Return to Ripper's Cove: Vertebrate Fauna from CA-SCAI-26, Catalina Island

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Abstract

Although the Ripper's Cove site (CA-SCAI-26) was excavated in 1977 and reported in considerable detail shortly thereafter in this journal (Reinman and Eberhart 1980:61-105), the extensive archaeofaunal collection recovered from that site remained unstudied and unreported for more than three decades. This article remedies that lapse by quantifying and interpreting this "cold case" archaeofaunal collection and by applying an allometric technique for estimating the dietary biomass represented by the faunal remains. While intensive use of fish is expected on an island site, at Ripper's Cove this reliance was found to be far greater than might have been predicted. Nearly 30 percent of total vertebrate dietary biomass is attributed to fish. Another 25 percent of dietary biomass is dolphin. There is little evidence of use of mainland taxa in the diet. Numerous previously unrecorded bone artifacts were also discovered during the faunal analysis.

Introduction

In 1977, California State University, Los Angeles, excavated portions of the Ripper's Cove site (CA-SCAI-26) on the northeastern coast of Santa Catalina Island (Figure 1). A total of 28 1.5 m x1.5 m units were excavated around three datum points (A, B, and C) with a total excavated volume of 30.48 m^3.[1] Although the Reinman and Eberhart (1980) report presented detail on the excavation, recovered burials, and artifacts (lithic, bone, and shell), the unmodified (i.e., dietary) faunal collection was neither analyzed nor described. It was, however, placed in storage at the Catalina Island Museum with all other recovered materials.

There is meager chronological context for the Ripper's Cove faunal collection other than four radiocarbon dates obtained by the original excavators. These ranged between AD 1340 and AD 1730 and were noted as being "Late Prehistoric Period" (Reinman and Eberhart 1980:72). It is now appropriate to consider these dates to be "protohistoric" (Erlandson and Bartoy 1996; King 1978). Reinman and Eberhart (1980:72) acknowledged that the most recent date might be considered "postcontact" since Spanish explorers had visited the Channel Islands by that time. Small quantities of historically introduced artiodactyla are found in the SCAI-26 collection. Although some unidentified artiodactyl bone is found as deep as 40-50 cm, identified artiodactyl bone (bison or cattle, sheep, goat) is found no deeper than 10-20 cm (see discussion of *Odocoileus hemionus* below). Historically introduced swine (*Sus scrofa*) is often found on Catalina Island, but none was identified in the Ripper's Cove collection.

Unfortunately, field records of the excavation are not available, and detailed stratigraphic and depositional context for the faunal materials is, for the most part, missing. Diagrams of sidewalls of six Datum A units are presented by Reinman and Eberhart (1980:66-67). In general, they identified upper levels of the units (Stratum I) as the primary midden and Stratum II below that as having minimal cultural content quickly diminishing to sterile (1980:65). Stratum I was shallow, extending 20 to 30 cm thick. Midden was present below 60 cm depth in only four units, and much of this depth was attributed to slumping from upper terraces of the site or to measurement technique. No historical materials were mentioned by the excavators (Reinman and Eberhart 1980:68).

The Present Study

As part of the ongoing UCLA *Pimu* Catalina Island Archaeology Project, which includes analysis of previously unstudied collections held by the Catalina Island Museum, the vertebrate faunal materials from Ripper's Cove were transmitted to UCLA in 2010 for detailed study. Faunal artifacts, both bone and shell, were also transmitted for additional examination. This report documents analysis of the unmodified (i.e., dietary) bone and updates previously published data on bone artifacts. The unmodified vertebrate bone is first described and quantified in terms of depositional density, frequency or fragment count (i.e., Number of Identified Specimens, or NISP), and weights by datum and unit/level provenience. The nutritional yield of this archaeofauna is then assessed in terms of biomass.

Summary of the Unmodified Faunal Collection

For the purpose of this analysis, all unworked (i.e., non-artifact) bone is considered to have been dietary. Vertebrate remains were recovered from all units. This collection consists of 7,010 fragments of non-piscine bone weighing 5,386.77 g. Piscine bone is quantified by weight rather than by fragment count (i.e., frequency). Total fishbone weight is 4,160.92 g.

The density of faunal remains from excavations around each datum for both NISP and weight per

Figure 1. Excavation units at Ripper's Cove are seen below the boat and to the right. Reinman and Eberhart image reproduced from archived photograph, Fowler Museum, UCLA.

cubic meter of excavation is presented in Table 1. Datum C units in the "upper terrace" of the site produced the greatest density in terms of faunal weight, while the Datum B units nearest the cliff edge produced the greatest density in terms of fragment count. Datum C unit densities are problematic, however, since units assigned to this datum were separated by 60 m on two different portions of the terrace. Overall site faunal density was 230 fragments (313 g) per m^3 of excavation.

