Analysis of the pinniped remains from site 35 LNC 14 reveal the presence of four species: *Eumetopias jubata* (Stellar sea lion), *Zalophus californianus* (California sea lion), *Callorhinus ursinus* (Northern fur seal), and *Phoca vitulina* (Harbor seal). Ratios based on minimum number of individuals calculations disclose a high incidence of mature Stellar males, concentrations of which occur only on breeding grounds. Inferences are made regarding hunting and butchering techniques and seasonal occupation of the Seal Rock Site.
An Osteo-archaeological Investigation of Pinniped Remains at Seal Rock, Oregon (35 LNC 14)

by

Sandra Lee Rambo

A THESIS

submitted to

Oregon State University

in partial fulfillment of the requirements for the degree of

Master of Arts in Interdisciplinary Studies

Completed 27 April 1978

Commencement June 1978
APPROVED:

Redacted for Privacy

Associate Professor of Anthropology, in charge of major

Redacted for Privacy

Assistant Professor of History

Redacted for Privacy

Associate Professor of Zoology

Redacted for Privacy

Graduate Representative

Redacted for Privacy

Head of Department of Anthropology

Redacted for Privacy

Dean of Graduate School

Date thesis is presented 27 April 1978

Typed by Linda Morgan for SANDRA LEE RAMBO
ACKNOWLEDGMENTS

The initial idea for this study was suggested by Dr. Richard E. Ross, director of the Seal Rock excavations. His enthusiastic interest in all aspects of Oregon coastal prehistory proved to be a constant source of encouragement during the course of my research.

Access to site 35 LNC 14 was generously granted by the Brown family of Seal Rock, Oregon. Bill Brown has shown a continuing interest concerning the protection and archaeological utilization of the site. Without his cooperation this study would have been impossible.

Dr. Bruce Mate and Dr. Richard Stroud were instrumental in helping us obtain pinniped materials for our comparative skeletal collection as well as providing stimulating ideas concerning pinniped behavior and anatomy.

Many friends and fellow students worked at some time during the past few years either on washing and cataloging the seemingly endless supply of pinniped bones or spent hours engaged in the less pleasing aspects of building a comparative collection. These often thankless tasks provided the foundation for this faunal analysis.

Photographs were taken by Dr. Ross and printed by Terry Zontek. Linda Morgan typed the final copy.
# TABLE OF CONTENTS

**INTRODUCTION** ........................................ 1
  - Physical Setting .................................. 1
  - Site Description ................................. 3
  - Faunal Analysis ................................. 6

**ARCHAEOLOGICAL BACKGROUND** ......................... 8
  - North Coast .................................... 8
  - Central Coast .................................. 11
  - South Coast .................................... 11

**HISTORIC AND ETHNOGRAPHIC BACKGROUND** ............ 16
  - Coastal Pinniped Hunters .................... 16
  - The Alsea ...................................... 24

**BEHAVIOR & ADAPTATIONS OF THE ORDER PINNIPEDIA** .... 31
  - General Characteristics ..................... 31
  - Eumetopias jubata ............................ 36
  - Zalophus californianus ....................... 40
  - Callorhinus ursinus ......................... 44
  - Phoca vitulina ................................ 47

**OSTEO-ARCHAEOLOGY** ................................ 51
  - Quantification Methods ...................... 51
  - Laboratory Procedures ....................... 58
  - Results ....................................... 67

**CONCLUSIONS** ......................................... 78

**BIBLIOGRAPHY** ........................................ 85

**APPENDIX** ............................................. 93
LIST OF ILLUSTRATIONS

Figure 1: Previously excavated sites on the Oregon coast ........................................ 10
Figure 2: Linguistic divisions of the North Pacific coast ........................................... 17
Figure 3: Herding sea lions; Bering Strait ................................................................. 20
Figure 4: Stellar sea lions (Eumetopias jubata) ......................................................... 37
Figure 5: California sea lions (Zalophus californianus) swimming ............................. 41
Figure 6: California sea lion (Zalophus californianus) ................................................ 41
Figure 7: Northern fur seal (Callorhinus ursinus) ....................................................... 45
Figure 8: Harbor seal female and pup (Phoca vitulina) ............................................... 48
Figure 9: Classification levels for individual bones and fragments ............................. 65
Figure 10: Male Eumetopias jubata canine with exposed annual growth ridges .......... 68
Figure 11: Minimum number of individuals calculations for Eumetopias jubata .......... 70
Figure 12: Minimum number of individuals calculations for Callorhinus ursinus ........ 71
Figure 13: Minimum number of individuals calculations for Zalophus californianus .... 72
Figure 14: Minimum number of individuals calculations for Phoca vitulina ................. 73
Figure 15: Male Eumetopias jubata humerus with calcium deposits ......................... 76
Figure 16: Deformed juvenile Eumetopias jubata radius ............................................ 77
Figure 17: Male Eumetopias jubata skull with holes in cranium ............................... 81
AN OSTEO-ARCHEOLOGICAL INVESTIGATION
OF PINNIPED REMAINS AT SEAL ROCK, OREGON (35 LNC 14)

INTRODUCTION

The basic research material of this paper resulted from excavations carried out on a deep coastal shell midden at Seal Rock, Oregon under the direction of Dr. Richard E. Ross, associate professor of anthropology, Oregon State University. Archaeological investigation of this midden (35 LNC 14) is only a part of a planned long-term study of the numerous prehistoric sites along the central Oregon coast. Seal Rock was chosen as the first step in the proposed integrated investigations because of the depth of cultural deposits, increasing damage to the site from both human and natural elements, and for its placement in a relatively unexplored region archaeologically. An intensive study of this rich midden will serve as the basis for comparisons of additional excavations which will be conducted along the coast in succeeding years in an effort to gain a better understanding of aboriginal cultural adaptations before inundation of the area by Euro-Americans.

The Physical Setting

Site 35 LNC 14 is situated on the central Oregon coast approximately ten miles south of the city of Newport. The Seal
Rock shell midden lies on top of a consolidated sand dune, rising 15 meters above the beach, and covers an area of 30 by 100 meters. Maximum depth of the midden itself is about three meters. This may only be a fraction of the original midden; Oregon coastal storms wearing down the face of the sand bluff have caused the erosion and subsequent loss of the westernmost edge of the deposit (Ross 1975).

Seal Rock takes its name from the offshore rocks which are used presently as hauling out spots by harbor seals and sea lions. During a minus or low tide, these small islands are easily accessible from the shore via the flat sand beach which extends seaward from the base of the bluff. In addition to the sea mammals, these rocks and adjacent pools of water left by the receding tide contain a wide variety of various marine invertebrates including *Mytilus* sp. (mussels), *Balanus* sp. (barnacles), *Strongylocentrotus* sp. (sea urchins) and *Mediaster aequalis* (star fish) (Arnold 1968).

On a line roughly parallel to and often intercepting the shore, the Coastal Mountain Range reaches from southwestern Washington to approximately the middle fork of the Coquille River in Oregon. A mature formation, the southern section is characterized by steep slopes and sharp ridges which gradually become less severe further to the north. Summits in this heavily forested range reach 450 to 750 meters (Franklin and
Numerous birds, rodents and some larger mammals inhabit the area including the Black-tailed deer, a subspecies of the mule deer (*Odocoileus hemionus*).

The *Picea sitchensis* (Sitka spruce) Zone, which includes most of the Washington and Oregon coastline, is characterized in sand bluff areas such as Seal Rock by *Gaultheria shallon* (salal), *Vaccinium ovatum* (evergreen huckleberry), and *Pinus contorta* (lodgepole pine) (Franklin and Dyrness 1973). In addition to these species, various short grasses and herbaceous plants provide ground cover.

Climatic conditions along this area of the coast are reasonably temperate. The January average minimum temperature is an invigorating $2.5^\circ C (34^\circ F)$; July average maximum temperature is a comfortable $20^\circ C (68^\circ F)$. Rainfall averages around 180 cm (72 in.) per year. This maritime climate is characterized by prolonged cloudy periods, mild but wet winters and relatively cool, dry summers (Franklin and Dyrness 1973).

**Site Description**

Excavations of site 35 LNC 14 took place during the summer field seasons of 1972 and 1974 under the direction of Dr. Richard E. Ross. A north-south oriented grid, tied into a primary and secondary datum point, was superimposed over the main midden deposit between the highway and the eroded western edge in order
to maintain horizontal control within the site. Vertical control was maintained by use of line levels, transit and stadia rod. Arbitrary 20 cm levels were used in the absence of a natural stratigraphic sequence except in the case of excavations involving a historic house floor. Here the feature was exposed along structural lines.

Because of previous construction activities the northern one quarter of the site was disturbed. Gardening and plowing activities on the midden surface had severely mixed the first 40 cm beneath the sod. The bulk of the site deposit, however, illustrated the typical midden composition with lenses of charcoal, sand, shell, and interspersed bone in an organically dark soil matrix.

C 14 dates obtained from two levels within the midden point to the initial utilization of this site beginning approximately 400 years ago (WSU 1642: 160±80; WSU 1643: 375±70). Lack of trade beads, metal artifacts, or any other post-contact material in the midden proper suggests that the site was inactive at least by the early nineteenth century. Typically, sites in use during or following the period of intensive white contact and trading along the coast (1830-1840) have yielded numerous artifacts diagnostic of the era (Ross 1976). None were recovered from the Seal Rock Site (Ross:personal communication).

Around 1850 a four by four meter (12 by 12 ft.) semi-subterranean house was constructed into the midden. Artifacts
associated with the remnants of the structure suggest a Euro-American man, possibly a trapper or trader, and a native American woman were the only residents. Fire apparently destroyed the small plank dwelling, evidenced by numerous charred wood wall fragments (Ross:personal communication).

The early twentieth century saw a hotel built on the northern border of the site and a vegetable garden in cultivation on the rich soil of the midden itself. Following the closing of this establishment the entire site was converted into a three-hole golf course during the 1930s. Construction of Highway 101 and the addition of a trailer park on the eastern edge of the deposit in the mid-1960s further altered the original configuration of the site. Vandals have exploited the site sporadically over the years.

Of the few artifacts resulting from the excavations, a high percentage of the total consisted of large chert and chalcedony points which, together with bone barbs, formed the composite harpoon heads used in hunting seals and sea lions. As mentioned previously articles of metal and other historic goods were found only in association with the 1850s house.

At the conclusion of field work in 1974, 131.6 cubic meters of soil had been excavated. Pinniped (seal and sea lion) material recovered from the site totalled 881 lbs., 806 lbs. of which was identifiable at least to species. There were 6.7 lbs. of pinniped bones per cubic meter. It was these figures which
indicated a detailed faunal analysis on the pinniped material might prove to be worthwhile.

Faunal Analysis

Faunal analysis as a basic component of archaeological research has been a fairly recent development. Only in the past 10 to 15 years have animal bones from sites begun to receive the attention of precise field and laboratory techniques which have theoretically long been standard procedure in the treatment of artifacts. At least one archaeologist has proposed that faunal remains are artifactual in themselves by virtue of being included in a midden, the existence of which is directly attributable to human behavior (Daly 1969).

Initial osteo-archaeological contributions to site reports usually were tucked neatly into the final pages of the manuscript and contained little more information than a list of species present (Olsen 1971; Grayson 1973). These lists typically used raw data with no explanation of whether fragments, epiphyses, etc. were included in the count, essentially blocking any sound comparisons between sites and leaving the reader unsure whether "Odocoileus sp....10" should be interpreted as ten rib fragments, ten left humerii, or something in between.

