

Dates, Demography, and Disease: Cultural Contacts and Possible Evidence for Old World Epidemics Among the Protohistoric Island Chumash

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Abstract

For the California coast, the Protohistoric period (ca. AD 1542-1769) was long regarded as a final respite before Mission period colonial expansion devastated traditional California Indian societies. Recent papers have argued that epidemics of Old World diseases may have impacted the Chumash and other California tribes well before the first missions were established, but the evidence for such epidemics has been largely circumstantial. We discuss the encroachment of Old World disease frontiers on Alta California and the extent of Protohistoric contacts between Europeans and southern California's coastal tribes, then examine archaeological evidence for changes in Island Chumash settlement over the past 2000 years. Analyzing the temporal distribution of 215 ¹⁴C dates from Island Chumash sites, we found that the number of dated sites occupied in the century following Cabrillo's AD 1542-43 expedition declines dramatically. If this pattern holds true as more sites are dated, it may provide circumstantial evidence for the Protohistoric transmission of Old World diseases to the Island Chumash.

Introduction

For several regions in the Americas, evidence now suggests that Old World disease epidemics devastated some Native American cultures before detailed historical accounts or precontact population estimates were recorded (e.g., Campbell 1990; Cook and Lovell 1991; Dobyns 1983; Ramenofsky 1987; Thomas

1991; Thornton 1987; Upham 1986). In some cases, Native American tribes appear to have been decimated by Old World infectious diseases even before they had direct contact with Europeans. Major questions still remain, however, about the size of Native North American populations prior to European contact, the timing and geographical extent of early disease epidemics, and the magnitude of the mortality and other human consequences that followed in the wake of such diseases. New methods and theories have emerged with which North American archaeologists and other scholars can now approach these important issues, and there is much to be done to evaluate the nature and effects of Old World disease epidemics on Protohistoric and Historic period populations across North America. The issues are complex, however, and reconstructing the broader history of post-contact demographic collapse in Native North America requires careful evaluation of both archaeological and historical data on a regional basis.

In California, the issue of when and how severely Native American societies were affected by European

contacts—including the effects of Old World diseases—seemed to have been settled decades ago by such anthropological giants as Alfred Kroeber, Robert Heizer, and S. F. Cook. Although some more recent scholars noted that Protohistoric disease epidemics may have occurred (Brown 1967:78; Chertkoff and Chertkoff 1984:256; Erlandson and Bartoy 1995:168; Thornton 1987:84; Walker and Johnson 1992:128), most written histories of the effects of European colonialism on the first Californians considered significant changes to have started with the land-based Portolá Expedition in AD 1769 and the institution of the Spanish Mission system (Castillo 1978:100; S.F. Cook 1978:91; Kelsey 1985:502). For instance, the preeminent 20th century authority on such topics, Sherburne Cook, wrote that:

The destruction of the Indians of California occurred in a series of steps.... The first of these stages accompanied the settlement of the coastal strip from San Diego to San Francisco, and was associated distinctly with the development of the Catholic missions. This phase may be considered as beginning...in 1769 (Cook 1978:91).

Kelsey (1985:502) echoed Cook's appraisal of the effects of early European contacts on California Indians of the Protohistoric period:

Seemingly all the changes were minor: a few European words in the languages, a few children of mixed blood, a few iron knives and pieces of cloth, perhaps a few ideas about the Christian religion. Otherwise, there is little or nothing to indicate an important European influence among the Indians of California prior to the eighteenth century.

Although the "destruction" of most California Indian tribes predicted by Cook and other early anthropologists has not occurred, a growing number of scholars

have suggested that significant impacts of colonialism on California Indian societies may have begun well before the institution of the Spanish Mission period in AD 1769 (e.g., Erlandson and Bartoy 1995; Erlandson, Kennett, and Walker 1997; Preston 1996, 2002; Walker et al. 2002). This is particularly true in coastal California, where pre-Mission epidemics of Old World diseases may have spread into California from Baja California and the American Southwest, or via early contacts with five maritime expeditions starting with Cabrillo in AD 1542-43 and ending with Vizcaíno in AD 1602-3 (Erlandson and Bartoy 1995, 1996).

Despite growing circumstantial evidence that Old World diseases impacted California's coastal tribes in Protohistoric times, the topic remains both controversial and difficult to resolve. William Preston (1996, 2002) has made compelling arguments that Old World epidemics may have afflicted California Indians prior to the Mission period, but there remains little tangible archaeological evidence for such impacts and interpretations of the existing data vary widely (Broughton 1999; Erlandson and Bartoy 1995; Glassow 2002; Kealhofer 1996; Preston 2002; Stannard 1992:24; Walker et al. 2002). A major part of the problem is related to methodological difficulties associated with reconstructing demography from archaeological data.

Unfortunately, many archaeological chronologies for the California coast have no periods corresponding precisely to the Protohistoric era, inhibiting recognition of associated cultural changes. Until recently such chronologies also relied primarily on dates expressed in radiocarbon (^{14}C) years rather than calendar years or on typological comparisons to such dated assemblages. This poses a variety of problems, including the inappropriate comparison of dates on samples from different carbon reservoirs (i.e., wood or charcoal vs. marine shell) and the fact that equal intervals of radiocarbon time vary widely in the number of calendar years they contain after calibration.

