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Resource Distribution and Prehistoric Utilization of Southern Oregon's Coastal Islands

Abstract

The portion of the Oregon coast extending from Cape Blanco south into California has long been recognized as a unique physiographic region, resulting in distinct prehistoric subsistence and settlement patterns when compared with other coastal areas. Several researchers have proposed models emphasizing littoral adaptive strategies for this region but have failed to outline the type, distribution, and abundance of subsistence resources available to prehistoric populations. I propose that the abundant offshore rocks and islands along this section of coast served to concentrate marine resources and were, therefore, of economic importance to prehistoric populations. In particular, I demonstrate that 1) rocky coastlines are highly productive environments providing a variable, abundant, year-round food supply of immediate use to humans; 2) this high productivity can be directly related to the increased habitat provided by offshore rocks and islands; and 3) these offshore resources were utilized by prehistoric peoples. A combination of archaeological testing of one offshore island site and a sample survey of selected rocks and islands provides evidence of prehistoric utilization of offshore features. A majority of settlement/subsistence models tend to use observed site distributions to infer a region's relative biotic productivity, an inaccurate approach. This paper illustrates an alternate approach by determining the resources provided by a rocky coastline, inferring human use of those resources, and collecting archaeological evidence of that use.

Introduction

Archaeological research along the Oregon coast has been dominated by models emphasizing littoral adaptive strategies (Lyman and Ross 1988, Minor and Toepel 1983, Gould 1976, Draper 1988). Support for these models has been based principally on site distribution, or, in the case of Lyman and Ross (1988), on the high productivity of estuaries. While some notice has been given to latitudinal variation in coastal morphology, little attention has been paid to variation in the distribution, density, and variety of subsistence resources between the southern and northern portions of the coast. Draper's (1988) is the only model which directly addresses the unique rocky character of the southern Oregon coast and suggests that this region supported large, sedentary populations. He found that residential sites were concentrated within the marine habitat, with some sites less than 3 km apart. Sites also appeared to be associated with highly productive physical settings, the most frequently occupied being stream mouths and bluff/cliff areas (Draper 1988:318). Estuarine habitats exhibited the lowest site density. Draper infers a settlement pattern of sedentary villages located in areas where resources were predictably aggregated at known times of the year, with subsistence resources being harvested within the village's immediate vicinity. Because prime village locations (those in proximity to several habitats) are few, these locales exhibit nearly continuous occupation through time (Draper 1988).

All other models describe a land-use system where winter villages were occupied for a considerable portion of the year, with task groups moving annually to areas having predictable, concentrated resources. These locales could exist up to fifteen miles from the main village and were used for resource harvest and processing before transportation back to the main winter village. This process suggests a heavy wintertime reliance on stored foods and the need to maintain a large catchment area (Gould 1976, Lyman and Ross 1988, Minor and Toepel 1983).

Draper's work suggests that rocky coasts are more productive in terms of usable foodstuffs than previously considered. In this paper I propose that rocky coastlines are highly productive settings capable of supporting Draper's settlement/subsistence model. The offshore rocks and islands served to attract and concentrate subsistence resources important to indigenous hunter-gatherers and may account for these higher observable site densities. I provide the first evidence for prehistoric utilization of offshore islands there.

Instead of using site distribution and/or density as an implied measure of a region's productivity, I focus on the availability and distribution of subsistence resources and from this information suggest the most likely settings for resource extraction. This appears to be a promising tool for deciphering prehistoric land use patterns.

