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FIRST REPORT ON BIRD REMAINS FROM BULDIR ISLAND, ALEUTIAN ISLANDS, ALASKA

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ABSTRACT: The bird remains of two test pits excavated on the Buldir Island midden are studied. The species identified are mostly marine, the Alcidae being the most numerous. The incoherencies between the zooarchaeological spectrum and the present avifauna are discussed, by taking into account such parameters as the accessibility of the colonies and the body-weight of the different species.

KEYWORDS: BIRDS, ALEUTIAN ISLANDS, ARCHAEOZOOLOGY, PALEOBIOGEOGRAPHY

RESUMEN: Se estudian los restos de aves de dos muestras excavadas en el yacimiento de Buldir Island. Las especies identificadas son principalmente marinas, y los Alcidae son los más numerosos. Las incoherencias apreciadas entre el espectro arqueozoológico y la distribución actual se valoran, considerando parámetros antropológicos tales como la accesibilidad a las colonias así como el peso de las diferentes especies implicadas.

PALABRAS CLAVE: AVES, ISLAS ALEUTIANAS, ARQUEOZOOLOGIA, PALEOBIOGEOGRAFIA

INTRODUCTION

The Aleutian Islands provide a rich example to document human adaptations to cold maritime environments, but most of the zooarchaeological studies concerned the Eastern Aleutians (Yesner, 1977). A research program, focused on the Western Aleutians, started in 1990, including zooarchaeological and paleobiogeographical studies, which should allow reconstruction of Aleuts' exploitation patterns of animal resources and to document the former biodiversity of the islands.

The Aleutian Islands are a mountainous chain of volcanic origin, extended along a rim of some 1.800 km, like a link between Asia and America. They are lying between the 51st and 55th parallels, and delimit the separation between the North Pacific Ocean and the Bering Sea. The islands are divided in five groups, including 14 large islands and 55 smaller ones, as well as innumerable rocks and islets. From East to West, they are know as the Fox Islands, the Islands of the Four Mountains, the Andreanof Islands, the Rat Islands and the Near Islands (Figure 1).

The climate is characterized by constant rain, wind of high velocity, and dense fog, but with moderate and fairly uniform temperatures. The winter average is 0°C, the summer average is 10°C, and the islands are ice-free and opened to navigation during the whole year. The waters surrounding the Aleutians are among the richest in the world, with 16 species of whales, sea lions and seals, sea otters, and huge numbers of seabirds.

The islands were settled from East to West, as now agreed by most authors (Black, 1983). The oldest human occupations are documented in the eastern islands since the VIth millennium. The

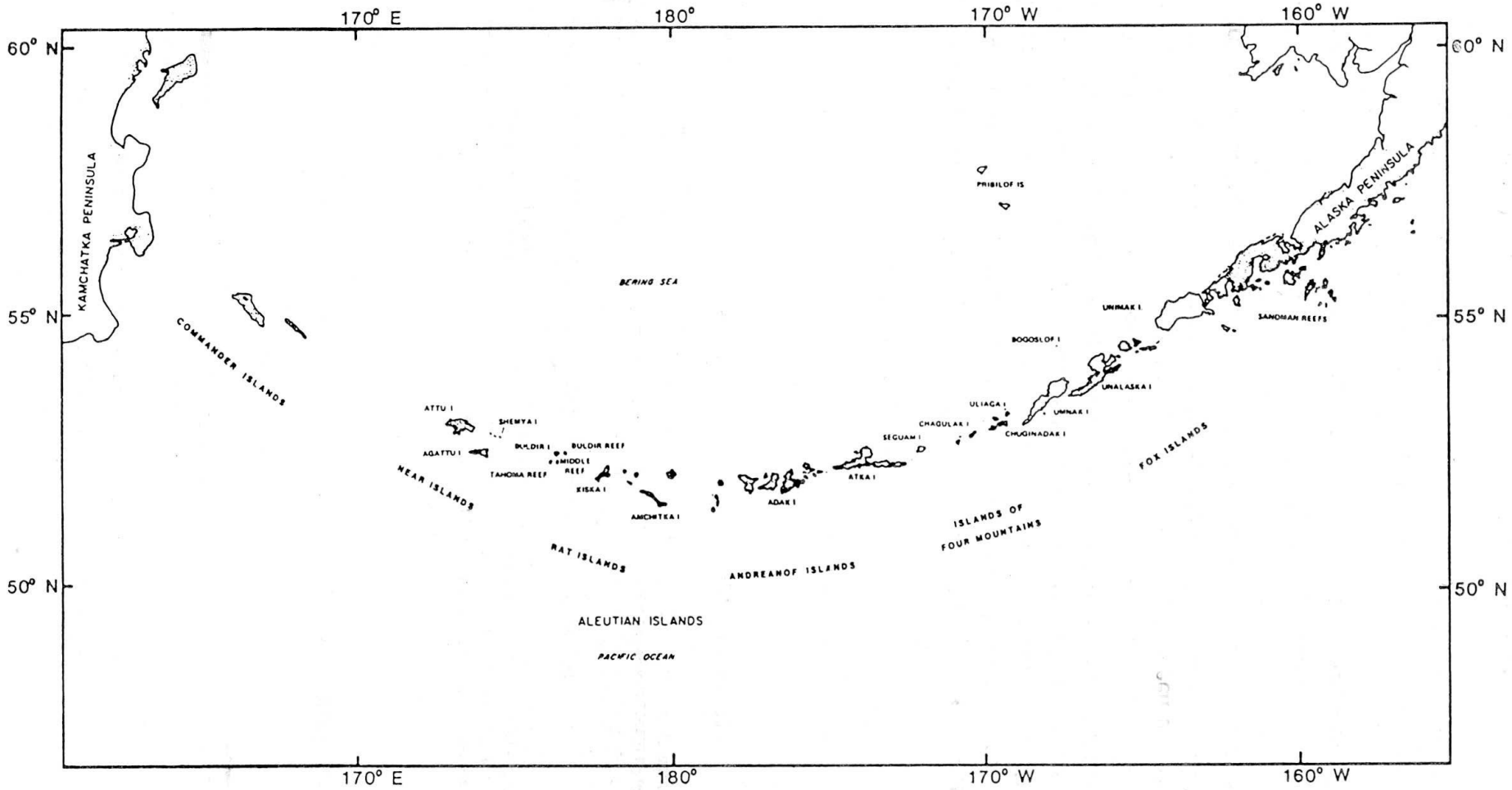

FIGURE 1 - The Aleutian Islands, Alaska. From Byrd and Day, 1986.

