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Authors
Rosenthal, Jeffrey S
Hildebrandt, William R
King, Jerome H

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Donax Don't Tell: Reassessing Late Holocene Land Use in Northern San Diego County

JEFFREY S. ROSENTHAL, WILLIAM R. HILDEBRANDT, and JEROME H. KING
Far Western Anthropological Research Group, Inc.
2727 Del Rio Place, Davix, CA 95616

This paper considers the two competing models of late Holocene settlement and subsistence on the northern San Diego County coast. A large body of regional data derived from single-component site contexts at Camp Pendleton and surrounding areas suggest that neither the coastal decline nor the coastal intensification alternative is entirely accurate, and that a more detailed analysis of late Holocene land use is required. This synthesis draws parallels with other parts of the California coast as well as to interior regions of San Diego County. Evidence for intensive use of coastal resources is limited primarily to an interval corresponding to the Middle Period elsewhere in southern California. Late Period economies, on the other hand, appear to have had a terrestrial focus, with short-term seasonal occupations of the coastal zone directed primarily at the harvesting of bean clam (Donax gouldii) and other seasonally abundant resources.

INTRODUCTION

Interpretations of prehistoric subsistence and land use change in central and northern San Diego County continue to be dominated by what Byrd (1998) terms the "coastal decline model." This model posits a major demographic shift in the productivity of coastal lagoons after about 4000 B.P. Following the silting-in of these estuaries, it is believed that coastal peoples moved to the interior to take advantage of more productive inland environments (Warren 1964, 1968; Warren and Pavesic 1963). However, Byrd (1998) has questioned the accuracy of this reconstruction, proposing an alternative "coastal intensification model." Citing recent work at a number of prehistoric sites on the Camp Pendleton coast, he calls attention to several post-4,000 B.P. deposits which he characterizes as extended, multi-season occupations, and argues that these sites document a general process of late Holocene intensification focused on coastal resources.

The goal of this paper is to evaluate the relative merits of these alternative scenarios through a review of regional archaeological assemblages. We begin with a discussion of the competing models, followed by a detailed review of data obtained from sites at Camp Pendleton and surrounding coastal and inland contexts in northern San Diego County. We then compare our findings to ethnohistoric reconstructions of interior settlement-subsistence systems, and present a formal analysis of assemblage diversity in an attempt to quantify the intensity of Late Period coastal occupation. Based on these findings, we present a new synthesis of local land-use patterns in which we hope to provide a better understanding of adaptive variability along the California coast.

THE COASTAL DECLINE MODEL

The coastal decline model was first proposed in the 1960s, based on excavations by Crabtree et al. (1963), Warren et al. (1961), Warren and Pavesic (1963) and Warren (1964, 1968), and later supported by the work of Gallegos (1987, 1992), Gallegos and Kyle (1988), Christenson (1992), and Warren et al. (1998). Most of the early excavations focused on sites located next to extant estuaries, or at the mouths of canyons where estuaries once existed; many of these sites produced components dating between 8,000 and 5,000 B.P. These early occupations yielded artifact assemblages dominated by handstones, millingstones, and core/cobble tools, but produced very few implements associated with big game hunting or marine fishing. Archaeofaunal remains were consistent with the lack of hunting and fishing gear, as most assemblages were composed largely of estuary shellfish and small terrestrial game. Based on these findings, Warren concluded that:

> ... collecting of seeds was nearly as important to the economy as shellfish collecting, and perhaps more so. The numerous milling stones and shell midden are prime indicators of these activities at these sites. Fishing and hunting of land or sea mammals all appear relatively unimportant to the economy, if the few quantitative analyses of middens and the field observations recorded can be considered valid. These observations seem substantiated by the relatively rare occurrences of hunting and fishing equipment ... [1967:235]

Sometime after 4,000 B.P., when Holocene sea level rise stabilized, estuaries along much of central and southern California coast began to fill in with silt and, in some cases, disappeared completely (see Erlandson 1988; Masters and Gallegos 1997). Due to the reduced productivity of these important estuary habitats, a major reorganization of settlements is thought to have taken place. In areas where estuaries survived into the late Holocene (e.g., San Diego Bay, Mission Bay, Batiquitos Lagoon), populations maintained large-scale settlements until the historic period. Areas characterized by open sandy beach (e.g., much of northern San Diego County), in contrast, were largely abandoned for the interior, where acorn-based economies assumed a higher degree of importance. Warren posits that the extensive beaches precluded settlement in this area:

> ...it seems likely that the straight sandy beaches of the San Diego coast north of Mission Bay were not as heavily utilized as seal rookeries as the rocky points and islands in the Santa Barbara Channel. Given the limited resources of the littoral zone and the shift inland of population and center of economic activities, the development of maritime culture was prohibited and nothing comparable to the maritime adaptation of the Campbell Tradition [of the Santa Barbara Channel] is found on the San Diego coast. [1968:7]

Subsequent research along the San Diego coast largely supported the proposals of Warren (1968). Masters and Gallegos' (1997:21) recent summary of middle Holocene adaptations on the San Diego coast is in full agreement with the coastal decline model, arguing that the siltation of estuaries at ca. 3,500 B.P. caused a depopulation of the outer coast, evinced by a distinctive gap in the cumulative profile of radiocarbon dates throughout the coastal region. Their compilation of dates, however, clearly indicates a resurgence in coastal occupation after about 1,500 B.P. (Masters and Gallegos 1997:Figure 2.2).

THE COASTAL INTENSIFICATION MODEL

Byrd (1998; also see Byrd 1996; Waters et al. 1999) questions the applicability of the coastal decline model to northern San Diego County, noting that it has been applied to the area without supporting data. In a test of the model, he presents data from nine recently excavated sites at Camp Pendleton and evaluates these against three test implications (Byrd 1998:201): (1) there should be a lower frequency of coastal archaeological sites post-dating 4,000 B.P. than those predating 4,000 B.P.; (2) post-4000 B.P. sites should be small and consistent with short-term or single season occupations; and (3) shellfish use in general (and thus density of shellfish in archaeological deposits) should decline significantly after 4,000 B.P.

Byrd's (1998) analysis of 33 radiocarbon dates from these sites reveals two major periods of occupation, one dating between 8,000-6,000 B.P. and the other post-dating 1,200 B.P. – the latter providing clear evidence for coastal occupation after 4,000 B.P. The great majority of dates fall into the latter interval, but Byrd concedes that site discovery biases confound any simple equation between numbers of radiocarbon dates and occupational intensity (Byrd 1998:206). Seasonality data obtained from plant macrofossils and faunal remains from the later sites indicate primarily summer use, with some evidence for spring and fall occupation at a few sites. Evidence for changes in site size is also problematic, as the few early settlements tend to be larger than later sites. Similarly, post-4,000 B.P. shellfish densities actually decrease slightly, and are much more narrowly focused on bean clam.

Despite the somewhat equivocal results of these tests, Byrd argues that the presence of substantial Late Period coastal middens with at least some multiseason occupation clearly contradicts the expectations of the coastal decline model. He argues that the appearance of large quantities of bean clam in many of these sites is due partially to late Holocene development of the sandy beach habitat which the species requires, but primarily to a general pattern of coastal intensification in which bean clam was subject to a carefully scheduled mass harvest (see also Byrd 1996:325). Byrd argues that this reflects a larger pattern of intensification documented in other parts of California that "corresponds to worldwide diachronic trends in coastal adaptations" (Byrd 1998:211).

ETHNOHISTORIC CONSIDERATIONS

The north coast of San Diego County was occupied by the Luiseño at historic contact. Unfortunately, however, most ethnographic information regarding subsistence-settlement patterns is limited to peoples who lived in the interior (Sparkman 1908; Strong 1929; White 1963). White's (1963) review of Luiseño ethnographic data indicates that local populations were divided into approximately 50 social units known as rancherias. Rancheria size varied according to local environmental conditions, and occupied a primary settlement (where permanent houses were located) and several temporary camps strategically located in outlying areas for the collection and processing of seasonally available subsistence resources. Territories were designed to maximize environmental variability, so that:

> ...each rancheria is composed of several definite topological units, arranged so that all necessary types of terrain are included within its boundary; for example, oak groves, chaparral-covered slopes, river bottoms, springs, and so forth. None is so large that a man could not reach any part of it on foot in about half a day, starting from the major dwelling site or village; each includes all features necessary for maximum efficiency in the harvesting of food and other resources.... [White 1963:116-117].

White (1963) also stressed the importance of acorns, suggesting that they constituted 50% of the Luiseño diet, and noted that the best stands were located several miles from the coast. Early Spanish visitors made similar observations regarding correlations between large oak groves and Indian settlement, reporting large population centers within the interior valleys near Pauma, Escondido, Pala, and other interior locales (see various citations in White 1963:117-118).

Expanding on the work of White (1963), True and Waugh's (1982) analysis of ethnographic and archaeological data from the upper San Luis Rey drainage indicates that between A.D. 1500 and the protohistoric period, each major tributary supported an autonomous community that controlled a well-defined territory (see also True 1993). A primary village was typically established where water was available for the longest period of time, usually "at the head of the alluvial fan on each drainage where the stream emerges from its narrow canyon" (True and Waugh 1982:36). The primary villages were occupied in winter, but during the summer the entire population moved to an upland settlement where a wide variety of resources could be accessed with little difficulty. This bipolar system of settlement persisted until protohistoric times, when the primary villages consolidated into a smaller number of large, complex villages at several key locations throughout the area. Most of the large, complex villages were located near the most reliable regional water supplies, perhaps in response to "one of the several recent periods of extended drought postulated for southern California" (True and Waugh 1982:37; see also Raab and Larson 1997:323). They also propose that this consolidation process "could only occur within a social matrix capable of sustaining the mosaic of productive, ritual, and social relationships inherent to 'village' organization" (True and Waugh 1982:37).

The paucity of ethnographic and archaeological data from the coast not only prohibits detailed land-use reconstructions such as those provided by True and Waugh (1982), but could also be construed as evidence for the lack of coastal settlement (i.e., supporting the coastal decline model). White (1963:199), however, dispels this notion, suggesting that coastal people "were the most exposed and therefore the first to suffer extermination by disease and other vicissitudes introduced by the Europeans". Prior to these epidemics, he proposes that a series of rancherias noted by Boscana (a priest at San Juan Capistrano between 1814 and 1826) supported significant populations along the coast.

INTERSITE COMPARISONS: DATA PRESENTATION

Because Byrd's (1998) test implications regarding the number, size and distribution of pre- and post-4,000 B. P. sites on the northern San Diego County coast are clouded by issues of site visibility and preservation, we argue that a meaningful evaluation of the coastal decline versus coastal intensification models must focus on the evidence for duration and intensity of occupation of both coastal and inland sites, and the overall settlement system that they reflect. Moreover, we argue that shellfish densities in archaeological deposits are a relatively poor proxy for occupational intensity, and tell us little about the larger settlement context. It is possible, for example, that many Late Period coastal sites represent only short-term camps established by interior peoples taking advantage of brief periods of bean clam availability (see Reddy 1996a). Such a scenario, while not predicted by the coastal decline model, is not inconsistent with it.

To fully evaluate the validity of these competing models, it is necessary to expand the analysis beyond shellfish, and include data sets associated with site structure and assemblage composition. Archaeological deposits reflecting long-term residential activities often include evidence for residential structures (e.g., house floors, charred structural remains), processing features (bedrock milling areas, cooking hearths/ovens), and human burials (formal cemeteries, isolated interments). In addition to these structural remains, artifact assemblages usually include a full range of implements reflecting the acquisition (e.g., projectile points) and processing (e.g., milling gear) of subsistence resources, as well as tools to produce and maintain other tools and facilities (e.g., bone awls used to make basketry). Faunal and floral remains also provide important information regarding site function. Long-term residential areas should reflect resources harvested during multiple seasons and, perhaps more importantly, they should include resources obtained from a variety of habitat types. Late Period settlements on the coast, for example, should include large quantities of acorns and other interior resources. Coastal resources should also be diversified, including both local (e.g., bean clams) and non-local foods (e.g., estuary shellfish).

