ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/280567993

Prehistoric Settlement Trends on San Clemente and San Nicolas Islands, Alta California

Article · January 2015

CITATION
1

READS
200

2 authors:

Brian F. Byrd
Far Western Anthropological Research Group
66 PUBLICATIONS **1,238** CITATIONS

SEE PROFILE

Adrian Whitaker
Far Western Anthropological Research Group
26 PUBLICATIONS **210** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Project China Lake Paleoecology View project

All content following this page was uploaded by Brian F. Byrd on 30 July 2015.

The user has requested enhancement of the downloaded file.

Prehistoric Settlement Trends on San Clemente and San Nicolas Islands, Alta California

Brian F. Byrd
Far Western Anthropological Research Group, Inc., Davis, CA 95618 (brian@farwestern.com)

Adrian R. Whitaker
Far Western Anthropological Research Group, Inc., Davis, CA 95618 (adie@farwestern.com)

Abstract Analysis of temporal and spatial patterns in settlement between San Clemente and San Nicolas islands suggest that the trajectory of human adaptations differed significantly. On San Clemente, site densities increased dramatically during the latter portion of the late Holocene, including numerous small-sized upland residential sites targeting terrestrial resources. In contrast, occupation of San Nicolas was intensive and constant from the latter half of the middle Holocene onward, and subsistence was more marine-oriented. These divergent trends in land use intensity and settlement organization were driven in part by modest geographic and environmental differences between the islands tied to land mass, annual rainfall, and terrestrial vegetation.

Resumen Una comparación de los patrones temporales y espaciales de asentamientos entre las islas de San Clemente y San Nicolás sugiere que la trayectoria de las adaptaciones humanas se diferenció significativamente entre esos. En San Clemente, la densidad de sitios aumentó dramáticamente durante la última parte del Holoceno tardío, incluyendo muchos sitios residenciales de tamaño pequeño en las tierras altas donde se enfocaron en recursos terrestres. A diferencia de San Clemente, la ocupación de San Nicolás fue intensiva y constante desde la última mitad del Holoceno medio en adelante, y la subsistencia se orientó más hacia los recursos marinos. Estas tendencias divergentes en la intensidad del uso de la tierra y en la organización de asentamientos resultaron en parte por modestas diferencias geográficas y ambientales entre las islas relacionadas con sus tamaños, la precipitación anual, y la vegetación terrestre.

California Archaeology, Volume 7, Number 1, June 2015, pp. 1–32.
Copyright © 2015 Society for California Archaeology. All rights reserved

Islands have long held a unique attraction to archaeologists interested in gaining new insight into the past, largely owing to the perception that more variables can be held constant than in mainland settings. As Fitzhugh and Hunt (1997) noted, archaeologists have variously stressed the suitability of islands for gaining insight into topics such as the colonization of new lands, human biogeography, cultural adaptations, and the rise of social complexity. In doing so, the fragile nature of island ecologies, the impact of paleoenvironmental and human-induced change, and the role of isolation (both physical and perceived) in the construction of social identity and regional interaction have often been highlighted (Barrowclough 2010; Fitzpatrick and Anderson 2008; Fitzhugh and Hunt 1997).

The Channel Islands of southern California, as Raab et al. (2009) have pointed out, offer excellent natural laboratories for research on hunter-gatherers since the number of discrete ecological zones and resources is small and human populations were circumscribed by the ocean. Indeed, they have been the focus of a series of sustained archaeological investigations exploring Native American maritime adaptations (e.g., Arnold et al. 2004; Braje 2010; Gamble 2008; Jazwa and Perry 2013; Kennett 2005; Rick et al. 2005). This article compares broad patterns of settlement from two of the southern Channel Islands: San Clemente and San Nicolas. Such a study is only possible due to the sustained level of archaeological investigations that have produced a robust and well-documented archaeological record on each island (e.g., Byrd and Raab 2007; Cameron 2000; Martz 2005, 2008; Raab 1997; Raab et al. 2002, 2009; Reddy 2007; Schwartz and Martz 1992, 1995; Vellanoweth et al. 2002; Yatsko 2000).

Our aim is to explore diachronic trends in land use intensity and settlement organization, as well as the impact of environmental fluctuations and resource potential at the macro-level (i.e., between two nearby island settings), in order to gain new insights into the potential range of factors influencing human adaptations. In doing so, we first examine radiocarbon dating results from each island as a trans-Holocene proxy for overall population and land-use. We then examine the spatial distribution of dated archaeological site components across each island's topographic zones to assess variation in intra-island land use through time, and compare geographic land use patterns between islands. Next, we take a closer look at a much smaller span of the late Holocene record on each island to scrutinize potential impacts on human settlement caused by the Medieval Climatic Anomaly (MCA). Finally, we assess similarities and divergences in the archaeological records of these two islands, offering possible explanations for the potential differences.

Setting

San Clemente Island (SCLI) and San Nicolas Island (SNI) are part of group of eight Channel Islands situated off the coast of southern California between modern day Santa Barbara and San Diego (Figure 1). In archaeological and ecological literature, the islands are generally divided between those near Santa Barbara to the north (Santa Cruz, Santa Rosa, San Miguel, and Anacapa) and those west of Orange and San Diego counties to the south (SNI, SCLI, Santa Catalina, and Santa Barbara). SNI is situated approximately 80 km south of the northern Channel Islands and 98 km from the nearest point on the mainland (near Mugu Lagoon at the northwest edge of the Santa Monica Mountains in Ventura County). SCLI is located 79 km from the nearest point on the mainland (Palos Verde Peninsula in Los Angeles County), but is only 34 km from the south shore of Santa Catalina.

SNI is 80 km northwest of SCLI. SNI and SCLI have many environmental similarities along with several micro-climatic and geographic divergences

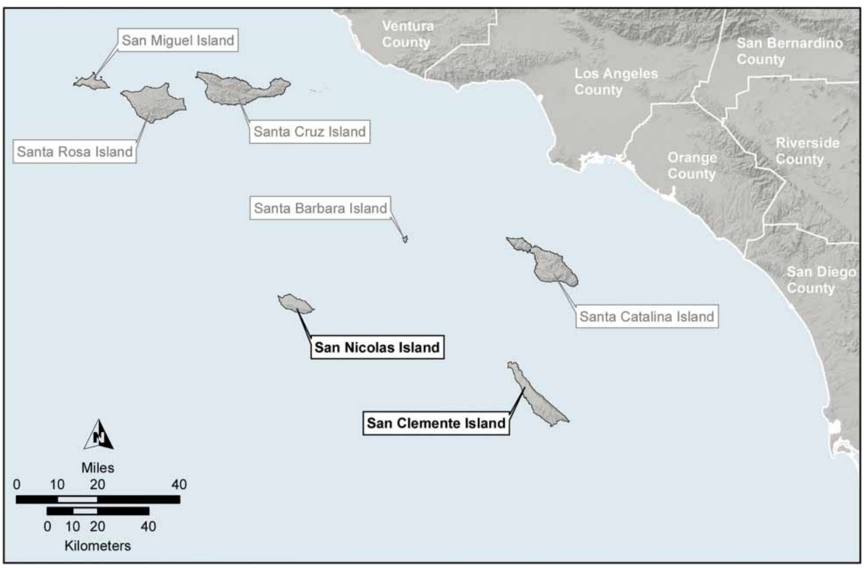

Figure 1. Map of southern California showing the Channel Islands.

(Dailey et al. 1994; Engle 1994; Junak et al. 2007; Moody 2000). The impacts of these differences on the archaeological record have been noted in prominent archaeological overviews (Altschul and Grenda 2002; Jazwa and Perry 2013:6; Raab et al. 2009; Reddy 2007). Both islands are oriented northwest to southeast, although SCLI is much longer and narrower; SCLI is 2.6 times larger than SNI, encompassing 36,622 acres versus 14,234 acres. Maximum elevation of the two islands differs considerably as well—SCLI has a maximum elevation of 599 m (1,965 feet) amsl and correspondingly more varied terrain, while the smaller SNI only rises to 276 m (907 feet) amsl.

Table 1 presents the areal extent of the topographic zones constructed and used by archaeological investigators to subdivide each island and explore spatial variation in the distribution of sites (e.g., Martz 2002; Raab et al. 2009; Yatsko 2000). Each island is characterized by a plateau, a near-shore coastal terrace, and intermediate sloping terrain. Both islands also have an area dominated by sand dunes at the northwest end—on SNI it is larger and referred to as the "West End," while on SCLI these "Sand Dunes" are much less extensive in nature. Upland marine terraces are a topographic zone unique to SCLI. These are found along the southwest side of SCLI and serve as an intermediate, relatively even terrain suitable for habitation (at least in contrast to the steeply sloping

Table 1. Distribution of Radiocarbon Dates by Island Geotopographic Zones.

Topographic Zone	Acres (n)	Acres (%)	Sites	Dates	Components
San Nicolas Island					
Coastal Terrace (Northern and Southern)	1,885	13.2	21	39	32
Central Plateau	6,004	42.2	16	59	43
West End	3,026	21.2	29	139	96
Cliffs	3,328	23.4	3	5	4
Total	**14,243**	**100.0**	**69**	**242**	**175**
San Clemente Island					
Coastal Terrace	2,896	7.9	43	128	84
Major Canyons/Eastern Escarpment	7,635	20.9	0	0	0
Plateau	12,301	33.6	93	130	113
Upper Marine Terraces	12,869	35.1	24	40	38
Sand Dunes	920	2.5	4	6	5
Total	**36,621**	**100.0**	**164**	**304**	**240**

eastern escarpment and the major canyons on the west) between the coastal terrace and the plateau.

The two islands were considerably larger at the end of the Pleistocene than they are today but have shrunk as the result of post-glacial sea level rise (Porcasi et al. 1999: Table 1, Figures 6 and 12). SNI is estimated to have been 4.6 times larger than today at 12,000 cal BP, and still 2.5 times larger at 10,000 cal BP. By comparison, SCLI was only 1.7 times larger than today, and 1.4 times larger at 10,000 cal BP. The additional land mass of SNI was concentrated on the north, while it was more evenly distributed around the margins of SCLI. By the middle Holocene, sea level rise slowed considerably and the size of both islands was much closer to their size today (Yokoyama et al. 2000).