With the apparent redirection of some archaeologists toward a more complete understanding of the interworkings of the
myriad systems which make up any culture, new emphasis is being placed on extracting all possible information from each site. Faunal materials, depending on the circumstances of the site, may provide several types of data. These may include climatic interpretations, biological information regarding territorial and migration patterns of extinct and modern species, seasonal occupation indicators, and in some cases approximate dating of the site. From an anthropological perspective, however, the bones are most important for the available food and raw materials for manufacturing processes which they represent (Daly 1969).

A faunal analysis of the pinniped material from site 35 LNC 14 could hopefully answer many of these questions, both anthropological and biological. The first proposed step would be to identify by species, age and sex all of the elements possible and with this information to determine which, if any, were most numerous and why. From this basic data, inferences might be made regarding the seasonality of the site, and changes in migration patterns of the species involved. Human behavior could be studied through an analysis of this "cultural" bone assemblage and the corresponding artifact inventory.
ARCHAEOLOGICAL BACKGROUND

Archaeological investigations along the Oregon coast have, up until the past few years, been few in number. Probably the earliest "official" excavations took place under the direction of Paul Schumacher (1874) representative of the Smithsonian Institution. He traveled the Oregon coast recording village locations and commenting on various aspects of American Indian life, as it had been, through observations of numerous sites and collections of artifacts. His account makes interesting reading but is of little value at the present time for its archaeological impact.

Following Schumacher, no archaeological excavations were conducted until well into the twentieth century when professional interest concerning Oregon coastal prehistory was in its inception. During the last forty years, sites from north of Tillamook to within a few miles of the Oregon-California border have been investigated, each one adding a bit of information to the prehistoric background.

Northern Oregon Coast

Of all the excavations on the coast only one site, located on the north coast, appears to be much older than 400 years. Bob Drucker and George Phebus, working on a large site near Seaside, Oregon, report a date of 600 B.C. originating from a
Figure 1: Previously excavated archaeological sites on the Oregon coast (after Baldwin 1964:X).
lower level house pit. Work is still in progress with a report forthcoming (Drucker:personal communication).

In the mid-1950s an intensive excavation was carried out on Netart's Spit (35 Ti 1) near Tillamook (Newman 1959). Analysis of the site, including 15 housepits and several shell middens, indicated continuous occupation by marine-adapted peoples for a period of 400 years, ending around 1800 A.D. The latest occupants were probably Tillamook.

Central Oregon Coast

Other than the Seal Rock shell midden only one site has been excavated in the area between the Siletz and Umpqua Rivers. This site, a shell midden at Neptune State Park (35 LA 3), was excavated in 1973 and appears to be late prehistoric in age, probably contemporaneous with the Seal Rock site (Ross:personal communication). Analysis of material resulting from the Neptune shell midden is currently underway.

Southern Oregon Coast

The geographical region south of the Umpqua River has witnessed by far the most intensive archaeological activity. A large shell midden on the South Slough of Coos Bay (35 CS 30) yielded dates spanning two centuries following the mid-1600s. As with several others, the site seems to have been abandoned by
1850 A.D. but up to that time had been utilized by a small, marine-oriented group as evidenced by the numerous fish and shellfish remains. Stubbs (1973) concluded from his preliminary study that the site was occupied on a permanent rather than a seasonal basis in contrast to the seasonality of the more un-protected middens such as 35 LNC 14 and 35 LA 3 which directly front the ocean and receive the full impact of winter's inclement weather.

Site 35 CS 23, just south of the city of Coquille, was investigated following its accidental discovery during earth-moving activities by a local lumber company (Cressman 1952). Badly deteriorated faunal materials and some artifacts were scattered through 80 cm of deposit which lay 2.5 meters below the surface. Choppers, scrappers, and large amounts of river mussel shell were recovered. The site was dated at 300-450 B.P. (Newman 1959) but was not studied intensively due to time restraints.

In the late 1930s three house pits and the accompanying midden accumulation on Bullard's Beach (35 CS 3) were studied by Leatherman and Krieger (1940). Three burials and approximately 150 artifacts were recovered from this site along with several large chunks of whalebone. Based on the artifacts, it was determined that this site had been occupied only for a few years, probably sometime during the mid-nineteenth century. Another site approximately five miles up the Coquille was tested and
reported to have been markedly different from 35 CS 3 both in material culture and in time span. Artifacts from the upper site indicated an earlier occupation date than the historic Bullard's site, but no definite chronological date could be established.

Salvage work at 35 CS 3 in 1974 further resulted in the recovery of one complete and portions of two additional burials dating around 1840, based on associated artifacts (Ross 1976).

Cressman (1952) examined a site (35 CS 5) along the Coquille River in the early 1950s. Located on the Bandon sand-slit at the mouth of the Coquille, it had been badly eroded by the meandering river but still contained several house pits and one burial. Faunal remains and the artifact assemblage indicated a maritime-riverine adaptation with supplementary utilization of land mammals. Abandonment of the site occurred around 1850.

Another site, overlooking Floras Lake (35 CU 47), contained five houses and a shallow shell midden only 25 cm thick at maximum. The superficial nature of the site and the types of artifacts found suggested a fairly brief occupation time by the Tututni or other Athabascan group probably during the first half of the nineteenth century (Newman 1959).

Further down the coast at Port Orford (35 CU 9) field work during the summer of 1976 revealed both shell middens and what may have been a village site. As in many of the previously mentioned sites, lack of contact goods suggest that this late
prehistoric site was probably abandoned by the early 1800s (Ross 1977).

Heflin (1966) attempted to salvage information and artifacts from the rich Pistol River site which was being badly vandalized and was scheduled for destruction with the construction of Highway 101. Forty house pits were located in the area along with numerous artifacts and a faunal assemblage of land and sea mammals. Again, this site was late prehistoric and historic in range.

A Chetco site on Lone Ranch Creek (35 CU 37) yielded the remnants of four plank houses and 23 burials (Berreman 1944). The shell midden, up to ten feet deep and 200 feet in diameter suggested a more or less continuous occupation for several hundred years, culminating early in the nineteenth century. This trait, mentioned several times previously, seems to be typical of the coastal sites studied to this point.

In addition to these excavations several extensive site surveys have been accomplished along the coast. Included are Berreman (1935), Collins (1953), Cole and Davis (1963), Cole and Rice (1965), Davis (1968), and Ross (1976). Results of these surveys show no lack of archaeological sites but many are endangered by weather, vandals, construction projects or a combination of all these factors. In some cases, especially of sites more exposed to the elements, much of the cultural material has already been lost.
Of all the excavated sites, few give information concerning the presence or absence of pinniped material among the faunal remains. Archaeological investigations by Newman (1959) on Netart's sandspit indicated the occupants made use of *Eumetopias jubata* (Stellar sea lion), *Phoca vitulina* (Harbor seal) and *Zalophus californianus* (California sea lion) (Scheffer 1952), probably hunting them with composite-type harpoon heads, several of which were found during the course of excavation.

L. S. Cressman's report on the Bandon sandspit site (35 CS 5) mentioned both composite harpoon heads and an apparently heavy reliance by the Coos on sea mammals as a source of food (Cressman 1952). No information was included in the report concerning the specific pinnipeds involved.

The Chetco area Lone Ranch Creek (35 CU 37) yielded remains of both *Eumetopias* and *Phoca* and were assumed to be of significant economic importance. Fragments of composite harpoon heads were also recovered (Berreman 1944).

Additionally, a cursory examination of a small portion of the material resulting from both the Seaside and Neptune excavations revealed the presence of pinniped remains in these sites.

Although the inclusion of these mammals in coastal shell middens such as these is not unusual, reporting even the species present has been inconsistent in the past and it can only be assumed that in many cases their presence simply went unrecorded.
HISTORIC AND ETHNOGRAPHIC BACKGROUND

Coastal Pinniped Hunters

Because of the paucity of information on actual hunting practices of the Alsea for procuring pinnipeds, information of this type may be inferred to some extent from the ethnographically documented groups of seal and sea lion hunters along the northern California and Pacific Northwest coasts. It must be remembered, however, that even geographically contiguous groups are not uniform in these hunting practices and in the subsequent utilization of sea mammals so any inferences drawn in relation to the Alsea must of necessity be recognized as approximations at best.

Archaeological evidence from the Northwest coast indicates that members of the genus Phoca were hunted by residents of what is now Bella Bella territory in British Columbia as early as 9,000 years B.P. The first Otarrid (sea lion) remains are present by 4,500 B.P. but are so few in number that they may be indicated of a chance exploitation (Friedman and Gustafson 1975).

Sites along the Olympic coast of Washington have yielded numerous pinniped remains as well as composite harpoon heads, one form of which was used for hunting seals and sea lions. The abundance of Callorhinus ursinus (northern fur seal) (Scheffer 1958) bones in the middens suggest a healthy maritime economy
Figure 2: Linguistic divisions of the North Pacific Coast (after Drucker 1965:104).
which utilized these sea mammals for the past 2,000 years (Gustafson 1968; Friedman 1976). Sealing harpoons as well as remains of *C. ursinus*, *P. vitulina*, and *E. jubata*, have also been located in lower Chehalis territory excavations (Roll 1974).

Nineteenth century visitors to the Northwest coast and Alaska islands often recorded their impressions of aboriginal hunting practices. Charles Scammon, in his picturesque account of Pacific marine mammals written from observations made as captain of a whaling vessel, recounted with some amusement the techniques employed by the Aleut for taking sea lions. Although he does not specify which genus is involved it is assumed from the location and certain behavioral characteristics that *E. jubata* was the object of the hunt. Under cover of darkness a few men placed themselves between the water and the animals on the northern tip of the island rookery, separating a few from the herd and driving them inland for a short distance where they were guarded while others were brought in. The herding implement had previously been a stick with a piece of cloth attached to the end,

"...but, since our adopted country-folk have become more Americanized, that Yankee production, a cotton umbrella, has been substituted, and it is said that any refractory *siutch* in the drive is instantly subdued by the sudden expansion and contraction of an umbrella in the hands of a pursuing native" (Scammon 1874:136).
After a repeat performance over several consecutive nights the herd was driven slowly south to the village where they were shot and butchered.

It is uncertain as to whether this basic method was employed prehistorically or whether it was a relatively new introduction. The skill involved and knowledge of sea lion behavior necessary to carry out such a venture plus the fact that the carcasses were utilized fully by the people themselves rather than for economic gain suggests that the occurrence of rookery and village on one island may be precipitated this unique hunting method.

As a general rule, most groups residing on the Northwest coast hunted and utilized pinnipeds to some extent (Drucker 1950; Friedman and Gustafson 1975). Seal and/or sea lion rocks were approached by canoe and the animals were either clubbed or harpooned, usually with a composite harpoon head. Methods varied in detail among the various groups and apparently were influenced more on some occasions by opportunity rather than a rigid scheme. Several groups, however, are known to have had specific rites preparatory to pinniped hunting (Drucker 1950; Drucker 1951).

If harbor seals were found isolated from the water, especially at low tide, their difficulty in moving quickly across land made them easy prey for clubbing. Seal and sea lion clubs were three to five feet long and could be used to easily kill a seal with one blow. A harpooned animal was played out and
Figure 3: Herding sea lions; Bering Strait (from Coffey 1977:139).
then drawn to the canoe and dispatched by a blow on the head with a short, heavy club (Drucker 1951). Hunting, especially of seals, might take place year round but the most favored time was in spring and summer when the seas were calm (Garfield 1966; Drucker 1951).

Nootkan and Kwakiutl groups evidently preferred seal to sea lion meat although the Kwakiutl took them for producing lines and thongs from their hides (Boas 1921; Drucker 1950).