Previous attempts to examine demographic changes in coastal California from the analysis of ^{14}C date frequencies also often relied not just on uncalibrated dates but on intervals of time that do not correspond to key Protohistoric events such as the Cabrillo, Drake, or Vizcaíno expeditions (Breschini and Haversat 1996; Glassow 1999; Kealhofer 1996; Lambert 1994:66). As a result, despite some recent progress, the idea that Old World diseases impacted Native peoples along the southern California coast prior to the Mission period remains largely untested with archaeological data. Walker et al. (2002) may have identified evidence for the transmission of venereal syphilis to the Island Chumash around the time of Cabrillo's voyage (see also Cybulski 1980; Erlandson and Bartoy 1995), but the antiquity of two syphilitic individuals excavated by Phil Orr from a cemetery at CA-SRI-2 in the 1950s remains uncertain (Rick 2002).

In this paper, we analyze the temporal distribution of 215 calibrated ^{14}C dates from archaeological sites on the Northern Channel Islands to evaluate the evidence for Island Chumash demographic changes during the past 2000 years. Before we discuss the patterns identified and their possible explanations, we provide some background on the demography of California Indian populations, avenues from which Old World epidemic diseases could have been transmitted to Native Californians during Protohistoric times, and the methods we used to examine the demography of the Island Chumash.

Disease Frontiers and Protohistoric California

West of the Sierra Nevada, California Indians were renowned for their large populations and complex cultures. During the Late Holocene, many groups lived in large and closely spaced villages or towns, with extensive social, political, and economic interaction between communities. Coastal tribes like the Chumash and *Tongva* had highly developed trade networks, maintained through the use of shell bead

money, extensive trail systems, and sophisticated boats. Inter-marriage between villages was widely practiced, and many communities held annual fiestas that brought together large numbers of people from different villages. Paleopathological studies suggest that warfare and raiding were relatively common along the California coast and some Native American communities suffered from a variety of metabolic disorders related to periodic resource shortages, crowding, and sanitation problems (Lambert 1994; Lambert and Walker 1991:967; Walker 1989; Walker and Lambert 1989:210). All these traits suggest that Native Californians would have been highly susceptible to Protohistoric epidemics of Old World diseases (see Ramenofsky 1987). For such diseases to have affected California tribes, however, contact had to take place with disease carrying members of European expeditions or neighboring tribes. How much contact and opportunity for disease transmission was there in Protohistoric California?

Erlandson and Bartoy (1995, 1996), Preston (1996, 2002), and others have assembled a variety of circumstantial data that suggest that Old World diseases were encroaching on Protohistoric California from several fronts during the 1500s, 1600s, and early 1700s AD. Between AD 1520 and 1595, waves of Old World epidemic diseases (smallpox, chicken pox, measles, mumps, influenza, bubonic plague, typhus, yellow fever, etc.) and possibly some indigenous hemorrhagic fevers devastated native peoples across Central Mexico and Guatemala (Acuna-Soto et al. 2002; Cook and Lovell 1991:47, 59). In the mid-1500s, several Spanish expeditions explored the American Southwest. By AD 1598 the Spanish began to establish Franciscan missions among Pueblo peoples in New Mexico. These missions became centers for the spread of disease, with at least 15 Old World epidemics decimating Indian peoples between AD 1636 and 1770 alone. In Baja California, 19 missions were founded by the Jesuits from AD 1697 to 1768, hastening the northward spread of Old World diseases

along the Pacific Coast. Baptismal and burial records are sketchy for the early years of the Baja missions, but sharp declines in the Native American populations of several missions leave little doubt that disease epidemics occurred by at least the 1720s (Jackson 1994). On Cedros Island off Baja California's Pacific Coast, a smallpox epidemic reportedly "preceded the first mission contacts..." and "wiped out three-fourths of those Indians before the missionaries ever saw them" (Aschmann 1959:166-167).

Even earlier contacts took place between European maritime expeditions and Native American peoples of the Alta California coast. The members of five documented maritime voyages contacted California's coastal tribes during the 16th and 17th centuries: Cabrillo in AD 1542-3, Drake in AD 1579, Unamuno in AD 1587, Cermeño in AD 1595, and Vizcaíno in AD 1602-3. Except for Drake, each of these voyages sailed from Mexican or Philippine ports rife with Old World diseases. In 1535, for instance, Cortés described "distressing deaths from... disease" at the port of La Paz along the Pacific Coast of Mexico (Holmes 1963:76). Although long sea voyages may have exhausted the communicability of some acute diseases (e.g., influenza) characterized by a relatively rapid development and recovery, a variety of chronic illnesses could survive such voyages (see Preston 1996:8). The nature of contacts with early maritime expeditions varied considerably, but extensive contacts took place with the crews of the Cabrillo (AD 1542-43), Drake (AD 1579), Cermeño (AD 1595), and Vizcaíno (AD 1602-03) expeditions (Erlandson and Bartoy 1995, 1996; Wagner 1929). Cabrillo wintered among the Chumash in the Santa Barbara Channel, for instance, and Drake spent five weeks among the coastal Miwok along the northern California coast.

Manila Galleons as Maritime Vectors?

These maritime expeditions may be the tip of the proverbial iceberg, poised atop a significantly larger

number of undocumented maritime contacts between Native Californians and Spanish Manila galleon crews (Chartkoff and Chartkoff 1984:255). Most chroniclers of Pacific Coast exploration and contact history have dismissed or under emphasized the importance of the Manila galleon trade linking the Philippines and New Spain, probably because the vast wealth carried by the galleons caused the Spanish to shroud their Pacific trade "in such secrecy that the rest of the world could know nothing of these argosies and their tempting cargoes" (Schurz 1959:257). There are several reasons to suspect that Manila galleon contacts with Native Californians were more extensive than generally portrayed.