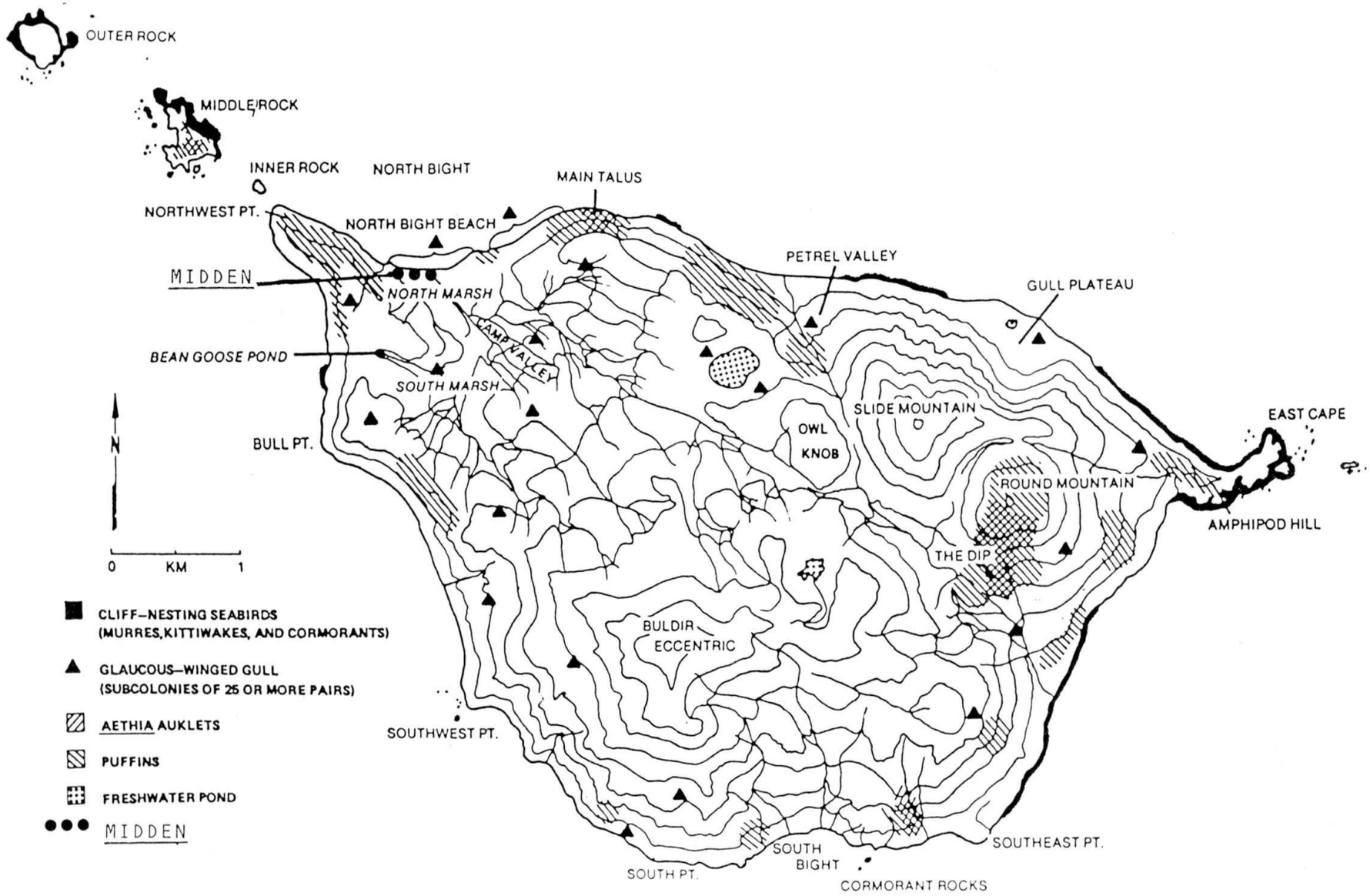

FIGURE 2 - Buldir Island, Alaska, showing place names, concentration of nesting seabirds and the midden. From Byrd and Day, 1986.

central part of the chain was occupied around 3.000 BC, and no dates previous to the first millennium are known for the western islands (Dumond, 1987). Aleuts are of Eskimoid origin, and they share many cultural features with the Eskimos. They were highly dependent on the sea, where they hunted marine mamals from their *baidarka*, a kayak-like skin-covered light craft.

Buldir has a peculiar location among the chain, because it is the most isolated island of the Aleutians. It is the westernmost island of the Rat Islands group, lying about 110 km both from Shemya Island to the west and Kiska Island to the east, "providing the only landfall in a 220 km-wide pass" (Byrd & Day, 1986: 109). The island is approximately 6,4 km long and 3,2 km wide (Sekora, 1973), and its characteristics "include boulder-strewn beaches, frequently backed by steep sea cliffs (over 50% of the 20 km-long coastline), steep mountains, coastal talus slopes, and one alluvial valley near sea level" (Byrd & Day, 1986: 109). Buldir was sighted for the first time on the 28th of October, during the second Bering expedition, in 1741.

MATERIAL AND METHODS

The Buldir Island midden

The midden was discovered in 1962 (Jones, 1963), on North Bight Beach, along the only flat meadow of the island, known as Camp Valley (Figure 2). During a survey in 1972, the site was not relocated, and was "considered to have been possibly destroyed during the intervening period" (Sekora, 1973: 115). In 1989, the Bureau of Indian Affairs (BIA) surveyed several islands in the Western Aleutians, and relocated the site on North Bight Beach. "Exposed cultural debris" was observed covering almost 400 m.