Both islands have a Mediterranean climate with dry, warm summers and wet, cool winters (Dailey et al. 1994; Schoenherr et al. 1999). Unlike the mainland, these islands have little variation between high and low temperatures at any given time of year, no frost, and greater humidity due to a more pervasive marine layer. SNI is the most arid of the Channel Islands, receiving only 170 mm (6.6 inches) of annual rainfall (Schoenherr et al. 1999:333). SCLI is also considered semi-arid but gets up to nearly twice as much rainfall (300 mm [12 inches]; Raab et al. 2009:35; Schoenherr et al. 1999:316). In contrast, the nearby mainland Los Angeles Basin averages about 380 mm (15.4 inches) annually.

Compared to the mainland, SNI and SCLI have a relatively limited diversity of terrestrial animal and plant species (Junak et al. 2007; Schoenherr et al. 1999). The two main terrestrial mammals of any size are the domestic dog (*Canis familiaris*) and the island fox (*Urocyon littoralis*), both of which were introduced by Native Americans (Vellanoweth et al. 2002). Both islands, however, have an exceedingly diverse and productive suite of marine resources, owing to local upwelling (Dailey et al. 1994; Engle 1994). These include marine mammals, fish, and shellfish from littoral and nearby kelp beds along with an assortment of littoral and seagoing avifauna. Terrestrial plants are dominated by relic native coastal sage scrub and chaparral vegetation, with SCLI having almost two times the number of taxa as SNI (Junak et al. 2007; Moody 2000; Rick et al. 2005:Table 1). Unfortunately, reconstructing the nature and extent of prehistoric vegetation communities is very difficult since the islands have been heavily impacted by historic-era overgrazing and the introduction of non-native plants (e.g., Moody 2000). Philbrick and Haller (1977) distinguished four vegetation communities on SNI (southern coastal dune, coastal sage scrub, valley/foothill grassland, and coast marsh) while SCLI has these and three additional communities (island woodland, coastal bluff, and maritime cactus scrub).

Using Archaeological Radiocarbon Sequences to Explore Occupation Trends

Beginning with a seminal paper by Rick (1987), archaeologists have used radiocarbon dates to infer population dynamics in the archaeological record. The approach has been used in the Channel Islands as well. For instance, Glassow (1999) examined three sets of dates from the Santa Barbara Channel mainland coast, the northern Channel Islands, and the northern Santa Barbara coast (within Vandenberg Air Force Base). He found that regional trends were broadly similar but varied slightly, perhaps owing to different responses to environmental fluctuations. Erlandson et al. (2001) analyzed 215 dates from Island Chumash (i.e., northern Channel Island) sites to examine proto-historic population change. They found that the number of dated sites dramatically decreased in the sixteenth and early seventeenth century AD, after Cabrillo's AD 1542–1543 expedition and inferred an earlier population collapse than previously hypothesized. Braje et al. (2005) applied a radiocarbon database that included several new dates from archaeological survey on San Miguel Island and determined that occupation along the island's south coast was more extensive than previously thought. Most recently, Perry and Glassow (2015) examined the radiocarbon record in concert with subsistence and site-type data from Santa Cruz Island and found that interior settlement changed dramatically through time with an apparent gap in occupation between 3,000 and 1,500 cal BP.

More targeted studies using radiocarbon dates have also explored occupation trends on the southern Channel Islands. Using smaller samples sizes available at the time for SNI, Martz (2005:77) and Vellanoweth et al. (2002) noted rises and falls in the frequency of radiocarbon dates and attributed falls to periods of environmental downturn around 1,450 cal BP and 800–650 cal BP that led to population declines (Martz 2005:77; Vellanoweth et al. 2002:87–92). Yatsko (2000) systematically sampled sites on SCLI and generated a radiocarbon database to explore whether parts of the island were depopulated during the MCA. He concluded that his hypothesis was somewhat supported by the data and recommended further radiocarbon studies to evaluate the hypothesis.

Analytical Approach

Owing to sustained archaeological programs run by the Navy on both islands, robust and comparable databases are available. Notably, the smaller SNI has been subjected to 100 percent inventory survey and a systematic 10 percent site "index" testing and evaluation program (Martz 2002, 2005, 2008; Schwartz and Martz 1992, 1995). In contrast, archaeological investigations on SCLI have been somewhat less spatially comprehensive (but includes a 15 percent stratified sample survey) due to its much larger size and an off-limits area in the southern third of the island (Raab and Yatsko 1990, 1992; Yatsko 2000; Yatsko and Raab 2001, 2009).

Radiocarbon data from archaeological sites on SCLI were gathered from technical reports and published literature (Berryman et al. 2010; Breschini et al. 1996; Byrd 2000a, 2000b; Byrd and Andrews 2002, 2003; Byrd et al. 1998:64, 2012, 2014; Hildebrandt and Jones 1992; Raab 1997; Raab et al. 1995, 2009; Whitaker and Byrd 2013a, 2013b; Yatsko 2000; York 1997). In contrast, a full list of radiocarbon data from SNI was provided by former Base Archaeologist Steven Schwartz for an island-wide overview (Byrd et al. 2012) and updated with more recent work (Byrd et al. 2014). Conventional radiocarbon dates were then corrected for $^{12}C/^{13}C$ fractionation and calibrated using Calib 6.0 software. Calibration of all shell dates used a marine reservoir effect of Delta-R value of 225 ± 35 (Raab et al. 2009). The median probability age of each date was then used for subsequent analyses. Although it can be hazardous to attempt to unravel complex settlement trends using radiocarbon dates owing to a variety of factors (such as taphonomy and the emphasis of archaeological investigation), a large portion of the archaeological record on these two islands has been produced by very similar CRM-related management objectives. As a result, these robust data sets are probably as comparable as can be expected for exploring regional trends in land use.

Two measures of occupation are used throughout the following discussion: (1) total number of radiocarbon dates, and (2) number of components. The total number of radiocarbon dates includes all dates, while the number of components counts multiple dates from the same site within a given 250-year period as a single component. This method prevents sites with numerous dates due to more intensive fieldwork (e.g., CA-SCLI-43, CA-SNI-168) from biasing the record too heavily. The temporal span of 250 years is somewhat arbitrary, but was chosen to provide a reasonable span of time such that trends could be ascertained (data runs using shorter time segments provided fairly similar results).

For all analyses, a chi-square test of independence is used to evaluate the overall differences between classes of sites through time. For samples that meet the statistical criteria, an adjusted residuals analysis is used to identify which individual cells in a chi-square test vary significantly from expectations.

An adjusted residual value greater than ±1.69 represents a cell that is significantly different at a threshold of $p = 0.10$; an adjusted residual value greater than ±1.96 is significant at a $p = 0.05$ value. In common terms, a value of ±1.96 or greater represents a cell value that is expected to occur by random sampling of the same population no more than 5 percent of the time. Values that do not meet this criteria are more likely to be the result of random sampling and therefore not a true reflection of differences between assemblages.

We acknowledge that there are interpretive limitations to using radiocarbon date tabulations as indices of settlement history, as these dates only provide evidence of human presence/absence in a particular locality and not on the character of the occupation. To fully understand settlement patterns and the adaptations that underlie such organizational practices requires detailed insight in the range of environmental variables that may have conditioned settlement positioning (including proximity to the full range of resources, and more subtle environmental factors such as accessibility and view-shed) at a particular point in time. It would also require robust reconstructions of a suite of sociocultural factors, including insight into site function, seasonality, settlement longevity, and the distribution of contemporaneous settlements.

Trans-Holocene Temporal Trends by Island

In total, 69 sites have been dated on SNI and 164 on SCLI (see Table 1; Supplemental Tables 1 and 2 www.maneyonline.com/doi/suppl/10.1179/1947461X15Z.00000000054). In all, the chronological presentation is based on 304 radiocarbon dates from mapped archaeological contexts on SCLI and 242 on SNI. These dates are then transformed into 240 distinct components on SCLI and 175 on SNI (using a temporal span of 250 years to define components) (Table 2). To formally subdivide the Holocene, we follow Walker et al.'s (2012) recent chronology that is based on geological investigations: early Holocene (11,700–8,200 cal BP), middle Holocene (8,200–4,200 cal BP), and late Holocene (4,200–0 cal BP). We note that neither island has a radiocarbon dated terminal Pleistocene record, despite recent documentation of sites dating between 12,200 and 11,200 cal BP on the Northern Channel Islands of Santa Rosa and San Miguel (Erlandson et al. 2011; Rick et al. 2013), and to the south on Isla Cedros, Baja (Des Lauriers 2006, 2008).

On SNI, no sites have been radiocarbon dated to the early Holocene (see Table 1 and Supplemental Table 1), although Davis et al. (2010) documented 18 crescents from SNI (none of which are clearly associated with a discrete site component) that appear similar in techno-morphology and raw material

Table 2. Count of Components on San Clemente versus San Nicolas with Adjusted Residual Analysis of Differences.

	Components (*n*)			Adjusted Residuals	
cal BP	**San Nicolas Island**	**San Clemente Island**	**Total**	**San Nicolas Island**	**San Clemente Island**
0–2,000	62	155	215	**–3.61**	**2.98**
2,000–4,000	56	53	110	1.61	–1.34
4,000–6,000	51	18	65	**4.27**	**–3.30**
6,000–8,000	6	6	12	0.42	–0.36
8,000–10,000	0	8	8	–1.85	1.57
Total	**175**	**240**	**410**	–	–

Note: See Supplemental Tables 1 and 2 for full list of dates by site.

with crescents dated to 12,000–8,500 cal BP on the northern Channel Islands. The earliest dated component on SNI occurs after 7,000 cal BP in the middle Holocene, and there is then a relatively steady increase in the number of components across the middle Holocene (Figure 2a). Although the overall number of dated components increases in the subsequent late Holocene, several cycles of upturns and downturns in dated components are apparent. Three main downturns can be discerned—ca. 3,750–3,500 cal BP, 2,500–2,250 cal BP, and 1,750–1,500 cal BP. A smaller downturn may also be present around 500 to 250 cal BP.

On the other hand, the record on SCLI stretches back to nearly 10,000 cal BP, with a low density of dates and components throughout the early and middle Holocene. The sites with early and middle Holocene dates are few in number and widely dispersed (Figure 2b). Beginning around 4,000 cal BP, the number of sites and radiocarbon dates increased markedly, doubling in frequency over the preceding interval. After a dip in frequency from 1,250 to 750 cal BP (the time interval that includes the dry intervals of the MCA; Jones et al. 1999; Yatsko 2000), the frequency of both components and radiocarbon dates increases dramatically to nearly 10 times the middle Holocene values, and five times the frequency of the prior interval that includes the medieval droughts.

