Journal of California and Great Basin Anthropology
Vol. 24, No. 1, pp. 53– 68 (2004)

Middle to Late Archaic Period Changes in Terrestrial Resource Exploitation

Along the Los Peñasquitos Creek Watershed in Western San Diego County: Vertebrate Faunal Evidence from the Scripps Poway Parkway Site (CA-SDI-4608).

MICHAEL W. TUMA
SWCA Environmental Consultants, Inc., 23392 Madero, Suite L, Mission Viejo, CA 92691

Archaic Period subsistence data recovered from two temporally distinct features at the Scripps Poway Parkway site (CA-SDI-4608) were assessed in an analysis of differences between Middle and Late Archaic Period subsistence practices at inland sites along the Los Peñasquitos watershed. The Late Archaic sample was hypothesized to show evidence of a more intensive terrestrial focus, exhibiting greater proportions of deer and Leporid species, and greater species diversity, due to more intensified exploitation of terrestrial resources in response to degradation of the coastal habitat at Los Peñasquitos Lagoon following increased sediment flux ca. 3,500 B.P. Although species diversity measures were essentially equal between the samples, indicating cultural continuity rather than cultural change between Middle and Late Archaic Periods, species proportions by bone weight indicated a higher reliance on Leporid species during the Late Archaic Period, which may have been in response to an overharvest of deer, indicating intensification on terrestrial resources. Los Peñasquitos Lagoon, which remained open and tidally flushed throughout the Late Holocene, was nonetheless affected by sediment flux and habitat degradation, which necessitated an intensification on terrestrial resources.

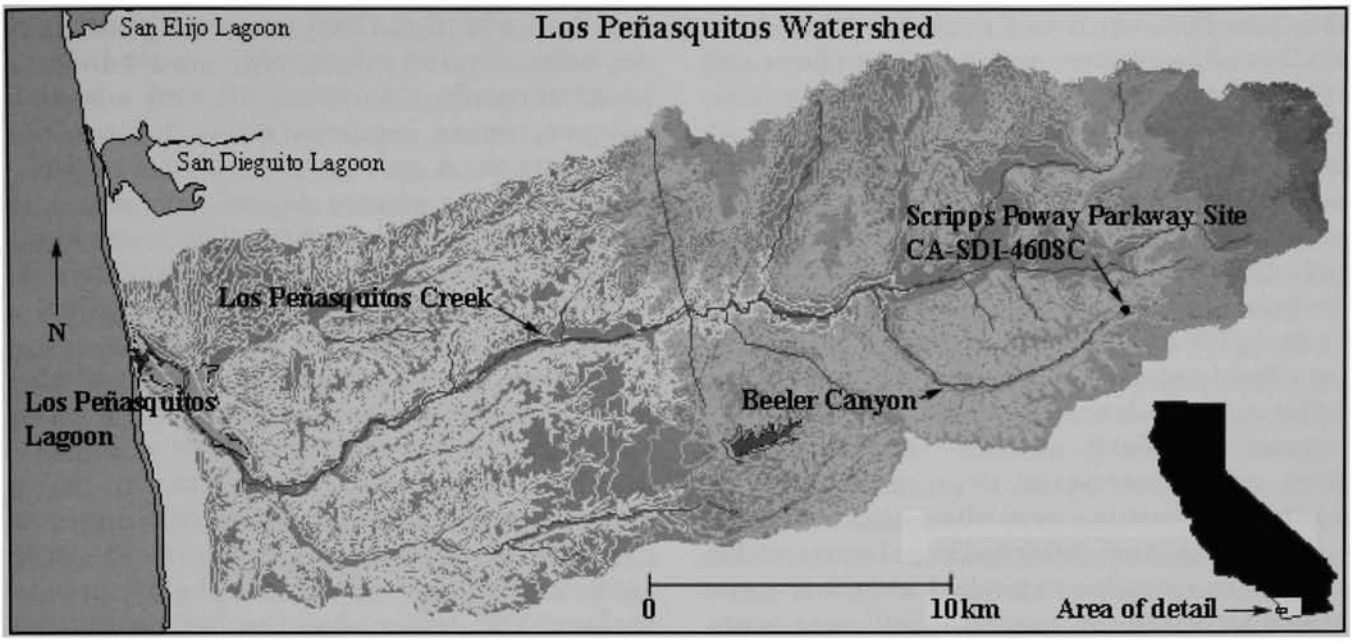
This study is an examination of Archaic Period subsistence practices at the Scripps Poway Parkway Site (CA-SDI-4608), located at an inland valley in western San Diego County. Analysis of the vertebrate faunal material recovered from two temporally distinct features at the site, which dated to the Middle and Late Archaic Periods, will aid in determining whether or not the subsistence economies of populations who inhabited the Los Peñasquitos Creek watershed differed following environmental changes that occurred during the Middle to Late Holocene along coastal San Diego County.