The Manila galleon trade, which began in AD 1565 and ended 250 years later in AD 1815, "was carried on with surprising regularity from the beginning. Galleons came and went almost every year, the continuity of the line broken only by the chance of shipwreck or war" (Schurz 1959:24). In some years, multiple galleons sailed for New Spain, an arduous voyage that averaged about six months. The galleons followed the prevailing westerly trade winds across the North Pacific, usually crossing between about 36 and 40 degrees north latitude. According to Warren Cook (1973:5), the Manila galleons were "Crammed to the gunwales with cargo, supplies, and passengers, with the deck a veritable barnyard for fresh meat, they were unusually prone to infestations of rats and other pests and were incubators for disease." Firsthand accounts of this crossing suggest that Manila galleons often arrived along the Pacific Coast badly battered, short of fresh water and food, and with large percentages of the crew dreadfully sick from scurvy, beriberi, and other illnesses. According to Schurz (1959:243), the only treatment for beriberi at the time was to spend time ashore. Dunmore (1965:40-41) also noted that, whenever possible, French captains in the Pacific treated scurvy by providing "frequent opportunities for the crews to take exercise ashore."

Although many Manila galleons surely passed the California coast without stopping, there was no uniformity in the galleon routes to Acapulco. According to Schurz (1959:240), many galleons sighted land in the general vicinity of Cape Mendocino on the northern California coast, then sailed south past Point Reyes, the Farallon Islands, Monterey Bay, and Point Conception, then through the Santa Barbara Channel and the heart of Chumash territory. After months at sea, with many crew members incapacitated by illness, and provisions both “scarce and foul” (Schurz 1959:212), it seems highly unlikely that all the undocumented galleons sailed *directly* to Mexico, another month from Alta California. Many galleons may have stopped to obtain freshwater, fresh food, or timbers and bitumen for ship repairs along the California coast. When such stops took place, many galleon crews probably contacted California Indians. Taylor (1922:637) described such crews, assembled in disease-ridden southeast Asian ports, as “a rough class of men, intemperate... given to excesses when they went ashore, commonly afflicted with venereal disease, irresponsible, and turbulent.” Even occasional contacts could have transmitted Old World diseases—especially venereal diseases—to Native Californians.

Evidence for Demographic Changes among the Coastal Chumash

Due to the sporadic nature of Protohistoric contacts, few Old World epidemics were noted in the scanty written records of early Pacific Coast explorers. Thus, evidence for Protohistoric disease epidemics must be uncovered in different ways than their historic counterparts: through changes in settlement, the size of sites, the number of sites, burial patterns, etc. To search for evidence for Protohistoric disease epidemics, we turn to archaeological data from the Santa Barbara Channel, home of the maritime Chumash Indians (Fig. 1). Epidemiologically, the Santa Barbara Channel was almost certainly a virgin “ground zero” in AD 1542, occupied by dense Chumash populations

vulnerable to Old World epidemic diseases with which they had no prior experience and no immunological resistance. The Santa Barbara Channel was probably the most densely populated area in native California. Glassow and Wilcoxon (1988:39) estimated the Chumash population density along the mainland coast to be at least 8.8 people per square kilometer, with somewhat lower densities for the Channel Islands. The maritime Chumash lived in numerous large towns and villages, with extensive trade, travel, and social interaction.

The Chumash are also the best documented of California’s coastal tribes, with a wealth of historical, ethnographic, archaeological, and bioarchaeological data available. Most studies of Chumash contact history begin in AD 1769, however, 227 years after Cabrillo’s ships wintered in the Santa Barbara Channel. Contrary to Kelsey’s (1986) assertions, analysis of Cabrillo’s log suggests that his three ships anchored for about eight weeks in Cuyler Harbor on San Miguel Island. Cabrillo’s crews had extensive contacts with the island and mainland Chumash for an even longer period (Erlandson and Bartoy 1995; Wagner 1929).

Based on his analysis of cemetery and ethnohistorical data, King (1978:65-66) suggested that significant changes occurred in Protohistoric settlement among the coastal Chumash, including abandonment of numerous villages and consolidation into a smaller number of “interethnic” towns. Kealhofer (1996:6) acknowledged that Protohistoric settlement changes occurred along the southern California coast but claimed that populations and cultural complexity increased during the Protohistoric period. However, her conclusions appear to rest primarily on broad archaeological syntheses (i.e., Chartkoff and Chartkoff 1984; King 1978, 1981; Moratto 1984) written when California chronologies still relied on uncalibrated ¹⁴C dates rather than calendar ages directly comparable to historical events.

