DENA'INA USE OF MARINE RESOURCES FOR FOOD AND TOOLS

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ABSTRACT

Archaeological excavations around lower and middle Cook Inlet are providing insights into traditional Dena'ina Athapaskan marine resource use, despite the paucity of remains typical in Dena'ina sites. Data from twenty-three sites show an impressive number of marine species used, especially north of Kachemak Bay. Sites containing marine species are found far from the natural distribution of the resource, indicating the effort the Dena'ina went to obtain some marine resources. Interpretations of faunal remains in archaeological sites, especially shellfish in noncoastal sites, need to go beyond the traditional dietary analysis and consider whether tool use or manufacture is a better context for analysis. The recent discovery of a prehistoric cache in a house wall at a site near Kasilof (KEN-360) provides a rare opportunity to examine the organic and inorganic contents of a Dena'ina tool kit. The cache contained shells used for containers and tool manufacture, indicating some of the nondietary purposes to which marine resources were put.

KEYWORDS: archaeology, shellfish, nondietary

INTRODUCTION

The Cook Inlet Dena'ina are unique among Northern Athapaskans in having territory on the North Pacific Coast. Cornelius Osgood's (1966) study of the Dena'ina documented the Kachemak Bay Dena'ina's extensive use of marine resources as they borrowed hunting and fishing techniques, other items of material culture, and language from Pacific Eskimo neighbors. But Osgood collected less information on marine resource use by more northern Dena'ina, possibly because his informants were less knowledgeable about such practices or because fewer marine resources are available north of Kachemak Bay. More recent ethnographic work and archaeological research are enlarging the picture of traditional Dena'ina marine resource use on the western Kenai Peninsula.

The importance of salmon to the Dena'ina is undeniable, but rather than salmon this paper focuses upon other marine resources found in Dena'ina sites, using data from unpublished collections and contracted compliance studies of limited distribution. This paper reviews the current archaeological data about Dena'ina marine resource use, specifically sea mammals, fish, and shellfish. Goals of this paper are, first, to recognize data showing the use by prehistoric Dena'ina north of Kachemak Bay of the marine resources available to them. A second goal is to document that the prehistoric Dena'ina used marine resources, particularly shell, as raw material and as containers.

Identifying traits of Dena'ina sites have been summarized by Reger and Boraas (1996:161): Dena'ina sites north of Kachemak Bay typically contain cache pits, rectangular housepits with raised earth walls, and within each house a central hearth consisting of ash without a rock-lined perimeter. In addition to these criteria, sites

were considered Dena'ina for this study because the original investigators so concluded or because they are late Prehistoric to historic in age and well within traditional Dena'ina territory. Sites of questioned ethnicity have generally been excluded from the sample.

NATURAL ENVIRONMENT

When Europeans began recording ethnographic data in Alaska, the Dena'ina inhabited several microenvironments including the full marine setting of Kachemak Bay and lower Cook Inlet, the river-like setting of the upper Cook Inlet, and an almost continental environment in the Susitna Valley and the Iliamna Lake/Stoney River areas (Reger 1998:162). From the full maritime setting in their southern range the Dena'ina's environment transitioned to a more riverine setting about halfway up Cook Inlet (Fig. 1). The shift occurs within a fluctuating zone at about the south end of Kalgin Island, just south of the Kasilof River on the eastern coast of the inlet. Freshwater laden with glacial sediment flows out of the Susitna, Knik, and other large watersheds in upper Cook Inlet and eventually converges with clear Gulf of Alaska saltwater near Ninilchik in a zone known to local fishermen as the "mid-channel rip" (Burbank 1977:163). Marine animals such as sea otter (*Enhydra lutra*),[1] sea lions (*Eumetopias jubatus*), and porpoise (*Phocaena* sp.) are found south of the transition zone, while belugas (*Delphinapterus leucas*), harbor seals (*Phoca vitulina*), and larger whales (Cetacea) venture north of the zone during the summer season. Individual belugas have been tracked into upper inlet water even during the winter, but only occasionally, and not in conditions where they might be human prey.

