Subsistence, Settlement, and Environmental Change at San Diego Bay

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San Diego Bay archaeology has long been a testing ground for ideas of coastal resource use. It has been assumed to serve as a contrast to models of environmental decline built on smaller estuaries along the central San Diego County coast. A closer examination of shellfish data indicates that similar processes were occurring at San Diego Bay and northern lagoons, and that the presumed refuge from coastal change did not exist. The data from San Diego Bay provides a means to reexamine and reassess earlier models of coastal decline.

Some of the earliest archaeological research in San Diego County was focused on the shell middens around San Diego Bay. Early investigators like Gifford (1916) used the data for comparisons with sites in the San Francisco Bay area. An absence of spectacular artifacts and stratigraphy reduced further interest, and very limited research was conducted in the area before the advent of cultural resource management.

Claude Warren and other students from UCLA excavated and surveyed sites and areas near some of the smaller estuaries and lagoons along the central San Diego County coast in the 1960s (Warren and Pavesic 1963; Warren et al. 1961). This was a time when environmental change was in the spotlight of both the American people and American scientists. An awareness of sea level change and the development and siltation of coastal lagoons came together. Warren took this environmental data and his archaeological experience near these lagoons and built a series of models in his 1964 dissertation that are still, now 40 years later, serving as frameworks from which to test data (Warren 1964). The longevity of these models serves as a testament to their importance (Warren et al. 1993).

To quickly summarize things, geological evidence showed that rapidly rising sea level around 9000 B.P. filled in the canyons cut by coastal drainages in San Diego County, creating bays and estuaries. The lagoons along the central San Diego County coast as well as Mission and San Diego bays were initially formed this way. These bays created new habitats for shellfish, fish, and birds. They were quickly utilized by local Native Americans who took advantage of the richness of these new resources.

As sea level rise began to slow, a pattern of shifting shellfish species use could be seen in the archaeological record. This was equated with lagoon siltation and environmental decline. Models of population movement and environmental change as an impetus for cultural change were built on this data (Warren 1964).

One of the important untested assumptions in many of these models was that San Diego and Mission bays were large enough to never have experienced the same environmental decline and closure to the ocean due to siltation (Warren 1964). This is a very logical assumption given the size of both these bodies of water and the strength of their tides. There is still no evidence that either of these bodies of water was ever closed to the ocean or silted to a point of declining estuary resources.

Gallegos (1987) built on Warren's data from the Batiquitos Lagoon area and more formally documented a clear pattern of species change in the archaeological sites around this lagoon. Species change was directly linked with siltation and environmental decline. The shift was from the use of *Argopecten* (scallops) to *Chione* (clams). Because *Argopecten* requires deeper and more flushed water and *Chione* lives in muddy substrates that are often above tide for long periods, the explanation for this shift was siltation. Gallegos (1987) even linked a gap in dated archaeological sites from the area with a presumed period when the lagoon was closed to the open ocean. Again none of these assumptions were tested at San Diego Bay or expected to apply there.

Working with Gallegos at the Ballast Point Site, Pat Masters built an excellent reconstruction of the evolution of the San Diego Bay environment (Gallegos and Kyle 1988). Because the work was focused on the rocky shore habitat of Point Loma and the questions asked of this data were different, Warren's models about the role of San Diego and Mission bays were not fully

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tested. The expectations of Gallegos' *Argopecten/Chione* shift model have also never been fully tested at San Diego Bay.

Nearly 15 years of additional San Diego Bay data has accumulated since Master's work. This information was used to test some of the models of coastal and environmental decline and better understand the evolution of coastal environments and the human response to change. Based on Warren's and Gallegos' models, some of the questions that can be addressed are:

- *Is the shift from* Argopecten *to* Chione *in archaeological sites an indicator of siltation and environmental decline?*
- Did San Diego Bay, because of its size, remain a highly productive resource and population focus?
- Did coastal populations respond to environmental decline at middle coast lagoons by migrating to San Diego Bay?

PATTERNS OF SHELLFISH USE AT SAN DIEGO BAY

Recent work at the southern end of San Diego Bay (Pigniolo et al. 2001) in combination with earlier work in the region allowed the compilation of shell species data from a series of sites associated with bay resources. These sites were separated into two major categories: those associated with the open bay area, and those associated with Point Loma where rocky shores may affect the pattern.

