**Demographic Artifacts of the Radiocarbon Calibration Curve: Implications for Identifying Mechanisms of Social Transformation**

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**INTRODUCTION**

Working on the Northern Channel Islands of California, we have measured the changing frequency of radiocarbon-dated components through time as a proxy for demographic change (e.g., Arnold 1992; Erlandson et al. 2001; Glass 1999). Fluctuations in the number of dated components have been interpreted as demographic changes in response to climatic instability, introduction of disease, or social transformation (Arnold 1992; Erlandson et al. 2001; Kennett and Kennett 1990; Kennett 2005), assuming a correlation between the number of dated components and population size (see Rick 1997). Figure 1 depicts the distribution of dated components derived from the recently updated Northern Channel Islands Radiocarbon Database, which suggests gradually increasing population through the Holocene until a sharp rise and large fluctuations after 1400 cal BP. Component frequency is a degraded in the unstable period of the Late Medieval Climate Anomaly (MC). Since 1994, numbers only to decline around the arrival of the Spanish. To what extent are these numbers affected by variations in the calibration curve? Here we model the relative creation of double-arched artifactuals to explore the effect of variable atmospheric $^{14}$C production calibrated component frequencies, focusing on the last 3000 cal BP.

We show that some periods are likely to systematically over- or underestimate the number components present when intereases are used to organize $^{14}$C databases for demographic analyses.

**MODELING THE EFFECTS OF AVERAGING**

Artifacts of the calibration curve should be identifiable by modeling common resolution of double-arched component into the archaeological and assuming equal preservation and recovery, and calibrating with the Intcal04 curve. This is simulated with calendar age resolution of double-arched artifactuals. As seen in Figure 2, single interesees correspond directly to a cal BP date. In contrast, the graphic resolution in this study corresponds to several possible actual ages, resulting in multiple intereases with the same calendar age. The fact this is the stage where archaeologists typically date the component is a problem - having obtained a common $^{14}$C age on a sample. Calibrating the results is flawed. Some double-arched artifactuals are misdated as single events. As can be seen, there is no resolution on the distribution curve; multiple intereases which would not concentrate the averaged intereases. Common time periods are more likely to be represented than others if interesees are used to organize a large database.

**BASES DURING THE LAST 1000 YEARS**

Averaged interesees are modeled on the Intcal04 calibration curve (Stuiver et al. 1998) assuming relative introduction and recovery of double-arched component into the record. Averaged interese frequencies per 50-year period is summarized in the histogram below.

**COMPRISS ON THE CURRENT CHANNEL ISLANDS $^{14}$C DATABASE**

The archaeologists working on the Northern Channel Islands of California have shown that stratigraphic fluctuations in radiocarbon calibration can create false trends (or obscure real trends) in component frequency when dates are organized by averaged interese. Assuming that increasing chronometric resolution by measuring component frequency in 50-year bins exacerbates the problem. Model data are reinterpreted in 100-year bins below.

The current distribution of dated components reflects trends similar to those described by Erlandson et al. (2001): increasing after 1500 cal BP reduced component frequency during the MCA, a peak in 700-800 cal BP and a decline following the arrival of the Spanish. Notably, the Middle/Late Transition (800-650 cal BP) is marked by a sharp increase in dated components, rather than a decline as proposed by Arnold (1992).

Having the data is the key; perhaps the component frequencies in Figure 3 could be reinterpreted in 50-year bins which were transformed proportions to the modeled frequency. This baseline would remain, though component declines in the MCA appear to lack a statistically significant change in the Proterozoic period coincide with the arrival of the Spanish. This could indicate that the impact of European disease brought to California varied in time and space, and that the impact of European disease was greater than Erlandson et al. (2001) estimated, as well as the population rebound preceding the Mission Period.

This manipulation should be viewed with some caution. However, the wide swings in the component frequency during the Late and Post-Mission periods that decrease in demographic shifts in response to changing environmental conditions are consistent with, or introduction of European diseases. But, where the model shows widespread decreases of expected frequency $^{14}$C component frequency is a problem - having obtained a common $^{14}$C age on a sample. As can be seen, a resolution on the distribution curve; multiple intereases which would not concentrate the averaged intereases. Common time periods are more likely to be represented than others if interesees are used to organize a large database.

ORGANIZING DATA FROM FIGURE 3

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**GRAPHIC REFERENCES**

- **Figure 1.** Northern Channel Islands Calibrated $^{14}$C Component frequencies 5000-0 cal BP.
- **Figure 2.** Modeled averaged interese frequency per 50-year period, assuming equal preservation and recovery the last 3000 cal BP.
- **Figure 3.** Modeled averaged interese frequency per 50-year period, assuming relative introduction and recovery of double-arched component into the record. Averaged interese frequencies per 50-year period is summarized in the histogram below.
- **Figure 4.** Comparison with an earlier plot (Erlandson et al. 2001).
- **Figure 5.** The model data reinterpreted in 100-year bins so the 50-year model is most variable, when sequential 50-year periods are used to organize a large database.