Identification of Non-Piscine Specimens

Identifications of non-piscine faunal specimens were made using reference collections from the Los Angeles County Natural History Museum and the Zooarchaeology Laboratory at the Cotsen Institute of Archaeology at UCLA. Each archaeological specimen was identified to the most discrete taxonomic level possible using species and/or genus when possible, element, portion of element, side, and weight, as well as age/sex and condition (burned, cut, or worked) to the extent that these characteristics could be determined. Specimens not identified to the species or genus level were identified more broadly to the family, order, or class level as appropriate. Of the total collection, 2,548 specimens (36 percent) were identified to species/genus or family level. Another 3,985 specimens (57 percent) were identified as either mammal or bird, and 477 specimens (6.8 percent) were unidentified only as vertebrates. Table 2 summarizes the non-piscine dietary faunal collection.

Birds

Twenty-three species or genera of birds were identified (Table 2). The most common species were Cassin's auklet (*Ptychoramphus aleuticus*) (213 specimens), cormorant (*Phalacrocorax* spp.) (68 specimens), and the northern fulmar (*Fulmarus glacialis*) (55 specimens). The auklet remains are particularly interesting since the three major forelimb elements (e.g., humerus, radius, ulna) (101 specimens) comprise 47 percent of the auklet collection while the three major elements of the hindlimb (femur, tarsometatarsus, and tibiotarsus) (32 specimens) account for only 15 percent. Since these lower limb elements preserve as well as the forelimb elements, there is no apparent taphonomic cause for this disparity. Yet, it is clear that wing elements were deposited three times more frequently than lower limb elements. There are also numerous coracoid specimens (n = 39) of this bird. Coracoids are an important element of the forelimb structure. If these specimens are added to the three major forelimb elements, the overall major wing elements would be 140, or nearly 66 percent, of the auklet remains. There are extremely minor frequencies (total of 73 specimens) from all other anatomical portions of the birds (e.g., crania, vertebrae). Thus, the concentration of wing elements is exceptional, and there appears to have been some selection of body part involved in the skewed deposition. Whether the concentration of wing elements indicates that these were preferred for some reason (possibly for the feathers) or that they were most willingly discarded (having little edible

Table 1. Faunal Density by Datum.

Datum	Vol. (m^3)	NISP[a]	NISP (m^3)[a]	Wt. (g)	Wt. (g per m^3)
A	12.37	1826	147.62	3537.52	285.98
B	10.91	3887	356.28	3320.36	304.34
C	7.20	1129	156.81	2549.46	354.09
Total	**30.48**	**6842.00**	**660.71**	**9407.34**	**944.41**

[a] NISP excludes fish.

Table 2. The CA-SCAI-26 Bird Archaeofauna.

Taxon	Common Name	NISP	Weight (g)
Accipitridae			
Pandion haliaetus	osprey	1	1.09
Accipitridae	hawk, unidentified	1	0.35
Alcidae			
Cepphus columba	pigeon guillemot	2	0.51
Cerorhinca monocerata	rhinoceros auklet	3	0.88
Fratercula cirrhata	tufted puffin	3	0.68
Ptychoramphus aleuticus	Cassin’s auklet	213	33.36
Uria aalge	common murre	4	2.15
Alcidae	auk, unidentified	1	0.21
Anatidae			
Anas americana	American wigeon	2	2.10
Anas spp.	duck	4	2.10
Anatidae	duck/goose, unidentified	1	0.13
Anser albifrons	greater white-fronted goose	2	4.16
Branta spp.	goose	3	2.88
Melanitta perspicillata	surf scoter	15	9.55
Gaviidae			
Gavia immer	common loon	1	1.03
Gavia pacifica	Pacific loon	1	0.67
Gavia spp.	loon	9	10.44
Ardeidae			
Ardea herodias	great blue heron	1	1.44
Procellariidae			
Fulmarus glacialis	northern fulmar	55	23.74
Puffinus griseus	sooty shearwater	1	0.36
Puffinus spp.	shearwater	2	1.03
Phasianidae			
Callipepla californica	California quail	2	0.27
Cathartidae			
Cathartes aura	turkey vulture	1	0.45
Laridae			
Laridae	gull, unidentified	4	2.46
Pelicanidae			
Pelecanus spp.	pelican	4	20.67
Phalacrocoracidae			
Phalacrocorax spp.	cormorant	68	59.62
Podicepedidae			
Podiceps nigricollis	eared grebe	1	0.37
Aves	bird, unidentified	450	102.70
Total		**855**	**285.40**

flesh) is unknown. The auklet is not a large bird (21 to 23 cm long), weighing about 200 g. It is found on marine islands throughout the year and nests in small, shallow burrows. The overall frequency of this species suggests proximity to and intensive exploitation of a rookery by Ripper's Cove occupants.