Accordingly, we present a review of data from coastal sites, focusing on components dating to the early/middle Holocene (pre-5,000 B.P.), an interval we here designate as the Middle period (ca. 2,500-1,500 B.P.), and the Late Period (ca. post-1000 B.P.), followed by an analysis of Late Period findings in the interior. Although a Middle Period is not recognized by most San Diego County researchers, the data provided below indicate that it may represent an interval with affinities to the Santa Barbara Channel area. If so, it may have considerable significance for local prehistory.

The data presented here were assembled from a variety of sources (Table 1). Although single-component areas are rarely specifically identified in the original reports, we have isolated these contexts by identifying temporally discrete assemblages or subassemblages that have clearly definable vertical and/or horizontal spatial continuity. All components have been radiocarbon dated with the exception of four interior sites (i.e., Pala, Molpa, Pankey, and Bonsall) that were dated through other means (True et al. 1991).

Early/Middle Holocene data are available from four general areas: Agua Hedionda, Las Flores Creek, Santa Margarita River, and the San Luis Rey River (Figure 1). The Agua Hedionda sample is derived from the work of Gallegos (1991) and Koerper et al. (1991), and corresponds to occupations dating between about 8,400 and 7,000 B.P. Artifact assemblages from both sites (CA-SDI-10965 and CA-SDI-9649) are relatively broad, and include flaked, battered, and ground stone tools, and (in the case of CA-SDI-9649), shell and bone artifacts, tarring pebbles, and quartz crystals (Table 2). No human burials or features were reported from either site.

Mammalian faunal remains from CA-SDI-10965 and CA-SDI-9649 are dominated by rabbits and hares, followed by lesser frequencies of deer and undifferentiated carnivore bone (Table 3); identifiable marine mammal bone was not recovered. Fish bone is only available from CA-SDI-9649 and is represented by relatively high frequencies of taxa that seasonally enter shallow bays, sloughs, and estuaries, particularly those with sandy or sand/mud bottoms (bat ray, shovel-nosed guitarfish, croakers). Herrings and anchovies are also present, and could have been captured from near-shore contexts or in estuaries like Agua Hedionda. The remaining taxa recovered from the site (surf perches, mackerels/tunas) occur in more open marine settings (Wake 1997).

Shellfish from CA-SDI-10965 and CA-SDI-9649 are both dominated by estuary species, particularly chione and scallops, which both favor sandy mud flats in bays and estuaries (Table 4; Morris 1966). Other minor taxa include oyster (rocky substrate in bays/estuaries), little neck clam (coarse sandy bottoms in protected areas), undifferentiated mussel (protected or open coast), and bean clams (open sandy beach).

The Santa Margarita River (CA-SDI-10156/12599; Strudwick et al. 1996) and San Luis Rey River (CA-SDI-6015/5130; Moratto 1994) sites are located along major drainages, six to nine kilometers from the current coastline. Radiocarbon dates from the Early/Middle Holocene components at these sites range between ca. 7,000-5,300 B.P. (Table 2). The artifact assemblages are not as robust as those from Agua Hedionda, but include a broad range of forms including flaked, battered, and ground stone tools, some bone and shell artifacts, and a few intrusive pottery fragments. Site CA-SDI-10156/12599 contained a bedrock milling feature, while the CA-SDI-5130/6015 site complex yielded a hearth feature (Feature 101), a concentration of metavolcanic cobbles (Feature 112), and a human burial (Feature 103), all of which were radiocarbon dated between ca. 6,300-5,100 B.P. (excluding the single outlier date; Moratto 1994:D23).

Vertebrate faunal data are only available from CA-SDI-10156/12599, and these are limited to a small sample of mammal bone (see Table 3). Similar to Agua Hedionda, the assemblage is dominated by rabbits and hares, followed by

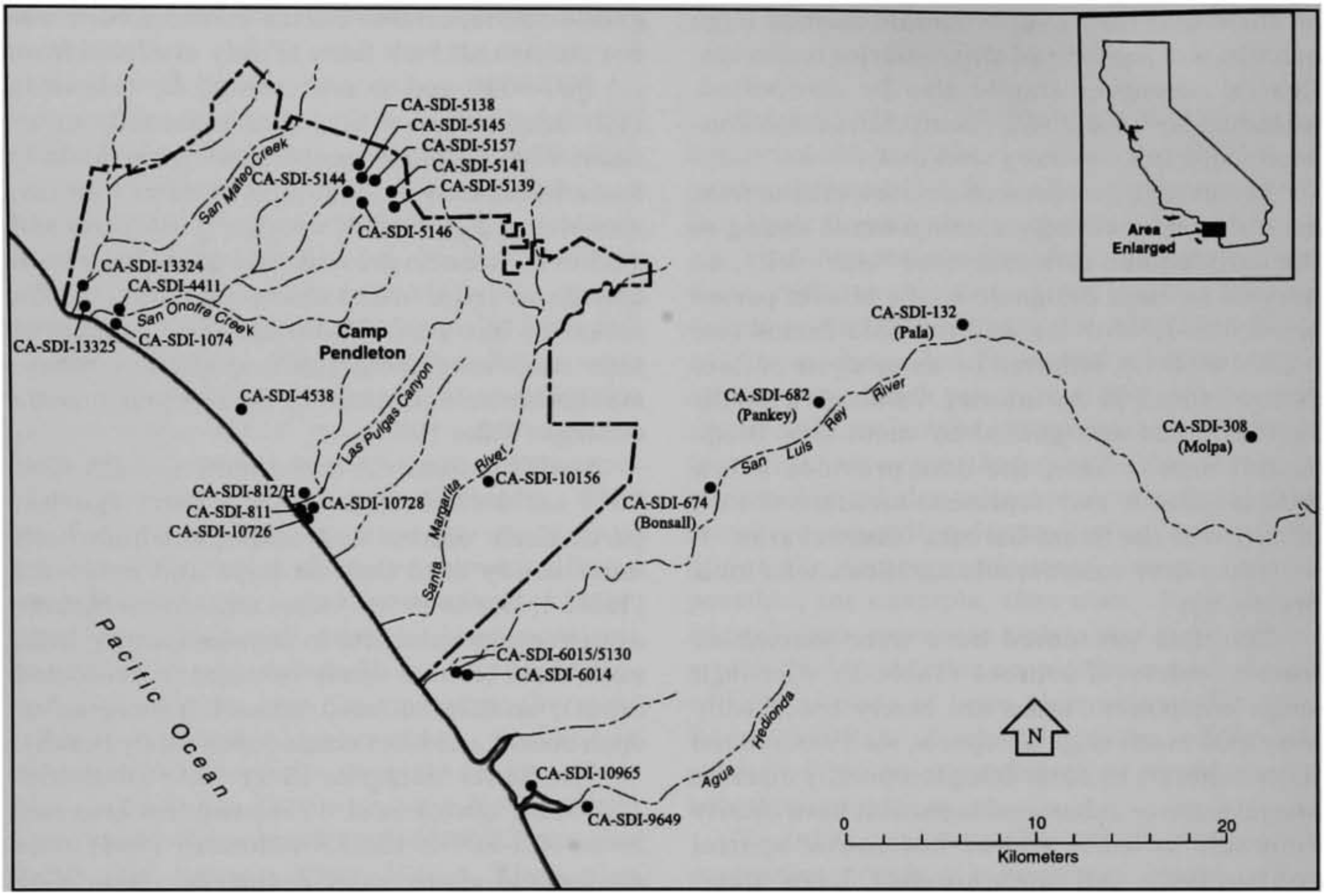

Figure 1. Sites employed in regional comparison.

lesser frequencies of deer, squirrel, and dog/coyote. Marine mammals are completely absent from these sites. Marine fish are also lacking, perhaps due to the more inland location of the deposits. Shellfish are dominated by estuary taxa at both site locations (chione, scallop, oyster), despite the fact that well-developed estuaries no longer exist at the mouths of these drainages today.

The final group of Early/Middle Holocene components are along the Las Flores drainage within a kilometer of the coast (CA-SDI-10726, CA-SDI-10728). Ranging in age between ca. 7,590 and 6,570 B.P., both artifact assemblages are relatively small, limited to less than 25 tools. Nevertheless, these small assemblages remain broad, and include a variety of flaked, battered, and ground stone tools, as well as spire-lopped *Olivella* shells (perhaps beads) and a few pieces of intrusive pottery; no burials or features were reported. Mammalian faunal remains are only available from CA-SDI-10728, and are dominated by rabbits and hares, with lower frequencies of squirrels, carnivores (mostly dog/coyote), and deer. Marine mammals continue to be rare or absent, represented by single elements of sea otter and sea lion/fur seal.

Fish remains are present at both CA-SDI-10726 and CA-SDI-10728 (see Table 3). Similar to the other Early/Middle Holocene sites, the assemblage is dominated by species favoring estuary habitats, including bat ray, shovel-nosed guitarfish, and halibut, as well as small schooling fishes such as herrings/sardines and anchovies. The CA-SDI-10728 assemblage differs from all others by including a high frequency of silversides, and when combined with the moderate presence of surf perches, could reflect near-shore fishing along the outer coast. It should be noted, however, that some species within these generalized taxonomic groups (i.e., silversides and surf perches) are also known to visit estuary environments on a seasonal basis (Wake 1997). Shellfish are dominated by estuary species, with the majority represented by chione and scallop. Other species found in low but significant frequencies include oyster, little neck clam, and Pismo clam, the latter reflecting a minimal use of open sandy beach habitats.

Only two sites produced materials dating to the Middle Period (CA-SDI-13325 and CA-SDI-811), and the latter (CA-SDI-811) has unfortunately been contaminated with materials post-dating 500 B.P. (Table 5). Site CA-SDI-13325 lies near the mouth of San Mateo Creek, about 900 m from the existing coastline (Byrd et al. 1995). The Middle Period component produced radiocarbon dates ranging between 2,490 and 1,830 B.P. (excluding one assay of 3,720 B.P.), and yielded a small but diversified assemblage of flaked, battered, and ground stone tools. It differs significantly from Early/Middle Holocene assemblages by the presence of several bone implements, shell beads, and shell fish hooks. The circular shell fish hooks (n=3), combined with a single stone net weight, represent the earliest specialized fishing gear recovered from the local area. These findings are consistent with technological developments on the southern Channel Islands and along the Santa Barbara coast where circular fish hooks, barbed harpoons, and plank canoes were all in use shortly after 2,000 B.P. (Davenport et al. 1993; King 1990; Raab et al. 1995). No burials are reported at the site (Byrd et al. 1995).

Faunal remains from CA-SDI-13325 continue to show high frequencies of hares/rabbits, followed by lesser numbers of deer, but differ from the earlier collections by yielding significant frequencies of sea lion/fur seal (n=46) and sea otter (n=8). Fish remains follow a similar trend, showing taxa from rocky outer coast environments for the first time (rock fish, sheep head) and, more importantly, large numbers of mackerel/tuna which were probably obtained from deep water contexts with the use of boats (Hudson 1995). Shellfish from CA-SDI-13325 show a dominant presence of little neck clam, which favors protected bays with coarse sand or sandy-mud substrates, as well as several rocky, open coast taxa such as dusky turban snail, wavy top snail, chiton, abalone, barnacle, and limpets (Tables 6 and7).

