

PRELIMINARY ANALYSIS OF FAUNAL REMAINS FROM FOUR SITES
ON SANTA CRUZ ISLAND

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ABSTRACT

This paper is a presentation of preliminary analysis of faunal remains from four sites on western Santa Cruz Island, near Santa Barbara, California. The analysis includes discussions of density of bones in sites, bone preservation, and relative contributions to the diet of several classes of fauna. This analysis is one aspect of the Santa Cruz Island Archaeological Project, directed by Dr. Arnold of the University of California, Los Angeles, and will ultimately provide data useful for understanding the emergence of cultural complexity in the Santa Barbara region.

INTRODUCTION

At the time of European contact the Santa Barbara Channel area was one of the most densely populated areas of North America and the Chumash were one of the most politically and economically complex hunting and gathering groups in the region (Johnson 1988; Landberg 1965). Unfortunately, Spanish colonization of the region in the form of the Franciscan missions nearly eliminated the Chumash population and essentially destroyed their social system. A major focus of recent archaeological research in the Santa Barbara area is to understand the timing and causes of the development of complexity among the people of the Santa Barbara Channel region. The following paper is a preliminary report on faunal analysis associated with the Santa Cruz Island Archaeological Project (Arnold 1991), a project focused on the emergence of complexity in the Santa Barbara region.

BACKGROUND

The Chumash occupied a territory ranging from Malibu Canyon to San Luis Obispo, including the Northern Channel Islands (Figure 1). They spoke several related languages, and have recently been described as being organized at the simple chiefdom level (Johnson 1988). Much of what we know about the Chumash and their predecessors has been reconstructed from explorers' accounts, mission registers, John Harrington's work with Chumash

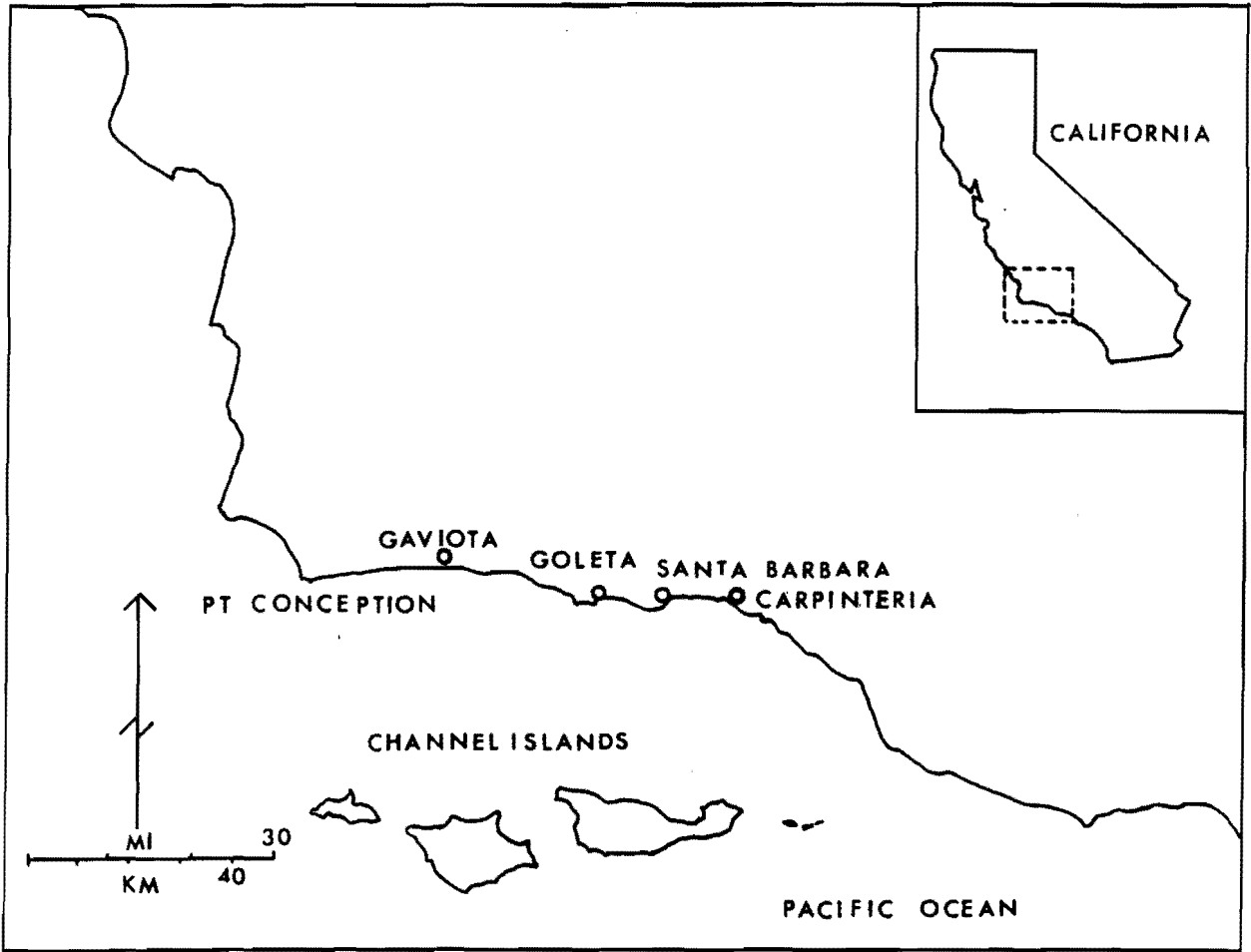


Figure 1. Study area.

descendants, or archaeological research. Some of the characteristics that suggest chiefdom-level complexity include: hereditary chiefs with special privileges, including polygamy and large houses (King 1969:42); craft and occupational specialization (Arnold 1987); relatively high population density (Brown 1967; Keeley 1988); regional religious (Blackburn 1976), political, and exchange (King 1976) networks; settlement hierarchy (some villages were "capitals"); several levels of social differentiation (elite, specialist, commoner, vagabond); several levels of social organization (lineage, village, inter-village); and food storage. When did this complexity develop, and why?

Arnold's (1987) earlier work indicates that microblade craft specialization developed on Santa Cruz Island at the beginning of the Late Period (King 1990), approximately A.D. 1300. Recent research indicates that shell bead production on Santa Cruz Island expanded dramatically at this time as well (Munns and Arnold 1992), and mortuary studies from the mainland suggest changes in social organization after A.D. 1100 (King 1982; Martz 1984). According to Arnold's (1991) model, these changes were in response to a combination of several variables: technological development, population/resource imbalance, and environmental change.

The historic Chumash had sophisticated fishing technology, including hooks, nets, harpoons, and boats. The plank canoe, or tomol (Hudson et al. 1978), and other fishing technology had all been developed by about A.D. 500. Although precise estimates are lacking, population apparently increased fairly steadily throughout the prehistory of the region. A recent summary of radiocarbon dates over the last 10,000 years in Santa Barbara County (Breschini et al. 1990) suggests a relatively steady increase during this time period. There are many problems with estimating population this way, but given the importance of population in emergent complexity and the lack of more precise calculation methods, these are useful data to consider.

