# Zooarchaeological Analysis at ADK-011, Adak Island, Central Aleutian Islands, Alaska

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*Abstract.* Although William Dall explored the Central Aleutians nearly 140 years ago, surprisingly little archaeological research has occurred in this area since then. During 1999 the Western Aleutians Archaeological and Paleobiological Project excavated archaeological sites on north Adak Island, Alaska. Faunal remains from two excavation pits at ADK-011 are analyzed here. This is the first analysis of faunal remains from this particular island. Our research reveals that late prehistoric Aleuts depended on marine mammals, birds, fish, and invertebrates. Although whale remains were recovered, it is currently impossible to tell if these represent hunted or stranded animals. Birds were hunted for their valuable bones as well as for their meat. Aleuts captured both pelagic and near-shore fish. Invertebrate remains indicate that prehistoric Aleuts depended on nearby high energy reefs as well as the calmer waters of Clam Lagoon for subsistence. Additionally, the marine reservoir effect must be considered when understanding radiocarbon dates from Aleutian archaeological sites.

## Introduction

Adak is one of the main islands of the Andreanof Island group in the Central Aleutians (Fig. 1). Measuring approximately 48 km long and 32 km wide, the island presents 260 km of irregular coastline with numerous bays, coves, harbors, and lagoons. During 1999 the Western Aleutians Archaeological and Paleobiological Project investigated archaeological sites surrounding Clam Lagoon on the northeast part of the island. One of these sites, ADK-011, is a large village site overlooking Sitkin Sound. Containing over 100 pit features, this site contains well-preserved kitchen midden accumulations. This first analysis of the faunal remains from an Adak midden area provides information about Central Aleutians human subsistence strategies and adaptations.

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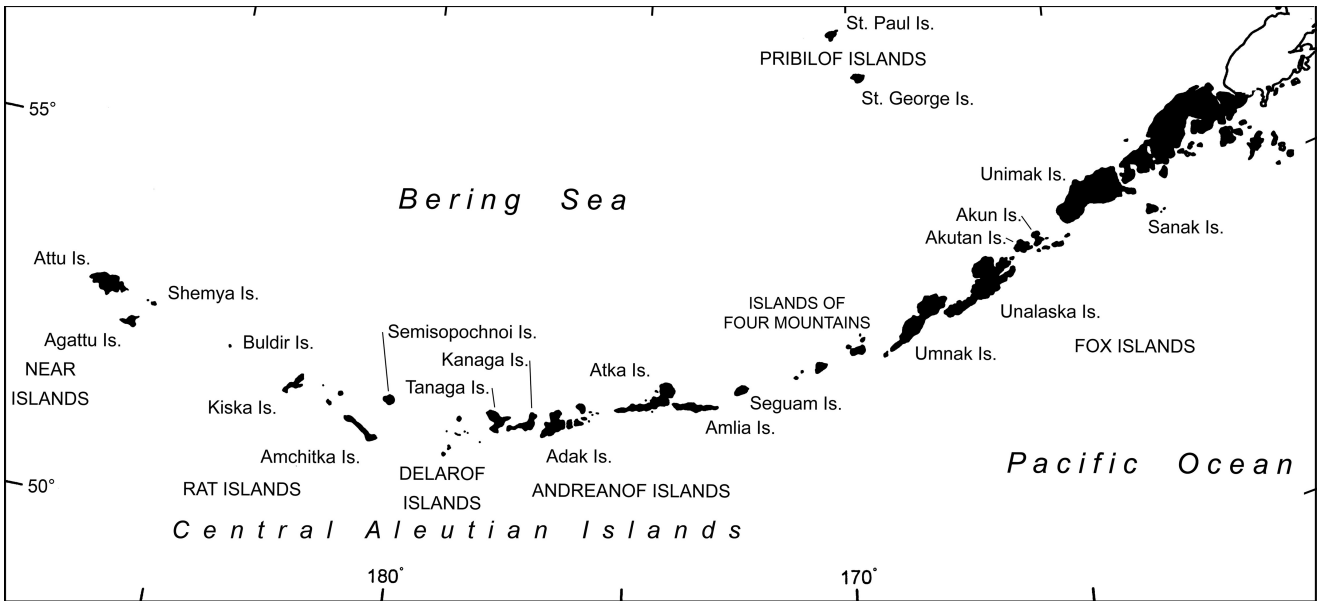


**Figure 1. Location of Adak Iskand in the Aleutian chain.**

## History of Investigations

Although its history of exploration spans nearly 140 years, surprisingly little archaeological work has been done on Adak. William Dall (1877) engaged in a hydrographical and geographical investigation of the Aleutian archipelago with the U.S. Coast Survey between 1871 and 1872, and first reported the existence of numerous ancient villages on the island. Ted Bank II (1956) explored several village sites on Adak, giving relatively good indications of their locations and providing brief descriptions of their sizes. From the 1970s onward, more systematic archaeological surveys took place throughout the archipelago. In 1972, McCartney (1972, 1974) participated in a 24-day boat survey sponsored by the Wilderness Studies Division of the U. S. Fish and Wildlife Service. He observed the coasts and shorelines from the research vessel M/V *Aleutian Tern*, limiting the thoroughness of his observations. Nevertheless, he recorded 36 sites on Adak. In July 1975, during a survey expedition sponsored by the Aleut Corporation and the University of Connecticut, Frohlich and Kopjanski (1975, 2002) circumnavigated Adak Island in a small inflatable boat that allowed them a close inspection of coastal areas and accurate settlement identification. Several areas of coastline (Kuluk Bay, Clam Lagoon, and Andrew Bay) could not be visited because of U. S. Navy restrictions, time constraint, or poor weather conditions. Frohlich and Kopjanski identified 36 "definite" settlement sites and an additional 23 "possible" settlement sites. In 1983, under the auspices of the U.S. Bureau of Indian Affairs, and in the context of the Alaska Native Claims Settlement Act (ANCSA), a major survey of the Central and Western Aleutians was initiated. Work on Adak concentrated mostly on the southern two-thirds of the island, and only four sites were investigated in the northern third (O'Leary 1998a, 1998b). This investigation provided the earliest radiocarbon date for the island: 6410±60 B.P. (Beta 122574, shell) at ADK-171 in the Clam Lagoon vicinity. Veltre (1997), sponsored by the Aleut Corporation, surveyed the northern part of Adak and reported nine sites.