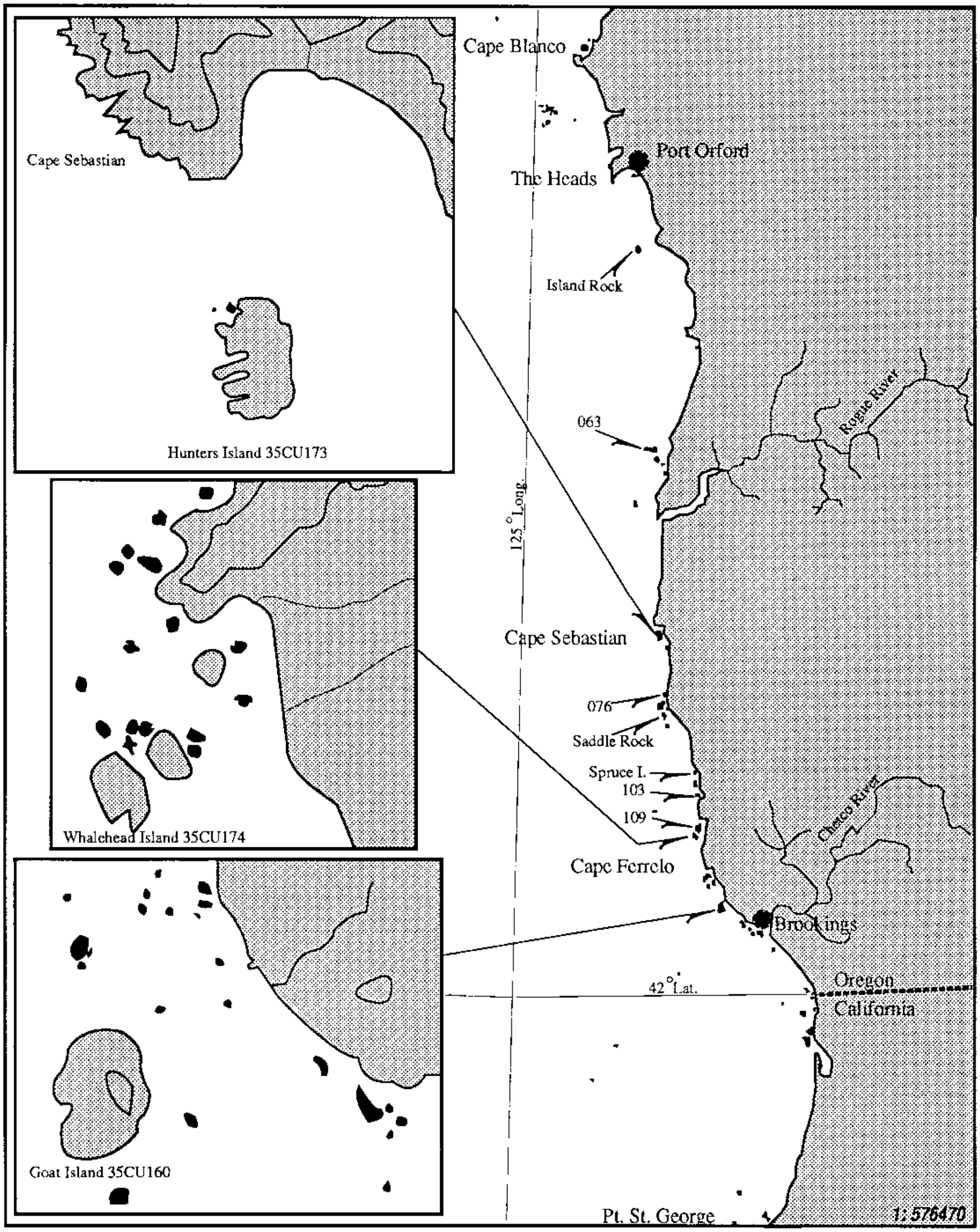

Figure 1. Study area with insets of offshore islands containing archaeological sites.

Setting

The coastline from Cape Blanco south into northern California is physiographically distinct from the remainder of the Oregon coast (Figure 1). Its unique geologic origin is reflected in the character of the coastline. The southwestern corner of Oregon and the northwestern corner of California fall within the Klamath Mountain region of the

Pacific border province (Fenneman 1931). Bounded on the north and south by the Oregon and California coast ranges respectively, on the east by the Cascade Mountain ranges, and by the Pacific Ocean along the western edge, the Klamath Mountains have twice the relief of the Coast Ranges and more rugged topography than the Cascade Range (Dicken 1965). Canyons tend to be narrow and are separated by east/west trending, knifelike ridges, with relief ranging from 600 to 1,500 m (Baldwin 1976). The coastline is rugged and rocky, with steep sea cliffs, narrow, coarse gravel beaches (when they occur), and numerous offshore islands and rocks (Dicken 1961). Extensive, well-developed marine terraces occur throughout the region.

With the exception of the Rogue River, which has its headwaters in the Cascade Mountains, the numerous coastal streams and rivers originate in the Klamath Mountains. Typically, they have a dendritic drainage pattern, relatively short courses, steep gradients, and a low sediment load (Oceanographic Institute of Washington, [OIW] 1977). The Rogue and Chetco rivers are the largest drainage systems of the region and are the only rivers with significant estuaries (U.S. Army Corps of Engineers [ACE] 1971). Recent tectonic uplift within the Klamath Mountains has resulted in downcutting and stream channelization. Tidal influence rarely extends inland more than 1.5 km (OIW 1977). This can be contrasted with broad, drowned river valleys of the northern coast, with their 24 to 32 km inland tidal influence. The southern coast comprises over one-fifth of the total coastline of the state, yet contains only 2% of the estuarine shoreline.

In general, before the arrival of Euro-Americans, coastal cliffs, headlands, and islets were covered with low grasses, sedges, and herbs, with height and density of vegetation increasing inland and culminating in a dense climax forest. The diverse, rich plant communities found within the study area provide abundant habitat for terrestrial wildlife (Franklin 1981), while the rugged, rocky coastline contributes to a plethora of marine organisms, waterfowl, and seabirds. Coastal streams support anadromous fish and provide fresh water habitat.

Rocks and Islands of Southern Oregon

One of the unique features of the coast of southern Oregon is the preponderance of offshore rocks, sea stacks, and islands. While often cited as contributing to the beauty of the area, no archaeologist has previously considered that these features may have had a direct influence on overall productivity and resource abundance. I define offshore islands and rocks as those surrounded by water even during minus tides, a critical distinction, allowing these features to provide essential habitat components. Further, to be considered an island rather than a rock, a feature must exhibit vegetation or soil development. Onshore islands and rocks, on the other hand, are those accessible dry-shod at low tide. That these onshore features were utilized by prehistoric inhabitants has been documented, but they represent a separate habitat assemblage and are not considered here.

Gould (1966, 1976) documents prehistoric utilization of some rocks off Point St. George. A large sea lion rookery was exploited, and cormorant fledglings were harvested from nearshore rocks. Several researchers (Berreman 1944, Chase 1873, Ross 1977, Schumacher 1877a, 1877b) note the association of offshore rocks with large mainland village sites. Heflin (1966:162) cites an unpublished work by T. T. Waterman stating that an island known as *Maski,* now called Hunters Island, was used for hunting otters and collecting cormorant and gull eggs. Heizer (1951) reports an island used for religious purposes off of Patrick's Point, California. Draper (1988:321) notes the presence of four archaeological sites on coastal islands, considering them extensions of headland ecological communities. Given the placement of three of these sites—Eagle Rock (35 CU 94), Harris Beach (35 CU 80), and Zwagg Island (35 CU 94), this interpretation is probably correct since these are onshore rocks, some of which are surrounded by water only at extreme high tides. Of these, Goat Island (35 CU 160) is the only true island, isolated by water year-round and providing unique habitat for plant and animal species.

