# INTENSIFICATION, CLIMATIC STRESS, AND WARFARE: COMPETITIVE SELECTION IN LATE HOLOCENE COASTAL SOUTHERN CALIFORNIA

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*Reconstructions of Late Holocene cultural developments in coastal southern California have long favored idealized scenarios of cultural and environmental dynamics. This can be seen clearly in a variety of archaeological models, old and new, that posit redistribution of surplus food as a pathway to increasing social complexity and successful cultural adaptation. Recent evidence suggests that redistributive systems were much less effective than is generally assumed. Combined with Late Holocene climatic stress and the effects of resource intensification, warfare in the Chumash area may have been a bigger factor in culture change than food surplus redistribution.*

## INTRODUCTION

As we enter a new millennium, time-honored orthodoxies of California prehistory are fading. One example of this trend is debate about culture change on the southern California coast during the Late Holocene, a period defined here as approximately A.D. 800 to Spanish contact (1542). Nearly all authorities agree that this period was marked by exceptionally dynamic patterns of culture change, including the emergence of some degree of social complexity, and new patterns of trade, economy, and settlement. Yet fundamental disagreements remain about the kinds of adaptive challenges that created these patterns, and the explanatory frameworks that best account for the observed patterns of culture change. The present discussion attempts to define some of these issues with greater clarity. First, I briefly consider the utility of evolutionary ecology for modeling the research problems at hand. Next, I examine some existing models of Late Holocene cultural dynamics, identifying the essential assumptions and conclusions of each. With these models in mind, I then examine some recent research on the major cultural and environmental constraints that affected Late Holocene coastal populations of southern California. Finally, I isolate some cultural variants that seem likely to have enjoyed a selective advantage in the effective environment of the Late Holocene. When all of this evidence is considered, I argue that certain forces played a particularly powerful role in shaping Late Holocene culture patterns, including resource scarcity, periodic paleoenvironmental stresses, and chronic, inter-community warfare. Observed changes in settlement patterning, social organization, economy, and regional trade can be accounted for as selectively-favored responses to these pressures.

### Evolutionary Ecology

A comprehensive review of evolutionary ecology as an archaeological research strategy exceeds the space available here, but several points deserve emphasis. During recent decades, the shortcomings of functionalist systems theories, mechanistic environmental or historical models, simplistic ethnographic analogies, and the muddled causality of post-modernist "contextualism" have become apparent (Bettinger 1991; Broughton and O'Connell 1999; Jones *et al.* 1999; Kelly 1995; Raab 1996; Raab and Bradford 1997). An increasing number of archaeologists have turned to evolutionary ecology because this approach offers a robust theoretical and empirical research program for modeling culture change (Broughton and O'Connell 1999).

Evolutionary ecologists generally hypothesize that variants of cultural behavior are subject to selective forces within given cultural and environmental constraints (Broughton and O'Connell 1999; Kelly 1995; Smith and Winterhalder 1992). Perhaps the most significant prediction that arises from this neo-Darwinian hypothesis is that these selective forces will determine "the statistical propensity of a [cultural] variant to leave descendants" (Smith and Winterhalder 1992:59). This propensity is affected by reproductive success, survival frequency, resource acquisition rates, and other variables that can be studied as selection "currencies" (Smith and Winterhalder 1992:1-60). In this discussion, I try to show that this approach, even at a fairly heuristic level, yields more logically-

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consistent, realistic, and empirically-warranted hypotheses about many aspects of California prehistory than alternative theoretical schemes.

Models based on theories of evolutionary ecology already demonstrate considerable success in California archaeology, particularly studies of resource intensification. Studies of foraging efficiency, including prey-choice and diet-breadth models, offer insights into a wide range of prehistoric cultural variation, including changes in economy, technology, social organization, trade, and health (Broughton and O'Connell 1999). Still, studies of foraging efficiency by no means exhaust the utility of evolutionary ecology as an archaeological research program. This point deserves repeated emphasis. Although resource intensification studies may be the best known aspects of evolutionary ecology to date, it is a mistake to conclude that the applications of evolutionary ecology are limited merely to reconstructions of techno-economic or techno-environmental patterns. As the following discussion may suggest, a wide range of research problems can be tackled within the theoretical framework of evolutionary ecology.

## MODELING THE LATE HOLOCENE RECORD

Nearly all researchers agree that coastal southern California experienced relatively rapid, far-reaching patterns of culture change during the Late Holocene. Beginning perhaps 2,000 years ago, but accelerating rapidly after about A.D. 1000, consumption of marine foods (notably fish) increased; trade in commodities such as marine shell beads and objects of steatite (soapstone) expanded; and some coastal sites grew to unprecedented size (Chartkoff and Chartkoff 1984; Moratto 1984). Although specialists differ in their assessment of the socio-economic impacts of these developments, some degree of social ranking can be inferred for groups such as the Chumash (Arnold 1992; Glassow 1996; Johnson n.d.; King 1990; Martz 1984). While there is broad recognition of these patterns, there are significant areas of disagreement among theorists about what caused them.

### Eco-Functionalism

For many traditional theorists, the most serious adaptive challenge faced by most prehistoric Californians was redistribution of food and other goods across disparate but highly productive and essentially unchanging natural resource zones. The dynamics of this scenario are clearly drawn in traditional accounts of Chumash Indian prehistory. Following incremental techno-economic and social-organizational innovations, King (1990), Chartkoff and Chartkoff (1984), and others envision a millennial-scale ascent to a Late Holocene cultural climax by the ancestors of the historic Chumash Indians. According to this model, Chumash elites secured considerable socio-economic power from managing the redistribution of food and other valuable goods within regional trade networks (King 1990). This model combines theoretical ideas from the 19th and 20th centuries. The 19th-Century influences are made clear in King's (1990:9) citation of Herbert Spencer, the renown 19th-Century progressive cultural evolutionist, as a source of inspiration. Another set of ideas were incorporated from 20th-Century cultural ecology. This theme can be seen in portrayals of the Late Holocene Chumash as "affluent hunter-gatherers"enjoying an optimally-adapted cultural climax – an adaptation built on a system of culture-environment relations that were highly productive, stable, and "nature-friendly" (Blackburn and Anderson 1993; Haley and Wilcoxon 1997; King 1990; Chartkoff and Chartkoff 1984).

This theoretical program suffers from a host of logical and empirical difficulties. Notably, the model described above exhibits the essential problems of what we might call eco-functionalist reconstructions: namely, a tendency to view particular cultural or cultural-environmental arrangements in relation to "systems" consisting of various ritual, political, and economic "functions" (King 1990, 1994). But how do such systems, which presumably exist because they tend toward homeostatic balance, ever change? Functionalist models often side-step this issue by attributing various goal-seeking motives to the actors involved in ancient cultural systems, or they appeal to influences such as invention, migration, or diffusion. In this way, change can always be accounted for either in relation to special, goal-seeking tendencies of the system, or as an accommodation to forces such as invention. Another conspicuous problem of these models is that change is usually in the direction of increasingly well-adapted systems. Negative or unsuccessful cultural traits virtually never play a role in eco-functionalist formulations, severely undercutting the realism of these models. Beyond these logical difficulties, we shall see below that a growing body of empirical research contradicts utopian, eco-functionalist scenarios in California. In short, there are plenty of good reasons to reject eco-functionalism as a basis for explaining culture change.

