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Late Period Hunting Adaptations on the North Coast of California

WILLIAM R. HILDEBRANDT

THE northwest coast of North America has been viewed as a distinctive culture area for many years (among others, Kroeber 1939; Drucker 1955; Elsasser 1978a). This can be attributed partially to the presence of abundant marine mammal resources and to their exploitation with sophisticated techniques. Although the most elaborate forms of marine-mammal hunting developed between Puget Sound and southern Alaska, marginal expressions extended south to the vicinity of Cape Mendocino (Elsasser 1978a). Despite limited ethnographic and archaeological information for the latter region, it is generally thought that there was a transition from marine-mammal hunting to more terrestrially oriented hunting south of the cape. The goals of the present study are to test whether or not this supposed geographic shift in economic orientation occurred and, if confirmed, consider potential explanations for it. To do so, a simple predictive model is constructed and tested against archaeological data from seven late period sites (Fig. 1).

Explored here are data derived from archaeological deposits estimated to postdate A.D. 1000: Point St. George (DNO-11), excavated by Richard Gould (Univ. of California, Berkeley) in 1964 (Gould 1966); Stone Lagoon (HUM-129), excavated by David Fredrickson (Sonoma State Univ.) in 1976 and 1978 (Milburn et al. 1979); Patrick's Point

(HUM-118), excavated by Robert Heizer (Univ. of California, Berkeley) in 1948 (Elsasser and Heizer 1966); Gunther Island (HUM-67), excavated by L. L. Loud (Univ. of California, Berkeley) in 1913 (Loud 1918); and the Mattole River (HUM-175, -176, -177, MM-5), Spanish Flat (HUM-277, -279, -281), and Shelter Cove (HUM-182, -184, -186, -248) sites, excavated by Valerie Levulett (Univ. of California, Davis) in 1976 and 1977 (Levulett n.d.). Since the eleven sites investigated by Levulett form three spatially distinct groups, for present purposes the tightly clustered sites comprising each group are treated collectively, with each considered to represent a single site complex (for a description of the original site-specific data, see Hildebrandt [1981]).

The initial objective of this study is to construct a model of general resource availability. Relevant mammalian resources are then considered in light of the various hunting techniques that were potentially available for resource exploitation. Alternative procurement strategies are evaluated by examining the range of possible combinations of resources and hunting techniques. Each combination has discrete archaeological consequences that can be compared to extant archaeological data. Finally, the combination that best fits the data—and inferred to be the probable prehistoric hunting strategy—is evaluated in terms of the variables that may have led to its adoption.

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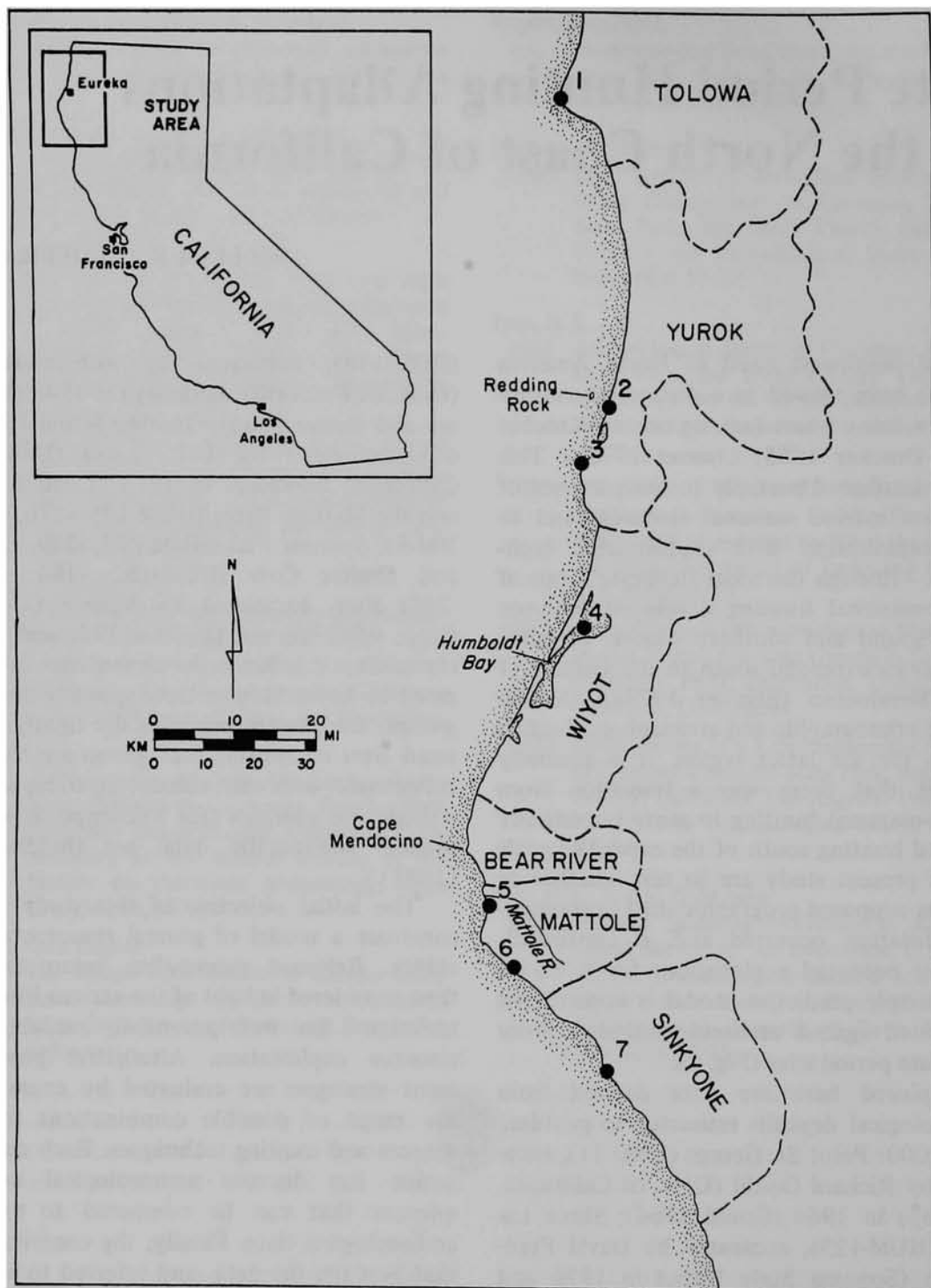