Coastal Productivity

The southern coast of Oregon is a highly productive region. Intense upwelling provides essential nitrogen and phosphorous for phytoplankton development from July through September (Fisher 1970, OIW 1977). Upwelling is more pronounced south of Cape Blanco, compared to the remainder of the Oregon coast, due to the narrower continental shelf and the orographic effect of the Klamath

Mountains, which result in intensified offshore winds (Fisher 1970, Ramberg 1970). Abundant phytoplankton provides a rich food base, while the offshore rocks and islands provide great habitat diversity, increasing the coastline's topographic complexity by increasing the linear area of shoreline, reducing wave shock, creating a mosaic of substrates, and providing more horizontal living space for zonal animals. These factors account for the greater diversity and abundance of animals associated with this section of coast (Ricketts *et al.* 1985:15, Williams and Monroe 1976:13).

Animals of greatest economic importance to prehistoric people associated with offshore rocks and islands are shellfish, principally California mussels (*Mytilus californianus*) (Barner 1981, Berreman 1944, Erlandson 1988, Gard 1990, Gould 1976, Greengo 1952, Heflin 1966, Winterhalder 1981, Yesner 1980), pelagic and demersal fishes which are attracted to the intertidal areas (Gard 1990, Zontek 1983), sea birds, particularly those that use the islands as breeding sanctuaries (Gard 1990, Gould 1966, 1976), and marine mammals (Berreman 1944; Gard 1990; Gould 1966; Heflin 1966; Hildebrandt 1984; Lyman 1988, 1989, 1991; Rambo 1978; Ross 1977). A list of species associated with offshore rocks and islands and their surrounding waters is provided in Table 1.

The coastal rocks and islands are the central element in a dynamic system. As with all ecosystems, there is a high degree of interrelatedness. Dense bird colonies develop because rocks and islands provide secure nesting habitat, while offshore waters provide abundant food for rearing broods. In turn, bird guano, high in nitrogen and phosphorus, accumulates on the rocks and is subsequently washed off by wave action and heavy winter rains, thereby enriching the surrounding waters and furthering plankton production (Mizutani and Wada 1988, Zelickman and Golovkin 1972). A similar cycle probably occurs around sea mammal rookeries and intensively used haulouts. Planktophageous fishes are attracted to rocks and islands by abundance of food and are, in turn, preyed upon by sea birds, sea mammals, and carnivorous fish. High predation upon plankton-consuming fish makes more plankton available to intertidal and benthic invertebrates, whose increased availability supports other consumers such as oyster catchers and sea otters. Sea otters have a direct effect upon their environment by preying upon sea urchins (*Stronglyocentrotus spp.*), thereby fostering the development of kelp beds, yet another productive habitat (Mate 1981).

Island Archaeology

Optimal foraging theory predicts that 1) people choose food to maximize benefits (e.g., gather maximum net energy per time allotment), or 2) they hunt and gather in such a manner as to minimize costs, especially the time required to meet their energetic requirements (Pulliam 1981:65). Employing either criterion, offshore rocks and islands should have been exploited since abundant, diverse, concentrated resources provide both maximum return and minimum time expenditure. To evaluate this hypothesis, I conducted archaeological testing on Goat Island (35 CU 160), the only previously known offshore site on the Oregon coast (Gard 1990), and performed an offshore survey of accessible rocks and islands.

Goat Island (35 CU 160)

Goat Island is an 8.5 hectare, vegetated island located 600 m offshore and approximately 5 km northwest of the Chetco River outlet (Figure 2). Rising over 60 m from mean sea level, the perimeter of the island consists of sheer cliffs. Unlike any other island along the southern coast of Oregon, a small sand beach is located on the lee side, greatly facilitating island access.

This island and others along the Oregon coastline are administered by the United States Fish and Wildlife Service (USFWS) and comprise the Oregon Islands National Wildlife Refuge. Goat Island is managed for use by colonial nesting sea birds and as a wintering habitat for migratory waterfowl, especially the dusky Canada goose (*Branta canadensis occidentalis*) and the endangered Aleutian Canada goose (*B. c. leucopaeia*). Because of Goat Island's refuge status, access is strictly controlled, as is the case with all Oregon coastal islands, and must be timed to avoid conflict with the use of the islands by birds. The goal of archaeological sampling was to illuminate the role of the site in prehistoric economies by determining its integrity, function, content, chronological placement, and season of use. (See Gard 1990 for complete discussion.) Two excavators conducted testing with assistance from the USFWS Coastal Biologist, who provided transportation and monitored the excavations to ensure minimal disturbance of wildlife

TABLE 1. Representative Species Found on the Southern Oregon Coast.