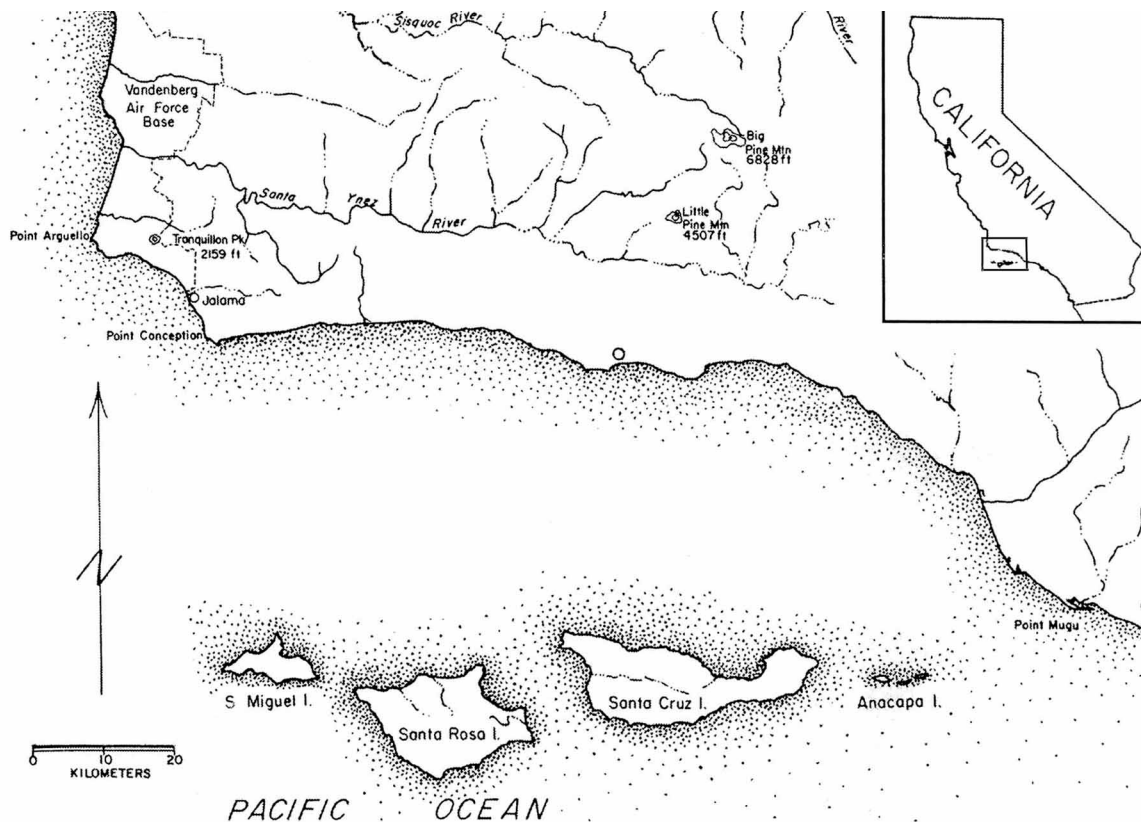


Fig. 1. Location map of the Santa Barbara Channel region.

Radiocarbon Dates and Demography

To examine the evidence for demographic changes among the Island Chumash over the past 2000 years, we analyzed a large body of published and unpublished calibrated ^{14}C dates from archaeological sites on the Northern Channel Islands. Overall, there are now more than 1200 ^{14}C dates from Santa Barbara Channel archaeological sites, including 551 from the Northern Channel Islands. For the islands, 215 of the available ^{14}C dates fall within the last 2000 years. We calibrated these dates to calendar years using the CALIB 4.3 program (Stuiver and Reimer 1993, 2000). We then plotted the resulting ^{14}C components, each representing the date or dates from a single site whose midpoints fell within a given 50-year or 100-year interval. For the high resolution (50-year) distribution,

recognizing the chronological uncertainties built into ^{14}C dating (see below), we also smoothed the distributions by adding one-half a component to the two 50-year time intervals bracketing each intercept. This spread the distribution of each ^{14}C component over a period of about 150 years while emphasizing the most likely age of each dated sample. The resulting patterns are provocative, but several methodological problems lead us to interpret them cautiously.

Many of these problems are related to the accuracy and precision of ^{14}C dating itself. Confidently attributing a date to a 50 or 100-year interval—even one representing no more than the most probable age of the dated sample—pushes the limits of the precision of ^{14}C dating (Glassow 1999:54; Taylor 1987:141). This is true for all but high precision dates

(i.e., those with statistical errors of 30 years or less), which make up a small percentage of our data base. It is especially problematic, however, for dates run early in the development of ^{14}C dating, which often have statistical errors ranging from 150 to 360 years. Of the 215 dates from the Northern Channel Islands, 28 (14%) have errors exceeding 100 years and just 19 (9%) have statistical errors of 30 years or less.

Calibrating dates obtained on materials (i.e., charcoal vs. marine shell) from different carbon reservoirs allows the direct comparison of such dates, but poses problems for marine samples for which corrections vary somewhat through space and time (Erlandson et al. 1996; Kennett et al. 1997). Another problem, especially at this level of chronological resolution, is that ^{14}C dates represent the growth of a dated sample rather than its use by humans, two events that can differ by anywhere from a few days to centuries. Dates for wood or charcoal are particularly problematic (Blong and Gillespie 1978; Schiffer 1986), unless care is taken to select only short-lived samples such as small twigs, seeds, etc.

Other problems are related to sample size and interpretive issues. The number of ^{14}C dated sites in our data base, for instance, is still just a small percentage of all sites recorded for each of the Northern Channel Islands. On San Miguel Island, where relatively intensive dating has been conducted, only about 48 (7.8%) of 615 archaeological sites had been ^{14}C dated at the time of our analysis. Many of these, moreover, were not adequately dated. In many cases, archaeologists have dated the base of occupational deposits but not the top or intermediate levels. In others, no ^{14}C dates have been obtained for deposits that contain glass beads or other evidence for occupation after European contact. Although objects of European manufacture are rare in Protohistoric contexts, sites dating after Spanish colonization may be under-represented in our sample. Finally, our analysis does not compensate for variability in the size and density of individual sites or occupational components,

variations generally related to the number of people and the length of occupation represented (Erlandson 1997:105; Erlandson et al. 1992). At SRI-2, for example, Rick (2002) has documented occupation for every 100-year interval from AD 1150 to 1850, but we still know relatively little about the numbers of people who occupied the site at any particular time.