Several lines of evidence suggest environmental change occurred in the region approximately A.D. 1100 to A.D. 1200. Pias's (1978) research with radiolaria from varved deep sea cores documents changes in sea temperature for the region for the past 8,000 years¹. Pias (1978:379-380) notes periods of water temperature higher than modern levels for the periods from 6000 to 3400 B.C., 1800 to 1600 B.C., and A.D. 200 to 1250. Independent data from tree rings (Larson et al. 1989) indicate that there were a series of droughts during the last period. Of primary importance to this discussion is the correlation of periods of significantly reduced rainfall and elevated sea temperature. These periods of environmental degradation apparently occurred at four times: A.D. 620-650, A.D. 700-750, A.D. 980-1000, and A.D. 1120-1200 (Larson et al. 1989:28). The last of these events was the most extreme.

What would the impacts of these environmental changes have been on the local ecosystem, particularly the marine environment?

Changes in sea temperature have significant impacts on kelp forests which were an important source of food for California Indians. We may be able to use modern El Niño events as sources of information about the impacts of warm water events on the local marine ecology. There are a variety of factors involved with El Niño, including: warm water, depressed thermocline and reduced nutrient upwelling, increased rainfall, higher sea levels, and intense storms. The impacts of El Niño events on kelp bed communities and associated fauna during recent events are well documented (Barber and Chavez 1983; Glynn 1988, 1990; Tegner and Dayton 1987). Recent research on the biological consequences of El Niño events has demonstrated that pinniped (Limberger 1990; Trillmich and Limberger 1985), bird (Schreiber and Schreiber 1989), and fish (Schoener and Fluharty 1985) populations exhibited significant disruptions in reproduction, high mortality, and anomalous geographical distributions. Some animals cease to reproduce during El Niño events, die of starvation, or migrate far beyond their normal ranges. The effects of these disruptions of animal populations can extend beyond the duration of the warm water event. Although populations can recover in relatively short periods of time, a long term event or series of events would undoubtedly have significant impacts on human foragers reliant on marine resources. The warm water cycle that occurred around A.D. 1150-1250 was an event of longer duration than recently observed El Niño events and, in combination with a severe drought, probably had significant impacts on the marine ecosystem and human foragers.

In summary, the Chumash had complex social organization at European contact, and the emergence of complexity appears to have been around A.D. 1150-1250. The stimulus for changes in economic and political organization was partially environmental. Analysis of faunal data from sites occupied around the time of the environmental change should provide useful information to help evaluate this model. Faunal data may provide information about diet, indicators of environmental change, and indicators of complexity. Complex organization in faunal exploitation may include: trade in faunal material; differential distributions in species, body parts, or animal products; and specialized animal processing sites.

FAUNAL COLLECTIONS

This paper is a progress report on my analysis of mammal and bird bones and includes a brief discussion about ongoing analyses of fish and shellfish remains. The current phase of detailed analysis focuses on approximately 70 excavation levels from 5 units at 4 sites on the western end of the island. The excavated material spans the Middle Period through the early historic period (King 1990). I have identified mammal and bird bones from about 30% of these levels so far, including some from all time periods. Although the work is at an early stage, it will be possible to talk about methods involved in this analysis and to

characterize the collection in terms of several variables and their changes through time. The following sections describe: density of material, preservation of faunal material, general classes of fauna present, relative proportions of various classes of fauna, relative contributions to the diet of various faunal categories, and differential distribution of body parts.

RESEARCH AREA

Santa Cruz Island is the largest of the Northern Channel Islands and is located about 40 km south of Santa Barbara. Although Santa Cruz is the most biologically diverse of the islands, the terrestrial flora and fauna are impoverished in comparison to the adjacent mainland. There have been significant impacts to the vegetation since European contact, notably by domesticated animals and introduced plant species. The largest native mammal is the Island Fox (*Urocyon littoralis*), which is about the size of a small house cat. There is a species of spotted skunk on the island, and some reptiles and amphibians, but no other native terrestrial fauna. Birds are abundant, including numerous species of sea birds. Some of the most common birds in the archaeological assemblages are sea birds, including gulls, pelicans, and cormorants. In the samples that I have analyzed to date, cormorant bones are more frequent than all other bird bones combined. The marine fishery around the island is particularly productive. The rugged coastline includes both rocky and sandy habitats supporting a diverse array of shellfish.

Several varieties of marine mammals inhabit the seas around the islands. Rookeries for a number of kinds of pinnipeds occur on the western end of San Miguel Island, two islands to the west. Some of these marine mammals, several of which have been identified in the archaeological collections, include sea otters, eared seals (including Guadalupe fur seal and California sea lion), true seals (including harbor seal and elephant seal). I have also identified cetacean remains, including dolphin and porpoise, and some chunks of whale bone that are not identifiable to species. The latter are large pieces of cancellous bone identified on the basis of size.

ANALYSIS

Laboratory crews roughly sort the faunal remains into general categories, then bag and tag them by provenience. The rough sorted samples include bulk fish bone, mammal bone, bird bone, vertebrae, otoliths, teeth, and bone tools. There are many complete or nearly complete bones. This material is resorted, and the bird and mammal bones are identified to the lowest taxon possible. Comparative material used to identify this assemblage is housed in the Zooarchaeology Laboratory in the Institute of Archaeology at the University of California, Los Angeles. Additional specimens of sea mammals from the Los Angeles County

Museum of Natural History have also proved useful in bone identification.

The faunal material considered here is derived from four sites on the west end of the island (Figure 2). These are SCRI-330, near Forney's Cove, SCRI-191 near Christy Beach, SCRI-474 at Posa drainage, and SCRI-192 at Morse Point. These coastal middens are extremely dense, some composed entirely of cultural material with essentially no soil. In order to quantify the density of bone, I have calculated the number of bones per m^3 for several of the time periods represented in my sample. For a 5 cm level in a 1-m by 1-m unit, the densest site contains approximately 27,000 bones, including the fish remains. Figure 3 shows these densities adjusted to demonstrate density per m^3 . The highest density site is from the Late Period, and there are over 500,000 bones per m^3 in the Late Period level of this deposit. The Middle Period level contains 87,000 bones per m^3 , the Middle/Late Transition level contains 101,000 bone per m^3 , and the Late Period level contains 537,200 bones per m^3 .

In order to quantify preservation, I have calculated average weight of bird and mammal bones (Figure 4). The Middle Period bones are the smallest, which may be a function of age or different cooking or processing techniques. Although I have not quantified burning for this analysis, it appears that a higher percent of the Middle Period bone is burned.