Fig. 1. Map of study region and archaeological sites discussed in text: (1) Point St. George; (2) Stone Lagoon; (3) Patrick's Point; (4) Gunther Island; (5) Mattole River; (6) Spanish Flat; (7) Shelter Cove; dashed lines indicate ethnographic boundaries.

Two major hunting strategies are emphasized (cf. Jochim 1976; Hildedrandt 1981):

- searcher predator that travels through the environment cleaning a wide range of prey
- pursuer predator that exploits a specialized resource highly predictable over space and time.

The searcher strategy is optimal in environments containing dispersed resources, while the pursuer strategy is optimal in environments containing clumped resources. This distinction is of significance for considering the possible forms of work organization that were directly associated with particular hunting techniques. More specifically, it is suggested that the pursuer strategy was more effectively carried out by large, organized groups of people, while the searcher strategy was more effective when carried out by small groups or individuals.

BEHAVIOR AND DISTRIBUTION OF PREY SPECIES

The resource availability model is based on behavioral data for seven prey species: Roosevelt elk, black-tail deer, stellar sea lion, California sea lion, northern fur seal, harbor seal, and sea otter.

Roosevelt Elk (*Cervus canadensis roosevelti*)

Roosevelt elk live in herds, the sizes of which are a function of the available resources and the seasonal phase of the reproductive cycle. Herds usually consist of 10 to 25 animals, but on rare occasions may contain 40 to 50 members (Graf 1955; Harper, Bentley, and Yocum 1967).

In northwest California, these elk favor habitats characterized by high rainfall and thick timber interspersed with small grassland prairies and marshland (Graff 1955; McCullough 1969). It is common for herds to live in

the interior during the fall, winter, and spring, and during summer to migrate to the coastal prairies where fog keeps grasses lush (Graf 1955; P. Smith, personal communication 1978).

In California, bulls can reach weights near 400 kg. Females are smaller, weighing up to 290 kg. (Harper, Bentley, and Yocum 1967).

Black-tail Deer (*Odocoileus hemionus colubianus*)

Black-tail deer are behaviorally quite different from Roosevelt elk. The deer are a non-migratory species that favors a brushy, ecotonal environment as opposed to dense climax forest. Rather than forming large herds, black-tail deer live in small groups that are spatially highly dispersed. In areas of good food, cover, and water, the home range of does, yearlings, and fawns averages less than a half-mile in diameter, while bucks usually have a larger range of about three-quarters of a mile (Dasmann 1953; Taber 1965).

Bucks can weigh up to 70 kg., does slightly less (Ingles 1965; Taber 1965).

Stellar Sea Lion (*Eumetopias jubata*)

The breeding range of the stellar sea lion extends from the Bering Straits to the Channel Islands of southern California. In spring, males of reproductive age arrive in California to battle other males over the scarce mating grounds on offshore rookeries. Anticipating the arrival of receptive females, dominant bulls establish their territories by the end of May (Daugherty 1965; Orr and Poulter 1967; Mate 1975). Female stellar sea lions begin to arrive in early June and reach their maximum numbers in July. Soon after their arrival, pupping occurs at which time they again become fertile and begin to breed.

During the breeding season, only females and subordinate males leave the rookery in search of food. Infants do not develop the

physical ability to swim until the end of July and dominant males will not leave their territories until breeding has been accomplished. As a result of these behavioral characteristics, stellar sea lions represented a productive late spring/early summer (Maxwell 1967; Orr and Poulter 1967; Gentry and Withrow 1978) resource for hunter-gatherers in northwest California. By the end of summer, all males leave California and females and young are much reduced in number (Mate 1975).

Mature stellar sea lion males often exceed three meters in length and can weigh up to 900 kg. Mature females are much smaller, measuring a little over two meters in length and weighing 270 kg. (Scheffer 1958; Bryden 1972; Gentry and Withrow 1978).