BIRDS

Taxon	Common Name
Haematopus bachmani	Pacific oyster catcher
Larus occidentalis	Western gull
*Oceanodroma furcata**	Fork-tailed storm petrel
*Oceanodroma leucorhoa**	Leach's storm petral
Phalacrocorax auritus	Double-crested cormorant
Phalacrocorax pelagicus	Pelagic cormorant
Phalacrocorax penicillatus	Brant's cormorant
Uria aalge	Common murre
*Cepphus columba**	Pigeon guillemot
*Frateroula corniculata**	Tufted puffin
*Cerorhinca monocerata**	Rhinoceros auklet
*Ptychoramphus aleuticus**	Cassin's auklet
Branta canadensis	Canada Goose

*Burrow Nester

MOLLUSCS/CRUSTACEANS

Taxon	Common Name
Ostrea lurida	Native oyster
Tresus nuttalli	Gaper clam
Clinocardium nuttalli	Cockle
Macoma nasuta	Bentnose clam
Mya truncata	Softshell clam
Protothaca staminea	Littleneck clam
Saxidomus giganteus	Butter clam
Siliqua patula	Razor clam
Tresus capax	Horse clam
Mytilus californianus	California mussel
Cryptochiton stelleri	Gumboot chiton
Katherina tunicata	Black chiton
Olivella biplacata	Purple olive
Searlesia dira	Dire whelk
Mitella polymerus	Gooseneck barnacle
Balanus cariosus	Horse barnacle
B. glandulus	Acorn barnacle
Cancer magister	Dungeness crab
C. productus	Red rock crab
Stronglyocentrotus spp.	Sea urchin

FISH

Taxon	Common Name
Clupea harengus pallasi	Pacific herring
Sardinops sagax	Pacific sardine
Thunnis alalunga	Albacore
Engraulis mordax	Northern anchovy
Rhacohilus vecca	Pile perch
Amphistichus rhodoterus	Redtail surfperch
Cymatogaster aggregata	Shiner perch
Embiotoca lateralis	Striped sea perch
Hyperprosopon argenteum	Walleye surfperch
Phanerodon furcatus	White sea perch
Scorpaenidae	Rockfishes
Ophiodon elongatus	Lingcod
Scorpaenichthys marmoratus	Cabezon
Enophrys bison	Buffalo sculpin
Hemilepidotus spp.	Irish lords
Hexagrammos stelleri	White spotted greenling
H. decagrammus	Kelp greenling
Raja binoculata	Big skate
Psettichthys melanostictus	Sand sole
Parophrys vetulus	English sole
Platichthys stellatus	Starry flounder
Anarrhichthys ocellatus	Wolffish
Galeorhinus zyopterus	Soupfin shark
Squalus acanthias	Spiny dogfish
Thaleichthys pacificus	Eulachon
Lampetra tridentata	Pacific lamprey

SEA MAMMALS

Taxon	Common Name
Eumetopias jubata	Steller sea lion
Zalophus californianus	California sea lion
Phoca vitulina	Harbor seal
Callorhinus ursinus	Northern fur seal
Enhydra lutris	Sea otter
Mirounga angustirostris	Northern elephant seal

and damage to nesting habitat. A single 1 x 2 m test pit was dug in 10 cm arbitrary levels, with all excavated soils bagged by level for water-screening through graduated meshes (ranging from 6 mm to 1.5 mm) at the Oregon State University archaeology laboratory. A total of .4 m^2 of soil was excavated. Sediments are a dark brown, loamy clay, containing approximately 50 percent shell, by volume. The shell is extremely fragmented, with average pieces about 5 mm in diameter. Soils are extensively mixed, attributable to considerable bioturbation by a myriad of burrowing invertebrates, an unknown salamander species, and, particularly, the activity of burrow-nesting storm petrels, tufted puffins, and auklets. Burrow densities reach a maximum of 50 per m^2 (Lowe pers. comm. 1989), limiting the potential for conducting intrasite spatial analysis at some later date. Furthermore, although the test pit was excavated in 10 cm levels to provide vertical control, disturbance limits the utility of these controls. Therefore, the materials discussed are treated as a single analytical unit.

Figure 2. Aerial view of Goat Island, looking southwest. Photo by R. Lowe, USFWS.

Cultural materials extend to a depth of 30-35 cm below surface. Charcoal recovered from a deflated hearth feature yielded a radiometric date of 880 ± 50 B.P. (Beta 31003), which places utilization of the site within the late prehistoric period (Lyman and Ross 1988).

The most abundant faunal remains recovered are shellfish, totaling 5.459 kg dry weight (Table 2). California mussel comprises more than 80 percent of the shell. The rock margins around the island are thickly covered with these molluscs, as well as with gooseneck barnacle. Although gaper and littleneck clams are generally considered bay/estuary species, they can be found on the island along its beach or on the mainland directly across from the island. Chitons and barnacles are common residents. The dire whelk, represented by a single shell, also is found on rocky shores with quiet, protected waters but is usually associated with bay/estuary habitats. There are four olivella specimens missing distal end spirals, which may be beads (Moratto 1984).

Marine fish are the second most abundant taxa in the sample (Table 2). All fish identified to genus are inhabitants of rocky shores and kelp beds and/or can be found in nearshore waters. The surfperches, which cannot be confidently identified to genus due to the skeletal similarities of related genera, are probably striped sea perch (*Embiotoca lateralis*) since it prefers rocky shores and kelp beds.

Most of the bird remains identified to species (Table 2) belong to storm petrels, with tufted puffins second most abundant. Because of normal fledgling mortality and the burrowing habits of the two species, it is probable that their remains have been naturally incorporated into the site, an interpretation supported by a high percentage of fresher looking bone in the faunal sample. Three bone fragments cannot be attributed to natural deposition: a proximal humerus head and a distal coracoid end from a pelican-sized bird and a medial ulna fragment from a cormorant-sized bird. These are too fragmentary for species determination but appear to be concurrent in age with the mammal bone believed to be coincident with human occupation.