For purposes of this discussion, the Archaic Period includes the La Jolla Complex (Rogers 1939; Moriarty 1966), Encinitas Tradition (Warren 1968), and Milling Stone Horizon (Wallace 1955). The Archaic Period manifestation in San Diego County is characterized by a dominance of coastal shell midden sites, but also includes numerous inland sites. Although the coastal shell midden sites are well documented in the region, comparatively little is known from the inland

sites. Since the 1960s, numerous authors have hypothesized that these inland sites were occupied by the same peoples who occupied the coastal sites (Warren et al. 1961; True 1958). Recent evidence indicates that the coastal and inland sites may have been occupied on a seasonal basis, suggesting that Archaic Period peoples practiced a settlement pattern that included seasonal exploitation of both coastal and inland habitats. Norwood (1980) suggested that inland Archaic Period sites along the San Dieguito River Valley were the location of resource procurement camps during winter months. Oxygen isotope analysis data from CA-SDI-10,238, a coastal La Jolla Complex site overlooking San Dieguito Lagoon, suggest that coastal shell midden sites were occupied between April and September (Smith 1986). Fish otolith data from coastal Archaic Period sites indicate that the majority of fishing occurred in the summer and fall months (see Noah 1998). From these data, it would appear that Archaic Period peoples practiced a settlement system based on exploitation of primarily marine resources at coastal sites during the summer, and exploitation of primarily terrestrial resources at inland sites during the winter. Although the exact nature of the coastal/inland settlement pattern has yet to be addressed for Archaic Period populations in San Diego County, the most likely scenario would involve movement between the coast and inland valleys by way of the major drainages that fed the coastal bays, estuaries, and lagoons. The assumption of the foregoing research is that Archaic Period populations who occupied the Los Peñasquitos watershed practiced a seasonal subsistence round, whereby coastal shell midden sites located around Los Peñasquitos Lagoon were occupied during summer months, and inland sites along Los Peñasquitos Canyon and adjoining canyons were occupied during winter months.

Analyses of Archaic Period occupation of western San Diego County have identified patterns of differential use of the area over time and space, which were influenced by changes in coastal environments. Rising sea levels between 9,000 and 3,500 B.P. created a number of resource-rich bays, estuaries, and lagoons along the southern California coastline (Masters 1988). Human habitations, which exhibited a specialization on exploiting marine resources, blossomed around these coastal hydrological features between 7,500 and 6,000 B.P. (Gallegos 1992). As sea levels stabilized around 3,500 B.P., these features were subjected to a period of sedimentation, which apparently closed off several lagoons along the central San Diego County coastline, degrading important habitat and leading to a decrease in biotic richness and productivity (Gallegos 1987, 1992; Masters 1988; Masters and Gallegos 1997; Miller 1966). This environmental change resulted in a decline of human use of this area of the San Diego coastline, which included Buena Vista, Agua Hedionda, Batiquitos, and San Elijo Lagoons, until approximately 1,300 B.P. Lagoons and estuaries fed by larger drainages in northern and southern San Diego County likely experienced a degree of sedimentation, but remained open to the coast, allowing for continued human occupation (Byrd 1998). Important to this study are the Archaic Period sites around Los Peñasquitos Lagoon and the adjoining Sorrento Valley, where occupations around this coastal feature continued well into the Late Holocene. Site CA-SDI-4629 at Los Peñasquitos Lagoon produced dates ranging from 7,140 to 2,355 B.P. (Smith and Moriarty 1985). Radiocarbon dates from adjacent Sorrento Valley indicate occupation from 5,000 B.P. until the end of the Archaic Period (Carrico and Taylor 1983; Carrico and Gallegos 1988; Gallegos et al. 1989; Smith and Moriarty 1983; WESTEC 1975). These sites indicate that Los Peñasquitos Lagoon was continuously occupied throughout the Archaic Period, a condition that would have allowed for a persistence of the coastal/inland settlement pattern.

The catchment sizes of the watersheds that fed the various coastal features along the San Diego County coastline differed markedly, which likely produced varying degrees of sedimentation and habitat degradation at these hydrological features. Larger catchment sizes



produced greater water flow, flushing the coastal features, and keeping them open to the ocean, which provided rich, productive habitats (see Byrd 1998). Some degree of sedimentation likely occurred at the coastal features fed by medium-sized watersheds, however, including the Los Peñasquitos Creek watershed. This increased sediment flux probably occurred ca. 3,500 B.P. following stabilization of sea levels. Although Los Peñasquitos Lagoon remained open throughout the Holocene, which allowed for continued human exploitation and a persistence of the seasonal subsistence round and settlement system, some habitat degradation likely occurred at the lagoon, thereby necessitating intensification of inland resource procurement by Archaic Period populations who occupied the Los Peñasquitos Creek watershed. Late Archaic populations within the Los Peñasquitos Creek area may have, in response, intensified their use of terrestrial resources, which should be reflected in the archaeological record.