In 1991, the Western Aleutian Archaeological and Paleobiological Project (WAAPP) initiated a long term program of survey in the western part of the Aleutian Chain, and conducted several excavations on Buldir, Shemya, and Attu islands (Corbett, Lefèvre et al. 1997; Corbett, Lefèvre, and Siegel-Causey 1997; Corbett, Causey et al. 2008; Corbett, West, et al. 2001; Lefèvre and Siegel-Causey 1993; Lefèvre et al. 1997, 2001; Savinetsky et al. 2004; West et al. 1999, 2003). In 1999, an accident experienced by the U.S. Fish and Wildlife research ship M/V *Tiglax̂* forced the WAAPP team, bound for Attu in the Near Islands, to work on the more easily accessible Adak Island. Turning the unpleasant event to good account, and with permission from the Department of the Navy, WAAPP archaeologists visited two areas on the northeast side of the island: Sweeper Cove, to the south of Adak Naval Station, and Clam Lagoon, to the north (Fig. 2). Three sites were investigated more thoroughly: ADK-009 at Sweeper Cove, ADK-011 at Zeto Point, and ADK-171 near Clam Lagoon (West, Lefèvre, et al. n.d.). WAAPP archaeologists excavated 1 m × 1 m test pit, 1.92 m deep in Feature 12 at ADK-009, cleaned and excavated several cubic meters of profile on the eroding face of the


**Figure 2. Map of north Adak with location of ADK-009, ADK-011, and ADK-171.**

ADK-171 midden, and dug two pits in ADK-011: 6 m² in Feature 1 and a 2 × 2 m test pit in Feature 2. Samples collected for radiocarbon analyses provided five dates for ADK-009, ten for ADK-011, and four for ADK-171 (Table 1).

In July of the same year, U.S. Fish and Wildlife Service archaeologist Mark Luttrell and a small crew of U.S. Fish and Wildlife Service and Bureau of Indian Affairs archaeologists conducted additional investigations on the island (Luttrell and Corbett 2000). Funded by the Department of the Navy, the crew evaluated nine known sites to determine their eligibility for the National Register of Historic Places, and reported 18 previously unknown sites. As sites were (re)located, features were mapped and described and artifacts in test excavations, as well as organic samples for radiocarbon dating, were collected. Seventeen new occupation dates were added for the island (see Luttrell and Corbett 2000).

This series of investigations of Adak Island yielded a more complete archaeological map of the island. Previous to the 1999 work, almost no chronological and cultural data were available to understand the peopling and prehistory of Adak. This paper presents the first faunal analysis for Adak Island and provides ecological and subsistence information for the later prehistoric period in the Central Aleutians.

## ADK-011 Site Description

The Zeto Point site (ADK-011) is the largest known site of the Clam Lagoon area. It is situated 1.75 km north of Zeto Point, on a terrace 10 m above sea level, on a long north-south trending sandy ridge parallel to a small cobble and sand beach. It was first reported by Bank (1956) as a small site. During his survey in 1972, McCartney did not visit the site because it was within a Naval Station restricted zone. BIA archaeologists visited the site in August 1998 and recorded 36 pit features strung out along a ridge overlooking a small, sandy cove; the site was bounded on the north by cliffs and three adjacent ponds (O'Leary 1998a).

WAAPP archaeologist surveyed and mapped the site on June 1999. They identified 75 house-pit depressions, and opened two test pits at the rim of the bluff in two large house-pit depressions, described in detail below. In July 1999, further investigations of the site by U.S. Fish and Wildlife Service and Bureau of Indian Affairs archaeologists

revealed 26 additional depressions, for a total of 101 features. Most depressions possessed well-defined edges and measured approximately 3 × 3 m, but some are much larger, measuring up to 14 × 15 m.

Feature 1 is approximately 6 m² and was excavated in two units. In Unit 1, under a 10-to-35-cm-thick root zone and vegetation horizon, a rich clamshell midden was exposed. This 35-to-65-cm-thick layer of organic deposits contained numerous cockle shells (*Clinocardium nuttalli*), fish, and bird and mammal bones. Radiocarbon dates on terrestrial organisms indicate that the midden accumulated some 500 years ago (Table 1). This midden was situated on top of a succession of cultural layers, varying in color from medium to dark brown, dark grey, orange mottled to banded, sandy loam with dense charcoal. The lowest cultural layer provided a date of 2160±40 B.P. (Table 1).

In Unit 2, under the same root zone and vegetation horizon encountered in Unit 1, two distinct layers of cockle midden, Level 1 and Level 3, were embedded in a succession of sand layers. The bottom sand was dated to 2490±50 B.P. (Table 1).