Razor clams (*Siliqua patula*) are now present in sufficient numbers to be a food source to people as far north as Harriet Point on the west side of Cook Inlet and just south of the Kasilof River to the Homer Spit on the east shore (McLean et al. 1977). Hard shell clams such as Washington clams (*Saxidomus giganteus*), Pacific littlenecks (*Protothaca staminea*), and cockles (*Clinocardium nutalli*) thrive in clearer waters and sandy gravel beaches in the lower inlet. Cockles and surf clams (*Spisula* sp.) are occasionally collected on Clam Gulch area beaches and become slightly less rare in the Deep Creek area. Some

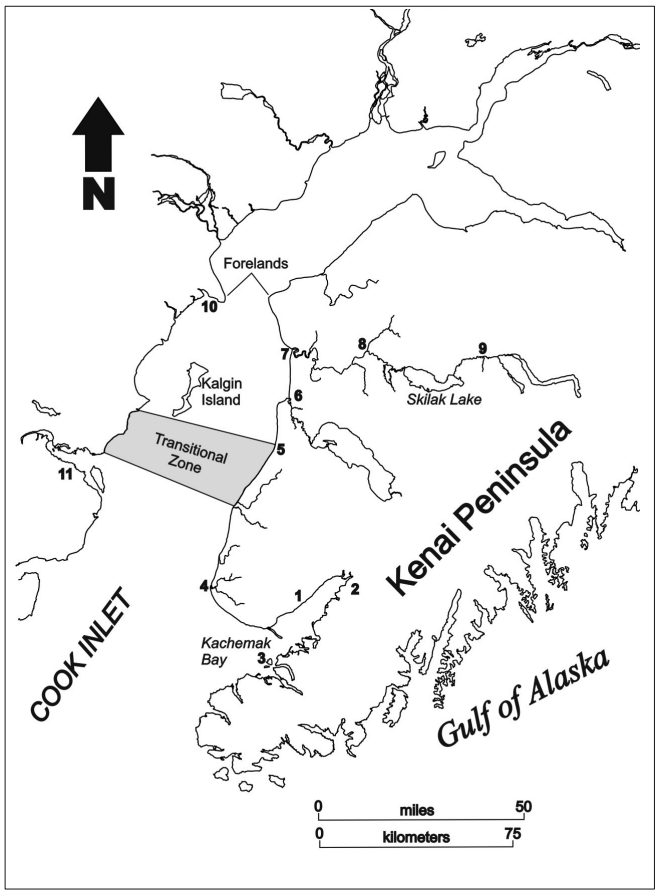

Figure 1. Cook Inlet map and localities mentioned in text. (1) Cottonwood Creek, (2) Seal Beach, (3) Yukon Island, (4) Anchor Point, (5) Clam Gulch, (6) Kasilof River, (7) Kenai River, (8) Moose River, (9) Russian River, (10) Kustatan, (11) Tuxedni Bay.

very small mollusks can be found in the upper inlet but not species useful to area inhabitants.

Marine fish are primarily found south of the transition zone, with migrating salmon (*Oncorhyncus* spp.) the major food source seasonally found north of the zone. The salmon join late spring runs of herring (*Clupea pallasi*) that spawn along the inlet shore in limited numbers and eulachon (*Thaleichlys pacificus*) that spawn in streams as far up the Inlet as Turnagain Arm.

ETHNOGRAPHIC DATA

Osgood (1966) describes Dena'ina hunting of marine mammals most commonly in Kachemak Bay. Seal was the

1 Many species names have changed in the scientific literature through time. The most recent usage is noted here for marine species where known. Because of the focus of this paper and space restrictions, terrestrial fauna and birds are not identified with scientific notations.

most important species there and in the upper inlet. Sea lion, sea otter, porpoise, and beluga whale were also hunted. Seal and beluga were hunted into the upper inlet area, where an elaborate method of hunting beluga involved using tree stumps as a hunting platform (Stanek 1996:135). The upper inlet Dena'ina erected platforms of poles or tree stumps with the roots upper-most, then waited to harpoon passing beluga and pursue the stricken whales to kill them (Kari and Fall 2003:75; Wrangell 1970:12). Seabirds were taken as the opportunity arose.

The Dena'ina harvested salmon along the shore of Cook Inlet by using weirs or A-frame structures to dip-net passing fish (Alexan 1965:60; Elliott 1886:95), but most salmon fishing took place in streams or lakes.

In addition to salmon, deep-sea fish were caught, especially halibut (*Hippoglossus stenolepus*) and cod (*Gadus* sp.). Crab and shellfish were harvested throughout their ranges and the Dena'ina traveled long distances to dig clams. The Iliamna Dena'ina traveled to Cook Inlet even into modern times to hunt brown bear and seal and to dig clams. The clams were shucked, smoked, and dried on a stick (Jensen 1985). Tyonek people traveled as far as Tuxedni Bay to collect razor clams (Stanek et al. 1982). Peter Kalifornsky described how the Kustatan people processed razor clams, storing them in beluga stomachs for winter food (Kalifornsky 1991:213).

