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Fish Tales from the Ballona: The Role of Fish Along the Mainland Coast of Southern California

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Using a robust data set from a series of Native American sites in the Los Angeles Basin, we explore whether these coastal settlements are best characterized as representing maritime or littoral adaptations. In doing so, we examine the range of food exploited, while focusing attention on the relative role of fish, marine mammals, and terrestrial mammals in these subsistence economies. We conclude that the uniformly low exploitation of marine mammals and fish—and deep sea fish in particular—in this coastal southern California setting and many others south of Malibu is due in large part to the rich terrestrial and littoral resources of the area. As such, these more readily available foods were consistently favored over the higher risk and labor investment strategy that typifies exploitation of offshore resources. We conclude with a broader consideration of differences and similarities between Los Angeles Basin adaptations and those in other settings within southern California.

SUBSISTENCE CHANGE AMONG COASTAL NATIVE Californians is a widely discussed and often hotly debated topic (e.g., Basgall 1987; Bettinger 2009; Bettinger and Wohlgemuth 2006; Broughton 1994a, 1994b, 1997, 2004; Broughton and Bayham 2003; Eerkens and Rosenthal 2002; Hildebrandt and McGuire 2002; Hildebrandt et al. 2009; McGuire and Hildebrandt 2005; Raab et al. 1995a; Raab et al. 1995b; Whitaker 2009; Whitaker and Byrd 2014; Wohlgemuth 1996). Given the diversity of resources across California, prehistoric populations could potentially focus on a wide variety of plants and animals, depending on their particular location. In coastal settings, marine resources were invariably an important food source through time, although the nature

of their exploitation varied over time and space. Notably, considerable attention has been placed on the relative role of marine mammals and fish in coastal adaptations, particularly along the central coast, the north coast, and the Channel Islands/Santa Barbara coast (Erlandson 1991a, 1991b; Glassow 1996; Jones 1991; Jones et al. 2008a, 2008b, 2008c; Kennett 2005).

With regard to the role of fish as an important food source, researchers have focused on data from coastal central California, the North Coast, and the Channel Islands. This is primarily a result of the greater availability of high-resolution subsistence data (faunal and floral remains) from these settings relative to the southern coastal region. In the past two decades, however,

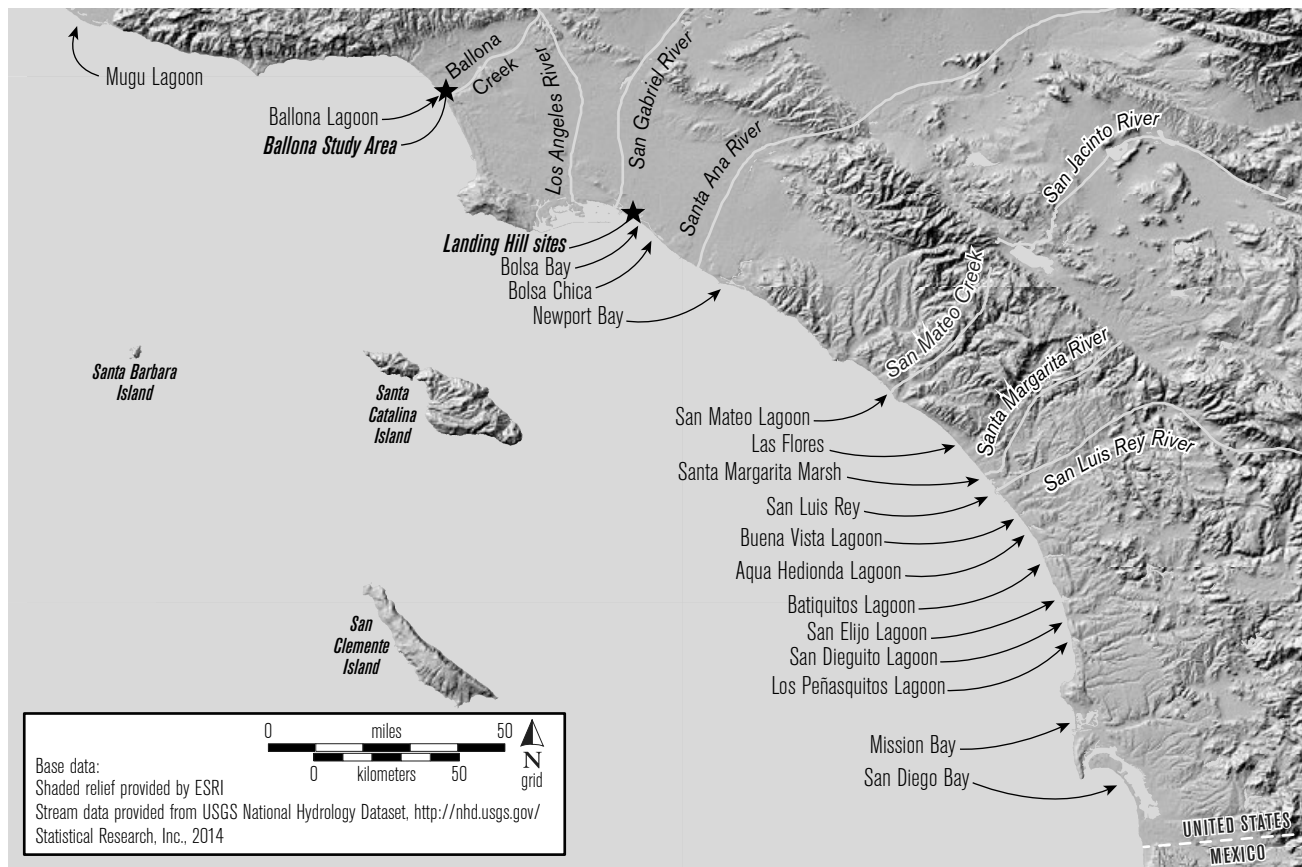


Figure 1. Study area.

important subsistence studies have been conducted along the mainland coast of southern California, which provide valuable data to address these issues (e.g., Altschul et al. 1992a; Byrd and Reddy 1999, 2002; Gallegos 1987, 2002; Gallegos and Kyle 1998; Reddy 1999, 2009; Vanderpot et al. 1993). Recent studies in the Ballona region of the Los Angeles Basin have added a substantial body of new information to mainland coastal subsistence studies (Altschul et al. 2005; Ciolek-Torello et al. 2013; Homburg et al. 2015; Reddy and Douglass 2015).

The nature of fishing, as a primary or a supplemental subsistence economy in coastal mainland southern California, shows an interesting spatial dichotomy. Fishing, particularly deep sea fishing, was an important practice throughout the Channel Islands and among the mainland Chumash (Arnold 1992a, 1992b; Gamble 2008; Porcasi et al. 2000). However, archaeological investigations south of Malibu (in Los Angeles County and southward) along the mainland coast typically indicate that deep sea fish were not a key food resource.