A 2 × 2 m test pit was placed in Feature 2,

Table 1. Radiocarbon dates from samples collected by WAAPP on Adak Island in June 1999.

| Lab number | Pit / Feat | Level | Conventional RCY B.P. | Cal B.P. 2 sigma, 95% probability | Material |
|---|---|---|---|---|---|
| **ADK-009 Sweeper Cove Site** | | | | | |
| IEMAE-1287 | Unit 1 | Midden 1 Level 1 | 1505±73 | | fish bone |
| IEMAE-1264 | Unit 1 | Midden 2 Level A | 755±72 | | fish bone |
| IEMAE-1242 | Unit 1 | Midden 2 Level F | 1126±103 | | fish |
| IEMAE-1288 | Unit 1 | Midden 2 Level K | 1360±74 | | fish bone |
| IEMAE-1265 | Unit 1 | Midden 2 bottom of cultural layer N | 1888±50 | | fish bone |
| **ADK-011 Zeto Point Site** | | | | | |
| Beta-132878 | Feature 1 | Unit 1 Level 3 | 440±40 | 530–450 | charred material |
| UCIAMS-28896 | Feature 1 | Unit 1 Level 1 Midden | 1325±14 | | shell |
| UCIAMS-28899 | Feature 1 | Unit 1 Level 1 Midden | 1235±15 | | fish bone |
| UCIAMS-28900 | Feature 1 | Unit 1 Level 1 Midden | 335±15 | | ptarmigan bone |
| UCIAMS-28902 | Feature 1 | Unit 1 Level 1 Midden | 320±20 | | charcoal |
| Beta-132880 | Feature 1 | Unit 1 bottom | 2160±40 | 2310–2230, 2190–2010 | charred material |
| Beta-133745 | Feature 1 | Burial | 840±40 | 955–790 | bone |
| Beta-132879 | Feature 1 | Unit 2 Level 5 | 2490±50 | 2745–2360 | charred material |
| Beta-132882 | Feature 2 | Level 5 | 180±60 | 315–5 | charred material |
| Beta-132881 | Feature 2 | Level 3 S corner | 220±50 | 425–390, 320–255, 225–135, 30–0 | charred material |
| **ADK-171 Tutiakof Site** | | | | | |
| Beta-141262 | | | 5960±60 | 6545–6210 | shell |
| IEMAE-1281 | | Upper cultural layer Level 2 | 6141±123 | | fish bone |
| IEMAE-1248 | | Level 1 | 6172±192 | | fish bone |
| IEMAE-1296 | | Level 1 | 6525±94 | | fish bone |

a depression located 5 m east of Feature 1. Under the vegetation cover, an organic layer provided numerous faunal remains and was dated to 220±50 B.P. and 180±60 B.P. (Table 1). All faunal remains come from ADK-011 layers dating no earlier than 440 ± 40 B.P. (Table 1).

## Faunal Remains from Zeto Point

The brief stay on Adak compelled the WAAPP team to adjust excavation techniques and sampling choices in light of time constraints. In both units of Feature 1, the richness of the Clinocardium midden resulted in the recovery of a huge volume of faunal material. We collected a 20% random bulk sample by keeping one out of every five of the one-gallon buckets of material. The sampled buckets were screened through a 1/4 in mesh. The densest pockets of the organic level in Feature 2 were screened through a 1/4 in mesh; bones from the remaining areas were collected by hand and bagged as they were encountered. The bone preservation is generally very good. A total of 8,248 mammal, bird, fish, and invertebrate specimens were examined.

Lefèvre analyzed the remains of mammals and birds recovered through the excavation with the help of the Comparative Anatomy osteological collection of the Paris Natural History Museum. West analyzed invertebrates using modern comparative samples collected from the island. Susan Crockford (Pacific Identifications, Inc.) analyzed a representative sample of fish remains from Feature 1, Unit 1 and Feature 1, Unit 2, Level 3. The faunal analysts employed the NISP (number of identified species) basic analytical unit for the vertebrates and, when possible, for the invertebrates. NISP is a count of individual bone or shell specimens. To better illustrate and describe the contribution of each taxa, an estimation of the minimum number of individuals (MNI) was also calculated.

### Mammals

A total of 149 mammal bones were collected in the two features (Table 2), but only 57 specimens (38%) were identified to family level or lower. The unidentified specimens included fragments of ribs, vertebrae, and sternebrae. The identified taxa are those commonly represented in Aleutian sites: cetaceans, pinnipeds, and sea otters.

Two worked bones from Feature 1 were attributed to cetaceans, but were not identifiable to a lower level than the order. The specimen from Unit 1 is a sub-rectangular fragment (141 × 60 mm, 22 mm thick) with the mark of a drill on one face and fine cutting marks on the other. The specimen from Unit 3 is a flat spongy worked fragment (54 × 57 mm, 6 mm thick). Four specimens recovered from Feature 2 were attributed to cetaceans; it was possible to propose a more precise identification for two of them. A fragment of rib (286 to 306 × 80 mm, 39 mm thick), with flake scars at one end was successfully compared with a 15-m-long humpback whale skeleton (*Megaptera novaeanglia)* on display at the Comparative Anatomy Gallery of the Paris National Museum of Natural History. A transverse process of a vertebra (226 to 276 × 170 mm large, 25 mm thick) compared favorably with a mounted whale skeleton of the genus *Balaenoptera*, 20 meters in length, on display at the same gallery. The third fragment is also a piece of vertebral transverse process that may belong to the same bone, but no clear refitting was possible. The last fragment is a spongy piece (56 × 35 mm, 15 mm thick) with one cortical face showing a clear cutmark.

The pinnipeds are represented by 39 identified specimens (26% of the total number of mammal specimens). Two specimens of fur seals (*Callorhinus ursinus*) from Unit 1 of Feature 1 clearly belong to two distinct individuals: a juvenile and an adult. The juvenile is older than a pup, and therefore does not provide precise information on the season of occupation of the site.

The Steller's sea lion (*Eumetopias jubatus*) is represented by a total of 17 specimens. Seven specimens from Feature 1, Unit 1 belong to two different individuals: a large adult, probably a male, and a second, smaller adult. Ten specimens from Feature 2 belong to at least one large adult.

The harbor seal (*Phoca vitulina*) is represented only in Feature 2, with 20 specimens belonging to at least two individuals: a juvenile and an adult. A lack of comparative specimens of known age did not allow us to narrow the age range of the juvenile. No processing or butchering marks were observed on the pinniped specimens.