ARCHAEOLOGICAL DATA

Faunal remains in Dena'ina sites are not abundant but most have a few specimens. The reasons for the lack of remains may include cultural proscriptions on disposal of household waste and personal effects (Boraas and Kalifornsky 2000; Boraas and Peter 1996), as well as acidic soil conditions. A few sites—notably in the more southern range of Dena'ina territory—defy that generalization. Kachemak Bay Dena'ina sites with significant midden deposits (i.e., larger numbers of faunal remains) include the Seal Beach site, Cottonwood Creek (upper layer), the historic component at the Yukon Island Fox Farm, and the upper component in the site west of Halibut Cove (SEL-010). The Clam Gulch site, further north, is a seasonal Dena'ina site with abundant faunal remains. Another Dena'ina site near Anchor Point (SEL-247) contains a small but significant faunal collection. A number of Dena'ina sites with limited faunal remains are scattered along the coastal bluff between Anchor Point and the Kenai River. Eight more late prehistoric sites identified as Dena'ina and containing limited fauna, mostly shells, have been documented along the Kenai River. Sites and collections mentioned here are discussed in the following sections.

The sampling and collecting strategies used during archaeological excavation of two deep shell midden sites in the Kachemak Bay area, Cottonwood Creek (SEL-030) and the Fox Farm Bluff site (SEL-041), were described by Lobdell (1980:97ff). All bone was collected during excavation while shells were identified in the field and not systematically collected. Midden was not screened in favor of careful trowel excavation. A similar approach to collecting faunal remains was true at virtually every other site mentioned in this paper. The data reviewed and new data presented are adequate for demonstrating the breadth and types of marine resource use by the Dena'ina. Consideration of the intensity of Dena'ina usage, which would require rigorous statistical analysis of the data, is outside the goals of this effort.

KACHEMAK BAY

Archaeological evidence shows that prey mentioned in ethnographic accounts was also harvested in prehistory. Seal and porpoise bones dominated the faunal assemblage at the Kachemak Bay sites of Cottonwood Creek (SEL-030) and Seal Beach (SEL-079), both of which contain Dena'ina cultural deposits overlying extensive shell midden deposits from the earlier Kachemak tradition (Lobdell 1980; Workman and Workman 1988). The Dena'ina component at Cottonwood Creek remains undated and the Dena'ina component at Seal Beach is historic. The Workmans observed that shellfish were less represented at the two sites compared to sea mammals, and that otherwise "subsistence patterns were relatively unchanging both through time and across cultural boundaries in Kachemak Bay" (Workman and Workman 1988:351). Yesner (1996:227) noted that a small increase of land animal species in the upper levels at Cottonwood Creek and Seal Beach fit the broader pattern seen in other Dena'ina faunal collections.

The post-ash component identified by K. Workman at the Seal Beach Site contained abundant harbor seal bones, with lesser numbers of porpoise and beluga (K. Workman 1996:216; W. Workman 1980). Fish remains were uncommon. The most numerous shellfish present were surf clams, whelk (*Neptunea* sp.), and Nuttall cockle. Soft-shell clams (*Mya* sp.), Washington clams, Pacific littleneck, limpets (*Notoacmaea* sp.), and dogwinkle (*Nucella lima*) were also

present in smaller numbers. Many terrestrial animals were also represented in the later levels of the Seal Beach site, including porcupine, marmot, bear, beaver, canids, lynx, weasel, marten, land otter, red squirrels, and rabbit (Karen Workman 2005, personal communication).

The historic Dena'ina collection excavated from the Yukon Island Fox Farm site (SEL-041) in Kachemak Bay by the Workmans contained marine mammals including harbor seal, porpoise, and sea otter, though land animals (caribou, marmot, porcupine, beaver, rabbit, red squirrel, and bear) were more broadly represented (Yesner 1992:173; 1996:229). Shellfish were not common.

When de Laguna (1975:22) reported the site located west of Halibut Cove (SEL-010), she described as Dena'ina a housepit and thin midden containing unspecified shell, beluga, and seal remains. Boraas and Klein (1992:186) dated the Dena'ina occupation to AD 1260, but did not report significant faunal remains from the deposit.

To summarize, in Kachemak Bay the marine fauna reported in late prehistoric and historic Dena'ina sites indicates a people well attuned to harvesting local resources, though they appear not to have pursued offshore fish or birds to the same extent as did the earlier Kachemak tradition people.

NORTH OF KACHEMAK BAY

Few Dena'ina sites north of Kachemak Bay contain extensive faunal remains. On a high bluff overlooking the Anchor River is a site (SEL-247) consisting of three small cache pits and a two-room house with raised walls, a short entry, and a central hearth lacking a rock perimeter. A radiocarbon date of 400±90 ^{14}C yrs BP (WSU-4473) was obtained from hearth charcoal and another of 220±85 ^{14}C yrs BP (WSU-4474) was derived from wood recovered near one corner of the house. Averaged and converted to a calendar date, the samples place the occupation at around AD 1575±75.