This list of problems sounds daunting, but similar sampling and precision problems affect virtually all archaeological analyses and should not inhibit the search for patterns and meaning in the archaeological record. As more and better data become available, the patterns we have identified can be further evaluated. In the meantime, potentially meaningful patterns can be used to generate and test hypotheses about the demographic dynamics of the Island Chumash and the causes for any observed changes.

Temporal Trends in the Northern Channel Islands Radiocarbon Record

Glassow's (1999) analysis of uncalibrated ^{14}C components for the Northern Channel Islands, conducted in 200-year intervals, contained just 45 occupational components for the past 2000 years. A preliminary analysis by Erlandson et al. (1997) was limited to 123 calibrated dates. In contrast, our current analysis is based on a total of 215 calibrated ^{14}C dates from the past two millennia, with 185 and 170 occupational components, respectively, for our analysis of 50-year and 100-year intervals. These significantly larger samples of ^{14}C dates and components should be considerably more representative of Island Chumash settlement patterns over the past two millennia.

Examining the data in 50-year intervals (Fig. 2), several potentially significant fluctuations are evident, with depressions of 50 percent or more between about AD 100 to 149, 450 to 499, 650 to 899, 950 to 999, 1050 to 1149, 1550 to 1649, and 1700 to 1799. The

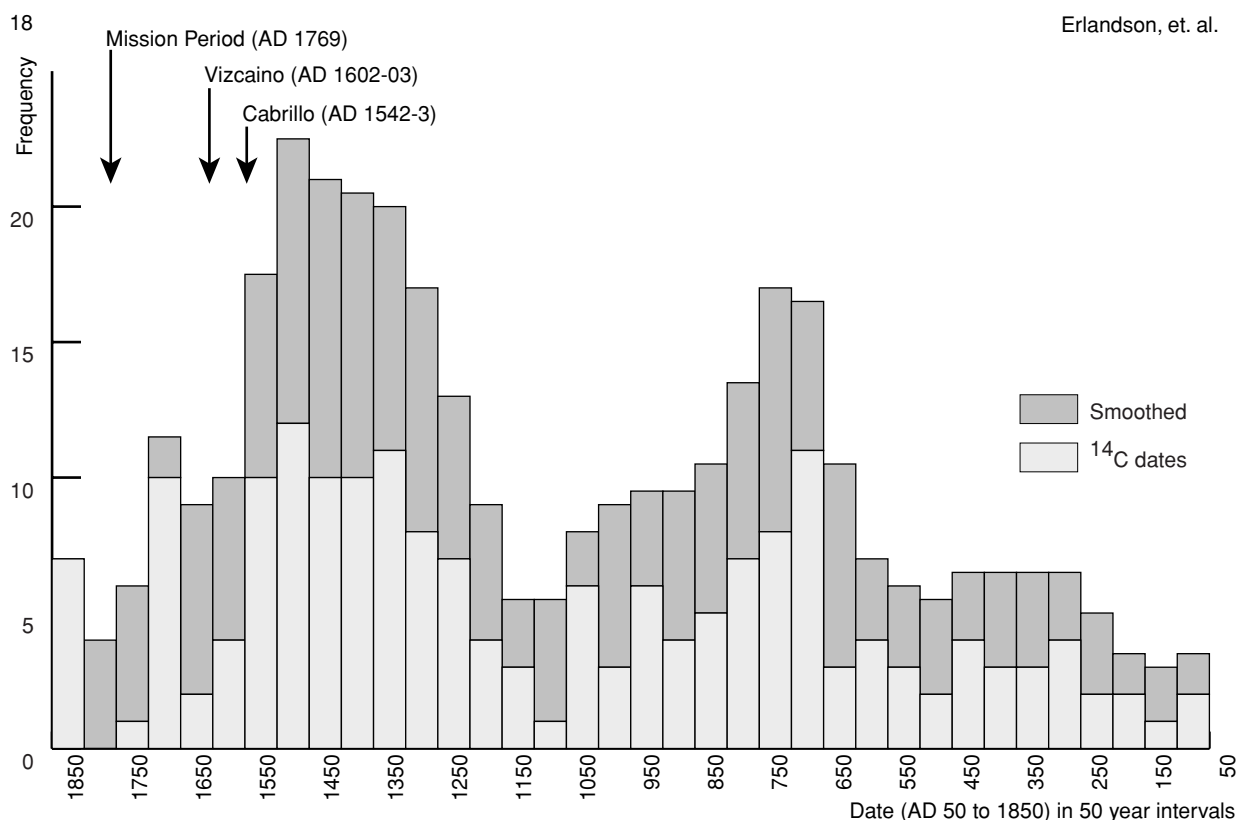


Fig. 2. Distribution of all ^{14}C components for the Northern Channel Islands, AD 50 to 1850.

two earliest depressions are minor, however, with relatively few ^{14}C dates for surrounding intervals, and they may result solely from sampling error. The period from AD 650 to 899, during which the number of ^{14}C dated island sites declines by 73 percent, corresponds to a portion of King's Middle period during which increased evidence for stress-related interpersonal violence and health problems among the coastal Chumash has been noted (Lambert 1993, 1994; Lambert and Walker 1991). An increase in projectile wounds and warfare at this time, in the centuries following the introduction of the bow and arrow (Lambert 1994), may have led to population decline, an abandonment of smaller villages for defensive purposes, and/or the consolidation of the Island Chumash into fewer but larger village sites. A decline of up to 86 percent in the number of dated sites between AD 1050 and 1149 marks a broader 150 year decline that roughly corresponds to the Middle-to-Late

Transition period when drought conditions may have led to village abandonments and aggregations on the Channel Islands (Arnold 1992; Arnold, Colten, and Pletka 1997; Colten 1994; Jones *et al.* 1999; Raab and Larson 1997; Yatsko 2000). This is followed by rapid growth in the number of dated sites and a sustained peak in the intervals from AD 1200 to 1549.