### Punctuated Culture Change and Neo-Marxism

In another widely cited model, Arnold (1992, 1995) and Colten and Arnold (1998) envision a starkly

different trajectory of Late Holocene culture change than that envisioned by eco-functionalists. Arnold (1992) contends that, between about A.D. 1100 and 1300, a combination of environmental stresses, including drought and sea-temperature flux, impacted coastal southern California. Rising sea temperatures are though to have depressed the heavily marine-dependent economies of the island Chumash, allowing the ascent of powerful, hereditary chiefs, who exploited this crisis through control of trade networks involved in the exchange of Channel Islands craft commodities (marine shell beads) for mainland foodstuffs. The model also posits that large, ocean-going canoes (*tomols*) were used in this trade, offering another choke-point of elite control over vital resources (Arnold 1995).

The Arnold-Colten formulation clearly differs form King's in arguing for coercive rather than consensual elite control, abrupt rather than gradual culture change, and some degree of environmental flux over environmental stability. References to paleoclimatic stress and sea-temperature variation suggest the importance of extra-cultural, region-wide dynamics (Arnold 1992; Colten and Arnold 1998), yet other discussions appear to reject these forces in favor of unique "contextualized" factors in trying to explain culture change (Arnold *et al.* 1997). However, the causal weight assigned to these various forces remains ambiguous, rendering the Arnold-Colten model confusing.

### Ancient Social Classes?

Despite their differences, the King and Arnold-Colten models share surprisingly similar methodological approaches and basic assumptions. For instance, both models credit prehistoric cultural formations with the socio-economic aspirations of modern social classes. As noted earlier, King's model imbues Chumash elites with the characteristics of a socially-beneficial managerial class, much like those envisioned by 19th-Century progressive social evolutionists. In neo-Marxist fashion, Arnold and Colten posit what amounts to a chiefly over-class that emerged from exploitation of the means of production: namely, specialized crafts production and the canoes required for food redistribution. True, these two models postulate polar opposite elite roles, but neither model flinches from the idea that the ancient Chumash possessed motives in some way similar to interest groups in modern, state-level societies.

It remains far from clear, however, that models designed to explain the social stratification of industrial political economies are the best theoretical approach to understanding culture change among prehistoric California foragers. Proponents of eco-functionalism and neo-Marxism are of course free to assert the explanatory power of their models, but we should be alert to a potentially problematic begging-of-the-question that arises from drawing analogs between modern and ancient socio-economic dynamics: if we begin with the assumption that the ancient Chumash were motivated by contemporary socio-economic impulses, it hardly seems surprising that some archaeologists then "discover" prehistoric political-economic patterns remarkably like those of contemporary state-level societies. This is a danger that Landberg (1965:129-133) warned against in Chumash studies more than three decades ago – a caution that has gone largely unheeded in some quarters.

## CALIFORNIA EDEN

Before moving on, I should note two other areas of critical agreement between the King and Arnold-Colten models. Despite divergent views on the sources of elite power, both models argue that Late Holocene trade activities resulted in redistribution of food stores on a scale that tended to level-out resource imbalances across the Chumash region, thus improving the effective subsistence conditions of many Chumash communities. This conclusion in turn rests on the assumption that southern California natural environments were, overall, productive enough to produce the surpluses necessary to sustain large-scale food redistribution.

That the King and the Arnold-Colten models share the assumption of essentially productive environmental conditions and effective food redistribution is not surprising in historical perspective. During most of this century, California was portrayed as a land of nearly mythical abundance for its native inhabitants. A. L. Kroeber, one of the luminary anthropologists of this century, helped to establish this motif:

> The food resources of California were bountiful in their variety rather than in their overwhelming abundance along special lines. If one supply failed, there were a hundred others to fall back upon (Kroeber 1925:524).

Coastal southern California was singled out for special praise:

> Marine life along the Chumash shores is exceptionally rich, the climate far famed, and every condition favored

> the unusual concentration of population among a people living directly upon nature (Kroeber 1925:551).

In the most recent and utopian twist on this theme, some theorists posit extensive Indian manipulation of the natural environment, yielding high degrees of subsistence security and abundance (Blackburn and Anderson 1993). Whatever the source of the California cornucopia, anthropologists from Kroeber's day to the present have relentlessly promoted an image of Native Californians living in a continuously rich, easily exploited natural environment that virtually emancipated them from subsistence crises (Bean and Lawton 1976; Chartkoff and Chartkoff 1984; King 1976, 1990; Landberg 1965; McCawley 1996). Following this line of thought, the only effective constraints on ancient populations were cultural and volitional – i.e, the ability of native populations to manage nature's bounty more or less effectively through innovations in social organization and trade. As we saw earlier, the Arnold-Colten model departs from this scenario to the extent that it hypothesizes localized (Channel Islands) subsistence distress resulting from drought and changing sea temperatures. But this model never questions the ultimate effectiveness of food redistribution, hypothesizing that trade with the mainland allowed the islanders to avert disaster. The King and Arnold-Colten models offer differing mechanisms of abundance management, to be certain, but both are quite conventional in assuming that abundance could be managed.

Most contemporary authorities reject the hypothesis that large-scale redistribution of food surpluses served as a pathway to social complexity, despite the huge popularity of such models a generation ago in anthropology (Raab 1996).

> All over the world, there were identified prehistoric redistributive systems organized by central chiefly agents, nice people who passed out the goods and generally made life secure for their followers (Binford1989:218).

Eventually, a host of ethnographic and archaeological studies demonstrated that where redistribution existed at all, it was in cases where social power had emerged long before (Price and Feinman 1995). Why, then, have redistributive models of emergent complexity remained popular in California?

Paradoxically, the nearly complete absence of direct, archaeological evidence of prehistoric food surpluses in the Chumash region helped to sustain this position. Now, there can be little doubt that prehistoric California populations relied on stored acorns, seeds, and other commodities for survival. It remains far from clear, however, that this food *storage* included a *disposable food surplus* capable of financing the aspirations of a social elite. Careful reading of the literature in favor of elite-brokered surplus redistribution reveals scant archaeological data in support of the cultural-evolutionary dynamics being advanced (e.g., Arnold 1992; Bean and Lawton 1976; King 1976, 1990, 1994; Landberg 1965; McCawley 1996). Instead, highly interpretive accounts of ethnohistoric information almost exclusively form the bulwark of such interpretations (Raab 1999). Given the long-standing faith in California's natural food abundance, it appears that few found reason to doubt such scenarios. As we shall see next, however, the growth of empirical data on California prehistory during the last two decades now affords good reasons to question all of these orthodoxies.