Cultural groups of the Northwest California coast also were pinniped hunters. The Tolowa held the sea lion in highest esteem and hunted them intensively during the spring and summer when the ocean was fairly calm. Special sea lion songs were sung before the expedition of one or more canoes left for the rocks (Kroeber and Barrett 1960; Drucker 1940). Hunting techniques included the use of clubs, harpoons with heads of barbed elkhorn, short clubs and darts. Generally a canoe approached the rocks quietly to allow one or two men to club sleeping sea lions. If the animals was only stunned and fell into the water it was harpooned by a hunter in the canoe. A flat fin on the end of the shaft trailed behind the wounded animal, marking its location for the hunters who followed and seized the harpoon. The sea lion was exhausted after a length of time, hauled up to the canoe and killed with a short, heavy dart or a small club (Kroeber and Barrett 1960; Curtis 1924; Drucker 1940). Butchering could take place either beside the canoe in the water or on shore (Kroeber
and Barrett 1960).

On the hunters safe return a feast of several foods, including sea lion, was held. Young animals were preferred because of their tenderness but fully mature adults were brought in as well (Kroeber and Barrett 1960). Oil was stored in kelp bottles (Kroeber and Barrett 1960) or in the sea lion paunch (Drucker 1940). Bones of the first pinnipeds killed, as well as those of the first salmon, were returned to the sea to insure future luck in hunting (Gould 1966).

An archaeological site at Point St. George on the northern California coast revealed large quantities of E. jubata remains but also included Z. californianus, C. ursinus and P. vitulina. Most numerous of the elements were phalanges. Ethnographically reported as the most desirable part of the animal, the flippers were usually given to the wealthy old men of the community. The abundance of harpoon heads scattered among the sea lion bones seems to indicate that no effort was made to remove them from the carcass for further use (Gould 1966).

Among the Yurok seals were rarely taken. However sea lions were harpooned or occasionally clubbed with a six or seven foot hardwood pole on the offshore rocks which were "owned" by that group. The clubs were symbols of partnerships and were often handed down as heirlooms. Typical also among the Tolowa and other California coastal groups, their harpoon heads were of one piece and were barbed. Five or six men traveled by canoe to
the rocks where a few, disguised in deer or bear skins (Kroeber 1925) imitated sea lion sounds and movements to attract the animals. When one approached to within 30 feet all the hunters threw their harpoons, aiming at the thorax. In the canoe they waited for the shaft to rise after the animal dove, caught hold of it and waited for the sea lion to tire (Kroeber and Barrett 1960). A large male required several hours with the canoe in tow before it was exhausted enough to pull close for the final spear thrust so hunts of this type always began early in the morning (Kroeber 1925; Kroeber and Barrett 1960).

Sea lions were not skinned, rather the hair was singed off and the hide cut up with the meat. The skin layer was then removed and kept for emergency rations. Oil was processed out and stored in the stomach (Kroeber and Barrett 1960).

The Wiyot of northern California enjoyed both the meat and oil of seals and sea lions. Pinnipeds were harpooned as they lay asleep on the rocks and were consequently followed by a canoe as in other groups. Other small harpoons were planted as opportunity allowed and the animals were dispatched by a blow from a small club (Kroeber and Barrett 1960; Curtis 1924). The carcass was towed to shore by piercing the nose and passing a line through it. Oil was stored in the paunch and in the bladder, which had a four or five gallon capacity (Kroeber and Barrett 1960).

Unlike the other pinniped hunters, Mattole men often swam
to the seal and sea lion rocks where the animals were harpooned with a blue flint tip thought to be poisonous which would insure death. Hunting in canoes and clubbing the animals on the rocks were also practiced. Bones were left on the beach after butchering and the oil was stored in kelp bottles (Kroeber and Barrett 1960).

The Hupa, Bear River, and Sinyone groups also hunted seals and sea lions but very little detailed information regarding techniques and utilization is available (Kroeber and Barrett 1960). It is known the Hupa men, like the Yurok, decorated ceremonial headbands with pinniped teeth (Curtis 1924).

The Alsea

Following the European age of exploration and during the subsequent establishment of trading posts and settlements, the Indians of the Oregon coast came into contact sporadically with Spanish, Russian, French, and English sailors, trappers, and traders. Along with exposure to the dubious virtues of western European culture, the indigenous populations fell victim to numerous viral and bacteriological diseases for which they had no immunity. It may be fairly assumed that the resulting decrease in population numbers also weakened the culture of the groups affected. Pressured by an ever-increasing influx of European and American settlements, the coastal Indians were gradually displaced until 1856 when the groups between the Nestucca River in Oregon
and the Klamath River in California were removed to the Siletz reservation. J. Owen Dorsey, visiting the reservation in 1884 for linguistic and ethnographic information, noted that the Indians had built several board houses, and had fenced in the fields where they cultivated oats, potatoes, and several kinds of vegetables. Evidently acculturation had progressed more quickly than expected over that thirty year period for he was "...surprized to find no Indians in their native attire" (Dorsey 1889:55).

From that time until the 1930s occasional ethnographers and other interested persons questioned informants in the hope of fulfilling the Boasian goal of recording cultural traits before the knowledge was irrevocably lost. Even at the time, anthropologists recognized the mammoth proportions and ultimate failure of the realization of such a goal to its fullest extent.

"It is sincerely to be hoped that the information regarding these...stocks of the Siletz reservation can be procured without delay, for the appalling death-rate in the groups, due particularly to the ravages of tuberculosis, makes their early disappearance inevitable" (Farrand 1901:247).

These Siletz groups were studied only rarely through this period because of ethnographic priorities being placed on the more colorful groups of the Northwest coast and of California. The first detailed account of what was regarded as the "...humdrum little drama of Alsea life" (Drucker 1939:101) was researched in the summer of 1933. By this time the oral tradition was
several generations removed from the events and activities which were described and was far from complete. Barnett (1937) recognized the weaknesses inherent in this manner of data accumulation; "...it cannot be too vigorously insisted that the account of one individual, no matter how excellent his memory or integrity, is not to be accepted as the final word on his tribal life...." (Barnett 1937:157).

Fortunately, Dorsey's information was communicated to him within the first generation following the formation of the Siletz reservation. He estimated a total of 20 "Al-si" villages and camps and recorded many of their names including Ku-tau-wa at Seal Rock (Dorsey 1890). This site was supposedly the largest and northernmost village of the Alsea however its exact location is unknown at present. Drucker (1939) reported that these people were never numerous and probably never inhabited more than a dozen permanent villages at any one time although there were perhaps twice that many temporary camps and fishing sites scattered up the Yaquina and Alsea rivers.

Bordered to the south by the Yaquina and the Siuslaw who were related to the Alsea through their common Yakonan linguistic stock, they were to a large extent isolated from both the Salishan groups of the Northwest coast and from the Athabascans in southern Oregon and northern California (Dorsey 1889; Barnett 1937). Although cultural influences from both directions were ascertainable, Drucker (1939) reached the conclusion that the
Alsea retained culture components of the Northwest coast to a much greater degree.

From his interviews Drucker (1939) concluded that the Alsea had relied primarily on fish, especially salmon, for their basic subsistence and that they did not possess the technology necessary in securing offshore species. Any other game procured was considered merely supplementary.

The only fishing ritual reported involved wrapping the bones of the first killed salmon in leaves of a water plant until enough had been caught for all to eat at which time the bundle was unceremoniously discarded (Drucker 1939). (Compare with "first killed" rituals of Tolowa, page 22.)

Canoes, considered to be indispensable to these riverine-oriented people, were of three types. The most highly prized was an oceangoing vessel of Nootka manufacture, obtained from the north by trade. Assuming that the Alsea did not engage in offshore fishing, these large canoes may have been used primarily for travel up and down the coast. A smaller version of this canoe as well as a "shovel-nose" type were manufactured similarly from a single piece of wood by the Alsea (Drucker 1939).

Around 1870, according to a recent ethnohistoric interview, the Alsea engaged in the construction of Kwakiutl type canoes, aided by a Haida or Kwakiutl man who lived among them while trapping for the Hudsons Bay Company. As stated in this account, he was solely responsible for carving of the structurally
important canoe prow. On such a vessel a crew of men might remain at sea for two or three days fishing for halibut and return with the hold filled to its one ton capacity (Caday: personal communication). If this report is factual it would seem that not all the Alsea had been removed or retained on the reservation since the informant also states that each newly completed canoe was "christened" at Seal Rock in conjunction with a feast centering around an adult male sea lion, killed especially for the occasion. The reliability of this informant has been questioned, not regarding his honesty, but because of both the sizable number of years intervening and the fact that the informant himself did not witness the events related; essentially the same problems inherent in oral traditions recognized by Barnett and Drucker.

In many cases these difficulties arising from understandably incomplete ethnographic accounts and mythologies may be overcome by employing archaeological data. As a case in point, neither Barnett nor Drucker credit the Alsea with the technological capability or the willingness to undertake the hunting of pinnipeds on more than one occasion. Although one informant remembered hearing of a rock where men went out to club or harpoon seals and sea lions, Drucker concluded that unlike the Northwest coast and northern California coast cultures, "...sea hunting was known but was adjudged too difficult to be worthwhile" (Drucker 1939:84).
Myths obtained from Siletz reservation informants in 1910 and 1913, however, suggest a traditional basis supporting the routine hunting of pinnipeds. The Aslea creation myth specifically recounts the creation of both seals and sea lions to inhabit the offshore rocks, "...in order that my children may catch and eat them" (Frachtenberg 1920:91). Seal Rock is the setting for another myth which gives us our only information on sea lion and seal hunting techniques, many of which resemble similar methods in use by groups both to the north and south of the Alsea, especially the Tolowa. The mythological characters repeatedly remark on the unusual behavior of the harpooned seal in towing the canoe in a straight direction, indicating some knowledge based on past experience of the reactions of these animals under such circumstances (Frachtenberg 1920).

As a result of excavations at the Seal Rock site it has been determined that the amount of pinniped remains recovered are indicative of a more fully developed utilization of this resource than is suggested in the literature. Further, the proportions of adult male Stellar sea lions (*Eumetopias jubata*) present indicate a focus on a definite sex and species rather than a catch-as-catch-can approach. Additionally, although few artifacts were among the organic remains of the shell midden, several examples of large, composite type harpoon heads, typical of Northwest coast pinniped hunters, were included in the inventory. A more detailed discussion of inferences drawn from the
archaeological findings may be found in the final chapter of this paper.
BEHAVIOR AND ADAPTATIONS OF THE ORDER PINNIPEDIA

Pinnipeds ("wing-" or "feather-footed") are divided into three families: Otariidae, Odobenidae, and Phocidae. The Odobenidae (walruses) are out of the study range of this paper and for that reason will not be discussed here.

Physically the most diagnostic of the Otariid characteristics are the presence of small external ear flaps and the flexibility of the hind flippers, which may be turned forward to aid in locomotion across land. Eumetopias jubata (Stellar sea lion), Zalophus californianus (California sea lion) and Callorhinus ursinus (Northern fur seal) are included in the family.

Phocids, the "true" or "earless" seals, are unable to rotate their hind flippers forward under the body. Movement across land is accomplished by wriggling motions of the torso. Phoca vitulina (common or harbor seal) and Mirounga angustirostris (Northern elephant seal) fall into this category.

Victor B. Scheffer (1958) in his extensive work on pinnipeds described the general characteristics of the order. Unless otherwise noted, the information following was drawn from this source.

The pinniped body, streamlined for swimming, is larger on the average than that of the carnivores and probably developed in response to a cold environment. An increase in body mass,
accompanied by smaller appendages, actually decreases the surface area thus aiding in more efficient heat retention in northern marine climates. Tough, thick skin not only is adapted to water but stands up to the rough, cutting edges of rocky hauling out areas and rookeries.

