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AVIFAUNA OF A BEAGLE CHANNEL ARCHAEOLOGICAL SITE

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ABSTRACT Lancha Packewaia, an archaeological midden on the north shore of the Beagle Channel, Territory of Tierra del Fuego, Argentina, has yielded 1183 identifiable avian bones from a minimum of 177 individuals of 20 species. Of these, 16 species, 608 specimens (51.8%), and 95 individuals date from an occupation from 4120 ± 305 to 4020 ± 70 ybp (the Ancient Component); and 15 species, 487 specimens (41.2%), and 79 individuals from an occupation from 1590 ± 50 to 280 ± 85 ybp (the Recent Component). *Phalacrocorax atriceps* is the most abundant species in the Ancient Component, and *Spheniscus magellanicus* in the Recent; the proportion of individuals comprised by each species differs between components. Six procellariiform species occur, and their representation does not differ between components. Uncommon species include two caracaras, another penguin, three additional cormorants, two steamer ducks, one gull, and one tern. Medium–large marine littoral species predominate in both components, consistent with littoral dependence of humans of both components; the only two species of landbirds are an owl and a parrot. Midden remains suggest that *Eudyptes chrysocome* and *Puffinus gravis* were more common previously in the Beagle Channel than they now are. The composition of the avifauna is consistent with apparent habitat stability for at least

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the past 4000 yr. The presence of a migratory tern and juveniles of five species, as well as wintering procellariiformes, confirm that humans used the site both during the austral breeding and nonbreeding seasons. We provide data of archaeological significance, including which species were utilized; what characteristics determine their use; the amount of meat provided by common prey species; and seasonality of midden use.

Key words: Zooarchaeology; Tierra del Fuego; Beagle Channel; Archaeoavifauna.

RESUMEN La avifauna de Lancha Packewaia, un conchero arqueológico en la costa norte del Canal Beagle, Territorio de Tierra del Fuego, Argentina, está constituida por 20 especies de aves con un total de 1183 huesos identificados correspondientes a un mínimo de 177 individuos. La avifauna proviene de dos ocupaciones de humanos: el Componente Antiguo, 4120 ± 305 hasta 4020 ± 70 ybp, y el Componente Reciente, 1590 ± 50 hasta 280 ± 85 ybp. De esas especies, 16 (representadas por 608 huuesos [51.8%], correspondientes a 95 individuos) provienen del Componente Antiguo y 15 (representadas por 487 huuesos [41.2%], correspondientes a 79 individuos) provienen del Reciente. *Phalacrocorax atriceps* es la especie más abundante del primer componente, y *Spheniscus magellanicus* la más abundante del segundo; la proporción de individuos comprendidos en cada especie difiere entre ambos componentes. Seis especies de procellariiformes estaban presentes: *Diomedea melanophris*, *Macronectes giganteus*, *Fulmarus glacialoides*, cf. *Daption capense*, *Puffinus griseus*, y *P. gravis*, no difirendo su representación entre componentes. Especies representadas en números bajos incluyen *Eudyptes chrysocome*, *Phalacrocorax magellanicus*, *P. bransfieldensis*, *P. brasilianus*, *Tachyeres patachonicus*, *T. pteneres*, *Polyborus plancus*, *Milvago chimango*, *Larus dominicanus* y *Sterna hirundinacea*. *Eudyptes chrysocome* y *Puffinus gravis* parecen haber sido más comunes antiguamente que ahora. Como la avifauna de los dos componentes contenía mayormente aves de tamaño medio-grande del litoral marítimo, es consistente con la dependencia del litoral marítimo de los humanos en ambas ocupaciones. Estaban representadas sólo dos especies exclusivamente terrestres, *Tyto alba* y *Enicognathus ferrugineus*. La presencia de huesos de un gaviotín migratorio, un procellariiform que solamente es un visitante invernal, y de juveniles de cinco especies muestra que el sitio fue usado por los humanos en varias estaciones. La composición de la avifauna es consistente con la estabilidad de los habitats en los últimos 4000 años por lo menos. Se presentan datos sobre el peso total de los músculos y fórmulas para calcular el peso de carne para siete especies comunes.

Palabras claves: Zooarqueología; Tierra del Fuego; Canal Beagle; Arqueoavifauna.