Cultural deposits around the central hearth and immediately outside the entry at SEL-247 contained scattered shell and bone. Sea mammals were represented by seven harbor seal bones, two bones from an immature sea otter, and two beluga teeth. A spine barb with attached skin from a rockfish (*Sebastes* sp.) was found, as was an unidentified otolith. Shellfish consisted of sea urchin (*Strongylocentrous* sp.) (n = 44), blue mussel (*Mytilus edulis*) (n = 40+), Nuttall cockle (n = 32), Arctic surf clam (*Mactomeris polnyma*) (n = 14), Pacific littleneck clam (n = 1), and eighteen thick unidentified clam fragments. Bear, moose, wolverine, porcupine, and rabbit were represented among the few land mammal bones.

Frederica de Laguna (1975:132) reported a two-room housepit containing bones and shell near Cape Starichkof (SEL-024). Her field notes identified the shells as mussel, "plain" clam, barnacles (*Balanus* sp.), and cockles (de Laguna 1930:79). One surf clam shell contained red hematite pigment (de Laguna 1975:146).

Bacon and Maxwell (1987) reported a two-room housepit (KEN-219) north of Ninilchik near Corea Creek that contained no artifacts and no fauna except for dogwinkle shells. The presumed late prehistoric site is probably Dena'ina. Not far away is a historic Dena'ina site (KEN-347) consisting of at least two small houses, numerous cache pits, and a midden containing dogwinkle shells and a clam shell fragment (Mobley 2000:11).

The Clam Gulch site (KEN-045) is a Dena'ina midden containing a variety of faunal remains (DePew 1992; Reger 1987). Marine mammals represented include harbor seal, toothed whale, porpoise, and a single bone of sea otter. Marine fish bones are from salmonids, halibut (*Hippoglossus stenolepis*), starry flounder (*Platyichthys stellatus*), and cod (*Gadus* sp.). The most numerous shellfish are dogwinkle, razor clam, surf clam, Washington clam, blue mussel, whelk, and Nuttall cockle, with four more species each represented by a single shell. Small numbers of land mammal species and various birds were also recovered (Reger 1987:Table 1).

Four thick clam shell fragments were fashioned into artifacts. Two were shaped into flat rectangular pieces, well polished on both faces and all four edges (Fig. 2). Two hinge pieces were grooved for breaking, and one had a triangular groove in the outer surface. No marine

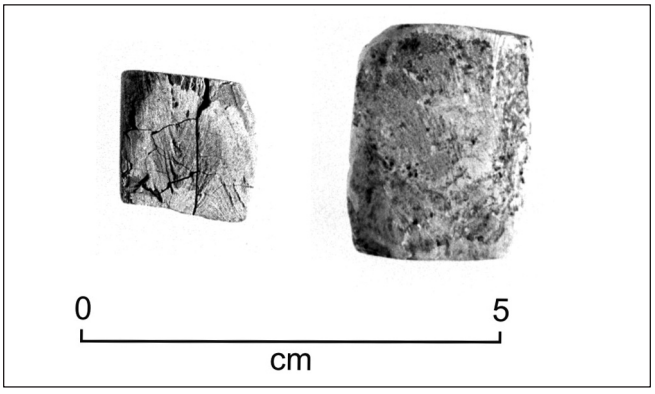

Figure 2. Cut and polished shell rectangles from the Clam Gulch site.

mammals are represented among the many bone artifacts. Radiocarbon dates from the site document the occupation at about AD 1500 (Reger 1987:98).

Five miles up the Kasilof River are two sites containing marine shells. A cache pit site (KEN-369) located up a tributary of the Kasilof River yielded more than twenty-three razor clam shells, fifteen surf clam shells, and twenty-five thin unidentifiable shell fragments that may have been either razor or surf clams. Land animals present were rabbit, beaver, and unidentified bird. No diagnostic artifacts were recovered at the site where several hearths were excavated. Charcoal from the site yielded dates of 610±60 ^{14}C yrs BP (Beta-173687) and 770±60 ^{14}C yrs BP (Beta-173685), placing the occupation between calibrated ages of AD 1280 and AD 1430 (Mobley et al. 2003:76).

The second Kasilof River site (KEN-366) consists of four cache pits and a typical Dena'ina housepit with raised walls and an unlined hearth. A narrow test trench through the hearth yielded four blue mussel shell fragments and a salmon vertebra. Charcoal from the hearth produced a date of 730±60 ^{14}C yrs BP (Beta-173688), or a calibrated range of AD 1200 to AD 1390 (Mobley et al. 2003:73). No diagnostic stone or bone artifacts were recovered.