California Sea Lion **(*Zalophus californianus*)**

The California sea lion ranges from central Mexico to Vancouver Island (Bartholomew and Boolootian 1960; Bigg 1973). Their breeding grounds are located primarily in Baja California and rarely occur north of Point Piedras Blancas—approximately 50 mi. south of Big Sur on the coast of central California (Scheffer 1958; Mate 1978). Mating occurs between May and August and, as a result, during late spring and early summer California sea lions should be minimally present along the northern California coast (Peterson and Bartholomew 1967; Morejohn 1968; Mate 1975). As the breeding season ends, the males move north for the winter, regularly being observed in the vicinity of Vancouver Island and on the coast of northern California. Although little is known about the distribution of female sea lions during winter, they are not known to go north of the San Francisco Bay area (Morejohn 1968; Bigg 1973; Mate 1975).

Large male sea lions can weigh up to 360 kg. and reach lengths of 2.5 m. Females are

smaller, usually no longer than 1.6 m. and weighing no more than 110 kg. (Scheffer 1958; Mate 1978).

Northern Fur Seal **(*Callorhinus ursinus*)**

Northern fur seals range from Alaska to the central coast of California. Their breeding grounds are generally restricted to islands off the coast of Alaska (Kenyon and Wilke 1953). The majority of pups are born by mid-July and remain at the rookery until fall. As the days become cooler, immature males and all females migrate south. Many travel as far south as the central California coast where they are usually observed between the months of November and March (Brooks 1937; Hanna 1951). During the southern migration, the seals remain offshore unless they become sick or injured (Jewett 1921; Starks 1922; Hall 1940; Scheffer 1958; Fiscus 1978).

Large male northern fur seals may reach lengths of 2.2 m. and weights in excess of 270 kg. Females are much smaller, reaching 1.5 m. in length and weighing up to 65 kg. (Scheffer 1958; Bryden 1972; Fiscus 1978).

Harbor Seal **(*Phoca vitulina*)**

The non-migratory harbor seal occurs from the Bering Sea to islands off the coast of Baja California (Scheffer 1958; Newby 1978). Breeding usually takes place in September (Daugherty 1965), and parturition the following spring (Bigg 1969). Because pups are able to swim immediately after birth, they can be delivered in the ocean. As a result of this important adaptation, there is no time when the harbor seal is necessarily restricted to a terrestrial habitat. In addition, Peterson and Bartholomew (1967) noted that, due to the fine vision of this animal, observation of it is quite difficult from close range because the seals flee into the water when an approaching human is sighted (such a reaction has been

triggered and observed by the author). In light of such behavior, wakeful harbor seals may have been a difficult animal for hunter-gatherers to hunt.

Male harbor seals can reach two meters in length and weigh up to 120 kg. Females are of nearly the same size, with lengths up to 1.6 m. and weights reaching 110 kg. (Scheffer 1958; Bryden 1972).

Sea Otter (*Enhydra lutris*)

The non-migratory southern sea otter, now generally restricted to the California coast between Santa Barbara and somewhere north of Santa Cruz, was formerly abundant as far south as Baja California and as far north as Oregon and perhaps Washington (Scammon 1974). Little is known of the reproductive behavior of this animal. However, Miller (1974) estimated that the gestation period is eight to nine months. Although no births have been witnessed in California, more pups seem evident from December through March (Wild and Ames 1974).

Of all the animals thus far considered, the otter appears to spend the least amount of time onshore (Miller 1974). However, ethnographic sources (e.g., Kroeber and Barrett 1960) indicate that otters were often found sleeping afloat and thus readily accessible to the maritime hunter.

Male sea otters reach lengths of two meters and weigh up to 45 kg. Females are only slightly smaller, with lengths of 1.7 m. and weights of 35 kg. (Kenyon 1978).

RELATIVE IMPORTANCE OF PREY SPECIES

Seven vegetation communities are thought to have been present in the study region during late prehistoric times. These consist of mixed evergreen forest, coastal prairie, red-

wood forest, Sitka spruce - grand fir forest, coastal salt marsh, beach and dune, and coastal cypress - pine forest (Kuchler 1977). As mentioned previously, deer favor a brushy, ecotonal habitat that includes acorn-bearing oak groves. In the study region, oak and shrubby underbrush are abundant only in the mixed evergreen forest. Elk favor humid climax forests interspersed with grassland and marsh. Such habitats are more common in the redwood forest, Sitka spruce - grand fir forest, coastal cypress - pine forest, coastal salt marsh, and coastal prairie vegetation communities.

Table 1 describes the areal extent, on a percentage basis, of elk and deer habitats within a 16-km. radius of each of the seven subject archaeological sites. Although somewhat arbitrary, the figure of 16 km. was selected in light of ethnographic data (Gould 1975) suggesting that hunter-gatherers in northwest California routinely foraged inland 8-24 km. from coastal sites. The data arrayed in Table 1 show that northern areas of the study region are dominated by the climax forest - prairie - marsh complex (elk-favored), while in the extreme south the mixed evergreen forest is dominant. Mattole River lies in a transitional area where relatively equal amounts of both habitats can be found. Assuming a simple, direct relationship between local vegetation, game, and prehistoric dietary patterns, therefore, the remains of elk should dominate the faunal assemblages at the northern sites (Point St. George, Stone Lagoon, Patrick's Point, Gunther Island), those of deer should be dominant at the southern sites (Spanish Flat, Shelter Cove), and both species should be more-or-less equally represented in the faunal record at Mattole River.