The sea otter (*Enhydra lutris*) is represented by 12 identified specimens (8% of the total number of mammal specimens). Three specimens from Feature 1, Unit 1 belong to two different individuals: a skull and a left mandible of an adult individual, and a right mandible of a juvenile. The brain case is broken and there are burn marks around the breakage. This might indicate brain removal for consumption. Nine specimens from Feature 2, all from the post-cranial portion of the skeleton, indicate the presence of at least two individuals: a juvenile and an adult. Here again, the juvenile probably represents an animal under one year of age.

The pinniped and sea otter samples are too small to allow for a more detailed discussion of carcass utilization or butchering patterns. It is interesting to note that all the major mammalian species are represented in the limited samples from this site.

Table 2. Mammal remains from Zeto Point site (ADK-011). NISP = Number of identified specimens; MNI = Minimum number of individuals. Identifications by C. Lefèvre.

| | Feature 1 Unit 1 | | | | Feature 1 Unit 2 - Level 1 | | | | Feature 1 Unit 2 - Level 3 | | | | Feature 2 | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | |
| **MAMMALS** | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| **Cetacea** | 1 | 4.0 | 1 | 14.3 | | | | | 1 | 33.3 | | | 4 | 3.3 | 2 | 28.6 | 6 | 4.0 |
| **Pinnipedia** | | | | | | | | | | | | | | | | | | |
| *Callorhinus ursinus* - Northern Fur Seal | 2 | 8.0 | 2 | 28.6 | | | | | | | | | | | | | 2 | 1.3 |
| *Eumetopias jubatus* -Steller Sea Lion | 7 | 28.0 | 2 | 28.6 | | | | | | | | | 10 | 8.3 | 1 | 14.3 | 17 | 11.4 |
| *Phoca vitulina* - Harbor Seal | | | | | | | | | | | | | 20 | 16.5 | 2 | 28.6 | 20 | 13.4 |
| **Carnivora** | | | | | | | | | | | | | | | | | | |
| *Enydra lutris* - Sea Otter | 3 | 12.0 | 2 | 28.6 | | | | | | | | | 9 | 7.4 | 2 | 28.6 | 12 | 8.1 |
| **Total Mammals identified** | **13** | 52.0 | **7** | | | | | | **1** | **33.3** | **1** | | **43** | 35.5 | **7** | | **57** | 38.3 |
| Mammals unidentified | 12 | 48[2] | | | | | | | 2 | 66.6[2] | | | 78 | 64.5[2] | | | 92 | 61.7[2] |
| **Total Mammals** | **25** | 1[1] | **7** | | **0** | 0[1] | | | **3** | 0.06[1] | **1** | | **121** | 17.9[1] | **7** | | **149** | 1.8[1] |

[1] % of grand total (all vertebrates and invertebrates). [2] % mammals unidentified.

Table 3. Bird remains from Zeto Point site (ADK-011). NISP = Number of identified specimens; MNI = Minimum number of individuals. Identifications by C. Lefèvre.

| | Feature 1 Unit 1 | | | | Feature 1 Unit 2 - Level 1 | | | | Feature 1 Unit 2 - Level 3 | | | | Feature 2 | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | |
| **BIRDS** | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| **Gaviiformes** | | | | | | | | | | | | | | | | | | |
| *Gavia arctica pacifica* - Arctic Loon | | | | | | | | | | | | | 2 | 0.4 | 1 | | 2 | |
| **Procellariiformes** | | | | | | | | | | | | | | | | | | |
| *Diomedea albatrus* - Short-tailed Albatross | | | | | | | | | | | | | 5 | 1.1 | 1 | 2.2 | 5 | 0.8 |
| *Oceanodroma furcata / leucorhoa* - Storm-petrels | | | | | 1 | 3.7 | 1 | 20.0 | | | | | 43 | 9.6 | 9 | 20.0 | 44 | 7.0 |
| *Puffinus griseus / tenuirostris* - Shearwaters | | | | | 1 | 3.7 | 1 | 20.0 | | | | | 3 | 0.7 | 1 | 2.2 | 4 | 0.6 |
| **Pelcaniformes** | | | | | | | | | | | | | | | | | | |
| *Phalacrocorax* sp. - Cormorants | 25 | 15.3 | 1 | 7.7 | | | | | | | | | 39 | 8.7 | 4 | 8.9 | 64 | 10.2 |

(*continued*)

Table 3. (*Continued*)