## END OF EDEN

During the last two decades, empirical archaeological research has produced a vastly larger, better controlled, and more varied body of data on southern California prehistory than ever existed previously. These advances suggest that Late Holocene populations of this region were affected by considerably more rigorous cultural and environmental constraints than many researchers previously recognized: resource intensification, paleoclimatic stress, and warfare.

### Resource Intensification

Quite a different perspective on prehistoric California has emerged from the application of models based on principles of evolutionary ecology, notably models aimed at measuring foraging efficiency. By foraging efficiency, researchers usually mean exploitation of specific resource patches, where:

> foragers will generally seek to maximize the net rate of energy capture, since this means either more food acquired absolutely, or more time made available to other (fitness related) activities once a 'sufficient' amount of food is in hand (Broughton and O'Connell 1999:154).

In keeping with principles of evolutionary ecology, efficiency of energy capture directly impacts Darwinian fitness and, in the case of human foragers, conditions the persistence of variant cultural behaviors

(Broughton 1994a, 1994b, 1997; Broughton and O'Connell 1999; Earle and Christenson 1980; Winterhalder and Smith 1981).

Utilizing prey-choice or diet-breadth models, researchers present evidence of two broad, trans-Holocene patterns of declining foraging efficiency in California. One of these patterns involves harvest of animal species. Studies point toward over-exploitation of medium to large-bodied mammals and fish in various regions of California, followed by increasing reliance on lower-ranked food items such as shellfish and small fish, birds, and mammals (Broughton 1994a, 1994b, 1997; Byrd 1997; Glassow 1996; Grayson 1991). In coastal settings, several studies show long-term declines in the harvesting of seals and sea lions and the most productive shellfish stocks, followed by increased emphasis on fishing, hunting of small mammals (sea otters) and collection of the smallest classes of shellfish (Botkin 1980; Colten and Arnold 1999; Hildebrandt and Jones 1992; Jones and Hildebrandt 1995; Jones and Richman 1995; Porcasi 1995; Porcasi *et al.* n.d.; Raab 1992; Raab *et al.* 1995).

Studies of plant resources utilized for food show a similar pattern. Particularly telling are the data on use of acorns. Since the inception of California anthropology, acorns have anchored utopian scenarios. Said to be abundant, storable, and nutritious, acorns were long posited as the basis of quasi-agricultural native economies (Kroeber 1925; Bean and Lawton 1976). Yet, Basgall (1987) and Wohlgemuth (1996) find no archaeological evidence from California that acorns appeared anywhere in significant amounts earlier than about 5000 years B.P.; in some regions of the state, acorn consumption began only during the last millennium. This pattern seems odd in view of the fact that humans and acorn-producing oak trees have occupied California for at least 10,000 years (Moratto 1984). If acorns were so productive, why did it take so long for California groups to exploit them?

If this question troubled early researchers, it was dismissed with explanations based on changing food tastes, "settling in" to the environment, discovery, experiments ,and other inscrutable processes. On the other hand, Basgall (1987) makes a convincing case that when the cost-benefit characteristics, chronology, and health correlates of intensive acorn use are all considered, this food source is much less productive than researchers have traditionally assumed. Wohlgemuth (1996) finds at least partial support for Basgall's model in an analysis of floral remains and ground stone artifacts from archaeological sites in central California. Recent research on the Camp Pendleton Marine Corps Base, coastal San Diego County, reveals similar trends (Byrd *et al.* 1995; Byrd 1996,1997; Reddy 1997). There, acorn use, accompanied by a shift toward consumption of very small shellfish (bean clams, *Donax gouldii*) and grass seeds appears after about A.D. 400. As an indicator of declining foraging efficiency, patterns of acorn consumption parallel the faunal data examined earlier.

Models of resource intensification are also bolstered by other, seemingly unlikely sources. Colten and Arnold (1998), for instance, explicitly reject resource intensification as a factor in maritime culture change. Yet, their archaeofaunal data from the northern Channel Islands almost perfectly replicate key trans-Holocene prey-choice shifts documented by previous studies of the California coast (Hildebrandt and Jones 1992; Jones and Hildebrandt 1995; Raab *et al* 1995).

How do we know that declining foraging efficiency was likely to have stressed Late Holocene populations of coastal southern California? As Kelly (1995:65-110) and others correctly caution, understanding accurately the energetic basis of extant foraging systems is by no means a simple task, much less the reconstruction of archaeological cases. In California, critics argue that coastal foragers have always consumed a wide range of food items, and even in cases where it is possible to show shifts in prey choice over time, such shifts are not necessarily a cause of stress or culture change (see, for example, Colten and Arnold 1998). Despite these cautions, several lines of evidence suggest comparatively low levels of foraging efficiency during the Late Holocene.

It seems reasonably clear that many plant foods (including acorns and small seeds) and the smallest classes of birds, fish, reptiles, and mammals tend to yield a smaller return (kcal/hr), than foraging patterns that include an ample supply of medium to large animals (Kelly 1995:65-110; Broughton 1994a, 1994b). This effect can be explained by the fact that as diet breadth increases, the total search time for resources is extended, energy must be expended on production and maintenance of specialized collecting and processing gear, and the need for additional labor to render some foods edible (such as seeds and acorns) increases substantially. This is the point that many critics of optimization models miss: consumption of many food types, and the prevalence of particular items in nature (such as acorns), have nothing to do necessarily with "abundance." If we compare broad patterns of Late Holocene economy in coastal southern California with ethnographic cases from around the world (see Kelly 1995:65-90 for comparison), many California groups, including the

Chumash, were subsisting at comparatively modest levels of foraging efficiency (Raab 1996).

Only a relatively small number of studies currently offer detailed, diachronic analyses of prehistoric foraging behavior in coastal southern California. However, the studies that have been published report prey-choice and diet-breath trends similar to those described earlier (Colten and Arnold 1998; Glassow 1996; Hildebrandt and Jones 1992; Porcasi *et al.* n.d.; Raab *et al.* 1995). Some of the most detailed studies of resource intensification in the region come from recent research on the Camp Pendleton Marine Corps Base. This research shows that acorns and intensified use of seeds and very small shellfish appeared on the San Diego coast during the Late Holocene (Byrd *et al.*1995; Byrd 1996,1997; Reddy 1997), reflecting patterns of foraging efficiency constrained to comparatively low levels by a combination of low-yield food resources and high labor demands related to acquisition and processing. This same research points to a general decline in the consumption of medium to large terrestrial mammals from about 7000 years B.P. to European contact, reaching quite low levels in the Late Holocene. Although a wide range of animal species was consumed across the Holocene, fauna were more diverse, and large terrestrial species such as deer more common, during Early and Middle Holocene time ranges. Late Holocene archaeofaunal assemblages from 14 Camp Pendleton sites are dominated by small mammal taxa, primarily rodents, followed by rabbits (Wake 1997). These findings also show similarities to trends documented in the region of Vandenberg Air Force Base, Santa Barbara County, by Glassow (1996).

