A COOT KILL SITE AT LAKE CAHUILLA

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ABSTRACT

16,501 vertebrate specimens were recovered from 31 units on the Elmore Ranch Site, Imperial County, California. The majority of identifiable specimens (1675) were from American Coot (*Fulica americana*). Also included were Lesser Scaup, Grebes and Canvasback. The species identified were mostly either divers or dip feeders that are unable to take off vertically from the water indicating a likelihood of capture by nets. Coot sex ratio deviated significantly from the expected 0.50 proportion of females common to monogamous birds. The difference could relate to different feeding schedules during the breeding season, which would not only indicate the season of capture, but also the time of day.

INTRODUCTION

This study is based on 16,510 vertebrate specimens recovered from 31 units and 4 surface points at the Elmore Ranch Site. Subsurface material comprised 16,501 specimens; only nine were from the surface collection. Distribution of faunal material was concentrated in two horizontal loci and one stratum (Figure 1).

Hypotheses

Three hypotheses were tested using the faunal material from the site:

1. Nets were used for procuring birds.
2. Sex ratio was the expected 0.50 proportion of females.
3. Time of year and time of day may be indicated.

Methods

Hypothesis 1, Nets were Method of Procurement:

In order for net procurement to be effective it must be applied to birds with a horizontal take-off pattern, or divers which swim under water to avoid predation. A skewed representation of diving birds or birds with a small wing area to body mass ratio, which must build up speed with a gradual ascent to become airborne, would suggest the procurement of the animals by nets. I would expect birds that flush vertically, like herons and dabbling ducks, to be under-represented because of their ability to fly over the net. The proportions of birds with horizontal rather than vertical take-off patterns were compared to the abundances of those types of birds using the present Salton Sea.

Hypothesis 2, Sexual Bias of Procured Species:

Sexual dimorphism is evident in most of the identified bird species and quite pronounced in the Western Grebes (*Aechmophorus* sp.) and the ducks. In all these cases, size of adult specimens was taken as an indication of gender.

American Coots (*Fulica americana*) have little sexual dimorphism in some of their external measurements where feathers are an important part of the determination, but body masses of the sexes do not overlap. Fortunately the differences in mass are reflected in size of skeletal elements. Virtually all specimens of sufficient completeness to determine size were easily assigned to a size category.

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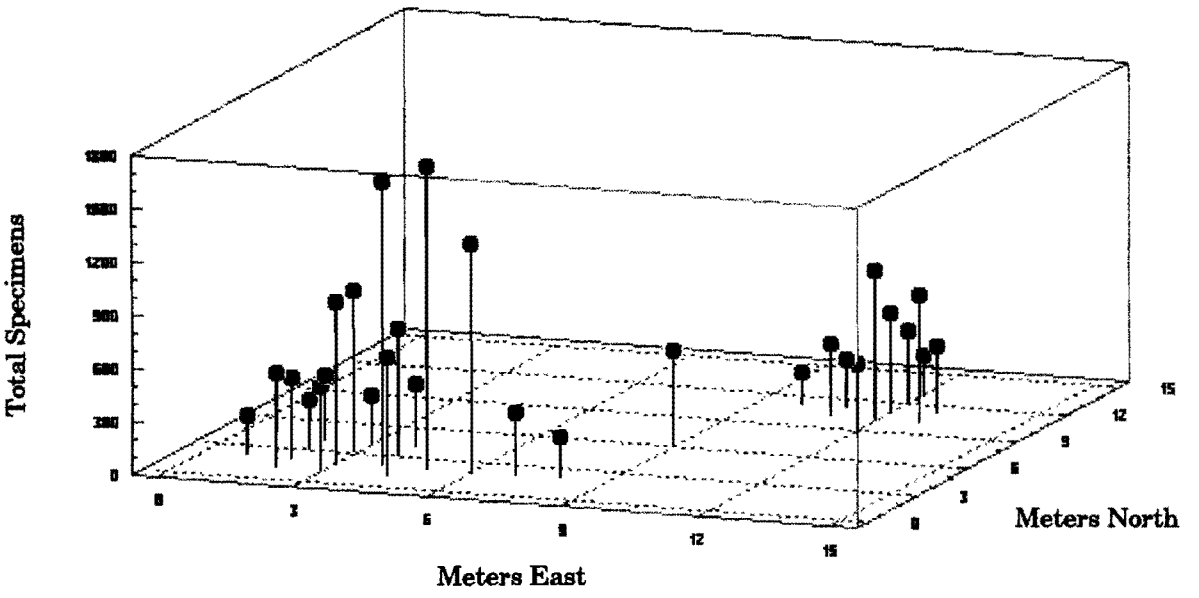

Figure 1. Horizontal distribution of vertebrate specimens. Elmore Ranch Site, CA-IMP-6427, Imperial County, California.