During the past several thousand years, human inhabitants of the coasts of the Beagle Channel created many kitchen middens (concheros), which contain large quantities of mollusk shells and mammal, fish, and bird bones. There are hundreds of these shell mounds (Bird, 1938; Ortiz-Troncoso, 1971a, 1971b, 1972, 1973; Laming-Emperaire, 1972; Saxon, 1976; Orquera et al., 1977; Orquera and Piana, 1991), which vary in height above the natural substrate from a few decimeters to more than a meter and are easily recognizable by their rounded shape; all the mounds presumably contain bird bones. Anthropologists of the Fundación Antropológica Argentina and the Asociación de Investigaciones Antropológicas have excavated some of the less disturbed sites (Orquera and Piana, 1983, 1987, 1988; Orquera et al., 1982) and here we report on the abundant avian remains from one of these, Lancha Packewaia (Orquera et al., 1977). The Lancha Packewaia site contained birds in several layers; two of these were radiocarbon dated at 4215 ± 305 and 4020 ± 70 years before present (ybp), which together are called the "Ancient Component of Lancha Packewaia." These layers are separated by a large gap from the several layers comprising the "Recent Component" that were deposited during more or less continuous occupation from 1590 ± 50 ybp until 280 ± 85 ybp (Orquera et al., 1977). Both components were created by groups of littoral-dependent humans probably ancestral to the Yámana (or Yahgan). Birds comprised about 7% of the diet of the people who deposited the Ancient Component, and less than 3.5% of the diet of those who created the Recent Component (Orquera et al., 1979).

Little has been published on the prehistoric avifauna of the Beagle Channel; Saxon (1979) presented a preliminary list of the birds found in Lancha Packewaia, but considerable additional avian material has become available since. Bird remains from several other archaeological sites in the Chilean channels west of Tierra del Fuego and on the Fuegian Atlantic coast were studied by Lefèvre (1989); those from Túnel 1, a large archaeological site about 1 km east of Lancha Packewaia, are currently under study (Rasmussen and Humphrey, 1991; Humphrey and Rasmussen, unpubl. data). Biogeographic analyses attempting to establish effects of vicariance events on speciation and distribution of the avifauna of Fuego-Patagonia (Devillers and Terschuren, 1978; Humphrey and Péfaur, 1979; Vuilleumier, 1985, 1991; Livezey, 1986a; Rasmussen, 1987, 1990, 1991; Corbin et al., 1988) generally have been hampered by the paucity of published information on the prehistoric occurrence of bird species within the region. The abundant avian material excavated from Lancha Packewaia and other radiocarbon-dated archaeological sites in the Beagle Channel and elsewhere in the region will eventually allow comprehensive reconstruction of the palaeoavifauna and determination of whether changes in species composition and abundance have occurred in relation to climatic fluctuation.

In this paper, we infer the life assemblage for birds in several ages in the Lancha Packewaia area based on the deposited assemblage. This enables documentation of the past occurrence, abundance, and breeding of certain avian species there, and testing for change in species composition over time. We also provide data of archaeological relevance, including (1) which bird species were utilized by the native humans of the two components and in what proportions; (2) characteristics of these species making them more likely to be utilized than other species; (3) the amount of meat provided by major prey species; and (4) seasonality of midden use.

MATERIALS AND METHODS

Locality

Lancha Packewaia (54°49'15" S, 68°09'45" E) lies on the north shore of the Beagle Channel 14 km from the eastern end of the town of Ushuaia (Fig. 1), on Isla Grande de Tierra del Fuego, Territory of Tierra del Fuego, Argentina. This grass-covered site is 6–8 m above sea level and occupies a surface area of 55 x 35 meters, being delimited by a forested ravine with a stream, a cliff face, and a rocky beach and headland (Orquera et al., 1977). Several Pleistocene glaciations originated to the west and covered the entire Beagle Channel east of Lancha Packewaia at least to Isla Gable (Fig. 1; Porter et al., 1984; Heusser and Rabassa, 1987), but all ice had apparently receded well prior to recorded occupation of the Lancha Packewaia archaeological site.

Methods

Orquera et al. (1977) gave a detailed account of the locality and methods utilized in excavation. Each element was labeled to one of eight trenches and six natural layers, and associated radiocarbon dates were available for most of the trenches (Table 1). As excavation numbers were not unique, we assigned each bone a Lancha Packewaia catalogue number. For coracoids, humeri, and tarsometatarsi of *Phalacrocorax* species, the numbers listed in the present paper are equal to the one- to three-digit catalogue numbers plus 1000.

The five most abundantly represented osteological elements in the midden (coracoid, humerus, femur, tibiotarsus, and tarsometatarsus) were included in this study. Preliminary examination of other skeletal elements available indicated that their inclusion would not add more species or individuals to the avifauna of Lancha Packewaia. A small collection of worked avian bones from Lancha Packewaia were retained by the Asociación de Investigaciones Antropológicas and are not included in this study.