Several miles north of the Kasilof River is Kalifornsky Village (KEN-014), a late prehistoric to historic Dena'ina site. Excavations in a late prehistoric house uncovered "hundreds" of dogwinkle shells, mostly concentrated near the entry and in side rooms, but no other marine faunal remains were recovered (Boraas 1975:9).

A housepit at the Coyle site (KEN-007), near the mouth of the Kenai River, yielded a small faunal collection containing seven seal bones, a porpoise bone, and a shell (Kent et al. 1964:125). Examination of the collection in the University of Alaska Museum (Accession No. 971) revealed the shell to be Washington clam, and the artifacts indicate a Dena'ina occupation around the mid-nineteenth century.

SITES UP THE KENAI RIVER

The Moose River site (KEN-043) at the confluence of the Moose and Kenai rivers yielded no marine faunal remains except for one unworked Washington clam shell from House 7 (Reger 2004a:Vol.2–34). The occupation has been radiocarbon dated between 250 and 500 ^{14}C yrs BP (Reger and Boraas 1996:158). The Dena'ina component also contained bones of several rabbits, moose, bald eagle, owl, and salmonid.

Another undated but undoubtedly late prehistoric Dena'ina housepit with mounded walls at KEN-178, eroding from the bank of the Kenai River forty-seven miles up from the river mouth, yielded a single Washington clam shell (Reger 2004a: Vol. 2–77). Two housepit sites near the junction of the Russian and Kenai rivers have yielded marine shells and shell artifacts. KEN-094 contained forty-one shell fragments, a shell labret (Fig. 3), and a cylindrical shell bead (Gibson 1985:133). The labret and bead were made from thick shell—probably clam. Intact shells were identified as surf clam, Alaska great-tellin (*Tellina lutea*), blue mussel, California mussel (*Mytilus californianus*), Nuttall cockle, and Greenland cockle (*Serripes groenlandianus*) (Yesner 1986:IV-45). A charcoal radiocarbon date from the housepit, Feature 1, at KEN-094 places occupation of the house 335±55 ^{14}C yrs BP (Reger and Boraas 1996:159). The second housepit site (SEW-214) contained fifty-seven marine shell fragments and a single cylindrical shell bead (McMahan 1985:210). The shell fragments were of surf clam, Washington clam, razor clam, Pacific littleneck clam, soft-shelled clam (*Mya* sp.), blue mussel, Nuttall cockle, and Greenland cockle, with the most numerous being surf clam. A radiocarbon date from Feature 6, where the shell was found, placed the occupation at about 565±65 ^{14}C yrs BP (WSU-3089) (McMahan 1985:170).

Another small collection of marine fauna was recovered from a complex of housepits near the Russian River (SEW-756), with a Dena'ina occupation radiocarbon dated from about 1000 ^{14}C yrs BP to the historic period (Corbett 2000:3, 5). Corbett reported the excavations produced one spine of a marine rock fish, one sea otter bone, and one cormorant bone, along with unidentified and uncounted marine shell.

Even further up the Kenai River from the Russian River mouth is the historic New Village housepit site (SEW-298), where excavations produced numerous salmonid remains as well as three unidentified clam shells, a

Figure 3. Shell labret from KEN-094, Feature 1. The labret is 2.78 cm long.

single Pacific littleneck shell, and a Washington clam shell (Reger 2004b:12ff). Artifacts of European or American manufacture indicate an occupation dating around AD 1750–1800.

The furthest upstream site in the Kenai River drainage where clam shell was found is along Quartz Creek, which empties into Kenai Lake. There, in a rocky midden (SEW-187) probably reflecting late prehistoric Dena'ina fishing, Yarborough (1983:24–29) found a fragment of unidentified clam shell.

WEST SHORE OF COOK INLET

Frederica de Laguna noted numerous depressions around the historic Dena'ina village of Kustatan (KEN-034) on the west shore of Cook Inlet. Her testing in a vaguely defined house on the second beach terrace revealed a 0.75-m-thick midden containing beluga bones, surf clams, and large cockles (de Laguna 1975:139). She noted one piece of worked shell but did not describe or illustrate it. De Laguna compared the small artifact collection to "a culture like that of Kachemak Bay," but she did not specifically link the areas or cultures. Photographs of the Kustatan artifacts suggest they are probably Dena'ina, comparable to the late prehistoric artifacts from KEN-360 and the Clam Gulch site.