Western Grebes (*Aechmophorus* sp.) have recently been divided into two species in North America: Western Grebe (*A. occidentalis*) and Clark's Grebe (*A. clarkii*). Both species are found in the area today. Livezey and Storer (1992) have shown that the two species are of slightly different size skeletally, and both are highly dimorphic sexually. Clark's Grebe is slightly smaller and more dimorphic than the Western Grebe. The two species are not reliably distinguishable by measurement, but the gender can be distinguished for the congeners based on size. Since the behavior and gender-related size of these two genera are similar with respect to their use by humans, they have been treated as a single species in this study and assigned a minimum number of individuals.

Two taxa (Coot and Western Grebe) were tested for differences from presumed 0.50 proportion of females (Caughley 1977) common to monogamous birds in the wild (Mayr 1939). Ducks were excluded because of the possibility of geographic variation in their sex ratios (Mayr 1939). Numbers of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) were subjected to Chi-squared goodness-of-fit test for two variables (Caughley 1977; Zar 1974). Only elements from adult birds that were clearly large or small were used. Medium or indeterminate sized specimens were excluded from the tests. In Coot, the indeterminate/ medium sized categories were tested for difference in frequency of element type from the two sized groups and were also graphed by percent completeness to determine possible sex bias in the indeterminates. The G-test was performed on the nine elements with a NISP greater than 50. The two major depositional areas were tested by a G-test for independence of site area and sex to indicate uniformity of sex ratio between areas. The NISP and an estimate of minimum numbers individuals (MNI) were tested from the two areas.

Hypothesis 3, Time of Year and Day:

Evidence of seasonality was inferred from migrating, hibernating, and mating behavior of the species identified. While we may assume the presence of the remains of a migratory species to indicate the co-occurrence of the species with humans during the season of its availability, the absence of the species in the cultural assemblage may indicate human absence during that season, cultural selection (Davis 1987), or it may be a function of the method of procurement. I assume the behavior patterns of the birds at Lake Cahuilla were not significantly different from those of their descendants at the Salton Sea and the absence of evidence of other available species to be the result of procurement methods.

RESULTS

1. Capture by Nets

All of the specimens identifiable to species where NISP was greater than 10 were either Coots, Grebes or Pochards. The Pochards and their allies (*Aythya* sp.), and the Grebes (*Aechmophorus* sp. and *Podiceps nigricollis*) are all divers. The posterior position of the legs and shortened wing-length-to-body-size ratio necessary for this adaptation make for high wing loading which would preclude vertical take off from the water. When flushed these birds either dive or run across the surface of the water flapping their wings in an effort to build up enough momentum to become airborne. American Coots also take off in this manner (Ehrlich et al. 1988). All these birds would be vulnerable to driving into nets stretched across the water and partly submerged (Beezley 1991). The preponderance of Coots indicates their probable role as the target species.

Great Blue Heron (*Ardea herodius*), Great Egret (*Casmerodias albus*), and Black-crowned Night Heron (*Nycticorax nycticorax*) are all capable of vertical takeoff. They are common to abundant at the present Salton Sea throughout the year, but do not occur in the recovered faunal assemblage. Small waders and shorebirds are also completely lacking in the prehistoric assemblage despite their abundance in the area year-round.

Snow Goose (*Chen caerulescens*), Ross' Goose (*Chen rossii*), Canada Goose (*Branta canadensis*), Green-winged Teal (*Anas crecca*),

Northern Pintail (*Anas acuta*), Northern Shoveler (*Anas clypeata*), American Widgeon (*Anas americana*), and Ruddy Duck (*Oxyura jamaicensis*) are common to abundant during fall and winter when the site is thought to have been occupied. Of these, only the diving Ruddy Duck was recovered at the site.