In comparing the SNI record with that from SCLI, it should be noted that although the latter component record is slightly larger (1.4 times), the land mass is 2.6 times larger; thus, there is a much smaller fraction of sites in

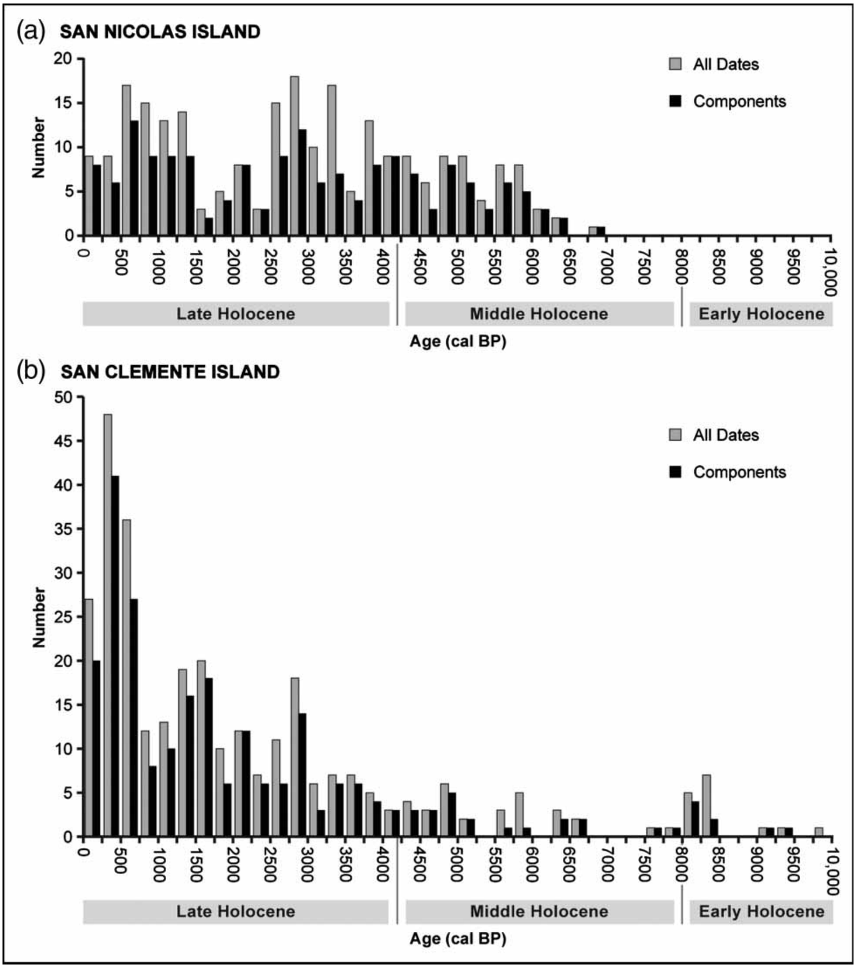

Figure 2. Radiocarbon dates and site components in 250-year intervals on (a) San Nicolas Island and (b) San Clemente Island.

relationship to land mass that have been dated on SCLI (one component per 153 acres) than on SNI (one component per 81 acres). In contrast to the relatively substantial and fairly steady pattern of occupation across the middle and late Holocene on SNI (albeit with some oscillations), SCLI's record begins much earlier, stays at more reduced levels throughout the early and middle Holocene, and then increases markedly at the very end of the late Holocene sequence (see Tables 1 and 2, Figure 2).

These differences in the structure of the archaeological record on the two islands are highlighted when the radiocarbon dated components are collapsed into 2,000-year increments and compared statistically (Table 2). This inter-island variation is statistically significant overall ($X2 = 52.64$, $df = 4$, $p > 0.0001$) for the whole assemblage, and adjusted residual analysis shows where particular cells represent statistically over- or under-represented samples. The most obvious trend is the massive difference between the number of components dating to the last 2,000 years on the two islands. Almost two-thirds (65 percent) of all site components on SCLI are dated within this time period, whereas only 35 percent of those on SNI date to this time segment. The opposite is true in the latter half of the middle Holocene (6,000–4,000 cal BP; this 2000-year interval includes 200 years of the late Holocene) when this time segment represents 28 percent of the SNI record but only 8 percent of the SCLI record. Finally, the lack of dated components before 8,000 cal BP on SNI stands out, although the large number of components on SCLI is attributable mainly to the Eel Point (CA-SCLI-43) occupation (Cassidy et al. 2004; Raab et al. 2009). We suspect that the considerably greater percentage of early Holocene land mass lost to sea level rise on SNI may also be a factor in the modest differences between islands in the early portion of the sequence (Davis et al. 2010; Porcasi et al. 1999).

Intra-Island Temporal Trends

There are clear differences in trans-Holocene temporal trends between the two islands. Given the similar history of mainly cultural resource management-driven studies on SNI and SCLI and similar histories of disturbance, the two datasets should be comparable. It is useful then to explore and compare intra-island trends in the distribution of sites to gain additional insight into the underlying causes of these divergent patterns and to examine whether these are based on divergent socioeconomic and settlement trends or geographic differences between the islands.

On SNI, when dates and components are examined by topographic setting, some differences in the temporal span and intensity of occupation emerge. Figure 3 compares the distribution of middle and late Holocene sites across the island. Probably the most noteworthy aspect of this distribution is the more numerous late Holocene sites along the coastal terraces and, to a lesser extent, on the Central Plateau. Figure 4 provides a finer-grained presentation of dates and components between the three main settings (it should be noted that there are sample size differences between topographic zones, as

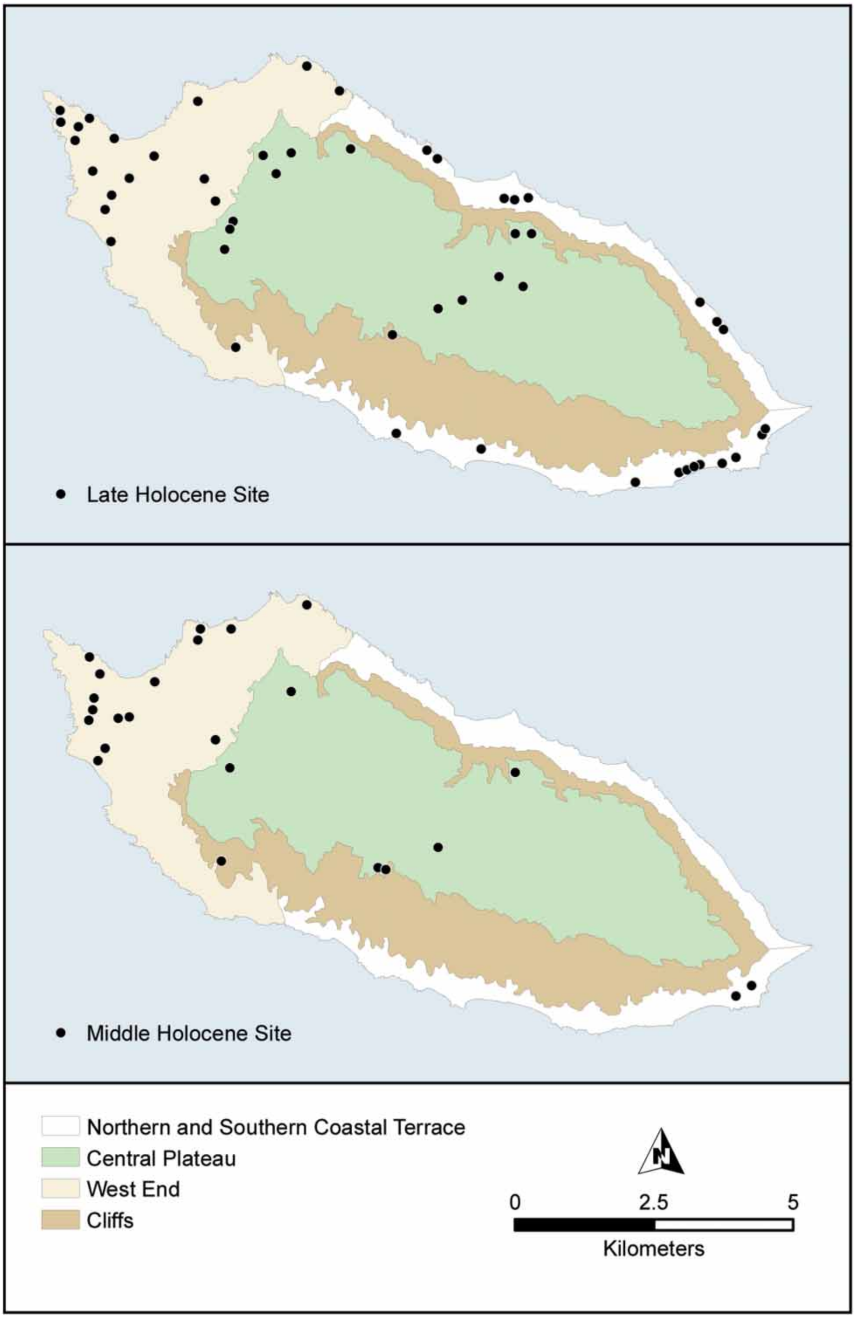

Figure 3. Middle and late Holocene site locations on San Nicolas Island.