Studies of prehistoric human skeletal remains reported elsewhere show that Late Holocene populations of the Santa Barbara Channel region and other areas of California experienced some of the most severe health problems of the whole Holocene record (Raab 1996; Raab and Larson 1997). Clearly, this evidence argues against the proposition that Late Holocene coastal populations achieved unmitigated adaptive success. Studies of stable carbon and nitrogen isotopes ($^{*13}C$, $^{15}N$) found in the same skeletal series offer a complementary perspective on foraging efficiency. Walker and DeNiro (1986) and Goldberg (1993) show that broad subsistence patterns, such as the relative contributions of marine and terrestrial food resources to the diet across time, can be gauged through the study of stable isotopes derived from human bone. These data probably should be regarded as suggestive rather than definitive, owing to the comparatively limited scope of this type of research to date (Baird 1999). Even so, one of the most interesting aspects of this research is the finding that foraging location is strongly correlated with carbon-nitrogen ratios – in fact, more so than with than any other variable, including time period (Baird 1999; Goldberg 1993; Walker and DeNiro 1986). Walker and DeNiro (1986) found that, across all time periods, the Channel Islands, mainland coast, and mainland interior regions formed a continuum of isotopic values, clearly pointing to the overriding importance of local ecological conditions in determining dietary patterns. As Lambert and Walker (1991:965) point out, these data lead directly to another conclusion: "...during the Late Period, the redistribution of food was insufficient to equalize local differences in resource availability."

This observation has critical implications for arguments about foraging efficiency. Arnold (1992), King (1990) and others are undoubtedly correct in assuming that various kinds of goods were exchanged during the Late Holocene, including trade between the mainland and Channel Islands. However, if such trade were capable of substantially altering local dietary patterns – a central tenet of both eco-functionalist and neo-Marxist models – it seems logical to expect a trend toward homogenization of isotopic values across all ecological zones. Such a trend could logically be interpreted as an isotopic signature of general improvements in subsistence security and abundance. Moreover, we might expect even small skeletal samples to reflect this signature, given what are imagined to be the pervasive benefits of redistribution. Yet, the isotopic data do not point in the direction of increasingly effective redistribution, nor do they suggest a remedy for stresses attendant to resource intensification. The isotopic data are a serious empirical challenge to the scenarios of managed redistribution that have been staples for decades of theorizing about California prehistory. Although not reviewed here, the same is true for trans-Holocene health trends in the Santa Barbara Channel region (Raab and Larson 1997).

## Late Holocene Climatic Stress

Existing models are also challenged by recent paleoenvironmental research. Jones *et al.* (1999) recently summarized a wide range of archaeological and paleoenvironmental data from the western United States, correlating cultural changes across a wide area, including coastal southern California, with the Medieval Climatic Anomaly (MCA), an interval of global climatic perturbations dating to about A.D. 800 to 1350. Perhaps the most extreme and persistent drought events of the last three to four millennia struck California and western North America during the MCA (Stine 1994). Some of these events, lasting

for more than a century, appear far more severe than any droughts known from the historical record. At the same time, we find abrupt and dramatic changes in social organization, economy, settlement patterning, trade, and human health in many regions of California and the arid American west (see also Raab and Larson 1997). No exercise in simple determinism, however, Jones *et al.* argue that climatic stress had differential impacts across time and space in California:

> On the coast, there is significant evidence for settlement instability, population movement, exchange breakdown, and interpersonal violence during the terminal centuries of the Medieval Climatic Anomaly. Research of the past several decades has emphasized the high population density of California hunter-gatherers, their intensified economies, and their relatively complex sociopolitical systems. Still, the dependence of these people on a few ubiquitous, labor-intensive, storable resources put them in ecological jeopardy (Jones *et al.* 1999:155).

One implication of this model is that climatic stresses, even highly punishing conditions, are not in themselves an adequate explanation of culture change. Earlier in the Holocene, in times characterized perhaps by generally lower population densities and more productive foraging conditions, even high levels of climatic flux might be expected to produce fewer stress-induced cultural changes. In the Late Holocene, it appears that coastal populations in southern California, operating at low foraging efficiency levels on a densely occupied landscape, had few mechanisms for escaping disaster in the event of serious climatic deterioration.

Critically, the paleoclimatic data imply decades-long trends toward depression of terrestrial resource production for whole regions, events that weigh against food surpluses available for buffering stress at the local level or in the form of regional trade. Like the bone-isotope information noted earlier, the paleoclimatic and intensification data offer additional lines of evidence against the food redistribution scenarios featured in neo-functionalist or neo-Marxist reconstructions. Moreover, these same data challenge neo-functionalist stereotypes of hunter-gatherers easily managing stressful conditions through fertility control, shifts to alternative food supplies, and flexible settlement arrangements. What we may now have to accept is that populous, storage-dependent hunter-gatherers of southern California were at greater risk from climatic deterioration than many had been led to suppose by a simple faith in Kroeberian food-abundance scenarios.

## Late Holocene Warfare

In *War Before Civilization*, one of the most comprehensive treatises of recent decades on warfare in foraging and tribal societies, Keeley (1996) concludes that modern anthropology has largely — and unjustifiably — pacified the past. Similarly, in another major work on prehistoric warfare, LeBlanc (1999) shows that over the last few decades, despite copious evidence that warfare played a significant and widespread role in prehistoric culture change around the globe, many anthropologists have either minimized or ignored this role. High rates of Late Holocene inter-personal violence have been known from California for decades (e.g., Moratto *et al.* 1978), yet these rarely have been acknowledged in modeling culture change.

With some recent exceptions, the same myopia regarding warfare has infused models of southern California coastal prehistory. Warfare plays no role in eco-functionalist formulations. This omission is not surprising, since the utopian character of these scenarios envisions few sources of social or economic stress that might give rise to warfare. As we saw before, neo-Marxist models subscribe to a sort of class-based economic warfare, but this model makes no use of warfare in its conventional sense: that is to say, organized violence carried out between opposing communities.

The omission of warfare from these models of emergent social complexity is striking, if we consider the range of evidence for warfare in Chumash ethnohistory and archaeology, and the likely socio-economic impacts of such warfare. Linda King (1992), in her study of proto-historic Chumash social organization and warfare, argues that incessant inter-village conflict was perhaps the single most commonly noted feature of Chumash culture by early European observers. More recent work by Lambert (1993,1994) and Lambert and Walker (1991) documents the comparatively intense warfare in the Chumash area after about A.D. 1100, warfare that closely correlates with the intensification and paleoclimatic trends described earlier. As Lambert and Walker (1991) argue, the Late Holocene appears to have been a time of mounting stress, with shrinking water and food supplies encouraging greater territorial defense and escalating rates of inter-personal violence (see also Jones *et al.* 1999; Raab and Larson 1997). This is a pattern that characterizes other regions of California, as well (Jones *et al.* 1999).