Lesser Scaup (*Aythya affinis*) and Canvasback (*Aythya valisineria*) are common only during the winter. Eared Grebes (*Podiceps nigricollis*) are abundant year-round except in summer, when they are uncommon. Western and Clark's Grebes are uncommon except in winter, when they are common. All are divers and all were represented at the site.

2. Sex Ratio of Coots and Western Grebes

The ratio of identified specimens (NISP) of large to small Coots (*Fulica americana*) was highly significantly different from the expected 0.500 proportion of females ($X^2 = 77.13 >> X^2_{0.05(1)}$). The ratio of large to small number of individuals (MNI) was also significantly different from the expected ($X^2 = 4.787 > X^2_{0.05(1)} = 3.841$). The ratio of identified specimens of large to small Western Grebes (*Aechmophorus* sp.) was highly significantly different from the expected 0.50 proportion of females ($X^2 = 10.841 >> X^2_{0.05(1)} = 3.841$), but the ratio of large to small MNI was not significantly different by the Chi-squared test ($X^2 = 1.143 < X^2_{0.05(1)} = 3.841$). The Chi-squared test, however, is sensitive to the sample size rather than the ratio. The sample size was too small to reflect any difference (Table 1).

Indeterminate sized specimens were excluded from this comparison. Two differences were found between indeterminate sized specimens and those assigned to a size category. The indeterminate specimens were less complete (Table 2), and two elements, sternum and humerus, were represented by a higher percentage of indeterminates than large or small class specimens (Figure 2). The frequency of the element type was independent of the size class when compared by a G-test of large vs. small specimens ($G = 13.774 < 15.507$). When the indeterminates were included in the contingency table this independence was lost ($G = 72.436 > 39.252$, $p < 0.001$). The relative frequencies of humerus and sternum were higher for the indeterminates than for the two size classes. Because these two elements were not important in the determination of MNI, due to their low frequencies, there appears to be no interjection of bias by excluding the indeterminates from the comparison.

Sex ratio was independent of the area of deposition in the site using NISP ($G = 0.0102 < 3.841$), MNI ($G = 0.0250 < 3.841$), and the adjusted MNI ($G = 0.6215 < 3.841$). Frequency of elements was also independent of depositional area (Figure 3).

3. Seasonality

Evidence from migratory patterns of the birds presently occurring at the Salton Sea indicates use of the site during autumn and winter (Table 2). Greater Scaup (*Aythya marila*) would be available in autumn and winter only. Lesser Scaup (*Aythya affinis*) and Canvasback (*A. valisineria*) were taken in a season other than the summer. Summer would also be the season of lowest abundance for Eared Grebe and Ruddy Duck. Western Grebes are most common in the winter. No species were identified that would occur at the site exclusively in the summer.

Coot behavior could provide evidence to narrow the time of use of the site for bird exploitation. The skewed sex ratio of the Coots is most likely to occur during the breeding season when diurnal behavior patterns vary between the sexes. Unlike some ducks, the coots do not segregate for molting during the breeding season. Both sexes of coots incubate the eggs and care for the nestlings. The males, however, incubate the eggs at night and the females forage during that time (Gullion 1954). If nets were used to capture the birds, they could be strung across an inlet or stretched parallel to the shore. Birds could then be driven into the nets at night when then they would be least capable of detecting and avoiding the trap. The yield under this set of conditions would be mostly female coots.

Table 1. Numbers of identified specimens and minimum numbers of individuals for American Coot and Western Grebe males and females with proportions of females (P_f) for both categories. Elmore Ranch Site, CA-IMP-6427, Imperial County, CA.

Taxon	Sex	NISP	MNI
Fulica Americana	Male	420	79
American Coot	Female	716	109
	(P_f)	0.63	0.59
Aechmophorus sp.	Male	41	24
Western Grebe	Female	76	32
	(P_f)	0.65	0.57

Table 2. Seasonal occurrences of the most frequently encountered species from the Elmore Ranch Site, CA-IMP-6427, Imperial County, California.

