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Protohistoric artiodactyl rebound and resource deintensification in northern California

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ABSTRACT

Prehistoric increases in human population densities frequently correspond with overexploitation of large game and a greater dependency on high cost resources. Similarly, there is an expectation that when human population densities decline significantly, there should be a reversal in resource intensification and a rebound in large game populations due to the relaxation of hunting pressures. Multiple lines of evidence from Kathy's Rockshelter, located in the northern Sierra Nevada foothills, California, indicate that local abundances of artiodactyls increased and the use of small game and plant resources declined over the past four hundred years. The timing of this deintensification coincides with European contact with distant indigenous peoples but prior to direct contact with local indigenous groups. While suggestive of a demographic collapse of interior indigenous populations due to the spread of epidemics into the interior, further studies in human paleodemography in the region are necessary.

1. Introduction

Archaeological evidence of large game resource depression in western North America illustrates the considerable influence precontact foragers had on the structure of their surrounding landscapes (e.g., Broughton, 1994a, 1994b, 1997, 1999, 2002a, 2002b; Broughton et al., 2013; Burton et al., 2001; Butler, 2000; Butler and Campbell, 2004; Cannon, 2000; Goshen, 2013; Grayson, 1991, 2001; Hildebrandt and Jones, 2002; Janetski, 1997; Morgan, 2015; Preston, 2002a, 2002b; Ugan, 2005). Yet, the archaeological data on resource depression and intensification is a stark contrast to the historic record of California that frequently speaks of a landscape rich with fauna (e.g., Broughton, 2002a, 2003; Preston, 2002a, 2002b). This contradiction between the prehistoric and historic observations may be explained by catastrophic depopulation or other major socioeconomic changes that were initiated by European contact and colonization: the spread of disease in advance of direct European contact in the protohistoric period could have resulted in a significant human depopulation and the subsequent reduction in hunting pressures allowed for animal populations to rebound to the historically observed levels (Broughton, 2002a, 2002b; Broughton et al., 2010, 2013; Butler, 2000; Lyman, 2006; Martin, 2002; Martin and Szuter, 1999; Preston, 2002b).

Expectations regarding the effects of human depopulation on animal resources may be derived from optimal foraging models developed in human behavioral ecology. In particular, the prey choice model not only predicts the observed economic intensification and resource depression of some animal populations but also the historical accounts of game abundance in California and elsewhere. Broadly speaking, this model predicts what resources should appear in a forager's diet based on relatively simple economic principles: hunters should always pursue animals that provide the highest net returns when encountered, and the inclusion of lower ranked resources in the diet will depend on the encounter rates of higher ranked resources. Preferred resources are typically large-bodied prey when caloric returns are used as the currency for measuring return rates (Broughton et al., 2011), although variance in success may be important considerations when considering differences among men and women foraging behaviors (e.g., Bird, 1999; Bird et al., 2009; Codding et al., 2010). Decreased foraging efficiency is a marker of resource intensification and may be identified through an expansion of the diet breadth to include a range of higher cost resources with a concomitant decreased dominance of high ranked items (see Morgan, 2015). One cause of intensification is resource depression. Since large-bodied prey typically have low recruitment rates, they are more susceptible to over-predation (see Whitaker, 2009 for alternative view). The resulting lower encounter rate with large game subsequently leads to economic intensification through an expansion of the diet breadth.

The prey choice model is well supported by a number of archaeological studies in western North America where we see the decreases in various large-bodied mammal (e.g., artiodactyls such as elk, deer, and bighorn sheep), bird (e.g., geese), fish (e.g., sturgeon), and shellfish (e.g., abalone, freshwater mussel) representation corresponding with an

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increase in human population densities. Generally implicit in such work is that intensification and/or resource depression of game populations is a result of increases in human populations, reduced mobility, and greater territoriality. While ethnographic observations of resource management practices exist among Native Californians (e.g., Anderson, 2005; Blackburn and Anderson, 1993), such examples consist almost entirely of plant resources. Many of these are high cost plant resources, such as seeds and geophytes that benefit from increased exploitation through ground-disturbance activities, anthropogenic burning, and dispersal, in contrast to large bodied prey that may be overexploited due to their low recruitment rates (Hildebrandt and Jones, 2002). In other words, resource intensification may have resulted in greater productivity for plants while simultaneously being detrimental to large game (Hildebrandt and Jones, 2002).

If the effects of Euro-American exploration and colonization caused Native American populations to rapidly decline, there would have been a relaxation of hunting pressures that allowed large game populations to rapidly increase (Butler, 2000). The prey choice model therefore predicts that lower ranked resources should be dropped from the diet and the dominance of higher ranked resources should increase at this time.