Although blubber functions to some extent in a thermo-regulatory capacity, the more important aspects of the thick layer of subcutaneous fat have to do with pinniped metabolism. Many pinnipeds are known to survive without food or water due to these energy reserves for varying lengths of time with little or no deleterious effect (Scheffer 1958; Ingles 1965). Blubber supplies the necessary base for maintenance of body heat during fasting periods in spite of the high metabolic rate typical of pinnipeds. The fat layer aids also in buoyancy and fills out the body shape to its torpedo-like proportions.

Skeletal characteristics have evolved to cope with a marine environment. Bones are generally lighter in weight, their internal structure showing markedly less differentiation between marrow and compact bone than is typical in land mammals. This composition may result in greater buoyancy but especially illustrates an adaptation to the stresses on the appendicular skeleton from long periods of swimming rather than locomotion on land. The thoracic limbs are attached directly to muscle rather than to a clavicle, allowing for greater flexibility. Humerii and femora
are broader and shorter in relation to the body than is usual in land carnivores. Pelvic structures of pinnipeds are more conducive to powerful movements rather than to speed.

All pinnipeds feed underwater and appear to be totally carnivorous although highly variable in diet, according to the species. Jaws and teeth are developed for grasping and tearing rather than chewing, resulting in a reduction of the sagittal crest. In males of polygynous species, this muscle attachment is still somewhat developed due to the necessity of strong jaws in conflicts concerning territory maintenance on the rookery. Dentition is fairly uniform and simple; two to three incisors, one canine, and from four to six sharp-pointed post-canines per mandible, all of which become severely worn during an individual's lifetime.

At least some pinniped species exhibit an unusually high blood clotting time; as quickly as five seconds for Callorhinus (under natural conditions). Given territorial combat between breeding males, attack by sharks and killer whales, and the snapping apart of the umbilicus of newborn pup, rapid clotting time would prove to be of great survival value.

Reproductive behavior is variable between the Otariids and the Phocids. Otariids are polygynous; that is, one male breeds many females with ratios of females to males ranging from 15:1 to 40:1, depending on the species. Copulation takes place a few days after pupping and, with very few exceptions, is accomplished
on land. Polygynous species illustrate a high degree of sexual dimorphism as a result of male intraspecific conflict during the spring breeding season.

Phocids, with only two exceptions, do not form harems and maintain territories. Being essentially monogamous for the season, the male and female are nearly equal in size and breed in the water rather than on land.

In both Phocids and Otariids the fertilized egg remains in an arrested stage for two or three months before implanting into the uterine wall where continued development of the fetus takes place (Newby 1972). Actual gestation periods among species vary but the end result is that all pups will be born during a limited time each year at the rookery.

Newborn of all species receive milk which is extremely high in fat content (42-53%) and, in some species, may increase in weight by 50% after the first week. Weaning varies among the species, occurring anywhere from two or three weeks to eighteen months. Both the rich maternal milk and extended nursing periods allow the pups to prepare for the rigors of their first winter at sea.

Sexual maturity is also variable but occurs generally late compared to land mammals. Even after physical maturity is attained, these social animals often do not become reproductively active for several more years. In the males of polygynous species
this probably emphasizes the relative size and strength necessary to challenge rivals and endure the rigors of the rookery.

Pinnipeds in general are long-lived, in some cases between 30 and 40 years although the average is probably lower. Some deaths occur in the rookery during birth or from pups being crushed by heedless adult males.

Predators chiefly prey upon the pups who are not fully skilled in escape maneuvers, however partially digested remains of adults have also been found in the stomachs of killer whales, sharks, and polar bear.

Because of their marine orientation it should come as no surprise that many pinnipeds roam thousands of miles from the rookery during the year, although a few species are much more sedentary (Seed 1972). Migration patterns of Callorhinus have probably been studied more extensively than any other because of the fur seal's high economic impact in the past. Generally, however, little is known concerning the specifics of other pinniped migrations due to observational difficulties.

A closer examination, on an individual basis, of the four species represented at Seal Rock will assist in clarifying some of the more general points in the preceding discussion.
Eumetopias jubata

Stellar sea lions range from the Pribilof Islands south to Santa Rosa Island, off southern California (Mate 1973). Although marine in nature Scheffer (1958) reports one captured nearly 75 miles inland at Oregon City.

Migrations of Eumetopias follow the same general patterns year after year. Males depart from the California rookeries immediately after the breeding season concludes, heading north (Gentry 1972). In Oregon, the movement of Eumetopias males from coastal rookeries to hauling areas further north is evident by mid to late July and by the end of September, no adult males remain in the state. During the winter most male Stellars find hauling out areas north of Puget Sound, Washington (Mate 1973).

Female Eumetopias and pups, after leaving the rookery a few weeks behind the adult males, move north along the Oregon coast until mid-winter when there are few left in the state. An exception is the case of Sea Lion Caves where some female Stellars are known to over-winter with Zalophus although the two species do not intermingle (Mate 1973).

During March and April a southward-bound wave of female and yearling Eumetopias, some of which are still nursing, pass through Washington and by the end of May and early June, have reached the rookeries of California (Orr and Poulter 1967) although many drop out of this migration to breed in Oregon (Mate 1973).
Figure 4: Stellar sea lions (*Eumetopias jubata*).
Males appear increasingly in Oregon during March and April and by mid-May have established territories on the rocky, offshore rookeries (Mate 1973). California populations are only a few weeks behind this schedule.

Selection of rookery locations (and hauling areas to some extent) are dependent on several factors including isolation from human disturbance, easy access from the water, availability of food, and protection from waves and wind. Moreover, *Eumetopias* seems to prefer a rocky island rather than the flat sand beaches selected by *Zalophus* (Peterson and Bartholomew 1967).

Territorial bulls, who may be three times larger than the females, are spaced evenly across the rookery. They spend the initial days making noisy threats toward other males and attempting to entice females into their semi-permanent "harems." Although breeding males may go without food for up to 60 days (Gentry 1972) bulls on small rookeries are known to make short feeding trips and return to claim their territory unchallenged (Mate 1973). "Bachelor" males, too young to secure a harem, and unsuccessful territorial bulls haul out on the fringes of the rookery or on nearby rocks (Orr and Poulter 1967).

Females are not bound to one territory and move freely over the rookery. Birth of a single pup per female begins a few days after the females arrive early in June. Copulation may take place anytime after the middle of the month (Orr and Poulter 1967; Gentry 1972) and, as in most pinnipeds, delayed implantation
is the rule.

Pups, although fairly strong at birth, spend the first two weeks close to their mothers, nursing often. After this period the mother copulates and resumes feeding trips into the ocean, leaving her pup in the company of other young who amuse themselves by playing in splash pools and mock fighting (Gentry 1972; Orr and Poulter 1967).

Fear of humans is not developed in the pups until much later and they are easily approached (Orr and Poulter 1967) unless their mothers are nearby to carry them to safety in their teeth (Scheffer 1944). Even when hauled out adults take flight, pups usually are hesitant to leave the rookery for the safety of the ocean.

Adults react in alarm to unusual noises or an upright, moving form. Warning vocalization by one animal may result in the immediate desertion of the hauling area by the others of the group. In a rookery situation, however, territorial males are reported to stand their ground even after receiving several rifle slugs in the chest (Mate: personal communication).

Eumetopias pups double their body weight and increase their length by 25% during the first seven weeks (Scheffer 1944; Bryden 1972). Length at birth is approximately 100 cm (40 in.). Weight averages about 20 kg (44 lbs.) (Bryden 1972). Weaning may take place as early as 12 weeks (Bryden 1972) or well into their second year, especially among northern populations (Gentry 1972).
In contrast with the rapid postnatal growth, sexual maturity is relatively late. Males reach puberty at four or five years but are not socially and physically ready for the rigors of breeding until around nine years of age. *Eumetopias* females are capable of breeding as early as their third year but their reproductive activity appears to be determined by population fluctuations (Mate: personal communication).

At maturity, large males measure 315 cm (124 in.) in length and weigh 1,016 kg (2,240 lbs.). The females are smaller: 231 cm (91 in.) in length and 274 kg (605 lbs.) in weight (Scheffer 1958). Fiscus (1961) determined by skull measurements that the growth rate levels off at about eight years in females and ten years in males.

*Zalophus californianus*

The California sea lion breeds from San Miguel Island, off the coast of California, to Mazatlan, Mexico. At the end of the breeding season, many four to ten year old *Zalophus* males begin a slow, organized migration north, often hauling out with the few *Eumetopias* still in the area. Although many over-winter in Oregon, a few continue into the waters of British Columbia (Mate 1972).

Exact migratory patterns of females and pups are not known but they evidently do not follow the northward course taken by
Figure 4: California sea lions (Zalophus californianus) swimming (from Coffey 1977:124).

Figure 5: California sea lion (Zalophus californianus) (from Walker 1969:1290).
the males along the Oregon coast (Mate 1973).

In the spring, irregular groups of Zalophus males returning to their rookeries in California pass through Oregon coastal waters during April and May. Between mid-June and mid-August no Zalophus are found in Oregon (Mate 1973). It is during this time that territorial males establish themselves on the rookeries. Unlike Callorhinus, these sites are not permanently fixed, traditional locations. While they breed on the same sections of coast every year the precise area may be shifted slightly due to heavy waves, human disturbance, or for no apparent reason (Peterson and Bartholomew 1967). They seem to prefer sandy beaches or flat rocky areas rather than the more rugged terrain typical of Eumetopias rookeries.

Zalophus rookery behavior is parallel to that of Eumetopias and other polygynous species. Bulls maintain a territory and unsuccessfully attempt to restrict the movement of females on the rookery. Copulation takes place a few weeks after pupping and delayed implantation again coordinates the birth of the next season's young with the gathering of males and females (Mate 1972).

Reaction to human disturbance during the breeding season is also similar to Stellar behavior. "During June and July, a territorial bull may refuse to retreat and may chase a man to its territorial boundary" (Peterson and Bartholomew 1967:17). Females with new pups will usually remain with them long after other
adults have fled into the water.

Normally, because of their poor vision on land, *Zalophus* may be approached fairly easily. A distinct silhouette and rapid movements will cause an alarm response whether the object is a human or a threatening *Zalophus* bull. By keeping a low profile and moving slowly, however, it is possible to come to within two meters of a group of females and pups. These sea lions will also react with alarm to any sharp noise or unfamiliar odor (Peterson and Bartholomew 1967). Repeated disturbances over several years may cause the animals to abandon a rookery site permanently.

Growth rates are typical of pinnipeds in general; late sexual maturity following a rapid increase in total body size in the first weeks after birth. Yearlings often continue nursing into their second year although it is not certain whether this relationship is maintained after the birth of a new pup (Peterson and Bartholomew 1967).

As polygynous *Otariids*, the California sea lion exhibits a disparity in body size between males and females. Large males may weigh 281 kg (620 lbs.) and be up to 236 cm (93 in.) in length. Female maximum weight is around 91 kg (200 lbs.) and may be 183 cm (72 in.) long (Scheffer 1958).
Callorhinus ursinus

During its five to eight months away from the rookery, the Northern fur seal ranges across the subarctic waters of the Sea of Japan, Bering and Okhotsk Seas, and the North Pacific Ocean. Migration patterns of Callorhinus, the object of intensive pelagic sealing, have been studied in more detail than any other pinniped since the capture of the animals necessitates knowledge of their movements in the water (Kenyon and Wilke 1953; Rovnin 1971).