Skeletal trauma spanning a period of about 8,000 years attests to a spectrum of combat intensity in the

Chumash area. At one end of this spectrum, Walker (1989) documents a distinctive pattern in which compression fractures of the skull occur with some frequency. The number of these injuries varies according to locality and time period, but nearly twenty percent of all crania examined from the northern Channel Islands exhibit one or more of the characteristic fractures (Walker 1989:313). However, the frequency of these fractures, along with their characteristic size and form, suggests a style of combat that was *not* intended to inflict death (Walker 1989:319). At the other end of the spectrum, an escalating pattern of lethal combat is reflected in a number of mainland and Channel Islands archaeological sites in the Chumash area during the Late Holocene (Lambert and Walker 1991:970). One of the most provocative instances of this trend is the Calleguas Creek cemetery (CA-VEN-110), located on theVentura County coast near Point Mugu, California. Based on radiocarbon dates and time-sensitive artifacts, this cemetery appears to have been in use primarily during the 13th Century (Raab 1995). A sample of nearly 100 burials, including children and adults, presents perhaps the highest rate of interpersonal violence in the whole 8,000-year skeletal sequence from the region (Raab 1995). Warfare during this period involved a significant escalation of violence, not only in terms of the number and character of the victims involved, but also in terms of weaponry and tactics:

> Traumatic injuries associated with warfare are common at VEN-110. About 10 percent of the adults have evidence of arrow wounds. One person had three arrow points embedded in the vertebral column and another individual had an arrow point in the pelvis. An additional person had a fractured arrow point encapsulated in reactive cancellous bone. Fragments of arrow points that shattered upon impact were found with two additional burials (Walker and Lambert 1989:210).

Lambert and Walker (1991:970) note that the bow and arrow appeared in California sometime after about A.D. 500, at least in part because of its utility in warfare. Although a ten-percent casualty rate may not strike some as evidence of "serious" warfare, several points should be borne in mind. The ten-percent figure probably is a conservative estimate of war-related injuries and deaths, since it does not take account of unrecognized soft-tissue wounds, or of victims who may not have been buried in the Calleguas Creek cemetery. An example of the latter, perhaps, is an adult male burial (Number 34) at Calleguas Creek containing three human skulls. The placement of these skulls clearly indicates their status as "grave furniture," not the unintended intrusion of adjacent burials (Raab 1995). One might argue that these are the skulls of kin or ancestors, suggesting some connection with ancestor worship. While the significance of these skulls is admittedly ambiguous, it remains a possibility that they were taken as war trophies. Keeley (1996:100), in his survey of warfare in non-state societies around the world, shows that "By far the most common and widely distributed war trophy was the head or skull of an enemy." Closer to home, L. King notes that:

> Mutilation of men slain in war either by decapitation or removal of hands and feet was widely reported in California, including the Chumash territory (L. King 1982:170-171).

The killing of men and women of various ages (Lambert 1993; Lambert and Walker 1991; Raab 1995; Walker and Lambert 1989) suggests a style of warfare based on raids and ambushes. As Keeley (1996) and LeBlanc (1999) document, the cumulative effects of this nearly universal style of primitive warfare can be devastating. Over extended periods, this kind of combat can result not only in crippling casualty rates, but in equally lethal secondary stresses, including poor health and heightened morbidity resulting from an inability to forage effectively for food and other materials because of chronic fear of attack (LeBlanc 1999:15). Warfare imposes severe social impacts, as much from a credible fear of attack as from actual fatalities (LeBlanc 1999:6-10).

Also to be considered are the large, and in many cases sedentary, communities that appeared on the southern California coast during the Late Holocene, recognized as a hallmark of this period by most researchers (Chartkoff and Chartkoff 1984; Moratto 1984). Although a number of factors may have been involved in the emergence of such communities, LeBlanc (1999:305) notes that ancient populations had few available strategies for making their communities more defensible in the event of chronic hostilities. Beyond building fortifications or this is where I stopped .locating living sites on easily defended terrain features, large population aggregates offer a measure of protection because the more populous a community, the more difficult it is to overrun successfully. Moreover, if defense of vital resources such as water and foraging space is at stake, the strategic location of a large, permanently occupied community may well be an effective defensive option. As I note elsewhere (Raab 1995), the Calleguas Creek site (VEN-110), with its associated cemetery, and its placement at the mouth of a major coastal stream (Calleguas Creek) is arguably an instance of such a

positioning strategy. Keeley (1996), LeBlanc (1999), and Haas and Creamer (1993) note that a tendency toward population aggregation may well be one of the most reliable archaeological indicators of warfare in any region. This is a topic that deserves greater attention by California archaeologists.

There are also good reasons to think that chronic warfare was a powerful stimulus to the emergence of social hierarchy. Boone (1992:328-329), in a review of this topic, suggests that warfare imposes particularly severe constraints on processes of group formation and dissolution. These constraints are illustrated in formal behavioral models that describe the circumstances under which individuals join or leave (or are excluded from) social groupings, depending on the various costs and benefits that accrue to the group's members. These models predict, in essence, that a group operating under few external constraints will dissolve when it becomes too large to be "profitable" for its members, or as some participants are perceived to gain unfair rewards from membership. Boone argues, however, that warfare tends to constrain this kind of segmentation by imposing a mandatory need to maintain the "public good":

> Organized defense against outside attackers is a good example of a public good that is relatively indivisible and nonexcludable: it benefits everyone who is part of the group ... This is especially true of the deterrence aspect of group defense: if the group is safe from attack because of organized defense, *everyone* in the group is safe (Boone 1992:329).

In the defense case, failure to maintain the public good could very well result in the entire group being routed, enslaved, or massacred. At the same time, the costs of contributing to the "war effort" are high; there is the risk of death or injury in fighting, and at the very least, there is a high expenditure of time, resources, and lost opportunities (although some individuals may benefit greatly from participation in warfare). It is a game with very high stakes.

Several mechanisms come into play in this "game" that allow social ranking to emerge and persist. This discussion does not permit an exhaustive review of these mechanisms, but among them are inter- and intra-community pressures that select for successful leadership in organizing warfare and military alliances (see LeBlanc 1999 for an excellent discussion of these dynamics). These pressures are virtually unavoidable under credible threat of attack, since, as Boone emphasizes, communities that fail to respond to such threats run the risk of serious harm or even extinction. Warfare thus easily takes on a "political" character. Competition and conflict provide powerful stimuli for individuals and whole communities to support efforts designed to control violence by political means. This dynamic is both paradoxical and crucial in terms of cultural evolution: communities prepared to annihilate each other have a powerful motive to maintain socio-economic linkages. In terms of adaptive fitness, it seems likely that Chumash communities that were able to form effective military alliances persisted, where less adept communities did not.

This is scarcely a new idea. Landberg, in his classic description of the Chumash, concluded that:

> The possible existence of a hierarchical ranking of lineages among the Chumash, however vaguely defined, may have been the basis for their socio-political system ... If a segmentary lineage system did develop on the Santa Barbara Coast the extension of the lineage concept beyond the village level provided a framework of sanctions for preventing feuds and warfare which undoubtedly were an ever-present source of disruption and instability and a concomitant of population growth (Landberg 1965:132).