Site CA-SDI-811 is located near the mouth of Las Flores Creek, adjacent to an open sandy beach habitat. Despite producing radiocarbon dates ranging from 2,850-1,560 B.P., the site also yielded 30 pieces of pottery and adobe brick/tile, clearly indicating contamination from material post-dating ca. 500 B.P. Two Middle Period components are represented at the site dating between 2,005-1,560 B.P. and 2,850-2,445 B.P. Both assemblages are limited to a few flaked stone implements, primarily casual flake and core tools. The younger component includes a small amount of ground stone (completely lacking in the older component), a few bone tools and beads, a drilled stone disk, and two possible storage pit features (one containing mortar fragments). In the older component, two tarring pebbles were identified as was a possible fish hook blank (compare Rasmussen and Woodman 1998:Fig. 8-3 with Strudwick 1986:Fig. 16), and two rock features. Faunal remains reveal the standard dominance of rabbits/hares in both assemblages, with a limited, but significant presence of sea otter and other pinniped bone (see Table 6). Fish remains include relatively high frequencies of taxa favoring estuary habitats (croakers, bat ray, shovel-nosed guitarfish, and various small schooling fishes), as well as those obtained from rocky outer coast (rock fish, sheep head) and deeper water contexts (mackerel/tuna). Shellfish in the older component is made up primarily of chione and scallop, while the younger assemblage is dominated by bean clams (see Byrd 1998), but also shows a variety of estuary (chione, scallop, oyster, little neck clam), and other sandy beach species (Pismo clam). The abundance of bean clams in this assemblage appears to represent the earliest evidence for significant exploitation of this species in the Camp Pendleton area, apparently beginning some time around 2000 B.P.

Late Period (post-1000 B.P.) data are available from ten coastal sites, three from the San Mateo/San Onofre area (CA-SDI-1074, CA-SDI-4411, CA-SDI-13324; Byrd et al. 1995; Reddy et al. 1996), four from the Las Flores and Horno Canyon area (CA-SDI-4538, CA-SDI-10728, CA-SDI-10726, CA-SDI-812/H; Byrd 1996, 1997; this volume), one from the Santa Margarita River (CA-SDI-10156; Strudwick et al. 1996), and two from the San Luis Rey River valley (CA-SDI-5130, CA-SDI-6014; Moratto 1994). The San Mateo/San Onofre components date between 770 and 390 B.P., and produced very sparse artifact assemblages characterized by a handful of flaked and battered stone tools, and a near-absence of ground stone implements (see Table 5; also see large, unreported assemblage from CA-SDI-1074 [Chace 1975]). Features and burials were not encountered at these sites during the Byrd et al. (1995) and Reddy et al. (1996) excavations, and implements made of bone, shell, and pottery were also lacking, with the exception of a possible shell fish hook reported from CA-SDI-13324 (Reddy et al. 1996). Vertebrate faunal assemblages are equally depauperate, being limited to a few jack and brush rabbit bones, one piece of marine mammal bone, unidentified carnivore, surf perches, and croakers (see Table 6). Shellfish remains are dominated by little neck clam, indicating that some protected estuary habitats persisted into the late Holocene in the vicinity of the San Mateo and San Onofre drainages (see Table 7). Secondary contributors include taxa obtained from estuary, rocky outer coast, and open sandy beach habitats, the latter dominated by bean clams.

The four sites from the Las Flores and Horno Canyon produced radiocarbon dates ranging from 1,270 B.P. to the Historic Period (see Table 7). Artifact assemblages from CA-SDI-4538 and CA-SDI-10728 are similar to those from the late San Mateo/San Onofre sites, as the frequency of all tool types is quite low. Although human burials have been observed at CA-SDI-4538, none have been firmly dated, and no other features are reported from either site. Site CA-SDI-812/H produced a larger sample of flaked and battered stone tools, but formal ground stone is limited to six implements. The combined assemblages from Las Flores and Horno Canyon also produced three bone tools and 68 pieces of pottery, probably indicating that some level of residential activity occurred at the sites; however, no burials and only one informal rock feature were encountered.

Mammalian faunal remains include hares and rabbits, a few pieces of deer bone, and little else. The fish assemblage is composed largely of herrings/sardines and anchovies, but a significant number of croaker bone was also found at CA-SDI-4538 (see Table 6). All four shellfish assemblages have over a 99% representation of bean clams, reflecting a very narrow subsistence orientation (see Table 7).

Components from the Santa Margarita and San Luis Rey river valleys (CA-SDI-10156, CA-SDI-5130, CA-SDI-6014) appear to date between 670 B.P. and the Historic Period. Lying over 6.0 kilometers from the coast, these sites produced higher relative and absolute frequencies of ground stone tools than the other Late Period sites, perhaps indicating longer term occupations. Flaked stone tools remain relatively rare, however, as do bone tools and shell ornaments. Pottery sherds are also rare, as the three sites produced only nine items, all from CA-SDI-6014. Site CA-SDI-5130 produced a pit feature with milling gear, faunal remains, and human bone (Feature 102, Burial 1), and some other features that remain undated, but no features or burials are reported from the other sites. Vertebrate faunal remains are essentially limited to hares/rabbits and deer (marine mammals and fish are completely absent), while the shellfish samples are composed of over 98% bean clams at all three sites.

Late Period data from the interior (see Table 8) are derived from seven small camp sites in the uplands of Camp Pendleton (Reddy 1997a), and four large residential areas located along the San Luis Rey drainage (Meighan 1954; Rosen 1984; True et al. 1974, 1991). The seven single component assemblages generated by Reddy (1997a) are located at elevations between 2,100-2,500 ft. near Case Spring, about 15-20 km. from the coast. Radiocarbon dates obtained from these sites range between 740 and 240 B.P., excluding a single assay returning a date of 90 ± 80 B.P.

The combined flaked stone assemblage from the seven upland camps shows a relatively high frequency of bifaces and projectile points, probably reflecting an emphasis on deer hunting in the mountainous areas surrounding the sites (see Table 8). Five sites also have small ground stone assemblages (largely handstones and milling slabs), while four have bedrock milling features (including mortars and milling slicks). Bone and shell implements are quite rare (only three items recovered from one site), as are pottery sherds, which total only four specimens from two sites. Evidence of human remains was found at CA-SDI-5146, and a small hearth was discovered at CA-SDI-5137; neither of these sites contained bedrock milling features, however.

Mammalian faunal remains were quite rare at these sites, limited to a handful of rabbit and deer bone from four sites (see Table 9). Five pieces of marine fish bone were found at one site (CA-SDI-5139), while shellfish were only found at CA-SDI-5138 and CA-SDI-5139 (see Table 9). Both shellfish assemblages are relatively diverse, and differ significantly from one another in the mix of species represented. Site CA-SDI-5138 is dominated by little neck clam, followed by lesser but significant amounts of turban snail, undifferentiated mussel and chiton, and trace amounts of four other taxa. Bean clam is the dominant contributor to the CA-SDI-5139 assemblage, followed by little neck clam, turban snail, chiton, and small amounts of three other taxa (see Reddy 1997a for a more detailed accounting of the faunal remains).

The four interior habitation sites are located along the San Luis Rey drainage. Site CA-SDI-674 is located approximately 20 km. from the coast near the town of Bonsall (Rosen 1984; True et al. 1991). The Pankey site (CA-SDI-682) lies about 26 km. up the valley (True et al. 1991). CA-SDI-132 is situated near the town of Pala, roughly 32 km. from the coast. Molpa (CA-SDI-308) is located further into the interior along the upper reaches of the San Luis Rey drainage (True et al. 1974; Map 5). The artifact assemblages from all four sites are quite robust, and contain a mix of tools one would expect from a major residential base (see Table 8). Site CA-SDI-682 (also known as *Tom-Kav*) and CA-SDI-308 are both represented by San Luis Rey II components (ca. post-450 B.P.) and contain incredibly high frequencies of flaked, battered, and ground stone tools, and over 1,100 bedrock milling elements (no doubt indicating an intensive use of acorns). Bone tools and pottery fragments are also quite plentiful, as are non-utilitarian items such as shell beads, various types of pendants, and stone pipe fragments. Vertebrate faunal remains are only available from CA-SDI-682, and are dominated by hares/rabbits and deer; marine mammals and fish were not observed in the deposit. A small amount of marine shellfish was also recovered from CA-SDI-682, consisting almost entirely of chione and scallops (see Table 9).

Similar, but less robust, assemblages were recovered from CA-SDI-674 (Rosen 1984; True et al. 1991) and CA-SDI-132 (Meighan 1954). The former site is represented by a San Luis Rey II component, and includes flaked and ground stone tools, as well as several bone tools and pottery fragments (although it appears that the entire assemblage is not reported; see True et al. 1991). Site CA-SDI-132, with only one pottery sherd, dates to San Luis Rey I times (pre-500 B.P.). Notwithstanding pottery, it includes the full range of artifact types recovered from the other three sites. Faunal remains are poorly reported from CA-SDI-132 and CA-SDI-674, but do include chione, scallop, and significant amounts of bean clams.

INTERSITE COMPARISONS: DISCUSSION

Early/Middle Holocene sites along the northern San Diego coast show ample evidence of long-term occupation. All of the sites reviewed as part of this study include broad assemblages consisting of flaked, battered, and ground stone tools, with the latter (largely handstones and milling slabs) found in significantly large quantities. Bedrock milling features, hearth features, and human burials have also been identified, but not at every site.

Most of these deposits lie near the edge of existing estuaries (e.g., Agua Hedionda) or where estuaries once existed in the distant past. As a result of these settlement locations, faunal assemblages consist of estuary shellfish (e.g., chione, scallop) and various fishes known to visit estuary habitats (e.g., bat ray, small schooling fishes), while outer coast shellfish, open water fishes, and marine mammals are rare or absent. These findings, combined with terrestrial mammal assemblages dominated by hares and rabbits, reflect an adaptation originally identified by Warren (1968), who attributed this pattern to the Millingstone Horizon or La Jolla Complex.

The next phase of coastal settlement identified by the current study dates between ca. 2,500 and 1,500 B.P., and corresponds to what several archaeologists in coastal southern California call the Middle Period (e.g., Glassow 1996; King 1990). Although this time interval is not typically recognized by investigators in the San Diego region, data recovered from Camp Pendleton and elsewhere in the county indicate that this period may represent a major change in subsistence-settlement orientation. Archaeological excavations at CA-SDI-13325 (Byrd et al. 1995) reveal a component documenting the emergence of important fishing technologies (e.g., circular shell fish hooks), as well as the significant exploitation of marine mammals (represented by sea lion/fur seal and otter bone) and deep water fishes (e.g., mackerel/tuna). The significant presence of deep water fishes at the site impressed Brenda Bowser (a faunal analyst with experience on the Santa Barbara Channel), leading her to conclude that these taxa were probably captured during cooperative "offshore expeditions. . .conducted by small groups of skilled men in relatively sturdy vessels" (Wake 1997:136; see also Byrd et al. 1995:173).

In the Santa Barbara Channel region, evidence for a Middle Period emergence of maritime adaptations is well documented. According to Glassow (1996:22), coastal sites appear to have been occupied for longer periods of time, at least in part due to a greater reliance on fishing and marine mammal hunting. Increases in the importance of fishing are attributed to the introduction of circular shell fish hooks at about 2,500 B.P. and the use of barbed harpoons and plank canoes after 1,700 B.P., the latter evidenced by canoe drills and asphaltum plugs (King 1990). Excavations on San Clemente Island also show substantial Middle Period increases in the abundance of fish bone concurrent with the introduction of the circular fish hook (Raab et al. 1995).

In addition to the findings at CA-SDI-13325, excavations at several other coastal sites provide substantial corroborating evidence for more intensive maritime adaptations at this time. The work of Gallegos (Gallegos and Kyle 1988) and colleagues at Ballast Point (CA-SDI-48), for example, encountered a stratigraphically intact deposit that produced ten radiocarbon dates ranging between 3,600-1,000 B.P., and only two corresponding to an earlier component dating between 6,500-5,500 B.P. Although it is difficult to segregate artifacts and faunal remains by temporal component because the authors thought the deposit represented a single La Jolla Complex occupation, the site produced a significant number of composite fish hooks (all corresponding to the Middle Period levels of the site), as well as bones from the California sea lion, northern fur seal, sea otter, and harbor seal. The unique nature of these findings was recognized by the faunal analyst, who noted that composite fish hooks and marine mammal bone are rarely found in La Jolla Complex sites (Christenson and Roeder 1988). These findings, however, were considered less than significant as the conclusion of the report states that the "site is a single component, La Jolla Complex site occupied for over 5,000 years" (Gallegos and Kyle 1988:12-35). Subsequently, Masters and Gallegos (1997:19) have acknowledged the regional significance of this more maritime-oriented adaptation, but they continued to characterize the assemblage as La Jollan, disregarding the stratigraphic and radiocarbon evidence indicating that the relevant and distinctive portions of the deposit date to the Middle Period (see Masters and Gallegos 1997;

Gallegos and Kyle 1988:Figure 11-6).