Figure 5 shows the proportion, by count, of various classes of fauna. Although there are numerous bird and mammal taxa represented in these deposits, fish constitutes about 99% of the faunal assemblage for the 3 time periods shown. Fish bone does not weigh very much, and as you might imagine, is not quite as prominent by weight. Figure 6 shows the same basic relationships by weight rather than count. Although mammals and birds are more important by weight than by count, fish still comprise 65-75% of the bone. Another interesting pattern is that sea mammal increases in proportion through time.

I have analyzed the non-fish assemblage in greater detail for this paper. I divided the mammals and birds into general categories including bird, sea mammal, land mammal, and undifferentiated mammal. There are a few reptile bones in the assemblage as well, but at this stage they represent such a small percentage of the assemblage that I do not discuss them in this paper.

When graphed by frequency (Figure 7), the undifferentiated mammal is the most prominent category. The undifferentiated mammal is nearly all small fragments that are difficult to identify. Most of this material is probably sea mammal, given the very low percentage of terrestrial mammal identified in the collection and the limited availability of terrestrial mammal to the island's occupants. When graphed by weight (Figure 8) the situation is quite different. Sea mammal is the most abundant non-fish faunal

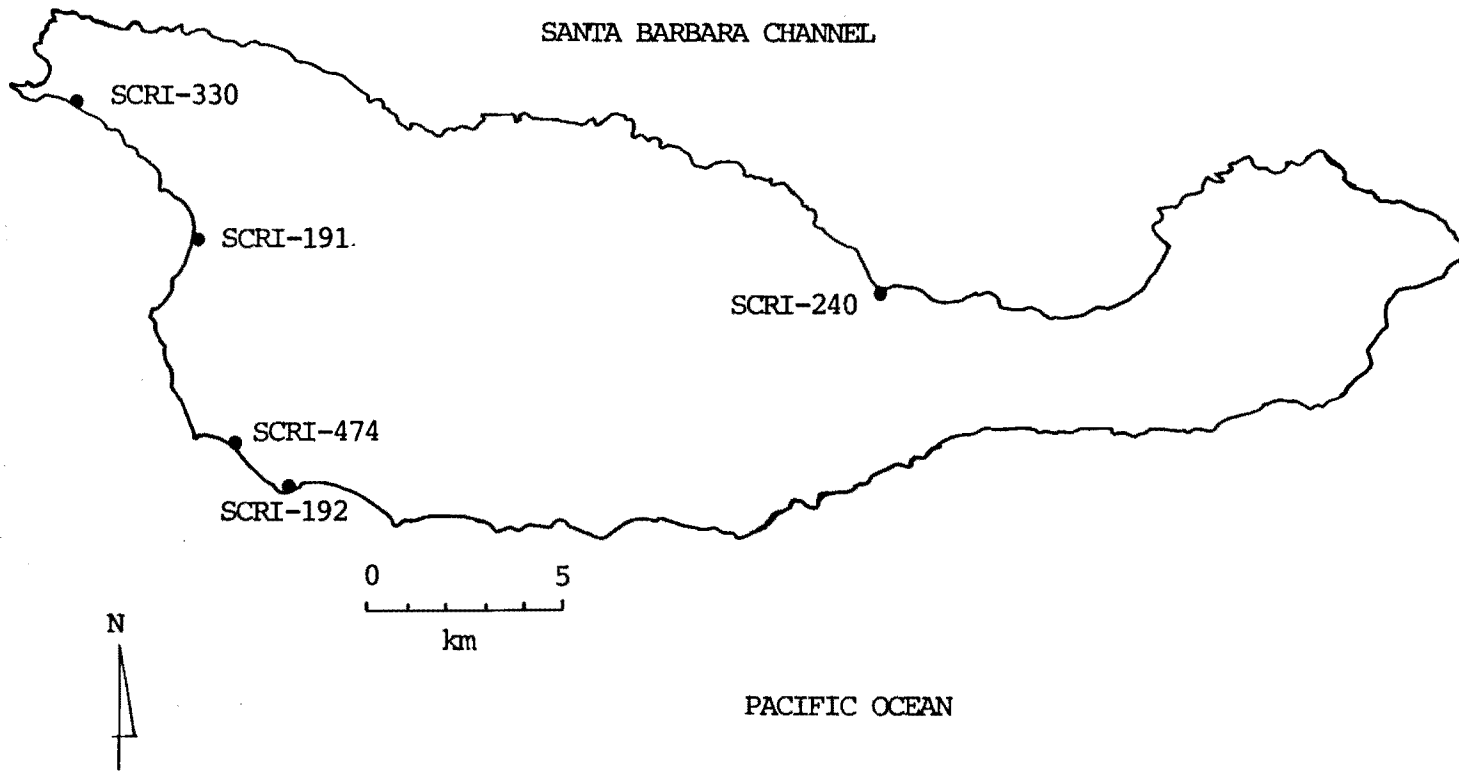


Figure 2. Santa Cruz Island with sites mentioned in text.