The fulmar is a medium size (96 cm long) oceanic glider that colonizes open seacliffs. It breeds north of the United States-Canadian border and is considered to be entirely pelagic. Thus, its capture on the islands seems to be enigmatic. Nevertheless, it has been found in considerable quantity on the California islands (Porcasi 1999:45). Prehistoric ranges may have been different from modern ranges. It can be found along the California coast during most of the year, except summer months (Garrett and Dunn 1981:42).

Three cormorant species may be found all year in large nesting colonies along the California coast. They are similar in size and general anatomy. For this reason, the SCAI-26 remains are identified only to the genus level. Cormorants are fairly large (63 to 91cm long) and have 1.2 m wingspans. The large representation of these birds in the Ripper's Cove collection is typical of Channel Islands sites.

Marine Mammals

Eight species of marine mammals were identified: four dolphins, three pinnipeds, and the sea otter (*Enhydra lutris*) (Table 3). Dolphins included the common dolphin (*Delphinus delphis*), the bottlenosed dolphin (*Tursiops truncatus*), the white-sided dolphin (*Lagenorhynchus obliquidens*), and the northern right whale dolphin (*Lissodelphis borealis*). These species were identified by diagnostic characteristics of the tympanic-periotic elements.

The pinnipeds included the California sea lion (*Zalophus californianus*), the harbor seal (*Phoca vitulina*), and the southern (Guadalupe) fur seal (*Arctocephalus townsendi*). Some pinniped bone is identified only as otariidae (eared seal) or as arctocephalinae (fur seal). The sea lion and harbor seal remain populous throughout the Channel Islands and are typically found in island archaeofaunas. The southern fur seal, on the other hand, was hunted to near extinction by 1825, mainly by Russian and allied Native fur hunters. The presence of this species at Ripper's Cove suggests that this archaeofauna clearly precedes that time period.

There was also a considerable quantity of unidentified dolphin and other cetacean bone, making up a surprisingly large proportion of the archaeofaunal collection in terms of both weight and NISP. While the method of capturing dolphins is unknown, a large quantity of dolphin bone is consistent with findings from other sites on the Channel Islands such as Little Harbor (CA-SCAI-17) and Eel Point (CA-SCLI-43) on nearby San Clemente Island (Porcasi and Fujita 2000). It appears that the people of Ripper's Cove were equally adept at capturing dolphin as the people of other Catalina Island sites and neighboring islands.

Terrestrial Mammals

Identified native terrestrial mammals (Table 4) included the diminutive island fox (*Urocyon littoralis*) and the California ground squirrel (*Spermophilus beecheyi*). Both are endemic, and the squirrel is notorious for site bioturbation. Its considerable presence in the archaeofauna creates uncertainty about site stratigraphy. Two fragments of unmodified black-tailed (mule) deer (*Odocoileus hemionus*) were recovered. Although found throughout California, the deer is not native on the island. There are, however, some additional SCAI-26 artifacts fashioned from artiodactyl bone (see artifact discussion below).

All identified artiodactyl elements are from the lower legs of the animal (i.e., metapodials and associated carpals and tarsals). The metapodials are particularly suitable for toolmaking because the cortex is thick and

Table 3. The CA-SCAI-26 Marine Mammal Archaeofauna.

Taxon	Common Name	NISP	Weight (g)
Cetacea			
Cetacea	cetacean, unidentified	70	177.12
Delphinidae	dolphin/porpoise, unidentified	847	1651.81
Delphinus delphis	common dolphin	1	7.94
Lagenorhynchus obliquidens	white-sided dolphin	4	31.03
Lissodelphis borealis	northern right whale dolphin	1	11.87
Tursiops truncatus	bottlenosed dolphin	1	5.09
Total		**924**	**1884.86**
Pinnipedia			
Arctocephalinae	fur seal	13	44.81
Arctocephalus townsendi	southern fur seal	24	143.37
Phoca vitulina	harbor seal	22	39.87
Pinnipedia	pinniped, unidentified	144	294.21
Otariidae	eared seal	98	191.00
Zalophus californianus	California sea lion	30	136.37
Total		**331**	**849.63**
Mustelidae			
Enhydra lutris	sea otter	96	177.05
Total		**96**	**177.05**
Grand Totals		**1351**	**2911.54**

the elements are uncurved with a planar proximal end. However, metapodials provide minimal flesh relative to other leg elements, and there is a notable void of other deer elements representing dietary flesh. This suggests that these especially useful portions of the animal were imported from the mainland specifically for tool-making purposes or that already finished tools made from metapodials might have been imported. Apparently artiodactyls played little or no role in island diet, and trade with the mainland for animal flesh appears to have been minimal or non-existent. Historically introduced mammals include the bison (*Bison bison*), cattle (*Bos taurus*), sheep (*Ovis aries*), and goat (*Capra hircus*). Unidentified artiodactyla are identified herein as ovicaprines (sheep/goat). Most of the unidentified bone in this collection closely resembles pinniped bone. Since these specimens are nondiagnostic, however, they are not quantified as pinniped bone.