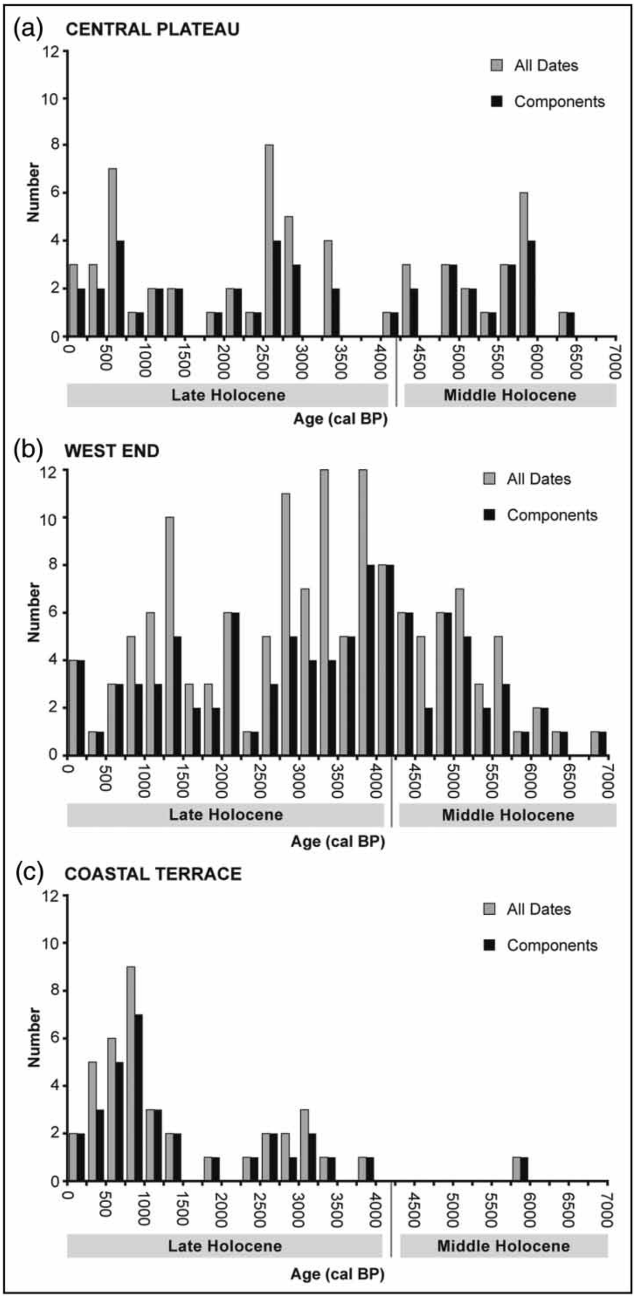

Figure 4. Radiocarbon dates and site components by geomorphic provenience on San Nicolas Island.

shown in Table 1). Both the West End and the Central Plateau have evidence of occupation during the entire sequence, although the larger West End sample is the most consistent across the sequence and also appears to have a modest upswing near the transition between the middle and late Holocene. In contrast, the record for the Coastal Terraces (northern and southern) is almost exclusively a late Holocene phenomenon, and around 1,500 cal BP it increases markedly, peaking around 1,000 cal BP. These sites are primarily situated near the southeast end of the island and along the north shore (see Table 1).

On SCLI during the early and middle Holocene, sites are primarily distributed on the Central Plateau (Figure 5), while sites are more broadly distributed during the late Holocene. When the dates are broken out by topographic setting (keeping in mind the sample size differences; see Table 1), differences in the temporal span and intensity of occupations emerge (Figure 6). Notably, the Coastal Terrace has evidence of occupation during the entire sequence. Of course, the early and middle Holocene occupation data are almost exclusively based on the long occupational sequence at Eel Point (CA-SCLI-43). Another clear trend is that the intensity of occupation does not increase on the Coastal Terrace to the same extent that it does elsewhere. In fact, only one or two components occur in each 250-year time span through much of the Holocene; around 1,000 years ago, however, the number of components increases slightly over a 500-year interval.

In contrast to the Coastal Terrace record, Plateau occupation on SCLI is largely concentrated during the last 5,000 years. Then around 3,000 years ago, the number of components increases and peaks around 1,500 cal BP. After this initial peak in occupation, there is a downturn in the number of occupation components between 1,500 and 750 cal BP (the time period that includes the MCA), followed by a dramatic spike in site density from 750 to 250 cal BP. The third region, the Upland Marine Terraces, has the smallest sample size. This modest data set is restricted to the last 5,000 years, increases notably after 1,500 cal BP, and spikes after 500 cal BP. While the Upland Coastal Terraces have been underemphasized in the research program on the island, it is notable that there are no dates older than 5,000 cal BP.

Settlement Patterns During the Medieval Climatic Anomaly

In order to gain greater insight into these late Holocene trends in land use, we examine how they correlate with rainfall fluctuations during the MCA (Larson and Michaelsen 1989). Previously, researchers have debated the relative

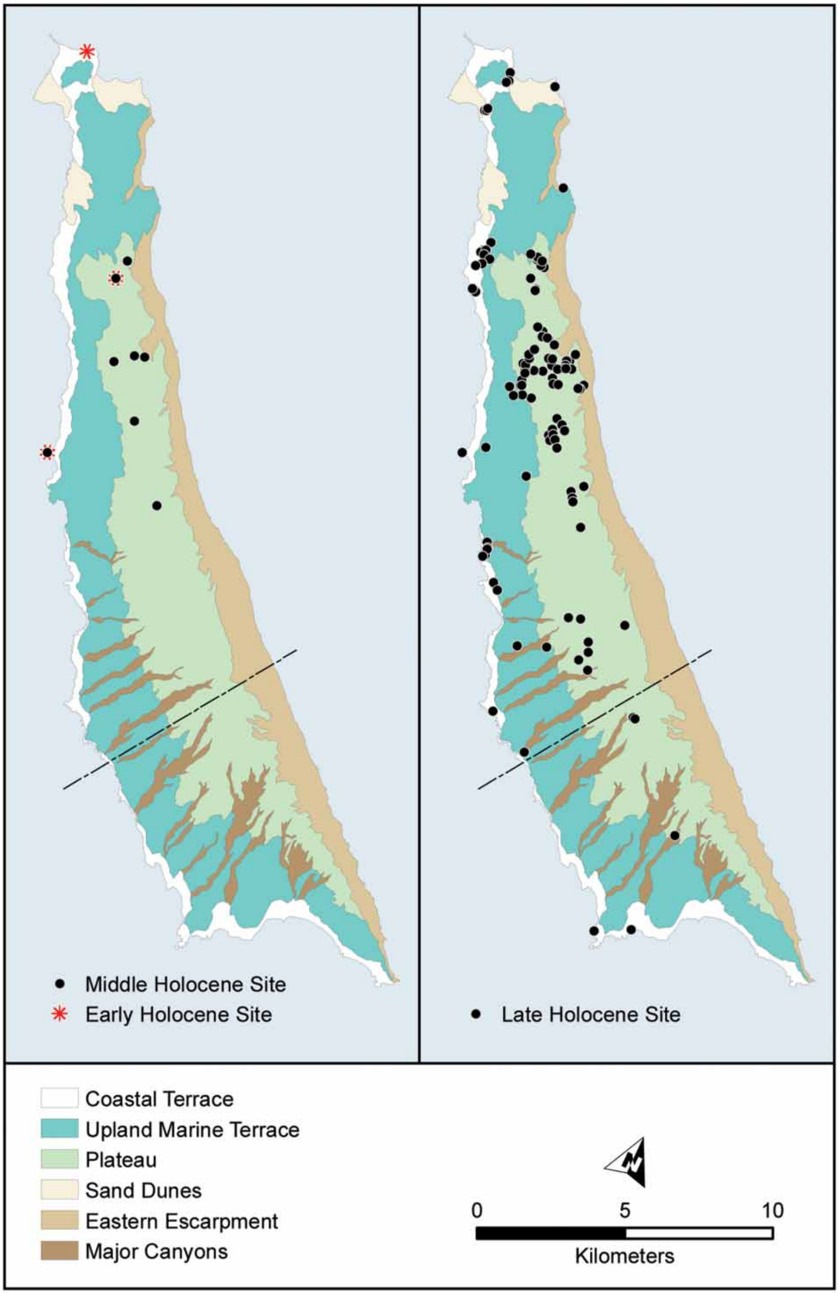

Figure 5. Early, middle, and late Holocene site locations on San Clemente Island.

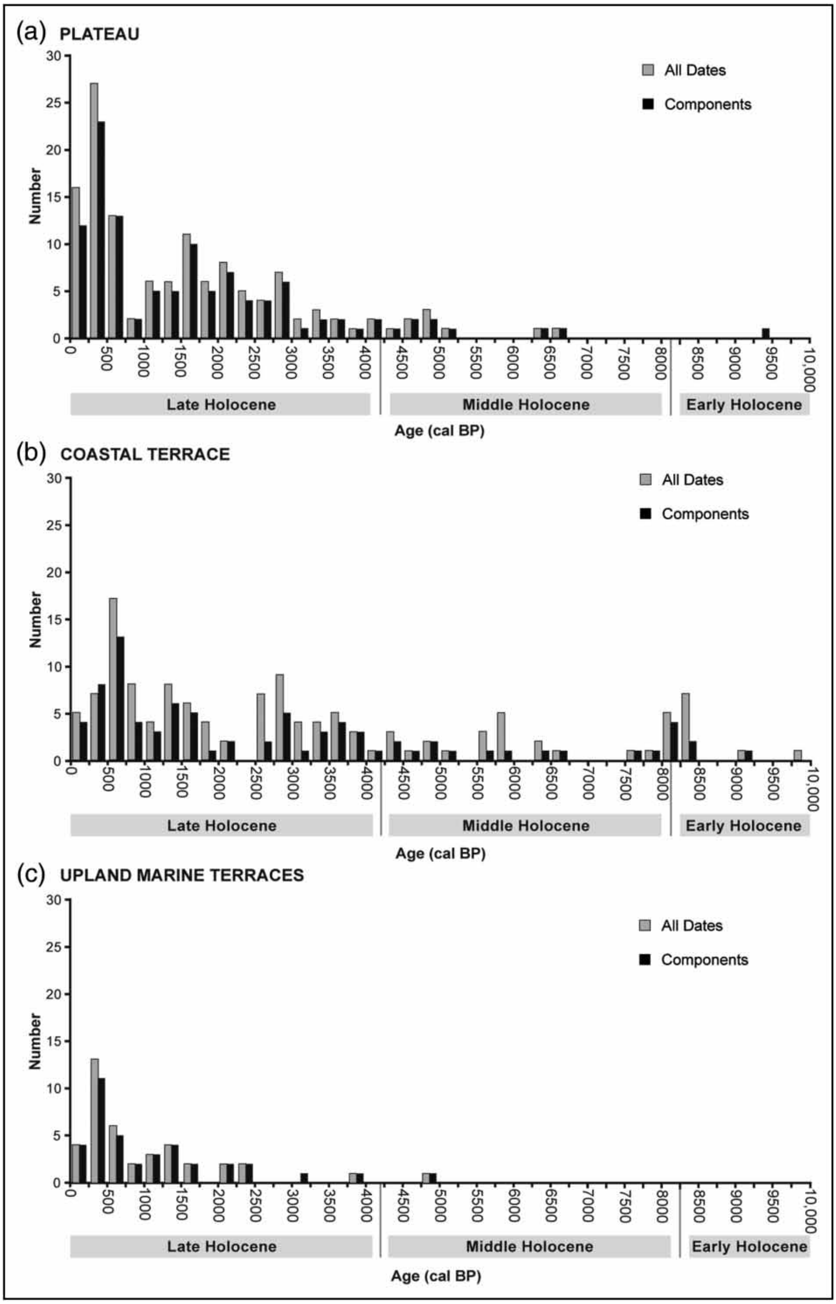

Figure 6. Radiocarbon dates and site components by geomorphic provenience on San Clemente Island.

impact of these environmental fluctuations (both precipitation and sea surface temperature) on human adaptation on the Channel Islands (e.g., Arnold 1992; Jones et al. 1999; Kennett and Kennett 2000; Raab et al. 1995). Notably, Yatsko (2000; Yatsko and Raab 2009) conducted a systematic survey and dating program to assess whether reduced precipitation during MCA drought episodes resulted in abandonment or changes in settlement locations on SCLI. Yatsko (2000:124) found that although site frequencies were significantly lower during drought intervals, the island was not abandoned, and the remaining sites were in areas with more constant sources of water (lowland terraces with bedrock substrata).