At a pictograph and rock shelter site (KEN-229) near the head of Tuxedni Bay, where de Laguna (1975:138) uncovered seal, porpoise, clams, and whelk shells, National Park Service archaeologists recently collected several charcoal samples. Though the stratigraphic setting is complex and disturbed, the samples dated to 490±40 ^{14}C yrs BP (Beta-186616) and 460±50 ^{14}C yrs BP (Beta-186617) (Baird 2006:138). The site is within traditional Dena'ina territory, but the samples were from a shallow depth and not definitely associated with the faunal remains de Laguna uncovered.

KEN-360

Recent testing at a large complex of house and cache pits (KEN-360) near the mouth of the Kasilof River produced an exceptional amount of shell and bone for a Dena'ina site, with all tested (six of seven present) houses containing marine fauna (Mobley et al. 2003:42). More house and cache pits (KEN-370) across Kalifornsky Beach Road may be an extension of the same village. One house at KEN-360 contained a few elements of mustelid, salmon, and cod, another contained a sea otter bone, and another contained bones of unspecified cod fish. Radiocarbon dates from the houses of KEN-360 cluster between AD 1500 and AD 1650.

House 8 (though KEN-360 contained only seven houses, all features—cache pits as well as housepits—were numbered in one consecutive feature series) contained a central hearth containing thirty-one cod otoliths and a large number of shells. Also found in the hearth were more than 450 dogwinkle shells, blue mussels, and cockles, with several Washington clam shells nearby. Land mammal bones included fox and moose.

A bark-lined cache excavated by the House 8 occupants into the raised wall berm contained stone and bone artifacts, as well as Washington clam, blue mussel, probably razor clam, and a single valve of unspecified chiton (Class Amphineura). The cache contents were packed tightly with clam shells nestled together and inside one another, mussel shells inside larger Washington clam shells, and stacked pieces of broken clam. In addition to shell the cache contained hammerstones, stone flakes and nodules, faceted pumice abraders, baked siltstone, a stone planing adze bit, broken bone pieces, a spoon made from a scapula, and an antler foreshaft. One large clamshell contained a worked piece of bone cemented to the shell with an iron oxide or ocher substance. Another Washington clam shell displayed a flat ground facet and a deep parallel groove representing an unfinished attempt to saw—probably with an abrasive-laden cord—a shell blank for further manufacture into a small tool (Fig. 4).

DISCUSSION

The archaeological data confirm Dena'ina use of marine resources as mentioned by historic accounts and Osgood's (1966) informants. But the fauna assemblages are typically small and not described in equal detail from site to site, with bone counts or presence/absence by species being the norm. Only two sites—Seal Beach and Yukon Island Fox Farm—contained large enough samples to produce meaningful counts of minimum number of individuals. We thus cannot discuss Dena'ina use of marine resources in terms of meat weight or calories. However, evident in Kachemak Bay is an adaptation to the marine environment balanced with use of terrestrial resources. Sites as far north as Kenai and Kustatan confirm the exploitation of *available* marine fauna, specifically seal, beluga, porpoise, and shellfish, comparable to the opportunistic approach that