Ezell's (1975) excavation of a Middle Period burial along Las Flores Creek provides another interesting hint about maritime adaptations during this interval. Burial 10 was covered by a whale scapula and returned an uncorrected shell date of around 2,000 B.P. (Ezell 1975:56). One of the major goals of Ezell's work was to establish the cultural affiliation of the people buried at the site, and he notes that

> At first, the artifact inventory seemed to me to represent the culture pattern called La Jolla, and early La Jolla at that, but I was puzzled by the presence of the late type of projectile point and the burial pattern so different from the La Jolla culture.... When the Channel Islands element, the whale bone over burial 10, appeared, I felt even more puzzled [Ezell 1975:68].

All of these examples, and probably several others, indicate that the prevailing taxonomic framework used in coastal San Diego cannot easily accommodate potential variability in the local record and underscores a need for flexible cultural chronologies that allow for the discovery of new and unique patterns in the archaeological record, such as a "Middle Period" described here. By assuming cultural continuity between 6,000 and 1,000 B.P. (e.g.,Gallegos and Kyle 1988), or lumping the archaeological record into two phases (pre- and post-4,000 B.P.; e.g., Byrd 1998), a great deal of variability can be obscured, some with important implications for interpreting adaptations both on a local and inter-regional level.

Ultimately, the Middle Period emphasis on marine resource use appears to have been short-lived, as little evidence for advanced maritime adaptations exists at Camp Pendleton after about 1,500 B.P. Most of the later sites produce small artifact collections, lack residential features and burials, and have narrowly focused marine faunal assemblages dominated by bean clams and small schooling fishes. Although Byrd (1998) is correct in recognizing that habitations were present along the north coast of San Diego County in the Late Period and thus seem to contradict the original tenets of the Coastal Decline Model, few of the coastal sites investigated to date seem to evince long term or permanent occupation of the area. Evidence for the intensive use of plant foods (particularly acorns) is not reflected at these sites either by the frequency of milling gear or by plant macrofossils (Reddy 1996b, 1997b; cf. Wohlgemuth 1996), nor are the deposits characterized by rich, diverse middens containing significant amounts of fire-affected rock and formal cooking features, as is found at other long-term residential sites in coastal California (e.g., the Santa Barbara Channel region, San Francisco Bay, northwest California). This is not to say that extended coastal occupations did not occur during the Late Period; rather, the low-density residues suggest that residential use of any one site was probably periodic and of limited duration.

It is also important to emphasize that Late Period subsistence remains lack the diversity of marine resources (i.e., shellfish, marine mammals, and various fishes) found in Early/Middle Holocene and Middle Period assemblages along the northern San Diego County coast. In fact, excluding sites found in the San Mateo/San Onofre drainages, shellfish assemblages are overwhelmingly dominated by a single taxon, bean clam. As Reddy (1996a) has noted, the energetics involved in bean clam collection make it an attractive resource only during sporadic bloom years and, given their life-cycle, the presence of homogenous bean clam assemblages argues for purely seasonal exploitation. Moreover, if multi-season occupation was the norm, and coastal resources were the primary contributor to the diet, then species harvested during the remaining portions of the year should also be predominant in Late Period sites. Only where estuary environments persisted into the late Holocene do we see strong evidence for a reliance on other shellfish species.

In sum, a review of the local archaeological record indicates that while there was a general increase in diet breadth through continued incorporation of increasingly lower-ranked resources in the native diet throughout the Holocene, the most intensive use of marine resources appears to have occurred during the Middle Period. During this interval, significant new technologies were developed (e.g., watercraft, composite fish hooks, circular fish hooks, harpoons) which allowed for the capture of previously under-utilized species such as marine mammals and deep-water fishes. After about 1,500 years ago, however, exploitation of marine resources appears to have narrowed to one or two primary genera of shellfish and small schooling fishes, most likely captured seasonally in near-shore environments. Although the faunal assemblages from the late coastal sites evince primarily seasonal use (Byrd 1998; Hudson 1995:145, 1996:253; Wake 1997:115), diversified artifact assemblages from these same sites are consistent with some degree of extended occupation, implying more than simple task-specific use of the coastal sites during the Late Period. As these data do not seem to conform to either the Coastal Decline Model or the Coastal Intensification Model (Byrd 1998), subsistence-settlement patterns along the coast are probably best evaluated with reference to existing models of Late Period land use developed in the interior of these same drainage systems.

LATE PERIOD SUBSISTENCE-SETTLEMENT PATTERN CHANGE IN NORTHERN SAN DIEGO COUNTY

According to True et al. (1991), Late Period settlement variability in the interior can be explained by a major shift in land use that occurred at around 500 B.P. Between 1,500 and 500 B.P., the San Luis Rey I settlement system is thought to have been composed of several small, short-term encampments spread across a variety of environmental contexts, showing a high degree of similarity to a "forager" adaptation (*sensu* Binford 1980). True et al. (1991) identify several small encampments on the upper San Luis Rey drainage, many that are comparable to the milling camps reported by Reddy (1997a) at Camp Pendleton (see Table 1). This forager pattern of settlement is replaced in San Luis Rey II times (post-500 B.P.) by a centralized village system, where each major tributary contained an autonomous community supported by two permanent residential locations, one in the lowlands for winter use and the other in the uplands for the summer.

True et al. (1991) argue that the increased degree of sedentism at San Luis Rey II villages was made possible by the strong "verticality" of the upper San Luis Rey drainage: "the nature of the village locations and estimated catchment boundaries make significant use of subsidiary camps somewhat superfluous, since almost all resources were located within easy reach of the primary [villages]" (True et al. 1991:47). It follows, therefore, that short-term camp sites with associated bedrock mortars would not be part of the San Luis Rey II system, but should reflect activities associated with the earlier, pre-pottery San Luis Rey I pattern. As outlined above, the predictions of True et al. (1991) hold quite well for the upland milling camps reported by Reddy (1997a), where excavations at seven Late Period sites identified only four pot sherds, and nine of eleven radiocarbon assays ranged between 740 and 400 B.P..

These settlement reconstructions in the interior should have broad implications for the coast. During San Luis Rey I times, for example, one might expect short-term forager base camps to be located along the ocean, designed to take advantage of periodically abundant resources. In fact, all of the Late Period sites listed in Table 5 have produced radiocarbon dates falling within the San Luis Rey I period (i.e., 1,500 to about 500 B.P.), indicating widespread use of the coastal zone during this time period. As noted above, and consistent with True et al.'s (1991) observation on the interior, San Luis Rey I sites from Camp Pendleton contain diverse, albeit sparse, artifact assemblages and narrowly focused subsistence remains, and are, therefore, characteristic of a forager-type adaptation.

Given the development of permanent, centralized villages in the interior during the San Luis Rey II period, it seems likely that people closer to the coast also participated in a village-based system at this time. However, judging from the nature of the coastal archaeological record as it is currently represented from the excavation of CA-SDI-812/H and other nearby sites with San Luis Rey II components, it appears that we have not discovered such villages, but instead have encountered short-term habitations oriented toward the acquisition of seasonally available resources. If so, then the coastal system is clearly different from that reconstructed for the interior. True et al. recognize this possibility, stating that

> First and foremost, it should be clearly understood that the bipolar subsistence-settlement model proposed for the interior upland region of the upper central San Luis Rey River drainage... does *not* apply [emphasis in original] to the lower central and lower lower San Luis Rey River Valley, or to the valley lands to the north and northwest. For these regions there is no ethnographic or archaeological support for a seasonal relocation of the principal villages or camps, and the verticality that marks the interior upland settlements is not likely to have been a factor in the lowland settlement-subsistence systems [True et al. 1991:47].

Because of a lack of verticality in areas closer to the coast, exploitation of important resource patches may have required semi-extended occupations, resulting in the development of more formalized, short-term camps than was the case in the interior. Indeed, it appears that a fission-fusion adaptive strategy may have prevailed along the coastal zone during San Luis Rey II times (see Thomas 1983). Sites like Pankey and Bonsall may represent more strategically placed winter villages that were vacated seasonally as people dispersed to more productive resource tracts, including the coastal zone. Such primary residential localities may exist within the confines of Camp Pendleton as well, perhaps along the northern drainages, where a broader marine resource base could complement a suite of primary terrestrial resources (i.e., deer, rabbits and acorns) and foster extended residential occupation.

ASSEMBLAGE DIVERSITY AND SUBSISTENCE CHANGE – MEASURING THE INTENSITY OF LATE PERIOD COASTAL HABITATION

These proposed subsistence-settlement patterns are borne out by comparison of density and diversity statistics from coastal and inland Late Period assemblages. Densities of flaked stone, ground stone, and non-utilitarian artifacts from Late Period coastal sites are quite low, ranging from 0.3 to 10.0 items per cubic meter (Table 10). The interior village sites at Molpa (CA-SDI-308) and Pankey (CA-SDI-682), in contrast, have densities that are more than twice that found at the most productive Late Period coastal site (mean = 24.9 per m^3 see Table 10). Moreover, when artifact densities from coastal sites are compared with those from interior upland "camps" (Reddy 1997a), there is very little difference in the frequency of tools per cubic meter. Although the highest density of artifacts (48.0 per m^3) from all sites was identified at one of these upland camps (CA-SDI-5139), the average density from all other upland sites (6.0 per m^3) is quite similar to that identified on the coast (5.6 per m^3). Thus, the absolute number of artifacts in late coastal deposits is more comparable to that found in San Luis Rey I upland camp sites, than it is to San Luis Rey II interior villages. A correspondence in density is also noted between Late Period coastal sites and the interior lowland site of Pala (at 4.2 per m^3), further emphasizing the similarities between interior San Luis Rey I sites and those found in the coastal zone.

Analysis of artifact diversity also provides important insights regarding the nature of Late Period subsistence-settlement patterns. Diversity is a measure incorporating both richness (the number of artifact or ecofact classes) and evenness (the distribution of amounts within each class or category). Researchers have long been concerned with the relationship between these aspects of ecofactual assemblages as a reflection of diet breadth changes, both in agricultural and hunter-gatherer contexts (Bettinger and Baumhoff 1982;

Christenson 1980; Clark 1987; Grayson 1991). While one might expect both assemblage richness and evenness to increase with diet breadth, Bettinger (1994:47) succinctly notes that the relationship is not straightforward: "Increasing diet breadth may cause species richness to increase slightly, but will generally have greater effect on [evenness], which will decrease as diet becomes extremely broad as a function of the disproportional representation of small, costly, but abundant taxa." The theoretical relationship between diversity measures and diet breadth has been termed the reverse "C" curve (Figure 2), and while originally conceived as a model to describe agricultural intensification (Christenson 1980), it also applies to hunter-gatherers who intensify by focusing on a few key taxa. As described by Schalk and Atwell:

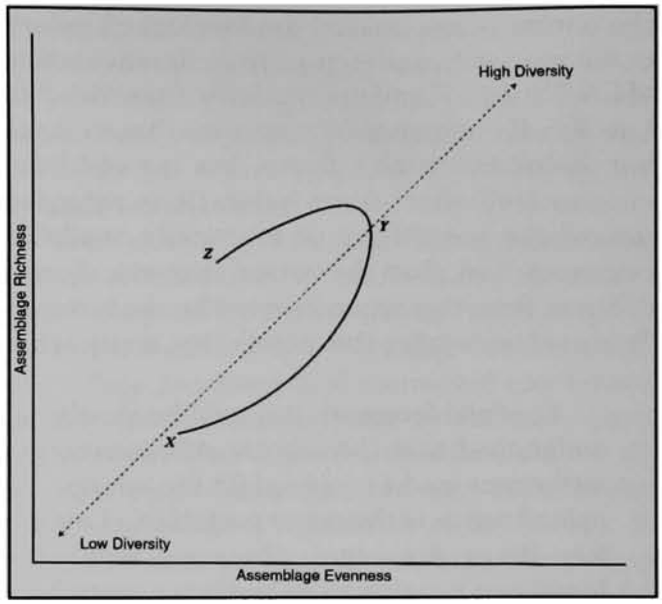

Figure 2.A model of assemblage changes during economic intensification.