We reassess the hypotheses proposed by Yatsko (2000) for changes in settlement patterns during MCA drought intervals using a much larger and more widely distributed sample from SCLI and a comparably robust data set on SNI. In doing so, we compared dated sites from the dry and wet episodes. Unfortunately, there is little resolution in the record as to the exact timing of the MCA on the Channel Islands, and few data are available to evaluate competing dates for the droughts. Therefore, we follow the reconstruction proposed by Larson and Michaelsen (1989) based on a dendrochronological study from the Santa Barbara coast, as it is comparable to the previous studies that used data from SCLI (see also Raab and Larson 1997; Yatsko 2000). Under this scheme, the dry intervals of the MCA are from 1,300 to 1,150 cal BP, 950 to 900 cal BP, and 850 to 700 cal BP; these are contrasted in aggregate with wet episodes from 1,400 to 1,300 cal BP (just prior to the MCA), 1,150 to 950 cal BP, and 900 to 850 cal BP (Larson and Michaelsen 1989). Our sample from SCLI includes 37 components from 21 sites dated to the MCA (as compared to five in Yatsko [2000]), while the SNI sample includes 41 components from 21 sites.

For SCLI, the presence of sites dating to drought intervals throughout the island (while a smaller density than the periods before and after the droughts) supports Yatsko's (2000) findings and reveals continuity of occupation even during the MCA episodes (Table 3). Strong spatial patterns are also discernible on SCLI, as the Plateau was occupied extensively during wet periods but only minimally during the drought intervals. The Coastal Terrace has more sites that were occupied during dry intervals (seven) than during wet intervals (five). Finally, twice as many upland marine terrace sites date to the wet intervals (six) than the dry (three). A chi-square test on this distribution demonstrates a statistically valid pattern ($X2 = 4.44$, $df = 2$, $p < 0.037$). On SCLI, these trends may indicate that island inhabitants shifted settlement patterns in direct response to changes in environmental conditions. When

Table 3. Distribution of Radiocarbon Dated Components by Topographic Province during Wet and Dry Periods of the Medieval Climatic Anomaly.

	Wet Intervals[a]	Dry Intervals[b]
San Clemente (X2 = 4.44, df = 2, p = 0.037)		
Coastal Terrace	5	7
Plateau	14	2
Upland Marine Terrace	6	3
San Nicolas (X2 = 0.57, df = 2, p = 0.75)		
Coastal Terrace	6	9
Central Plateau	4	3
West End	9	10

[a]1,400–1,300 cal BP, 1,150–950 cal BP, 900–850 cal BP.
[b]1,300–1,150 cal BP, 950–900 cal BP, 850–700 cal BP.

environmental conditions began to worsen, settlement patterns appear to have constricted, with surface water as a limiting factor. Settlement patterns quickly became more dispersed when greater precipitation was available.

In contrast, examination of the SNI data during the wet and dry portions of the MCA reveals little difference (see Table 3). This is particularly clear when one considers the island as a whole—19 components fall within the wet intervals and 22 components fall within the dry intervals. When different portions of the island are compared, this same evenness in site occupation across the drought periods is present. Overall, SNI settlement positioning appears not to have been impacted by these major rainfall fluctuations.

The divergence of settlement responses to drought intervals on the two islands is unexpected. Although the underlying causes are not readily apparent, we suspect that several factors played a role in the relative stability and conservative nature of SNI trends and the much more spatially dynamic nature of land use on SCLI. For SNI, these may have included a residential settlement strategy that was already preconditioned for drought events, owing to generally low annual rainfall and the concentration of seeps and springs at the West End, and a greater reliance on littoral and kelp bed associated resources rather than upland plant resources. For SCLI, its larger size and more mesic and varied landscape may have facilitated terrestrial plant resources being a more integral aspect of hunter-gatherer adaptations; during wet intervals, these plant resources took on even greater importance discernible in annual settlement patterning.

Inter-Island Differences in Site Size and Function

In order to gain additional insight into these divergent settlement trends, we examine spatial patterning in site size and possible site function. Comparison of survey-level data on the two islands employs a modified version of the size categories developed by Yatsko (2000) for SCLI: small (less than 30 meters diameter/707 square meters), medium (30–60 meters diameter/707–2,827 square meters), and large (greater than 60 meters diameter/2,827 square meters). For SNI, we used the full island survey results of Martz (2002, 2005). Although considerable survey has been undertaken on SCLI (Yatsko 2000; Yatsko and Raab 2009), site size data were not readily available for this synthesis. Therefore, the data employed are derived from five small surveys that inventoried segments of the north end and central portion of the island and presented site sizes (Byrd and Andrews 2002; Byrd and Hale 2004; Byrd and O'Neill 2001; Byrd and Victorino 2000; Whitaker 2014). Overall, these SCLI projects surveyed 1,430 acres and documented 241 sites. Although there is potential for surveyor-based differences in the way that sites were recorded (e.g., Reddy 2007), the well-preserved nature of sites on both islands and often excellent surface visibility reduce the potential for systematic biases in site recording. Furthermore, the criteria applied programmatically in culture resource management work has emphasized a sufficient buffer around sites (30 meters on SNI, at least 10 meters on SCLI) that we believe site size classifications are broadly accurate. The one difference between the two islands is the greater extent of deflation at many sites on San Nicolas due to devegetation and wind erosion resulting from historic grazing. This may have the effect of spreading deposits and therefore exaggerating site sizes in certain areas of the island, especially where sand dunes predominate.

With this caveat in mind, there are still striking differences in the relative frequency of sites by size category between the two islands (Figure 7). The SCLI sample is positively skewed, dominated by small-sized sites (76 percent), with the relative frequency decreasing for medium-size sites (17 percent) and large-sized sites (6 percent). We estimate that average SCLI site size is approximately 1,080 square meters. In contrast, SNI site size distribution is U-shaped: large-sized sites dominate the island (50 percent; 8 times more ubiquitous than on SCLI), small-sized sites are well-represented (39 percent; half the relative frequency of SCLI), and medium-sized sites are infrequent (11 percent). Mean site size on SNI is 8,945 square meters, more than eight times that of SCLI. This size distribution trend, with larger-sized sites predominating, is not a typical hunter-gatherer prehistoric site size distribution for the California

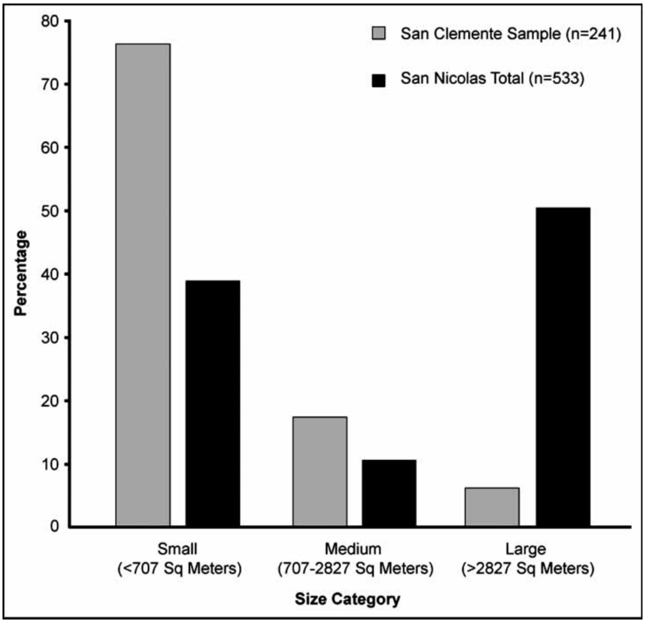

Figure 7. Distribution of sites by size category on San Clemente and San Nicolas islands.

region. Generally, in both semi-arid coastal and arid desert settings, smaller-sized sites predominate and are often extractive or special-function sites (e.g., Byrd 1998; Byrd et al. 2010; Reddy 1999).

Clearly, SCLI is dominated by smaller-sized sites while SNI is dominated by larger-sized sites. Site density also differs markedly—SNI has a site density of one site per 27 acres, while the SCLI survey sample is almost four times as dense, with a site density of one site per six acres. When site size is factored in, archaeological sites on SNI cover approximately 1.8 times the area of sites on SCLI. Although erosion and deflation may have played a greater role in the creation of larger sites on SNI, owing to the greater prevalence of sand dunes versus SCLI, cultural factors also significantly structured these trends.

On SNI, larger sites are concentrated at the West End of the island (34 percent of large sites and 28 percent of medium sites) and the adjacent Central Plateau, particularly its western portion (33 percent of large sites and 30 percent of medium sites). Using Martz's (2002) site types, large-sized sites are dominated by residential sites (which includes habitation and camp site types), comprising 50 percent of this size category. In contrast, small sites are more frequent on the Coastal Terraces (45 percent) and the Central Plateau (23 percent), particularly the eastern portion. They also comprise only 9 percent of the sites on the West End of the island. This size category is dominated by shellfish processing sites (43 percent), while small residential sites are very rare (6.6 percent). For SNI, this distinctive settlement pattern appears to be driven by two major factors: the small size of the island and access to readily available water. On a small island such as this, there would be less impetus to create temporary camps, since much of the island is within the daily foraging range of the location of any major settlement. Moreover, access to potable water (most abundant on the western end of the island) may have been a limiting factor that further structured the archaeological record.