We conducted a prospection during the summer of 1991 (Siegel-Causey et al., 1991). By that time, the east-west section of the midden was exposed on 180 m along the beach. The width of the midden was estimated between 25 and 30 m, limited on its eastern and southern borders by a stream. The distance from the beach exposure to the high tide limit measured 23 m at point 0 and 29 m at point 143.

The vegetation covering the midden (beach rye *Elymus arenarius*, cow parsnip *Heracleum lanatum*, wild celery *Angelica lucida*, and Aleutian fern *Athyrium felixfemina*) was very high when we started to work, at the end of July, preventing any observation of surface features or any test pits elsewhere than along the beach exposure. For this reason, we decided to sketch nine profiles along this exposure, excavating two test pits (Siegel-Causey et al., 1991).

The first pit, located at Point 0, measured 1 x 1 m. Under the vegetal cover, 80 cm of sterile sand were observed above the archaeological sediment, which was excavated following 6 artificial levels of 10 cm. No natural distinctions between the layers were detected. The filling was mainly made of a black and wet soil, water saturated throughout most of the pit, allowing a very good artifactual preservation. Numerous bones were associated with few artifacts, such as lithic points, griddle stones, awls and worked wood fragments, and lenses of dense vegetation mat or sea urchins were observed. The study of the mammal remains indicated the presence of at least 17 individuals of sea lions (*Eumetopias jubatus*). The study of the fish bones is in progress. Two radiocarbon datings on wood indicate an age comprised between the XV and XVI centuries.

The second test pit, located at Point 143, had a 1 m length and a 10 cm width. Cultural layers started just under the vegetal cover. Seven layers were observed as a succession of different fillings of various depth. The density of bone remains was variable, and very few mammal bones were seen. Two radiocarbon datings on wood provide ages of 530 +/- 60 BP (Beta-54255) for layer 3 and 1160 50 BP (Beta-54256) for layer 7.

All the bones from both pits were collected. The sediment was screened with 1/4 and 1/16 inch mesh. The bones are kept at the Kansas University Museum of Natural History. Comparative skeletal specimens used are those from the KUMNH collection. We tried to identify all the elements, except those from level 5 of Pit 2. Due to a lack of time, only the coracoïdes, humeri, femora, tibiotarsi and tarsometatarsi were identified in Pit 2, the remaining bones entering the accounts of the unidentified fraction.

RESULTS

Some 6.000 bird bones were collected in the Buldir Island midden, almost 75% of them coming from Pit 2 (Table 1, Table 2). Keeping in mind that this pit was excavated on 10 cm width only, such a number gives an idea of the bone density of some of the levels in this pit. The percentage of unidentified remains amounts to 22,7% in Pit 1, and to 54,3% in Pit 2. This higher proportion is due to the fact that the identification was restricted to five osseous elements only (see above).

If we combine the numbers of species identified in both pits, we have a total of 23. Except for the Canada goose and a passeriform, they are all marine species. All but two are presently breeding on the island (Table 3). The first exception is *Larus hyperboreus*, the glaucous gull, a spring migrant. The second exception is *Brachyramphus sp.*, the marbled or Kittlitz's murrelet. The first one, *B. marmoratus*, is not known to breed beyond Unalaska Island (Murie, 1959). The second one, *B. brevirostris*, was "not rare at Amchitka and Adak" in 1879 (Murie, 1959: 188), and a pair was collected on Attu Island in June 1937 (Op. cit.). Both of them are not recorded in the last census of the avifauna of the island (Byrd & Day, 1986).

In both cases, the most abundant group are the Alcidae. In Pit 1, the most numerous is *Aethia pygmea*, the whiskered auklet, with 28% of the minimum numbers of individuals (Table 1, Figure 3). In Pit 2, *Aethia cristatella*, the crested auklet, is the most abundant, with 25% of the minimum number of individuals, followed by *Ptychoramphus aleuticus*, Cassin's auklet, with 20% of the MNI (Table 2, Figure 4).

DISCUSSION

It was not possible to link the test pits to either particular sequences or structures. Pit 1 can be considered as one single layer, due to the fact that no natural differences were observed in the stratigraphy. The study of the mammal remains confirmed the impression we had during the digging: we were able to assemble bones from levels 2 and 4 (1 case), 2 and 6 (1 case), 3 and 5 (1 case) and from 5 and 6 (3 cases). On the other hand, the 7 levels observed in Pit 2 correspond to different moments in the story of the midden, but that is all we can say. For these reasons, the results of this study are limited. They can be considered from two points of view.

BULDIR 91 - PIT 1														
Levels	**1**		**2**		**3**		**4**		**5**		**6**		**TOTAL**	**TOTAL**
	NISP	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**
Diomedea albatrus					1	1					1	1	**2**	2
Fulmarus glacialis											3	1	**3**	1
Oceanodroma leucorhoa			1	1	2	2	9	2	11	2	36	6	**59**	13
Phalacrocorax sp.	1	1	2	1	6	1	2	1	3	1			**14**	5
Branta canadensis			1	1	2	1	1	1	3	1	11	3	**18**	7
Larus sp.							1	1					**1**	1
Larus glaucescens			2	2					2	2			**4**	4
Larus hyperboreus	1	1	11	2	16	2	9	1	19	3			**56**	9
Rissa tridactyla	1	1	8	1	23	2	21	4	39	6	18	2	**110**	16
Rissa brevirostris					8	2					1	1	**9**	3
Uria sp.					3	1					3	1	**6**	2
Uria aalge							2	1					**2**	1
Uria lomvia	1	1					5	2					**6**	3
Cephus colomba			5	1					5	3	3	1	**13**	5
Synthliboramphus antiquus			48	8	21	4	59	9	56	7	66	7	**250**	35
Ptychoramphus aleuticus	1	1			24	6							**25**	7
Cyclorrhynchus psittacula					5	1	15	7	20	3	17	4	**57**	15
Aethia pusilla	4	1	4	3			1	1			3	2	**12**	7
Aethia cristatella	2	1	11	5	14	4			15	5	6	3	**48**	18
Aethia pygmaea			13	3	60	11	42	11	151	22	199	18	**465**	65
Cerorhinca monocerata									2	1	9	2	**11**	3
Fratercula cirrhata									1	7	2	1	**3**	8
Fratercula corniculata			1	1			5	1					**6**	2
Unidentified	0		30		41		27		96		154		**348**	
TOTAL	**11**	**7**	**137**	**29**	**196**	**38**	**199**	**42**	**423**	**63**	**532**	**53**	**1528**	232

TABLE 1 - Buldir 91 - Pit 1. Number of identified specimens (NISP) and minimum number of individuals (MNI) for levels 1 to 6.