> In the initial stage, increments in population [growth] result in increased diversity of resources exploited as well as a widening of niche width or greater *evenness* in resource exploitation. This initial phase of intensification [*X* to *Y*] has been referred to as the 'broad spectrum revolution' and has been described for numerous archaeological sequences around the world. In any ecosystem, limits to the number of resources that can be added are eventually reached, and continued population pressure may result in a different kind of intensification – the expansion of dependence on one or a few resources. During this second stage of intensification [*Y* to *Z*], niche width (i.e., the evenness of resource exploitation) declines and resource diversity either levels off or declines as well [Schalk and Atwell 1994:5-16].

Thus as intensification proceeds, a flex point is eventually reached, at which time further intensification requires an emphasis on comparatively high cost resources that are harvested and processed *en masse*. This second phase of intensification is evidenced by decreasing resource diversity, particularly evenness.

To the extent that hunter-gatherer artifact assemblages reflect primarily economic pursuits, artifact diversity statistics can also be used as a proxy for intensification, and thus should reflect the general pattern described above (Atwell et al. 1995). Here we present diversity statistics for artifact assemblages from coastal, interior upland and interior lowland sites (Table 11, Figure 3). We employ a sample size-adapted version of Shannon's diversity statistic (see Odum 1983; Zar 1984):

$$H' = \frac{n \log n - \sum f_i \log f_i}{n}$$

where n is the number of specimens in the sample and f_i is the number of specimens in each artifact class.

Pielou's evenness statistic *E* is Shannon's diversity measure divided by the number of classes. A value of 1 reflects maximum evenness (i.e., all classes represented in equal proportions):

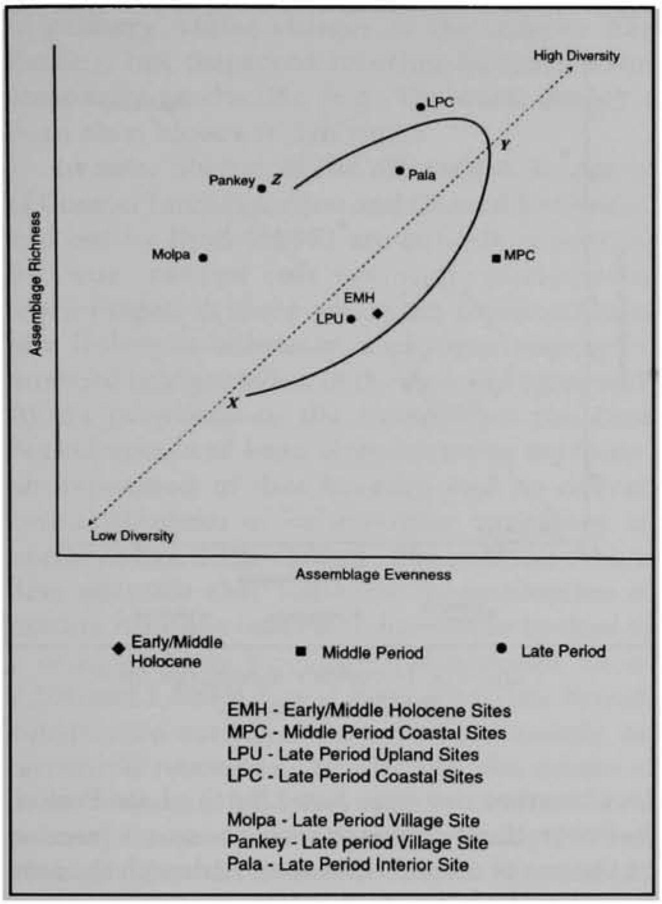

Figure 3. Diversity measures for artifact assemblages.

$$E = \frac{H'}{\log t}$$

where t is the number of classes or taxa.

Margalef's richness statistic R is a ratio of the number of classes or taxa to the log of the sample size. Larger values reflect higher richness (numbers of classes in relation to sample size). A value of 0 indicates an assemblage with only a single class:

$$R = \frac{t-1}{\log n}$$

When these statistics are applied to the regional data sets, the results strongly conform to the predictions of the reverse "C" model and are consistent with True's characterization of settlement subsistence changes for the interior region (see Table 11; Figure 3). These data reflect a generalized expansion in artifact types from the Early/Middle Holocene through the Middle Period, culminating in a peak during San Luis Rey I times (as inferred from the position of the Late Period coastal sites and the interior San Luis Rey I site of Pala). By the San Luis Rey II interval, the flex point is reached. This second phase of intensification is evidenced by decreasing artifact diversity at the San Luis Rey II village sites of Pankey and Molpa. The only exception to these chronological trends involves the Late Period (i.e., San Luis Rey I) upland camp sites, which fall more in line with those obtained from Early/Middle Holocene sites, implying that use of the upland zone during the San Luis Rey I period was more narrowly focused on only a few highly productive resources.

Marine subsistence remains also show some changes in diversity statistics over time. Analysis of shellfish assemblages from Early/Middle Holocene, Middle Period, and Late Period coastal sites (Tables 12 and 13; Figure 4), reveal that the highest diversity of species are represented in the earlier assemblages. Early/Middle Holocene sites, while clearly influenced by the presence of paleoestuaries, show low richness yet high evenness values, reflecting an emphasis on just a few of the most productive taxa. Middle

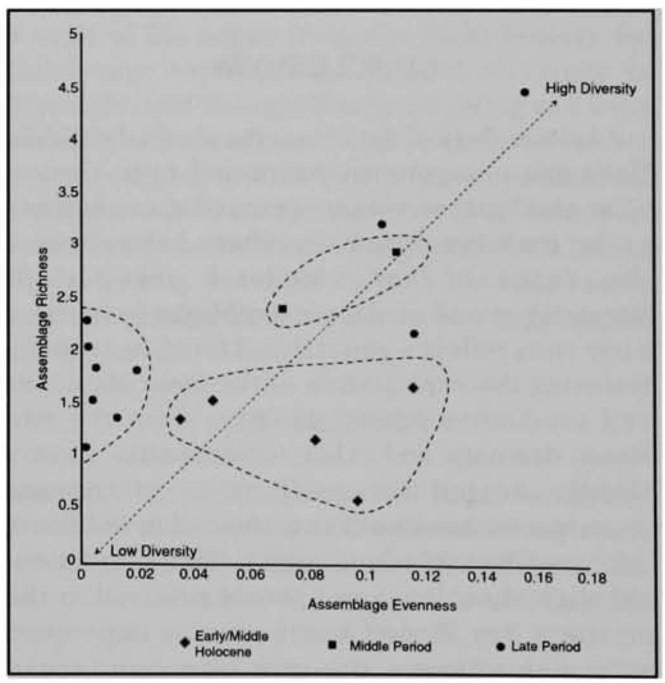

Figure 4. Diversity measures for shellfish assemblages.

Period samples have the highest diversity values, consistent with an expansion in diet breadth over time. The Middle Period values are equaled or surpassed only by two Late Period sites located in the San Mateo/San Onofre drainage, where estuary and rocky coast environments persisted into the late Holocene. Along other portions of the coastline, however, Late Period evenness values approach zero, reflecting the heavy exploitation of a single taxon (i.e., *Donax*). The same temporal pattern is seen among the marine fish assemblages from coastal sites. The earliest collections have the highest diversity measures, while the Late Period fish remains have the lowest, again due to an emphasis on only a few taxa (Table 14; Figure 5). While it is clear that the combined fish and shellfish assemblage from Middle Period sites evinces a more intensive use of the coastal zone than during the previous period, subsequent Late Period assemblages, actually reflect a narrowing in the use of coastal resources, emphasizing just a few abundant, seasonally available taxa. This is not to say that Late Period economies were not intensive. Rather, the focus of diet breadth expansion and intensification appears to have been on terrestrial as opposed to marine resources.

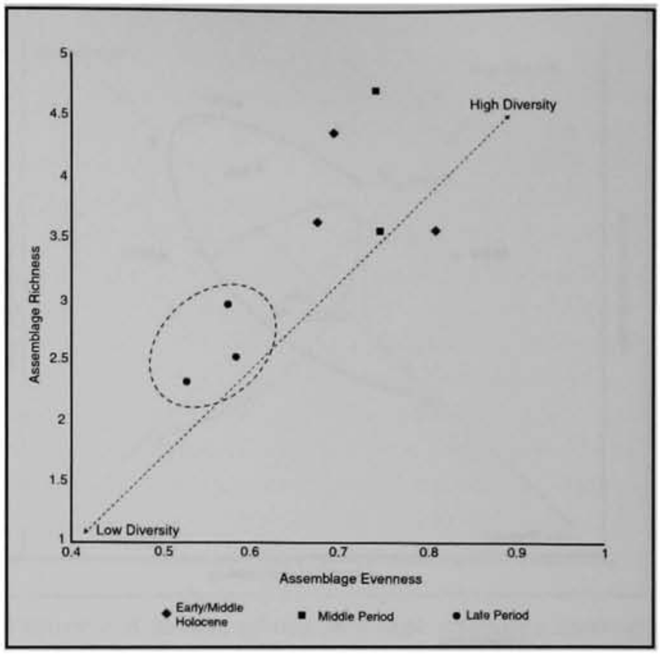

Figure 5. Diversity measures for fish assemblages.

CONCLUSIONS

Archaeological data from the six Early/Middle Holocene components examined here show a clear emphasis on estuary resources, conforming to the traditional view that these habitats were the focus of early coastal occupation. Subsistence and artifact assemblages from these early sites reflect a generalized foraging strategy featuring the exploitation of the most abundant and productive resources. Data from the San Mateo drainage and other regional sites show a Middle Period intensification of marine resources, not unlike that witnessed in the Santa Barbara-Channel Island region. This adaptation, although short lived and poorly resolved in the northern San Diego County area, is important, as it may reflect a site unit intrusion (*sensu* Warren 1968) from the north and, perhaps, a failed attempt to intensify the productivity of the local marine resource base. By the Late Period, however, there appears to have been a retraction in the use of coastal resources. Although the area was not abandoned, coastal occupation seems to have been of short duration, and completely unlike the cultural elaboration witnessed along the Santa Barbara coast at this time. As Warren (1968:7) has pointed out, the difference is probably due to the low productivity of sandy beach habitats, which characterize the northern San Diego County coastline during the late Holocene.

Based on our analysis, the Late Period settlement pattern is consistent with the original ideas of True (True et al. 1991). That is, San Luis Rey I appears to represent a forager-like adaptation, where residential moves were timed to accommodate the changing seasonal productivity of different habitats. During San Luis Rey II times, in contrast, a more formalized, circumscribed system appears to have developed. In the interior, a bipolar residential pattern evolved, which featured seasonal moves between primary upland and lowland villages. On the coast, however, a fission-fusion type system may have developed, where people congregated in primary winter villages in the interior like Pankey, but dispersed to other habitats when seasonally productive (e.g., the coast during a bean clam bloom or fish run).