Taxon	Winter	Spring	Summer	Autumn
Eared Grebe	abundant	abundant	uncommon	abundant
Western Grebe	common	uncommon	uncommon	uncommon
Canvasback	uncommon	uncommon	absent	uncommon
Greater Scaup	occasional	absent	absent	occasional
Lesser Scaup	common	common	absent	common
Ruddy Duck	abundant	abundant	common	abundant
American Coot	common	common	common	common

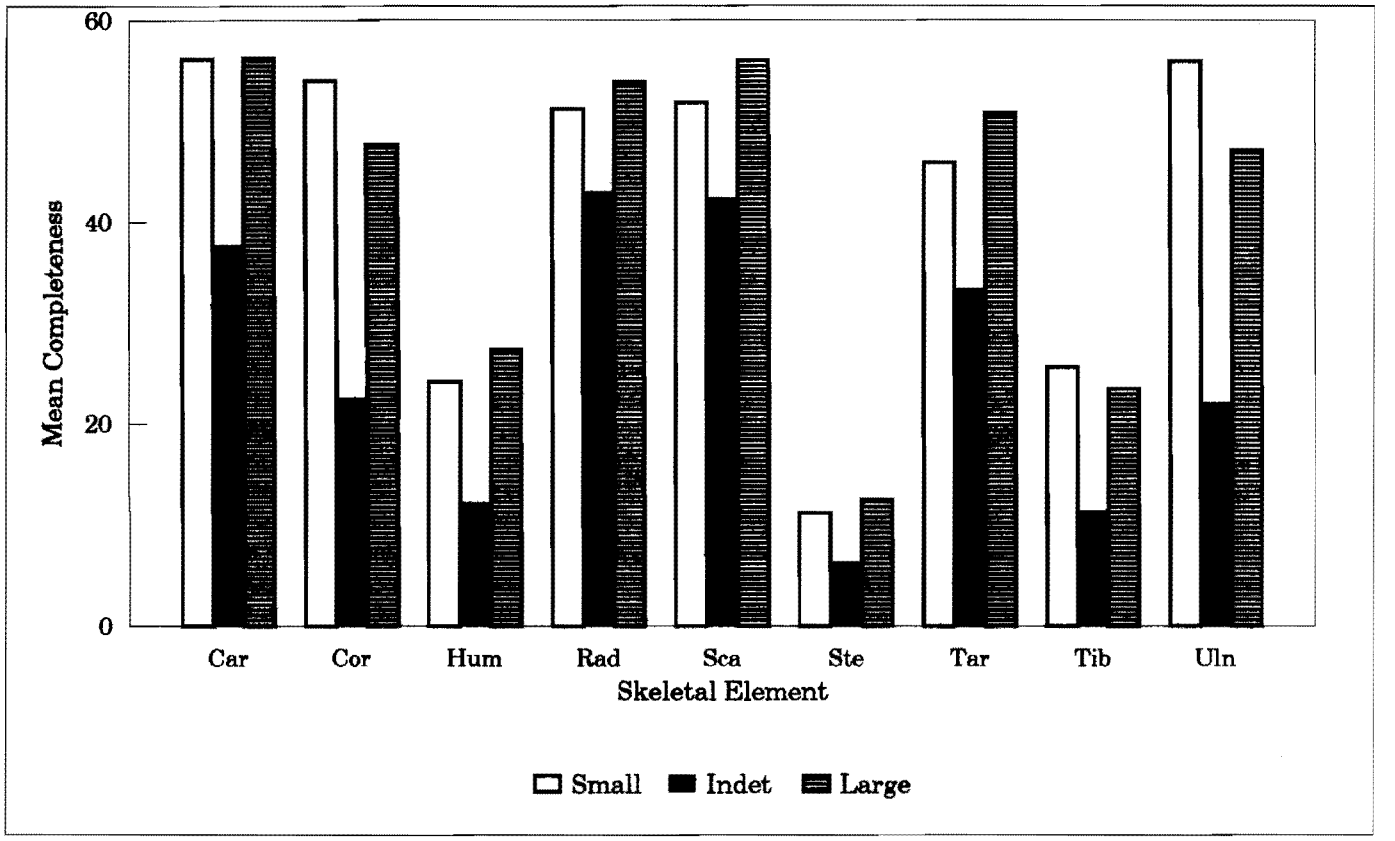

Figure 2. Relative fragmentation of small, Indeterminate and Large classes of elements of American Coot. Car=carpometacarpus, Cor=coracoid, Hum=humerus, Rad=radius, Sca= scapula, Ste=sternum, Tar=tarsometatarsus, Tib=tibiotarsus, Uln=ulna. Elmore Ranch Site, CA-IMP-6427, Imperial County, California.