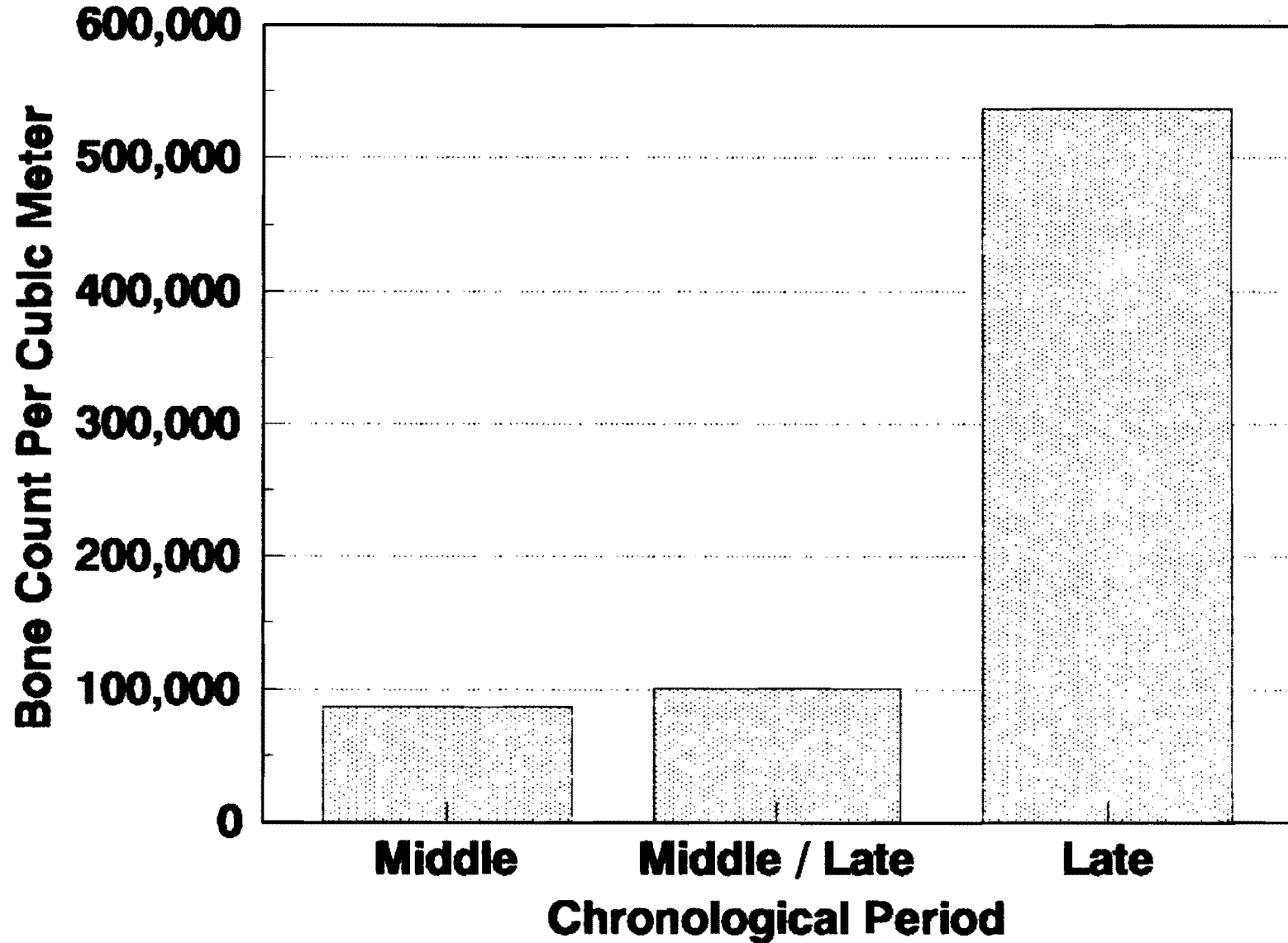


Figure 3. Bone density by chronological period.

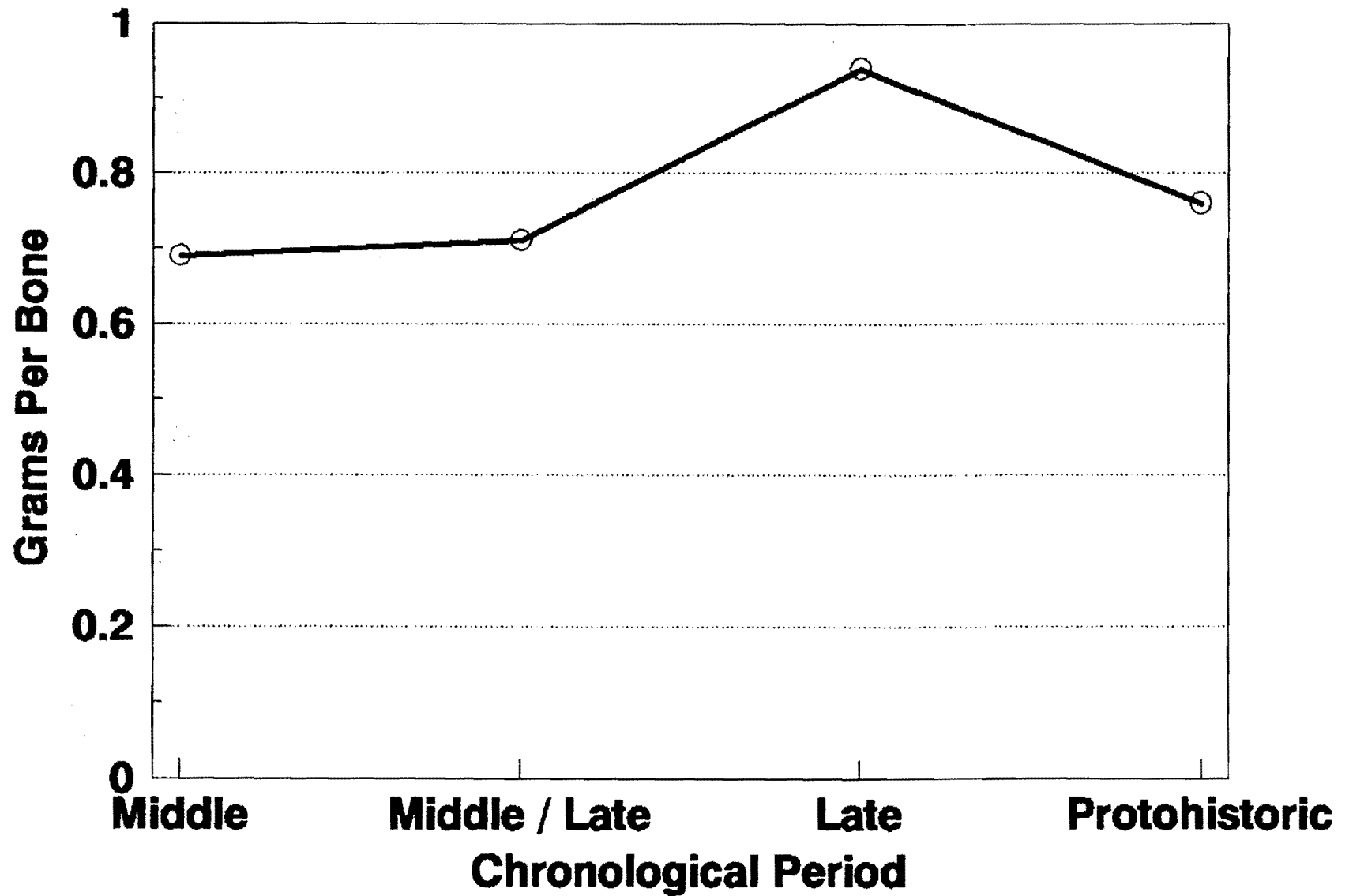


Figure 4. Average bone weight by time period.