In sum, neither of the alternative scenarios of Coastal Intensification and Coastal Decline as laid out by Byrd (1998) are entirely supported by our review of regional component assemblages. A more satisfying explanation of late Holocene subsistence changes requires a nuanced interpretation of the data. We agree with Byrd's proposals to the extent that the Late Period uptake of bean clam seems to represent an expansion of diet breadth and an overall intensification of subsistence practices in northern San Diego County. However, our review demonstrates that full-scale intensification of marine resources seems to have been limited to a comparatively brief interval between about 2,500 and 1,500 B.P., and that by the Late Period, subsistence activities were focused mainly on terrestrial resources. In addition, the nature of bean clam as a food resource precludes it as a primary focus of intensification (Reddy 1997a). We argue that the adoption of bean clam should be seen within the context of a settlement-subsistence reorganization that made the seasonal use of this resource attractive (Laylander 1997). While Warren (1968) and other researchers may have overstated the lack of evidence for late Holocene coastal occupation in San Diego County, their characterization of subsistence patterns as terrestrially oriented appears to be essentially correct.

Byrd objects to the Coastal Decline concept not only because Warren and others proposed it without much supporting data, but also because it appears to run counter to a general pattern of "intensive utilization of littoral resources within hunter-gatherer subsistence regimes [corresponding to] worldwide diachronic trends in coastal adaptations" (Byrd 1998:211). It is important to recognize, however, that northern San Diego County, in lacking a strongly developed maritime focus, is scarcely the lone exception to this trend. Researchers reviewing the archaeology of coastal California have documented a great deal of variability in the degree of maritime focus along the coast; such variability is demonstrably correlated with differences in the nature of the coastal environment (Hildebrandt and Levulett n.d.; Jones 1992). We argue that future progress in understanding the processes that lead to maritime intensification in some areas of the California coast is not aided by glossing over these important regional differences. Progress will depend on a detailed understanding of the local environment and prehistory in those areas where marine resource intensification did not occur, as well as those where it did.

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Table 1.
Summary of Single Component Site Proveniences Used in Regional Analysis

	Locus	Unit/Provenience	Radiocarbon Range	Radiocarbon No.	Obsidian Hydration Mean	Obsidian Hydration Range	XRF	Reference
Early/Middle Holocene Single Component Assemblages: Coastal Sites								
Agua Hedionda								
SDI-9649	N/A	all	6850-7520[a]	7	7.8	5.2-13.7	Coso	Koerper et al. 1991
SDI-10965	N/A	all	7040-8390[a]	4	9.1	4.4-18.2	NA	Gallegos 1991
Las Flores								
SDI-10728	A	Units 3, 4, 7, and Unit 5, Strata 2-6 (50-80 cm)	6570-7590	5	-	-		Byrd 1997
SDI-10726	B	Unit 5 (70-100 cm)	6750-6870	2	18.6	-	Coso	Byrd 1996
San Luis Rey River								
SDI-6015	C	all	5310-6220	7	-	-	-	Moratto 1994
Santa Margarita River								
SDI-10156/12599	N/A	Units 15, 16: Stratum 3 (70-120 cm)	5710-7035	3	1.9/4.4	-	O. Butte	Strudwick et al. 1996
Middle and Late Period Single Component Assemblages: Coastal Sites								
San Mateo/San Onofre								
SDI-1074	South	Units 3 and 4	580-610	2	-	-	-	Byrd et al. 1995
SDI-4411	-	all	470	1	-	-	-	Byrd et al. 1995
SDI-13324	-	all	390-770	2	-	-	-	Reddy et al. 1996
SDI-13325	A	Units 1, 2, 5, and 6	1830-3720	4	-	-	-	Byrd et al. 1995
Las Flores								
SDI-811 (A)		Units 107, 113, 114, 115, 116, 117, 119, 120, and 109, 90-150 cm	2445-2850	3	-	-	-	Rasmussen and Woodman 1998
SDI-811 (B)	-	all	1560-1740	3	-	-	-	Byrd 1996
		Units 100, 122 and 109, 0-60 cm	1585-2005	4	-	-	-	Rasmussen and Woodman 1998
SDI-812/H	A, C, D, E	Data Recovery Units 1, 4-6, 9-13; Test Units 13-15, 17,19, 19a, 19b, 24	100-505	19	3.5	3.5-3.6	Coso	Rosenthal et al. 2001
SDI-10726	A, B	Units 1, 4, 5 (0-70 cm), 6, 7	290-1270	3	-	-	-	Byrd 1996
SDI-10728	B	Units 1 and 2	780-870	2	-	-	-	Byrd 1997
Horno Canyon								
SDI-4538	A	Units 1-6	570-1120	4	-	-	-	Byrd 1996
Santa Margarita River								
SDI-10156	N/A	Units 1-8, 13 and 14	600-630	2	1.9	1.1-2.2	O. Butte	Strudwick et al. 1996
San Luis Rey River								
SDI-5130	B	447E/405N, 446E/405N, 451E/404N	670	1	-	-	-	Moratto 1994
SDI-6014	E	all	165-615	5	-	-	-	Moratto 1994
Late Period Single Component Assemblages: Interior Sites								
SDI-5137	-	all	740	1	-	-	-	Reddy 1997a
SDI-5138	-	all	530-590	2	2.3	2.2-2.3	O. Butte	Reddy 1997a
				1	2.3	-	Coso	
SDI-5139	-	all	550-590	4	2.3	1.6-3.1	O. Butte	Reddy 1997a
				2	4.9	3.1-6.6	San Felipe	
SDI-5141	-	all	480	1	-	-	-	Reddy 1997a
SDI-5144	-	all	400	1	-	-	-	Reddy 1997a
SDI-5145	-	all	90-470	2	6.4	-	Coso	Reddy 1997a
SDI-5146	-	all	240-440	2	-	-	-	Reddy 1997a

Notes: [a] radiocarbon years before present, not corrected for local reservoir effect; all other dates corrected; single component areas determined by the vertical and/or horizontal continuity in temporally discrete, radiocarbon dated assemblages. Temporally mixed and undated proveniences not included; O. Butte = Obsidian Butte.

Table 2.
Single Component Artifact Assemblages from Early to Middle Holocene Sites, Northern San Diego County

	Agua Hedionda		Las Flores		San Luis Rey River	Santa Margarita River
CA-SDI-	10965	9649	10728(A)	10726(B)	6015	10156/12599
Radiocarbon Dates [a]						
Range	7040-8390 [b]	6850-7520 [b]	6570-7590	6750-6870	5310-6220	5710-7035
Number	4	7	5	2	7	3
Flaked Stone						
Projectile Points	2	-	1	-	-	-
Bifaces	8	11	-	-	-	-
Drills	1	-	-	-	1	-
Crescentics	6	2	1	-	-	-
Flake Tools	72	679	1	1	-	4
Heavy Duty Battered Stone						
Cores	9	28	3	2	2	3
Choppers	3	41	1	-	-	-
Hammerstones	14	136	-	1	8	3
Other Core/Cobble	6	162	1	-	1	1
Ground Stone						
Manos	5	93	9	1	10	12
Metates	1	35	4	-	13	10
Mortars	-	-	-	-	-	-
Pestles	-	-	-	-	-	-
Miscellaneous Ground Stone	4	18	-	-	10	-
Bedrock Milling Features	-	-	-	-	-	+
Other Artifacts						
Tarring Pebbles	-	8	-	-	-	-
Bone Tools/Beads	1	9	-	-	-	1
Shell Beads	-	32	36	4	-	2
Shell Artifacts	-	14	-	-	-	-
Pottery	-	-	7	2	1	-
Pipe Fragment	-	-	-	-	-	1
Quartz Crystals	-	7	-	-	-	-
Total	132	1275	64	11	46	37
Burials	-	-	-	-	1	-
Features	-	-	-	-	2	1

Note: [a] - radiocarbon years before present, corrected for local reservoir effect; [b] not corrected for local reservoir effect.

Table 3.
Single Component Mammal and Fish Assemblages from Early to Middle Holocene Sites, Northern San Diego County

	Agua Hedionda				Las Flores			San Luis Rey River		Santa Margarita River	
Site	SDI-10965		SDI-9649		SDI-10728(A)[a]		SDI-10726(B)	SDI-6015		SDI-10156/12599	
Radiocarbon Dates[b]											
Range	7040-8390[c]		6850-7520[c]		6570-7590		6750-6870	5310-6220		5710-7035	
Number	4		7		5		2	7		3	
Mammals											
Artiodactyl	-		-		2		NA	-		-	
Deer	21		40		7		NA	-		19	
Lagomorphs	-		266		38		NA	-		-	
Jackrabbit	61		191		63		NA	-		21	
Brush Rabbit	826		20		134		NA	-		52	
Ground Squirrel	31		10		32		NA	-		20	
Carnivore	-		32		3		NA	-		-	
Dog/Coyote	-		-		14		NA	-		2	
Sea Otter	-		-		1		NA	-		-	
Racoon	-		-		1		NA	-		-	
Pinniped											
Sea Lion/Fur Seal	-		—		1		NA	-		-	
Total	939		559		296		-	-		114	
	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/8"	1/16"	1/8"	1/16"
Bony Fish											
Herrings/Sardines	NA		NA	13	35	5	86	79	-	-	- -
Anchovy	-	-	4	-	-	48	40	-	-	2	-
Silversides	-	-	-	-	-	256	-	-	-	-	-
Flat Fish/Halibut	-	-	-	-	14	14	1	-	-	-	-
Surf Perches	-	-	3	1	4	20	10	-	-	-	-
Mackerels/Tunas	-	-	8	1	-	-	3	-	-	-	-
Croakers	-	-	7	-	5	18	6	-	-	-	-
Others	-	-	8	7	5	3	-	-	-	-	-
Sharks/Rays											
Bat Ray	-	-	58	1	17	7	11	-	-	-	-
Shovel-nosed Guitarfish	-	-	19	-	29	14	7	-	-	-	-
Other	-	-	5	3	10	7	2	-	-	-	-
Total	-	-	125	48	89	473	159	-	-	2	-

Notes: [a] - Units 3,4,7; [b] - radiocarbon years before present, not corrected for local reservoir effect; [c] not corrected for local reservoir effect; NA - not available.

Table 4.
Single Component Shellfish Assemblages from Early to Middle Holocene Sites, Northern San Diego County

	Agua Hedionda				Las Flores				San Luis Rey River		Santa Margarita River	
Site CA-SDI-	10965		9649		10728(A)[a]		10726(B)		6015		10156/12599	
Radiocarbon Dates[b]												
Range	7040-8390[c]		6850-7520[c]		6570-7590		6750-6870		5310-6220		5710-7035	
Number	4		7		5		2		7		3	
Shellfish	weight	%	weight	%	weight	%	weight	%	weight	%	weight	%
Chione	24,862.4	89.7	na	56.0	12,095.3	71.1	1509.0	53.1	1631.4	88.3	321.1	77.4
Scallop	2226.4	8.0	na	35.0	2511.5	14.8	1110.0	39.1	152.1	8.2	90.0	21.8
Oyster	317.7	1.1	na	5.0	748.8	4.4	na	na	38.6	2.1	2.9	0.7
Pismo Clam	-	-	-	-	785.7	4.6	na	na	-	-	-	-
Littleneck Clam	62.8	0.2	-	-	420.2	2.5	na	na	0.7	<0.1	-	-
Washington Clam	18.6	0.1	-	-	277.3	1.6	na	na	-	-	-	-
Mussel	226.5	0.8	na	4.0	0.6	-	na	na	0.6	<0.1	-	-
Bean Clam	7.3	<0.1	na	1.0	164.5	1.0	221.0	7.8	0.3	<0.1	0.6	0.1
Total	27,721.7		na		17,003.9		2840.0		1823.7		414.6	

Notes: [a] - Units 3, 4, 7; [b] - radiocarbon years before present, not corrected for local reservoir effect; [c] not corrected for local reservoir effect; na - not available; weight in grams.