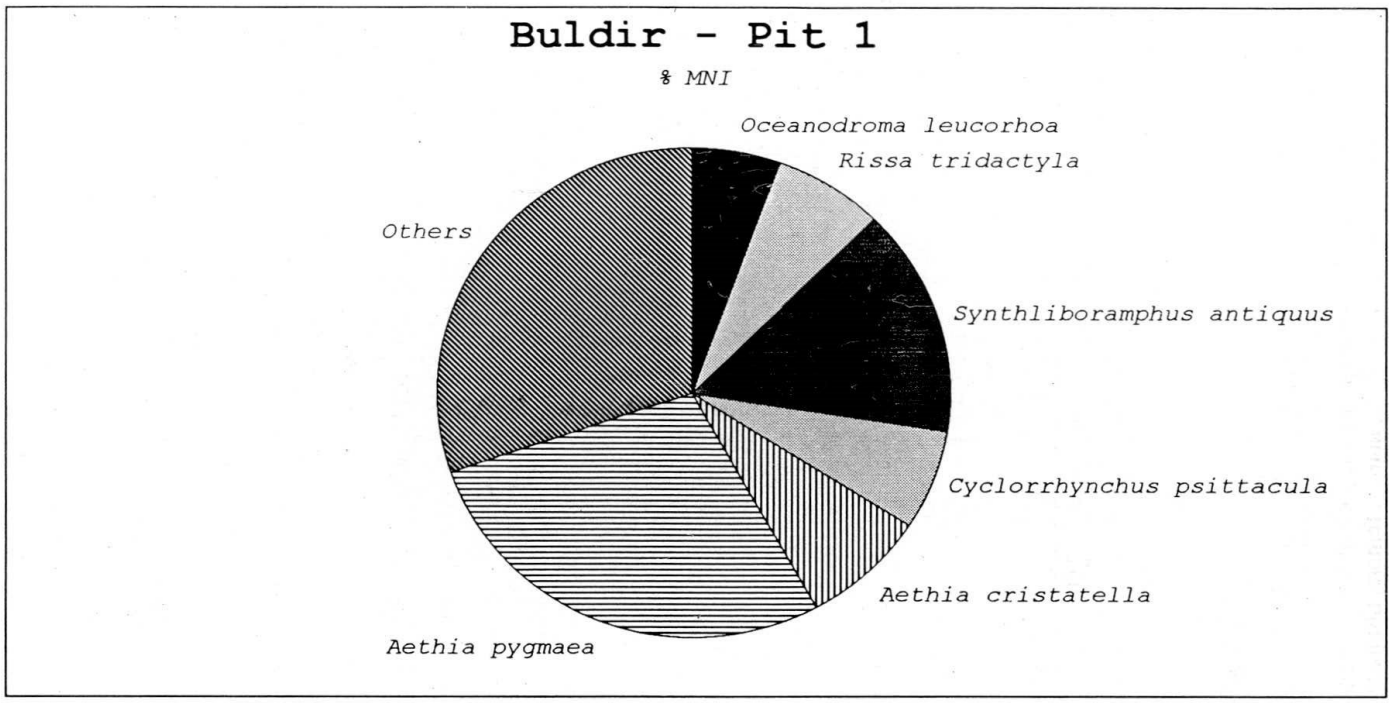

FIGURE 3 - Buldir 1991, Pit 1. Representation of the Minimum Number of Individuals (MNI) for the main species.