In order to track changes in the intensity in inland terrestrial resource procurement within Los Peñasquitos watershed, comparisons between faunal samples from the Middle Archaic (5,500 – 3,500 B.P.) and Late Archaic Period (3,500 – 1,300 B.P.) are necessary. Intensification of terrestrial resource procurement at inland sites should be evidenced by greater species diversity, with a strong representation of a variety of species, including small mammals, birds, and reptiles. This broadening of the resource base can be attributed to resource intensification at these sites, as they were likely occupied for longer periods of time, and additional habitats may have been exploited for increased resource yield. In addition, proportions of deer and Leporid species (rabbits and hares) should increase in Late Archaic samples in relation to Middle Archaic samples, as the result of an intensified harvest of stable, bulk protein sources.

Data recovered from the Scripps Poway Parkway Site indicates that the Late Archaic component to the site, which exhibited dates ranging from 3,400 to 1,900 B.P., was occupied much more intensively than the Middle Archaic component, with dates ranging from 5,200 to 5,800 B.P., supporting the notion that terrestrial resource intensification indeed occurred during the Late Archaic Period (Raven-Jennings and Smith 1999). Examination of faunal material recovered from these temporal components at the site will allow for an assessment of changes in subsistence practices at inland sites within

the Los Peñasquitos Creek watershed, as evidenced in relative species proportions and species diversity, throughout the Archaic Period. For purposes of this discussion, the Middle Archaic Period will be referred to as the period spanning 5,500 to 3,500 B.P., a period marked by major occupations along the coast that included inland sites. The late Archaic Period will be referred to as the period spanning from 3,500 to 1,300 B.P., a period marked by increased rates of sediment flux and marine habitat degradation at coastal lagoons and estuaries. Subsistence and settlement data from inland terrestrial sites can be used to address questions regarding the nature of responses by Archaic Period populations within the Los Peñasquitos watershed and other major drainages along the southern California coast, thereby increasing our knowledge of how environmental changes affected Archaic Period populations throughout the region.

METHODS

The material for the current study was recovered from the Scripps Poway Parkway Site (CA-SDI-4608), located at an inland valley in eastern Poway. The site is located on a south-facing slope within Beeler Canyon (Figure 1). Beeler Canyon is a major drainage that feeds into Los Peñasquitos Canyon; their junction is located eight kilometers west of the site. Los Peñasquitos (Soledad) Lagoon on the coast is located at the terminus of Los Peñasquitos Canyon, approximately 16 km. west of the junction of Beeler and Los Peñasquitos Canyons. The site was determined to be eligible for inclusion in the National Register of Historic Places in February 1995. A data recovery program was performed by Brian F. Smith and Associates from August 1995 to January 1996 in order to mitigate impacts that would result from construction of Scripps Poway Parkway. The excavations were centered on Locus C, where radiocarbon dates identified deposits from three human occupations; the earliest dated from 5,800 to 5,200 B.P., a second major deposit dated from 3,400 to 1,900 B.P., and the third dated to 600 B.P.. Two temporally distinct Archaic Period features, including a prehistorically excavated pit and a hearth feature, were encountered during the excavations. A substantial amount of well-preserved vertebrate faunal remains was recovered from each feature. The lower levels of the pit feature had a mean radiocarbon date of 5,300 B.P. while the hearth feature had a mean date of 2,800 B.P.

Feature F was a prehistorically excavated pit, which was exposed over six 1 x 1 meter units. The pit contained a deposit of midden-like materials to a depth of 100 cm. below ground surface in an area where adjacent units contained no midden and encountered sterile subsoil at a depth of 30 cm. below ground surface. This feature had the highest amount of faunal recovery on the site, with an abrupt increase in bone weight at the 60 to 70 cm. level. Bulk soil samples were taken from the sidewall of Unit 179 at the 40 to 50 cm. level, which radiocarbon analysis dated to 5,210±80 B.P.; and from the 80 to 90 cm. level, which dated to 5,370±70 B.P. Three units within the block were sampled between the 40 and 90 cm. levels, including Units 174, 185, and 188. More than 470 g. of vertebrate faunal material were obtained from this sample, and used in the analysis. This sample should provide evidence of the subsistence economy of the Archaic Period populations that utilized the site as part of a seasonal round prior to stabilization of sea levels and major sedimentation events at Los Peñasquitos Lagoon.