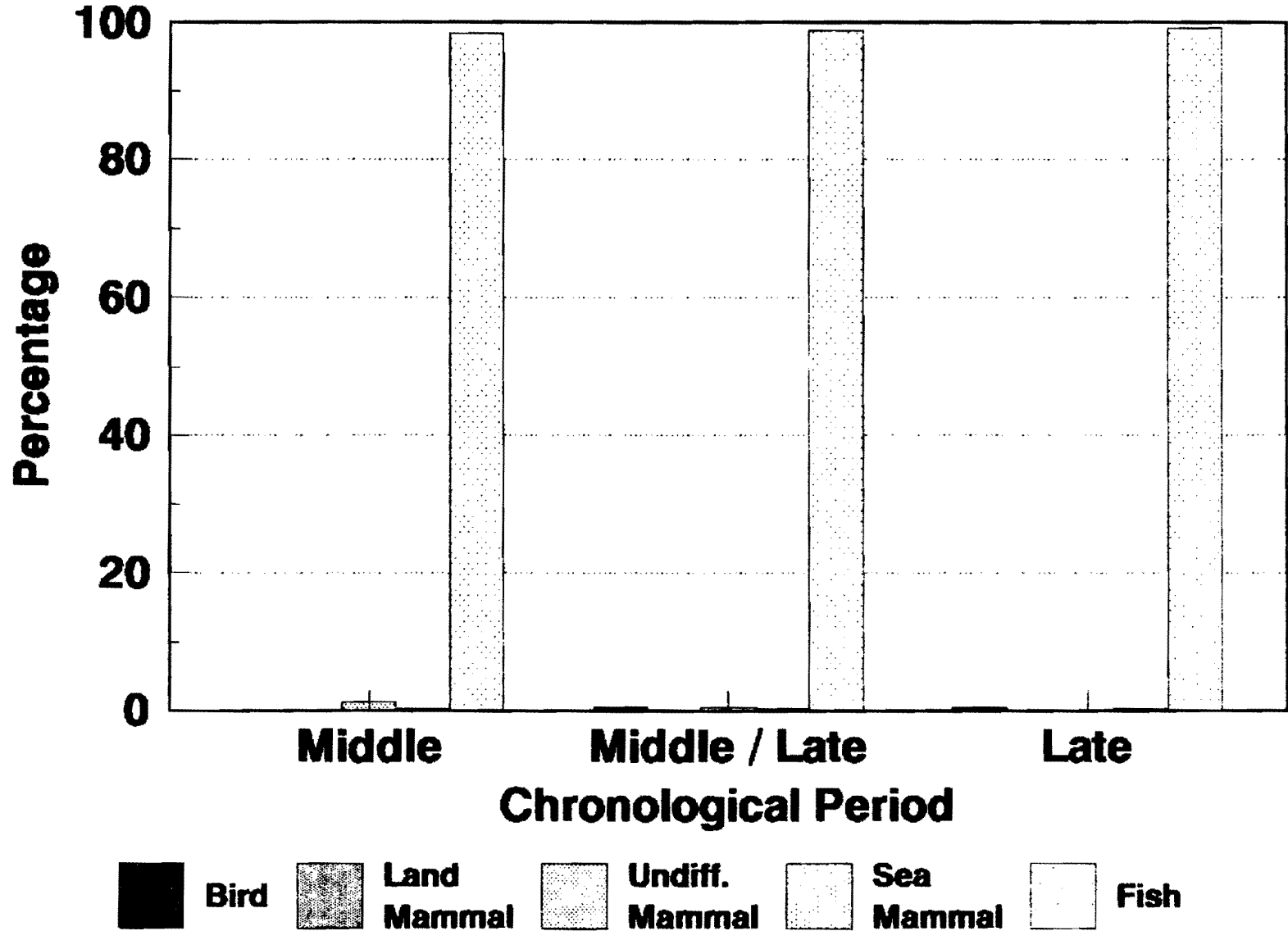


Figure 5. Bone count percentages.

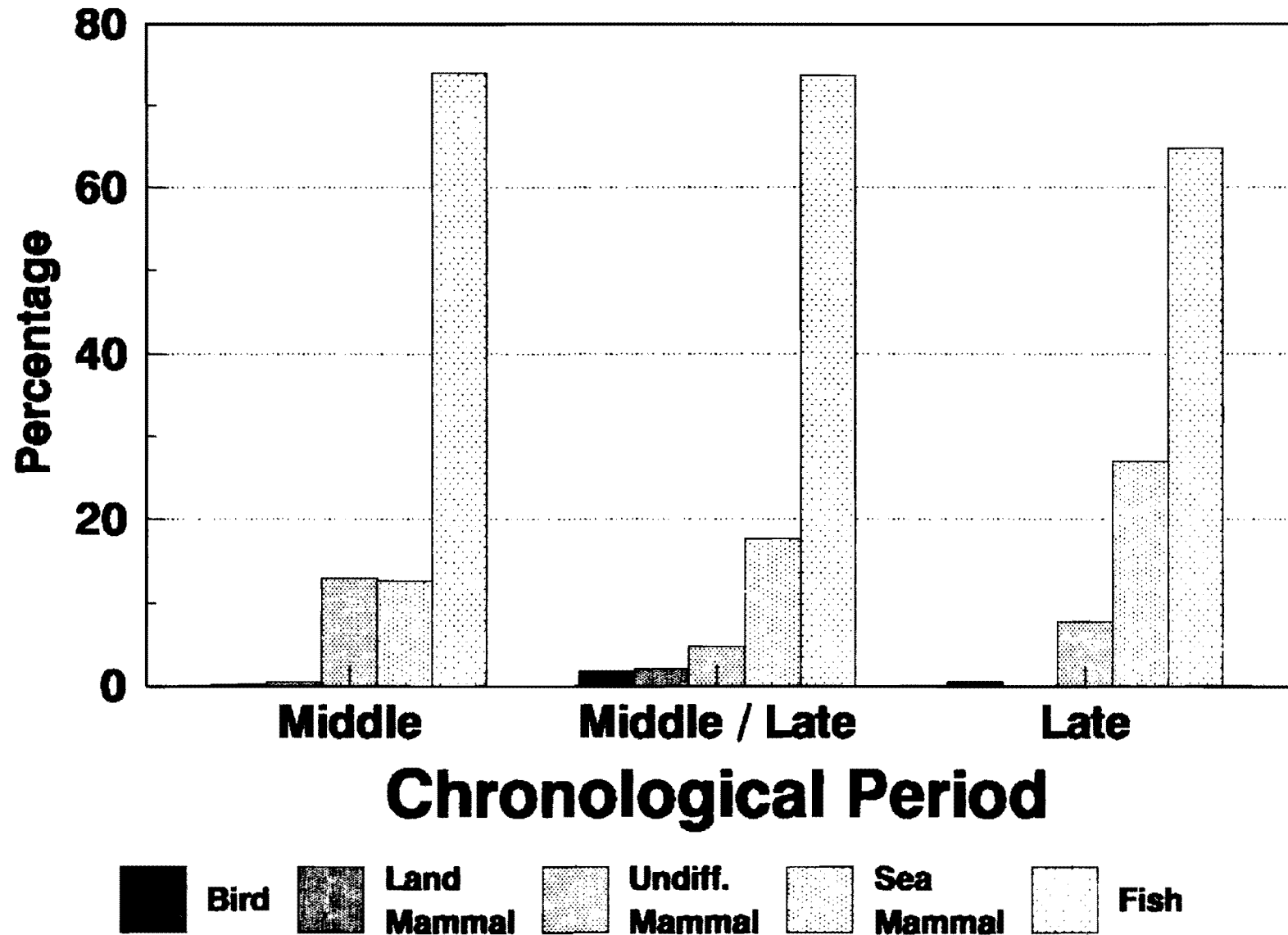


Figure 6. Bone weight percentages.