Landberg (1965:132-133) goes on to suggest that inter-*rancheria* feasts and ceremonies were integral components of this mechanism for controlling violence. This is also a prime mechanism for various forms of inter-community exchange.

In this context, Arnold's (1992) conjectures regarding the link between social power and crafts items, particularly shell beads, raise interesting questions: if control of bead production could bring power, as Arnold contends, then why did this monopolistic control arise only in the Late Holocene, given that beads were made for millennia in the Chumash area (King 1990)? A reasonable answer may be that increasing bead production during the Late Holocene, driven by demands for display, exchange, and elite gift-giving, are logical correlates of increasing status complexity. It makes little sense, however, to argue that bead production and trade, in themselves, were a source of social power.

Unlike the increasingly dubious notion that food redistribution was a pathway to social complexity among the Chumash, the hierarchy-inducing forces of warfare seem a far more direct, credible, and empirically supported mechanism of emergent social complexity during the Late Holocene. Morever, as regards the survival of competing cultural variants, the selective pressures of warfare may have had a

particularly profound influence on the "the statistical propensity of a [cultural] variant to leave descendants."

Are there reasons to suppose that warfare actually did shape Chumash social organization? Johnson (n.d.) has recently identified an intriguing post-marital residence pattern in Spanish mission records: After marriage, about 70 percent of Chumash men departed their natal localities to live in the communities of their wives. Unanticipated by previous ethnohistoric research on the Chumash, this is a pattern that points strongly to matrilocal post-marital residence at the time of European contact. More than merely a curiosity, Johnson points out that in cross-cultural surveys, matrilocality is strongly correlated with certain patterns of warfare. The nub of this connection is that:

> Matrilocality prevents the creation of feuding residence groups of patrilineally related males and is therefore given a selective advantage under conditions of external aggression (Johnson n.d.:18).

As Johnson correctly notes, a matrilocal residence pattern is consistent with the fact that the ethnohistoric Chumash are nearly universally described as embroiled in inter-village feuds and warfare (Landberg 1965; Lambert 1994; L. King 1982). Once again, we have strong empirical evidence that the Late Holocene Chumash adaptative environment was powerfully shaped by conflict.

## CONCLUSIONS

One of the conclusions that we can draw from the foregoing discussion is that existing models of California prehistory often fail to account for important constraints on culture change and, as a result, propagate inaccurate scenarios of prehistoric cultural development. Among these constraints is evidence of a long-term and widespread decline in foraging efficiency, exacerbated by intense Medieval-era droughts. Elevated levels of warfare in the wake of these stresses also appears to have imposed critically important constraints on culture change in at least some regions. Although the Arnold-Colten model recognizes the possibility that Medieval-era droughts impacted the Channel Islands (Arnold 1992), this model ignores the larger regional implications of climatic stress, perhaps creating a false impression that Late Holocene cultural innovations were fundamentally island-centered, rather than regional in scope (Raab and Larson 1997). The true scale of these stresses, combined with the dietary evidence considered earlier, tends to rule out trade as an effective mechanism for ameliorating scarcity. By the same token, regional trade in economically significant quantities of foodstuffs seems an increasingly unlikely pathway to social power. This perspective does not deny, of course, that trade in high-status items may have accelerated during the Late Holocene as social elites emerged for other reasons, such as heightened territorial competition and warfare. Overall, however, it seems fair to hypothesize that cultural and natural environments of the Late Holocene were characterized more by stress and scarcity than by the managed resource abundance envisioned by traditional reconstructions of California prehistory.

If so, what cultural patterns might we expect to gain a selective advantage? Resource intensification is an obvious response to scarcity, particularly techniques that allow a greater amount of food to be produced from a fixed amount of land. This option may have worked for a time, but eventually must have reached its limits. Based on the analysis by Jones *et al.* (1999), it appears that many California groups were able to cope with increasingly stressful conditions for a considerable period of time. By about A.D. 1100 to 1300, however, coping strategies appear to have failed in many regions. Among other resulting shifts in cultural behavior, it appears that warfare, even with its associated human and material costs, became prevalent in at least some areas.

A powerful selective advantage potentially accrues to groups that can acquire the resources of competitors. As LeBlanc (1999:11-12) notes, violent inter-community conflict is not pleasant to contemplate, and certainly is not welcomed in politically-correct discourse. But we should not discount warfare's appeal to potential combatants, particularly in circumstances where vital resources are scarce. Pleasant or not, ethnographic surveys amply document the potential advantages of warfare, particularly under circumstances involving food crises and natural disasters (Ember and Ember 1992; Keeley 1996:108-112). Keeley (1996:109-110) offers a telling case study from northern California, in which attacks by the ethnohistoric Wappo on neighboring Pomo communities forced the latter to concede control of substantial foraging territories. Keeley concludes that:

> This pattern of abandoning territory out of fear in order to widen a buffer zone, followed by gradually intensified use of the zone by the victors, illustrates the most common mechanism by which primitive warfare expanded and contracted the domains of prestate societies (Keeley 1996:110).

As Ember and Ember (1992) also document, and regardless of the justifications offered by combatants themselves, success in warfare nearly always results in seizure of land or other important resources. In a Late Holocene environment characterized by widespread resource depression and weak systems of food redistribution, it seems reasonable to hypothesize that successful warfare offered potentially high payoffs in terms of increased foraging productivity. These dynamics may help to explain a puzzle noted by Lambert and Walker (1991:970), who observe that rates of violence in the Chumash area, based on the skeletal evidence, declined after about A.D. 1350, yet violence continued to be a common theme in early ethnohistoric records. This pattern is not anomalous, if we recognize that the early historic Chumash were probably the descendants of populations selectively shaped for centuries by warfare. The institutions surrounding warfare, once selectively established, seem likely to have persisted for considerable periods of time.

Various claims have been made about the degree of social complexity that emerged in Late Holocene coastal southern California. Some of the most ambitious of these envision powerful male chiefs presiding over regional polities that achieved the status of "nationhood" (Bean and Lawton 1976). Regional, hegemonistic chiefdoms, based on either consensual or coerced redistribution, are a common feature of existing models (Arnold 1992; Chartkoff and Chartkoff 1984; King 1990; McCawley 1996). While this is not the place to engage a full-scale debate about these issues, the data presented above weight against these kinds of reconstructions. If we consider the constellation of pressures that Late Holocene populations were responding to, it seems likely that selective forces favored more multi-dimensional and local patterns of social power such as those documented by Johnson (n.d.). Male sodalities, organized around matrilocal residential units, seem likely to have emerged in response to a need for leadership and organization in warfare, economic production assigned to males, and war-related "diplomacy," including trade.

One might argue that the echo of these patterns, surviving in fragmentary ethnohistoric information, have been selectively amplified by contemporary theorists. The skewing of the resulting reconstructions results from the nature of the theories that are employed. Some of these, as discussed above, involve analogs with social classes found in state-level societies. There are other biases, however, including gender-based notions. Prevailing models, which frequently feature powerful male chiefs, probably need to be expanded to include the axes of social power that attend matrilocal residence groups.