| | Feature 1 Unit 1 | | | | Feature 1 Unit 2 - Level 1 | | | | Feature 1 Unit 2 - Level 3 | | | | Feature 2 | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | |
| **BIRDS** | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| **Anseriformes** | | | | | | | | | | | | | | | | | | |
| *Branta / Chen* - Geese | 5 | 3.1 | 1 | 7.7 | 1 | 3.7 | 1 | 20.0 | 3 | 16.7 | 1 | 20.0 | 10 | 2.2 | 2 | 4.4 | 19 | 3.0 |
| *Somateria* sp. - Eiders | 6 | 3.7 | 1 | 7.7 | | | | | 3 | 16.7 | 1 | 20.0 | 1 | 0.2 | 1 | 2.2 | 10 | 1.6 |
| *Aythya marila* - Greater scaup | | | | | | | | | 4 | 22.2 | 1 | 20.0 | | | | | 4 | 0.6 |
| *Cygnus* sp. - Swans | | | | | | | | | 1 | 5.6 | 1 | 20.0 | | | | | 1 | 0.2 |
| *Anas* sp. - Ducks | | | | | | | | | 2 | 11.1 | 1 | 20.0 | 6 | 1.3 | 3 | | 8 | 0.3 |
| **Galliformes** | | | | | | | | | | | | | | | | | | 0.0 |
| *Lagopus* sp. - Ptarmigans | 25 | 15.3 | 4 | 23.1 | 10 | 37.0 | 2 | 40.0 | | | | | 4 | 0.9 | 1 | 2.2 | 39 | 6.1 |
| **Charadriiformes** | | | | | | | | | | | | | | | | | | |
| **Alcidae** | | | | | | | | | | | | | | | | | | |
| *Aethia pygmaea* - Whiskered Auklet | 3 | 1.8 | 2 | 15.4 | | | | | | | | | 12 | 2.7 | 2 | 4.4 | 15 | 2.4 |
| *Aethia cristatella* - Crested Auklet | 3 | 1.8 | 1 | 7.7 | | | | | | | | | 9 | 2.0 | 2 | 4.4 | 12 | 1.9 |
| *Synthliboramphus antiquus* - Ancient Murrelet | 6 | 3.7 | 1 | 7.7 | | | | | | | | | 45 | 10.0 | 9 | 20.0 | 51 | 8.1 |
| *Ptychoramphus aleuticus* - Cassin's Auklet | | | | | | | | | | | | | 4 | 0.9 | 2 | 4.4 | 4 | 0.6 |
| *Cepphus columba* - Pigeon Guillemot | | | | | | | | | | | | | 5 | 1.1 | 3 | 6.7 | 5 | 0.8 |
| *Cyclorrhynchus psittacula* - Parakeet Auklet | | | | | | | | | | | | | 1 | 0.2 | 1 | 2.2 | 1 | 0.2 |
| *Lunda cirrhata* - Tufted Puffin | | | | | | | | | | | | | 3 | 0.7 | 2 | 4.4 | 3 | 0.5 |
| *Uria aalge* - Thick-billed Murre | 3 | 1.8 | 1 | 7.7 | | | | | | | | | | | | | 3 | 0.5 |
| *Uria lomvia* - Common Murre | 2 | 1.2 | 1 | 7.7 | | | | | | | | | | | | | 2 | 0.3 |
| *Uria aalge / lomvia* - Murres | | | | | | | | | | | | | 11 | 2.5 | 3 | 6.7 | 11 | 1.8 |
| **Laridae** | | | | | | | | | | | | | | | | | | |
| *Larus glaucescens* - Glaucus-winged Gull | | | | | | | | | | | | | 10 | 2.2 | 2 | 4.4 | 10 | 1.6 |
| **Passeriformes** | | | | | | | | | | | | | | | | | | |
| *Melospiza melodia* - Song Sparrow | 1 | 0.6 | 1 | 7.7 | | | | | | | | | | | | | 1 | 0.2 |
| **Total Birds identified** | **79** | 48.5 | **13** | | 13 | 48.5 | **5** | | **13** | 72.2 | **5** | | **213** | 47.5 | **45** | | **318** | 49.3 |
| Birds unidentified | 84 | 51.5[2] | | | 14 | 51.5[2] | | | 5 | 27.8[2] | | | 235 | 52.5[2] | | | 338 | 50.7[2] |
| **Total Birds** | **163** | 7[1] | **13** | | **27** | 7.8[1] | **5** | | **18** | 0.35[1] | **5** | | **448** | 66.4[1] | **45** | | **656** | 7.9[1] |

[1] % of grand total (all vertebrates and invertebrates). [2] % birds unidentified.

## Birds

The bird specimens total 656, with an identification rate of 50% (Table 3). Most of the unidentified bones are vertebrae, ribs, and diaphysis fragments. Birds are present in all levels of both units and features, and are far more numerous in Feature 2 than in Feature 1. The avifaunal spectrum, wider in Feature 2 than in Feature 1, shows quite a variety of species: 1) marine species such as albatross (*Diomedea albatrus*), shearwaters (*Puffinus* sp.), and petrels (*Oceanodroma* sp.); 2) coastal birds such as cormorants (*Phalacrocorax* sp.) and alcids (Alcidae); 3) coastal and freshwater birds such as geese (*Branta*/*Chen*), eiders (*Somateria* sp.), and greater scaup (*Aythya marila*); and 4) terrestrial birds such as ptarmigans (*Lagopus* sp.).

The bird bones collected from the thick cockle midden of Unit 1 in Feature 1 largely represent cormorants and ptarmigans; each represents over 30% of the number of identified bird specimens (16% of the total number of bird specimens). No albatross, petrel, or shearwater specimens are present, and the remaining specimens represent geese, eiders, and alcids. Only one cut mark was observed on a bone in this sample, occurring on the proximal extremity of a cormorant tarsometatarsus. This particular mark could have resulted from the skinning process. Burn marks are also very rare: one burn mark was observed on a distal end of an eider tibiotarsus.

The samples from Unit 2, collected in the two distinct midden layers, are fairly small (respectively 27 and 18 specimens, with 13 identified specimens in each sample). Most of the identified specimens in Level 1 of Unit 2 are ptarmigans; two bones have been attributed to a storm-petrel and a shearwater, and another one to a goose. Two ptarmigan bones, an ulna and a humerus, reveal burning marks. All of the identified specimens in Level 3 of Unit 2 belong to the Anatidae family: geese, eiders, swans (*Cygnus* sp.), and greater scaup.

The Feature 2 sample is larger than the Feature 1 sample, with 448 bird specimens, of which 213 are identified specimens. The alcids are the most numerous, representing over 37% of the identified specimens. Albatrosses, storm-petrels, shearwaters, and cormorants are the next most numerous species in this sample. Two albatross bones had been worked: a partial humerus shaft shows a long flake scar and a saw mark is present at the end of a fragment of an ulna shaft. It is interesting to note that all the storm-petrel bones, except two, are porous, typical of sub-adult individuals. Two coracoids, identified as *Anas* sp., represent two different juvenile individuals. Among the unidentified specimens, six vertebrae are also from juvenile birds.