We currently lack readily accessible, comparable data of a similar resolution and scale for SCLI. Several comments, however, can be made at the present time. Not surprisingly, the ubiquitous, smaller-sized sites are widely distributed on SCLI. In addition, these smaller-sized sites documented on the Plateau appear to be dominated by short-term residential encampments of sufficient duration that anthropogenic sediment (i.e., midden) developed (e.g., Byrd 2000b; Whitaker and Byrd 2013a, 2013b). The presence of numerous, smaller-sized sites well away from the shoreline and from the largest residential sites is partly due to the larger scale of the island (2.6 times bigger than SNI), greater annual rainfall (especially on the Plateau), and probably more effective precipitation as well (owing to regular, persistent fog).

The explosion of smaller-sized sites on the Plateau during the late Holocene, primarily during periods of greatly enhanced rainfall, suggests that these settlement trends are in part facilitated by changes in background conditions. They may also be evidence of increased population density and greater population pressure, requiring greater subsistence effort for terrestrial plant resources, as well as small, littoral resources such as *Tegula* and near-shore fish—all of which consistently occur at these small Plateau sites (Byrd and Andrews 2002, 2003; Whitaker and Byrd 2013a, 2013b). For example, Reddy (2002, 2003) noted that archaeobotanical remains from Plateau sites (dominated by grasses, legumes, and *Calandrinia*) occur in significantly higher densities than at sites near the shoreline. The occupation duration of these smaller-sized sites on SCLI (including seasonality and range of subsistence activities) and the full nature of their role within annual settlement trends remain only partially understood at present. It is predicted that spring through early summer are likely seasons of occupation for many of the smaller-sized sites on the Plateau, when people would have capitalized on the ripening of small seeded resources.

Conclusion

Overall, these results suggest that the trajectory of human adaptations on SCLI and SNI differed significantly, considering the similarity in background conditions for these two semi-arid island settings. On SCLI, site densities increased dramatically during the latter portion of the late Holocene (after 1,500 cal BP, and particularly after 500 cal BP), primarily represented by small-sized residential sites on the Plateau—a trend periodically muted by MCA droughts. We also note that this temporal trend is broadly consistent Jazwa and Perry's (2013:16) observation that population increased on the Channel Islands around 1,300 cal BP, and with Perry and Glassow's (2015) study on Santa Cruz Island indicating an uptick ca. 1,450 cal BP (see also Erlandson et al. 2001). In contrast, occupation of SNI appears to have been more intensive during the latter half of the middle Holocene (after 6,200 cal BP) and more constant throughout the late Holocene. Notably, settlement on SNI did not entail a tremendous upswing in small sites on the Plateau, although there was a modest increase in smaller and more specialized sites on the Coastal Terrace of SNI during the late Holocene. These sites were typically well away from the West End, where land use was both extensive and persistent from 6,200 cal BP onward, creating residential sites with a much larger mean size than those on SCLI. Land-use patterns on SNI also appear to have been much less impacted by MCA droughts.

We suspect that these divergent settlement trends were driven in part by modest geographic and environmental differences between the islands tied to land mass, maximum elevation, annual rainfall, and terrestrial vegetation. The smaller size of SNI would have allowed foragers to access the entire island within a single day. This was not possible on the narrow but long SCLI, where logistical and task-specific overnight camps may have been necessary, and repositioning residential bases (if only seasonally) near resource patches would have been a more viable option. Furthermore, SNI is more arid and settlements—regardless of climatic fluctuations—may have more consistently clustered around accessible fresh water sources (which occur primarily at the West End). The disruption or contraction of the distribution of small upland sites on SCLI may seem counterintuitive, since overall rainfall was greater than on SNI. These differences may reflect a greater reliance on terrestrial resources, which were subject to resource depression during droughts, as well as a decline in more seasonal or ephemeral water sources.

Overall patterns of population also may have been driven by the relative isolation of SNI compared to SCLI—the distance between SCLI and Santa Catalina is about one-third the distance from SNI to any other island and the distance to mainland from SCLI is around half as far. This may have allowed for easier abandonment of SCLI in hard times and potentially greater influxes of population in boon times. It may also have allowed for increased trade goods from the mainland and other islands, more rapidly spreading new technologies and other adaptive traits. On the other hand, the more persistent and stable occupation trends indicated on SNI may reflect its greater geographic isolation from nearby islands and the mainland.

It is not surprising, then, that differences in subsistence strategies and resource emphasis are also evident between the two islands. On SCLI, resource intensification may have occurred during the latter portion of the late Holocene (after 1,500 cal BP, and particularly after 500 cal BP), with an increased focus on small-scale resources, including those more readily available in upland terrestrial settings (Byrd and Raab 2007). This increased emphasis on terrestrial resources is consistent with Goldberg's (1993) study of stable carbon isotopes on a sample of human remains from the island, where sites predating 3,000 cal BP had an extremely high reliance on marine resources, and sites postdating 3,000 cal BP had significantly greater reliance on terrestrial resources. Goldberg (1993:151) suggested that this shift was due to the consumption of mainland terrestrial resources acquired via trade. However, we suggest that this trend more likely reflects greater reliance on small plant foods available on SCLI (e.g., Gill 2013; Reddy 2002, 2003).

These trends on SCLI parallel mainland coastal patterns, particularly those observed by Byrd and Reddy (1999, 2002) in northern San Diego County at the end of the late Holocene (after 1,250 cal BP, and particularly after 550 cal BP). These include greater site type diversity with an explosion of small, often specialized sites, and increased emphasis on smaller (probably lower ranked) resources, including plants, shellfish, and small fish. These results are consistent with increasing population density and population pressure. Similar trends have been documented along the coast of Orange County at the end of the late Holocene (Koerper et al. 2002; Mason and Peterson 2014). It is interesting to note that at historic contact, each of these three areas were occupied by Uto-Aztecan speaking groups—the island Gabrieliño on SCLI, the Luiseño in northern San Diego, and the Juaneño and mainland Gabrieliño along the Orange County coast—that only arrived in the region at some point in the latter portion of the Holocene.

In contrast, occupants of SNI appear to have had a greater focus on marine resources and clustered in settlements typically situated in contexts where the inhabitants could focus on near-shore and off-shore resources. The general subsistence adaptation appears to be more stable and consistent through time (particularly from 6,200 cal BP onward). This suggestion is consistent with Harrison and Katzenberg's (2003) stable isotope analysis of human remains from three sites on SNI dated between 4,200 and 300 cal BP. They found that the strong reliance on marine resources remained broadly stable across the late Holocene on SNI consistent with Goldberg's (1993) SNI results from a more temporally limited data set. Resource intensification trends, however, have been noted during the late Holocene on SNI, with a greater focus on small shellfish and smaller fish (Vellanoweth et al. 2002).

It is possible that for much of prehistory, SNI may have been more closely aligned in terms of adaptive strategies, sociopolitical interaction, and perhaps even intermarriage patterns with inhabitants of the Northern Channel Islands rather than the inhabitants of Santa Catalina and San Clemente islands to the south (e.g., Kennett 2005; Rick et al. 2005). For example, Rick et al. (2005:188–189) noted the strong similarity in subsistence orientation between SNI and the Northern Channel Islands rather than with SCLI. Similarly, Vellanoweth et al. (2002) pointed out that many of the archetypical Chumash items are actually from SNI, which is effectively as close to the Northern Channel Islands as to SCLI and Santa Catalina Island. Based on genetic data from burials on SNI, Valentin (2010) suggested that the arrival of Uto-Aztecan populations (presumably ancestral to the Gabrieliño) took place around 1,600–1,000 cal BP. This time span fits well with the shift toward increased exploitation of the coastal terrace (including the modest rise in smaller and more specialized sites) and could signal a shift from an adaptive pattern consistent with ancestral Chumash on the Northern Channel Islands to one more broadly characteristic of Takic-speaking populations during the late Holocene on the mainland of coastal southern California and on SCLI. This adaptive trend was, however, muted by the ecological constraints imposed by SNI. An intriguing possibility is that the very late intensification on the coastal terrace of SNI, especially at the eastern end most distant from the primary water sources, marks the onset of this shift.

Overall, the results of this study are consistent with Jazwa and Perry's (2013) recent overview of Channel Island prehistory, where they observed that late Holocene subsistence diversification took place between islands and acknowledged that until recently less attention has been given to the terrestrial environment in understanding Channel Islands adaptations. Recent studies by Gill (2013), Perry and Glassow (2015), and Reddy and Erlandson (2012) are highlighting the role of plant food exploitation in understanding the nature of and shifts in settlement and subsistence trends across time and space on the Channel Islands.

Future Directions

This article has shown the utility of exploring trends and differences between the Channel Islands, as well as the continued importance of these islands as natural laboratories for understanding human adaptations (Arnold et al. 2004; Jazwa and Perry 2013; Raab et al. 2009; Rick et al. 2005:197). Most recent studies on SCLI and SNI have tended to be very detailed and focused on several sites or a single site, providing a great deal of valuable insight into trends in subsistence strategies, historical ecology, and ceremonial practices (e.g., Cassidy et al. 2004; Vellanoweth and Erlandson 1999; Vellanoweth et al. 2008). Supplementing such investigations with periodic, broad, comparative perspectives, such as the one used here to examine settlement patterns on San Clemente and San Nicolas islands, will facilitate the identification of larger trends and inter-island differences that are more difficult to discern with only a reliance on site-specific data. As Glassow (1999) noted, synthetic radiocarbon studies are best used to provide hypotheses that can be tested using finer-grained analysis. Future studies that incorporate site activity profiles and seasonality studies can address many of the hypotheses generated regarding shifts to more logistically based subsistence and settlement patterns. This work provides a baseline for such studies.

Acknowledgments

This study was undertaken as part of a broader archaeological study under United States Department of the Navy Contract N6243-11-D-220. We greatly appreciate the ongoing and consistent support and encouragement of the following Navy cultural resources staff members: Catherine Girod, George Herbst, Noelle Shaver, Steven Schwartz, Lisa Thomas, and Andrew Yatsko. The paper was improved with comments from three anonymous reviewers. Figures were produced by Jill Bradeen and Kathleen Montgomery.