This broad peak, suggestive of relative demographic stability for a period of 250-300 years, is followed by a dramatic drop in the number of dated sites between AD 1550 and 1649. For this century immediately following Island Chumash contact with the Cabrillo expedition, there is an average of only three dated island sites in each 50-year interval, a decline of 77 percent from the AD 1500-1549 interval. The only two calibrated dates falling between AD 1600 and 1649, moreover, have relatively large standard deviations (± 150 and ± 120 years), and one is a conventional date

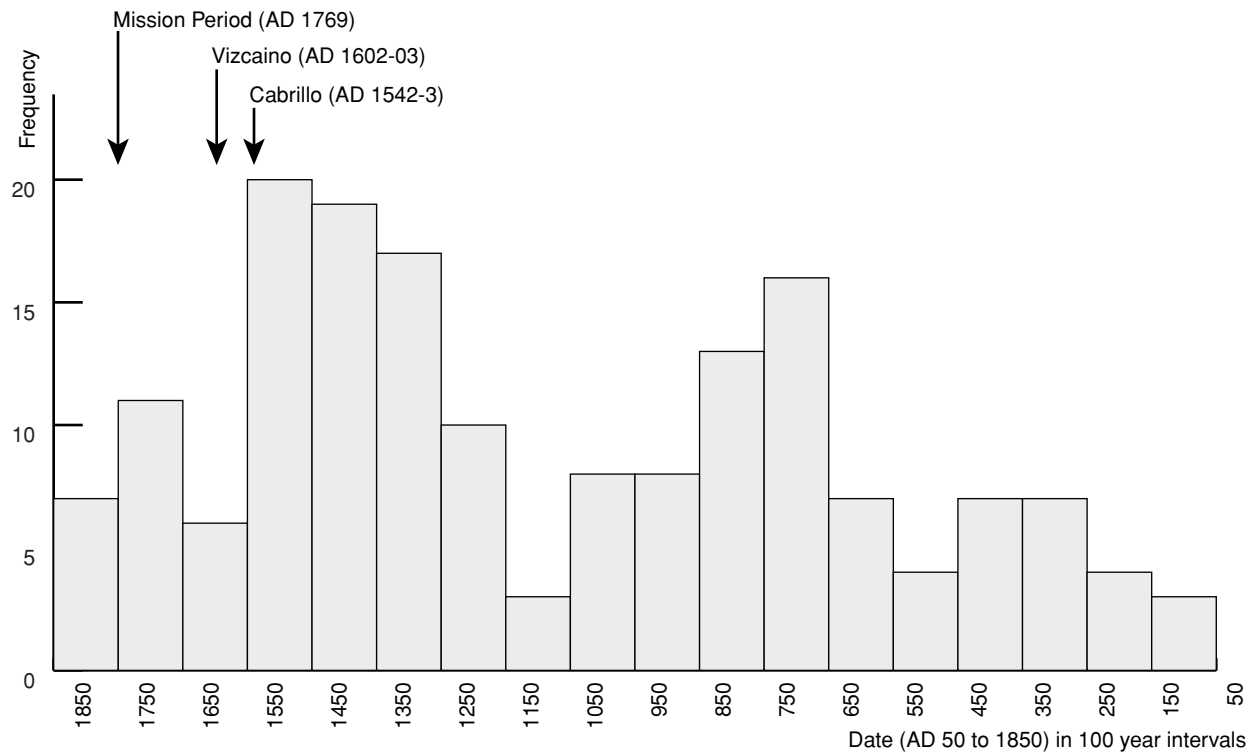


Fig. 3. Distribution of ^{14}C components for the Northern Channel Islands, AD 50 to 1850.

on charcoal that measures the *growth* of the wood rather than its use by the Chumash. Finally, calibration of four of the six dates falling in the century after Cabrillo's voyage also produced multiple calibrated intercepts, including intercepts falling outside of the Protohistoric period. Thus, the decline in the number of dated early Protohistoric settlements on the Northern Channel Islands may be even more dramatic than Figure 2 suggests. The unsmoothed curve shows a significant increase in the number of dated sites late in the Protohistoric period (AD 1650-1699), followed by another dramatic decline between AD 1700 and 1799, and a sharp increase in sites occupied between about AD 1800 and 1849.

The smoothed curve shows broadly similar patterns throughout the past 2000 years, but some small-scale fluctuations are eliminated and others are rendered less dramatic. Nonetheless, the smoothed 50-year

curve shows a marked decline in the number of dated settlements from AD 750 to 1149, followed by dramatic growth from AD 1150 to about 1500 and several step-like reductions and rebounds during the Protohistoric and Historic periods.

