAN-229 (Raab 1990: 11). Small-sized (less than 150 mm. standard length) steelhead and fresh-water arroyo chub at CA-LAN-229 would have come from Malibu Creek itself.

The finding of at least three species of freshwater fishes among the remains at CA-CCO-309 in the watershed of Walnut Creek is expected (Table 2, Fig. 1). The Sacramento sucker (*Catostomus occidentalis*), three species of minnows (Cyprinidae; not recovered), the hitch (*Lavinia exilicauda*), Sacramento squawfish (*Ptychocheilus grandis*), and Sacramento blackfish (*Orthodon microlepidotus*) have been recorded in Walnut Creek (Leidy 1984:49-53). The three missing minnow species are probably well-represented among the 101 elements ident-

ified only as "Cyprinidae." The only tentative specific identification of a member of this family made here is of the currently rare splittail (*Pogonichthys macrolepidotus*) that was not encountered in that stream by Leidy (1984). It, along with the thicktail chub (*Gila crassicauda*), would formerly have been expected in Walnut Creek particularly in the sluggish-water marshy sections of the stream. (Splittail were the most common minnow identified at CA-SCL-690 [Table 2, Fig. 1] and were known to be a favorite fish of the Clear Lake Pomo in Lake County who called them "hitch" [Hopkirk 1988:185 as *Pogonichthys ciscoides*]). The Sacramento perch remains found at CA-CCO-309 probably indicate its recent extirpation from Walnut Creek since this species was not found by Leidy (1984:65) in his extensive survey. It, however, might have been obtained by the occupants of CA-CCO-309 from the Alameda Creek drainage to the south, where it was exploited by the residents of CA-ALA-483 (Fig. 1) (Gobalet 1990b:244-246).

The freshwater fish remains from CA-CCO-18 (Table 2) reflect the typical assemblage of native fishes of the slow-moving waters of the floor of the Central Valley (Fig. 1) and the species composition is similar to that found by Schulz and Simons (1973:108) at CA-SAC-145 located just south of Sacramento. The tule perch (*Hysterocarpus traski*) is conspicuously absent species at CA-CCO-18, -309, and -690. When present in regional middens, it generally has contributed little to the total number of elements recovered (e.g., CA-SAC-145 [Schulz and Simons 1973:108]; CA-COL-1 [Schulz 1979:275]; CA-ALA-483 [Gobalet 1990b:276]; CA-MNT-229 [Gobalet 1990a:682]). The absence of tule perch from CA-CCO-18, CA-CCO-309, and CA-SCL-690 is not extraordinary considering the generally poor recovery of fish remains at these sites. Most of the sites reported here were sampled with 1/8-in. or larger mesh screens. At CA-LAK-386 located along Cache Creek near its outflow from Clear Lake, however, where sampling was undertaken with screens of mesh size smaller than 1/16-in., individual tule perch estimated at under 100 mm. standard length, were the most abundant fish represented (Gobalet 1989:235). These were probably young and suggest spring or summer capture.

Despite the apparent availability of freshwater fishes at many inland archaeological sites, the pattern emerges that marine fishes were a regularly sought-after resource. The inland sites were situated along creeks and streams with intermittent seasonal flow and freshwater fishes may have been only seasonably available. A day's walk appears to have been no deterrent to obtaining apparently bountiful and reliable marine fishes.

CONCLUSION

Marine fishes appear to have regularly been transported inland from coastal sources all along central California. These distances ranged to more than 80 km. Apparently, whole fresh or minimally processed fishes were imported without carrying-weight being a major concern. Clearly there was an awareness of marine resources at considerable distance from their source. For example, Jett and Moyle (1986: 689-691) identified artwork in pottery depicting images of marine Gulf of California species in southwestern New Mexico, 750 km. from the Sea of Cortez. An equivalent distance from the California coast would have had the Native Americans of eastern Nevada aware of coastal marine resources. Marine fishes clearly were an important and significant part of the lives of Native Americans of western North America even when there was a need to transport them great distances.