Table 5.
Single Component Artifact Assemblages from Middle and Late Period Coastal Sites, Northern San Diego County

	San Mateo/ San Onofre	Las Flores		Horno Canyon	Las Flores			Santa Margarita River	San Mateo/ San Onofre			San Luis Rey River	
	Middle	Middle		Late	Late	Late	Late	Late	Late	Late	Late	Late	Late
CA-SDI-	13325	811(A)	811(B)	4538	812/H[a]	10728(B)	10726(A)	10156	1074	13324	4411	5130	6014
Radiocarbon Dates[b]													
Range	1830-2490[c]	2445-2850	1560-2005	970-1120[d]	100-505	780-870	290-1270	600-630	580-610	390-770	470	670	165-615
Number	3	3	7	4	19	2	3	2	2	2	1	1	5
Flaked Stone													
Projectile Points	-	-	-	1	7	1	-	4	1	-	-	1	2
Bifaces	7	-	-	2	18	-	1	13	-	-	1	-	1
Drills	-	-	-	-	2	-	-	-	-	-	-	-	-
Crescentics	-	-	-	-	-	-	-	-	-	-	-	-	-
Flake Tools	4	8	4	1	35	6	3	3	1	-	3	1	3
Heavy Duty Battered Stone													
Cores	2	11	6	3	7	-	2	3	2	1	5	1	4
Choppers	6	1	-	2	2	-	-	-	1	-	1	-	-
Hammerstones	-	1	1	1	2	-	4	-	2	-	1	6	1
Other Core/Cobble	-	-	-	-	7	1	-	-	-	-	-	-	-
Ground Stone													
Manos	6	-	1	-	5	2	2	11	2	-	-	4	5
Metates	1	-	-	-	-	-	3	-	-	-	-	1	-
Mortars	-	-	1	1	-	-	-	-	-	-	-	-	1
Pestles	-	-	-	-	1	-	-	-	-	-	-	-	-
Miscellaneous Ground Stone	-	-	-	-	3	-	-	-	-	-	-	2	1
Other Artifacts													
Tarring Pebbles	-	2	-	-	-	-	-	-	-	-	-	-	-
Bone Tools/Beads	7	-	3	2	1	-	-	-	-	-	-	-	1
Shell Beads	7	-	-	1	-	3	-	-	-	-	-	1	-
Shell Artifacts	3(hooks)	1(hook blank)	-	-	3	-	-	-	-	1(hook)	-	1	-
Pottery	1	2	28	-	64	-	4	-	-	-	-	-	9
Quartz Crystals	-	-	-	-	1	-	-	-	-	-	-	-	-
Net Weight	1	-	-	-	-	-	-	-	-	-	-	-	-
Drilled Stone Disk	-	-	1	-	-	-	-	-	-	-	-	-	-
Steatite Bead	-	-	-	-	-	-	-	-	-	-	-	1	1
Total	45	26	45	14	158	13	19	34	9	2	11	19	29
Burials	-	-	-	5[e]	-	-	-	-	-	-	-	1	-
Features	-	2	2	-	1	-	-	-	-	-	-	1	-

Notes: [a] - San Luis Rey I and II components only; [b] - radiocarbon years before present, corrected for local reservoir effect; [c] - excluding a date of 3720+/-70; [d] - excluding a date of 570 +/- 70; [e] - reported from earlier site erosion, but temporal placement unknown.

Table 6.
Single Component Mammal and Fish Assemblages from Middle and Late Period Coastal Sites, Northern San Diego County

	San Mateo/ San Onofre	Las Flores		Horno Canyon	Las Flores			Santa Margarita River	San Mateo/San Onofre			San Luis Rey River	
	Middle	Middle		Late	Late	Late	Late	Late	Late	Late	Late	Late	Late
Radiocarbon Dates[b] CA-SDI-	13325	811(A)	811(B)	4538	812/II[a]	10728(B)	10726(A)	10156	1074	13324	4411	5130	6014
Range	1830-2490[c]	2445-2850	1560-2005	970-1120[d]	100-505	780-870	290-1270	600-630	580-610	390-770	470	670	165-615
Number	3	3	7	4	19	2	3	2	2	2	1	1	5
Mammal													
Artiodactyl	7	3	-	-	2	-	na	-	-	-	-	1	9
Deer	36	5	3	2	-	1	na	2	-	-	-	-	-
Lagomorphs	34	1	6	1	16	1	na	-	3	-	6	7	6
Jackrabbit	86	13	19	1	2	2	na	-	-	6	-	7	24
Brush Rabbit	209	17	90	47	-	4	na	4	-	2	-	15	10
Ground Squirrel	9	1	4	9	-	2	na	10	4	1	2	7	3
Carnivore	4	4	1	-	-	1	na	-	1	-	-	-	-
Dog/Coyote	15	2	17	2	-	-	na	-	-	-	-	2	-
Sea Otter	8	1	3	-	-	-	na	-	-	1	-	-	-
Racoon	1	-	-	-	-	-	na	-	-	-	-	-	-
Pinniped													
Sea Lion/Fur Seal	46	4	1	-	-	-	na	-	-	-	-	-	-
Total	455	51	144	62		20	11	16	8	10	8	39	52

Bony Fish	1/8"	1/8"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	Dry	Wet	1/8"	1/8"	1/8"	1/8"	1/8"	1/8"	1/8"
Herrings/Sardines	-	-	-	12	7	182	-	21	3	62	na	-	-	-	-	-	-
Anchovy	-	-	-	8	2	204	-	101	-	16	na	-	-	-	-	-	-
Flat Fish/Halibut	-	5	-	2	-	-	-	-	-	-	na	-	-	-	-	-	-
Surf Perches	9	1	-	-	-	-	-	2	-	-	na	-	1	-	1	-	-
Mackerels/Tunas	81	12	7	5	2	-	2	5	-	-	na	-	-	-	-	-	-
Croakers	40	12	13	45	4	71	-	-	2	-	na	-	1	3	1	-	-
Others	7	-	-	-	-	-	4	3	1	8	na	-	4	3	2	-	-
Silversides	-	-	-	3	-	21	-	2	-	1	na	-	-	-	-	-	-
Rock Fish	14	-	8	6	-	-	-	-	-	-	na	-	-	-	-	-	-
Sheep head	18	10	10	18	4	6	-	-	4	-	na	-	1	-	1	-	-
Sharks/Rays											-	-	-	-	-		
Bat Ray	3	8	6	1	-	-	-	-	-	-	na	-	-	-	-	-	-
Shovel-nosed Guitarfish	6	6	7	2	1	-	-	-	-	-	na	-	-	-	-	-	-
Other	2	30	8	1	-	2	-	-	-	-	na	-	-	-	-	-	-
Total	180	84	59	103	20	486	6	134	10	87		-	7	6	5	-	-

Notes: [a] - San Luis Rey I and II components only; [b] - radiocarbon years before present, corrected for local reservoir effect; [c] - excluding a date of 3720 " 70; [d] - excluding a date of 570 " 70.

Table 7.
Single Component Shellfish Assemblages from Middle and Late Period Coastal Sites, Northern San Diego County.

	San Mateo/ San Onofre	Las Flores		Horno Canyon	Las Flores			Santa Margarita River	San Mateo/ San Onofre			San Luis Rey River	
	Middle	Middle		Late	Late	Late	Late	Late	Late	Late	Late	Late	Late
CA-SDI-	13325	811(A)	811(B)	4538	812/H[a]	10728(B)	10726(A)	10156	1074	13324	4411	5130	6014
Radiocarbon Dates[b]													
Range	1830-2490[c]	2445-2850	1560-2005	970-1120[d]	100-505	780-870	290-1270	600-630	580-610	390-770	470	670	165-615
Number	3	3	7	4	19	2	3	2	2	2	1	1	5
Chione	6.0	43.3	485.7	1.0	7.5	24.0	10.0	0.8	-	-	44.7	215.6	118.2
Scallop	10.0	43.8	214.4	4.0	-	3.5	25.0	0.4	0.1	3.0	5.5	446.4	358.8
Oyster	2.0	6.0	81.1	1.0	13.7	0.2	3.0	-	-	1.0	8.4	140.0	62.6
Pismo Clam	21.0	-	350.0	18.0	30.9	4.4	2.0	1.9	-	-	3.3	8.1	31.9
Littleneck Clam	14,878.0	-	90.2	20.0	5.0	0.7	3.0	-	82.2	5,794.0	7,516.0	4.8	-
Washington Clam	26.0	-	-	-	-	-	-	-	0.2	-	277.5	3.5	1.8
Mussel	2,425.0	1.8	4.6	10.0	18.1	-	1.0	-	0.1	828.0	59.4	0.4	0.2
Bean Clam	6.0	7.1	7358.8	25,390.0	6349.9	8,457.7	6,454.0	4,965.9	5.0	1.0	873.4	24,091.9	25,812.4
Tegula (Dusky Turban)	4,492.0	0.8	4.0	11.0	0.8	-	1.0	-	5.7	1,801.0	1,536.8	-	-
Astraea (Wavy Top Snail)	1,442.0	-	-	-	-	-	-	-	-	15.0	133.6	-	-
Limpets	226.0	-	-	-	1.6	-	-	-	0.2	444.0	156.3	-	-
Chiton	994.0	1.7	2.0	21.0	0.8	0.5	-	-	1.7	31.0	374.4	-	-
Abalone	344.0	-	1.0	1.0	4.2	-	-	-	0.1	-	4.0	-	-
Barnacle	262.0	1.2	-	-	-	-	-	0.2	0.1	329.0	5.3	0.9	-
Total	25,134.0	105.7	8591.8	25,477.0	6432.5	8491.0	6,499.0	4969.2	95.4	9,247.0	10,998.6	24,911.6	26,385.9

Notes: [a] - San Luis Rey I and II components only; [b] - radiocarbon years before present, corrected for local reservoir effect; [c] - excluding a date of 3720 " 70; [d] - excluding a date of 570 ± 70; all weights in grams.

Table 8.
Single Component Artifact Assemblages from Late Period Interior Sites, Northern San Diego County

								(Bonsall)	(Pankey)	(Pala)	(Molpa)
CA-SDI-	5137	5138	5139	5141	5144	5145	5146	674	682[a]	132	308
Radiocarbon Dates[b]											
Range	740	530-590	550-590	480	400	90-470	240-440	SLR II	SLR II	SLR I	SLR II
Number	1	2	2	1	1	2	2	-	-	-	-
Flaked Stone											
Projectile Points	-	4	13	2	1	1	1	30	83	46	329
Bifaces	2	10	23	2	5	4	5	9	7[c]	15	158
Drills	-	-	-	-	-	-	-	-	3	2	12
Crescentics	-	-	-	-	-	-	-	-	-	-	-
Flake Tools	-	2	3	2	-	6	2	7	30	10	95
Cores	-	2	3	2	-	6	2	-	6	-	-
Heavy Duty Battered Stone											
Choppers	-	-	-	-	-	1	-	-	-	-	1
Hammerstones	-	-	2	-	2	2	-	1	4	2	7
Other Core/Cobble	-	-	-	-	-	-	-	-	6	-	3
Ground Stone											
Manos	1	2	4	3	-	6	-	25	43	30	88
Metates	-	-	-	1	-	5	-	1	4	6	18
Mortars	-	-	-	-	-	-	-	-	1	4	9
Pestles	-	-	1	-	-	-	-	-	3	5	8
Misc. Ground Stone	-	-	-	-	-	-	-	-	7	-	4
Bedrock Milling Elements	-	-	14	3	9	-	7	102	245	+	864
Other Artifacts											
Molded Clay Object	-	-	-	-	-	-	-	-	1	1	4
Tarring Pebbles	-	-	-	-	-	-	-	-	-	-	-
Bone Tools/Beads	-	-	2	-	-	-	-	6	96	13	59
Shell Beads	-	-	1	-	-	-	-	-	17	11	16
Shell Artifacts	-	-	-	-	-	-	-	-	3	-	3
Pendants	-	-	-	-	-	-	-	-	-	-	-
Pottery	-	1	3	-	-	-	-	190	1,206	1	2,728
Pipe Fragment	-	1	-	-	-	-	-	-	4	1	7
Quartz Crystals	-	-	-	-	-	-	-	-	-	4	2
Shaft Straightener	-	-	-	-	-	-	-	-	-	-	1
Total	3	22	69	15	17	31	17	371	1,769	151+	4,416
Features	1	-	-	-	-	-	-	NA	+	+	+
Human Remains	-	-	-	-	-	+	-	NA	-	-	-

Note: a - 1958-1959 excavations only; b - radiocarbon years before present, corrected for local reservoir effect; c - includes some flake tools; + reported but not enumerated.