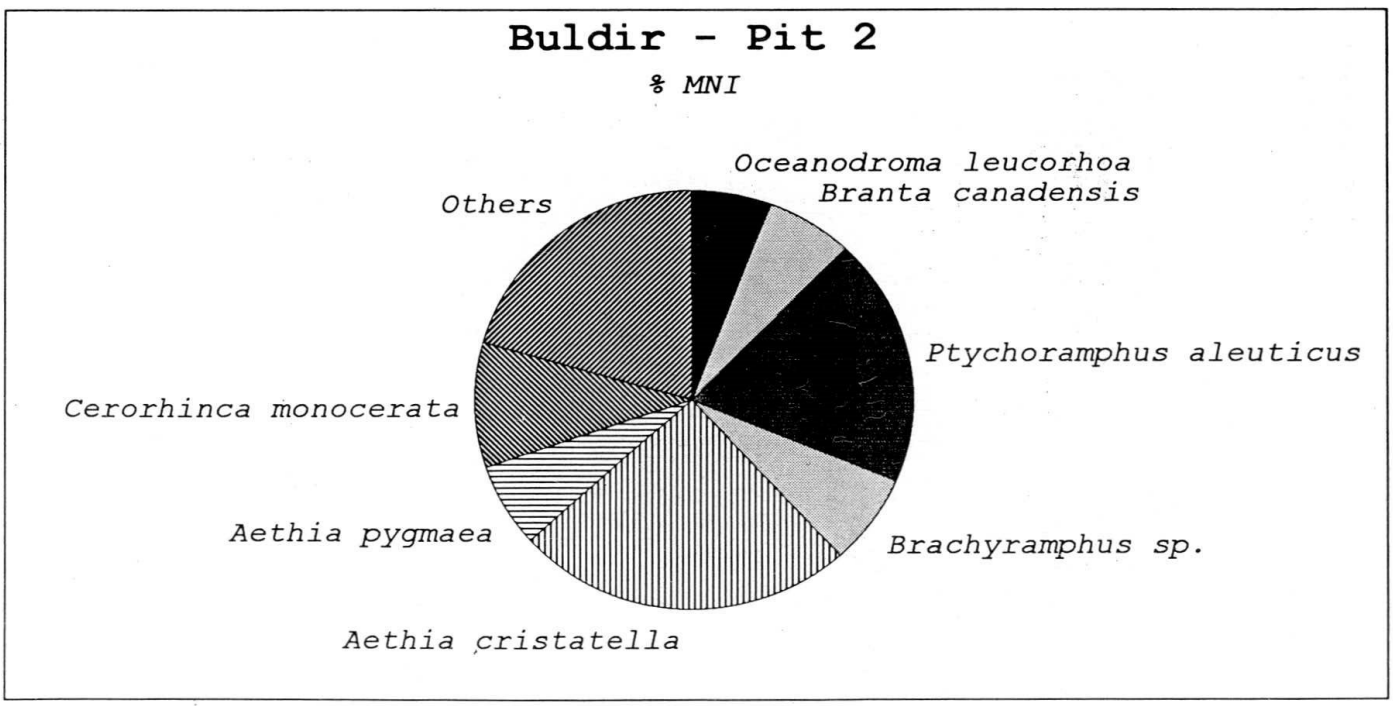

FIGURE 4 - Buldir 1991, Pit 2. Representation of the Minimum Number of Individuals (MNI) for the main species.

BULDIR 91 - PIT 2																
Levels	**1**		**2**		**3**		**4**		**5**		**6**		**7**		**TOTAL**	**TOTAL**
	NISP	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP***	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**
Diomedea albatrus					1	1							3	1	**4**	**2**
Oceanodroma leucorhoa									85	19	1	1			**86**	**20**
Phalacrocorax sp.					1	1									**1**	**1**
Branta canadensis					4	2			51	21					**55**	**23**
Larus hyperboreus			3	1					11	5					**14**	**6**
Uria lomvia	2	1			2	1									**4**	**2**
Synthliboramphus antiquus	6	1	12	5			3	1			17	3	20	4	**58**	**14**
Ptychoramphus aleuticus	2	1	17	2	6	2	4	1	410	54	14	3	37	4	**490**	**67**
Brachyramphus sp.					201	24									**201**	**24**
Cyclorrhynchus psittacula					2	1					1	1			**3**	**2**
Aethia pusilla			2	1	7	2	3	1			2	1	12	2	**26**	**7**
Aethia cristatella	11	2	14	4	304	30	11	3	291	42	18	3	13	3	**662**	**87**
Aethia pygmaea									114	22					**114**	**22**
Cerorhinca monocerata	1	1	7	2	14	6			147	21	3	1	8	3	**180**	**34**
Fratercula sp.											2	1			**2**	**1**
Fratercula cirrhata			2	1	20	4	23	2	44	8			1	1	**90**	**16**
Fratercula corniculata			8	2	24	3	1	1	43	10					**76**	**16**
Melospiza melodia									18	5					**18**	**5**
Unidentified	21		46		329		58		1888**		43		90		**2475**	**0**
TOTAL	**43**	**6**	**111**	**18**	**915**	**77**	**103**	**9**	**3102**	**207**	**101**	**14**	**184**	**18**	**4559**	**349**
* cor, hum, fem, tib, tar only					** other bones and unidentified											

TABLE 2 - Buldir 91 - Pit 2. Number of identified specimens (NISP) and minimum number of individuals (MNI) for levels 1 to 7. For level 5, identified specimens are coracoïdes, humeri, femora, tibiotarsi and tarsometatarsi only.

From the paleobiogeographic point of view, the list of species ideally provides data on both their presence and relative abundance. It can help in spotting particular changes which occured in the composition and distribution of the avifauna of the island. The case of Buldir is interesting because we know that no mammals such as rats or foxes were introduced, which means that "Buldir is a relatively pristine remnant of the Aleutian ecosystem" (Byrd & Day 1986: 116).

From the anthropological point of view, the list of identified species informs on the hunting preferences of the Aleuts, and documents their food habits, as well as the use of birds for clothing.

Paleobiogeography

Comparison of the zooarchaeological results with the present avifauna composition evidences incoherence in the list of identified species. Nowadays, the breeding avifauna of Buldir includes 32 species (Table 3, Figure 5), most of them (65%) belonging to a seabird family. In terms of breeding pairs (i.e. 99,9% of the individuals), the number from the two species of storm-petrels (*O. furcata* and *O. leucorhoa*) is so huge (1.500.000) that it completely hides the remaining species. This is why we present the percentages of breeding pairs both with and without the storm-petrels. Without the petrels one can see the importance of the Alcidae in the avifauna : 12 species are breeding on the island, representing 88% of the numbers of remaining pairs (i.e., after eliminating the petrel population). Among them, the most abundant ones are *Aethia pusilla*, the least auklet. After the Alcidae, come the Laridae in particular the kittiwakes (*Rissa tridactyla*).

A few remarks can be made on this discordant abundances between present and subfossil samples. Some species quite numerous today are poorly represented in the bone remains, and other species, absent or quite rare today, are common in the sub-fossil assemblages. Here are several cases:

- the kittiwake (*Rissa tridactyla*), presently well represented on the island, is absent in all the levels of Pit 2;

- the least auklet (*A. pusilla*), presently the most abundant of the Alcidae with 49% of the number of breeders, is poorly represented in the archaeological remains, with 3% of the MNI in Pit 1, and 2% in Pit 2

- the whiskered auklet (*A. pygmaea*), the most numerous species in Pit 1 with 28% of the MNI, is presently common but not abundant (1.250 pairs, 0,87%);

- the crested auklet (*A. cristatella*), the most numerous species in Pit 2 with 25% of the MNI, is presently common but not abundant (1.250 pairs, 0,87%);

- Cassin's auklet (*Ptychoramphus aleuticus*), the second most abundant species in Pit 2 with 25% of the MNI, is now represented by only 200 pairs, 0,14%;

- the rhinoceros auklet (*Cerorhinca monocerata*), 10% of the MNI in Pit 2, is now represented by only 12 breeding pairs;

- *Brachyramphus sp.*, 6,9% of the MNI in Pit 2, does not appear in the present avifauna of the island.