ACKNOWLEDGMENTS

Remains from CA-CCO-309 were provided by James Bard, Basin Research Associates, San Lean-

dro; those from the John Marsh State Historic Park (CA-CCO-18) by Philip Hines, California State Department of Parks and Recreation; Stanford West (CA-SCL-464) and Jasper Ridge (CA-SMA-204) by Barbara Bocek, Stanford University; CA-SCL-690, CA-MNT-515 and -567 by Dwight Simons, BioSystems Analysis Inc., Santa Cruz; CA-LAN-229 by L. Mark Raab, California State University North-ridge Center for Public Archaeology. In addition, the following have my gratitude for vital contributions of information, assistance, materials, review, or typing: Eloise Barter, Glenn Farris, Robert Orlins, Jeff Hall, Brian Wickstrom, John R. Johnson, Camm Swift, Jeff Seigel, Yolanda Ahumada, Vivian Cochneuer, Julie Gunn, Denise Candia, Nell Carey, Lloyd Findley, Mark Q. Sutton, and the late Rainelle Sica. Financial support for these projects was provided by Basin Research Associates Inc., California State Department of Parks and Recreation, Stanford University, Biosystems Analysis Inc., and California State University, Northridge, Center for Public Archaeology. My thanks.

DEDICATION

Bill Follett died recently. It was Bill to whom I turned 16 years ago when embarking on my first archaeological faunal project. He was extremely generous with his time and knowledge. His encyclopedic knowledge of fish skeletons and fish biology will be missed. He had a 65-year record of publication in ichthyology and has made many significant contributions to ichthyoarchaeology. This work is meant to be a tribute to this extraordinary man.

REFERENCES

Dietz, Steven A., William Hildebrandt, and Terry Jones

1988 Archaeological Investigations at Elkhorn Slough: CA-MNT-229, a Middle Period Site on the Central California Coast. Papers in Northern California Anthropology 3:1-475.

Eschmeyer, William N., Earl S. Herald, and Howard Hammann

1983 A Field Guide to Pacific Coast Fishes of North America. Boston: Houghton Mifflin Company.

Fitch, John E.

1972 Fish Remains, Primarily Otoliths, from a Coastal Indian Midden (SLO-2) at Diablo Cove, San Luis Obispo County, California. San Luis Obispo County Archaeological Society Occasional Paper No. 7.

1975 Fish Remains from a Chumash Village Site (VEN-87) at Ventura, California. In: 3501 Years on One City Block. Roberta A. Greenwood, ed., pp. 437-469. San Buenaventura Mission Plaza Project Archaeological Report, on file at the South Central Coastal Archaeological Information Center, University of California, Los Angeles.

Follett, W. I.

1963 Fish Remains from the Century Ranch Site (Lan-227), Los Angeles County, California. Los Angeles, University of California, Archaeological Survey Annual Report 1962-1963:298-314.

1965 Fish Remains from the Conejo Rock Shelter Site (Ven-69) Ventura County, Los Angeles, University of California, Archaeological Survey Annual Report 1965: 81-90.

1969 Appendix IV: Fish Remains from Century Ranch Site LAN-229, Los Angeles County, California. Los Angeles, University of California, Archaeological Survey Annual Report 10:132-143.

1972 Fish Remains from Mission La Soledad Cemetery, MNT-233, Monterey County, California. Monterey County Archaeological Society Quarterly 1(3):11.

1973 Fish Remains of the Church Rockshelter MNT-44, Monterey County, California. Monterey County Archaeological Society Quarterly 2(4):10-11.

1980 Fish Remains from the Karlo Site (CA-Las-7), Lassen County, California. Journal of California and Great Basin Anthropology 2(1):114-122.

1983 Fish scales from the Los Banos Site (CA-Mer-14), Merced County, California. California Department of Parks and Recreation, California Archaeological Reports 21:104-109.

1984 Fish Remains from CA-Ker-733, An Archaeological Site in Antelope Valley, Kern County, California. Pacific Coast Archaeological Society Quarterly 20(4): 73-76.

Gehlbach, Frederick R., and Robert Rush Miller

1961 Fishes from Archaeological Sites in Northern New Mexico. Southwestern Naturalist 6(1):2-8.

Gobalet, Kenneth W.
1981 Analysis of Fish Remains from Seven Pacific Grove, Monterey County, Archaeological Sites (Mnt-110, 111, 112, 113, 114, 115, 116). In: Report of Archaeological Excavations at Nineteen Archaeological Sites for the Stage I Pacific Grove-Monterey Consolidation Project of the Regional Sewerage System Vol. 3., Steven A. Dietz and Thomas L. Jackson eds., pp. E1-E29. Report on file at the Northwest Archaeological Information Center, California State University, Sonoma.

1989 Remains of Tiny Fish from a Late Prehistoric Pomo Site near Clear Lake, California. Journal of California and Great Basin Anthropology 11(2):231-239.

1990a Prehistoric Status of Freshwater Fishes of the Pajaro-Salinas River System of California. Copeia 1990(3):680-685.