The proportional use of faunal resources in terms of both NISP and weight is presented in Table 5. Not surprisingly, marine taxa, including fish, comprise 74 percent of the diet in terms of bone weight. Terrestrial mammals (both identified and unidentified and including rodents) comprise 6.26 percent of the diet. Nearly 44 percent of total bone weight is fishbone. This is almost five times the proportional weight of pinniped and more than double the proportional weight of dolphins. Overall, marine mammals account for 30.5 percent of bone weight. Dolphins and unidentified cetaceans account for about three times as much bone

Table 4. The CA-SCAI-26 Terrestrial Mammal Archaeofauna.

Taxon	Common Name	NISP	Weight (g)
Native Mammal			
Odocoileus hemionus[a]	black-tailed (mule) deer	2	22.76
Rodentia, unident.	rodent	3	0.11
Spermophilus beecheyi	California ground squirrel	363	128.72
Urocyon littoralis	island fox	22	15.83
Total		**390**	**167.42**
Introduced Mammal			
Bison bison	buffalo	2	26.01
Capra hircus	goat	2	73.38
Ovis or Capra	sheep/goat	231	93.08
Ovis aries	sheep	13	75.49
Artiodactyla	artiodactyl, unidentified	154	123.35
Total		**402**	**391.31**
Unidentified Mammal			
Mammal	mammal, unidentified	3535	1579.24
Vertebrata	vertebrates, unidentified	477	51.86
Total		**4012**	**1631.10**
Grand Totals		**4804**	**2189.83**

[a] Although native throughout California, deer is not native on the island.

as identified pinnipeds in terms of NISPs. Since even highly fragmented cetacean bone is highly distinctive and easily identified, this may account for the large NISP. However, much of the unidentified mammal bone is likely to be pinniped, since it is not characteristic of cetacean or artiodactyl bone.

Identification of Piscine Specimens

In most units fishbone is quantified only by total bulk weight for each level, but in 11 units from Datum areas A and B, the fishbone has been identified to genus, species, and/or family level by Salls (1988). These more detailed data provide a sufficiently large sample to represent the remainder of the fishbone collection. The fish taxa presented in this report are those identified in Salls' sample, with the addition of the Datum C (i.e., unidentified) units' fishbone weights (Table 6). An additional species (*Mola mola,* the ocean sunfish) is added to Salls' data. However, the NISP/Minimum Number of Individuals (MNI) technique used by Salls gives little insight into the vast quantity (i.e., weight) of fishbone at the site or of the potential biomass represented by the unidentified fishbone. For this reason, the fishbone collection is reiterated here in terms of bone weight data and is analyzed (along with the non-piscine collection) by a technique for converting fishbone weights to biomass.

Most of the species presented in Table 6 are consistent with species identified at other Catalina Island sites by Salls (1988:420-421), who noted the preponderance of sheephead, kelp bass, blacksmith, and moray eels at Ripper's Cove. These fish are most readily

Table 5. Proportion of Faunal Resources.

Resource	NISP	Weight (g)	NISP %[a]	Wt %
Bird	855	285.40	12.20	2.99
Pinniped	331	849.63	4.70	8.90
Sea otter	96	177.05	1.37	1.85
Dolphin	854	1707.74	12.20	17.90
Cetacean, unidentified	70	177.12	1.00	1.86
Island fox	22	15.83	0.30	0.17
Artiodactyl	404	414.07	5.76	4.33
Large mammal, terrestrial[b]	25	38.95	0.36	0.41
Mammal, unidentified[c]	3510	1540.29	50.00	16.10
Rodent, unidentified	366	128.83	5.22	1.35
Vertebrate, unidentified	477	51.86	6.80	0.54
Fish		4160.92		43.60
Total[d]	7010	9547.69	99.91	100.00

[a] Excludes fish.
[b] Assumed to be artiodactyla.
[c] More consistent with pinniped taxa than with cetacean or terrestrial taxa.
[d] Fish excluded in NISP total.

found in kelp bed, deep rocky reef, or shallow rocky reef habitats. Based on NISP, more than 50 percent of the identified specimens reported by Salls (1988:421) were sheephead. In the present study, when weight is used to quantify fishbone rather than NISP, the piscine collection is dominated by California sheephead, but at an even higher level (62 percent) of identified specimens. It is also reasonable to assume that this fish accounts for approximately the same proportion of unidentified fishbone (an additional 1,907 g). The sheephead inhabits kelp forests and rocky reefs where it feeds on sea urchins, mollusks, lobsters, and crabs.