References Cited

Altschul, Jeffrey H., and Donn R. Grenda

2002 *Islanders and Mainlanders: Prehistoric Context for the Southern California Bight*. SRI Press, Tucson, Arizona.

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.

Arnold, Jeanne E., Michael R. Walsh, and Sandra E. Hollimon

2004 The Archaeology of California. *Journal of Archaeological Research* 12:1–73.

Barrowclough, David A.
2010 Expanding the Horizons of Island Archaeology: Islandscapes Imaginary and Real, Ely: The Case of the Dry Island. *Shima: The International Journal of Research into Island Cultures* 4:27–46.

Berryman, Judy A., Steve Moffitt, and Linda Moffitt
2010 *Final Report: National Register Eligibility Determinations, 24 Archaeological Sites in TARs 14 and 15, San Clemente Island.* Report on file at NAVFACSW EV52 CRMP, San Diego, California.

Braje, Todd J.
2010 *Ancient Oceans, Modern Sites: Archaeology and Marine Conservation on San Miguel Island, California.* University of Utah Press, Salt Lake City, Utah.

Braje, Todd J., Jon M. Erlandson, and Torben C. Rick
2005 Reassessing Human Settlement on the South Coast of San Miguel Island, California: The Use of 14C Dating as a Reconnaissance Tool. *Radiocarbon* 47:11–19.

Breschini, Gary S., Trudy Haversat, and Jon Erlandson
1996 *California Radiocarbon Dates* (8th ed.). Coyote Press, Salinas, California.

Byrd, Brian F. (editor)
1998 *Springs and Lakes in a Desert Landscape: Archaeological and Paleoenvironmental Investigations in the Silurian Valley and Adjacent Areas of Southeastern California.* Report on file at the San Bernardino Archaeological Information Center, Redlands, California.
2000a *Archaeological Testing of Four Sites near West Cove, Northern San Clemente Island, California.* Prepared for NAS North Island. Report on file at NAVFACSW EV52 CRMP, San Diego, California.
2000b *Archaeological Testing of Three Sites along the LVT Road, North-central San Clemente Island, California.* Report on file at NAVFACSW EV52 CRMP, San Diego, California.

Byrd, Bryan F., and Sherri Andrews
2002 *Archaeological Testing of Five Sites in the Old Airfield Area, North-central San Clemente Island, California.* Report on file at NAVFACSW EV52 CRMP, San Diego, California.
2003 *Archaeological Testing of Four Sites in the Lemon Tank Area, Central San Clemente Island, California.* Report on file at Southwest Division of the Navy, San Diego, California.

Byrd, Brian F., and Micah Hale
2004 *Rose-Arizone Archaeological Survey and Site Recording Project, Central San Clemente Island, California.* Report on file at Southwest Division of the Navy, San Diego, California.

Byrd, Brian F., and Collin O'Neill
2001 *DC and U21 Archaeological Survey and Site Recording Project, Northern San Clemente Island, California.* Report on file at NAS North Island, San Diego, California.

Byrd, Brian F., and L. Mark Raab
2007 Prehistory of the Southern Bight: Models for a New Millennium. In *California Prehistory: Colonization, Culture, and Complexity*, edited by Terry L. Jones and Kathryn A. Klar, pp. 215–228. Altamira Press, Lanham, Maryland.

Byrd, Brian F., and Seetha N. Reddy
1999 Collecting and Residing Near the Shore: The Role of Small and Large Sites in Settlement Reconstruction. *Pacific Coast Archaeological Society Quarterly* 35:33–56.
2002 Late Holocene Adaptations along the Northern San Diego Coastline: New Perspectives on Old Paradigms. In *Catalysts to Complexity: Late Holocene Societies of the California Coast*, Vol. 6, edited by Jon M. Erlandson and Terry L. Jones, pp. 41–62. Perspectives in

California Archaeology, Cotsen Institute of Archaeology, University of California, Los Angeles.

Byrd, Brian F., and K. Victorino
2000 *BUDS/MAROPS Archaeological Re-Survey and Site Re-Recording, San Clemente Island, California.* Report on file at NAS North Island, San Diego, California.

Byrd, Brian F., Joseph Freeman, and Rand Herbert
2012 Historic Context and Status of Knowledge for San Nicolas Island, Naval Base Ventura County, California. In *Integrated Cultural Resources Management Plan*, pp. 14–62. Report on file at Naval Facilities Engineering Command Southwest, San Diego, California.

Byrd, Brian F., Ken Victorino, and L. Mark Raab
1998 *Archaeological Site Evaluation Project, Northern San Clemente Island, California.* Report on file at Naval Air Station North Island, San Diego, California.

Byrd, Brian F., D. Craig Young, and Kelly R. McGuire
2010 Pavement Quarries, Gypsum Period Residential Stability, and Trans-Holocene Settlement Systems of the Mojave Desert: A Case Study at Fort Irwin. *Journal of California and Great Basin Anthropology* 29:121–144.

Byrd, Brian F., John Berg, Adrian R. Whitaker, and Hannah Sistrunk
2014 *Section 110 National Register Eligibility Evaluations of Five Archaeological Sites on San Nicolas Island, California.* Report on file at U.S. Department of the Navy, Southwest Division, Naval Facilities Engineering Command, San Diego, California.

Cameron, Constance (editor)
2000 Archaeology of San Clemente Island, Parts 1–4. *Pacific Coast Archaeological Society Quarterly* 36:1–4.

Cassidy, Jim, L. Mark Raab, and Nina A. Kononenko
2004 Boats, Bones, and Biface Bias: The Early Holocene Mariners of Eel Point, San Clemente Island, California. *American Antiquity* 69:109–130.

Dailey, Murray D., Donald J. Reish, and Jack W. Anderson
1994 *Ecology of the Southern California Bight: A Synthesis and Interpretation.* University of California Press, Berkeley.

Davis, Troy W., Jon M. Erlandson, Gerrit L. Fenenga, and Keith Hamm
2010 Chipped Stone Crescents and the Antiquity of Maritime Settlement on San Nicolas Island, Alta California. *California Archaeology* 2:185–202.

Des Lauriers, Matthew
2006 Terminal Pleistocene and Early Holocene Occupations of Isla de Cedros, Baja California, Mexico. *Journal of Coastal and Island Archaeology* 1:255–270.
2008 A Paleoindian Fluted Point from Isla Cedros, Baja California. *Journal of Island and Coastal Archaeology* 3:271–276.

Engle, John M.
1994 Perspectives on the Structure and Dynamics of Nearshore Marine Assemblages of the California Channel Islands. In *Fourth California Islands Symposium: Update on the Status of Resources*, edited by W. L. Halvorson and G. L. Maender, pp. 13–26. Santa Barbara Museum of Natural History, Santa Barbara, California.

Erlandson, Jon M., Torben C. Rick, Douglas J. Kennett, and Phillip L. Walker
2001 Dates, Demography, and Disease: Cultural Contacts and Possible Evidence for Old World Epidemics among the Island Chumash. *Pacific Coast Archaeological Society Quarterly* 37:11–26.

Erlandson, Jon M., Torben C. Rick, Todd J. Braje, Molly Casperson, Brendan Culleton, Brian Fulfrost, Tracy Garcia, Daniel A. Guthrie, Nicholas Jew, Douglas J. Kennett, Madonna L. Moss, Leslie Reeder, Craig Skinner, Jack Watts, and Lauren Willis

2011 Paleoindian Seafaring, Maritime Technologies, and Coastal Foraging on California's Channel Islands. *Science* 331:1181–1185.

Fitzhugh, Ben, and Terry L. Hunt

1997 Islands as Laboratories: Archaeological Research in Comparative Perspective. *Human Ecology* 25:379–383.

Fitzpatrick, Scott M., and Atholl Anderson

2008 Islands of Isolation: Archaeology and the Power of Aquatic Perimeters. *Journal of Island and Coastal Archaeology* 3:4–16.

Gamble, Lynn H.

2008 *The Chumash World at European Contact: Power, Trade, and Feasting among Complex Hunter-Gatherers*. University of California Press, Berkeley.

Gill, Kristina M.

2013 Paleoethnobotanical Investigations on the Channel Islands: Current Directions and Theoretical Considerations. In *Small Islands, Big Implications: The California Channel Islands and Their Archaeological Contributions*, edited by Christopher S. Jazwa and Jennifer E. Perry, pp. 113–136. University of Utah Press, Salt Lake City.

Glassow, Michael A.

1999 Measurement of Population Growth and Decline During California Prehistory. *Journal of California and Great Basin Anthropology* 21:45–66.

Goldberg, Carol F.

1993 *The Application of Stable Carbon and Nitrogen Isotope Analysis to Human Dietary Reconstruction in Prehistoric Southern California*. Ph.D. dissertation, University of California, Los Angeles. University Microfilms, Ann Arbor, Michigan.

Harrison, Roman G., and M. Anne Katzenberg

2003 Paleodiet Studies Using Stable Carbon Isotopes from Bone Apatite and Collagen: Examples from Southern Ontario and San Nicolas Island, California. *Journal of Anthropological Archaeology* 22:227–244.

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.

Jazwa, Christopher S., and Jennifer E. Perry

2013 Introduction and the Ecological, Environmental, and Cultural Contexts for Island Archaeology. In *California's Channel Islands. The Archaeology of Human-Environment Interactions*, edited by Christopher S. Jazwa and Jennifer E. Perry, pp. 1–25. University of Utah Press, Salt Lake City.

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: Demographic Crises in Western North America during the Medieval Climatic Anomaly. *Current Anthropology* 40:137–170.

Junak, Steve, Denise A. Knapp, J. Robert Haller, Ralph Philbrick, Allan A. Schoenherr, and Todd Keeler-Wolf

2007 The California Channel Islands. In *Terrestrial Vegetation of California* (3rd ed.), edited by

Michael G. Barbour, Todd Keeler-Wolf, and Allan A. Schoenherr, pp. 229–252. University of California Press, Berkeley.

Kennett, Douglas J.
2005 *The Island Chumash: Behavioral Ecology of a Maritime Society*. University of California Press, Berkeley.

Kennett, Douglas J., and James P. Kennett
2000 Competitive and Cooperative Responses to Climatic Instability in Coastal Southern California. *American Antiquity* 65:379–395.