TABLE 2. Faunal remains from Goat Island (35 CL 160), listed in order of relative abundance.

SHELLFISH

Family	Taxon	Common Name	NISP/MNI
Mytilidae	*Mytilus californianus*	California mussel	+
Mactridae	*Tresus nuttallii*	Gaper clam	+
Veneridae	*Protothaca staminea*	Littleneck clam	+
Acanthochitonidae	*Cryptochiton stelleri*	Gumboot chiton	+
Mopaliidae	*Katherina tunicata*	Black chiton	+
Olividae	*Olivella biplacata*	Purple olive	+
Buccinidae	*Searlesia dira*	Dire whelk	+
Lepadidae	*Mitella polymerus*	Gooseneck barnacle	+
Balanidae	*Balanus sp.*	Acorn barnacle	+

FISH REMAINS

Family	Taxon	Common Name	NISP/MNI
Scorpaenidae	*Sebastes spp.*	Rockfish	9/4
	Sebastes siminiatus	Vermilion rockfish	2/2
	Sebastes melanops	Black rockfish	25/4
Embiotocidae	*Embiotoca lateralis* ?	Striped sea perch	7/1
Cottidae	*Enophrys bison*	Buffalo sculpin	1/1
Hexagammidae	*Hexagrammos decagrammus*	Kelp greenling	2/1
Unidentified fish bone fragments			609

AVIAN REMAINS

Family	Taxon	Common Name	NISP/MNI
Hydrobatidae	*Oceanodroma sp.*	Storm petrel	76/10
Alcidae	*Frateroula corniculata*	Tufted puffin	2/1
Unidentified (Pelican-sized bird)			2
Unidentified (Cormorant sized-bird)			1
Unidentified[1]			71

[1]The majority of these unidentifiable bird bone fragments appear to be eroded or from immature birds, lacking epiphysis.

SEA MAMMAL REMAINS

Family	Taxon	Common Name	NISP/MNI
Otariidae	*Eumetopias jubatus*	Steller's sea lion	1/1
	Callorhinus ursinus	Northern fur seal	1/1
Phocidae	*Phoca vitulina*	Harbor seal	1/1
Unidentified sea mammal frags			86

Mammal bone comprises the remainder of the faunal material recovered (Table 2), with only three elements identifiable to taxon (Gard 1990). Apparent butchering marks were found on one of the rib fragments, suggesting human activity.

The recovery of artifacts provides firm evidence of human utilization of the island, but the sample is too small to provide any definitive indication of specific tasks performed. Recovered debitage indicates that stone tool production and/or maintenance occurred on site. With only one exception, locally available material was utilized (Gard 1990). Nine artifacts were recovered, consisting of projectile points (Figure 3), blanks, preforms, retouched flakes, and bone tools (Gard 1990). Two stemmed projectile points are very similar to protohistoric specimens recovered in the interior Klamath Mountain region (Aikens 1986:114). This is consistent with the 880 ± 50 B.P. date obtained from the radiocarbon sample. A triangular, concave-base point is stylistically similar to composite harpoon tips described by Gould (1966:56) but is too small

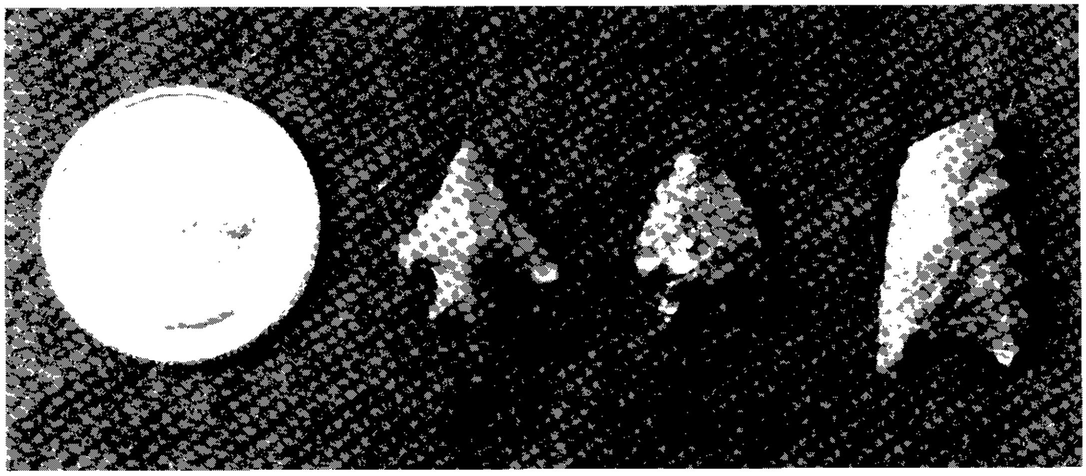

Figure 3. Projectile points recovered from the Goat Island Site, 35 CU 160.

to be a harpoon tip according to criteria established by Lyman *et al.* (1988). The points indicate extractive tasks were carried out on the island, an interpretation independently confirmed by the faunal remains.

With the exception of the puffin and petrel remains, faunal material appears to have been incorporated into the site as a result of human activity, thereby providing an indication of the range of exploited species. Some shellfish could have been deposited on the island by sea birds, but the quantity, presence of carbonized shell, and preferential selection of species suggest a human agent. The sheer cliffs which form the island perimeter would prevent the natural deposition of sea mammal bones at the site. Finally, none of the fish bone exhibits any evidence of digestive corrosion, thereby discounting the possibility that the bone was brought to the site in the stomachs of harvested sea lions, and the majority of the fish are too large to have been transported by birds.