Does this mean that the abundance of the species has increased or decreased during the last thousand years, or is it only a matter of human choice, in relation with the different purposes involved in bird hunting ? To try to answer such a question, we must examine what could have been those purposes from the anthropological point of view.

Buldir Island Present Abundance of Birds
Census Byrd & Day, 1986

	N Pairs		0%	0%
Oceanodroma furcata	650 000		39,56	Oceanodroma not include
Oceanodroma leucorhoa	850 000		51,73	
Fulmarus glacialis	115	*	0,01	0,08
Phalacrocorax pelagicus	100		0,01	0,07
Phalacrocorax urile	140		0,01	0,10
Branta canadensis	170		0,01	0,12
Anas crecca	5		0,00	0,00
Somateria mollissima	13	**	0,00	0,01
Haliaetus leucocephalus	1		0,00	0,00
Falco peregrinus	5		0,00	0,00
Stercorarius parasiticus	50		0,00	0,03
Larus glaucescens	2 500		0,15	1,75
Rissa tridactyla	10 800		0,66	7,55
Rissa brevirostris	2 200		0,13	1,54
Uria aalge	1 100		0,07	0,77
Uria lomvia	12 300		0,75	8,60
Cepphus colomba	125	**	0,01	0,09
Synthliboramphus antiquus	4 500	**	0,27	3,15
Ptychoramphus aleuticus	200		0,01	0,14
Cyclorrhynchus psittacula	5 000	**	0,30	3,50
Aethia pusilla	70 000		4,26	48,93
Aethia cristatella	1 250	**	0,08	0,87
Aethia pygmea	14 000		0,85	9,79
Cerorhinca monocerata	12	**	0,00	0,01
Fratercula cirrhata	9 000	**	0,55	6,29
Fratercula corniculata	9 000	**	0,55	6,29
Nyctea scandiaca	1		0,00	0,00
Troglodytes troglodytes	60	**	0,00	0,04
Melospiza melodia	150	**	0,01	0,10
Calcarius lapponicus	150	**	0,01	0,10
Plectrophenax nivalis	23	**	0,00	0,02
Leucosticte arctoa	87	**	0,01	0,06
TOTAL	**1 643 057**		**100**	**100**

*=data from 1976
**=means of the estimations

TABLE 3 - Present abundance of the Buldir Island avifauna. Census from Byrd and Day, 1986.

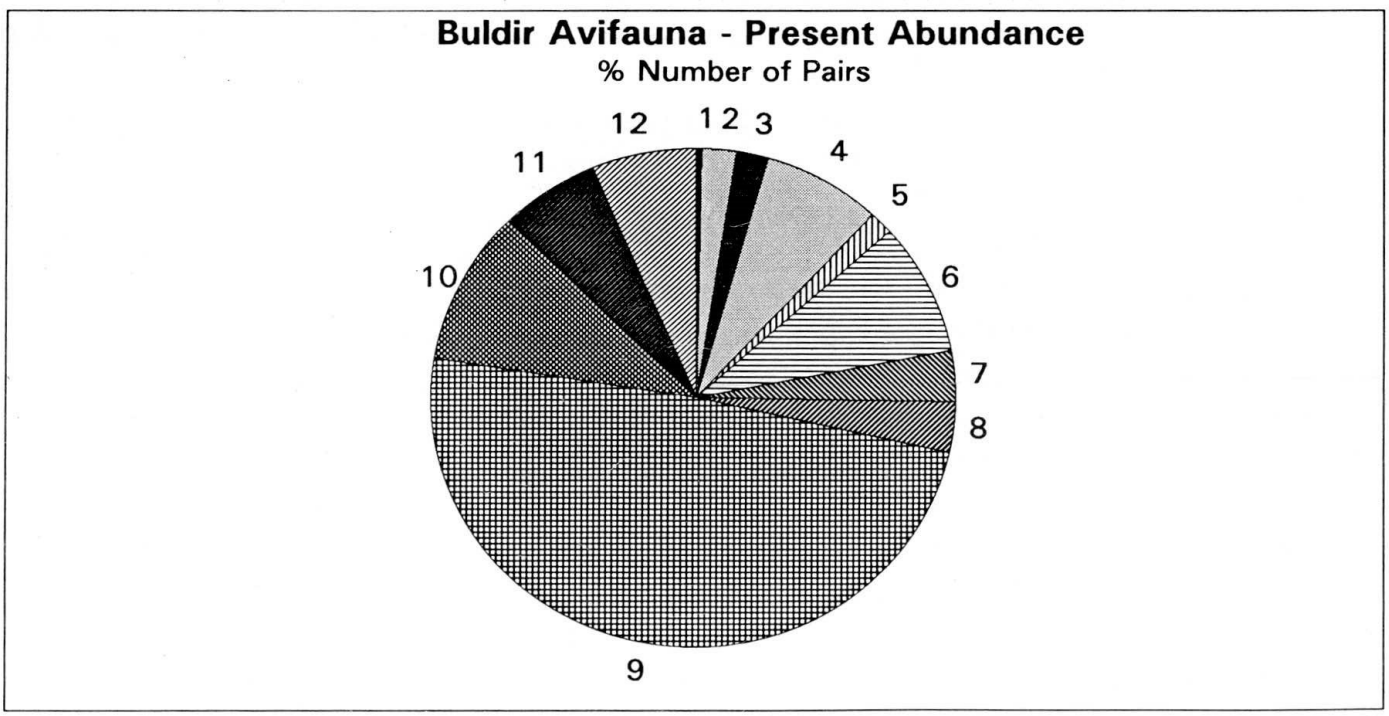

FIGURE 5 - Buldir Avifauna (not including *Oceanodroma sp.*). Representation of the present abundance, with the percentage of number of pairs. 1 = Passeriformes. 2 = Other species. *3 = Larus glaucescens. 4 = Rissa tridactyla.* 5 = *Rissa brevirostris.* 6 = *Uria lomvia.* 7 = *Synthliboramphus antiquus.* 8 = *Cyclorrhynchus psittacula.* 9 = *Aethia pusilla.* 10 = *Aethia pygmaea.* 11 = *Fratercula cirrhata.* 12 = *Fratercula corniculata.*

Anthropology

The Aleuts hunted birds for two main goals: food and clothing. The last one is well documented by the recent ethnographical sources (Fitzhugh & Crowell, 1988; Varjola et al., 1990): the Aleuts wore beautiful parkas made from skins of puffins, cormorants, guillemots or murres. We do not know how old is such a cultural practice. In case the bird remains could help in answering such a question, those coming from test pits not linked to any understandable structures are useless.