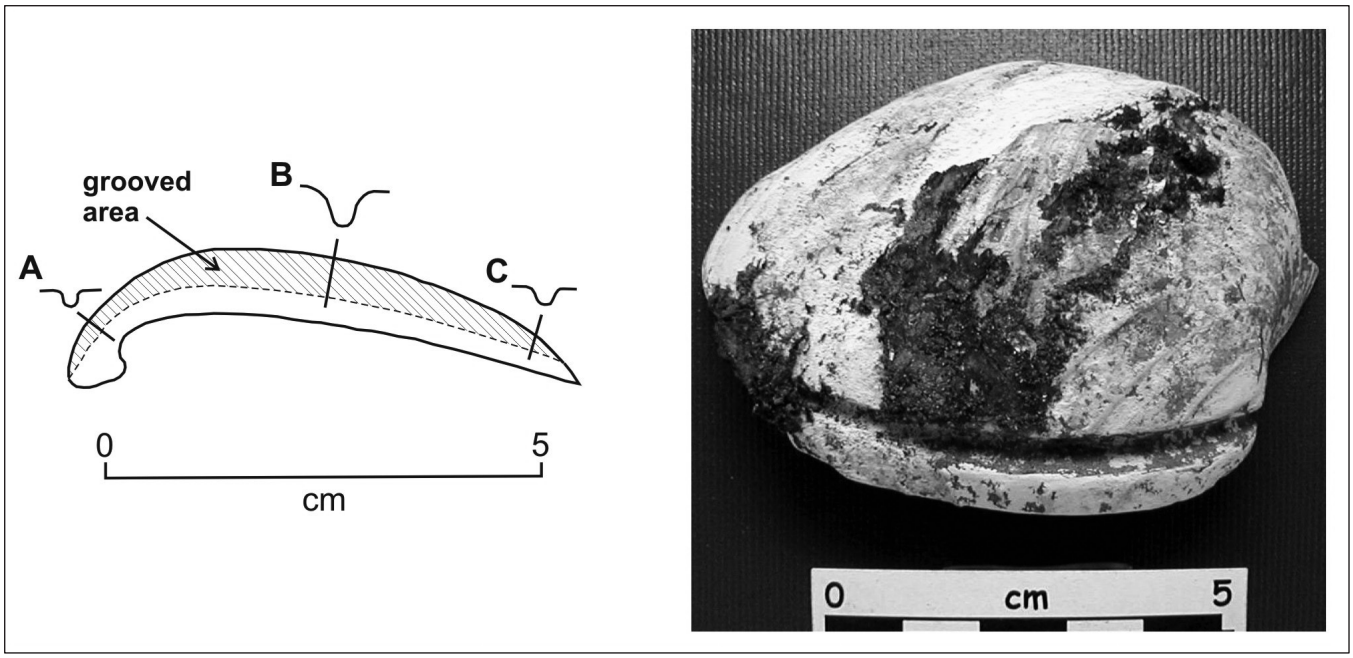

Figure 4. Cut **Saxidomus** *shell from KEN-360. A-C are profiles of the cut in this cross-section view.* **Mytilus edulis** *shell is plastered to the surface of the* **Saxidomus** *shell in the right-side image.*

Yesner (1996:225) noted for Dena'ina use of land animals. The marine environment contributed to the Dena'ina diet in diversity and quantity depending on species availability, as reflected in the diminished numbers of elements and species in sites north of Kachemak Bay. No sites tested north of the Forelands have produced marine fauna.

On the surface, use of shellfish follows the "generalist" pattern. The same species used in the earlier Kachemak tradition were favored by the later Dena'ina inhabitants. Surf clams, Washington clam, Pacific littleneck, cockles, and blue mussel were staples in the Dena'ina shellfish harvest. As one proceeds north up Cook Inlet, however, razor clams and dogwinkles appear in increased percentages at sites, and the numbers of Pacific littleneck (never numerous) and Washington clam decrease. The increase in razor clam in sites to the north is understandable given their need for sandy beaches and absence in most of Kachemak Bay. An interesting change is the increased percentage of dogwinkle in the sites north of Kachemak Bay. Dogwinkle do occur in some Kachemak Bay Dena'ina sites, but in low numbers. The major occurrences are at Clam Gulch and the Kasilof River sites, where dogwinkle counts vastly outnumber those of other shellfish. That may be the result of thickness and durability of the dogwinkle shells in acidic soils, but clam shells seem to endure just as well. Thinner-shelled species such as blue mussel, surf clams, and razor clams are less durable, but they are present in sites. The possible use of dogwinkles to obtain a dye has been noted (Lobdell 1980:207), but their primary value was probably as food.

The sea mammal suite of sea otter/seal/beluga/porpoise is represented in coastal Dena'ina sites as far north as Kustatan and as far back as AD 1200–1450, though not every species is found in every site and most collections cluster around AD 1500. Frequently a site may contain only a single bone of a particular species. Sites containing shellfish date as far back as about AD 1200. The adaptation to marine resource use described ethnographically by Osgood therefore extends at least five hundred years into prehistory and perhaps more.

Studies of faunal remains—particularly shellfish—from Cook Inlet archaeological sites have dwelt almost exclusively on their value as food. Lobdell (1980) considered only the nutritional value of species found in Kachemak Bay sites, for example. Yesner (1986) used a similar approach to analyze the faunal remains from upper Kenai River sites, including not just shellfish but land mammals, birds, and fish. But the Kenai River collections and that from KEN-360 provide an opportunity to view use of some faunal remains, specifically shells, differently.

Dena'ina used shellfish not only in their diet but they used shells as raw material for production of other items. Osgood (1966:52) discussed Dena'ina decoration and display of wealth using *Dentalium* shells, which were

obtained from sources far away on the Northwest Coast. *Dentalium* shells required little or no alteration to produce easily strung beads, and were highly prized. Osgood mentioned nothing about use of local shell, but his interviews occurred 150 years after European trade items entered the economic picture, by which time the collective Dena'ina memory may have lost knowledge about the craft of making beads from local shells. Glass trade beads were among the earliest goods sought by the Dena'ina of Cook Inlet and probably replaced most local bead materials.