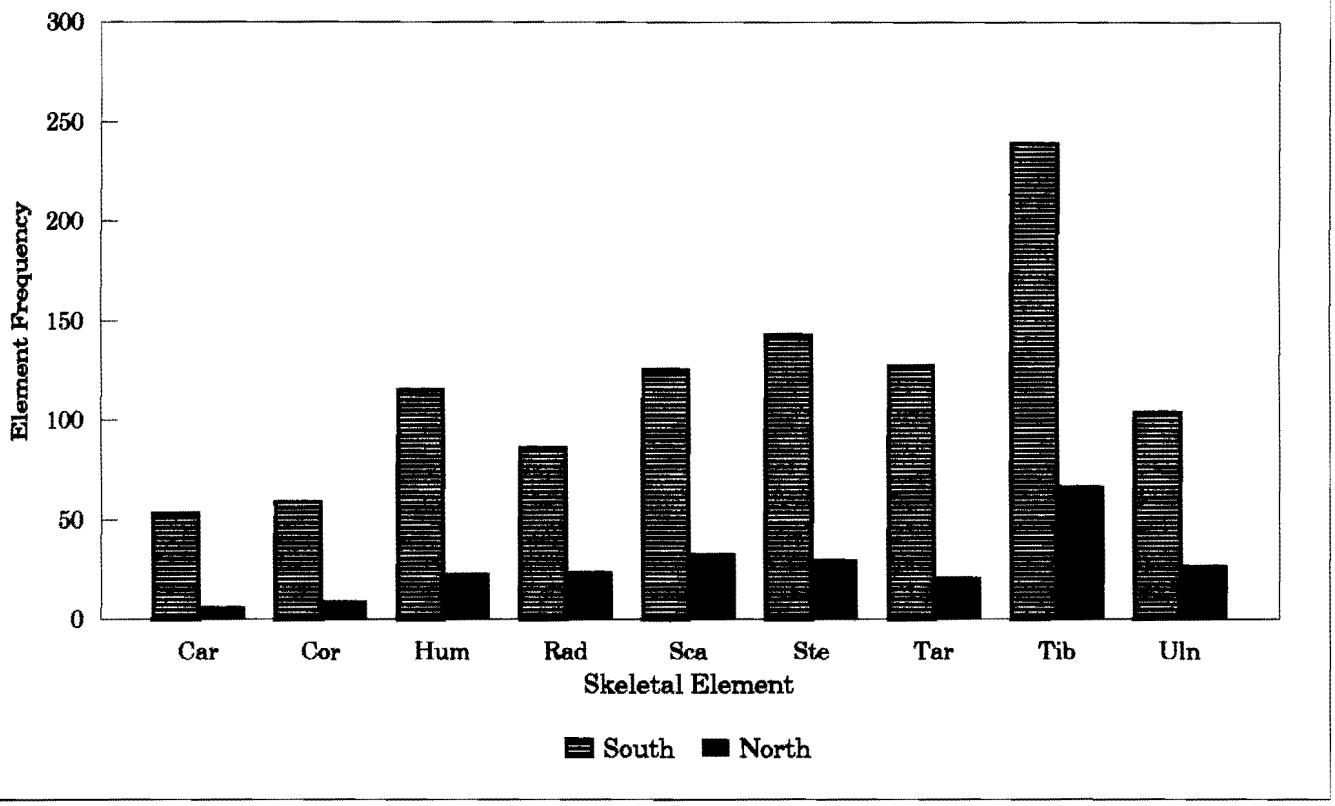

Figure 3. Proportions of elements of American Coot between the major depositional areas. Car=carpometacarpus, Cor=coracoid, Hum=humerus, Rad=radius, Sca=scapula, Ste=sternum Tar=tarsometatarsus, Tib=tibiotarsus, Uln=ulna. Elmore Ranch Site, CA-IMP-6427, Imperial County, California.

Although no information is available on egg dates for the Lake Cahuilla/Salton Sea area, data from the coastal area indicate eggs are first laid in April. Warmer temperatures in the desert may promote nesting early enough in the season to coincide with the occurrence of the Greater Scaups before they migrate north. The capture would then include the early breeding females and the males and females that have not yet begun to breed. A new moon would facilitate the drive.

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