Behavioral data on the five marine mammals discussed above are summarized in Table 2. Of the five, stellar sea lions would have been the most accessible to late-period hunters because they breed in the study region

Table 1
AREAL EXTENT (%) OF ELK AND DEER HABITATS WITHIN
A 16-KM. RADIUS OF STUDY SITES

Vegetation Community	Roosevelt Elk	Black-tail Deer	beach and dune
	climax forests (redwood, Sitka spruce - grand fir, coastal cypress - pine), coastal prairie, coastal salt marsh	mixed evergreen forest	
Archaeological Site			
Point St. George	89	-	11
Stone Lagoon	99	--	1
Patrick's Point	99	-	1
Gunther Island	92	-	8
Mattole River	48	52	--
Spanish Flat	9	91	-
Shelter Cove	20	80	-

Table 2
RELATIVE AVAILABILITY OF MARINE MAMMALS IN STUDY REGION

		Ranking:				
		1 Stellar Sea Lion	2 Harbor Seal	3 Sea Otter	4 California Sea Lion	5 Northern Fur Seal
Seasonal presence						
winter/spring	male		X	X	X	X
	female	X	X	X		X
late spring/summer	male	X	X	X		
	female	X	X	X		
fall/winter	male		X	X	X	X
	female	X	X	X		X
Reproduction						
in region	aquatic		X	X		
	terrestrial	X				
not in region					X	X
Ages/sexes present						
male	immature	X	X	X		X
	mature	X	X	X	X	
female	immature	X	X	X		X
	mature	X	X	X		X
Haulout?						
yes		X	X		X	
no				X		X

and, while breeding, mature males and infants are restricted to the rookeries. Although harbor seals and sea otters are year-round residents, in terms of relative availability they rank second and third because of their ability

to breed and give birth in the water. Sea otters rank lower than harbor seals because they rarely, if ever, haulout (come out of the water). California sea lions and northern fur seals are the least available because they breed

outside the study region and only portions of their populations are present on a seasonal basis. Northern fur seals rank lower in availability than California sea lions because they do not haulout.

Therefore, given the differences in the relative availability of marine mammals in the study region, it seems reasonable to expect that late-period hunters specialized on stellar sea lions in those areas where they breed. Conversely, marine-mammal hunting should have been more diversified in areas where the stellar sea lion does not breed. It must also be noted that the availability ranking in Table 2 assumes an even distribution of rookeries throughout the region. This is not the case. Rookeries are associated with only four (Point St. George, Stone Lagoon, Patrick's Point, Mattole River) of the seven sites (Bonnot 1928; Hildebrandt 1981).

In comparing the prehistoric importance of terrestrial- versus marine-mammal resources in the study region, two factors need to be taken into account. First, the dense climax forests north of Cape Mendocino contain a lower percentage of edible vegetation than does the mixed evergreen forest south of the cape. Hence, the large-game (elk/deer) carrying capacity should be much lower in the north than in the south. Second, three of the four northern sites are associated with abundant marine-mammal resources (i.e., breeding grounds), while two of the three sites south of Cape Mendocino lack associated rookeries.

The behavioral data on the seven prey species considered suggest that the three northernmost sites (Point St. George, Stone Lagoon, Patrick's Point) should contain faunal assemblages indicating a greater emphasis on marine as opposed to terrestrial mammal species. The assemblages should also feature relatively low levels of species diversity. Finally, because both marine and terrestrial prey in the northern part of the study region are

clumped (sea lion breeding harems, elk herds), and their aggregations predictable in space and time (annual offshore breeding grounds, migration trails), it can be expected that evidence of a pursuer hunting strategy and complex work organization can be found at the three northern sites.

Exactly the opposite situation is anticipated for the two southernmost sites (Spanish Flat, Shelter Cove). Terrestrial game appears to be far more abundant than marine game in the area, and both resources are generally dispersed (lack of marine-mammal breeding grounds, large deer population). Thus, faunal remains at the two sites should show relatively high levels of species diversity; and evidence can be expected of a searcher hunting strategy carried out by individuals or possibly small groups without formal organization.

All other things being equal, an intermediate form of these two opposing patterns (pursuer strategy/low species diversity vs searcher strategy/high species diversity) should be reflected in the archaeological record at the two sites immediately north and south of Cape Mendocino (Gunther Island, Mattole River).

ETHNOGRAPHIC HUNTING TECHNIQUES

Jobson and Hildebrandt (1980), Hildebrandt (1981), and Hudson (1981) have reviewed the techniques used to hunt marine mammals on the northern California coast. Results of their studies suggest that north of Humboldt Bay, where offshore rookeries beyond the reach of swimmers are common, oceangoing canoes and composite harpoons were employed to exploit these resources. In contrast, at Humboldt Bay and to the south, where offshore rookeries are rare, small canoes, rafts, or swimmers were used to procure inshore resources. Archaeologically, the former mode of exploitation is thought to be represented by composite harpoon tips and the remains of pelagic fish species. Evidence

considered indicative of the latter mode of exploitation includes the lack of harpoons and the predominance of intertidal fish species in faunal assemblages.