Finally, this brief discussion may help to indicate how archaeological model building in California has long subscribed to over-idealized and unrealistic concepts. It appears increasingly unlikely that ancient Californians occupied a land of mythic abundance. An ascent to complexity financed by elite-brokered trade in bulk food commodities – either consensual or coerced – is an increasingly dubious proposition, despite the decades-long popularity of this notion. Instead, we should perhaps turn to a consideration of the real constraints that shaped culture change, along with models based on evolutionary ecology.

## REFERENCES CITED

Arnold, Jeanne E.
1992 Complex Hunter-Gatherer-Fishers of Prehistoric California: Chiefs, Specialists and Maritime Adaptations of the Channel Islands. *American Antiquity* 57:60-84.

1995 Social Inequality, Marginalization, and Economic Process. In *Foundations of Social Inequality*, edited by T. D. Price and G. M. Feinman, pp. 87-103. Plenum Press, New York.

Arnold, Jeanne E. and Scott Pletka
1997 Bigger Boats, Crowded Creekbanks: Environmental Stresses in Perspective. *American Antiquity* 62:337-339.

Arnold, Jeanne E., Roger H. Colten and Scott Pletka
1997 Contexts of Cultural Change in Insular California. *American Antiquity* 62:300-318.

Baird, Marguerite L.
1999 The Application of Stable Isotopes in the Analysis of Resource Intensification in Prehistoric California. Unpublished M.A. thesis, Department of Anthrpology, California State University, Northridge.

Basgall, Mark E.
1987 Resource Intensification among Hunter-Gatherers: Acorn Economies in Prehistoric California. *Research in Economic Anthropology* 9:21-52.

Bean, Lowell J. and Harry Lawton
1976 Some Explanations of the Rise of Cultural Complexity in Native California with Comments on Proto-Agriculture and Agriculture. In *Native Californians: A Theoretical Perspective*, edited by L. J. Bean and T. C. Blackburn, pp. 19-48. Ballena Press, Ramona, California.

Bettinger, R. L.
1991 *Hunter-Gatherers, Archaeological and Evolutionary Theory*. Plenum Press, New York.

Binford, Lewis R.
1989 *In Pursuit of the Past*. New York: Thames and Hudson.

Blackburn, T. C., and K. Anderson (editors)
1993 *Before the Wilderness: Environmental Management by Native Californians*. Ballena Press, Menlo Park, California.

Boone, James L.
1992 Competition, Conflict and Development of Social Hierarchies. In *Evolutionary Ecology and Human Behavior*, edited by E. A. Smith and B. Winterhalder, pp. 301-337. Aldine De Gruyter, New York.

Botkin, Stephen
1980 Effects of Human Exploitation on Shellfish Populations at Malibu Creek, Calfornia. In *Modeling Change in Prehistoric Subsistence Economics*, T. K. Earle, and A. L. Christenson, eds, pp. 121-139. Academic Press.

Broughton, Jack M.
1994a Late Holocene Resource Intensification in the Sacramento Valley, California: The Vertebrate Evidence. *Journal of Archaeological Science* 21:501-514.

1994b Declines in Mammalian Foraging Efficiency during the Late Holocene, San Francisco Bay, California. *Journal of Anthropological Archaeology* 13:371-401.

1997 Widening Diet Breadth, Declining Foraging Efficiency, and Prehistoric Harvest Pressure: Ichthyofaunal Evidence from the Emeryville Shellmound, California. *Antiquity* 71:845-862.

Broughton, Jack M. and James F. O'Connell
1999 On Evolutionary Ecology, Selectionist Archaeology and Behavioral Archaeology. *American Antiquity* 64:153-165.

Byrd, Brian F. (editor)
1996 Coastal Archaeology of Las Flores Creek and Horno Canyon, Camp Pendleton, California. Prepared for Army Corps of Engineers, Los Angeles District. Report on file, South Coast Information Center, San Diego State University.

1997 Coastal Archaeology at CA-SDI-10,728, La Flores Creek, Camp Pendleton, California. Report prepared for U. S. Army Corps of Engineers, Los Angeles District, Contract No. DACA09-94-D-0019 by ASM Affiliates, Inc., Encinitas, California. Report on file with South Coast Information Center, San Diego State University.

Byrd, Brian F., David Pallette and Christopher Serr
1995 Archaeological Testing Along San Mateo Creek and San Onofre Creeks, Northwestern Camp Pendleton, San Diego County, California. Prepared for Army Corps of Engineers, Los Angeles District. Report on file, South Coast Information Center, San Diego State University.

Chartkoff, Joseph L. and Kerry K. Chartkoff
1984 *The Archaeology of California*. Stanford University Press, Menlo Park.

Colten, Roger H. and Jeanne E. Arnold
1998 Prehistoric Marine Mammal Hunting on California's Northern Channel Islands. *American Antiquity* 63:679-701.

Earle, Timothy K. and Andrew L. Christenson (eds.)
1980 *Modeling Change in Prehistoric Subsistence Economies*. New York: Academic Press.

Ember, Carol R. and Melvin Ember
1992 Resource Unpredictability, Mistrust and War: A Cross-Cultural Study. *Journal of Conflict Resolution* 36:242-262.

Glassow, Michael A.
1996 *Purisimeno Chumash Prehistory: Maritime Adaptations Along the Southern California Coast*. Harcourt Brace, Fort Worth.

Goldberg, Carol
1993 The Application of Stable Carbon and Nitrogen Isotope Analysis to Human Dietary Reconstruction in Prehistoric Southern California. Unpublished Ph.D. dissertation, Departement of Anthropology, University of California, Los Angeles.

Grayson, Donald K.
1991 Alpine Faunas from the White Mountains, California: Adaptive Change in the Late Prehistoric Great Basin. *Journal of Archaeological Science* 18:483-506.

Haas, Jonathan and Winifred Creamer
1993 Stress and Warfare Among the Kayenta Anasazi of the 13th Century A.D. *Fieldiana, Anthropology New Series, no. 22.* Field Museum of Natural History, Chicago.

Haley, Brian D. and Larry R. Wilcoxon
1997 Anthropology and the Making of Chumash Tradition. *Current Anthropology* 38:761-794.

Hildebrandt, William R. and Terry L. Jones
1992 Evolution of Marine Mammal Hunting: A View from the California and Oregon Coasts. *Journal of Anthropological Archaeology* 11:360-401.

Johnson, John R.
n.d. Social Responses to Climate Change among the Chumash Indians of South Central California. In press, Global Climate Change in History and Prehistory, edited by Roderick J. McIntosh, Joseph A. Tainter, and Susan McIntosh, Columbia University Press.

Jones, Terry L., Gary M. Brown, L. Mark Raab, Janet L. McVickar, W. Geoffrey Spaulding, Douglas J. Kennett, Andrew York, and Phillip L. Walker.
1999 Environmental Imperatives Reconsidered. *Current Anthropology* 40:137-169.