No distinct seasonal utilization period is indicated by the identified fauna; all the animals would have been available year-round. A larger sample of culturally incorporated bird remains would be the best indicator for seasonal use, since birds are the most seasonally restricted in terms of breeding activity. Sea mammals can provide indirect seasonal information, however. The presence, possibly, of an immature fur seal innominate suggests a late summer harvest for this individual.

Available data suggest that Goat Island served as a periodic camp site. A broad range of resources was exploited: molluscs, marine fish, sea mammals, and, possibly, sea birds. Individuals probably stayed on the island while resources were collected to conduct initial processing such as butchering, filleting, shucking, and drying. A more permanent settlement is not indicated. While a fresh water spring is present approximately 50 m west of the site, it is fouled by bird waste and unfit to drink.

Island Survey

The presence of the Goat Island site raised the possibility that other offshore rocks and islands were utilized prehistorically, and I therefore undertook a sample survey of offshore rocks and islands administered by the USFWS. The survey area extended from Cape Blanco south to Brookings Harbor, Oregon. Because rocks and islands number in the hundreds and vary with tide heights, I used four criteria to select those to be surveyed. First, the rock or island could not be subject to wave overwash at any time, since it would diminish the probability of artifact retention. This eliminated the majority of rocks from the sample. Second, if the approach was deemed too dangerous due to submerged rocks, lack of disembarking points, or sheer sides, it was not investigated. I assumed that if conditions were similar prehistorically, the rock or island would not have been utilized to any great extent. Third, it had to have vegetation and/or soil development, increasing the odds of any cultural material remaining, since vegetation/soil would indicate limited erosion. Finally, the rock or island could not be connected to land at extreme low tide. The survey was also constrained by availability of harbor facilities. Only an area extending north from the Chetco River to 48 km north of the Rogue River could be surveyed, given the range of our vessel. Nine rocks were physically inspected (Figure 1). Those without names are designated by a USFWS number. These yielded two additional prehistoric sites, one on Hunters Island (35 CU 173) and one on Whalehead Island (35 CU 174).

Hunters Island is an 8-hectare, steep-sided, vegetated island about 600 m offshore, south of Cape Sebastian (Figure 1). Vegetation obscures the site, which is visible only along a 120 m erosional cut face on the western side of the island. The cultural stratum visible within the cut face has been overlain by a sterile, dark, loamy stratum, and it rests atop a sterile, tan, sandy clay stratum. Artifacts and charcoal are visible throughout this central stratum, but no shell or other faunal remains are visible. Numerous artifacts are scattered across the gradual slope west of the cut face. Most common are oblong river cobbles, averaging 15 cm x 6 cm in size and unifacially flaked along one end to create an acute cutting edge. Steep-end and dome scrapers were also observed. Debitage is rare, and the few pieces noted represent initial reduction stages. Sufficient charcoal was gathered from a lense within the cultural stratum to obtain a radiocarbon date of 1,840 ± 70 B.P. (Beta 33175), falling within the late prehistoric period (Lyman and Ross 1988). No artifacts were collected.

Recorded artifacts suggest heavy butchering tasks and hide processing. However, these tools, which are relatively large and heavy, may owe their presence to their greater resistance to erosion and weathering than lighter, smaller, more specialized tools. Erosion may also account for the lack of visible faunal remains.

Whalehead Island is the outermost of two nearly identical islands located 550 m offshore (Figure 1). Approximately 4.5 hectares in area, the summit of the island is 74 m high. Unlike Goat or Hunters islands, vegetation on Whalehead is restricted to sparse patches of *Scophuleria* and *Calamagrostis*. A broad surface scatter of artifacts extends from the summit of the island down the western slope, covering an area of approximately 60 m^2. The assemblage, nearly identical to that on Hunters Island, consists of cobble choppers, scrapers, and primary flakes. It is unknown whether this assemblage reflects differential erosion or actual extraction and processing tasks. Ongoing erosion makes it doubtful that evidence of human utilization will remain much longer, but the presence of this site in conjunction with the others provides additional evidence of offshore land use and a marine orientation.

Discussion

That direct evidence of prehistoric utilization is not visible on every island surveyed does not discount the possibility that they were important to native groups and utilized for available resources. Erosion, such as that on Whalehead and Hunters islands, may have removed evidence of human activity on other rocks and islands. The coast of southern Oregon is a dynamic environment, subject to winter gales, heavy seas, and driving rains. Soil and vegetative disturbance from animals can accelerate erosional forces. Given these factors, it is remarkable that any offshore rocks retain evidence of human use. Dense vegetation is one of the principal factors preventing erosion, but it may also obscure sites from view. On two easily accessible nearshore islands offering the same broad range of animal resources as the islands with sites, no evidence of human utilization was found, possibly due to dense ground cover. Spruce Island is so thickly covered with salal and spruce, no portion of the ground surface is visible. Although vegetatively similar to Goat and Hunters islands, the ground surface on Saddle Rock is also obscured, necessitating subsurface testing to establish prehistoric use.

The manner in which offshore features were used and the range and nature of activities conducted on them could greatly affect whether or not materials would be left behind to become incorporated into the archaeological record. Collection and harvesting of certain resources may not have required tools, or collecting tools may have been saved for repeated use. Abandoned tools such as collecting baskets, bone fish hooks, nets, or the whalebone clubs used for harvesting sea mammals may have been perishable. Intensity of use would also have affected site development. If occasional, brief forays were made to an offshore feature to collect a few items, cultural deposits would have been less likely to form there, as compared to areas where individuals visited at regular intervals, camped overnight, and processed animals. It is conceivable that only the most intensely utilized island sites were discovered by this survey.