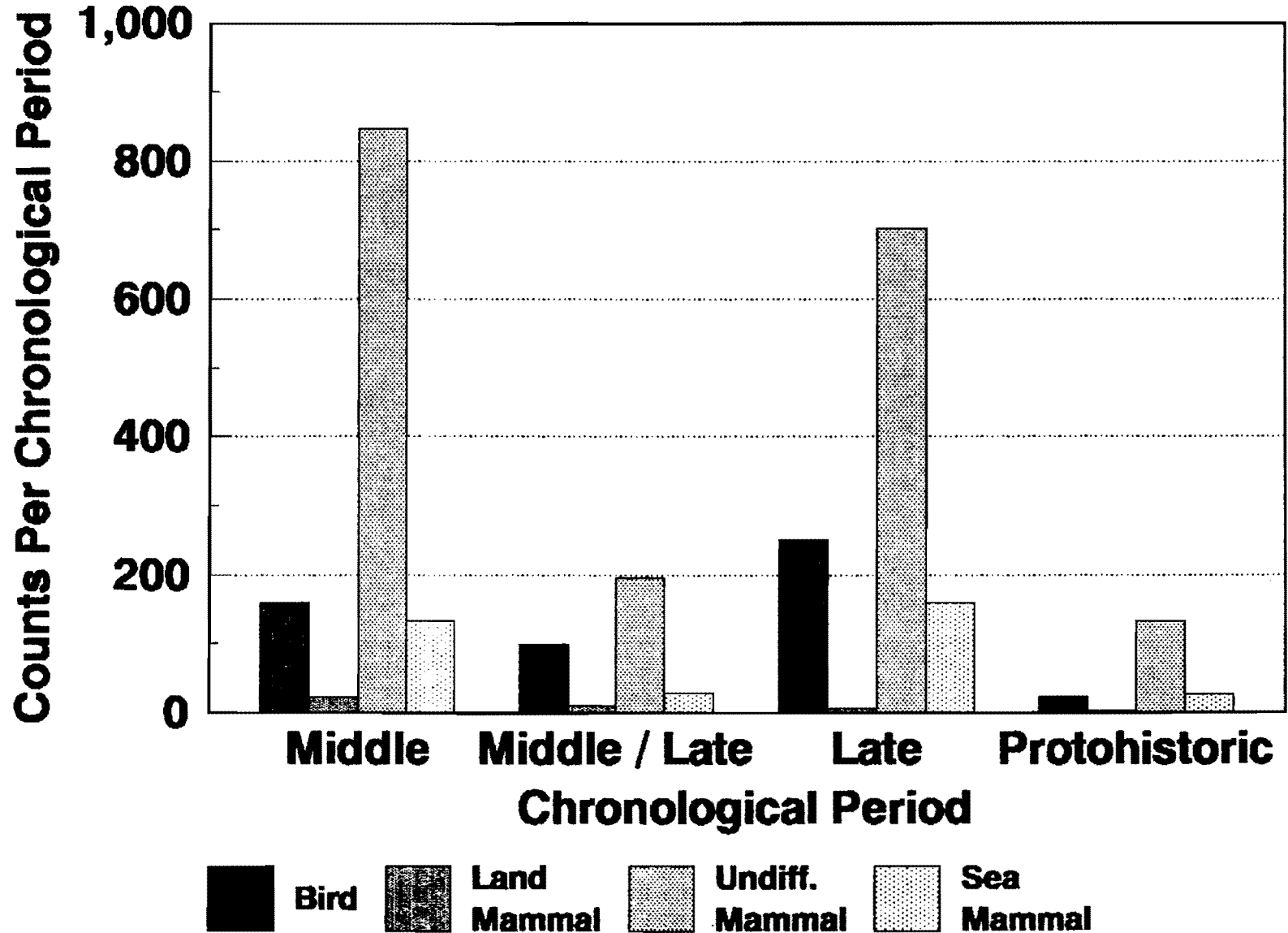


Figure 7. Counts of non-fish fauna.

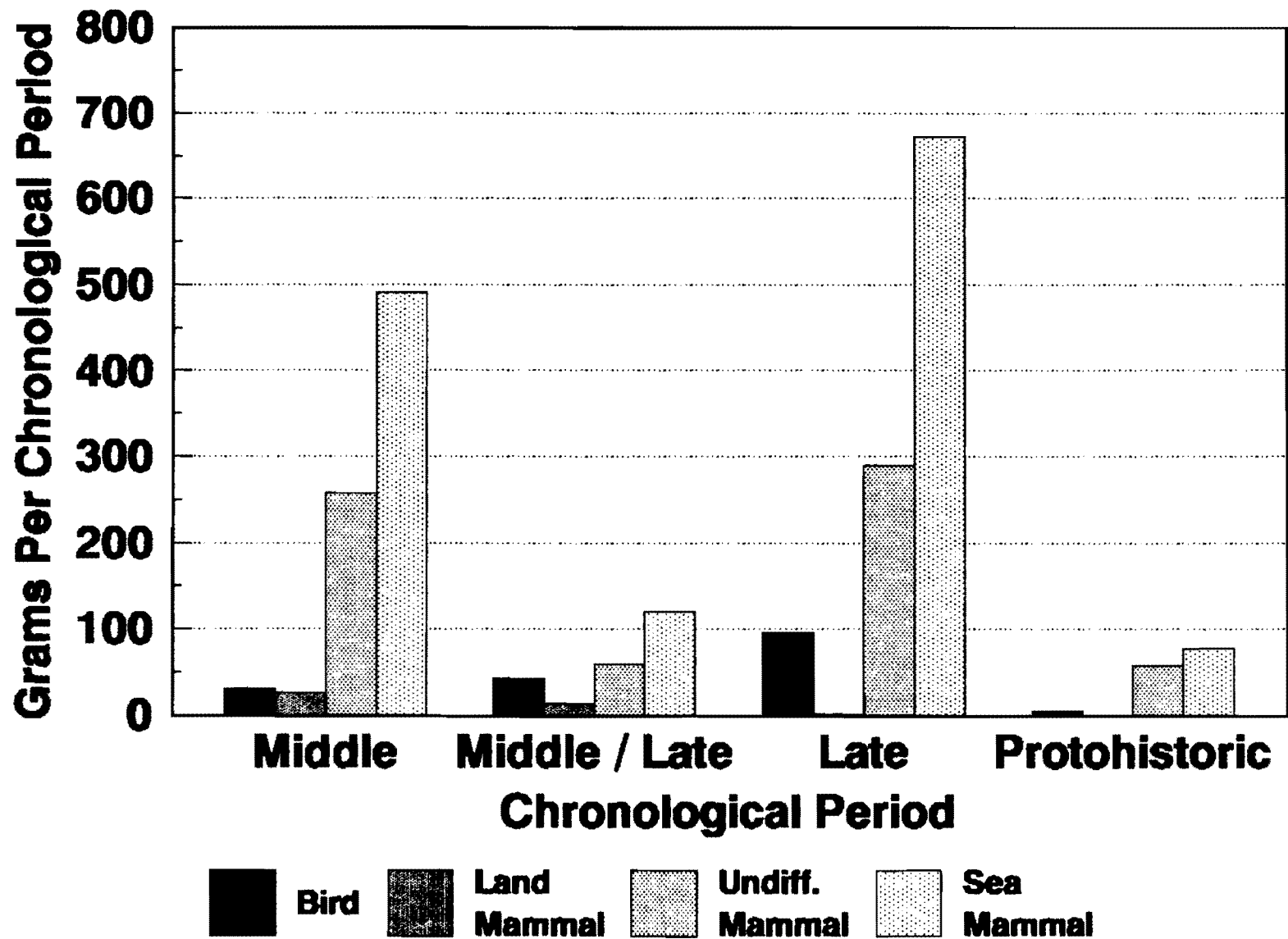


Figure 8. Weight of non-fish fauna.

category by weight. This further supports the proposition that the undifferentiated mammal is actually sea mammal.