In terms of terrestrial hunting, available ethnographic data generally support the habitat-derived predictions of geographic variability in deer- and elk-hunting patterns. However, most of this variability cannot be directly related to artifactual differences between archaeological deposits. Drive fences, snares, and other types of traps are difficult to find and document. Flaked stone projectile points and butchering tools do preserve, but their relative importance in identifying hunting patterns is hard to measure given the absence of material indicators of alternative hunting techniques. Further, relative to the subject sites, primary terrestrial hunting areas were probably located in the interior and are thus beyond the scope of this investigation. Faunal remains, consequently, constitute the principal source of information on terrestrial hunting patterns in the study region.

QUANTIFICATION OF FAUNAL REMAINS

Before presenting and testing the alternative implications of a general resource availability model, some of the methods available for quantifying faunal remains need to be discussed. Four are of interest: minimum number of individuals, raw counts, butchering units, and corrected weights.

Minimum number of individuals (MNI) is the most commonly used method. Essentially, it involves counting the most frequent, unique bone element from a taxonomic group and designating that number as the MNI value. Some of the problems with the method are: (1) accuracy of MNI values vary with sample size—Grayson (1978) demonstrated that very large samples tend to underestimate the importance of major taxa; (2) MNI values vary according to the analytical unit chosen—the value calculated using an entire site as the unit

of analysis will be lower than the overall site value computed when each excavation unit at the site (and/or each stratigraphic or arbitrary excavation level in that unit) is treated as a separate unit of analysis, stemming from the fact that MNI calculation takes place only once when the site is the analytical unit, but occurs repeatedly when individual excavation units / levels are the analytical units and their corresponding MNI counts are summed to obtain an aggregate MNI value for the site (Grayson 1973, 1979); and, (3) the method has no way to deal with the probability that not all individuals are represented in a MNI value—due to this handicap, the method ignores most of the identified bone and always underestimates the absolute number of animals represented (Guilday 1970).

The raw counts method—totaling of all identified bone fragments per taxon—is also commonly employed. Here the intent is to judge relative relationships among taxa without regard for absolute animal numbers. Three basic problems with the method are (Daly 1969): (1) it does not take into account that different animals have different numbers of skeletal elements; (2) it must be assumed that bones from different animals are equally distinguishable and anatomically identifiable; and, (3) bone fragmentation, either before or after deposition, is assumed to be constant regardless of species or provenience.

An improvement over MNI and raw counts methods is the butchering unit concept. Lyman (1979: 539) defined a butchering unit as:

A piece of the animal body that results from the act of butchering; consumption is of butchering units and not of complete animals in many cases, particularly if the animal is large.

Lyman (1979) noted that the actual butchering units used may be difficult to recognize in the archaeological record and, in such situations, an arbitrary measure can be employed

(e.g., skeletal portion). Once a butchering unit or skeletal portion has been defined, the amount of meat it represents is calculated using an appropriate conversion factor. Variables such as age, sex, and habitat must be considered in the derivation and application of such conversion factors (Smith 1975; Casteel 1978). Assuming selection of a proper conversion factor, a second problem involves transformation of raw faunal data into meaningful butchering units. Either of the quantitative methods discussed above could be used, but their inherent problems limit their utility. The minimum number of butchering units will continue to vary as a function of sample size and the unit of analysis. Also, the probability that the number of butchering units estimated does not account for all bone (i.e., all individuals) remains unknown and, as a result, most of the identified bone continues to be ignored (although not so much as when entire individuals are used as the units of analysis). The raw counts method also continues to overrepresent highly fragmented bone. For example, if a tibia is defined as the butchering unit and two non-articulating fragments of the same tibia are found in an archaeological deposit, the raw counts method would incorrectly calculate the presence of two butchering units.

These problems can be reduced with the use of the corrected weight method. This approach attempts to estimate the amount of meat (by weight) represented by a given amount (weight) of bone by using, again, an appropriate conversion factor. In the case of the broken tibia, if the ratio of meat weight to bone weight in tibias is known, conversion of the total bone weight of the two fragments to their potential total meat weight would yield a more accurate food measure. In contrast to the problems associated with the MNI and butchering-unit methods, if meat-to-bone weight ratios were known for all skeletal elements and for all species, all

identified bone could be used to estimate species-specific dietary contributions.

The corrected weight method, although superior to the others, is not without its problems. Casteel (1978), using data on the remains of butchered domestic pigs, argued that the ratio of meat to bone does not remain constant over the lifetime of an animal, thus making it difficult to develop and apply simple conversion factors. However, this problem may not be as critical among wild animals not subjected to modern husbandry practices.

In that meat-to-bone ratios per skeletal element have not been determined for many of the species most pertinent to prehistoric study, rough ratios for the entire skeleton will be used here to estimate the dietary contribution of particular prey species. The data will be manipulated according to the following equation (Ziegler 1973):

$$\frac{\text{average edible meat weight}}{\text{average skeletal weight}} \times \text{archaeological bone weight} \\ = \text{economic (food) potential (by weight)}$$

The meat-to-bone ratios for elk and deer are relatively comparable. Usable, unbled meat generally makes up 47% of the total body weight, whereas bone makes up about 10%. As a result, in this study the meat-to-bone ratio for elk and deer will be 4.7:1 (Ziegler 1973; Hakonson and Whicker 1971).