In this paper, we will explore the role of fishing in southern California coastal adaptations and the implications for perspectives on maritime adaptations by drawing on archaeological data from a setting directly south of the Chumash along the mainland coast. The subsistence data used in this paper are primarily from six sites (CA-LAN-47, CA-LAN-54/H, CA-LAN-62/H, CA-LAN-211/H, CA-LAN-193/H, and CA-LAN-2768/H; hereafter referred to without CA-) located along Santa Monica Bay in coastal southern California (Fig. 1). The sites are clustered near the ocean along the Ballona Lagoon, a drowned river valley and low-lying estuary/wetland area in the Los Angeles Basin. An 8,000-year span of occupation, from the Millingstone through Mission period, has been documented in the Ballona, and data from this research provides the basis for exploring the role of maritime resources in subsistence adaptations (Altschul et al. 2005; Ciolek-Torello et al. 2013; Homburg et al. 2015; Reddy and Douglass 2015; Reddy et al. 2016a; Stanton et al. 2015; Vargas et al. 2015).

BACKGROUND: DEFINING COASTAL ADAPTATIONS AS MARITIME OR LITTORAL

Today the mainland coast of southern California is host to a range of habitats, including sandy beaches, rocky shores, and periodic embayments. This diversity in coastal habitats is dynamic and has changed dramatically over the years due to sea level rise and climatic changes, as demonstrated by paleoenvironmental studies (e.g., Davis 2005; Homburg et al. 2015; Mason and Peterson 1994; Masters and Aiello 2007). Notably, open bays of the Terminal Pleistocene/Early Holocene gave way to estuaries and lagoons. What remained largely constant was the existence of a diversity of offshore marine and littoral resources, including marine mammals, near-shore fish, deep sea fish, and shellfish (which fluctuated in variety and density across space and time). Coastal prehistoric subsistence is “expected” to include marine foods in notable quantities; however, this was not always the case. Scholars generally agree that an ocean-resource-focused subsistence strategy was prevalent in specific California coastal cultures but was difficult to identify in others, despite similarities in coastal settings (e.g., Gamble 2008; Gamble and Russell 2002; Hildebrandt and Carpenter 2006; Jones et al. 2008a, 2008b). Given that coastal populations have a wide range of resources available for exploitation (lagoon/estuary, near-shore, sandy beach, deep sea/kelp beds, and terrestrial settings), what they ultimately focus the majority of their efforts on is what defines their subsistence adaptation.

Archaeologists have often distinguished between maritime and littoral subsistence strategies (see Jones et al. 2008b:292; Lyman 1991). There are significant distinctions between these two, and their differences may have implications for technology, logistical planning, subsistence strategies, and social organization. For example, deep-sea fishing—the hallmark of a maritime strategy—requires an oceangoing technology, and the construction, maintenance, and use of seafaring boats. This in turn requires a certain level of social organization, labor, and resource surplus (Gould 1975; Hildebrandt and Levulett 1997). Most discussions about maritime strategies have been centered on the Channel Islands and the coast of the central California mainland (Colten 1991; Erlandson 1991b, 1994; Erlandson et al. 2008, 2009; Gamble 2008; Glassow 1992; Jones et al. 2008a, 2008b; Kroeber 1925; Salls 1991). A clear distinction between

these two strategies was made by Lyman (1991:76), who defined maritime cultures as “those cultures which have a primary focus on the sea as a resource base,” whereas littoral cultures are those “which depend heavily on the sea as a source of resources, but which do not possess the sophisticated technology (for example, seaworthy boats) to use the open sea as a hunting and fishing area.” More importantly, littoral cultures focus their subsistence activities on the coastal tidal and adjacent terrestrial microenvironments (Charkoff and Charkoff 1984:81–83).

Like Lyman (1991) and Colten (1991), we believe that a maritime subsistence regimen should feature offshore species (such as kelpfish [Clinidae], sheephead [*Semicossyphus pulcher*], and soupfin shark [*Galeorhinus galeus*]). Indicators of maritime strategies would therefore include pelagic fish and sea mammals (especially those that had to be pursued in open waters like dolphins), while littoral strategies would be characterized by open-shore tidal shellfish, estuarine fish and shellfish, near-shore fish, pinnipeds (sea mammals) that inhabit mainland shores, and nearby terrestrial plant and animal resources.

The issue of pinniped exploitation is an intriguing facet of this debate on maritime versus littoral adaptations. Pinnipeds include seals (Phocidae), harbor seals (*Phoca vitulina*), walrus (*Odobenus rosmarus*), and sea lions (Otariidae). Although some pinnipeds were captured in open ocean waters through the use of watercraft, pinnipeds typically were slaughtered on beaches, in situations where the hunter(s) snuck up on the animals on shore and either killed them using clubs, or stabbed them with spears or arrows (Hildebrandt and Jones 1992; Porcasi and Fujita 2000; Whitaker and Hildebrandt 2010). These latter methods required a low labor investment with typically high returns, and it did not necessitate a seafaring technology. Therefore, the recovery of pinniped remains from an archaeological site does not necessarily indicate the presence of a seafaring technology or a maritime adaptation.

What remains unclear is whether these offshore fish and sea mammals should be the major components of the diet or not. The pursuit of offshore species was an expensive endeavor in terms of labor investment, but such fishing and hunting strategies are key to the recognition and development of a maritime adaptation. Using a combination of baselines put forth by Gamble (2008:154), Erlandson (2002) and Erlandson et al. (2008)

for a maritime subsistence profile, we consider a focus on pelagic fish, cetaceans (including dolphins), and deep water sharks as being a good indicator of a maritime subsistence. Furthermore, these resources should account for at least 30 percent (by weight) of the animal food diet.

Predicting Local Trends in the Use of Marine Resources

In defining whether an adaptation is maritime or littoral, we use the following dietary features as hallmarks of a maritime adaptation: a significant investment in hunting offshore sea mammals and large deep-sea fish; a diverse array of maritime resources, extending from estuarine to open-water organisms; a shift over time toward a greater emphasis on pelagic fish; and artifacts indicative of deep sea fishing and watercraft. Finally, we argue that the use of watercraft and other specialized technologies, such as shell and bone fishhooks, was essential to a true maritime adaptation along the southern California coast and reflects the increased labor investment required in a maritime adaptation.