Shell species data focused on weight and was collected in as close association with radiocarbon dates as possible. Species data used here is focused on *Argopecten*, *Chione*, and open-coast species (*Donax* and *Tivella*). Reviewing this data and the number of dated site components can help address some of the research questions.

The *Argopecten* pattern is perhaps the most interesting. I have been lucky enough to live close to an *Argopecten* population on Mission Bay the past few years. Contrary to a stereotype I had long held, these animals are not very active swimmers. They live in and adjacent to eel grass beds, and during lower winter tides they lie on the surface and can easily be collected (Figure 1). The ease of collection makes it clear why *Argopecten* should be a preference of early Indian people.

The archaeological shellfish record at San Diego Bay supports the early popularity of *Argopecten* (Figure 2). The bay was clearly formed by at least 8300 B.P. and the shellfish of preference was clearly *Argopecten*. As can be seen in Figure 2, from this starting point use was steady, but it rapidly declined to almost nothing by 4000 B.P. This does not fit the expectations for an open, well-flushed San Diego Bay. It also does not fit the model from Batiquitos Lagoon where *Argopecten* decline is assumed to be directly linked to lagoon siltation and closure. Again, there is no evidence San Diego Bay ever came close to closure and it would not be expected based on the size of its tidal surge.

I can readily think of two hypotheses, yet to be tested, for this pattern of *Argopecten* decline. The first potential explanation is overexploitation. With the *Argopecten* in Mission