The bird samples from both features indicate a rather extensive exploitation of avifauna by site occupants. The site is located close to various ecosystems, giving the inhabitants of Zeto Point access to a great range of resources, from the open sea to the lagoon, to the interior of the island.

## Fish

The Pacific cod (*Gadus macrocephalus*) is the most common species in Unit 1, while in Unit 2, the most common species are the Hexagrammidae, and especially Rock greenlings (*Hexagrammos lagocephalus*) (Table 4). Cottidae are better represented in Level 3 of Unit 2, and especially various species of Irish Lords (*Hemilepidotus* sp.). Other species identified include herring (*Clupea pallasi*), salmon (*Oncorhynchus* sp.), longnose lancet (*Alepisaurus ferox*), snailfish (Liparidinae), smooth lumpsucker (*Aptocyclus ventricosus*), and some flatfish.

Cod often dominate faunal collections recovered from Aleutian sites (Crockford et al. 2004, West et al. 2003), but not always (Lefèvre et al. 1997). Here, the fish represents 64% of the identified fish specimens in Unit 1, but only 27% in Unit 2.

## Invertebrates

It was not possible to use the NISP method to quantify all the invertebrates collected at Zeto Point. Small shell debris including crushed mussels, tiny fragments of cockle shells, or the broken parts of sea urchin shells were not taken into account in calculating NISP. The number of identified specimens indicated in Table 5 represents urchin mouthparts (i.e., Aristotle's lanterns), chiton fragments, gastropods complete enough to be counted, and cockle shells.

Most of the invertebrates collected in the two features excavated at Zeto Point are the large heart cockles *Clinocardium nuttalis* (Table 5), but their percentages differ in the various assemblages. In the thick midden of Unit 1 in Feature 1, they represent 83% of the number of identified invertebrates, and 570 specimens. Other identified species represent sea urchins and chitons. In Unit 2, the cockles account for only 30% of the number of identified invertebrates sampled in the first midden layer; the percentage of sea urchins and chitons represent respectively 55% and 12% of the of the number of identified specimens. Invertebrates are scarce in the lower midden layer of Unit 2, with only four chiton fragments, one limpet, and no cockles. In Feature 2, the cockles comprise 51 specimens, almost 50% of the number of identified invertebrates. Chitons represent the second largest group, comprising 38% of the number of identified specimens.

The high percentage of invertebrates in the faunal sample illustrates the strong reliance of

Table 4. Fish remains from Zeto Point site (ADK-011). NISP = Number of identified specimens; MNI = Minimum number of individuals. Identifications by S. Crockford (Pacific Identifications).

| | Feature 1 Unit 1 | | | | Feature 1 Unit 2 - Level 1 | | | | Feature 1 Unit 2 - Level 3 | | | | Feature 2 | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | |
| **FISH** | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| **Clupeiformes - Clupeidae** | | | Not calculated | | Not studied | | | | | | Not calculated | | Not studied | | | | | |
| *Clupea pallasi* - Herring | 87 | 7.2 | | | | | | | 126 | 2.5 | | | | | | | 213 | 3.4 |
| **Salmoniformes - Salmonidae** | | | | | | | | | | | | | | | | | | |
| *Oncorhynchus* sp. - Salmon | 1 | 0.1 | | | | | | | 5 | 0.1 | | | | | | | 6 | 0.1 |
| **Aulopiformes - Alepisauridae** | | | | | | | | | | | | | | | | | | |
| *Alepisaurus ferox* - Longnose Lancet | | | | | | | | | 8 | 0.2 | | | | | | | 8 | 0.1 |
| **Gadiformes - Gadidae** | | | | | | | | | | | | | | | | | | |
| *Gadus macrocephalus* - Pacific Cod | 774 | 64.2 | | | | | | | 1,362 | 26.6 | | | | | | | 2,136 | 33.7 |
| **Scorpaeniformes** | | | | | | | | | | | | | | | | | | |
| **Scorpaenidae** | | | | | | | | | | | | | | | | | | |
| *Sebastes* sp. - Rockfishs | 13 | 1.1 | | | | | | | 20 | 0.4 | | | | | | | 33 | 0.5 |
| **Liparidae** | | | | | | | | | | | | | | | | | | 0.0 |
| *Liparidinae* - Snailfishs | | | | | | | | | 3 | 0.1 | | | | | | | 3 | 0.0 |
| **Perciformes** | | | | | | | | | | | | | | | | | | |
| **Hexagrammidae** | | | | | | | | | | | | | | | | | | |
| *Hexagrammos lagocephalus* - Rock Greenling | 286 | 23.7 | | | | | | | 2,600 | 50.7 | | | | | | | 2,886 | 45.6 |
| *Hexagrammos* sp. - Greenling sp. | 4 | 0.3 | | | | | | | 39 | 0.8 | | | | | | | 43 | 0.7 |
| *Pleurogrammus monopterygius* - Atka Mackerel | 4 | 0.3 | | | | | | | 110 | 2.1 | | | | | | | 114 | 1.8 |
| **Cottidae** | | | | | | | | | | | | | | | | | | |
| *Enophrys* sp. - Unknown Sculpin #2 | | | | | | | | | 4 | 0.1 | | | | | | | 4 | 0.1 |
| *Hemilepidotus gilberti* - Banded Irish Lord | | | | | | | | | 16 | 0.3 | | | | | | | 16 | 0.3 |
| *Hemilepidotus hemilepidotus* - Red Irish Lord | 17 | 1.4 | | | | | | | 104 | 2.0 | | | | | | | 121 | 1.9 |
| *Hemilepidotus jordani* - Yellow Irish Lord | | | | | | | | | 10 | 0.2 | | | | | | | 10 | 0.2 |
| *Hemilepidotus* sp. - Irish Lord sp. | 4 | 0.3 | | | | | | | 505 | 9.9 | | | | | | | 509 | 8.0 |