A maritime subsistence economy along the mainland coast of southern California should have produced a nutritional profile in which, initially, most animal protein was derived from sea mammals and deep sea pelagic fish. Similarly, a large portion of fish would have been pelagic fishes captured in open waters, although some of them could have been schooling species that were captured nearshore and in kelp forests. Along with increasing nutritional gains from pelagic fish, there should have been, over time, a concomitant decrease in the importance of shellfish, as well as the terrestrial-mammal component. Avifauna, especially waterfowl, also should have constituted an important part of the collection (Jones et al. 2008b:307).

In addition to faunal evidence, detecting a true maritime economy along the southern California coast requires evidence of technological adaptations. Boats, especially the *tomol* (sewn-plank canoe), and shell fishhooks have long been considered specialized technological attributes of a maritime adaptation in this region. Although a variety of simple boats may have been available to early inhabitants of the coast (Fauvelle 2011), the development of the *tomol* at the end of the Middle period has been considered “the pivotal technology” as it “permitted open-ocean fishing of aggressive, large-bodied species such as swordfish and

several varieties of tuna” and “facilitated the transport of hefty sea mammals after their capture” (Arnold and Walsh 2010:113). Replicative experiments have shown that the shell fishhook was most effective in capturing bottom-feeding fish like those found in kelp beds and along rocky shorelines, rather than surface and schooling fish such as yellowtail (*Seriola lalandi*) or bonito (*Sarda chiliensis*) and other tuna family members (Scombridae; Strudwick 1986:133–135). The shell fishhook has a greater antiquity than the *tomol*, and smaller and less-effective watercraft were undoubtedly available to the people of the Millingstone and Intermediate periods. Strudwick (1986:270, 278) suggested that the shell fishhook was known to the inhabitants of the California coast as early as 4,500 B.P., if not earlier, and may have originated in the northern Channel Islands. Shell fishhooks, however, are most abundant in the Santa Barbara Channel area, especially on the islands, and are typically rare at coastal southern California mainland sites south of Malibu.

We distinguish this type of maritime adaptation from a littoral adaptation. The latter focuses more on the terrestrial resources of the coast and the aquatic (lagoonal and freshwater) resources of coastal estuaries and open coastlines. Unlike the maritime adaptation, terrestrial mammals dominate the vertebrate faunal remains in littoral adaptation strategies, and sea mammals and pelagic fish constitute a smaller part of the faunal assemblage. The technological hallmarks of the maritime adaptation, the *tomol* and the shell fishhook, are also infrequent in the littoral adaptation, in which mainly nets and spears were used to collect shallow-water species.

Using subsistence data from our research in the Los Angeles Basin along the Ballona Lagoon (Fig. 1), we discuss the nature of the adaptation as littoral or maritime in this area, which was part of Gabrieliño/Tongva territory during the Mission period. The Ballona is at the edge of the mainland Gabrieliño/Tongva culture area and near that of the Chumash (approximately 25 miles from Malibu).

RESOURCE EXPLOITATION IN THE BALLONA, COASTAL LOS ANGELES COUNTY

Subsistence data from six sites (LAN-47, LAN-54/H, LAN-62/H, LAN-211/H, LAN-193/H, and LAN-2768/H) in the Ballona provide the most detailed and longest

Table 1**SUMMARY OF ARCHAEOLOGICAL SITES IN THIS STUDY**

Site (CA-)	Millingstone (8,500 – 3,000 cal B.P.)	Intermediate (3,000 – 1,000 cal B.P.) ^a	Late period (1,000 – 408 cal B.P.) ^b	Protohistoric and Mission (A.D. 1542 – 1830)	Excavation Analytical Units used for Faunal Analysis
LAN-47			x		12 CUs
LAN-54/H	X	X			4 CUs, 13 non-burial features
LAN-62/H	X	X		X	14 CUs, 75 non-burial features
LAN-193/H	X	X			4 CUs, 6 non-burial features
LAN-211/H		X		X	5 CUs, 37 non-burial features
LAN-2768/H	X			x	7 CUs, 16 non-burial features

^aalso referred to as the Middle period

^bends with European contact in A.D. 1542

CU = Control Unit (1 x 1 m.)

X: substantial; x: minor

record of aboriginal subsistence in the Los Angeles Basin (see Fig. 1). The Ballona study area is less than 3 miles from the ocean in the city of Los Angeles. At different times in prehistory, the Ballona occupants had as many as five different biotic communities within their daily foraging range, including the Ballona wetlands (both lagoonal and freshwater marsh), freshwater riparian, Los Angeles upland and inland wetlands, Los Angeles Plain, and sandy coast (Reddy and Lev-Tov 2015). Rocky coast biotic communities, located to the southwest at Palos Verdes and to the northwest at Malibu and Topanga, were just outside the foraging range of the inhabitants of the Ballona. Excavations at these six sites documented a long span of cultural occupation with temporally distinct components identified at each site (Table 1) (Altschul et al. 1992b; Ciolek-Torello et al. 2013; Vargas et al. 2015). The character of adaptations during this 8,000-year occupation in the Ballona was well-attuned to this dynamic and rich wetlands setting (Ciolek-Torello et al. 2013; Homburg et al. 2015).

For much of the 8,000-year span—from the Millingstone through most of the Mission period—during which the Ballona was occupied, there were minor changes in subsistence practices in terms of the resources used. Such changes were directly related to climatic fluctuations and the evolution of the Ballona from an open embayment to a sediment-choked estuary (Reddy et al. 2016a). The notable changes in resource exploitation occurred primarily late in the cultural sequence, during the Protohistoric and Mission periods. What remained largely constant throughout the long

span of human occupation was a dependence on small to medium-sized terrestrial fauna, estuarine shellfish, and wild grasses (Reddy et al. 2016a). The paleodiet of the Ballona populations was a balance between protein gleaned primarily from the terrestrial fauna, augmented by estuarine shellfish and fish (occasionally pelagic fish), and by calories from grasses and other small-seeded plants. The broad-spectrum subsistence pattern depended on variation in resource availability. The main paleodietary components in each of the main cultural periods, of course, varied, but the overall signatures largely remained consistent.