Proportional Use of General Resource Categories

For additional analysis, the faunal collection may be grouped into more general categories (birds, pinnipeds, otters, cetaceans, terrestrial mammals, unidentified mammals, and fish). The proportional use of these major categories in terms of both weight and NISPs is shown in Figure 2. Most of the large quantity of unidentified mammal bone (16 percent of the archaeofauna) is more consistent with pinniped bone than with any other mammalian resource. If this quantity were to be included with the pinniped bone, marine faunal resources would increase to 90 percent, which is reasonable considering the insular setting and the apparent lack of fauna traded in from the mainland.

Biomass: Nutritional Analysis of the Ripper's Cove Archaeofauna

There are several methods for estimating biomass from an archaeofaunal collection. Perhaps the most commonly used technique is to multiply a derived number of animals of a given taxon (e.g., the MNI or a similar index) by a whole-body-weight conversion factor established for typical animals of that taxon (White 1953). Although this method has had numer-

Table 6. The CA-SCAI-26 Piscine Archaeofauna.

Family/Taxon	Common Name	Weight (g)
Heterodontidae		
Heterodontos francisci	horn shark	0.86
Lamnidae		
Isurus oxyrinchus	shortfin mako	0.80
Triakidae		
Triakidid fish	smoothhound shark	3.31
Triakis semifasciata	leopard shark	25.17
Squatinidae		
Squatina californica	Pacific angel shark	4.73
Rhinobatidae		
Rhinobatos productus	shovelnose guitarfish	0.14
Torpedinidae		
Torpedo californica	Pacific electric ray	0.87
Myliobatidae		
Myliobatis californica	bay ray	9.50
Muraenidae		
Gymnothorax mordax	California moray	41.37
Exocoetidae		
Cypselurus californicus	California flyingfish	0.08
Atherinidae		
Atherinopsis californiensis	jacksmelt	0.15
Scorpaenidae		
Scorpaena guttata	California scorpionfish	3.82
Sebastes carnatus	gopher rockfish	1.35
Sebastes constellatus	starry rockfish	0.61
Sebastes flavidus	yellowtail rockfish	0.70
Sebastes miniatus	vermilion rockfish	17.15
Sebastes mystinus	blue rockfish	1.32
Sebastes ovalis	speckled rockfish	0.11
Sebastes paucispinis	bocaccio	7.06
Sebastes rastrelliger	grass rockfish	10.73
Sebastes serranoides	olive rockfish	0.28
Sebastes serriceps	treefish	0.44
Sebastes spp.	rockfish	19.87
Sebastes umbrosus	honeycomb rockfish	0.89
Sebastes vexillaris	whitebelly rockfish	0.07

Table 6. Continued.

Family/Taxon	Common Name	Weight (g)
Hexagrammidae		
Ophiodon elongatus	lingcod	0.54
Cottidae		
Scorpaenichthys marmoratus	cabezon	3.59
Serranidae		
Paralabrax clathratus	kelp bass	133.22
Paralabrax nebulifer	barred sea bass	0.68
Paralabrax spp.	bass	0.31
Malacanthidae		
Caulolatilus princeps	ocean whitefish	14.82
Carangidae		
Seriola lalandi	yellowtail	37.06
Trachurus symmetricus	jack mackerel	6.87
Haemulidae		
Anisotremus davidsoni	sargo	0.43
Sciaenidae		
Atractoscion nobilis	white sea bass	3.10
Sciaenid fish	drums, croakers	2.47
Kyphosidae		
Girella nigricans	opaleye	1.98
Medialuna californiensis	halfmoon	1.15
Embiotocidae		
Amphistichus argenteus	barred surfperch	0.08
Embiotoca jacksoni	black perch	1.45
Embiotoca lateralis	striped seaperch	0.84
Embiotocid fish	perchiform fish	1.17
Damalichthys vacca[b]	pile perch	0.46
Rhacochilus toxotes	rubber lilp seaperch	1.42
Pomacentridae		
Chromis punctipinnis	blacksmith	0.88
Hypsypops rubicundus	garibaldi	4.33
Sphyraenidae		
Sphyraena argentea	Pacific barracuda	12.04
Labridae		
Halichoeres semicinctus	rock wrasse	0.06
Semicossyphus pulcher	California sheephead	672.49

Table 6. Continued.

Family/Taxon	Common Name	Weight (g)
Scombridae		
Euthynnus pelamis	skipjack tuna	1.10
Sarda chiliensis	Pacific bonito	0.72
Scomber japonicus	Pacific/chub mackerel	0.82
Thunnus alalunga	albacore	3.30
Scombrid fish	tuna/mackerel, unidentified	1.45
Molidae		
Mola mola	ocean sunfish	12.55
Unidentified fish		
Chondricthyes/elasmobranchia	cartilaginous fish, unidentified	12.33
Osteichthyes	bony fish, unidentified	3075.83
Total Weight		**4160.92**

[a] Cartilaginous fish such as sharks, rays, skates.
[b] Alternative genus is *Rhacochilus*.