Jones, Terry L., and William R. Hildebrandt
1995 Reasserting a Prehistoric Tragedy of the Commons: A Reply to Lyman. *Journal of Anthropological Archaeology* 14:78-98.

Jones, Terry L. and J. R. Richman
1995 On Mussels: *Mytilus californianus* as a Prehistoric Resource. *North American Archaeologist* 16:33-58.

Keeley, Lawrence H.
1996 *War Before Civilization.* Oxford University Press, New York.

Kelly, Robert L.
1995 *The Foraging Spectrum.* Smithsonian Institution Press.

King, Chester D.
1994 Prehistoric Native American Cultural Sites in the Santa Monica Mountains. Reported prepared for the Santa Monica Mountains and Seashore Foundation, and National Park Service, Western Region. Report on file, Santa Monica Mountains National Recreation Area.

1990 *Evolution of Chumash Society: A Comparative Study of Artifacts Used for Social System Maintenance in the Santa Barbara Channel Region Before A.D. 1804.* Garland, New York.

1976 Chumash Inter-Village Economic Exchange. In *Native Californians: A Theoretical Perspective*, edited by L. J. Bean and T. C. Blackburn, pp. 288-318. Ballena Press, Ramona.

King, Linda B.
1982 Medea Creek Cemetery: Late Inland Chumash Patterns of Social Organization, Exchange and Warfare. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.

Kroeber, Alfred L.
1925 *Handbook of the Indians of California.* Bulletin 78 of the Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Lambert, Patricia M.
1993 Health in Prehistoric Populations of the Santa Barbara Channel Islands. *American Antiquity* 58:509-522.

1994 War and Peace on the Western Front: A Study of Violent Conflict and Its Correlates in Prehistoric Hunter-Gatherer Societies of Coastal Southern California. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Santa Barbara.

Lambert, Patricia M., and Phillip L. Walker
1991 Physical Anthropological Evidence for the Evolution of Social Complexity in Coastal Southern California. *Antiquity* 65:963-973.

Landberg, Leif
1965 The Chumash Indians of Southern California. *Southwest Museum Papers 19.* Los Angeles.

LeBlanc, Steven A.
1999 *Prehistoric Warfare in the American Southwest.* University of Utah Press, Salt Lake City.

Martz, Patricia C.
1984 Social Dimensions of Chumash Mortuary Populations in the Santa Monica Mountains Region. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.

McCawley, William
1996 *The First Angelinos, The Gabrielino Indians of Los Angeles*. Malki Museum/Ballena Press Cooperative Publication, Banning and Novato, California.

Moratto, Michael J.
1984 *California Archaeology*. Academic Press, Orlando, Florida.

Moratto, Michael J., Thomas F. King, and William F. Woolfenden
1978 Archaeology and California's Climate. *Journal of California and Great Basin Anthropology* 5:147-161.

Porcasi, Judith F.
1995 Trans-Holocene Marine Mammal Hunting on San Clemente Island, California: Additional Data to Assess A Prehistoric "Tragedy of the Commons" and Declining Mammalian Foraging Efficiency. Unpublished M.A. thesis. California State University, Northridge, Department of Anthropology.

Porcasi, Judith F., Terry L. Jones, and L. Mark Raab
n.d. Trans-Holocene Marine Mammal Exploitation on San Clemente Island, California: A Tragedy of the Commons Revisited. In press, *Journal of Anthropological Archaeology*.

Price, T. Douglas and Gary M. Feinman (editors)
1995 *Foundations of Social Inequality*. New York: Plenum Press.

Raab, L. Mark
1999 Remodeling California Prehistory: Notes on the Changing Roles of Ethnohistory in Archaeology. In press, Proceedings of the Society for California Archaeology.

1996 Debating Prehistory in Coastal Southern California: Political Economy vs. Resource Intensification. *Journal of California and Great Basin Anthropology* 18:64-80.

1995 The Dead at Calleguas Creek: A Study of Punctuated Cultural Evolution During the Middle-Late Period Transition in Southern California. Prepared for the Environmental Division, Naval Air Weapons Station, Point Mugu, California. On file at Center for Public Archaeology, California State University, Northridge.

1992 An Optimal Foraging Analysis of Prehistoric Shellfish Collecting on San Clemente Island, California. *Journal of Ethnobiology* 12:63-80.

Raab, L. Mark and Katherine Bradford
1997 Making Nature Answer to Interpretivism: Response to J. E. Arnold, R. H. Colten, and S. Pletka. *American Antiquity* 62:340-341.

Raab, L. Mark and Daniel O. Larson
1997 Medieval Climatic Anomaly and Punctuated Cultural Evolution in Coastal Southern California. *American Antiquity* 62:319-336.

Raab, L. Mark, Judith F. Porcasi, Katherine Bradford, and Andrew Yatsko
1995bDebating Cultural Evolution: Regional Implications of Fishing Intensification at Eel Point, San Clemente Island. *Pacific Coast Archaeological Society Quarterly* 31:3-27.

Reddy, Seetha N. (editor)
1997 Camping and Milling in the Highlands, Archaeological Investigations of Case Springs and Firebreak Sites con Camp Pendleton, San Diego County, California. Report prepared for U. S. Army Corps of Engineers, Los Angeles District by ASM Affiliates, Inc., Encinitas, California. Report on file with Army Corps of Engineers and author.

Smith, Eric A. and Bruce Winterhalder
1992 *Evoutionary Ecology and Human Behavior*. Aldine de Gruyter, Hawthorne, N.Y.

Stine, Scott
1994 Extreme and Persistent Drought in California and Patagonia during Mediaeval Time. *Nature* 369: 546-549.

Wake, Thomas A.
1997 Vertebrate Faunal Remains. In Shellfish on the Menu: Archaeology of Limited Sparse Shell Scatters along Coastal Camp Pendleton, San Diego County, California, edited by N. Seetha Reddy. Draft report to U.S. Army Corps of Engineers District, Los Angeles.

Walker, Phillip L.
1989 Cranial Injuries as Evidence of Violence in Prehistoric Southern California. *American Journal of Physical Anthropology* 80:313-323.

Walker, Phillip L. and Michael L. DeNiro
1986 Stable Nitrogen and Carbon Isotope Ratios in Bone Collegen as Indices of Prehistoric Dietary Dependence on Marine and Terrestrial Resources in Southern California. *American Journal of Physical Anthropology* 71:51-61.

Walker, Phillip L. and Patricia M. Lambert
1989 Skeletal Evidence for Stress During a Period of Cultural Change in Prehistoric California. In *Advances in Paleopathology, Journal of Paleopathology, Monographic Publication No. 1*, edited by L. Capasso, pp. 207-212. Marino Solfanelli, Chieti, Italy.

Winterhalder, Bruce and Eric A. Smith
1981 *Hunter-Gatherer Foraging Strategies*. Chicago: University of Chicago Press.

Wohlgemuth, Eric
1996 Resource Intensification in Prehistoric Centeral California: Evidence from Archaeobotanical Data. *Journal of California and Great Basin Anthropology* 18:81-103.