During the Millingstone period, small terrestrial mammals were the main animal food, while fish—dominated by nearshore and estuarine species—were minor components (Lev-Tov and Van Galder 2015; Lev-Tov et al. 2015) (Table 2). Shellfish from the adjacent estuarine habitats were collected, and Pismo clams, which are found in the sandy intertidal zone, were also harvested (Table 3). In terms of plant consumption, the diet was relatively diverse and was primarily composed of grasses and other small-seeded annual plants with only minimal quantities of acorns or other nuts (Reddy 2015a). Overall, plant usage was low (with a seed density of 1.1 seeds per liter), possibly the result of poorer preservation in these older deposits. Sites in other parts of California, however, have yielded carbonized seeds and nutshell from such early sites in much higher densities (e.g., Wohlgemuth 1996). The diet breadth of the Millingstone populations in the Ballona was narrow, given that the strategies involved the procurement of a wide range of

Table 2
DISTRIBUTION OF VERTEBRATE FAUNAL GROUPS OVER TIME IN THE BALLONA

Category	Total Count	Millingstone Period (%)	Intermediate Period (%)	Late Period (%)	Protohistoric through Mission Period (%)
Fishes	25,711	5.00	9.00	6.00	16.00
Birds	12,503	6.00	2.00	6.00	8.00
Reptiles	5,333	2.00	2.00	—	3.00
Sea mammals, among all identified vertebrates	156	0.04	0.03	0.10	0.10
Terrestrial mammals, among identified vertebrates	29,338	87.00	84.00	86.00	72.00
Aquatic fauna (all fishes, all sea mammals, and waterfowl)	27,267	6.00	9.00	10.00	16.00

Note: Data are for identified vertebrates and do not include data from burials.

Table 3
RELATIVE ABUNDANCE OF PRINCIPAL SHELLFISH TAXA

Period	Scallop (<i>Argopecten</i> sp.) (%)	Venus Clam (<i>Chione</i> sp.) (%)	Abalone (<i>Haliotis</i> sp.) (%)	Oyster (<i>Ostrea</i> sp.) (%)	Littleneck Clam (<i>Protothaca staminea</i>) (%)	Pismo Clam (<i>Tivela stultorum</i>) (%)	Other (%)
Millingstone	27	24	1	15	20	10	3
Intermediate	30	19	1	17	22	8	3
Late Period	12	49	9	5	14	3	8
Protohistoric and Mission	44	23	17.3	0.4	12	0.3	3
Total (percent of total shellfish from all periods)	27	22	7	11	18	8	7

Note: screen sizes of 1/8-inch (with occasional 1/4-inch selective items)

small-package animal and plant resources. A portion of the plant collection was opportunistic during daily foraging forays and could have been a secondary activity during shellfish collection along the lagoon or on the sandy beaches to the west.

The Intermediate period (referred to as the Middle period elsewhere in the region) subsistence strategies retained much of the character of the previous Millingstone period, with several notable changes. Small mammals were still the primary sources of animal food and protein; however, fish exploitation, in particular the procurement of pelagic fish, increased slightly (Lev-Tov et al. 2015) (Tables 2 and 4). The collection of shellfish continued to be a focus of harvesting in estuarine habitats; however, there was a decrease in the use of open sandy-beach habitats, as

Table 4
SUMMARY OF FISH REMAINS FROM THE BALLONA

Category	Millingstone Period (%)	Intermediate Period (%)	Late Period (%)	Protohistoric through Mission Period (%)
Pelagic fishes ^a	16.0	42.0	14.0	3.0
Nearshore/estuarine fishes ^a	83.0	56.0	85.0	97.0
Freshwater/estuarine fishes ^a	1.0	—	1.0	0.2
All fishes, among vertebrates ^b	5.0	9.0	6.0	16.0

^aValues are percentages among identified fishes.

^bValues are percentages among identified and unidentified vertebrates.

Note: Calculations do not include data from burials. Screen sizes of 1/8-inch (with occasional 1/4-inch selective items)

evidenced by a decrease in the recovery of Pismo clams. Plant use during the Intermediate period was largely similar to that of the previous period in terms of the types of plants exploited, but the Intermediate period deposits had even lower densities of seeds. The Intermediate

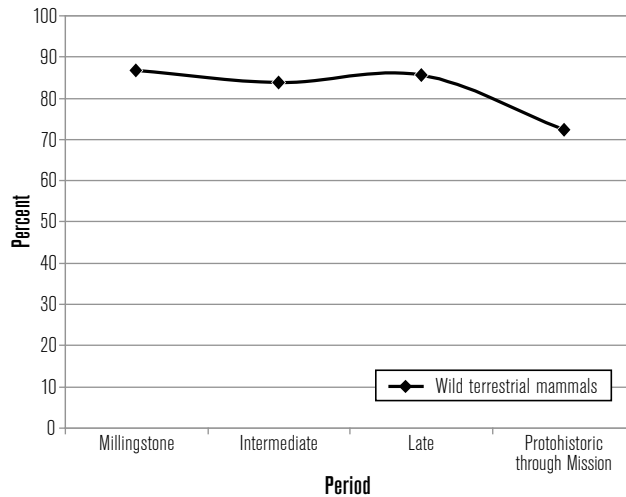


Figure 2. Exploitation of mammals over time in the Ballona.

period Ballona faunal exploitation was largely similar to that at Landing Hill (located to the south of the Ballona along the coast of Orange County). However, Hildebrandt and Carpenter (2007) did not find any pelagic sea mammals or pelagic fish at Landing Hill, and have described the prehistoric inhabitants as focused on estuarine resources (shellfish and fishes) and on medium-sized and small terrestrial mammals.

During the Late period, paleodiet and exploitation strategies continued to focus on estuarine resources, despite the reduced size of the estuary as suggested by the paleoenvironmental model (Homburg et al. 2015; Wigand 2015). This was also a period of reduced rainfall and periodic floods and droughts. Settlement was greatly reduced and restricted to the lagoon edge, and much of the Ballona was abandoned and the population greatly reduced (Altschul et al. 1992b; Ciolek-Torello et al. 2013). The exploitation of terrestrial mammals remained similar to that of previous periods (Fig. 2), but there was a noticeable decrease in fish consumption (Altschul et al. 1992b; Lev-Tov et al. 2015) (Fig. 3). Among the fish consumed, the focus was on estuarine fish, and there was a dramatic drop in pelagic fish (Tables 2 and 4) relative to the two previous cultural periods. Estuarine Venus clams continued to be the focus of exploitation, and oysters were also harvested. Subsistence data from the Late Period components in the Ballona study area suggest a focus on the immediate lagoon area, except for oyster procurement.

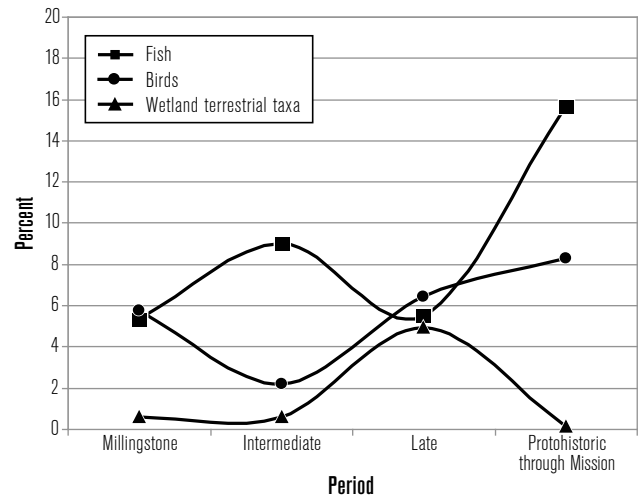


Figure 3. Aquatic-resource exploitation over time in the Ballona.