Table 9.
Single Component Mammal, Fish and Shellfish Assemblages from Late Period Interior Sites, Northern San Diego County.

CA-SDI-	5137	5138	5139	5141	5144	5145	5146	(Pankey) 682[a]	(Pala) 132	(Bonsall) 674	(Molpa) 308
Radiocarbon Dates[b]											
Range	740	530-590	550-590	480	400	90-470	240-440	SLR II	SLR I	SLR II	SLR II
Number	1	2	2	1	1	2	2	-	-	-	-
Mammal											
Artiodactyl											
Deer	-	1	1	4	-	3	-	29	+	NA	NA
Lagomorphs	-	-	-	-	-	-	-	-	+	NA	NA
Jackrabbit	-	-	2	-	-	-	-	120	-	NA	NA
Brush Rabbit	-	10	16	-	-	1	-	305	-	NA	NA
Ground Squirrel	-	-	1	3	-	-	-	47	-	NA	NA
Carnivore	-	-	2	-	-	-	-	-	-	NA	NA
Total	-	11	22	7	-	4	-	501	132	NA	NA
Bony Fish	-	-	5	-	-	-	-	-	-	NA	NA
Total	-	-	5	-	-	-	-	-	-	NA	NA
Shellfish[c]											
Chione	-	-	-	-	-	-	-	47.5	-	-	NA
Scallop	-	0.4	2.5	-	-	-	-	42.9	19.0	-	NA
Oyster	-	-	-	-	-	-	-	-	-	-	NA
Pismo Clam	-	-	-	-	-	-	-	-	-	-	NA
Littleneck Clam	-	62.8	8.1	-	-	-	-	-	-	-	NA
Washington Clam	-	-	-	-	-	-	-	-	-	-	NA
Mussel	-	16.4	0.8	-	-	-	-	-	-	-	NA
Bean Clam	-	2.7	49.4	-	-	-	-	4.7	5.0	27.8	NA
Tegula (Dusky Turban)	-	27.2	5.6	-	-	-	-	-	-	-	NA
Astraea (Wavy Top Snail)	-	1.0	-	-	-	-	-	-	-	-	NA
Limpets	-	-	-	-	-	-	-	-	-	-	NA
Chiton	-	12.4	4.4	-	-	-	-	-	-	-	NA
Abalone	-	-	0.3	-	-	-	-	-	6.0	-	NA
Barnacle	-	0.6	-	-	-	-	-	-	-	-	NA
Total	-	123.5	71.1	-	-	-	-	95.1	30.0	27.8	NA

Notes: [a] - Test Pit A; [b] - radiocarbon years before present, corrected for local reservoir effect; [c] - weight in grams; NA - not available; + reported but not enumerated.

Table 10.
Summary of Artifact Densities from Late Period Components

	m^{3a}	# of Artifacts[b]	# per m^3	Period	Reference
Interior Lowland[c]					
CA-SDI-132 (Pala)	38	160	4.2	SLR I	Meighan 1954
CA-SDI-682[d] (Pankey)	12.4	313	25.2	SLR II	True et al. 1991
CA-SDI-308 (Molpa)	35	864	24.6	SLR II	True et al. 1974
Interior Upland					
CA-SDI-5137	3.1	2	0.6	SLR I	Reddy 1997a
CA-SDI-5138	1.5	17	11.3	SLR I	Reddy 1997a
CA-SDI-5139	0.8	39	48.0	SLR I	Reddy 1997a
CA-SDI-5141	1.4	6	4.3	SLR I	Reddy 1997a
CA-SDI-5144	0.8	3	3.8	SLR I/II	Reddy 1997a
CA-SDI-5145	3.0	27	9.0	SLR I/II	Reddy 1997a
CA-SDI-5146	0.8	6	7.5	SLR I/II	Reddy 1997a
Coastal					
CA-SDI-13325	4.6	45	9.8	Middle	Byrd et al. 1995
CA-SDI-811(A)	2.4	10	4.2	Middle	Byrd 1996
CA-SDI-811(A)	2.8	6	2.1	Middle	Rasmussen and Woodman 1998
CA-SDI-811(B)	7.7	24	3.1	Middle	Rasmussen and Woodman 1998
CA-SDI-13324	7.0	2	0.3	SLR I	Reddy et al. 1996
CA-SDI-4538	2.6	14	5.4	SLR I	Byrd 1996
CA-SDI-812/H	15.2	94	6.2	SLR I/II	see this article
CA-SDI-10726	1.8	15	8.3	SLR I/II	Byrd 1996
CA-SDI-10156	9.3	34	3.6	SLR I	Strudwick et al. 1996
CA-SDI-1074	1.2	9	7.5	SLR I	Byrd et al. 1995
CA-SDI-4411	4.1	11	2.7	SLR I	Byrd et al. 1995
CA-SDI-5130	3.1	19	6.1	SLR I	Moratto 1994
CA-SDI-6014	5.8	20	3.5	SLR I/II	Moratto 1994
CA-SDI-10728	1.0	10	10.0	SLR I	Byrd 1997

Notes: [a] Control Units only - total cubic meters excavated was not always reported and it was sometimes necessary to infer total excavated volume from profiles, catalogs, and other descriptions; [b] - does not include flaked stone debitage or pot sherds; [c] - Bonsall (SDI-674) not included due to insufficient data; [d] - 1958-1959 excavations only.

Table 11.
Artifact Diversity Measures for Northern San Diego County Sites

	E/M Holocene	Middle Period	Late Coastal	Late Upland	Pala	Late Lowland Pankey	Molpa
Projectile Points	3	-	17	22	46	83	329
Bifaces	19	7	36	31	15	7	158
Drills	2	-	2	-	2	3	12
Crescentics	9	-	-	-	-	-	-
Cores	47	19	28	15	-	6	-
Choppers	45	7	6	1	-	-	1
Hammerstones	168	2	17	6	2	4	7
Other Core	171	-	8	-	-	6	3
Manos	130	7	31	16	30	43	88
Metates	63	1	4	6	6	4	18
Mortars	-	1	2	-	4	1	9
Pestles	-	-	1	1	5	3	8
Misc. Ground Stone	32	-	6	-	-	7	4
Tarring Pebbles	8	2	-	-	-	-	-
Bone Tools	11	10	4	2	13	96	59
Shell Beads	74	7	5	1	9	17	16
Modified Shell	14	4	4	-	2	3	3
Pipe	1	-	-	1	1	4	7
Quartz	7	-	1	1	4	-	2
Other 1	-	1	2	-	3	1	1
Other 2	-	1	-	-	1	1	4
Total	804	69	174	103	143	289	729
Total classes	17	13	17	12	15	17	18
Diversity	0.97	0.95	1.02	0.82	0.95	0.83	0.77
Evenness	0.79	0.85	0.83	0.76	0.81	0.67	0.62
Richness	5.51	6.53	7.14	5.46	6.50	6.50	5.94

Notes: E/M - Early/Middle; Other - one of a kind items not reported from other site assemblages.

Table 12.
Diversity Measures for Early/Middle Holocene and Middle Period Shellfish Assemblages in Northern San Diego County

	Early/Middle Holocene						MiddlePeriod	
CA-SDI-	10965	10728	10726	6015	10156	13325	811(A)	811(B)
Chione	24862	12095	1509	1631	321	6	43.3	485.7
Scallop	2227	2511	1110	152	90	10	43.8	214.4
Oyster	318	749	-	39	3	2	6	81.1
Tivella	-	786	-	-	-	21	-	350
Protothaca	63	420	-	1	-	14878	-	90.2
Saxidomus	19	277	-	-	-	26	-	-
Mussel	227	1	-	1	-	2425	1.8	4.6
Bean Clam	7	164	-	1	1	6	7.1	7358.8
Tegula	-	-	-	-	-	4492	0.8	4
Astraca	-	-	-	-	-	1442	-	-
Limpets	-	-	-	-	-	226	-	-
Chiton	-	-	-	-	-	994	1.7	2
Abalone	-	-	-	-	-	344	-	1
Barnacle	-	-	221	-	-	262	1.2	-
Total Weight	27723	17003	2840	1825	415	25134	105.7	8951.8
Total taxa	7	8	3	6	4	14	8	10
Diversity	0.18	0.44	0.39	0.17	0.25	0.57	1.23	0.42
Evenness	0.04	0.09	0.10	0.05	0.08	0.11	0.53	0.09
Richness	1.35	1.65	0.58	1.53	1.15	2.95	3.46	2.29

Table 13.
Diversity Measures for Late Period Shellfish Assemblages in Northern San Diego County

CA-SDI-	4538	812	10728	10726	10156	1074	13324	4411	5130	6014
Chione	1	7.5	24	10	1	-	-	44	216	118
Scallop	4	-	4	25	1	1	3	6	446	358
Oyster	1	13.7	2	3	-	-	1	8	140	63
Tivella	18	30.9	4	2	2	-	-	3	8	32
Protothaca	20	5	1	3	-	82	5794	7516	5	-
Saxidomus	-	-	-	-	-	1	-	277	4	2
Mussel	10	18.1	-	1	-	1	828	59	1	1
Bean Clam	25390	6349.9	8458	6454	4966	5	1	873	24091	25812
Tegula	11	1	-	1	-	6	1801	1537	-	-
Astraca	-	-	-	-	-	-	15	134	-	-
Limpets	-	1.6	-	-	-	1	4444	156	-	-
Chiton	21	1	1	-	-	2	31	374	-	-
Abalone	1	4.2	-	-	-	1	-	4	-	-
Barnacle	-	-	-	-	1	1	329	5.3	1	-
Total Weight										
	25477	6432.9	8494	6499	4971	101	13247	10996.3	24912	26386
Total taxa	10	10	7	8	5	10	10	14	9	7
Diversity	0.01	0.04	0.02	0.02	0.00	0.36	0.56	0.50	0.10	0.06
Evenness	0.00	0.01	0.00	0.01	0.00	0.16	0.12	0.11	0.02	0.01
Richness	2.04	2.36	1.53	1.84	1.08	4.49	2.18	3.22	1.82	1.36

Table 14.
Diversity Measures for Marine Fishes, Northern San Diego County Sites

	Early/Middle Holocene			Middle Period			Late Period		
CA-SDI-	9649	10728(A)	10726(B)	13325	811(A)	811 (B)	4538	812/H	10728(B)
Herrings/Sardines	48	91	79	-	-	12	189	21	65
Anchovy	4	48	40	-	-	8	208	101	16
Flat Fish/Halibut	-	28	1	-	5	2	-	-	-
Surf Perches	4	24	10	9	1	-	-	2	-
Mackerels/Tunas	9	-	3	81	12	12	2	7	-
Croakers	7	23	6	40	12	58	75	-	2
Others	15	8	-	7	-	-	-	7	9
Silversides	-	256	-	-	-	3	21	2	1
Rock Fish	-	-	-	14	-	14	-	-	-
Sheep head	-	-	-	18	10	28	6	-	4
Bat Ray	59	24	11	3	8	7	-	-	-
Shovel-nosed Guitarfish	19	43	7	6	6	9	1	-	-
Other	8	17	2	2	30	9	2	-	-
NISP	173	562	159	180	84	162	504	140	97
Total taxa	9	10	9	9	8	11	8	6	6
Diversity	0.77	0.77	0.64	0.71	0.79	0.87	0.55	0.41	0.45
Evenness	0.81	0.77	0.67	0.74	0.87	0.83	0.60	0.53	0.58
Richness	3.57	3.27	3.63	3.55	3.64	4.53	2.59	2.33	2.52