Feature E was a large hearth feature exposed over a block of seven 1 x 1 meter units. The hearth occurred between 30 and 70 cm. below ground surface, with a noticeable concentration of artifacts between 40 and 50 cm. Bulk soil samples were collected from the sidewalls of two units in the block; a sample was taken from Unit 130 at 30-40 cm., which radiocarbon analysis dated to 2,210±60 B.P.; a second sample taken from Unit 129 at 60-70 cm. dated to 3,460±80 B.P. Three units within the block were sampled between the 30 to 70 cm. levels, including Units 120, 121, and 134. More

than 530 g. of vertebrate faunal material were obtained from this sample, and used in the analysis. This sample should provide evidence of use of the site by Late Archaic Period populations that inhabited the Los Peñasquitos watershed following stabilization of sea levels and subsequent sedimentation and habitat degradation within Los Peñasquitos Lagoon.

The different cultural processes that produced the two features sampled in this analysis may have resulted in differences in bone identifiability between the samples. Feature F, a disposal pit, and Feature F, a hearth, were produced and used for different activities at the site. These activities could have influenced the representation of different taxonomic groups in the samples, as well as the preservation of the bones in each sample as the bones filtered through different sets of cultural processes. Nonetheless, the samples obtained for this analysis were sufficiently large, and very likely representative of the range and proportion of taxa harvested by the human groups who produced the samples, thereby making interpretations of the comparisons between them valid.

The zooarchaeological quantification measures used in describing the faunal samples included 1) bone weight, 2) number of identified specimens (NISP), and 3) minimum number of individuals (MNI).

Bone weight was particularly useful for this study because it is an excellent indicator of relative species importance. Bone weight, like meat weight, is proportional to the size of the animal. Because of this relationship, bone weight can be used as a rough estimate of relative species importance by meat weight. Using bone weight to quantify the faunal samples was especially useful for incorporating less identifiable material into the analysis, regardless of the degree of fragmentation. For example, among mammal bones, highly fragmented bones not identifiable to family, genus, or species were separated into broad taxonomic categories that included unidentified large mammal (which were remains from a deer-sized mammal), unidentified medium mammal (the remains from a raccoon to coyote-sized mammal), unidentified small/medium mammal (the remains from a rabbit to hare-sized mammal), and unidentified small mammal (which were remains from a mouse to squirrel-sized mammal). Unidentifiable bone was placed into these different size categories based on characteristics of the bone, including the size of the fragment, characteristics of the trabecular tissue, and thickness of the cortex in limb bones. When combined with the identified taxa from the same size category, the reliance on a particular size group (for example, deer or Leporids) could be more accurately assessed. Essentially, I assumed that all bones identified as "unidentified large mammal" were actually highly fragmented deer remains, and all bones identified as "unidentified small/medium mammal" were actually highly fragmented rabbit and hare remains. Without this technique, highly fragmented remains of these animals would be underrepresented in the analysis, as the unidentifiable remains could not be incorporated at all, thereby biasing proportions and ratios (i.e., relative species representation). Using weight as a unit of measure thus provided a way to quantify the assemblages regardless of the degree of fragmentation and identifiability.

Using bone weight is an especially appropriate measure for assessing subsistence economies in southern California because of the high degree of bone fragmentation prevalent in assemblages recovered from the region. A suite of taphonomic factors, including both natural and cultural processes, combines to increase bone fragmentation rates. The intensive animal processing practiced by aboriginal groups in the region likely contributed substantially to bone fragmentation. Ethnohistorical accounts indicate that animals, particularly hares, rabbits, rats, and squirrels, were highly processed by prehistoric groups in the area. For smaller mammals, the most common preparation technique was to crush the entire carcass in a mortar, producing a type of mash or pemmican. Bones were also cracked open during marrow extraction or crushed into

a powder that was later added to other foods (Bean 1972). Researchers analyzing blood protein residue have identified mouse, deer, and rabbit blood on manos, confirming this ethnohistorical evidence (Yohe et al. 1991). Natural taphonomic factors also contribute to bone fragmentation. Soils over most of San Diego County are acidic in nature, a condition that does not favor bone preservation (Chaplin 1971:16-18). Additionally, the activities of burrowing rodents, which are diverse and abundant in southern California, result in significant soil turbation at archaeological sites, possibly leading to higher rates of bone attrition. These natural taphonomic processes likely combine to further increase bone fragmentation at archaeological sites. Because of the high degree of bone fragmentation that results from these cultural and natural processes, identification of zooarchaeological samples are much more difficult, making bone weight proportions a more reliable way to assess relative species abundances.

Comparisons of species diversity were made between the samples using the jackknife technique developed by Kaufman (1998) with a statistical software program developed by Andrew Bradbury. Kaufman's technique, which assesses both richness and evenness, allows for determining statistical significance between samples. The richness measure assesses the number of taxa in each sample, while evenness allows for assessment of abundance within taxa. Because of the possibility of differential fragmentation of bones between the two features, and the need to use discrete units for statistical testing, minimum number of individuals (MNI) was used to analyze diversity measures between the samples. Only taxa identified to species or genus were used for the diversity analysis.