The Protohistoric and Mission periods in the Ballona witnessed a major change in Native Californian subsistence systems, with the introduction of domesticated plants and animals into the aboriginal diet (Reddy 2015b; Reddy et al. 2016a). There was an overall decrease in the exploitation of the smaller terrestrial mammals (but a surprising increase in artiodactyl exploitation; see Fig. 2 and Table 2) and an associated increase in fish consumption. The fish consumed, however, were primarily from nearshore/estuarine habitats (97 percent); pelagic fish accounted for only 3 percent of the fish collection (Lev-Tov et al. 2015; Table 4). This pattern reflects a long-term trend in which offshore fish exploitation continued to decrease from a small portion of the diet during the Intermediate period to a negligible part during the Protohistoric and Mission periods. More dramatic was the increase in plant usage, as evidenced by the very high densities of seeds (567 seeds per liter), dominated by native grasses (Reddy 2015a, 2015b), and large terrestrial mammals (Lev-Tov et al. 2015).

Maritime or Littoral Adaptation in the Ballona

In addressing the question of whether aboriginal subsistence in the Ballona involved a maritime or littoral strategy, the long-term trends in the faunal data indicate that the adaptation was always primarily littoral. This conclusion is based on the absence of a nutritional profile, during any period, in which at least 30 percent of the animal protein was derived from sea mammals (non-

pinniped) or pelagic fish. Although there was an increase in pelagic fish (such as mackerels, tunas, and fishes in the herring family) during the Intermediate period, these fish were not the primary component in the diet, and at no time did they constitute more than 2 percent of the NISP. Furthermore, there was no noticeable shift over time toward a greater emphasis on pelagic fish. In other words, at no time did the Ballona faunal collection indicate more than a seemingly occasional exploitation of offshore species, whether these were deepwater sharks, cetaceans, or pelagic fish.

Regardless of the period, the most important sources of terrestrial meat were rodents, rabbits, and artiodactyls, and these animals made up an increasing proportion of the diet through time (Fig. 2). Fishing, primarily from estuarine habitats, increased slightly through time, particularly during the Intermediate period, followed by a decline during the Late period, and a subsequent resurgence during the Protohistoric and Mission periods (Fig. 3). Animal foods from aquatic habitats (all fish, sea mammals, and water fowl) did not play a major role in the diet until the Intermediate period, when aquatic-vertebrate foods were incorporated in relatively higher frequencies. Aquatic fauna accounted for a modest (one-sixth) percentage of the diet during the Protohistoric through Mission periods (Table 3). Most of the fish from Protohistoric through Mission period deposits were from estuarine and nearshore habitats (including sandy and rocky shores), and included bat rays, stingrays, thornback rays, shovelnose guitarfish, herring, giant sea bass, white sea bass, surfperch, and other fish (Table 5). The great majority of the fish are from nearshore/freshwater/estuarine habitats in all periods, with the exception of the Intermediate period. The primary off-shore/pelagic fish added to the Intermediate period subsistence data include requiem shark, leopard shark, mackerels, and Pacific Barracuda (Table 5). This increase in fish exploitation, including the procurement of off-shore/pelagic species, during the Intermediate period is associated with a slight increase in the frequency of fishing equipment (Table 6). Given the low frequencies of these offshore species, it is also possible that some of these foods were acquired either through trade and/or were acquired opportunistically, such as when prey (particularly sharks) were inadvertently encountered within shallower waters.

Fishing was never a primary subsistence strategy in the Ballona, as is evident from the relatively lower abundance of fish compared to other vertebrate fauna (never more than 16 percent; see Table 2). This is consistent with the fact that only a handful of shell fishhooks and fishing implements (barbs, fishhooks, and harpoon heads) made of bone have been recovered (see Table 6). Harpoons have been used as indicators of a maritime adaptation (Hildebrandt 1981:101), because they were not only the most productive weapon used in hunting marine mammals, but also because they were used most effectively with oceangoing canoes. Barbs were used as early as the Millingstone period in the Ballona, whereas fishhooks first appeared in Intermediate period deposits starting around 3,000 cal B.P. Harpoon tools were found in very low frequencies in Intermediate and Protohistoric through Mission period deposits. There was evidence of fishnets in the Ballona; more than 100 carbonized cordage fragments were recovered from Protohistoric through Mission period burials, probably from nets made of bast fibers (Polanich 2015). These nets indicate that schooling surf and lagoonal fish were procured. No fishing-weir stakes have been recovered from Ballona contexts.

Plank canoes are considered a hallmark of the California maritime economy, but there is no direct evidence of watercraft in the Ballona archaeological data, nor have tools or materials related to their manufacture (lithic tool kits and asphaltum plugs) been recovered (Reddy and Douglass 2015). The presence of plank canoes in the Ballona during the Protohistoric and Mission periods is unlikely (see Gamble 2002 for a discussion of the absence of plank canoes in the Gabrieliño/Tongva region). Instead, the residents of the Ballona probably fished in the lagoon and on the coastal shores, using harpoons, barbs, and nets—a technology associated with littoral and inland economies. We also suspect that the inhabitants of the Ballona may have used tule boats for nearshore activities that involved the use of various items of fishing gear, including fishhooks. Alternatively, it is possible that the Ballona populations may have docked their plank canoes or other watercraft at the beach (a few kilometers from their settlements) rather than bringing the watercraft all the way to their lagoon-edge camps. This alternative might account for the lack of evidence of these boats in the archaeological record