Fish bones and shellfish remains are prominent constituents in these sites, and fish and shellfish were important parts of the diet. For the central block at SCRI-191 I have data on fish and shellfish in addition to the detailed mammal and bird analysis. Fish, mammals, birds, and shellfish have significantly different skeletal systems which make direct comparisons of weights of these remains inappropriate for dietary reconstruction. Therefore, I have converted these weight values to meat weights to characterize relative contributions of these classes of fauna to the diet. Conversion factors are those used by Erlandson (1988) for other Santa Barbara County sites. Figure 9 shows the relative contributions of several faunal categories in meat weight. As you can see the amount of fish increases significantly through the lower levels and then drops dramatically, with shellfish being the most important dietary contributor in the upper levels of SCRI-191. The contribution of sea mammal drops significantly in the upper levels as well. These patterns contradict a commonly held assumption that fish and marine mammals became increasingly more important throughout the prehistory of the Santa Barbara Channel.

One interesting aspect of previous work with marine mammals from Santa Barbara area archaeological sites is changing distributions of various body parts through time. Walker (personal communication) has suggested that the distribution of pinniped forelimbs is related to trade in sea mammal meat. The forelimbs of seals are considerably larger than the hindlimbs due to the nature of their locomotion, and contain greater amounts of meat than other body parts. I have plotted general body part by chronological period for all non-fish fauna to try to detect changes in distribution of skeletal elements through time. Virtually all skeletal elements are present in the collection, from teeth to long bones to phalanges. The general categories that I have used include: head, forelimbs, torso, and hindlimbs. Figure 10 shows that the torso is the most prominent, largely due to the numerous rib and vertebra fragments in the collection. The proportion of forelimbs is highest in the Middle - Late transition period. Some of the sites have a high density of pinniped cranial fragments. Crania are reliable sources of fat, which is important for people with a protein rich marine diet that could be limited in carbohydrates and fats. When larger samples have been identified, it may be possible to identify other patterns.

SUMMARY

Archaeological sites on western Santa Cruz Island have great preservation and good stratigraphy. These sites have a very high density of bone, largely from fish, shellfish, and sea mammal, which is not surprising, given the limited terrestrial fauna on

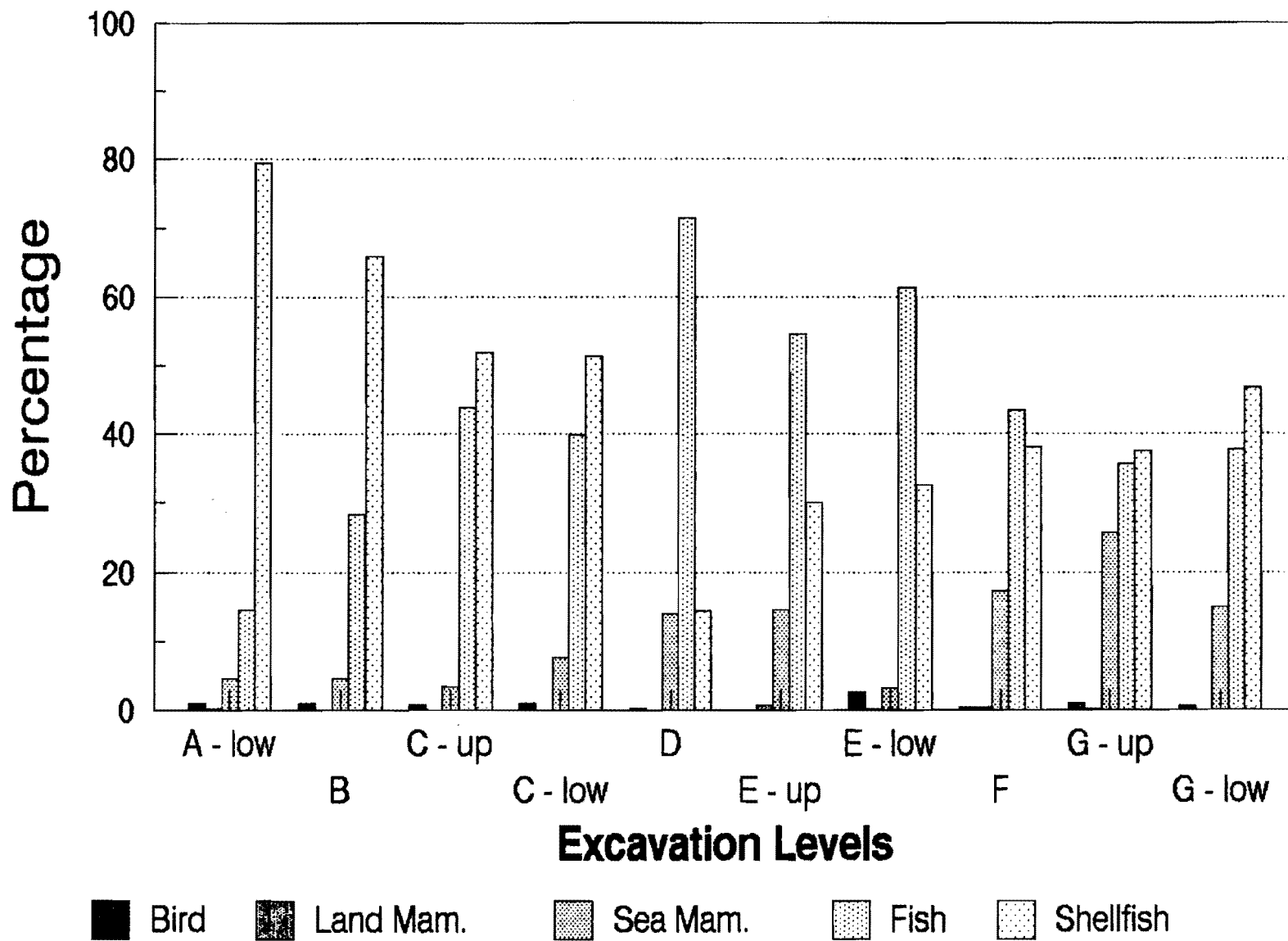


Figure 9. Edible meat weight percentages.