RESULTS

A total of 5,096 bone fragments weighing 470.8 g. were recovered from the Feature F sample. The weight of the bone was dominated by unidentified small/medium mammal (156.1g) and unidentified large mammal (128.2g). Among bones identified to genus or species, rabbit (60.9g) and deer (24.4g) were best represented, followed by hare (8.1g; Table 1). When combining the weight of deer with the weight of unidentified large mammal remains, this group accounts for 154.5 g., or 32.82% of the bone weight of the sample. Similarly, when combining the weight of rabbits and hares with the weight of unidentified small/medium mammal remains, this group accounts for 225.1 g., or 47.81%, of the bone weight in the sample (Table 2). In this light, deer and Leporids combine to account for approximately 80% of the weight of the sample. Medium mammals, with 6.86% of the bone weight, and small mammals, with 10.66%, were also important contributors to the sample. Reptiles, including western pond turtle and snakes, contributed 1.23% to the weight of the sample; birds and fish each contributed less than 1%.

Faunal remains recovered from the Feature E sample included 5,759 bone fragments weighing 537.7 g. As in the sample recovered from Feature F, unidentified small/medium mammal (211.5g) and unidentified large mammal (140.6g) were best represented. Among bones identified to at least genus, rabbit (78.9g), deer (18.9g), and hare (13.9g), were best represented (Table 3).

Again, combining these groups with the appropriate size categories of unidentified bone, deer accounts for 159.5 g., or 29.66% of the weight of the sample, while Leporids account for 304.3 g., or 56.59% of the bone weight in the sample (Table 4). Together, deer and Leporids combine account for more than 85% of the weight of the sample. In contrast to the sample from Feature F, medium mammal, with 5.52% of the weight of the sample, and small mammal, with 7.01%, were somewhat less important contributors to the assemblage. Bird, reptile, and fish remains contributed very little, with less than 1% of the bone weight.

Species diversity measures were very similar between the samples. Species richness from Feature E was 2.42, while the richness measure for Feature F was 2.22, results that are statistically insignificantly different (two-tailed

t-test; T=-0.1953, df=24, p=0.8468). The evenness measure from Feature E was 2.97, whereas the evenness from the Feature F sample was 2.84; the differences were statistically insignificant (two-tailed t-test; T=-0.0936, df=24, p=0.9262).

DISCUSSION

The question of changes in inland subsistence practices following changes in the coastal environment at Los Peñasquitos Lagoon during the Archaic Period was addressed through analysis of the faunal samples recovered from Features E and F at the Scripps Poway Parkway site. Because of the identification of these temporally diagnostic features, comparisons of relative species importance and diversity of the faunal remains recovered from them can be used to address the nature of cultural change and/or continuity in regards to inland, terrestrial resource-based subsistence economies following environmental changes along the coast during the Archaic Period.

The current study assumes that Archaic Period populations inhabiting major coastal drainages practiced a settlement system based on seasonal movements between coastal and inland sites. The coastal to inland valley seasonal subsistence round within the Los Peñasquitos Creek watershed included Los Peñasquitos Lagoon, and inland canyons and foothills drained by Los Peñasquitos Creek. Prehistoric peoples occupying this portion of San Diego County presumably moved between the lagoon and foothills areas through Los Peñasquitos Canyon, exploiting habitats along the drainage during times of resource abundance. For example, deer inhabiting inland canyons were likely harvested during the fall months, when concentrations of this resource were located in patches (rutting herds), and around oak groves feeding on acorns. Conversely, fish otolith data and marine mollusc shell oxygen isotope data from Archaic Period sites in San Diego County indicate occupancy of the coastal sites in the summer when greater proportions of fish and molluscs could be harvested. Moving between resource patches in a seasonal manner along major drainages, therefore, was the essence of the Archaic Period subsistence round and settlement system.

The proposed hypothesis states that as sediment flux occurred at major hydrologic features along the coast ca. 3,500 B.P., human populations were affected by varying rates of sediment flux and habitat deterioration within lagoons. Lagoons located along the central San Diego County coastline were apparently completely closed off from the coast, resulting in abandonment of these areas by humans (Gallegos 1992). Coastal hydrological features located at the mouths of medium-sized drainages (including Los Peñasquitos Creek) remained open to the ocean, although some degree of sedimentation and habitat degradation likely occurred. In response to a deterioration of coastal habitat within Los Peñasquitos Lagoon, Archaic Period populations are predicted to have intensified their exploitation of terrestrial resources at inland sites along the Los Peñasquitos watershed. According to this view, intensification of the use of inland terrestrial resources should account for differences in subsistence patterns observed at inland sites between the Middle and Late Archaic Periods.