Table 5
FISH REMAINS FROM THE BALLONA SITES

Taxon	Common Name	Habitat	Millingstone	Intermediate	Late Period	Prehistoric/ Mission
<i>Chondrichthyes</i>						
<i>Alopias vulpinus</i>	Thresher Shark	OS/IS	1	0		0
<i>Carcharodon carcharias</i>	Great White Shark	OS/P	0	0		1
<i>Triakis semifasciata</i>	Leopard Shark	OS/P	0	2		1
Carcharhinidae	Requiem Sharks	OS/P	1	8		1
<i>Squatina californica</i>	Pacific Angel Shark	BW/L	3	21		0
<i>Rhinobatus productus</i>	Shovelnose Guitarfish	BW/L	1	33		2
<i>Platyrrhinoidis triseriata</i>	Thornback Ray	BW/L	4	17		1
Rajiformes	Rays	BW/L	7	40		3
Rajidae	Skates	BW/L	2	10		0
<i>Myliobatus californica</i>	Bat Ray	BW/L	1	58		2
Chondrichthyes	Cartilaginous Fish (unidentifiable)	All/Any	373	566	34	317
<i>Osteichthyes</i>						
Clupeiformes	Anchovy, Herring, Sardine, & Shad	OS/P & BW/L	0	0		2
Clupeidae	Herring Fairly	OS/P & BW/L	34	93	34	25
Engraulidae	Anchovy	OS/P & BW/L	1	1		0
Salmoniformes	Salmon, Smelt, and Trout	BW/L	0	0		0
Atherinopsidae	New World Silversides	RS/SS/BW/L	2	5		0
<i>Sebastes</i> sp.	Rockfish	RC/SC	0	1		0
Perciformes	Perch	SC	0	15		1
<i>Stereolepis gigas</i>	Giant Sea Bass	RC/SC	0	0		30
<i>Paralabrax</i> sp.	Sea Bass	RC/SC	0	1		0
<i>Seriola lalandi</i>	Yellowtail Jack	RC/SC	0	0		2
<i>Trachurus symmetricus</i>	Jackmackerel	OS/P	0	0		4
Sciaenidae	Drums and Croakers	SC	11	21		3
<i>Atractoscion nobilis</i>	White Seabass	RC/SC	0	0		15
<i>Umbrina roncador</i>	Yellowfin Croaker	SC	1	0		0
<i>Genyonemus lineatus</i>	White Croaker	SC	0	1		0
Embiotocidae	Surfperches	SC	22	42		15
<i>Amphisticus</i> sp.	Barred, Calico, or Redtail Surfperch	SC	0	0		1
<i>Sphyrna argenta</i>	Pacific Barracuda	RC/SC	0	5		6
<i>Semicossyphus pulcher</i>	California Sheephead	RC/SC	0	4		3
Osteichthyes	Gobies	BW/L	1	8		0
<i>Gillichthys mirabilis</i>	Longjaw Mudsucker	BW/L	2	40		0
Scombridae	Mackerels	OS/P & BW/L	4	7		3
<i>Scomber japonicus</i>	Pacific Mackerel	OS/P	0	8		0
<i>Thunnus</i> sp.	Tunas	OS/P	0	0		3
<i>Thunnus alalunga</i>	Albacore	OS/P	4	0		0
Pleuronectiformes	Flat Fishes	SC	1	2		0
<i>Paralichthys californicus</i>	California Halibut	RC/SC	0	0		1
Pleuronectidae	Righteye Flounders	SC	0	1		0
Osteichthyes	Bony Fish (unidentifiable)	All/Any	1,856	5,342	376	13,702
Total Fish			2,332	6,352	444	14,144

OS/P = Offshore Pelagic BW/L = Ballona Wetlands and Lagoon IS = Inshore SC = Sandy Coast RC/SC = Rocky Coast/Sandy Coast

Table 6
FISHING EQUIPMENT RECOVERED
FROM THE BALLONA STUDY SITES

Fishing Equipment Category	Millingstone Period (n)	Intermediate Period (n)	Late Period (n)	Protohistoric through Mission Period (n)
Shell fishhooks				5
Barbs (bone)	9	13	1	9
Harpoons Heads (bone)		1		2
Net weights				1
Bone fishhooks		6	5	9
Total	9	20	6	26

at the campsites. However, this alternative is considered unlikely, as such valuable equipment would not have been left unprotected, and we would still expect evidence of watercraft construction and maintenance at the campsites, at least in low frequencies. The best evidence of canoes among the Chumash has been found in burial contexts (Gamble 2008), and there has been no such evidence with burials in the Ballona study area (Reddy et al. 2016b)

Gamble (2008) indicates that the Chumash maritime subsistence strategy was characterized by a diet consisting of sea mammals (40 percent) and fishes (25 percent). All of the Ballona sites had much lower frequencies of these resources, and sea mammals in particular were never very important. The collecting of shellfish and the hunting of small game, however, remained at steady levels through time. The contribution of aquatic game to the diet of Ballona populations varied through time, both in relative contributions of animal classes and in the type of fauna present within these classes. The coastal-dwelling Ballona populations always acquired a portion of their foods from the various bodies of water that bordered them. The extent to which they relied on such habitats for hunting, shellfish harvesting, and fishing also varied somewhat through time.

Based on evidence from Landing Hill, Hildebrandt and Carpenter (2007) asserted that pinniped rookeries did not exist in southern California because of a lack of appropriate rocky habitats (but note that Hildebrandt and Carpenter excluded the Palos Verdes area, which has a rocky shore). Although sea-mammal bones were not abundant within the Ballona, they were not as sparse

as at Landing Hill, where just one sea-mammal bone fragment (from a sea otter) was recovered. By contrast, 156 bones from whales, dolphins, sea otters, seals, and sea lions were recovered from dated contexts in the Ballona (but always comprising one percent or less of the faunal assemblage from any period). Most of these sea-mammal bones were either from Protohistoric through Mission period contexts (40 percent) or (secondarily) from the Intermediate period (26 percent). Of the 156 sea-mammal bones from dated contexts, 35 were from pinnipeds; most of these (n=29) were recovered from post-1,000 cal B.P. deposits. Hildebrandt and Jones (1992) suggested that there were no pinniped rookeries in southern California after 1,500 cal B.P., and (as noted) Hildebrandt and Carpenter (2007) suggested that the lack of these rookeries was the most likely explanation for the dearth of sea-mammal remains at Landing Hill. The data from the Ballona sites indicate that there were comparatively greater frequencies of sea-mammal bones from deposits dated after 1,000 cal B.P. It is possible that these pinnipeds were obtained from the islanders through trade or were hunted, incidentally, along the rocky shores of the Palos Verdes area. The frequencies were low enough that they could just represent animals that occasionally washed up onto the beach or ventured into the estuary. Seals often bask on the landward side of coastal dunes and commonly travel inland up drainages in search of freshwater or estuarine fish.

Hildebrandt and Carpenter (2006:285) asserted that maritime cultures in California were limited to the Chumash and the Gabrieliño/Tongva along coastal southern California, and the Tolowa and the Yurok on the North Coast. They also stated that the mainland Chumash and Gabrieliño/Tongva depended largely on ocean fishing and hunting (Hildebrandt and Carpenter 2006:285), but they were not clear about whether this was true only during the Protohistoric and Historic periods or whether it extended to earlier periods. Gamble (2008) and Gamble and Russell (2002) argued that there is no evidence of plank canoes (or maritime subsistence) among the mainland Gabrieliño/Tongva until the Historic period. The Ballona data suggest that there is no evidence of plank canoes at any time in prehistory or in the Historic period (Reddy et al. 2016a).