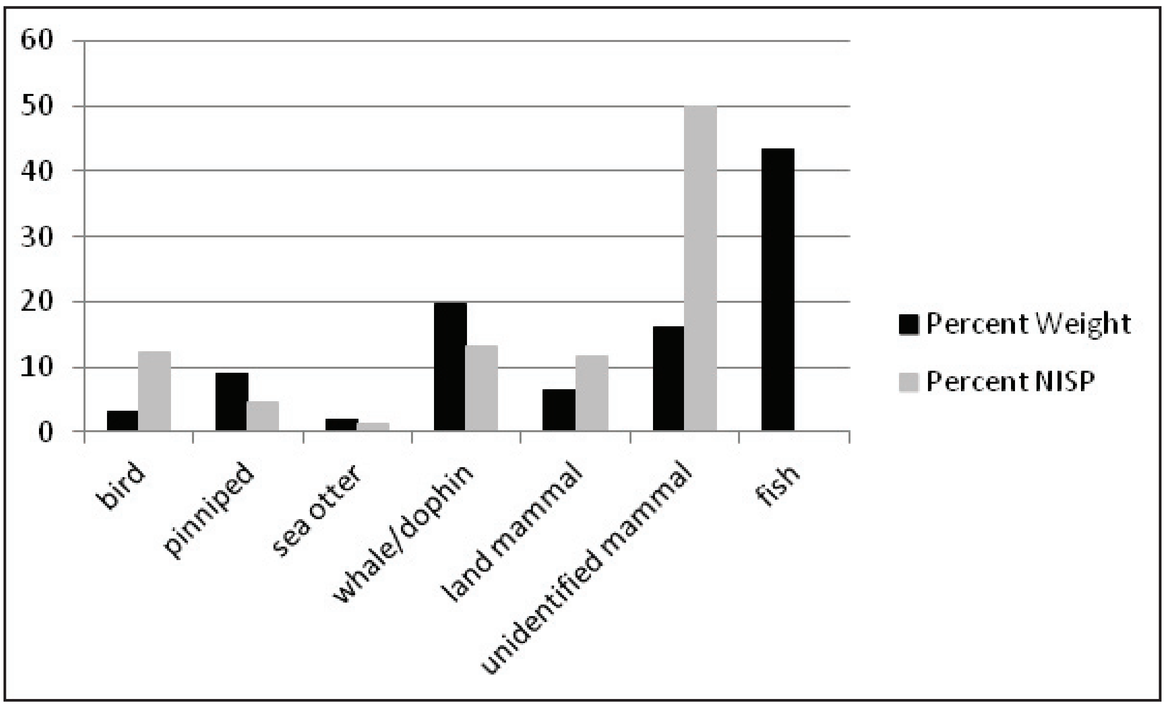

Figure 2. CA-SCAI-26 proportional use of faunal resources in terms of bone weight and NISP.

ous adherents over the years (e.g., Hesse and Wapnish 1985; Klein 1980; Ringrose 1993) and its use remains popular to this day (e.g., Knell and Hill 2012; Rick 2007), Reitz and Wing (2008:206) note that criticism of this technique is now a "growth industry" among zooarchaeologists, and they catalog numerous cautions and caveats about the MNI technique. Grayson (1973, 1979, 1984) and Lyman (1979, 2008) have also detailed various difficulties with using the MNI technique. Other researchers value the MNI when it is used in conjunction with another index such as the NISP (e.g., Klein and Cruz-Uribe 1984). Reitz et al. (1987), Reitz and Wing (1999, 2008), and Wing and Brown (1979) argue that a more accurate method is statistically based allometric calculation of biomass (flesh yield) derived from bone weight and/or dimensions. This method is applied in this research.

Allometry is a nonlinear regressional relationship that may be calculated between body mass and skeletal weight or dimensions (Reitz and Wing 1999:223, 2008:236-239). Allometric scaling considers only the flesh represented by the recovered archaeological specimens rather than by an entire individual (Reitz and Wing 1999:224, 2008:237-239). This avoids some aggregation problems associated with the MNI technique and also avoids having to select from diverse sets of conflicting conversion factors developed by different researchers for different resource classes as well as issues involved in estimating meat values of juvenile, sexually dimorphic, or undersized animals. It also accounts for unidentified bone as long as class can be established.