As hypothesized, the intensification of terrestrial resource use during the Late Archaic should have resulted in populations exploiting a wider range of species, with a greater focus on deer and Leporids. The relative species proportions by bone weight from both samples indicate a high degree of reliance on deer and Leporids throughout the Archaic Period, with little differences in species diversity, data that do not fully support this hypothesis. Some differences in the degree of use different taxa were observed, however. Of particular note are the proportions of bone weight among mammalian categories. Feature F, the Middle Archaic Period sample, indicated a slightly higher reliance on deer, a lower reliance on Leporids, and a higher reliance on medium and small mammals, reptiles, and amphibians, in

contrast to the sample from Feature E, the Late Archaic Period sample. The most notable difference is the greater proportion of Leporids from Feature E (56.59%) compared to Feature F (47.81%). These data, due to the large discrepancy of values, indicate that Leporids were more intensively harvested during the Late Archaic occupancy of the site. This might indicate an over-harvest of deer during the Late Archaic Period. An intensification of hunting could have resulted in the depletion of deer resources in the vicinity of the site, necessitating either long forays to resource-rich areas, or a shift to exploitation of more easily obtained local species, notably rabbits and hares. Data from the current study indicate that the Late Archaic occupants of the site intensified their harvest of Leporid species, appearing to choose the latter of these possibilities.

For the most part, differences between the vertebrate faunal samples recovered from Features E and F at the Scripps Poway Parkway site were small, indicating more of a continuum of subsistence practices rather than significant changes. The similarities, including nearly equal species diversity and a predominance of harvest of deer and Leporid species, provide evidence that subsistence practices between the Middle and Late Archaic Periods did not change significantly, indicating a continuation in the coastal/inland settlement pattern between the Middle and Late Archaic Periods. The more intensive use of the site during the Late Archaic Period, coupled with evidence that indicates overharvest of deer and a shift to a greater focus on Leporid species, suggests that some degradation of the coastal environment at Los Peñasquitos Lagoon may have occurred, thereby necessitating a somewhat stronger reliance on terrestrial resource procurement.

Another factor that may account for the observed differences in intensification of inland terrestrial resource exploitation during the Late Archaic Period is an increase in population size during that period. A larger human population during the Late Archaic Period would also have resulted in an intensification on terrestrial resources, possibly resulting in the same profiles observed within the faunal samples recovered from the Scripps Poway Parkway site. Future research should assess the nature of changes in prehistoric population sizes within the region.

From a comparative perspective, future research should also be directed at discerning the nature of Middle and Late Archaic Period subsistence and settlement patterns along the major river drainages along the San Diego coastline. In particular, questions should include establishing the presence or absence of an Archaic Period seasonal round along the major drainages between the coastal hydrological features and inland valleys, and assessment of how increased sediment flux ca. 3,500 B.P. influenced subsistence and settlement within those drainages. Important to the current study are the exact degree of sedimentation and the nature of any subsequent habitat degradation within Los Peñasquitos Lagoon.

The prediction made here is that watershed size played a significant part in the persistence and characteristics of the coastal to inland seasonal settlement and subsistence round within the watershed. The pattern of Archaic Period coastal/inland settlement was likely totally disrupted in the smaller watersheds, including Buena Vista, Agua Hedionda, San Marcos, and Escondido Creeks. Coastal hydrologic features flushed by the larger watersheds, including the Tijuana, Santa Margarita, San Luis Rey, San Dieguito, and San Diego Rivers, probably allowed for continued exploitation along the coast, and persistence of the coastal/inland settlement pattern along these drainages. The settlement pattern along medium-sized watersheds, including San Mateo and Los Peñasquitos Creeks, was likely affected by a limited deterioration of the coastal habitat; although the coastal hydrological features of these drainages remained open to the coast, allowing for their continued exploitation, some amount habitat degradation likely occurred, which would have necessitated a stronger focus on terrestrial resources at inland sites as

observed in this investigation. Basically, rates of sedimentation at coastal habitats should be predictors of Archaic Period settlement response within major drainages. Varying rates of sediment flux habitat within coastal hydrological features should have resulted in proportional rates of intensification on inland terrestrial resources procured at inland settlements.

REFERENCES

Bean, L. J.
1972 Mukat's People: The Cahuilla Indians of Southern California. University of California Press, Berkeley

Byrd, B.F.
1998 Harvesting the Littoral Landscape During the Late Holocene: New Perspectives from Northern San Diego County. Journal of California and Great Basin Anthropology 20(2):195-218

Carrico, R.L. and C. Taylor
1983 Excavations of a Portion of Ystagua: A Coastal Valley Ipai Settlement. MS on file, South Coastal Information Center, San Diego State University, San Diego, California

Carrico, R. L. and D.R. Gallegos
1988 Data Recovery program for a Portion of Pump Station 64 Force main Improvement. MS on file, South Coastal Information Center, San Diego State University, San Diego, California

Chaplin, R.E.
1971 The Study of Animal Bones from Archaeological Sites. Seminar Press, London

Gallegos, D.R.
1987 A Review and Synthesis of Environmental and Cultural Material for the Batiquitos Lagoon Region. In: San Dieguito-La Jolla: Chronology and Controversy, Susan M. Hector, ed., pp. 23-34. San Diego County Archaeological Society Research Paper (No. 1)
1992 Patterns and Implications of Coastal Settlement in San Diego County: 9000 to 1300 Years Ago. In: Essays on the Prehistory of Maritime California, Terry L. Jones, ed., pp. 205-216. Center for Archaeological Research at Davis, University of California, Davis.