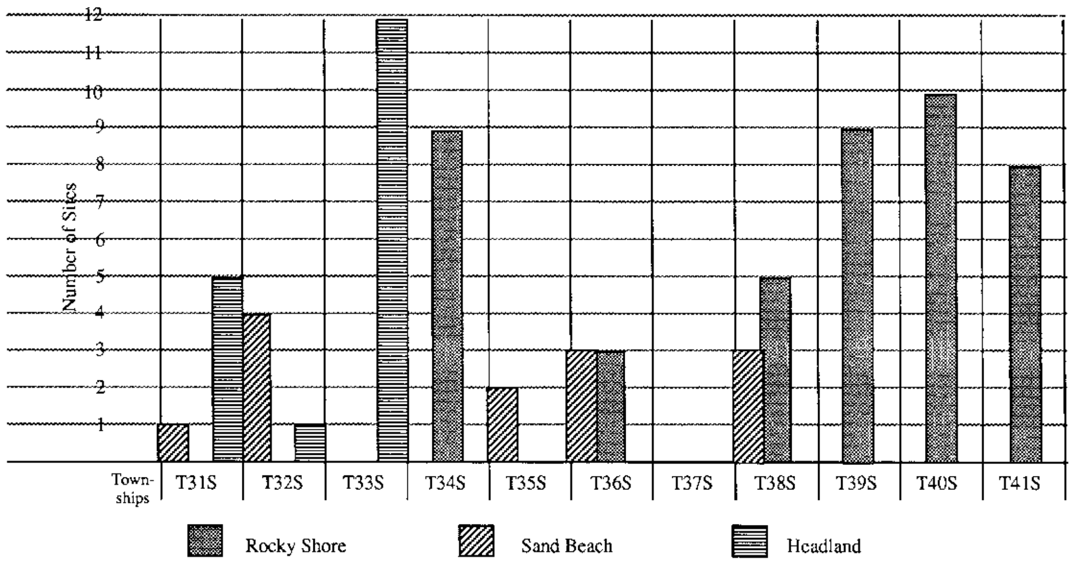

Figure 4. Site frequency by shoreline type, Cape Blanco, Oregon, to the California border.

Site frequencies from Cape Blanco south to California, plotted by township and coastline type (e.g., rocky/sand beach), indicate that higher site frequencies occur along rocky coastal areas (Figure 4). This correlation between rocky shoreline and high site density can be explained by the additional habitat offshore rocks and islands provide, concentrating animal resources in confined, predictable locations.

Conclusion

Draper (1988) found higher settlement density within the marine environment for the southern Oregon coast than had been previously considered, with the majority of coastal sites associated with either stream outlets or bluff/cliff areas. He interpreted this settlement pattern as a site selection strategy based upon proximity to subsistence resources, but he did not support this conclusion with hard data on the type, abundance, or availability of utilized marine resources. I have shown that 1) rocky coastlines are highly productive environments providing a variable, abundant, and year-round food supply of immediate use to humans; 2) this high productivity can be directly related to the increased habitat provided by offshore rocks and islands; and 3) these offshore resources were utilized by prehistoric peoples. Prehistoric use of offshore islands is indicated by data recovered from one tested island site, where intensive use involving the exploitation of a wide range of animals occurred after 900 years ago. Preliminary survey information indicates use of two other island sites, one of which was used approximately 2,000 years ago.

I propose that offshore islands along the southern Oregon coast were valuable foraging areas which played a disproportionate role in the availability of subsistence resources. The high biotic productivity associated with offshore rocks and islands accounts for the correlation between rocky shoreline and site density.

Acknowledgments

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Literature Cited

Aikens, C. M. 1986. Archaeology of Oregon. USDI, Bureau of Land Management, Oregon State Office.

Baldwin, E. M. 1976. Geology of Oregon. Kendall Hunt, Dubuque, Iowa.

Barner, D. C. 1981. Shell and archaeology: An analysis of shellfish procurement and utilization on the central Oregon Coast. Oregon State University, Corvallis. M.A. Thesis.

Berreman, J. V. 1944. Chetco Archaeology. General Series in Anth., No. 11.

Chase. H. A. 1873. Indian mounds on the coast of Oregon. Amer. J. Sci. Arts, 3rd Series 6(31):26-32.

Dicken, S. N. 1961. Some recent physical changes of the Oregon Coast. University of Oregon. Submitted to the Office of Naval Research, U.S. Dept. of the Navy, Contract No. Nonr-2771(04).

________. 1965. Oregon Geography: The People, the Places, and the Time. Edwards Brothers, Ann Arbor.

Draper, J. A. 1988. A proposed model of late prehistoric settlement systems on the southern Northwest Coast, Coos and Curry counties, Oregon. Washington State University, Pullman. Ph.D. Dissertation.

Erlandson, J. M. 1988. The role of shellfish in prehistoric economies: A protein perspective. Amer. Antiq. 53(1):102-109.

Fenneman, N. M. 1931. Physiography of Western United States. McGraw-Hill, New York.

Fisher, C. W. 1970. A statistical study of winds and sea water temperatures during Oregon coastal upwelling. Oregon State University, Corvallis. M.S. Thesis.

Franklin, J. F. 1981. Vegetation. *In* C. Masser, B. R. Mate, J. F. Franklin, and C. T. Dyrness (eds.) Natural history of Oregon coast mammals. USDA For. Serv. Gen. Tech. Rep. PNW-133. Pp. 372-458.