(*continued*)

Table 4. (*Continued*)

| | Feature 1 Unit 1 | | | | Feature 1 Unit 2 - Level 1 | | | | Feature 1 Unit 2 - Level 3 | | | | Feature 2 | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | |
| **FISH** | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| *Leptocottus armatus* - Staghorn Sculpin | 1 | 0.1 | | | | | | | | | | | | | | | 1 | 0.0 |
| *Myoxocephalus* sp. - Great-type Sculpin | 4 | 0.3 | | | | | | | 17 | 0.3 | | | | | | | 21 | 0.3 |
| *Myoxocephalus* sp. - Unknown Sculpin #2 (not jaok) | 3 | 0.2 | | | | | | | 6 | 0.1 | | | | | | | 9 | 0.1 |
| **Cyclopteridae** | | | | | | | | | | | | | | | | | | |
| *Aptocyclus ventricosus* - Smooth lumpsucker | 1 | 0.1 | | | | | | | 23 | 0.4 | | | | | | | 24 | 0.4 |
| **Bathymasteridae** | | | | | | | | | | | | | | | | | | |
| cf. *Ronquilus* sp. (3 bars) - Unknown Ronquil #2 | | | | | | | | | 1 | 0.0 | | | | | | | 1 | 0.0 |
| **Pleuronectiformes** | | | | | | | | | | | | | | | | | | |
| Flatfish sp. | | | | | | | | | 1 | 0.0 | | | | | | | 1 | 0.0 |
| **Pleuronectidae** | | | | | | | | | | | | | | | | | | |
| *Hippoglossus stenolepis* - Halibut | 7 | 0.6 | | | | | | | 153 | 3.0 | | | | | | | 160 | 2.5 |
| *Platichthys stellatus* - Starry Flounder | | | | | | | | | 11 | 0.2 | | | | | | | 11 | 0.2 |
| **Total Fish** | **1,206** | 58[1] | | | | | | | **5,124** | 99.5[1] | | | | | | | **6,330** | 76.7[1] |

[1] % of grand total (all vertebrates and invertebrates).

ancient Aleuts on shellfish, an observation often mentioned in the ethnographic literature as well (Jochelson 1925; Veniaminov 1984). At ADK-011 invertebrates appear to have been a reliable resource and were probably continuously accessible.

## Discussion of the Zeto Point Fauna

When discussing artifacts within an archaeological context, an accurate time frame is imperative. At archaeological site ADK-011, an interesting pattern emerges where marine based faunas consistently date older than terrestrial samples within the same context. For example, in Feature 1, Unit 1, Level 1 shell dates to 1325±14 B.P. (UCIAMS-22896) and fish dates to 1235±15 B.P. (UCIAMS-28899). Meanwhile, from the same feature, unit and level, a bone from ptarmigan, a terrestrial bird, provides a date of 335±15 B.P. (UCIAMS-28900), and a date on charcoal (320±20 B.P., UCIAMS-28902), another terrestrial sample, is in agreement with the bird bone date. Dumond and Griffin (2002) proposed that shell, fish, mammals, and other materials in the marine food web produce radiocarbon dates that vary between 600 and 1000 years older than those from terrestrial resources found within the same context. This disparity in radiocarbon dates is a result of strong upwelling of subsurface waters containing ancient carbon in the Aleutian region. In the North Pacific, fish, invertebrates, sea mammals, and many birds rely on a marine diet and intake ancient carbon that is incorporated into their bones and shells. More examples are provided in Corbett, Lefèvre et al. (2010: 197–199).

Our radiocarbon dates from ADK-011 illustrate: 1) a clear example of the marine reservoir ef-

Table 5. Invertebrate remains from Zeto Point site (ADK-011). NISP = Number of identified specimens; MNI = Minimum number of individuals. Identifications by D. West.

| | Feature 1 Unit 1 | | | | Feature 1 Unit 2 - Level 1 | | | | Feature 1 Unit 2 - Level 3 | | | | Feature 2 | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | | MNI | | NISP | |
| **INVERTEBRATES** | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| **Echinodermes** | | | | | | | | | | | | | | | | | | |
| *Strongylocentrotus dröbachiensis** - Sea Urchin | 81 | 11.8 | 16 | 5.1 | 175 | 55.0 | 35 | 36.5 | | | | | 14 | | 5 | 13.5 | 270 | 24.3 |
| **Mollusks** | | | | | | | | | | | | | | | | | | |
| Chitons | | | | | | | | | | | | | | | | | | |
| *Katharina tunicata* - Chiton | 32 | 4.7 | 4 | 1.3 | 39 | 12.3 | 5 | 5.2 | 4 | 80 | 1 | | 40 | | 5 | 13.5 | 115 | 10.3 |
| **Gatropods** | | | | | | | | | | | | | | | | | 0 | |
| *Littorina* sp. - Periwinkle | 1 | 0.1 | | | 1 | 0.3 | | | | | | | | | | | 2 | 0.18 |
| *Colisella* sp. Limpet | 1 | 0.1 | | | 7 | 2.2 | | | 1 | 20 | | | | | | | 9 | 0.81 |
| **Bivalves** | | | | | | | | | | | | | | | | | | |
| *Clinocardium nuttallii* - Large clam | 570 | 83.2 | 295 | 93.7 | 96 | 30.2 | 56 | 58.3 | | | | | 51 | | 27 | 73.0 | 717 | 64.4 |
| **Total Invertebrates** | **685** | 33[1] | **315** | | **318** | 92.2[1] | **96** | | **5** | 0.01[1] | **1** | | **105** | 15.6[1] | **37** | | **1,113** | 13.5[1] |

* Aristotle's lanterns only. [1] % of grand total (all vertebrates and invertebrates).

fect, 2) the need to date terrestrial organics rather than those associated with marine environments whenever feasible, and 3) the need to correct for the marine reservoir effect when only marine organics are used for dating. When taking into account the marine reservoir effect, it becomes clear that ADK-011 is represented by two occupations separated by nearly 2,000 years. The younger layers contain the middens and habitation areas between 180 and 440 B.P. The more deeply buried occupation levels date 2160±40 B.P. to 2490±50 B.P. The faunal remains represent late prehistoric subsistence practices on north Adak Island.