Gallegos, D.R., C. Kyle, and R.L Carrico
1989 Village of Ystagua (Rimbach Sdi-4523) Testing, Significance, and Management. MS on file, South Coastal Information Center, San Diego State University, San Diego, California

Kaufman D.
1998 Measuring Archaeological Diversity: An Application of the Jackknife Technique. American Antiquity 63(1):73-85

Masters, P.
1988 Paleo-Environmental Reconstruction of San Diego Bay, 10,000 Years B.P. to Present. In: Five Thousand Years of Maritime Subsistence at Ballast Point Prehistoric Site Sdi-48 (W-164) San Diego, California, Dennis Gallegos, ed., pp. 4.1-4.22, MS on file, South Coastal Information Center, San Diego State University, San Diego, California

Masters, P. and D.R. Gallegos
1997 Environmental Change and Coastal Adaptations in San Diego County During the Middle Holocene. In: Archaeology of the California Coast During the Middle Holocene, J.M.

Erlandson and M.A. Glasgow, eds., pp. 11-22 . Institute of Archaeology, University of California, Los Angeles

Miller, J.N.
1966 Present and Past Molluscan Faunas and Environments for Four Southern California Coastal Lagoons. Unpublished Masters Thesis, University of California, San Diego

Moriarty, J.R. III
1966 Cultural Phase Divisions Suggested by Typological Change Coordinated with Stratigraphically Controlled Radiocarbon Dating in San Diego. The Anthropological Journal of Canada 4(4):20-30

Noah, A.C.
1998 Prehistoric Fishing on the San Diego Coast. Pacific Coast Archaeological Quarterly 34(2):5-31

Norwood, R.
1980 The Archaeological Resources of the Fairbanks Ranch, Rancho Santa Fe. MS on file at the County of San Diego Environmental Analysis Division, San Diego, California

Raven-Jennings, S. and B.F. Smith
1999 Report of Excavations at CA-SDI-4608: Subsistence and Technology Transitions During the Mid-to-Late Holocene in San Diego County. MS on file, South Coastal Information Center, San Diego State University, San Diego, California

Rogers, M.J.
1939 Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas. San Diego Museum of Man Papers, No. 3, San Diego, California

Smith, B.F
1986 A Report of an Archaeological Sampling Program at Site W-36 (SDI-10238), La Vida Del Mar Project, Solana Beach, California. MS on file, South Coastal Information Center, San Diego State University, San Diego, California

Smith, B.F. and J.R. Moriarty
1983 An Archaeological Evaluation of a Drainage Channel Project at the South Sorrento Business Park. MS on file, Brian F. Smith and Associates, Poway, California
1985 The Archaeological Excavations at Site W-20, Sierra Del Mar. MS on file at the South Coast Information Center, San Diego State University, San Diego, California

True, D. L.
1958 An Early Complex in San Diego County, California. American Antiquity 23(3):255-263

Wallace, W.J.
1955 A Suggested Chronology for Southern California Coastal Archaeology. Southwest Journal of Anthropology 11:214-230

Warren, C.M.
1968 Cultural Tradition and Ecological Adaptation on the Southern California Coast. In: Archaic Prehistory in the Western United States, C. Irwin-Williams, ed., pp. 1-14. Eastern New Mexico University Contributions in Anthropology 1(3), Paleo-Indian Institute, Eastern New Mexico University, Portales, New Mexico

Warren, C.M., D.L. True, and A.A. Eudey
1961 Early Gathering Complexes of Western San Diego County. Archaeological Survey Annual

Report 1960-1961:24-25. University of California, Los Angeles

WESTEC
1975 Rimbach Property Archaeological Report. MS on file, South Coastal Information Center, San Diego State University, San Diego, California

Yohe, R.M. II, M.E. Newman, and J.S. Schneider
1991 Immunological Identification of Small-Mammal Proteins on Aboriginal Milling Equipment. American Antiquity 56(4):659-666

Table 1

VERTEBRATE FAUNAL REMAINS FROM FEATURE F.