The wall cache in House 8 at KEN-360 demonstrates the utilitarian value of marine shells to the Dena'ina. The cache contained numerous Washington clam shells, one of which contained red and yellow iron oxide, and another which had been worked prior to its storage. The worked specimen was in the process of being slabbed into rectangular strips by sawing parallel grooves through the shell (Fig. 4). The modified edge of the piece is ground flat, probably obliterating saw marks from the cut that removed the previous strip. The groove parallel to the edge facet is U-shaped in cross section, suggesting a cord and abrasive was used for cutting the shell. Judging from the fit of the groove on the shell surface, a bow saw was used. Other nonmarine objects such as a piece of long bone shaft from a large land mammal, hammerstones, nodules of agate or quartz, stone flakes, and unfinished tools attest to use of the cache to store raw material and finished tools.

The presence of single or a few marine shells—particularly thicker shells—in sites along the Kenai River becomes more understandable in light of the House 8 wall cache. The shells were likely items saved by the Dena'ina for their utilitarian value, rather than simply representing the discarded remains from a meal. This interpretation is logical when considering the distance to where shells such as Washington clam, cockle, or blue mussel could be harvested. No Dena'ina concerned about load weight or food freshness would consider keeping shellfish in the shell during the days needed to travel distances of 120 or 160 km. Sea food is notorious for spoiling rapidly and causing gastric distress. Historically and ethnographically, the Dena'ina shucked, smoked, and dried shellfish for storage or transport.

Types of shell items made by the prehistoric Dena'ina are illustrated by the shell labret and bead from KEN-094, the shell bead from SEW-214, and the shell squares and partially cut shell pieces found in the Clam Gulch site (Fig. 2). Use of large clam shells as containers is indicated by the shell in the House 8 wall cache containing the bone artifact cemented by iron oxide pigment, and the shell containing pigment reported from Cape Starichikof. Shells found in sites far from their source should be regarded as tools or raw material for tools rather than dietary discards.

Marine fauna found in archaeological sites as far north as Kustatan and Kenai raise questions about the past environment of Cook Inlet. Reger (1987) suggested that perhaps the clear water–turbid water interface in the late prehistoric period may have been further up Cook Inlet than it is now. The modern interface is centered near the south end of Kalgin Island and moves up and down Cook Inlet with each tide. A more northerly interface zone centuries ago was originally suggested because of the rich marine shellfish and offshore fish remains in the Clam Gulch midden (Reger 1987:95). Reports of porpoise in a decidedly nonmarine environment at Kenai and up Tuxedni Bay add fuel to the question of such a shift. Surf clam and cockle shells found in those northern sites also suggest a more marine, less estuarine environment. A long-term shift in Cook Inlet's clear-turbid interface zone could result from changes in relative sea level due to tectonic factors (earthquakes), isostatic rebound in which the earth's crust compensates for the removal of glacial ice, or global sea level changes, or such a shift could result from local changes in Cook Inlet currents.

For example, tidal marshes at the mouths of the Kenai River and Kasilof River were examined during the past decade to detect evidence of major Holocene earthquakes, leading Combellick (1994) to conclude that a major earthquake on the scale of the 1964 Great Alaska Earthquake occurred in the Cook Inlet basin between seven hundred and nine hundred years ago. A recent study (Hamilton and Shennan 2005:106) used diatoms to document accurate relative sea levels and suggest that rebound to pre-subsidence levels was rapid—a critical factor determining the rate at which shellfish beds would migrate up the inlet.

Alternatively, a climatic shift such as the Little Ice Age could change the location of the clear-turbid interface by changing the volume of silt-laden freshwater entering Upper Cook Inlet. Wiles (1992:222) has dated the Little Ice Age glacier advances in the southern Kenai Mountains to about AD 1300 to 1850. A decline in silty glacial runoff due to colder temperatures would allow the clearer oceanic water to penetrate further up the inlet. Movement of the interface 16 to 24 km north would align more with the marine resource suite recovered from archaeological sites. This simple model would be difficult to test given the dynamic geology and hydrology of the region.

We conclude that the Dena'ina, beginning in prehistory, used the near-shore marine resources available to them. They also traded to obtain marine resources, as shown by the chiton valve found at KEN-360 or clam shells recovered from sites near Russian River. Ethnographic accounts and historic studies also demonstrate that the Dena'ina took long journeys to dig clams and hunt seals, but they don't describe the nondietary importance of marine resources, especially of shells, that the archaeological data would otherwise indicate. The archaeological evidence shows that the Dena'ina people on the Cook Inlet coast were adept at using marine resources for at least the past five hundred years.

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