Our plot of ^{14}C components for 100-year intervals (Fig. 3) shows broadly similar patterns, with a generalized expansion in the number of dated sites between AD 50 and AD 749, an 84 percent decline from AD 750 to AD 1149, dramatic growth to all time highs between AD 1350 and 1549, followed by a 76 percent drop between AD 1550 and AD 1649. Again, several of the components dated to the early Protohistoric period are potentially problematic and may underestimate the magnitude of this decline. From AD 1650 to 1749 a 45 percent rebound occurs, followed by another significant decline after AD 1750. Like the 50-year curve, this 100-year curve matches

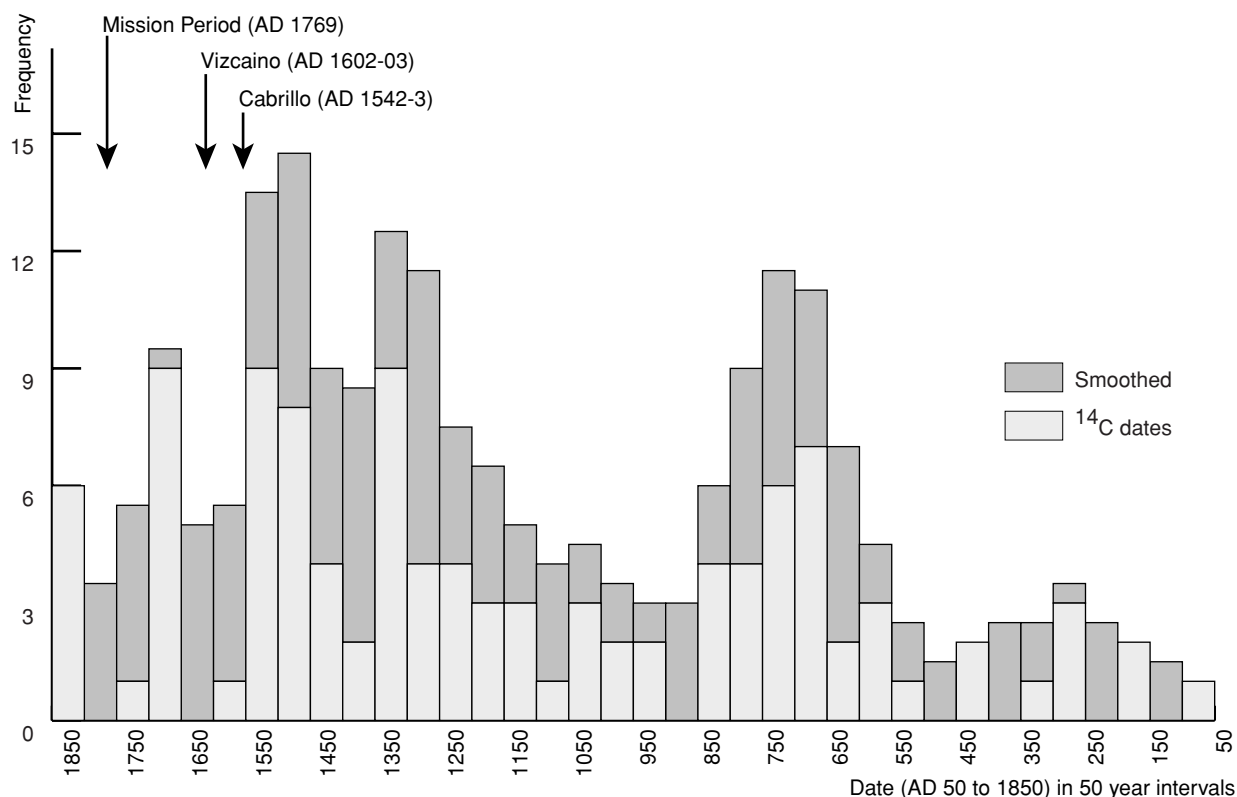


Fig. 4. Distribution of ^{14}C components for the Northern Channel Islands, short-lived samples only, AD 50 to 1850.

the general demographic expectations associated with a documented interval of increased violence and stress during the late Middle period and the Middle-Late Transition period. The Protohistoric and Historic portions of the two curves also match the patterns expected if the Island Chumash were impacted significantly by Old World diseases transmitted by early maritime expeditions (Cabrillo, Vizcaíno, etc.), followed by a demographic recovery prior to the advent of full-blown Spanish colonization and the abandonment of island villages in the early 1800s.

To evaluate the potential effects of the “old wood” problem and ^{14}C dates with large errors on our Channel Island distributions, we also plotted 113 dates run on short-lived samples (marine shell, charred twigs or seeds, etc.) that had standard deviations of 80 years or less (Fig. 4). Unfortunately, this eliminates

most of the dates from Santa Cruz Island, the largest and most heavily populated of the islands. The total number of components ($n = 107$) is also significantly reduced, with relatively small numbers of dated sites for the first 600 years of the curve. Nonetheless, the results are striking, with a broad decline in the number of sites dated between AD 700 and 1099, relatively large numbers of sites between AD 1300 and 1549, and a sharp decline of 90 to 100 percent in the two intervals (AD 1550-1649) immediately following the Cabrillo expedition. For the century preceding Cabrillo’s voyage, in fact, there are 17 dated components on the Northern Channel Islands, followed by just one component in the century after Cabrillo. Once again, there is a dramatic recovery in the number of dated sites later in the Protohistoric period, followed by large fluctuations between AD 1700 and 1850. Our smoothing of this curve preserves the general patterns

evident in the distribution of ^{14}C components alone, including a roughly 66 percent reduction in the number of smoothed components in the early Protohistoric period, but reduces the magnitude of fluctuations during the Historic, Protohistoric, and precontact eras.