Koerper, H. C., R. D. Mason, and M. L. Peterson
2002 Complexity, Demography, and Change in Late Holocene Orange County. In *Catalysts to Complexity: Late Holocene Societies of the California* Coast, edited by Jon M. Erlandson and Terry L. Jones, pp. 63–81. Perspectives in California Archaeology, Vol. 6, Cotsen Institute of Archaeology, University of California, Los Angeles.

Larson, Daniel O., and Joel Michaelsen
1989 Climatic Variability: A Compounding Factor Causing Culture Change among Prehistoric Coastal Populations. Unpublished manuscript on file at the Department of Anthropology, California State University, Long Beach.

Martz, Patricia C.
2002 *San Nicolas Island Prehistoric Archaeological Sites Mapping and Recordation Project*. Report on file at South Central Coastal Information Center, California State University, Fullerton.
2005 Prehistoric Context and Subsistence on San Nicolas Island. In *Proceedings of the Sixth California Islands Symposium*, edited by David K. Garcelon and Catherin A. Schwemm, pp. 65–82. National Park Service Technical Publication CHIS-05-01. Institute for Wildlife Studies, Arcata, California.
2008 *6,000 Years on Ghalas-at: Part One of the San Nicolas Island Index Unit Analysis Program*. Report on file at Naval Base Ventura County Environmental Division.

Mason, Roger D., and Mark L. Peterson
2014 Subsistence Remains and Intensification of the Newport Coast, Orange County, California. *Pacific Coast Archaeological Society Quarterly* 49:106–126.

Moody, Aaron
2000 Analysis of Plant Species Diversity with Respect to Island Characteristics on the Channel Islands, California. *Journal of Biogeography* 27:711–723.

Perry, Jennifer E., and Michael A. Glassow
2015 Prehistoric Settlement in Island Interiors: Evidence from California's Santa Cruz Island. *Journal of Island and Coastal Archaeology* (in press).

Philbrick, Ralph N., and J. Robert Haller
1977 The Southern California Islands. In *Terrestrial Vegetation of California*, edited by Michael G. Barbour and Jack Major, pp. 893–906. John Wiley and Sons, New York.

Porcasi, Paul, Judith F. Porcasi, and Collin O'Neill
1999 Early Holocene Coastlines of the California Bight: The Channel Islands as First Visited by Humans. *Pacific Coast Archaeology Society Quarterly* 35:1–24.

Raab, L. Mark
1997 The Southern Channel Islands during the Middle Holocene: Trends in Maritime Cultural Evolution. In *Archaeology of the California Coast during the Middle Holocene*, edited by Jon

M. Erlandson and Michael A. Glassow, pp. 23–34. Perspectives in California Archaeology, Vol. 4, Institute of Archaeology, University of California, Los Angeles.

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, and Andrew Yatsko

1990 Prehistoric Human Ecology of Quinquina: A Research Design for Archaeological Studies of San Clemente Island. *Pacific Coast Archaeological Society Quarterly* 26:10–37.

1992 Ancient Maritime Adaptations of the California Bight: A Perspective from San Clemente Island. In *Essays on the Maritime Prehistory of California*, edited by Terry L. Jones, pp. 173–193. Center for Archaeological Research Publication No. 10, University of California, Davis.

Raab, L. Mark, Katherine Bradford, Judith F. Porcasi, and William J. Howard

1995 Return to Little Harbor, Santa Catalina Island, California: A Critique of the Marine Paleotemperature Model. *American Antiquity* 60:287–308.

Raab, L. Mark, Jim Cassidy, Andrew Yatsko, and William J. Howard (editors)

2009 *California Maritime Archaeology: A San Clemente Island Perspective.* Altamira Press, Walnut Creek, California.

Raab, L. Mark, Andrew Yatsko, Thomas S. Garlinghouse, Judith F. Porcasi, and Katherine Bradford

2002 Late Holocene San Clemente Island: Notes on Comparative Social Complexity in Coastal Southern California. In *Catalysts to Complexity: Late Holocene Societies of the California* Coast, edited by Jon M. Erlandson and Terry L. Jones, pp. 13–26. Perspectives in California Archaeology, Vol. 6, Institute of Archaeology, University of California, Los Angeles.

Reddy, Seetha N.

1999 Plant Usage and Prehistoric Diet: Paleoethnobotanical Investigations on Camp Pendleton, Southern California. *Pacific Coast Archaeological Society Quarterly* 35:25–44.

2002 Prehistoric Plant Usage and Natural Fires: Elucidating Plant Usage at Five Sites in the Old Airfield Area, San Clemente Island, California. In *Archaeological Testing of Five Sites in the Old Airfield Area, North-central San Clemente Island, California*, edited by Brian F. Byrd and Sherri Andrews, pp. 133–150. Report on file at NAVFACSW EV52 CRMP, San Diego, California.

2003 Prehistoric Plant Usage at Four Highland Sites in the Vicinity of Lemon Tank on San Clemente Island, California. In *Archaeological Testing of Four Sites in the Lemon Tank Area, Central San Clemente Island, California*, edited by Brian F. Byrd and Sherri Andrews, pp. 93–102. Technical report on file at the Natural Resources Office, Naval Region SW, Naval Air Station, North Island, San Diego, California.

2007 *A Programmatic Approach to Determine Eligibility of Prehistoric Sites in the San Diego Subregion, Southern Coast Archeological Region, California, for the National Register of Historic Places.* Report on file at South Coastal Information Center, San Diego State University, San Diego, California.

Reddy, Seetha N., and Jon M. Erlandson

2012 Macrobotanical Food Remains from a Trans-Holocene Sequence at Daisy Cave (CA-SMI-261), San Miguel Island, California. *Journal of Archaeological Science* 39:33–40.

Rick, John
1987 Dates as Data: An Examination of the Peruvian Preceramic Radiocarbon Record. *American Antiquity* 52:55–73.

Rick, Torben C., Jon M. Erlandson, Nicholas P. Jew, and Leslie A. Reeder-Myers
2013 Archaeological Survey, Paleogeography, and the Search for Late Pleistocene Paleocoastal Peoples of Santa Rosa Island, California. *Journal of Field Archaeology* 38:324–331.

Rick, Torben C., Jon M. Erlandson, René L. Vellanoweth, and Todd J. Braje
2005 From Pleistocene Mariners to Complex Hunter-Gatherers: The Archaeology of the California Channel Islands. *Journal of World Prehistor*y 19:169–228.

Schoenherr, A. A., C. R. Feldmeth, and M. J. Emerson
1999 *Natural History of the Islands of California.* University of California Press, Berkeley.

Schwartz, Steven J., and Patricia Martz
1992 An Overview of the Archaeology of San Nicolas Island, Southern California. *Pacific Coast Archaeological Society Quarterly* 28:46–75.
1995 An Overview of Recent Archaeological Research on San Nicolas Island. *Pacific Coast Archaeological Society Quarterly* 31:4–12.

Valentin, Sylvère Charles Manuel
2010 Prehistoric Population Replacement on California's Channel Islands. Master's thesis, Department of Anthropology, California State University, Los Angeles.

Vellanoweth, René L., and Jon M. Erlandson
1999 Middle Holocene Fishing and Maritime Adaptations at CA-SNI-161, San Nicolas Island, California. *Journal of California and Great Basin Anthropology* 21:257–274.

Vellanoweth, René L., Patricia C. Martz, and Steven J. Schwartz
2002 Complexity and the Late Holocene Archaeology of San Nicolas Island, California. In *Catalysts to Complexity: Late Holocene Societies of the California Coas*t, edited by Jon M. Erlandson and Terry L. Jones, pp. 82–100. Perspectives in California Archaeology, Vol. 6, Institute of Archaeology, University of California, Los Angeles.

Vellanoweth, René L., Barney G. Bartelle, Amira F. Ainis, Amanda C. Cannon, and Steven J. Schwartz
2008 A Double Dog Burial from San Nicolas Island, California, USA: Osteology, Context, and Significance. *Journal of Archaeological Science* 35:3111–3123.

Walker, M. J. C., M. Berkelhammer, S. Björck, L. C. Cwynar, D. A. Fisher, A. J. Long, J. J. Lowe, R. M. Newnham, S. O. Rasmussen, and H. Weiss
2012 Formal Subdivision of the Holocene Series/Epoch: A Discussion Paper by a Working Group of INTIMATE (Integration of Ice-Core, Marine and Terrestrial Records) and the Subcommission on Quaternary Stratigraphy (International Commission on Stratigraphy). *Journal of Quaternary Science* 27:649–659.

Whitaker, Adrian
2014 *Bert Wall Rock Archaeological Survey and Site Recording Project, Special Warfare and Training Area 6, San Clemente Island, California.* Report on file with Naval Facilities Engineering Command Southwest Division, San Diego, California.

Whitaker, Adrian, and Brian F. Byrd
2013a *Archaeological Testing and Evaluations of 14 Sites in the PB, TAR-14, and TAR-16 Areas, San Clemente Island, California.* Report on file with Naval Facilities Engineering Command Southwest Division, San Diego, California.

2013b *Archaeological Testing and Evaluations of Four Sites in the TAR-10 and TAR-16 Areas, San Clemente Island, California*. Report on file with Naval Facilities Engineering Command Southwest Division, San Diego, California.

Yatsko, Andrew

2000 Late Holocene Paleoclimatic Stress and Prehistoric Human Occupation on San Clemente Island. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.

Yatsko, Andrew, and L. Mark Raab

2001 *Final Report–Legacy Resource Management Program Demonstration Project No. 83, a Probabilistic Archaeological Site Survey, NALF San Clemente Island, California*. Report on file at NAVFACSW EV52 CRMP, San Diego, California.

2009 Medieval Climatic Crisis. In *California Maritime Archaeology: A San Clemente Island Perspective*, edited by L. Mark Raab, Jim Cassidy, Andrew Yatsko, and William J. Howard, pp. 163–178. Altamira Press, Walnut Creek, California.

Yokoyama, Yusuke, Kurt Lambeck, Patrick De Deckker, Paul Johnston, and L. Keith Fifield

2000 Timing of the Last Glacial Maximum from Observed Sea-level Minima. *Nature* 406:713–716.

York, Andrew

1997 *An Archaeological Evaluation of Six Sites Near the Missile Impact Range, San Clemente Island*. Report on file at NAVFACSW EV52 CRMP, San Diego, California.

View publication stats