A minimum of three parameters must be considered in examining the use of birds as food: the size and weight of the species, the accessibility of the colonies and the hunting equipment.

Ethnographical sources, once again, can help to answer the last point (Collins et al., 1945; Laughlin, 1980). Nets and snares made of baleen and sinew were used to catch birds like puffins and auklets, without too many difficulties. Bolas could have been used to catch birds in flight. A light spear with a single barbed point at the end and a cluster of three other points projecting at an angle from near the center of the shaft was also used and cast by means of a throwing board. This might have been the equipment used to catch cliff nesting birds, otherwise inaccessible to a man.

The second point we must consider is the accessibility of the colonies to the hunters. Auklets (*Aethia sp.*, *Ptychoramphus aleuticus*, *Cyclorrhynchus psittacula*), murrelets (*Brachyramphus sp.*) and puffins (*Fratercula sp.*) are quite easy to approach: they breed in burrows and rock crevices on the boulders down the talus slopes, and such places are numerous on Buldir Island (Figure 2). Murres (*Uria sp.*) and kittiwakes (*Rissa sp.*) are more difficult to reach, nesting on steep cliffs hardly attainable. This differential accessibility to the colonies must be taken into account in order to explain the success of the first point regarding the diet of the Aleuts.

The last parameter, the size and weight of the species, was perhaps the most important. Here are examples of weight (in gramms) of the Alcidae (Bédart, 1969):

Uria. aalge	930,8	*Aethia pusilla*	86,3
Uria lomvia	975,5	*Aethia cristatella*	284,5
Cepphus columba	483,8	*Aethia pygmaea*	118,0
Synthliboramphus antiquus	233,5	*Cerorhinca monocerata*	571,0
Ptychoramphus aleuticus	172,6	*Fratercula cirrhata*	838,2
Brachyramphus sp.	236,0	*F. corniculata*	647,3
Cyclorrhynchus psittacula	317,6		

Figures 6 and 7 display the species weights in decreasing order, and indicate the percentage of minimum number of individual compared with the present abundance of breeding pairs. We will analyse such representations keeping in mind the parameter of accessibilty that we have discussed above.

- The murres (*Uria sp.*) and the puffins (*Fratercula sp.*) offer the highest body-weight ratio (almost a kilo). Both are fairly abundant today, but the murres are more difficult to reach than are the puffins. This can explain why the last ones are better represented in the archaeological samples than are the first ones.

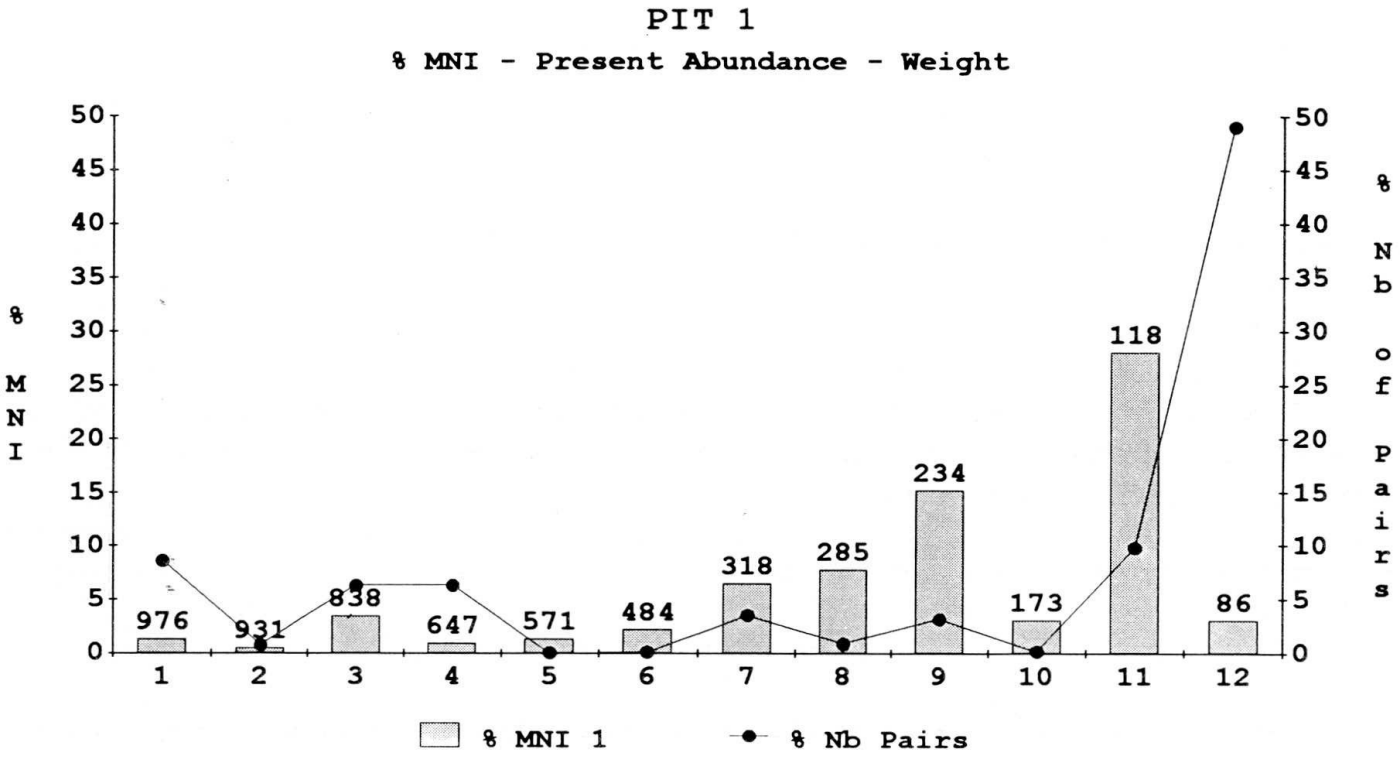

FIGURE 6 - Buldir 1991, Pit 1. Minimum number of individuals of Alcidae, presented in decreasing order of weight (indicated by the numbers on top of the bars), compared with the present abundance. 1 = *Uria lomvia*. 2 = *Uria aalge*. 3 = *Fratercula cirrhata*. 4 = *Fratercula corniculata*. 5 = *Cerorhinca monocerata*. 6 = *Cepphus columba*. 7 = *Cyclorrhynchus psittacula*. 8 = *Aethia cristatella*. 9 = *Synthliboramphus antiquus*. 10 = *Ptychoramphus aleuticus*. 11 = *Aethia pygmaea*. 12 = *Aethia pusilla*.