Marine mammals have a slightly higher unbled meat-to-bone ratio because the buoyancy of water reduces the demand for skeletal support, hence total bone weight accounts for a lower proportion of total body weight. Unbled meat constitutes approximately 38% of the total body weight, while bone contributes roughly 7%. Therefore, the marine mammal meat-to-bone ratio applied here will be 5.4:1 (Howell 1929; Bryden 1969, 1972).

ALTERNATIVE MODELS AND TESTS

A total of 2800 skeletal elements was identified at the seven sites considered. Table 3 presents the raw data (counts and weights). Tables 4-7 provide data in terms of corrected meat weights, expressed in terms of relative (%) representation at each site.

Insofar as marine mammals are concerned, hunters from all sites adjacent to rookeries (with the exception of Mattole River where the rookery is inshore) would have had to use oceangoing canoes to reach them. Therefore, at these three sites (Point St. George, Stone Lagoon, Patrick's Point) stellar sea lion remains should dominate the faunal assemblage to the near exclusion of other marine species. Alternatively, if oceangoing canoes were not used, species other than stellar sea lion should be relatively well-represented in the faunal collection.

As can be seen in Table 4, corrected meat weight data for sites situated near rookeries generally conform to the expected pattern—with the exception of Stone Lagoon. Point St. George, Patrick's Point, and Mattole River sites all show a predominance of stellar sea lion remains. At Patrick's Point, sea otter and northern fur seal remains are more abundant than expected. This could possibly reflect a local emphasis on procuring sea otter pelts, or hunters by chance encountering northern fur seals while on the ocean.

The unexpectedly abundant relative representation of northern fur seals at Stone Lagoon is most intriguing. As noted earlier, females and juveniles are found on the northern California coast only in winter and do not normally come to shore unless sick or injured. Further, no skeletal elements were found at the site that clearly indicated the presence of mature males, infants, or fetuses. Since necessarily intensive open-sea exploitation to account for their significant representation in the faunal record at Stone Lagoon appears

unlikely, as an alternative explanation it is proposed that northern fur seals used Redding Rock six miles off the coast as a resting area.

Corrected marine-mammal meat-weight data are presented on a relative basis in Table 5 for the three sites not associated with rookeries. Cultural deposits at these sites lack composite harpoon tips, and their faunal assemblages should reflect more - or - less equal contributions of the different species—bearing in mind differences attributable to relative species availability (Table 2).

At Gunther Island, the faunal assemblage shows the expected reduction in stellar sea lions, a virtually equal representation of stellar sea lions and harbor seals, a moderate occurrence of sea otters, and the complete absence of California sea lions and northern fur seals. The latter undoubtedly reflects the bay location of the site. Unlike stellar sea lion, harbor seal, and sea otter, California sea lion and particularly northern fur seal are marine-mammal species that rarely enter northern California bays. Bay habitats are favored by harbor seals and sea otters.

The greatest mix of marine-mammal faunal remains is found at Shelter Cove. This is well illustrated by the comparatively abundant representation of California sea lion, sea otter, and northern fur seal. Although a corrected meat-weight contribution of 7.9% is not extremely high relative to the total faunal assemblage, the nonetheless notable contribution of the northern fur seal is difficult to explain in light of its known behavioral characteristics. One potential reason is that a certain, regular percentage of these animals haul out during their winter migrations. California sea lions were probably taken under similar circumstances.

Marine mammals are poorly represented at Spanish Flat (only 17 elements). Stellar sea lion comprises the vast majority of faunal remains, with the remainder consisting solely of sea otter.

Table 3
RAW FAUNAL COUNTS AND WEIGHTS

Prey Species	Point St. George		Stone Lagoon		Patrick's Point		Gunther Island		Mattole River		Spanish Flat		Shelter Cove		Total	
	n	wt.*	n	wt.	n	wt.	n	wt.	n	wt.	n	wt.	n	wt.	n	wt.
Stellar Sea Lion	253	12,689	22	552	26	1,537	21	1,133	76	949	9	129	36	327	443	17,316
California Sea Lion	9	278	4	60	2	82	-	-	6	70	-	-	5	153	26	643
Harbor Seal	4	53	1	6	-	-	31	1,133	22	46	-	-	8	22	66	1,260
Sea Otter	38	201	8	35	17	272	15	133	5	31	8	23	33	95	124	790
Northern Fur Seal	1	16	74	440	6	142	-	-	1	8	-	-	5	51	87	657
Deer	8	133	27	154	9	91	30	853	119	453	283	731	240	727	716	3,142
Elk	36	1,297	32	212	23	1,764	89	2,559	14	370	-	-	11	64	205	6,274
Pinniped**	748	22,694	70	249	2	101	20	176	124	318	45	134	5	21	1,014	23,693
Cervid**	-	-	-	-	2	15	-	-	-	-	-	-	-	-	2	15
Other	6	85	16	8	1	12	-	-	28	13	41	209	25	80	117	407
Total	1,103	37,446	254	1,716	88	4,016	206	5,987	395	2,266	386	1,226	368	1,540	2,800	54,197

*All weights in g.

**Elements not identifiable at species level.

Table 4
RELATIVE REPRESENTATION (%) OF MARINE MAMMALS
IN FAUNAL ASSEMBLAGES AT SITES ASSOCIATED WITH ROOKERIES*

Prey Species	Point St. George	Stone Lagoon	Patrick's Point	Mattole River
Stellar Sea Lion	95.7	50.5	75.6	86.0
California Sea Lion	2.1	5.5	4.0	6.3
Harbor Seal	0.4	0.5	-	4.2
Sea Otter	1.5	3.2	13.7	2.8
Northern Fur Seal	1.1	40.3	7.0	0.7

*Based on corrected meat weight method.