Ballona subsistence systems differed considerably from those of the mainland Chumash to the north, but

shared many similarities with those defined farther to the south in the northern part of San Diego County. In both areas, the Ballona study area and San Diego County, small mammals were common in collections from the Millingstone and Intermediate periods (known as the Archaic period in northern San Diego; Wake 1999). The remains of sea mammals were recovered in very low frequencies in San Diego County in the Intermediate period, as in the Ballona, but unlike the pattern in the Ballona, remains of sea mammals disappeared completely after the Intermediate period. Fish were exploited throughout the sequence, but in low numbers. Wake (1999) asserted that there was a change in subsistence strategies in northern San Diego County starting about 1,000 B.P., marked by a decrease in fish, an absence of sea mammals, and a focus on small terrestrial mammals. Also noteworthy is the fact that large mammals were rare throughout the sequence, and shellfish were important near lagoons (e.g., Byrd and Reddy 2002; Gallegos 1987).

CONCLUSIONS: FINAL THOUGHTS ON THE ROLE OF FISHING

If a maritime adaptation is a hunting and fishing strategy in which deep-sea fish, cetaceans, and pinnipeds form substantial percentages of the diet (e.g., Gamble's [2008:154] estimates of 40 percent marine mammals and 25 percent fishes), then the diet of the Ballona area populations would never be characterized as maritime. The same would be true for most of the native groups that inhabited the mainland coast of southern California from Malibu south to near San Diego Bay. A maritime adaptation, therefore, was absent in the Ballona, despite the fact that the coastal Chumash immediately to the north were much more heavily maritime oriented, particularly during the Intermediate period (referred to as the Middle period in the Chumash literature; Gamble 2008, among others). Similarly, so were inhabitants of the Channel Islands, including the Gabrieliño/Tongva who inhabited the southern Channel Islands. The Ballona populations never turned to maritime strategies, undoubtedly because the local lagoonal resources provided an ample food base and were sufficiently stable to provide for the population. As evidenced by the recovery of pelagic fish and sea mammals (although in very low frequencies), it is

clear that these resources were obtained occasionally by happenstance or through trade, but they were not primary components of the diet. Instead, the inhabitants of the Ballona maintained a littoral adaptation throughout the occupation sequence, exploiting a diversity of nearshore, wetland, and terrestrial resources.

The littoral adaptation found along the southern California coast can be likened to the lacustrine adaptation documented in the Great Basin. The estuaries of the southern California coast, and vernal pools like those that once flanked the Ballona wetlands, presented adaptive opportunities similar to those offered by the wetlands of the Great Basin, and similar technologies and subsistence practices could have been employed in both regions (Ciolek-Torello and Douglass 2002; see also Hildebrandt 1997). The Great Basin, best known for vast stretches of sagebrush and arid mountain ranges, also contains extensive wetlands (Kelly 1999:117). Although they constitute only a small percentage of the area of the Great Basin, they were critical to the survival of both prehistoric and historic period Native American populations (Fowler and Fowler 1990). The use of wetlands by prehistoric hunter-gatherers was part of a regional land-use pattern that incorporated surrounding upland and desert habitats (Rhode 1990:107). Hildebrandt (1997) provides an interesting perspective on how and why prehistoric populations selected estuarine over lacustrine resources earlier in the cultural sequence in the southern Santa Clara Valley. An intensive use of lacustrine resources occurred only after 1,000 cal B.P., when access to estuarine resources was restricted by population increases and associated territoriality. This pattern bears similarity to the seasonal variability observed around lacustrine settings in the Great Basin, and Hildebrandt (1997:221) argues that their intensive use is "situational, and largely dependent upon the availability of alternative resources."

Like their coastal counterparts, Great Basin wetlands provided a host of plant resources, such as bulrushes, cattails, and various marsh grasses, whose roots, tubers, seeds, shoots, and pollen were exploited for food (Kelly 2001). In addition, they contained many waterfowl species and a variety of aquatic and terrestrial mammals that were important sources of food and pelts (Schmitt and Sharp 1990:91). Greenspan (1990:229) argued that freshwater fishes from these wetlands were also an

important dietary component throughout the Great Basin, although the populations living near the rich lacustrine basins of western Nevada showed the strongest reliance on fish in ethnographic times (see also Tuohy 1990). Caches found in caves in the nearby mountains contained numerous fishhooks, duck decoys, fishing lines, and nets, which attest to the importance of fishing and hunting waterfowl (Kelly 1999:140). Freshwater mussels, clams, and gastropods also were available, although their dietary role is generally considered to have been marginal (Drews 1990:63, 72). By contrast, upland areas were an important source of pinyon and big game, as well as stone for tools.

Although wetlands were critical components of settlement and subsistence systems in the Great Basin, the importance of other resource areas varied from place to place, as well as through time. Near the Carson Desert at Walker Lake, for example, uplands near the lake were occupied primarily for short-term logistical foraging from residential bases located near the lake, whereas uplands farther from the lake were occupied on a longer-term residential basis (Rhode 1990:107). Weide (1968) originally proposed that lake edges and valley floors were the primary foci of settlement and subsistence in the Warner Valley of southeastern Oregon. More-recent evidence, however, indicates a pattern more like that at Walker Lake, where a tethered strategy focused primarily on wetlands, with upland areas as a secondary focus (Cannon et al. 1990:179; Kelly 1999). A similar pattern is evident in the Lake Mohave area in the Mojave Desert during the Early Holocene, where upland resources were distant from the wetlands. As a result, settlement was concentrated in the wetlands, and smaller seasonal camps were used in the uplands.

The prehistoric adaptations on coastal estuaries, such as those in the Ballona in Los Angeles County (Homburg et al. 2015), and several systems in coastal San Diego County to the south, including San Mateo (Byrd et al. 1995; Reddy et al. 1996; Waters et al. 1999), Las Flores (Byrd 1996, 1998, 2003, 2004; Reddy 2005), Santa Margarita (Byrd 2005; Davis 2005), Batiquitos (Gallegos 1985, 1987), and San Elijo (Byrd et al. 2004), had much in common with those of the Great Basin wetlands, with the caveat, of course, that these coastal adaptations had a wider and richer resource base in the nearby ocean relative to that of the Great Basin (Fig. 1). For example,

in its early manifestation as an open lagoon, the Ballona would have presented opportunities to hunter-gatherers similar to the opportunities offered by the rich lacustrine areas of the Great Basin (Ciolek-Torello and Douglass 2002; Ciolek-Torello et al. 2013). With economic activities limited largely to fishing and shellfish collection, only temporary camps would be expected around the edge of the lagoon in the Ballona. As the lagoon developed, it came to resemble Great Basin wetlands like Stillwater Marsh (note, however, that waterfowl were important at Stillwater but not as much in the Ballona). Perhaps most importantly, we recognize that throughout much of its prehistory, the Ballona, like the Great Basin wetlands, was only one component of a much larger subsistence and settlement system.