Empirical data demonstrating economic deintensification and resource rebound must be identified in well-dated contexts from a range of localities to evaluate the timing and geographic extent of the proposed spread of epidemics and catastrophic depopulation of Native Californians. Population estimates place the California culture area as one of the most densely occupied areas in North America despite the non-agricultural economies (Ramenofsky, 1987; Ubelaker, 1992). Native Californians living in dense, sedentary populations on the coast and in the Central Valley would have been particularly susceptible to foreign epidemics (Erlandson and Bartoy, 1995; Erlandson et al., 2001; Hull, 2009; Ramenofsky, 1987). Diseases may have spread through interior California during the protohistoric era (defined here as 1519–1769 CE after Preston, 2002a:70) along different routes via the Alta California coast, Baja California, or from the American Southwest considering the documented epidemiological history during the Mission Period (1769–1833 CE) and early documented occurrences in Baja California and Central America (e.g., Erlandson and Bartoy, 1995; Preston, 2002a). Yet Jones (2014), in his spatial analysis of the spread of epidemics across North America, found that depopulation likely did not occur in interior California until relatively late (1767–1789 CE).

Evidence of protohistoric rebound of game populations representing catastrophic human depopulation in California is generally limited to the coast. Jones (1996) found that mussel shell size declined prehistorically with a reversal representing decreased harvest pressure occurring in the protohistoric period. Similarly, Erlandson et al. (2015) identified a rebound in black turban snail (*Chlorostoma funebralis*) shell size on San Miguel and Santa Rosa islands in southern California circa 1540–1820 CE. Further, Erlandson et al. (2001) found a marked reduction in the number of dated archaeological components in the Santa Barbara Channel region beginning in 1550 CE shortly after Cabrillo made contact on the coast, suggesting this rebound was due to depopulation rather than climate change. In the Pacific Northwest, Butler (2000) identified prehistoric resource depression and post-contact rebound in large mammals (deer, elk) and fish (salmon, sturgeon) using faunal assemblages from sites located in the Lower Columbia Valley. Due to the lack of temporal resolution, she was unable to determine whether the increased use in large game occurred prior to 1750 CE due to the spread of disease. At Cathlapotle in the Portland Basin, Lyman (2006) identified an increase in the relative abundance of deer (*Odocoileus virginianus leucurus* and *O. hemionus columbianus*) from pre-contact (1400–1792 CE) to post-contact (1792–1835 CE) periods that he attributes to a reduction in indigenous populations rather than external environmental changes.

Evidence for protohistoric deintensification in the interior comes from freshwater mussel data obtained from sites along the Pit River in the vicinity of Lake Britton on the eastern edge of the southern Cascade Range (Tiley et al., 2007; Chatters, 1997). Mean age of individual mussel specimens declines through time from 13 years to about 10–11 years, and rebounds back to a mean age of 13 years in the protohistoric/historic deposits. Chatters and Cleland (1997) argue that human population decline began in the Sacramento River Basin and moved upriver to the lower reaches of the Pit River, reaching the Lake Britton area by ca. 300 BP.

Collectively, these studies have identified significant changes in resource availability that occurred after European contact. However, almost all examples are limited to the coast or the evidence for economic deintensification or resource rebound is limited to a narrow set of faunal data. If protohistoric epidemics resulted in changes in the environmental, we should find evidence in densely populated interior regions that were well removed from direct contact with European explorers and colonizers. Kathy's Rockshelter in northern California offers a rich, late Holocene faunal assemblage that has the chronological resolution necessary to identify the extent of resource rebound and deintensification in interior northern California.

2. Materials and methods

2.1. Kathy's Rockshelter site background

Located in the interior of California between the Sacramento Valley and northern Sierra Nevada range, Kathy's Rockshelter (CA-BUT-301) provides a test case for evaluating both the timing and geographic extent of potential protohistoric epidemics introduced by Europeans after first contact with more distant indigenous populations.

The rockshelter is located in the Mesilla Valley at an elevation of 1150 ft. (350 m), placing it within the blue oak-foothill pine vegetation zone (Fig. 1). The site was excavated in 1969–71 by Sacramento State. Due to the relatively dry conditions at the site, a wide range of materials were recovered including milling equipment, flaked stone, faunal remains, floral remains, modified wood, basketry, cordage, and coprolites. With the exception of a thesis on projectile point typology (Bethard, 1988), the collection remained unanalyzed until 2013. At that time, the author began analyzing the bulk of the assemblage with the assistance of advanced undergraduate and graduate students. Archival documents are incomplete; the site excavation map and most profile drawings are notably missing. Nineteen 1.5 × 1.5 m units were

Fig. 1. Location of Kathy's Rockshelter (CA-BUT-301).