Table 5
RELATIVE REPRESENTATION (%) OF MARINE MAMMALS
IN FAUNAL ASSEMBLAGES AT SITES NOT ASSOCIATED WITH ROOKERIES*

Prey Species	Gunther Island	Spanish Flat	Shelter Cove
Stellar Sea Lion	44.7	84.9	50.8
California Sea Lion	—	--	23.8
Harbor Seal	44.8	—	3.4
Sea Otter	10.5	15.1	14.1
Northern Fur Seal	--	—	7.9

*Based on corrected meat weight method.

Table 6
RELATIVE REPRESENTATION (%)
OF TERRESTRIAL MAMMALS
IN FAUNAL ASSEMBLAGES*

Archaeological Site	Roosevelt Elk	Black-tail Deer
Point St. George	90.7	9.3
Stone Lagoon	57.9	42.1
Patrick's Point	92.7	7.3
Gunther Island	75.0	25.0
Mattole River	45.5	54.5
Spanish Flat	--	100.0
Shelter Cove	8.1	91.9

*Based on corrected meat weight method.

Table 7
RELATIVE REPRESENTATION (%)
OF MARINE AND TERRESTRIAL
MAMMALS IN FAUNAL ASSEMBLAGES*

Archaeological Site	Marine	Terrestrial
Point St. George	96.5	3.5
Stone Lagoon	80.5	19.5
Patrick's Point	65.7	34.3
Gunther Island	23.9	76.1
Mattole River	65.9	34.1
Spanish Flat	25.9	74.1
Shelter Cove	38.6	61.4

*Based on corrected meat weight method; not restricted

Outside of Gunther Island, the relatively minimal representation of harbor seals in the faunal assemblages at all other sites may be attributable to their superior vision, escape behavior, and preference for bay habitats (cf. Peterson and Bartholomew 1967).

With respect to terrestrial game, if Roosevelt elk and black-tail deer were exploited in proportions reflective of the hypothesized relative availability of these animals, then the faunal data displayed in Table 6 should show a dominance of elk at the four northernmost sites, more-or-less equal representations of each species at Mattole River, and a dominance of deer at the two southernmost sites. On the whole, the archaeofaunal data correspond rather well with the expected patterning. The correlations become even more clear when relative, corrected meat-weight data are collapsed and partitioned into three geographic categories: north of Cape Mendocino, Mattole River, and south of Cape Mendocino (respectively, for elk: 79.1%, 45.5%, and 4.0%; for deer: 20.9%, 54.5%, and 96.0%).

As discussed earlier, habitat and behavioral data suggest that elk/deer carrying capacity was lower and marine-mammal resources more abundant north of Cape Mendocino than to the south. Assuming the use of oceangoing canoes, intensive exploitation of offshore rookeries near the three northernmost study sites (Point St. George, Stone

Lagoon, Patrick's Point) should be evident in relatively high marine - to - terrestrial mammal ratios in the faunal assemblages at these sites. Conversely, if offshore rookeries were not exploited with the use of oceangoing canoes, then the faunal assemblages at the three sites should be comparable to those characterizing the two southernmost study sites (Spanish Flat, Shelter Cove)—i.e. relatively low marine - to - terrestrial mammal ratios.

Although it lacks a rookery association, Gunther Island is located in an area with the greatest terrestrial biomass of the four sites north of Cape Mendocino. Consequently, the marine - to - terrestrial mammal ratio in the faunal assemblage at the site should be comparable to those of Spanish Flat and Shelter Cove. Given an association with relatively abundant marine and terrestrial resources, Mattole River should display a faunal configuration falling somewhere in between the northern and southern extremes.

Generally, as can be seen in Table 7, the expected marine - to - terrestrial mammal ratios are confirmed for six of the seven sites under consideration. Marine mammals dominate the faunal assemblages at the three northernmost sites, while terrestrial mammals are dominant in the faunal collections from the two southernmost sites. Gunther Island displays the expected low representation (23.9%) of marine mammals. The only exception to the predicted general pattern is Mattole River, where the faunal assemblage shows a slightly higher marine - to - terrestrial mammal ratio than was anticipated.

SEARCHER VERSUS PURSUER HUNTING STRATEGIES

It was proposed earlier that because both marine and terrestrial resources in the northern part of the study region are clumped and their occurrences predictable in space and time, a pursuer hunting strategy should be

evidenced by faunal assemblages that display relatively low levels of species diversity. Conversely, it was also proposed that because both marine and terrestrial resources in the southern part of the region are generally dispersed, a searcher hunting strategy should be evidenced by faunal assemblages that display relatively high levels of species diversity.

In terms of terrestrial game, 3.3% of the identified faunal remains (corrected meat weight method) from sites north of Cape Mendocino represent species other than elk or deer. At the two southernmost sites, species other than elk or deer account for 15.7% of the identified bone. Thus, for six of the seven study sites the pursuer vs. searcher propositions seem to hold for terrestrial game. Again, however, Mattole River deviates from the expected pattern—only 2.8% of the identified faunal remains are represented by species other than elk or deer. In contrast to year-round occupation of the other sites, this could reflect occupation of the Mattole River area during only the spring and summer when the associated inshore stellar sea lion rookery would have been intensively exploited (Hildebrandt 1981). Specialized hunting of stellar sea lions would also help account for the unexpectedly low representation of terrestrial mammals in the faunal record (Table 7).