Comparison to Mainland Coast Patterns

In analyzing calibrated ^{14}C dates from mainland sites in coastal Santa Barbara and Ventura counties, Erlandson, Kennett, and Walker (1997) and Glassow (2002) identified patterns similar to key parts of our island curves including declines in the number of dated sites during the late Middle period, the Middle-to-Late Transition period, and the early Protohistoric period. In both mainland curves, however, the number of dated sites peaks roughly 100 years before Cabrillo, between AD 1400 and 1449. Erlandson, Kennett, and Walker (1997) suggested that this time lag might be due to the large number of charcoal dates from mainland sites and the impact of the old wood effect. For the Vandenberg area, charcoal dates heavily influence the peak for the century prior to Cabrillo, but Glassow (2002) argued that the basic pattern remained when charcoal dates were excluded and was best explained by factors other than Old World diseases. The effects of bioturbation in mainland sites are also a major problem, however, with numerous dates on aggregate samples of shell or soil organics from sites heavily mixed by gophers, earthworms, and other animals. This stratigraphic mixing and the related averaging of occupational ages for site components makes the correlation of ^{14}C dates with historical events even more difficult. To our knowledge, no one has yet analyzed the temporal distribution of relatively high-resolution ^{14}C dates (± 80 years or less) obtained solely on short-lived and individual samples (single shells or charred seeds, etc.) from mainland sites.

Summary and Conclusions

When they first came into contact with Europeans in the 16th century, the populous and highly interactive maritime peoples of the southern California coast would have been highly susceptible to Old World diseases. By both land and sea, disease frontiers were closing like a noose around Native California during the 1500s, 1600s, and 1700s. Contacts with European maritime expeditions, including documented voyages and those related to the largely undocumented Manila Galleon trade, were relatively extensive and provided multiple opportunities for the transmission of Old World epidemic diseases. For the Northern Channel Islands, the most extensive Protohistoric contacts took place when Cabrillo's three Spanish ships and roughly 250 crew wintered among the Island Chumash in AD 1542-43.

Our analysis of 215 calibrated ^{14}C dates from Northern Channel Island archaeological sites identified what appear to be shifts in settlement and demography consistent with large-scale population loss and/or village aggregation during the Protohistoric period, between about AD 1550 and 1649. For a sample of relatively high resolution ^{14}C dates on short-lived samples, for instance, there is a dramatic decline in the number of dated island sites—from 17 to 1—in the centuries before and after Cabrillo's expedition. This decline matches the expected pattern if early Protohistoric populations on the Northern Channel Islands were decimated by Old World disease epidemics. Nonetheless, our data should be used primarily as a baseline to guide future research on related issues, not as a quantitative or absolute measure of population fluctuations among the Island Chumash through time.

Our identification of demographic shifts associated with the late Middle period and Middle-to-Late Transition period lends confidence to the idea that the Protohistoric patterns may reflect real shifts in Chumash demography. Unlike the Middle-to-Late

Transition, however, we know of no evidence for increased violence or severe environmental disruptions associated with the early Protohistoric period that might provide an alternative explanation for the observed decline in the number of occupied island sites. Most indicators of violence and nutritional stress decline during the Late period, in fact, suggesting that Protohistoric changes in Chumash demography were caused by different processes than those of the late Middle period.

We emphasize, however, that thousands of archaeological sites in the Santa Barbara Channel area remain undated. Much more dating and other research is needed to confirm and explain the patterns we have identified. Other areas of Protohistoric California also need to be examined individually for evidence of demographic disruptions that may have resulted from the introduction of Old World diseases. Even if the patterns we have identified for the Northern Channel Islands are ultimately found to represent a Chumash population decline caused by the introduction of Old World diseases, we still see no glaring contradictions between the extensive archaeological, historical, and ethnographic records of the coastal Chumash. However, this does not necessarily indicate that Old World epidemics did not decimate the Island Chumash during the Protohistoric period. Such epidemics may have been sporadic or geographically limited, allowing coastal Chumash populations to rebound prior to the more sustained and disastrous contacts that accompanied Spanish colonization in the late 1700s. Our data suggest that a rise in the number of ¹⁴C dated sites on the Northern Channel Islands from AD 1650 to 1700 may reflect the recovery of Island Chumash populations prior to Mission period epidemics and the abandonment of the islands in the early 1800s.

We do not question the fact that historic and ethnographic accounts have greatly enriched the study of the history of California's Indian tribes. However, archaeologists should be extremely careful in using

such records to structure their interpretations of precontact cultural patterns. As Moss and Erlandson (1995) and others have noted, it may be more fitting to do the opposite—to use archaeological data to construct baselines with which to understand the timing and magnitude of the impacts of European colonization on Native Californians—and to test the validity of ethnographically derived models.

Acknowledgements

We are indebted to many colleagues—Jeanne Arnold, Kevin Bartoy, Matt Boxt, Scott Byram, Richard Carrico, Lynn Gamble, Mike Glassow, Jim Haggarty, Bill Hildebrandt, John Johnson, Chester King, Kent Lightfoot, Don Morris, Madonna Moss, Bill Preston, Mark Raab, Liz Sobel, Stead Upham, René Vellanoweth, and others—for their comments, sharing of sources or data, and encouragement. We also thank Hank Koerper, anonymous reviewers, Beth Padon, and the Editorial Board and production staff of the *Pacific Coast Archaeological Society Quarterly*. We alone are responsible, however, for the viewpoints expressed in this paper, as well as any errors of fact or omission.

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