1990b Native Status of Sacramento Perch (*Archoplites Interruptus*) in Alameda Creek, Alameda County, California: Evidence from Archaeological Site CA-ALA-483. California Fish and Game 76(4):244-247.

1990c Fish Remains from an Archaeological Site on the Big Sur Coast: CA-MNT-63, Monterey County, California. Report on file at Department of Biology California State University, Bakersfield.

1990d Fish Remains from Archaeological Site LAN-229: Freshwater and Marine Fishes Exploited. In: Archaeological Studies at Site CA-LAN-229: An Experiment in Inference Justification, L. M. Raab, ed., pp. 58-112. Northridge Center for Public Archaeology, California State University, Northridge.

1992 Colorado River Fishes of Lake Cahuilla, Salton Basin, Southern California: A Cautionary Tale for Zooarchaeologists. Bulletin of the Southern California Academy of Sciences 91(2):70-83.

Hallock, Richard J., and Donald H. Fry
1967 Five Species of Salmon, *Oncorhynchus*, in the Sacramento River, California. California Fish and Game 53(1):5-22.

Hopkirk, John D.
1988 Fish Evolution and the Late Pleistocene History of Clear Lake, California. Geological Society of America Special Paper 214:183-193.

Hubbs, Carl L., and Robert Rush Miller
1948 The Zoological Evidence: Correlation between Fish Distribution and Hydrographic History in the Desert Basins of Western United States. Bulletin of the University of Utah 30:17-166.

Hubbs, Carl L., W. I. Follett, and Lilian Dempster
1979 List of the Fishes of California. Occasional Papers of the California Academy of Sciences 133:1-51.

Huddleston, Richard W., and Lloyd W. Barker
1978 Otoliths and Other Fish Remains from the Chumash Midden at Rincon Point (SBA-1), Santa Barbara–Ventura Counties, California. Natural History Museum of Los Angeles County Contributions in Science No. 289.

Jett, Stephen C., and Peter B. Moyle
1986 The Exotic Origins of Fishes Deposited on Prehistoric Mimbres Pottery from New Mexico. American Antiquity 54(4):688-720.

Johnson, John R.
1982 Analysis of Fish Remains from the Late Period Chumash Village of Talepop (LAN-229). In: Archaeological Investigations of Talepop (LAN-229) by Chester King, pp. 12-1 to 12-29. Office of Public Archaeology, University of California, Santa Barbara.

Kelly, Isabel T.
1932 Ethnography of Surprise Valley Paiute. University of California Publications in American Archaeology and Ethnology 31(3).

Leidy, R. A.
1984 Distribution and Ecology of Stream Fishes in the San Francisco Bay Drainage. Hilgardia 52(8).

Miller, Robert Rush
1955 Fish Remains from Archaeological Sites in the Lower Colorado River Basin, Arizona. Papers of the Michigan Academy of Sciences, Arts, and Letters XL:125-136.

Miller, Robert Rush, and Gerald R. Smith
1984 Fish Remains from Stanton's Cave, Grand Canyon of the Colorado, Arizona, with Notes on the Taxonomy of *Gila cypha*. In: Archaeology, Geology, and Paleobiology of Stanton's Cave, Grand Canyon National Park, Arizona, R. C. Euler, ed., pp. 61-65. Grand Canyon Natural History Association Monograph C.

Minckley, William L., and Norman T. Alger
1968 Fish Remains from an Archaeological Site along the Verde River, Yavapai County, Arizona. Plateau 40(3):91-97.

Nichols, Frederick H., James E. Clone, Samuel N. Luoma, and David H. Peterson
1986 The Modification of an Estuary. Science 231:567-573.

Raab, L. Mark
1990 Archaeological Studies at Site CA-Lan-229: An Experiment in Inference Justification. Northridge Center for Public Archaeology, California State University, Northridge.

Robins, C. Richard, Reeve M. Bailey, Carl E. Bond, James R. Brooker, Ernest A. Lachner, Robert N. Lea, and W. B. Scott
1991 Common and Scientific Names of Fishes from the United States and Canada. American Fisheries Society Special Publication 20.

Salls, Roy A.
1989 The Fisheries of Mission Nuestra Señora de la Soledad, Monterey County, California. Research in Economic Anthropology 11:251-284.

Schulz, Peter D.
1979 Fish Remains from a Historic Central California Indian Village. California Fish and Game 65(4):273-276.

Schulz, Peter D., and Dwight D. Simons
1973 Fish Species Diversity in a Prehistoric Central California Indian Midden. California Fish and Game 59(2):107-113.