In terms of marine game, a comparable north-south gradient in faunal assemblage patterns is not evident due to the variability in associated habitats at sites near the center of the study region (i.e., lack of rookery at Gunther Island, presence of inshore rookery at Mattole River). However, when sites associated with rookeries are treated collectively, 26.1% of the identified faunal remains consist of species other than stellar sea lion. Conversely, 40.0% of the identified bones at sites not associated with rookeries is made up of species other than stellar sea lion (this figure climbs to 52.2% if Spanish Flat is excluded—

only nine elements comprise the 84.9% corrected meat-weight value for stellar sea lion at the site [see Table 3]).

SOCIAL IMPLICATIONS

It seems apparent that the use of oceangoing canoes in hunting marine mammals probably did not occur south of or at Humboldt Bay. At the three study sites north of Humboldt Bay (Point St. George, Stone Lagoon, Patrick's Point), identified faunal remains are comprised of 80.9% marine mammal and 19.1% terrestrial mammal. Of the identified bone at the four remaining sites, marine mammals account for 38.6% and terrestrial mammals for 61.4%. Therefore, it would appear quite clear that late period hunting north of Humboldt Bay was dominated by the exploitation of offshore rookeries using oceangoing canoes.

Of all known late period hunting techniques and materials in the study region, the oceangoing canoe required by far the greatest organization of capital and labor. These vessels were usually owned only by wealthy men who possessed the necessary resources to support workers during canoe construction. As described by Gould (1968: 17-18):

it was incumbent upon the man who wanted the canoe built that he provide his assistants with gifts of food while they worked for him. At times when additional labor was called for (for example, when the redwood log was hauled up out of the water, or when launching took place), the headman would call together all his relatives both affinal and consanguinal, to assist [in construction]; Usually the headman was the only person in the village who could afford to feed large numbers of people in this manner, so it is not surprising that only wealthy headmen owned such boats.

To the south there are no ethnographic accounts of comparable industrial products or work organization. In addition, and perhaps

directly relatable to this pattern, Elsasser (1978b: 195) stated that among southern Athapascan groups the emphasis on wealth was much less developed than among the northern groups. He also concluded (1978b) that social stratification was probably less rigid among the former.

SUMMARY AND CONCLUSIONS

The results of this study suggest that, during the late period, terrestrial habitats north of Humboldt Bay were relatively low yielding and dominated by Roosevelt elk (herding/migratory species). Areas south of the Mattole River contained greater terrestrial biomass and were dominated by black-tail deer (dispersed/non-migratory species). Of the marine habitats within the study region, those in northern areas featured highly concentrated marine mammal resources in the form of stellar sea lion rookeries. Marine-mammal resources in southern areas were generally dispersed and, lacking breeding habitats, were relatively non-abundant.

In light of archaeofaunal assemblages and behavioral data on prey species, it appears that late period hunters in the southern part of the study region centered their attention on terrestrial mammals, while marine mammals were the focus of animal exploitation in areas further to the north. Given the spatial and temporal dispersion of mammalian resources south of the Mattole River, it is postulated that a "searcher" hunting strategy was followed. This generalist adaptation is characterized by individuals or small groups moving through the environment exploiting a wide range of resources. Given spatially and temporally clumped mammalian resources north of Humboldt Bay, it is postulated that a "pursuer" hunting strategy was followed. This specialist adaptation is characterized by large groups of people organized to exploit particular resources. A pursuer strategy is well

illustrated by the use of oceangoing canoes—the construction of which required substantial capital investment and labor.

Archaeological evidence from the two sites near the center of the study region, Gunther Island and Mattole River, does not meet the expectations of the general model considered here. This appears to be a result of the absence of a rookery at Gunther Island and the presence of one at Mattole River. Notwithstanding the potential of an environmental explanation, such ambiguity is to be expected in boundary areas by virtue of their very nature:

The weakest feature of any mapping of culture wholes is also the most conspicuous: the boundaries. Where the influences from two culture climaxes or foci meet in equal strength is where a line must be drawn, if boundaries are to be indicated at all. Yet it is just there that the differences often are slight. Two peoples classed as separate areas yet adjoining each other along the interarea boundary almost inevitably have much in common. It is probable that they normally have more traits in common with each other than with the people at the focal points of their respective areas. This is almost certain to be so where the distance from the foci is great and the boundary is not accentuated by any strong physical barrier of abrupt natural change [Kroeber 1939: 5].

Recognizing the habitat variability at Gunther Island and Mattole River and the general problem of cultural boundary delineation, it is concluded that marine-mammal hunting adaptations were dominant in the north and terrestrial-mammal hunting adaptations were dominant in the south. It is also concluded, in light of the present study, that an environmentally derived predictive model at least partially accounts for the variability found in the archaeological record. Ultimately, though, in order to gain a comprehensive understanding of indigenous adaptations, it will be necessary to consider the full

range of socioeconomic variables associated with activities other than hunting.

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