The pit units excavated are small as are the faunal samples. It is still possible, however, to determine the breadth of Central Aleutians subsistence patterns. The faunal samples recovered during the 1999 excavation at Zeto Point provide some of the first archaeological faunal data available for Adak Island (but see Crockford 2012; Savinetsky et al. n.d.). They indicate that all the stratigraphic units of Feature 1 are characterized by a large percentage of *Clinocardium* shells, few to no mammal bones, quite a strong presence of terrestrial birds, and few fish specimens. Feature 2 differs from Feature 1 in that it has a more balanced distribution of the specimens: fewer cockles, more mammal bones, a mixed avifauna with more marine and coastal species and fewer terrestrial birds, and a stronger presence of fish. The fauna from the two excavated areas might represent differences in spatial activities (discarding of shellfish in one particular area vs. processing of vertebrates in another) practiced at ADK-011. The small size of the faunal assemblages precludes any definitive explanation.

The presence of whale bones in archaeological sites is always difficult to interpret. Should they be considered as kitchen refuse and taken into account in the diet of the inhabitants of the site? Or are they just pieces of bone recovered as a source of raw material? At Zeto Point, the six specimens are all clearly worked and can certainly be considered as bone industry refuse. But did they arrive in the site as "clean bones ready to be worked" or was the meat, once attached to them, consumed by site inhabitants? Black (1987:12), in her review of historical sources on whaling in the Aleutians, clearly points out the absence of "any reference to whaling in the Western and Central Aleutians though utilization of drift whales and whale products is regularly mentioned." The Zeto Point excavation was far too limited and the faunal sample studied here too small to contribute a new perspective about Aleutian whaling.

Although a variety of birds were captured at ADK-011, some species were probably used for more than their meat and fat. Luttrell and Corbett (2000:Table 4) describe a bone awl tip recovered from Feature 1 at ADK-011. They also list: 1) two worked bone fragments from Feature 1 Unit 1, 2) worked bone fragments from Feature 1, Unit 2, and 3) a small scored bird bone that is possibly a bead from Feature 1, Unit 1, Level 1. Lefèvre identified cormorant breastbones fashioned into spoons in the Near Islands (West et al. 2003). Because of the size and shape of their wing bones, birds of choice for fashioning awls on Buldir included murres, cormorants, and albatrosses (Corbett, Lefèvre, Corbett et al. 1997). The use of birdskin for clothing is also well documented in ethnographical times throughout the chain (Black 1984; Hrdlička 1945; Jochelson 1933; Varjola 1990; Veniaminov 1984), especially those of cormorants, puffins, and murres.

Pacific cod are bottom dwellers, while the other species well represented in the samples—Rock greenlings or Cottidae—are near shore fish frequenting intertidal and shallow water areas. Species such as salmon or herring can enter estuaries to breed. The presence of these different species indicates that late prehistoric Aleuts were adept at capturing both pelagic and near-shore species. The occurrence of fish hooks made of bone at many Aleutian archaeological sites (Jochelson 1925) indicates that Aleuts practiced deep-sea fishing. The near absence of salmon at ADK-011 is not surprising. During autumn spawning seasons for salmon, Aleuts probably established fish camps near streams where they spawned and processed the fish leaving their bones behind. ADK-011 is not located near a stream and the occurrence of immature birds in the more recent occupation layers at ADK-011 suggests that the site was occupied during spring or summer when salmon do not spawn.

Shellfish are very visible in the midden assemblages. *Clinocardium* prefer low energy, sandy mud flats systems like that found in Clam Lagoon. Periwinkles (*Littorina* sp.), chitons (*Katharina tunicata*), and limpets (*Colisella* sp.) are found in high-energy systems like those found in tidal rocks in the vicinity of modern Sitkin Sound. Archaeological site ADK-011 is in close proximity to both the quiet waters of Clam Lagoon and the high-energy tidal regime of Sitkin Sound. This explains the percentages of invertebrates recovered at the site.

Shellfish are high in protein, but possess relatively little fat (Watt and Merril 1963). They supply: 1) ascorbic acid (vitamin C), important in preventing scurvy, 2) thiamine that is imperative in regulating body temperature and heat production and, 3) the potassium necessary for cell regulation (Piantadosi 2003). Shellfish could also have provided at least some carbohydrates when ground berries, high in carbohydrates but only seasonally available, were inaccessible. Easy accessibility, minimal technology for processing, and the large amount of usable meat per shell would have made these shellfish attractive to Zeto Point residents.

Fat or carbohydrates are necessary for people living in cool/cold climates. To balance the ratio of protein extracted from shellfish, humans must consume fat to metabolize protein (Piantadosi 2003; Speth 1983, 1987). Fatty fish, sea mammals, and birds in a lower proportion, would have overwhelmingly provided the necessary fat resource to metabolize protein (Watt and Merril 1963). These food resources, although not as archaeologically visible as the shellfish at Zeto Point, were a necessary requirement of Aleuts living at Zeto Point and elsewhere.

This analysis of fauna from Adak Island provides information about late prehistoric subsistence in the Central Aleutians. We now know that large clams and fish obviously played an important part in the diet. The presence of marine mammals and seabirds attests to the exploitation of the littoral zone, but hunting inland is also demonstrated by the presence of ptarmigans. Aleuts practiced deep-fishing in pelagic zones as well as near shore fishing. These data indicate that Aleuts exploited a wide range of environments for their subsistence procurement.

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