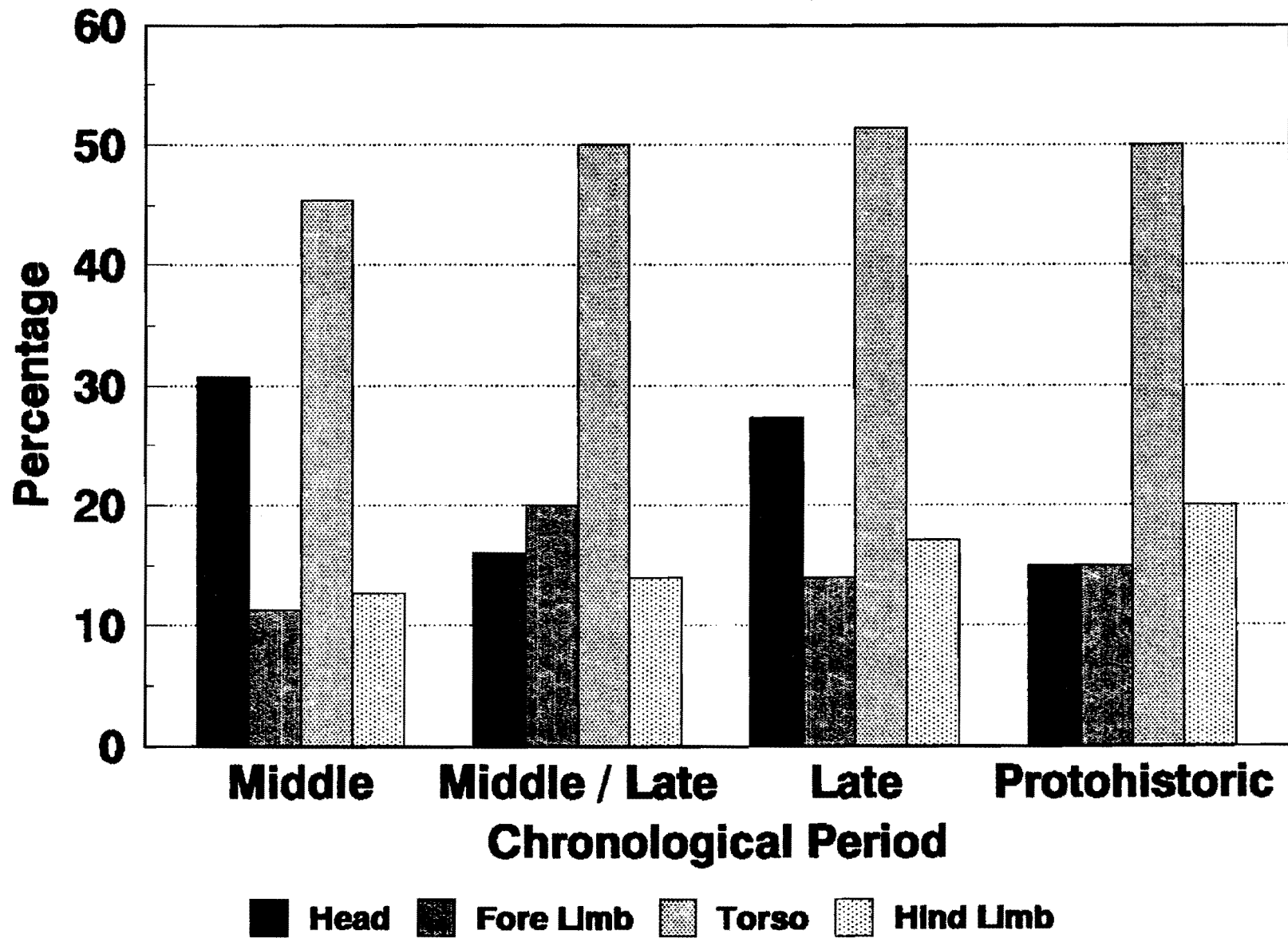


Figure 10. Frequency of non-fish body parts.

the island. Based on the analysis to date, there is a higher density of faunal remains later in time. The relative proportions of fish, shellfish, and sea mammal change through time, and body part distribution varies through time as well. Fish are important throughout the sequence, but shellfish are the primary contributor to the diet later in time, according to meat weight conversions. These results are preliminary, however, and we may see different patterns when the analysis is complete. The western portion of Santa Cruz Island may differ from other parts of the region in terms of faunal exploitation as well.

Later stages of this ongoing analysis will include complete identification of the collection to get larger sample sizes for each chronological period. Larger samples may allow us to reconstruct age profiles of pinnipeds which could yield some seasonality information because different species give birth in different seasons. Other scholars are analyzing macrobotanical remains recovered from these sites (Gummerman 1991), so we should be able in the near future to put together the first comprehensive reconstruction of the prehistoric diet for the Santa Barbara Channel area, including both fauna and flora.

Separate analyses of fish will help reconstruct the diet and may provide independent information on sea temperature. There are close to 3,000 otoliths in the collection, and identification of these elements will provide useful information on fish exploitation. By comparison to the fish data derived from postcranial material, we should be able to say something about processing of fish as well. Were fish brought to the site whole, or were their heads chopped off elsewhere?

Comparison to other sites in the region is an important aspect of reconstructing subsistence patterns. Although detailed faunal analyses from the Northern Channel Islands are rare, some of Rozaire's material from San Miguel, Orr's material from Santa Rosa, and Walker's ongoing analysis of the Prisoner's Harbor (SCRI-240 - see Figure 2) data from Santa Cruz Island are all relevant, as are data from some mainland sites. For example, analysis by Guthrie (1980) on San Miguel, Orr (1968) on Santa Rosa, and Brown (1989) near Marina Del Rey all suggest that people were harvesting sea birds for their skins. Although it was not evident in this analysis, SCRI-330 has a high percentage of bird bone, particularly cormorant. Brown's (1989) summary of uses of birds by Native Californians indicates that these skins were used for clothing. There are some interesting parallels between the Santa Cruz Island sites and others in the region, and this analysis will tell us much about prehistoric faunal exploitation in the region, and ultimately about emergent complexity.

NOTES

1. The dating of these environmental changes is unclear in the literature. If Piasias (1978) counted calendar years before A.D.

1950, as we count radiocarbon years, his last warm water period does not correlate with Larson et al.'s (1989) A.D. 1120-1200 date for coincidence of warm sea temperature and drought. If he counted back from A.D. 2000 as Soutar and Issacs (1969) did, the two sets of dates correspond. The dates I list for Pisiias's warm water periods are based on years before A.D. 2000. Clarifying the relationship between these various dates is important for understanding the role of environmental change in local prehistory.

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