Small groups of 10 to 15 females and pups, segregated according to age and sex, spend the winter widely dispersed at sea. In the Eastern Pacific they are found from Unalaska to San Francisco along the 100 fathom line, concentrating off the coast of central Oregon and Washington. Animals found on the beaches are usually sick and hauled out because of weakness. By early spring (March and April) most have begun the northward movement to the traditional breeding island of their birth in the North Pacific, arriving at the Pribilof Islands in late June and early July (Kenyon and Wilke 1953; Fiscus 1972).

Generally the bulls, with few exceptions, do not accompany the females on their southerly wanderings, remaining instead somewhere in the extreme northern Pacific and so begin to arrive at the rookeries during April and early May (Perlov 1971). The older, pregnant females also arrive ahead of the majority, usually beginning in mid-June (Fiscus 1972). Young
Figure 6: Northern fur seal, Callorhinus ursinus. Note male in upper right of photograph (from Walker 1969:1294).
seals of the previous two seasons rarely return to the rookery before September, spending the majority of their first year and a half at sea (Kenyon and Wilke 1953).

Pupping season peaks in mid-July and the outward migration of females and young begins in late October. By December only a few animals, usually adult males, are still hauled out on the islands (Fiscus 1972) often in the company of adult "sea lions" (Eumetopias?) (Chugunkov 1971).

As Otariids, Callorhinus rookery behavior and subsequent delayed uterine implantation is parallel to that included in the discussions of Eumetopias and Zalophus.

Pups adapt quickly to the marine environment, taking to the water by the first week in August. In contrast to Zalophus and Eumetopias weaning is early and abrupt, occurring when the mother leaves the rookery for the southward migration. There is no indication that pups follow their mothers, instead they usually leave the islands singly or in pairs to wander the ocean for the next year or more (Kenyon and Wilke 1953).

At birth, average length in pups is 64 cm (26 in.); weight is around 5 kg (11 lbs.) (Bryden 1972). Sexual maturity is attained at three to five years of age for females (Bryden 1972; Kenyon and Wilke 1953) when physically mature (Muzhchinkin 1971). Reproductive activity is initiated between five to six (Bryden 1972) or from seven to ten years (Kenyon and Wilke 1953) in males.
Adults have a lifespan of around 26 years for females but an average of only 17 years for males, the latter age possibly a result of the physiological stresses involved in territory defense and associated rookery behavior (Fiscus 1972).

Large males may measure 214 cm (84 in.) in length and weigh up to 278 kg (613 lbs.). *Callorhinus* females reach only 143 cm (56 in.) and weigh a maximum of 63 kg (138 lbs.) (Scheffer 1958).

**Phoca vitulina**

Harbor, or common, seals are distributed from Herschel Island in the Bering Sea, south to islands off Baja California, Mexico (Scheffer 1958). They commonly inhabit river and marine estuaries or small reef rocks but have been known to travel upriver for several miles (Ingles 1965).

Acute land vision enables these animals to perceive danger (e.g. the approach of humans) much more readily than the sea lions with which they occasionally haul out. One alarm sounded by a harbor seal results in an immediate flight reaction by sea lions and seals alike, making close observation of these Phocids extremely difficult (Peterson and Bartholomew 1967).

Pups, weighing about 10 kg (22 lbs.) and measuring 82 cm (33 in.) (Bryden 1972), are born singly in May and are capable of swimming only moments after birth (Newby 1972). By the third
Figure 7: Harbor seal female and pup, *Phoca vitulina* (from Coffey 1977:173).
week of their nursing period, their birth weight has doubled, due to the 42% butterfat content of the female's milk. The mother and pup relationship is continued for approximately six weeks until the estrus cycle of the female begins and weaning takes place (Newby 1972).

Phoca does not follow the territorial rookery pattern of the Otariids; rather the male and female copulate in the water during early September. Implantation of the fertilized egg in the uterine wall is delayed for a month, extending the normal gestation period to coincide with the spring pupping season (Ingles 1965; Newby 1972).

From birth to five years, growth of male and female seals remains constant and parallel at which time females are physically mature. Males continue to grow until the age of nine or ten years, but even at maturity are only 9% longer and 34% heavier than the females (Bryden 1972). Sexual maturity is attained for the male of the species between their third and sixth years. In the female, reproductive activity is possible for individuals as young as two to four years of age (Bryden 1972; Newby 1972).

Phoca life expectancy is estimated at around 29 years (Newby 1972).

Being non-territorial during the breeding season, Phoca
does not display the sexually dimorphic tendencies typical of the Otariids. Males may reach 173 cm (68 in.) in length and weigh 116 kg (256 lbs.) while large females nearly match these dimensions with a 154 cm (61 in.) length and weight of 110 kg (243 lbs.) (Scheffer 1958).
OSTEO-ARCHAEOLOGY

The recent advent of faunal analysis as an integral part of an archaeological investigation is, as yet, in its formative stages. Unlike the well-established methods of the study of lithic tools, pottery shards, or other artifactual material, the examination and consequent reporting of animal remains from sites has been inconsistent, to say the least. Typically, when faunal material is mentioned at all if often takes the form of a species list included in the appendices which give little or no solid quantitative information.

Increasingly, however, archaeologists are becoming aware of the information obtainable from a more stringently controlled investigation of the various bones recovered from their sites. With very few exceptions the faunal debris found in a site is a direct result of human behavior and as such, when studied in conjunction with other cultural evidence, may allow inferences regarding the technological and preferential aspects of hunting, the seasonal occupation of the site, and certain biological data.

Quantification Methods

If our goal in the study of faunal remains is truly to accomplish something more than a chart of species represented, then one of the most basic steps of the analysis should be concerned with quantification. Three approaches to this aspect
have been introduced over the past few years, each method
edorsed by its own following. It seems to be most important
at this stage to keep a proper perspective of what these methods
are capable of yielding in information as well as recognizing
each one's very definite limitations.

An archaeological excavation is, with some exceptions,
only a sample of the total site. In recognizing it as such it
should be obvious that no matter which method is employed the
results will be far from absolute numbers. That is, we cannot
state flatly that the site contained X number of elk and Y number
of sea lions. Rather, these various methods are only intended
to give figures which may then be manipulated statistically and
consequently yield information in ratios and relative numbers.

No matter which method is put to use, it is vital that
the investigator be consistent, explain why he chose a given
quantifier, and detail each step in his procedure. It is only
in this manner that a body of data results can then be either re-
evaluated by another researcher or compared with similarly
treated information from another site.

The first of these methods involves weighing of bone re-
covered from the site and multiplying the resulting figure by a
factor to give the amount of meat which is represented. This pro-
cedure contains several inherent limitations. Probably most
critical is the assumption that there is a constant relationship
between the total dressed carcass weight and the weight of the
bones of the carcass (Chaplin 1971). Although there may indeed be a measureable relationship of bone to meat, Chaplin (1971) is not satisfied that present knowledge is sufficient for computations of this nature. He maintains that this ratio changes through growth phases, seasonal fluctuations of body mass, and pregnancy so that in order to be accurate, separate determinations would have to be figured for each bone of each sex of all developmental stages of each species.

Additionally, many excavated bones are highly fragmented and could not be identified to the extent necessary for use in such a scheme. The resulting calculations would inevitably be biased if based only on whole bones (Chaplin 1971). Assuming the fragments could be utilized in some manner there is still a wide gap among osteo-archaeologists concerning how they may be manipulated to yield the pertinent information. Opinions range from the grab-bag concept of figuring weight based on fragments in general categories such as "Small Mammal" (Ziegler 1973) to a theoretical mix and match scheme attempting the masochistic task of assigning fragments to their species in a site where deer, sheep, goats, and gazelle are all represented (Daly 1969).

Other limiting elements include the fact that conversion factors necessary in meat weight calculations have never been standardized and thus fluctuate widely, a situation which once again could impair valid intersite comparisons. Also, much of
the information which is currently available on live or dressed animal weight is based on domesticated species only, which have been selectively altered and bear very little resemblance to their ancestors and give no help at all for weights of game species (Chaplin 1971).

If some of these problems could be remedied, this procedure might offer several positive returns. An assistant could take weights at any time during the analysis; relatively simple numbers would be more adaptable to data processing than many other methods; total bone weight figures could allow for easy site comparisons (Ziegler 1973). Standardization of this method appears to be possible in the future but in the meantime leaves the bone to meat ratio in a rather shaky position.

The second method involves counting of fragments or complete elements present for each species and reporting that figure for comparative interspecific calculations. Unsuitable as it is for the study of either domesticates (Chaplin 1971) or game animals (Daly 1969; Grayson 1973) it seems attractive at least superficially because it is faster than other methods and so has been in widespread use for some time.

Questions concerning the soundness of this method center around that fact that in many cases fragments belong to the same individual but are counted as though they were unique (Grayson 1973). Additionally, not all mammals have the same total number
of bones, especially metapodials, so a straight count of elements represented could greatly alter the true relationship (Daly 1969).

The third plan, which appears to be most effective, is calculation of minimum numbers of individuals (MNI) first introduced to archaeology by T. E. White (1953). Since that time numerous archaeologists have revised the basic method to accommodate their own sites and theories, however the underlying tenet remains constant. MNI is calculated by counting the number of unique skeletal elements of a species (i.e. left astragalus, right femora). The most numerous element will represent the least number of individuals necessary to account for the faunal assemblage of that species. Therefore, if the grey squirrel collection contains four right femora, six left radii, and seven right ulnae, then it follows that there were at least seven grey squirrels in the site.

At first glance the method seems fairly cut and dried but closer examination reveals several areas of possible confusion. The degree of bone deterioration varies from site to site depending on initial butchering practices, scavengers, and subsequent soil conditions leaving skeletal elements in every state from whole to badly fragmented. Bones which are moderately fragmented are still fairly simple to manipulate for an MNI figure by using only articulating ends of long bones, the glenoid fossa of the scapula, or several of the compact tarsals and carpals which normally have a higher survival rate than more delicate
structures. Assemblages of faunal material which are fragmented to a greater degree present more serious problems. A tedious but meticulous scheme has been developed for taking measurements of fragments and essentially reaffiliating them with the original bone (Chaplin 1971) but both lengthy analysis time required and the size of most faunal collections are usually prohibitive factors against this method.

For an MNI which is more nearly accurate the age, size, and sex of left and right elements may be compared to allow for the possibility that, for instance, not all left elements will match a right element thus increasing the MNI by the number of bones which do not fall into pairs (Ziegler 1973; Chaplin 1971). Size is an uncertain diagnostic tool since not all left and right elements from the same animal have the same measurements (Chaplin 1971). As for sexual determinations Chaplin excludes it as a solid criterion, particularly for domesticated species, "...since at present few bones may be accurately sexed, and fragments rarely so" (1971:70). This naturally would not be true of species where sexual dimorphism has resulted in differing anatomical developments or contrast in over-all body size.

The "bookkeeping" aspect of MNI calculations is, however, only part of the total picture; relative numbers of animals have no meaning except as they relate to the site. Three approaches to this question are common, each better suited than the others to various types of site situations and are mutually exclusive
where site comparisons are concerned. Grayson (1973) defined these as the maximum distinction, minimum distinction, and an unnamed "compromise" method.

Maximum distinction of MNI is based on calculations made by stratigraphic levels within each excavations unit. In this way each unit is viewed as a universe unto itself and minimum numbers are figured for each group of faunal material within that area. This scheme results in the most generous numbers by not taking into consideration that the units are purely arbitrary measurements which fail to recognize that skeletal elements from one individual may be scattered among several squares.

White (1953) computed minimum numbers from one component sites by treating each species in the faunal assemblage as an entire population. Grayson (1973) refers to it as the minimum distinction method, useful in poorly stratified sites but yielding a conservative MNI figure.