Gard, H. A. 1990. The role of southern Oregon's coastal islands in prehistoric subsistence. Oregon State University, Corvallis. M.A. Thesis.

Gould, R. A. 1966. Archaeology of the Point St. George site and Tolowa prehistory. University of California Publication in Anthropology, No. 4: pp. 1-107.

________. 1976. Ecology and adaptive response among the Tolowa Indians of Northwestern California. *In* L. J. Bean and R. C. Blackburn (eds.) Native Californians: A Theoretical Retrospective. Ballena Press, Ramona, California. Pp. 49-78.

Greengo, R. 1952. Shellfish foods of the California Indians. Kroeber Anth. Soc. Papers 7:63-144.

Heflin, E. 1966. The Pistol River site of Southwest Oregon. Univ. Cal. Archaeol. Survey Rep. 67:151-206.

Heizer, R. F. 1951. A prehistoric Yurok ceremonial site (HUM-174). Univ. Cal. Archaeol. Survey Rep. 11:1-4.

Hildebrant, W. R. 1984. Late-period hunting adaptations on the North Coast of California. J. Cal. Great Basin Anth. 6(2):189-206.

Lyman, R. L. 1988. Zoogeography of Oregon Coast marine mammals: The last 3,000 years. Marine Mammal Sci. 4(3):247-264.

________. 1989. Seal and sealion hunting: A zooarchaeological study from the southern Northwest Coast of North America. J. Anth. Arch. 8:68-99.

________. 1991. Prehistory of the Oregon Coast: The Effects of Excavation Strategies and Assemblage Size on Archaeological Inquiry. San Diego: Academic Press.

Lyman, R. L., and R. E. Ross. 1988. Oregon Coast archaeology: A critical history and a model. Northw. Anth. Res. Notes 22:67-119.

Lyman, R. L., L. A. Clark, and R. E. Ross. 1988. Harpoon stone tips and sea mammal hunting on the Oregon and Northern California coasts. J. Cal. Great Basin Anth. 10(1):73-87.

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Mate, B. R. 1981. Marine mammals. *In* C. Masser, B. R. Mate, J. F. Franklin, and C. T. Dyrness (eds.) Natural history of Oregon Coast mammals. USDA For. Serv. Gen. Tech. Rep. PNW-133. Pp. 372-458.

Minor, R., and K. A. Toepel. 1983. Patterns of aboriginal land use in the Southern Oregon coastal region. *In* R. E. Greengo (ed.) Prehistoric places on the southern Northwest Coast. Thomas Burke Memorial Washington State Museum, Seattle. Pp. 225-253.

Mizutani, H., and E. Wada. 1988. Nitrogen and carbon isotope ratios in seabird rookeries and their ecological implications. Ecology 69(2):340-349.

Moratto, M. J. 1984. California Archaeology. Academic Press, New York.

Oceanographic Institute of Washington. 1977. Summary of knowledge of the Oregon and Washington coastal zone and offshore areas. Vols. I-III. Prepared for USDI, Contract No. AA550-CT6-15.

Pulliam, H. R. 1981. On predicting human diets. J. Ethnobiol. 1(1):61-68.

Ramberg, D. A. 1970. Carbon and nitrogen reservoirs off the Oregon Coast. Oregon State University, Corvallis. M.S. Thesis.

Rambo, S. L. 1978. An osteo-archaeological investigation of pinniped remains at Seal Rock, Oregon (35 LNC 14). Oregon State University, Corvallis. M.A. Thesis.

Ricketts, E. F., J. Calvin, J. Hedgpath, and D. Phillips. 1985. Between Pacific Tides. Stanford University Press, Stanford, California.

Ross, R. E. 1977. Preliminary archaeological investigations at 35 CU 9, Port Orford, Oregon. Department of Anthropology, Oregon State University. Submitted to the Oregon State Parks and Recreation Department.

Schumacher, P. 1877a. Aboriginal settlements of the Pacific Coast. Pop. Sci. Monthly (10):353-356.

________. 1877b. Researches in the kjokkenmoddings and graves of a former population of the coast of Oregon. Bull. U.S. Geol. and Geog. Survey of the Territories (3):27-35.

U.S. Army Corps of Engineers. 1971. National shoreline study: Inventory report, Columbia-North Pacific Region, Washington and Oregon. U.S. Army Corps of Engineers, North Pacific Division.

Williams, J. C., and H. C. Monroe. 1976. Natural History of Northern California. Kendall Hunt, Dubuque, Iowa.

Winterhalder, B. 1981. Optimal foraging strategies and hunter-gatherer research in anthropology: Theory and models. *In* B. Winterhalder and E. A. Smith (eds.) Hunter-Gatherer Foraging Strategies: Ethnographic and Archaeological Analysis. University of Chicago Press, Chicago. Pp. 13-35.

Yesner, D. R. 1980. Maritime hunter-gatherers: Ecology and prehistory. Current Anth. 21(6):727-735.

Zelickman, E. A., and A. N. Golovkin. 1972. Composition, structure, and productivity of neritic plankton communities near the bird colonies of the northern shores of Novaya Zemlya. Marine Biol. 17:265-274.

Zontek, T. 1983. Aboriginal fishing at Seal Rock (35 LC 14) and Neptune (35 LA 3): Late-prehistoric archaeological sites on the central Oregon Coast. Oregon State University, Corvallis. M. A. Thesis.