Similar to the Ballona lagoon, the lagoons in coastal San Diego County had distinct evolutionary histories which directly affected resource exploitation. Byrd and Reddy (1999, 2002) argue that occupation of the San Diego coastal area persisted throughout the Late Holocene, and that prehistoric hunter-gatherers regularly exploited lagoonal or occasional rocky-shoreline shellfish in some localities, and in others concentrated entirely on sandy-shoreline species. Occupation along the northern San Diego coast appears to have increased greatly in the Late Holocene and included both major residential bases and numerous specialized sites (Byrd and Reddy 1999, 2002:47). Scholars (Byrd 1996, 1998; Byrd and Reddy 1999, 2002) have argued that the Late Holocene intensification in coastal San Diego County was driven by an increased focus on littoral habitats. Using recent data from coastal San Diego County, Whitaker and Byrd (2014) provide additional evidence for these adaptive trends and their focus on littoral resources, noting that generally poor terrestrial faunal resources required littoral intensification. Whitaker and Byrd (2014) further argue that the emphasis on *Donax* increased in association with territoriality and circumscription correlated with Luiseño villages late in time.

The exploitation of marine vertebrates was also highly variable, and (like shellfish) reflected emphases on different local habitats. For example, the emphasis was on lagoon and open-water fish at Buena Vista Lagoon, nearshore fish at Agua Hedionda and other places in northern San Diego County, kelp beds and open ocean habitat near Mission Bay, and rocky and soft substrates

along San Diego Bay. The “maritime” adaptation— involving an emphasis on marine mammals and pelagic fish—that characterized the Santa Barbara Channel area was not common anywhere along the San Diego coastline, except at one site along San Mateo Creek (SDI-13,325) and two along San Diego Bay (SDI-48 and SDI-10,945) relatively early in the cultural sequence (Byrd and Reddy 2002:60). Terrestrial resources were important throughout the region, although the emphasis during the Late Holocene was on small species.

Using data from Byrd et al. (1995) at SDI-13,325, Rosenthal et al. (2002) argue that for a brief period during the Intermediate Period (Middle Period) there is a maritime signal in northern San Diego County. The data used for this argument include pelagic fish (MNI=23; 5.6 percent of identified vertebrates) and sea mammals (MNI=5; 6.6 percent of identified vertebrates; Byrd et al. 1995). Again, as in the case with the Ballona collection, the low frequencies of pelagic fish and sea mammals does not indicate that the subsistence strategies of these populations can be considered maritime. Furthermore, there were very few artifacts indicative of deep sea fishing and/or watercraft production and maintenance. Only five shell fishhooks (including fragments) were recovered from all excavations at SDI-13,325 (Byrd et al. 1995). Given the low contribution of pelagic fish and sea mammals to the diet, Rosenthal et al.’s (2002) perspective about a short-lived maritime adaptation in northern San Diego County is questionable. Much like the case of Ballona settlements, perhaps these foods were obtained through trade with the Chumash or Gabrieliño/Tongva Channel Islanders (such as those inhabiting nearby Santa Catalina and/or San Clemente). Alternatively, the sea mammals recovered from the site (sea lions, fur seals, and sea otter) could have been clubbed or stabbed with spears or arrows when they were on the rocks at San Mateo Rocks (Orange County), less than 5 miles to the north and approximately 0.5 miles offshore (where sea mammals are observed today), or they could have been obtained opportunistically when they came ashore on the mainland.

Moving to the southern part of San Diego County, the inhabitants of the rocky coast of Point Loma in San Diego County appeared to have had an early maritime coastal adaptation. SDI-48, located on the bay side of Point Loma, has a record of human occupation from

5,000 cal B.P. (Gallegos and Kyle 1998); and SDI-10,945, also on the bay side, has evidence of human occupation dating to 2,000 cal B.P. (Pignuolo et al. 1991). Both sites have been characterized as exhibiting a maritime subsistence economy with evidence of sea-mammal hunting (Noah 1998). Taxa recovered included sea otter (*Enhydra lutris*), California sea lion (*Zalophus californianus*), southern fur seal (*Arctocephalus* spp.), and harbor seal (*Phoca vitulina*). On the basis of the high frequencies of California sea lions, Gallegos and Kyle (1998) concluded that there was a rookery, which has since disappeared, near the site.

Pelagic fishing would have been a higher risk and higher labor subsistence strategy when rich littoral and lagoon resources were readily available along coastal mainland southern California, south of Malibu. In addition, fishing may not have been as productive in southern California compared to other parts of California. Hildebrandt and Carpenter (2006:139) argued that there is a latitudinal variation in fish productivity, with the productivity of anadromous fish runs decreasing from north to south along the California coast. This raises the question of why the Chumash incorporated fish and marine animals into their diet to a greater extent. Similar habitats north of Malibu, along the Santa Barbara County coast, were also present in Chumash areas; but the Chumash combined both littoral and maritime resources in their subsistence. One hypothesis is that the distance between the mainland and the islands could have been an important factor in terms of access to technology and trade interactions. For example, Anacapa Island (the closest Channel Island within the Chumash area) is only 12 miles from the mainland, compared to 22 miles between Santa Catalina Island and the Gabrieliño/Tongva territory (Los Angeles Basin) on the mainland, and 54 miles between San Clemente Island and the Luisiño/Juaneño mainland territory in northern San Diego County. Shorter distances would have favored relatively more social and economic interaction between the mainland Chumash and their Chumash neighbors in the northern Channel Islands, compared to the groups further south along the coast.

Finally, this discussion raises the question of the appropriateness of a dichotomy between littoral and maritime foragers. Did such a dichotomy indeed exist? Perhaps there has been too little discussion of the definition of a maritime adaptation, as well as too few

attempts to isolate a littoral adaptation, because the dichotomy is limiting. Those who lived along coasts or islands, even if they often pursued sea mammals in rookeries or tuna from *tomols*, would not have missed the chance to hunt shorebirds and fish for estuarine or nearshore species. Certainly, people oriented toward both sea and shore harvested shellfish in abundance. Perhaps it would be more appropriate to think of these adaptations as a continuum against which we can measure people's relative dependence on the ocean. Much of the difference in adaptation also depends on the environment—the presence of estuaries versus rocky shores and/or access to deep water. But the variation in diet through time in the Ballona, as limited as it was, is significant and suggests other factors were at play, such as changing demographic patterns and social organization. Notably, a maritime adaptation required complex technological and social adaptations that were not necessary in a littoral adaptation.

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