Grayson (1973) favors the "compromise" method as most reliable and the most archaeologically sound when site conditions allow. MNI is calculated on the basis of stratigraphic concentrations regardless of the excavation units involved which seems to produce the most unbiased numbers of the several methods.

The minimum number of individuals approach to the quantitative aspect of faunal analysis results in figures which are comparable between sites, assuming that the actual calculations
were made in the same manner, and which allow more detailed inference than is possible with either the weight or the fragments method (Grayson 1973). Once again, the most vital part of MNI or any other method is the need for standardization among osteoarchaeologists with a succinct description of the process as used included. Only in this manner will faunal analysis reach its full potential.

Laboratory Procedures

With the theoretical and methodological base in mind, field and laboratory techniques may be considered. Although each site is unique, retrieval of faunal remains should be as consistently precise as condition will allow. Every archaeologist has a method of records and field notes and it is not within the scope of this paper to recommend procedures of this nature. Suffice it to say that all bone fragments should be kept and especially the larger fragments and whole bones should be located horizontally and vertically within each excavation unit.

Several experienced osteo-archaeologists (Chaplin 1971; Ziegler 1973) describe laboratory procedures in which all bones and fragments are packaged according to unit and level, thus relieving the lab workers the chore of individually marking each piece. It seemed much easier in my own case, however, to separate each species by element. In this way I was able to maintain a more consistent pattern with identification of age, sex, and
orientation of each bone than if I had been working with a package of mixed elements. Unidentifiable fragments were still labeled by unit and level and set to one side.

Most important, especially for those inexperienced in faunal identification, is access to a good quality skeletal comparative collection. Many departments on a university campus house cranial and pelt collections but those are of little value to the archaeologist who deals not only with the skull but with the post-cranial skeleton as well. Although there are many illustrated comparative guides for work of this nature (Gilbert 1973; Olsen 1972 & 1973) there is no substitute for the precision which is possible in comparing two bones side by side. The larger the collection the more likely a positive identification will be despite interspecific and intraspecific variations (Lyman 1976).

As each bone or fragment is identified, the information must be recorded in an organized fashion usually involving a type of printed form. There is no shortage of examples (Daly 1969; Ziegler 1973; Gilbert 1973) which may be used either as shown or adapted to suit. Typical categories include:

(a) Genus and species
(b) Approximate age - epiphyses fused or unfused
(c) Sex
(d) Name of skeletal element
(e) Position of the element in the body
(f) Condition of the bone - charred, evidence of pathology, etc.

(g) Whole, fragment, epiphysis, etc.

(h) Provenience

Ideally, each bone can be described in detail, allowing for subsequent data manipulation. There seem to be few "ideal" situations, however; many fragments seem to defy classification to this extent and present a further test of patience to the osteo-archaeologist. Bone fragment analysis may be accomplished on several levels and it is vital that the final report contain such procedural descriptions in detail.

Faunal materials excavated from site 35 LNC 14 indicated a unique situation compared to other shell middens tested along the Oregon coast because of the presence of unusually large quantities of pinniped remains. For this reason it was determined that the sea mammal materials would best be studied separately rather than as only one component of an entire faunal analysis.

A quick literature examination revealed a list of five species in the order Pinnipedia which range off the Oregon coast:

(a) *Eumetopias jubata* - Stellar sea lion

(b) *Zalophus californianus* - California sea lion

(c) *Callorhinus ursinus* - Northern fur seal

(d) *Phoca vitulina* - Harbor or common seal

(e) *Mirounga angustirostris* - Northern elephant seal

(Scheffer 1958).
With the cooperation of Dr. Bruce Mate, assistant professor of oceanography, Oregon State University, and Dr. Richard Stroud, associate in veterinary medicine, Oregon State University, a comparative skeletal collection including these species was initiated and is added to constantly. Long hours by several individuals were spent in processing the carcasses to form a working comparative collection.

The majority of the faunal material from Seal Rock has been cataloged according to horizontal and vertical position at the end of each field season. What little remained was washed and marked individually with the provenience and a catalog number. Small fragments with the same provenience were bagged and labeled in the same manner.

Most of the bones were marked individually, making it possible to separate out the pinniped material from the entire faunal assemblage with relatively little trouble. The sea mammal remains were then subdivided according to skeletal element for ease in identification.

As each group of elements was examined, the specific information from each bone was recorded on a form for the proper species which included several categories (see Appendix). Sex, at least from the more mature animals, was not difficult to determine because of the vast differences in body size between male and female of the same species.

Approximate age determinations for each bone were based on
the stage of epiphyseal fusion and on size and appearance. Each sex was divided into "Adult" and "Late Juvenile" categories; the former included all bones whose epiphyses were joined to the shaft. The latter classification designated elements which showed signs of incomplete fusion of either articulating end and often were slightly smaller than "Adults." A search of the literature for ages of pinniped epiphyseal fusion proved unfruitful. Because this process varies among mammals, it is not accurate to use data interchangeably among species. To complicate matters, some animals have unfused epiphyses well into maturity (Daly 1969). As a result, the "Adult-Late Juvenile" designations proved to be more a statement of bone development rather than an adequate age criterion.

"Juvenile" classification indicated a markedly immature, smaller bone showing no sign of epiphyseal fusion and a smoother surface lacking muscle attachment ridges and scars usually present in an adult animal. Vertebrae, although complete in basic structure, are without fused intervertebral discs.

"Infant" included all of the smallest representations of each species which were without the more mature, sharply defined form and were incompletely ossified. Some of these may have in fact been fetal animals.

Because individual aging of bones proved uncertain at best, especially between "Adult" and "Late Juvenile" animals, teeth were utilized in obtaining this information. Canines contain
annual growth ridges which have provided accurate information on
the aging of pinnipeds by marine mammologists for several years.
Although some prefer making a sagittal section of the tooth for
microscopic examination (Fiscus 1961; Orr, Schonewald, and Kenyon
1970) less time and no expensive equipment is required to remove
the cementum from the canine either with sandpaper or by chipping
it away to reveal the underlying rings (Mate: personal communication). Once exposed, a fairly accurate age may be determined by simply counting the prominent ridges. This latter method is especially recommended when a close rather than an exact age is sufficient.

Another category in the description of individual bones
is the side of the animal from which the appendicular element
originated. With a well-marked comparative skeleton this cri-
teron is usually quite simple to determine and is necessary for
figuring MNI and, in some cases, for inferences regarding butcher-
ing practices.

Provenience for each bone was also noted along with descrip-
tions of pathological conditions evident and the degree of frag-
mentation, if any.

The inevitable presence of fragmentary faunal remains from
an archaeological site requires the establishment of an identifi-
cation scheme. Fragments range from nearly whole elements to
pieces not much larger than bone dust and so cannot be treated in
the same manner. For purposes of the Seal Rock pinniped analysis,
fragments were assigned to a class depending on the extent to which they could be identified.

Figure 8 illustrates the classification scheme employed. Generally speaking non-fragmented bones could be completely identified from recognition as pinniped material down to its orientation within the body and for this reason would be regarded as belonging in Class A. A small fragment such as a midsection of rib might be identifiable only as far as species and recognition of the skeletal element. In this case it would be assigned to Class D. Fragments of Class F were usually so small that the characteristic bone composition of the pinnipeds was the only clue as to their origin.

Fragments in Classes A-D also were described according to the area of the element which they represent such as proximal or distal end of a bone, epiphysis fragment, vertebral spinous process, etc. Bone materials falling into Classes E and F were identified by provenience and bagged.

Following the conclusion of individual bone descriptions, minimum numbers for each of the four species were calculated. Because the Seal Rock shell midden was virtually unstratified (Ross:personal communication) Grayson's "minimum distinction" method for computing MNI was employed. In this manner all of the faunal materials of each pinniped species were regarded as belonging to one assemblage. In order to allow for the most liberal figure possible from this essentially conservative MNI method,
### Identification Classes

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Order</strong></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pinnipedia</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Genus and Species</strong></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Element</strong></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Side</strong></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Figure 9:** Classification levels for individual bones and fragments.
several unique elements were counted rather than merely one predetermined bone. This approach also allowed for a quick check to be sure no particular element was repeatedly missing or only rarely represented in the faunal assemblage.

Six elements, chosen both for their scattered placement in the body and for their relative resistance to deterioration, were counted. They were:

(a) Left radius
(b) Right femur
(c) Left calcaneus
(d) Atlas
(e) Axis
(f) Xiphoid of the sternum

Fragments of these elements were distinctive enough to rate an "A" classification with few exceptions and were included in the count.

Because of the paucity of remains (totaling 20 to 25 pieces per species, whole bones and fragments A-D included) for *Zalophus californianus*, *Phoca vitulina*, and *Callorhinus ursinus* the six elements chosen were not always represented. Therefore MNI for these three species was calculated by the group of elements present in each case. *Mirounga angustirostris*, with one possible exception, was not included in the Seal Rock materials.
Results

As discussed previously, teeth may be used to determine age more accurately than is possible by an examination of only the bones. Examination of the collection of loose teeth from site 35 LNC 14 also revealed that with only a very few exceptions they seem to be entirely from *Eumetopias jubata*. A *Callorhinus ursinus* post-canine and incisor, one post-canine of *Phoca vitulina* and a canine which may be from *Mirounga angustirostris* (Mate: personal communication) are the only other pinniped teeth present.

From a total of 36 male *E. jubata* canines, 18 were selected for use in age calculations by chipping off the cementum and counting the number of annual growth ridges. Many of the teeth were damaged, making an exact count impossible but still giving enough information for an estimate. Ages range between seven+ to fifteen+ years with an average of ten+ years.

Only two female *E. jubata* canines were available, one indicating seven+ and the other three+ years growth.

Minimum number computations served to reinforce what had been suspected during the excavations and laboratory work; male *E. jubata* remains are represented on a much greater scale than any other pinniped. Even if "Late Juvenile" values are added to "Adult" totals for both sexes, the ratio of male:female for *E. jubata* will be altered only slightly, resulting in a 4.4:1 relationship rather than the 4.8:1 ratio calculated for "Adults"
Figure 10: Male Eumetopias jubata canine with exposed annual growth ridges.
exclusively.

Ratios comparing the other represented species with *E. jubata* show a disparity of 9.6:1 for *C. ursinus* and *P. vitulina* and 14.5:1 for *Z. californianus* when based on combined figures for male and female of each species.

Figures 10-13 are summaries of the calculations made in determining the minimum number of individuals for each of the pinniped species. In an attempt to utilize the data to its maximum, several unique skeletal elements, rather than only one, were chosen from each species. From the resulting totals, the most numerous element was listed at the base of each column as the MNI for that age/sex category. As previously mentioned, the adult-late juvenile distinction proved to be more of an anatomical development than an actual criterion for age. However, in the interest of consistency, the originally recorded categories were retained.