Specifically, the allometric method for sample biomass is structured on the following formula presented by Reitz and Wing (2008:236, Method 3): $Y = aX^b$ where Y is the estimated sample biomass (i.e., meat yield) in kilograms contributed by the archaeological specimens for a taxon or a category of taxa, X is the weight of the archaeological specimens for a taxon or a category of taxa (in grams), a is the Y-intercept of the linear regression line, and b is the slope of the regression line. Constants for a and b are presented for a variety of vertebrates by Reitz and Wing (1999:72, 2008:68), who also note that the constants used for X and Y were derived from establishing the relationship between skeletal weight and total body weight of large numbers of reference specimens (1999:228, 2008:239). A meat weight percentage of total body weight is then applied. Meat weight for most mammals and birds is calculated at 70 percent of total body weight and 50 percent for artiodactyls and leporidae (White 1953:397). Fish flesh is estimated at 84 percent of total body weight (Wing and Brown 1979:132).

With their unique layering of blubber, the biomass potential of marine mammals is entirely different from that of terrestrial mammals. There is, however, no consensus about marine mammal body weights in general. The following data reflect this lack of consistency. Using four specimens from two species, Lyman et al. (1992) developed a meat utility index for phocid seals (two specimens were immature or juvenile). Shortly thereafter, Savelle and Friesen (1996) developed a utility index for otarid seals based on two male California sea lions that weighed 330 and 338 kg. Even though these weights included content of the viscera, these animals weighed less than the "typical" weight for male sea lions (392.5 kg) reported by Bleitz-Sanburg (1987), but they weighed much more than the weight for this taxon (250 kg) provided by Jameson and Peeters (1988:179). Savelle and Friesen (1996:714) also established live weight and consumable meat weight of the harbor porpoise (*Phocoena phocoena*) after defleshing a single subadult female that weighed 27.2 kg at the time it died in a fishing net. Jameson and Peeters (1988:195) note that an adult of this species weighs between 45 and 55 kg, or nearly twice as much as the Savelle and Friesen (1996) subject. Bleitz-Sanburg (1987) presented a live weight of 53 to 54 kg for this species (adult male or female). Lacking constants for allometric regression for these animals, however, their biomass is calculated here using the general mammal constants from Reitz and Wing (2008:68).

The biomass of the overall SCAI-26 vertebrate archaofauna, exclusive of rodentia, demonstrates that the major dietary sources were fish, followed by dolphins, and then by small mammals (Table 7). The summarized findings on this archaeofauna (NISPs, weights, and biomass) are shown in Figure 3. This figure also suggests the potential for analytical misinterpretation when a single data set is used to describe an archaeofauna. Note the disparity between weight and NISP of the marine mammals, the enormous disparity between NISP and weight of terrestrial mammals, and the considerable weight of unidentified mammal bone that is often unaccounted for in dietary analyses. For each animal category, biomass values track the weight values more closely than NISP, since biomass is based on bone weight.

A Brief Review of the Bone Artifacts

Reinman and Eberhart (1980:94) reported a total of 45 bone artifacts from the Ripper's Cove site, most of which are described as whole or partial gorges or "fishhook" points. However, no complete bone fishhooks were recovered from the site. It is more likely that the fragmentary bone points are broken gorges, barbs, or awl tips. During this faunal analysis, 122 worked bone artifacts were located as well as some possibly worked items and some natural bone items that were previously considered to be artifacts. The quantity of previously unidentified bone artifacts emphasizes the importance of complete investigation of faunal collections.

Two bone artifacts identified during the faunal analysis provide evidence of interaction, albeit minimal, with the mainland. In Unit 3N/75W (20-30 cm) two awl fragments fashioned from artiodactyl metapodial bones were found. These are most likely deer elements brought over from the mainland. All deer bones identified in this collection are lower leg elements (metapodials) or associated "riders" (carpals, tarsals, or phalanges) (see Binford 1984). This suggests that only important toolmaking materials (metapodials) were imported or traded into the island community rather than larger, flesh-bearing (i.e., dietary) elements.

Table 7. Biomass of Ripper's Cove Vertebrate Faunal Resources.

Faunal Category	Wt. (g)	Allometric Biomass (kg)	Proportion of Diet
Pinniped	849.63	7.97	12.00
Dolphin	1707.74	14.94	22.50
Otter	177.05	1.94	2.90
Bird	286.94	2.46	3.70
Fox	15.83	0.22	0.33
Fish	4160.92	19.57	29.46
Artiodactyla[a]	414.07	2.98	4.49
Mammal, large, unidentified[b]	38.95	0.50	0.75
Cetacean, unidentified	177.12	1.94	2.92
Mammal, unidentified[c]	1579.24	13.92	20.95
Total	**9407.49**	**66.44**	**100.00**

[a] All nonnative to the island.
[b] Probably artiodactyla.
[c] Most closely resembles pinniped bone.