Figure 1: Argopecten *habitat.*

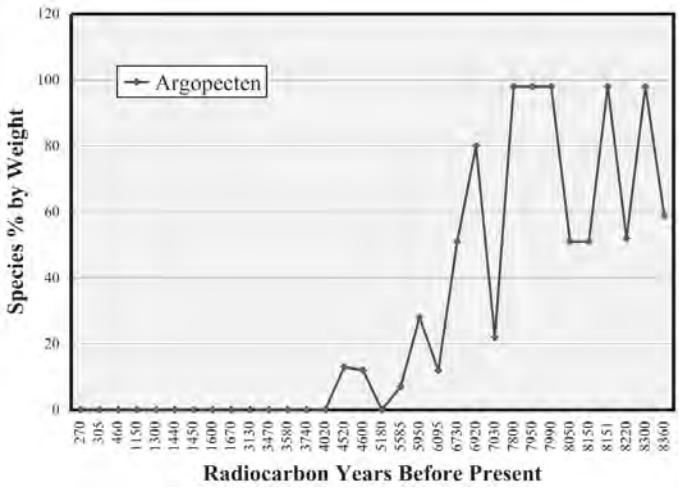


Figure 2: Argopecten *pattern.*

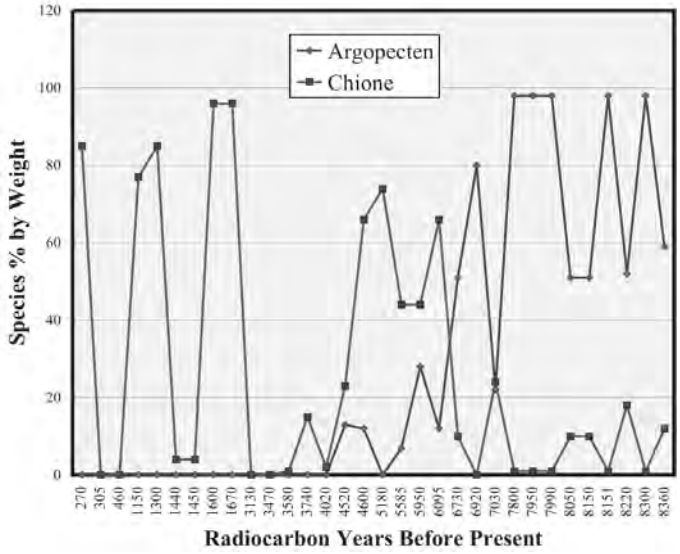


Figure 3: Argopecten-Chione *pattern.*

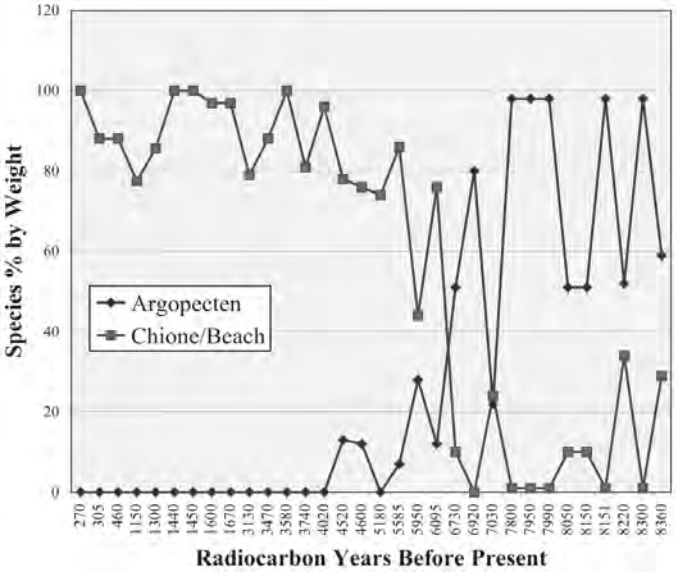


Figure 4: Argopecten-Chione/*beach pattern.*

Bay as an example, they are very easy to collect at low tide. A small group could clean a beach in a matter of hours with little effort. A lack of recovery in the 4,000 years since their initial decline would not be well explained by this hypothesis unless there was constant pressure on the resource.

The second possible explanation is environmental. The San Diego coast is currently near the northern edge of the range of *Argopecten* (Dyke 1987). At bays as close as San Quintín in Baja California, this species is much more abundant. *Argopecten* is very sensitive to extended periods of cold water. Populations in the San Diego area have appeared and disappeared with periods of cold water (Dyke 1987). Changing coastal currents may have extended periods of colder water in the area, changing the coastal habitat of the San Diego area from a good one 8,000 to 5,000 years ago, to the marginal one of today. I think the latter explanation may be more likely, based on current conditions. Whatever the cause, *Argopecten* declined to a sporadic and nearly non-existent presence by 4000 B.P. on the San Diego Coast regardless of siltation, lagoon closure, and lagoon size and has never really recovered.

At Batiquitos Lagoon, *Chione* takes *Argopecten*'s place in the archaeological record as shellfish of preference. The same pattern can be seen at San Diego Bay, although it is much more uneven in the record because open-shore species are also filling this same niche. If we look at just the *Chione* and *Argopecten* patterns alone we can still pick out the same crossover pattern seen by Gallegos at Batiquitos Lagoon (Figure 3).

Because the Silver Strand and Coronado/North Island area includes a large amount of sandy open coast, those resources appear to have had equal value to those of the bay. Sites can vary from a preference for shellfish from one habitat or another, not solely based on location. Two assemblages from the eastern side of the bay are notably dominated by open-coast species even though those would not be the most accessible.

If we combine the *Chione* and open-beach data into one curve, the pattern of *Argopecten* replacement becomes clearer (Figure 4). When we compare this pattern with that from the Batiquitos Lagoon data (Gallegos 1987), it is quite similar. This includes the period between 7000 and 6000 B.P. when the preference for *Argopecten* shifted dominance to other resources. The similarity of the two patterns in such different embayments suggests that this pattern is

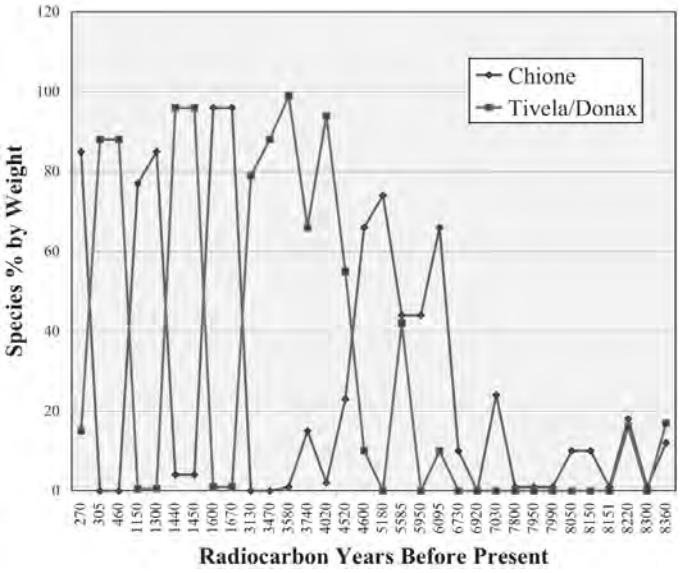


Figure 5: Chione-Tivela/Donax *pattern.*

not related to siltation and bay closure. It does not fit the model of environmental decline on the central coast and a refuge from these changes at San Diego and Mission bays.