One taxonomic problem should be noted here. Female *Eumetopias* and male *Zalophus* body weight and length ranges overlap, a situation which normally would not cause difficulties except that in this case the basic skeletal structure is so similar that a positive identification in some cases may be impossible. For this reason it is possible that a portion of the faunal material designated as female *Eumetopias* may in fact be male *Zalophus*. Bones listed as male *Zalophus*, however, were distinctive enough in size not to be confused with the female
<table>
<thead>
<tr>
<th></th>
<th>Adult Male</th>
<th>Late Juvenile Male</th>
<th>Adult Female</th>
<th>Late Juvenile Female</th>
<th>Juvenile</th>
<th>Infant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Radius</td>
<td>18</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>5*</td>
</tr>
<tr>
<td>Right Femur</td>
<td>19</td>
<td>3</td>
<td>5*</td>
<td>2</td>
<td>5*</td>
<td>5</td>
</tr>
<tr>
<td>Left Calcaneus</td>
<td>11</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Atlas</td>
<td>24*</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Axis</td>
<td>20</td>
<td>7*</td>
<td>3</td>
<td>2*</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Xiphoid</td>
<td>22</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MNI</td>
<td>24*</td>
<td>7*</td>
<td>5*</td>
<td>2*</td>
<td>5*</td>
<td>5*</td>
</tr>
</tbody>
</table>

Figure 11: Minimum number of individuals calculations based on whole elements and class A fragments for Eumetopias jubata.
<table>
<thead>
<tr>
<th>Bone</th>
<th>Adult Male</th>
<th>Late Juvenile Male</th>
<th>Adult Female</th>
<th>Late Juvenile Female</th>
<th>Juvenile</th>
<th>Infant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radius</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Tibia</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3*</td>
<td>0</td>
</tr>
<tr>
<td>Calcaneus</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pelvis</td>
<td>2*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Femur</td>
<td>0</td>
<td>0</td>
<td>1*</td>
<td>2*</td>
<td>1</td>
<td>1*</td>
</tr>
<tr>
<td>Axis</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sacrum</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MNI</td>
<td>2*</td>
<td>0</td>
<td>1*</td>
<td>2*</td>
<td>3*</td>
<td>1*</td>
</tr>
</tbody>
</table>

Figure 12: Minimum number of individuals calculations based on whole elements and class A fragments for Callorhinus ursinus.
<table>
<thead>
<tr>
<th></th>
<th>Adult Male</th>
<th>Late Juvenile Male</th>
<th>Adult Female</th>
<th>Late Juvenile Female</th>
<th>Juvenile</th>
<th>Infant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radius</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humerus</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Femur</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Scapula</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Atlas</td>
<td>2*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MNI</td>
<td>2*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 13: Minimum number of individuals calculations based on whole elements and class A fragments for *Zalophus californianus.*
<table>
<thead>
<tr>
<th></th>
<th>Adult</th>
<th>Late Juvenile</th>
<th>Adult</th>
<th>Late Juvenile</th>
<th>Juvenile</th>
<th>Infant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radius</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Tibia</td>
<td>2*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pelvis</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Humerus</td>
<td>0</td>
<td>1*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3*</td>
</tr>
<tr>
<td>Fibula</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Femur</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Scapula</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ulna</td>
<td>0</td>
<td>1</td>
<td>1*</td>
<td>0</td>
<td>2*</td>
<td>0</td>
</tr>
<tr>
<td>Atlas</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Axis</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MNI</td>
<td>2*</td>
<td>1*</td>
<td>1*</td>
<td>0</td>
<td>2*</td>
<td>3*</td>
</tr>
</tbody>
</table>

Figure 14: Minimum number of individuals calculations based on whole elements and class A fragments for *Phoca vitulina*. 
Eumetopias remains. This situation emphasizes the necessity for a comparative collection which includes not only all the species under investigation but whenever possible, to include more than one example of each sex of the species in order to clarify inter- and intraspecific differences.

Although these difficulties are unfortunate it is not of critical importance in the final analysis. Total numbers for both male Zalophus and female Eumetopias are small and, as will be seen in the final chapter, their very inclusion in the sample from Seal Rock is sufficient for the scope of this paper, to support present known migration and behavioral patterns of these species.

As an additional consequence of bone description and MNI calculations it became apparent that all skeletal elements were present in approximately the quantities expected for E. jubata with the exception of the baculum. Only one example of this element was recovered from Seal Rock and because of the lack of male comparative material, it remains unidentified. The sample size for the other three species is not adequate to confirm or deny the absence of particular skeletal elements.

Pathological conditions noted during the descriptive phase mainly took the form of varying degrees of calcium deposits on male Eumetopias bones. Out of 26 instances, only one of these bones belonged to a juvenile rather than an adult animal. Elements affected include thoracic and lumbar vertebrae, the pelvis,
one patella, plus several ribs, phalanges, humeri, ulnae, radii, and tibae. Two of the thoracic vertebrae were fused in this manner. Severity ranged from a thin crust to amounts which essentially hid the entire bone.

At least one individual, probably a juvenile or late juvenile male, was either congenitally deformed or severely injured soon after birth. A radius, an ulna, and a femur are all extremely contorted but show no sign of fracture and subsequent healing which might be expected from an accidental mishap with the possible exception of the radius.

Other than these cases involving *E. jubata* the only other skeletal abnormality observed in the pinniped collection was from an adult male *P. vitulina*. Two phalanges were fused, apparently the result of an earlier breakage.
Figure 15: Top: Male Eumetopias jubata humerus with calcium deposits.
Bottom: Normal male E. jubata humerus.
Figure 16: Top: Deformed juvenile *Eumetopias jubata* radius.

Bottom: Normal juvenile *E. jubata* radius.
CONCLUSIONS

Several statements may be made from the accumulated information. First, the ethnographic accounts which state that the Alsea did not hunt pinnipeds appear to be in error, at least in relation to the Seal Rock site. The numbers of individuals and the preponderance of old, adult males represented from the shell midden sample are enough to effectively negate a completely "chance exploitation" hypothesis in which their utilization by the Alsea would have been based primarily on the harvesting of beached carcasses.

The site appears to have been active during a period from spring to mid or late summer, a determination based on the overwhelming numbers of adult male *Eumetopias* (65% of total adult pinniped remains). Concentrations of males over seven years of age such as this occur only on the rookeries during the pupping and breeding season. Additionally, remains of infant or even fetal sea lions as well as larger juveniles suggest a time span of several weeks in the early summer during which the pups grow rapidly.

The presence of at least two male *Zalophus* is indicative of a time in late summer when the first of their number begin moving north and haul out on former Stellar rookeries. Lack of female *Zalophus* remains could be the result of (1) an incomplete
sample of the site; (2) non-utilization of these animals, or; (3) that, as in the present, *Zalophus* was not breeding as far north as the central Oregon coast during the occupation of the Seal Rock site. Considering the data at hand, the third is probably the most viable alternative.

A full-blown maritime economy was not necessary in order to exploit *Callorhinus ursinus* to the degree this species is represented in the midden. It is entirely probable that this number could be accounted for by the chance occurrence of animals blown toward land during a storm or diseased and weak individuals unable to swim. In these cases the fur seals might be simply harvested from the beach.

Harbor seal remains, at less than 5% of the total could also represent a chance encounter, however preferential hunting for sea lions rather than seals could explain this disparity as well. Several groups of pinniped hunters displayed a selective hunting philosophy of this type. The fact that these seals are much more difficult to approach on land could have a bearing on hunting results, depending on the techniques in use. Seal hunting techniques as illustrated in Alsea mythology however suggest that the behavioral knowledge necessary to procure these animals was well known to the hunters, if it is assumed that this legend was truly pure Alsea in origin.

Ethnographic accounts of pinniped hunters in California and along the Northwest coast report that animals were either
harpooned, clubbed, or a combination of the two. The artifact inventory from Seal Rock contains several examples of the large, composite-type harpoon head common among pinniped hunters to the north. Although not represented among the artifacts from the midden, clubs probably were used but under most circumstances would not have been discarded so readily as the harpoon heads appear to have been. Sea lion clubs, as mentioned previously, were often symbols of status and hunting partnerships, a possession not likely to be treated carelessly.

All skeletal elements seem to be present in the expected proportions with the exception of the baculae which may have been removed from the midden for modification into tools. Of all the elements of the pinniped skeleton, the baculum is probably the best suited for such use because of its unusually dense composition in comparison to the other, less compact bones. This element may also have been used in a ceremonial context but we have no indication of such either ethnographically or archaeologically.

Very few skulls were reasonably intact and only in one case was the cranium broken in a manner which suggests that access to the brain was the objective. The large size of the foramen magnum may have made this step unnecessary or access may have been gained by shattering the skull. In any case, the highly fragmented skulls make an exact determination impossible.

Butchering marks on the bone seem to indicate the practice
Figure 17: Male Eumetopias jubata skull with holes in cranium.
of cutting meat from the carcass and leaving the bones in the midden rather than chopping through joints, removing sides with ribs, etc. Ethnographic literature tends to support the "fillet" method among all documented groups. Unlike land mammals, long bones of pinnipeds were not split for marrow extraction because of their amorphous internal structure. Only two specimen are present among the Seal Rock pinniped collection that appear to have been broken for marrow and neither appear to have yielded satisfactory results.

From these statements, conclusions may be summarized as follows:

(1) The Alsea probably were in the Seal Rock area and hunted pinnipeds intensively during spring and summer. Rock fish and mussels of various types were also exploited during this season. With the fall storms and departure of the large numbers of sea lions on annual migrations, other resources were utilized including salmon runs in the rivers.

(2) Contrary to ethnographic literature, the Alsea did possess the technology and the will to hunt pinnipeds. Canoes, whether traded from the north or of local manufacture, were available and sufficiently seaworthy to transport hunters to the rookery rocks offshore. Harpoon heads similar to those in use among the Northwest groups appear to be a case of adoption of a cultural trait from outside the central Oregon coast and its subsequent adaptation by the indigenous.
(3) Seal Rock may have been somewhat ceremonial in nature historically if the description of the manufacture of Kwakiall-type canoes by the Alsea and the "christening" of each in conjunction with a sea lion feast, is factual. If so, this specialized hunting could account for part of the male Eumetopias jubata remains.

(4) Pinniped migration patterns and breeding territories have remained essentially stable on the central Oregon coast for the past 400 years, lacking any positive data to support an alternate hypothesis.

(5) Adult male Stellar sea lions were hunted to a much greater degree than any other sex or age class of any of the species represented. This could have resulted from their reluctance to abandon their territorial locations on the rookery rather than a taste preference by the hunters. Other pinniped hunters, however, were reportedly more anxious to procure a young tender sea lion rather than a tougher, mature animal.

Earlier in this paper it was stated that faunal remains recovered from archaeological sites are in many ways as indicative of human behavior patterns as are the more traditionally recognized artifacts. As a case in point, through the analysis of the pinniped material from 35 LNC 14 inferences regarding the seasonal occupation of the site and some aspects of Alsea hunting practices were made possible. Additionally, information concerning the behavior of the species themselves is available. The preponderance
of adult male *Eumetopias jubata* strongly suggested the presence of a rookery in close proximity to the site. In this case the faunal analysis provided the only clue since at present, the nearby rocks are used only as hauling out areas. Current migration patterns of all the species appear to have been constant over the last 400 years, a statement of interest particularly to marine biologists.

If maximum information is to be derived from such a study the bones and fragments should be afforded the same precision routinely used in the treatment of recovered artifacts. Experience gained in working with the pinniped material is valuable in emphasizing techniques which might be altered or refined for subsequent investigations of this type. In general, as is true of any analysis, it is preferable to have an excess of information rather than a scarcity. Specific methods may vary according to ultimate goals and circumstances of the study as long as consistency is the guide.

Further investigations of similar sites along the Oregon coast are needed in order to present a more solid bank of information on seals, sea lions, and their prehistoric hunters. Hopefully such faunal studies will become more commonplace in archaeological reporting in the near future.
Arnold, Augusta Foote

Baldwin, Ewart M.

Barnett, H. G.

Berreman, Joel V.

Boas, Franz

Bryden, M. M.

Caday, Pete
1978 Interview of Mr. Elmer Stone, Monroe, Oregon, April 9, 1977. Personal communication.

Chaplin, Raymond E.

Chugunkov, D. I.
Coffey, David J.

Cole, David L. and Wilbur Davis

Cole, David L. and Harvey S. Rice

Collins, Lloyd R.

Cressman, L. S.

Curtis, Edward S.

Daly, Patricia

Davis, Wilbur
1968   "Oregon coastal survey," field notes on file, Department of Anthropology, Oregon State University, Corvallis.