Taxa	NISP	Weight (g)	MNI
Mule deer (*Odocoileus hemionus*)	40	24.4	1
Unidentified large carnivore	1	1.9	
Unidentified large mammal	385	128.2	
Coyote (*Canis latrans*)	4	1.5	1
Bobcat (*Lynx rufus*)	1	0.2	1
Unidentified medium carnivore	1	1.4	
Unidentified medium mammal	185	29.2	
Black-tailed hare (*Lepus californicus*)	37	8.1	3
Unidentified rabbit (*Sylvilagus* sp.)	773	60.9	32
Unidentified small/medium mammal	2004	156.1	
California ground squirrel (*Spermophilus beecheyi*)	11	0.8	4
Valley pocket gopher (*Thomomys bottae*)	62	2.8	8
Unidentified wood rat (*Neotoma* sp.)	17	1.1	2
Unidentified medium rodent	137	4.8	
Unidentified small rodent	10	0.0	
Unidentified small mammal	1281	40.7	
California quail (*Callipelpa californica*)	1	0.0	1
Mourning dove (*Zenaida macroura*)	3	0.2	2
Unidentified hawk (*Buteo* sp.)	2	0.4	1
Unidentified medium Accipitrid	3	0.4	
Unidentified medium Passeriform	1	0.0	
Unidentified medium bird	6	0.5	
Unidentified small/medium bird	13	0.2	
Western pond turtle (*Actinemys marmorata*)	4	0.1	1
Unidentified Colubrid snake	54	2.8	
Unidentified rattlesnake (*Crotalus sp.*)	35	2.9	1
California sheephead (*Semicossyphus pulcher*)	1	0.1	1
Unidentified bass (*Paralabrax sp.*)	1	0.1	1
Unidentified medium Perciform	1	0.0	
Unidentified small/med Perciform	1	0.0	
Unidentified medium Osteichthys	1	0.0	
Unidentified Elasmobranch	1	0.0	
Unidentified vertebrate	19	1.0	
TOTAL	5,096	470.8	

Table 2
PROPORTION OF WEIGHT AMONG MAMMALIAN CATEGORIES FROM FEATURE F.

	Deer*	Medium Mammals**	Leporids***	Small Mammals****
Weight	154.5g	32.3g	225.1g	50.2g
Proportion	32.82%	6.86%	47.81%	10.66%

* including weight of bone from unidentified large mammal

** including weight of bone from coyote, bobcat, unidentified medium carnivore, and unidentified medium mammal

*** including weight of bone from unidentified small/medium mammal

**** including weight of bone from squirrels, rats, gophers, unidentified rodents, and unidentified small mammal

Table 3
VERTEBRATE FAUNAL REMAINS FROM FEATURE E.

Taxa	*NISP*	*Weight*	*MNI*
Mule deer (*Odocoileus hemionus*)	33	18.9	1
Unidentified large mammal	479	140.6	
Raccoon (*Procyon lotor*)	1	0.2	1
Coyote (*Canis latrans*)	1	0.1	1
Bobcat (*Lynx rufus*)	1	0.2	1
Unidentified medium mammal	262	29.2	
Black-tailed hare (*Lepus californicus*)	57	13.9	4
Unidentified rabbit (*Sylvilagus* sp.)	952	78.9	27
Unidentified small/medium mammal	2784	211.5	
California ground squirrel (*Spermophilus beecheyi*)	11	1	3
Valley pocket gopher (*Thomomys bottae*)	28	1.3	5
Unidentified wood rat (*Neotoma* sp.)	12	0.3	2
Unidentified medium rodent	44	1.4	
Unidentified small rodent	7	0	
Unidentified small mammal	978	33.7	
Unidentified medium bird	4	0.3	
California quail (*Callipelpa californica*)	2	0.2	1
Mourning Dove (*Zenaida macroura*)	2	0	1
California thrasher (*Toxostoma redivivum*)	1	0.1	1
Unidentified small/mediumbird	28	1.5	
Western pond turtle (*Actinemys marmorata*)	2	0.1	1
Unidentified Colubrid snake	52	3.3	
Unidentified rattlesnake (*Crotalus* sp.)	2	0.3	1
Unidentified large Perciform	2	0.4	
Unidentified small/medium Perciform	2	0	
Unidentified vertebrate	12	0.3	
TOTAL	5,759	537.7	

Table 4
PROPORTION OF WEIGHT AMONG MAMMALIAN CATEGORIES FROM FEATURE E.

	Deer*	Medium Mammals**	Leporids***	Small Mammals****
Weight	159.5g	29.7g	304.3g	37.7g
Proportion	29.66%	5.52%	56.59%	7.01%

* including weight of bone from unidentified large mammal

** including weight of bone from raccoon, coyote, bobcat, and unidentified medium mammal

*** including weight of bone from unidentified small/medium mammal

**** including weight of bone from squirrels, rats, gophers, unidentified rodents, and unidentified small mammal