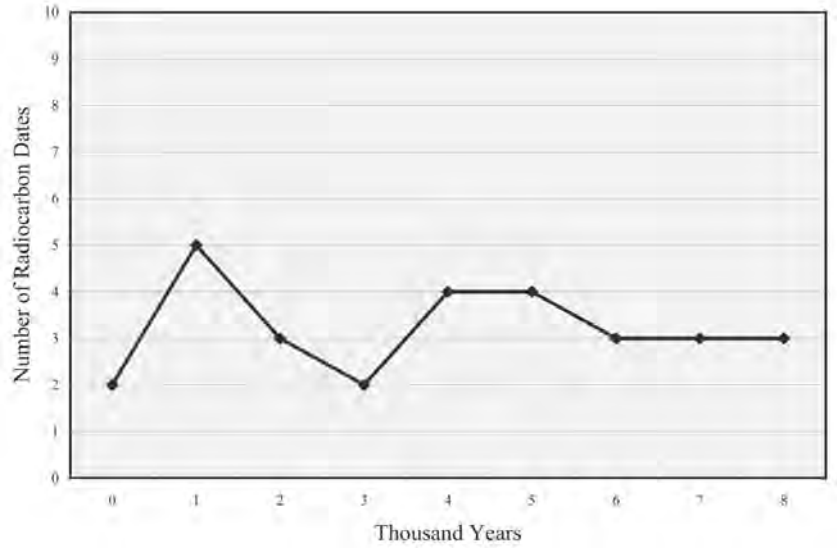
Another interesting pattern is the lack of selection for bay resources over open-beach resources in the San Diego Bay data. While there is clearly an early preference for the bay species *Argopecten*, once this species drops out of the record, the picture is mixed (Figure 5). Although partially based on location, this pattern seems to show an equal preference, or even a preference for open-coast species where both are equally available at sites along the narrow Silver Strand. This pattern also seems to conflict with the environmental decline model where the development of sandy beach habitats and related *Donax* resources were not seen to be as high a value replacement for declining bay resources.

The shellfish data we have looked at so far from San Diego Bay seems to reflect change and replacement rather than decline, or as models predicted, no change. The next question that remains to be answered is whether or not changes in central coast lagoon environments prompted a migratory response to San Diego Bay. Unfortunately, population data is hard to come by. By looking at the number of radiocarbon dated site components per 1,000 years we can get a rough proxy for population trends (Figure 6). As can be seen in the figure there is a general upward trend through time, but a spike associated with a shifting population is lacking. Again, this suggests to me that San Diego Bay did not serve as a refuge from environmental change, but followed the same general upward population trend through time as did the whole region. It also suggests that while the same environmental changes that were occurring at Central Coast lagoons were occurring here, the response was change in resource selection and not abandonment and depopulation.

DISCUSSION

Looking back at our research questions, the *Argopecten/Chione* shift is occurring at San Diego Bay without evidence of siltation and closure. This suggests it is not related to siltation. The second part of this question asks whether the *Argopecten/Chione* shift is a reflection of environmental decline. In so far as there is one fewer resource to select from, the answer is yes. We also have to consider that sandy beach resources were developing at this time and so as one resource declined others may have appeared. The record seems to suggest not a decline in resources, but just a change in resource selection. Admittedly *Chione* and *Donax* may have been more energy intensive to collect, but data seems to suggest they supported a population through this period of change.

Figure 6: San Diego Bay radiocarbon dates per thousand years.



San Diego Bay did remain a highly productive resource and population focus. However, it did not serve as an island of stability along a changing coastline. It appears to have remained

a highly productive resource while going through the same overall changes as other coastal lagoons.

Finally, Did coastal populations respond to environmental decline at middle coast lagoons by migrating to San Diego Bay? The population trend does not suggest a spike or significant shift in population as a response.

Clearly the coastal environment of San Diego County is one that has changed and is constantly changing. I think the San Diego Bay data suggests that perhaps a better model to test against the archaeological information along the San Diego coast is not one of an inability to adapt to this change and a need to abandon areas and shift economic focus. The response may have been quite the opposite, with Native Americans maintaining their population and economic focus by adapting to this changing environment through selection of either more energy-intensive resources like *Chione*, or the newly developed resources of the growing sandy beach environments.

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