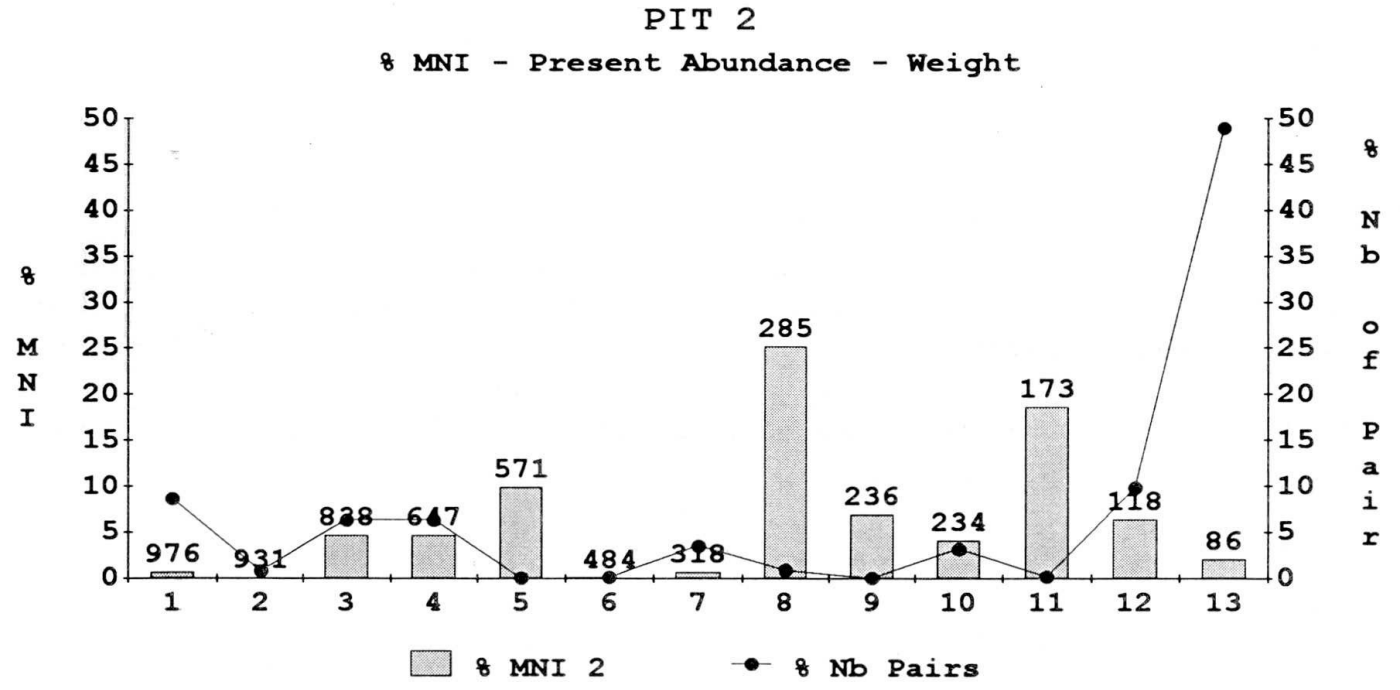

FIGURE 7 - Buldir 1991, Pit 2. Minimum number of individuals of Alcidae, presented in decreasing order of weight (indicated by the numbers on top of the bars), compared with the present abundance. 1 = *Uria lomvia*. 2 = *Uria aalge*. 3 = *Fratercula cirrhata*. 4 = *Fratercula corniculata*. 5 = *Cerorhinca monocerata*. 6 = *Cepphus columba*. 7 = *Cyclorrhynchus psittacula*. 8 = *Aethia cristatella*. 9 = *Brachyramphus sp.* 10 = *Synthliboramphus antiquus*. 11 = *Ptychoramphus aleuticus*. 12 = *Aethia pygmaea*. 13 = *Aethia pusilla*.

- *Cerorhinca monocerata* and *Cepphus columba* also have economically interesting body-weights (around a pound), but none are abundant today (12 and 125 breeding pairs recorded respectively). The first one is quite well represented in Pit 2. Can we suggest that the species was more abundant a thousand years ago?

- For the auklets, with a body-weight around 300 grams, the situation is not clear. We detect one common feature in both two pits: *Aethia pusilla*, the most abundant species among the Alcidae today, is poorly represented in the archaeological remains. It is also the species having the lightest body-weight, therefore constituting a less interesting prey item. Heavier species, such as *A. cristatella*, *Synthliboramphus antiquus*, or *Ptychoramphus aleuticus*, are better represented in the archaeological fauna than expected, due to their lower present-day abundance. Can we conclude that they used to be more numerous on the island, or is it only a hunting bias (accessibility of the colonies + decent body-weight = profitable prey) ?

CONCLUSION

The program on the western Aleutians is only beginning, and these results are very preliminar. Several questions have still to be answered, but this study already sheds new light on a few points. Concerning changes in the avifauna during past centuries, we must note the presence of *Brachyramphus sp.* prior to the XVth century. We have also noticed differences between archaeological and present day abundances for the Alcidae, but it is hard to interpret them in a straightforward way. The wide spectrum of marine species represented in the midden indicates the importance of bird exploitation, but these results will be more interesting when compared with the bone remains, from mammals and fish, whose study is still in progress.

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