Dorsey, J. Owen

Drucker, Bob
1977  Excavations at Seaside, Oregon (Personal communication).

Drucker, Philip


Farrand, Livingston

Fiscus, Clifford H.


Frachtenberg, Leo J.

Franklin, Jerry F. and C. T. Dyrness
Friedman, Edward I. and Carl E. Gustafson  
1975  

Friedman, Edward I.  
1976  

Garfield, Viola E.  
1966  

Gaskin, D. E.  
1972  

Gentry, Roger L.  
1972  

Gilbert, B. Miles  
1973  

Gould, Richard A.  
1966  

Grayson, Donald  
1973  

Gustafson, Carl E.  
1968  
Heflin, Eugene
1966
"The Pistol River Site of Southwest Oregon."
University of California Archaeological Survey
Reports, no. 67, pp. 151-206.

Ingles, Lloyd G.
1965
Mammals of the Pacific States. Stanford University Press, Stanford, California.

Kenyon, Karl W. and Ford Wilke
1953

Kroeber, A. L.
1925

Kroeber, A. L. and S. A. Barrett
1960

Leatherman, Kenneth E. and Alex D. Krieger
1940

Lyman, Richard Lee
1976

Mate, Bruce R.
1972

1973
"Population Kinetics and Related Ecology of the Northern Sea Lion, Eumetopias jubatus, and the California Sea Lion, Zalophus californianus, along the Oregon Coast." PhD dissertation. Department of Biology, University of Oregon, Eugene.

1978
Pinniped growth and behavior (personal communication).
Muzhchinkin, V. F.
1971

Newby, Terrell C.
1972

Newman, Thomas M.
1959
"Tillamook Prehistory and Its Relation to the Northwest Coast Culture Area." PhD dissertation. Department of Anthropology, University of Oregon, Eugene.

Olsen, Stanley J.
1971
"Zooarchaeology: Animal Bones in Archaeology and their Interpretation." Addison-Wesley Module in Anthropology no. 2. Reading.

1972

1973

Orr, Robert T. and Thomas C. Poulter
1967

Orr, Robert T., Jacqueline Schonewald, and Karl W. Kenyon
1970
Perlov, A. S.  
1971  "Fur Seal distribution in the region of the Commander Islands in Spring and Summer."  

Peterson, Richard S. and George A. Bartholomew  
1967  "The Natural History and Behavior of the California Sea Lion." Special Publication no. 1, American Society of Mammologists. Stillwater, Oklahoma.

Roll, Tom E.  

Ross, Richard E.  
1975  "Prehistoric Inhabitants at Seal Rock, Oregon."  


1977  "Preliminary Archaeological Investigations at 35 CU 9; Port Orford, Oregon." Report submitted to State Parks and Recreation. Manuscript on file, Department of Anthropology, Oregon State University, Corvallis.

1978  Coastal Archaeology (personal communication).
Rovnin, A. A.  
1971  

Scammon, Charles M.  
1874  

Scheffer, Victor B.  
1944  

1958  
Seals, Sea Lions and Walruses. Stanford University Press, Stanford, California.

Schumacher, Paul  
1874  

Seed, Alice  
1972  

Stubbs, Ron D.  
1973  

Walker, Ernest P.  
1964  

White, T. E.  
1953  

Ziegler, Alan C.  
1973  
"Inference from Prehistoric Faunal Remains." Addison-Wesley Module in Anthropology 43, Reading.
Data Organization

The data related here are by no means all inclusive, rather they are intended to serve as a typical sample of recording methods upon which this study was based. In the absence of a standardized form it was necessary to construct one in such a way to include all the pertinent qualifying statements. Although the resulting form functioned quite well in this sense, subsequent manipulation and recombination of the data proved to be bulky and time consuming since information had to be recopied onto an additional form. Consequently, it seems that the most efficient method would employ index cards, one card containing all the vital information for each bone or fragment. When different re-combinations of the data are required in the later analytic stages, the coded cards might simply be "reshuffled" (see Daly 1969 for sample card).

The following pages contain data resulting from the examination of the collection of Eumetopias jubata humeri from site 35 LNC 14. Coordinates include north and east unit designations to the left of the slash followed by the level from which the particular bone or fragment was recovered and the catalog number.

Abbreviations

<table>
<thead>
<tr>
<th>R - Right</th>
<th>Ad - Adult</th>
<th>j - Juvenile</th>
</tr>
</thead>
<tbody>
<tr>
<td>L - Left</td>
<td>LJ - Late Juvenile</td>
<td>I - Infant</td>
</tr>
<tr>
<td>M - Male</td>
<td>F - Female</td>
<td>? - Unknown</td>
</tr>
</tbody>
</table>
**SPECIES**: *Eumetopias jubata*

**ELEMENT**: Humerus

<table>
<thead>
<tr>
<th>SIDE</th>
<th>AGE/SEX</th>
<th>COORDINATES</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Ad M</td>
<td>64-30/10-16</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>48-30/9-8</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>48-30/9-8</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>48-30/9-6</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>48-30/9-8</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>48-30/9-8</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>64-30/9-8</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>48-30/8-8</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>48-30/9-8</td>
<td>epiphysis barely fused</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>48-30/9-8</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>48-30/9-6</td>
<td>distal epiphysis lacking</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>59-28/13-4</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>60-30/3-1</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>72-30/3-27</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>J M</td>
<td>64-30/8-9</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>J M</td>
<td>48-30/9-8</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>48-30/5-8</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>72-30/3-27</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>58-26/7-8</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>48-30/7-8</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>48-30/6-8</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>58-26/7-8</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>72-30/4-18</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>72-30/5-8</td>
<td>distal epiphysis lacking</td>
</tr>
<tr>
<td>L</td>
<td>LJ F</td>
<td>72-30/4-8</td>
<td>distal epiphysis lacking</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>72-30/5-8</td>
<td>proximal end missing</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>72-30/5-8</td>
<td>proximal ½ missing</td>
</tr>
<tr>
<td>R</td>
<td>LJ F</td>
<td>60-30/3-26</td>
<td>fragmented laterally</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>58-26/11-9</td>
<td>midsection</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>64-30/4-9</td>
<td>midsection</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>64-30/8-9</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>64-30/3-3</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>72-30/5-8</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>64-30/7-9</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>64-30/6-9</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>58-26/13-8</td>
<td>head fragment</td>
</tr>
<tr>
<td>R</td>
<td>J M</td>
<td>64-30/7-9</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>64-30/2-9</td>
<td>head fragment</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>64-30/8-8</td>
<td>distal end fragment</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>64-30/4-9</td>
<td>distal end fragment</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>48-30/9-47</td>
<td>distal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>J M</td>
<td>72-30/5-9</td>
<td>proximal epiph. fragment</td>
</tr>
<tr>
<td>Side</td>
<td>Code</td>
<td>Date</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>----------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>58-26/14-8</td>
<td>head fragment</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>48-30/9-47</td>
<td>proximal epiph. frag.</td>
</tr>
<tr>
<td>?</td>
<td>J M</td>
<td>72-30/5-8</td>
<td>proximal epiph. frag.</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>60-30/2-148</td>
<td>head fragment</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>60-30/2-90</td>
<td>head fragment</td>
</tr>
<tr>
<td>L</td>
<td>J M</td>
<td>64-30/6-9</td>
<td>head fragment</td>
</tr>
<tr>
<td>?</td>
<td>J M</td>
<td>72-30/5-53</td>
<td>head fragment</td>
</tr>
<tr>
<td>?</td>
<td>J M</td>
<td>72-30/4-46</td>
<td>head fragment</td>
</tr>
<tr>
<td>?</td>
<td>Ad F</td>
<td>48-30/8-42</td>
<td>ridge fragment</td>
</tr>
<tr>
<td>L</td>
<td>J ?</td>
<td>64-30/9-9</td>
<td>midsection</td>
</tr>
<tr>
<td>L</td>
<td>J ?</td>
<td>72-30/4F8-8</td>
<td>nearly complete</td>
</tr>
<tr>
<td>R</td>
<td>J ?</td>
<td>60-30/4-12</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>J ?</td>
<td>48-30/9-6</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>I ?</td>
<td>64-30/8-9</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>I ?</td>
<td>48-30/8-9</td>
<td>distal ½</td>
</tr>
<tr>
<td>R</td>
<td>I ?</td>
<td>72-30/4-8</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>I ?</td>
<td>72-30/5-6</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>I ?</td>
<td>48-30/4-x</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>J ?</td>
<td>48-30/8-40</td>
<td>distal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>48-30/9-121</td>
<td>distal fragment</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>54-32/9-22</td>
<td>calcium deposits</td>
</tr>
<tr>
<td>R</td>
<td>J M</td>
<td>46-30/6-16</td>
<td>fragmented and charred</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>44-30/5-14</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>58-32/3-34</td>
<td>fragmented</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>46-30/5-65</td>
<td>fragmented</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>46-30/3-37</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>44-30/4-16</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>46-30/3-46</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>54-32/10-13</td>
<td>fragmented and crumbly</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>44-30/4-80</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>46-30/3-36</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>56-28/2-5</td>
<td>fragmented and crumbly</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>44-30/7-14</td>
<td>extreme calcium deposits</td>
</tr>
<tr>
<td>R</td>
<td>LJ M</td>
<td>62-30/3-36</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>50-30/8-97</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>LJ M</td>
<td>50-30/8-10</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>56-28/2-7</td>
<td>distal ½</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>46-30/4-32</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad F</td>
<td>50-30/4-117</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad F</td>
<td>50-30/10-32</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>50-30/10-18</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>Ad F</td>
<td>50-30/10-25</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad F</td>
<td>54-32/3-35</td>
<td>distal ½, partially hollowed</td>
</tr>
<tr>
<td>R</td>
<td>J ?</td>
<td>54-33/8-45</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>J ?</td>
<td>50-30/8-15</td>
<td>proximal ½</td>
</tr>
<tr>
<td>R</td>
<td>J ?</td>
<td>50-30/5-61</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>I ?</td>
<td>68-30/6-9k</td>
<td>complete</td>
</tr>
<tr>
<td>Side</td>
<td>Side</td>
<td>Fragment</td>
<td>Date</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>L</td>
<td>I</td>
<td>56-28/2-20</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>I</td>
<td>50-30/6-97</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>I</td>
<td>56-32/9-25</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>I</td>
<td>58-32/9-13</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>I</td>
<td>52-32/8-x</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>I</td>
<td>54-32/4-169</td>
<td>midsection</td>
</tr>
<tr>
<td>R</td>
<td>I</td>
<td>46-30/6-73</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>I</td>
<td>54-32/4-174</td>
<td>midsection</td>
</tr>
<tr>
<td>R</td>
<td>I</td>
<td>46-30/9-59</td>
<td>complete</td>
</tr>
<tr>
<td>R</td>
<td>I</td>
<td>58-32/10-56</td>
<td>complete</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>68-30/4-21</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>68-30/5-8a</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>L/ M</td>
<td>46-30/?</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>62-30/3-69</td>
<td>frag. of head</td>
</tr>
<tr>
<td>L</td>
<td>Ad M</td>
<td>44-30/5-5</td>
<td>distal epiphysis</td>
</tr>
<tr>
<td>?</td>
<td>Ad M</td>
<td>54-32/10-62</td>
<td>frag. of deltoid ridge</td>
</tr>
<tr>
<td>R</td>
<td>J</td>
<td>54-33/8-44</td>
<td>proximal epiphysis</td>
</tr>
<tr>
<td>R</td>
<td>Ad M</td>
<td>68-30/4-30</td>
<td>complete</td>
</tr>
</tbody>
</table>