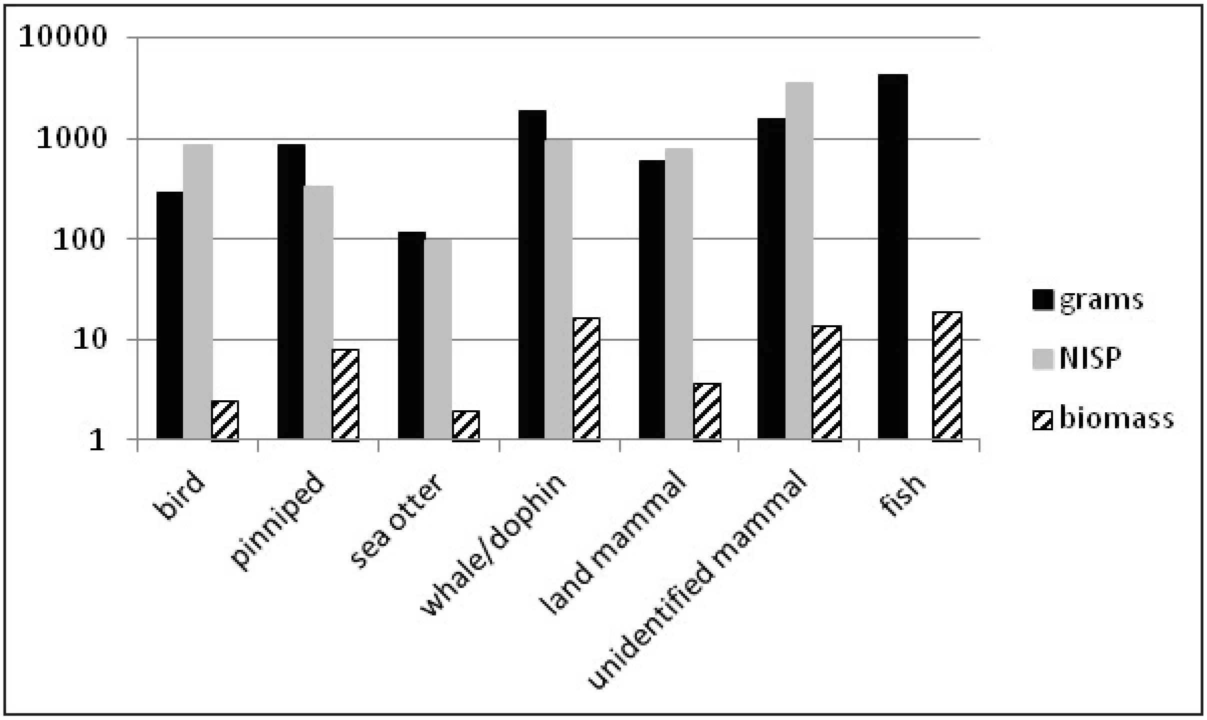

Figure 3. CA-SCAI-26 bone weight, NISPs, and biomass of faunal resources.

In Reinman and Eberhart's (1980:97) Figure 32, Item "s" is not a grooved marlin bill fragment as reported but rather a worked *Mola mola* ossicle (grooved along the upper curved surface). Two other bone "artifacts" (catalog numbers 18-57 and 18-58) reported by Reinman and Eberhart (1980) are natural (unmodified) *Mola mola* ossicles (see Porcasi and Andrews 2001).

Conclusions

The single most important faunal resource at the Ripper's Cove site was large-bodied marine mammals (identified pinnipeds and dolphins combined). Together these account for 34.49 percent of biomass. On the other hand, fish accounted for an extremely large proportion of dietary biomass (29.46 percent). The contribution of fish in the diet had not been quantified on Catalina Island prior to this analysis. However, if the unidentified cetacean and unidentified mammal (likely pinniped) specimens (23.87 percent) are added to the identified pinniped and dolphin biomass, this would total 58.36 percent, underscoring the reliance of island people on hunting these large animals.

The large quantity of dolphin bone is consistent with findings from other southern island sites, including Little Harbor on Catalina Island and Eel Point on San Clemente Island. However, those two sites face the open sea and have cavernous submarine canyons that may have fostered dolphin hunting (Porcasi and Fujita 2000). Ripper's Cove faces the mainland and has no submarine canyon, suggesting that dolphin hunting might have been possible from any location on the island. This makes the method of capturing dolphins even more enigmatic. All terrestrial mammals (including the unidentified terrestrial mammal which is probably artiodactyl) account for only 5.57 percent of total biomass. Furthermore, most of this artiodactyl bone is introduced (i.e., historic) species.

Endnotes

1. Reinman and Eberhart (1980:65) reported a total excavated volume of 30.2 m^3. The volume of 30.48 m^3 reported here is based on recalculation of unit sizes and the number of excavated levels within each unit that produced faunal remains. Three units were reduced to half size (0.75 m x 1.5 m) at various depths. An additional provenience (IV-1) produced 168 specimens (140.35g), but the location, size, and nature of this locus are not known due to lack of excavation documentation.

2. A partial sample of the CA-SCAI-26 fishbone is presented by Salls (1988:419-420, 733-735) in terms of identified specimen frequency and MNI.

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