Comparative material utilized in identifications included series of five or more skeletal specimens for each species, and we considered characters that were consistent for a species based on the material at hand to be valid for purposes of identification. The majority of the comparative material was from Tierra del Fuego and is located in The University of Kansas Museum of Natural History (KUMNH) collections, and a significant amount of the comparative material utilized was from the National Mu-

Fig. 1. Map of southern Patagonia and Tierra del Fuego, showing the location of Lancha Packewaia and other middens and cave sites from which birds have been reported in the region. Abbreviations: MC, Mylodon Cave; AdD, Alero del Diablo; FC, Fell's Cave (Humphrey et al., 1993); E, Englefield I; BC, Bahía Colorada; PB, Punta Baja; BB, Bahía Buena; PSA, Punta Santa Ana; PM, Punta María; SP, San Pablo (Lefèvre, 1989). The location of Túnel 1 (Humphrey and Rasmussen, unpubl. data) is shown on the inset map. The archaeological site Los Toldos, at Cañadon de las Cuevas, Santa Cruz Province, Argentina (Tambussi and Tonni, 1985), is north of the region covered by this map.

Table 1. Number system for associating bird remains from the Lancha Packewaia midden with trenches, natural layers, and radiocarbon dates. 1–20 = 101–20, 1–30 = 101–30, etc. Layers indicated by dashes were not present in the trenches.

Trench	Midden B	Soil C	Midden D	Soil D′ & Z[a]	Midden X & Y	Beach E
I	1–20	1–30	1–40	1–41	1–70	1–50
II	—	—	2–20	2–30	2–40	2–50
III	3–20[b]	3–30[c]	3–20[b]	3–30[c]	3–40	3–50
IV	4–27	4–30	4–26	—	—	4–50
V	5–20, 5–26	5–30	5–27	—	—	5–50
VI	6–20	6–30	6–40	6–90	6–80	6–50
VII	—	—	—	—	—	107–50
VIII	—	—	—	—	8–20	8–50
Approximate ages (ybp)						
I	—[d]	—[e]	1120 ± 50	—	4020 ± 70	—[d]
II	—[d]	—[e]	1590 ± 50	—	—[d]	—[d]
III	280 ± 85	410 ± 75	470 ± 50	—	—[d]	—[d]
VI	280 ± 85	455 ± 85	1080 ± 100	—	—[d]	4215 ± 305

[a] D′ and Z is undated.

[b] May pertain to midden B or D.

[c] May pertain to soil C or D′ and Z.

[d] For middens B and X & Y and Beach E, undated layers are assumed to be of the same age as the dated layers.

[e] Trenches I and II of Soil C are assumed to be from about 400 ybp.

seum of Natural History (USNM) and other collections. All identified midden specimens of the five included elements are listed under the "Material" section for each species, except for the two most abundant species—the Magellanic Penguin, *Spheniscus magellanicus*, and the Imperial Shag, *Phalacrocorax atriceps*—for which the subsets of the material listed are specified in the respective species accounts. All numbers in "Material" sections refer to LP (Lancha Packewaia catalog) numbers. For each species and each radiocarbon age, the number of identified specimens (NISP; Klein and Cruz-Uribe, 1984) was tabulated. Measurements of osteological elements follow von den Driesch (1976). Both left and right elements were included, and minimum number of individuals (MNI) for each species at each radiocarbon age was obtained by determining which element had the greatest number of complete and distal or proximal fragments for one side. In calculation of MNIs, we did not attempt to match left and right sides of an element to determine whether different elements could have been from the same individuals. Specimens from undated and equivocally dated layers were not used in calculation of MNIs except when there was clearly no possibility of overlap with dated remains.

Bones were identified as being from juveniles if they are less ossified than those of known adult specimens of the same species, or if they are comparable in ossification to known juveniles; care was taken to determine, however, that wear on the midden bones was not responsible for the apparent incomplete ossification. Except where noted as juveniles, specimens were either fully ossified or their degree of ossification could not be determined.

Osteological nomenclature follows Howard (1929) and scientific and English names of bird species are those used by Narosky and Yzurieta (1987), with the following exceptions: the Imperial Shag, *Phalacrocorax atriceps*, includes *P. albiventer* (Rasmussen, 1991); the Antarctic Shag, *P. bransfieldensis*, is considered specifically distinct (Siegel-Causey and Lefèvre, 1989); the genus *Phalcoboenus* is retained as distinct from *Polyborus* (Olson, 1976); and the name *Phalacrocorax brasilianus* is used (Browning, 1989).

We considered the composition of the modern Beagle Channel avifauna to comprise all species of known regular occurrence in and adjacent to the Beagle Channel (following Clark, 1986). Vagrant and historically introduced species were excluded. For habitat grouping, species were considered "marine littoral" if they regularly occur on beaches and the intertidal zone, even if they are primarily found in another habitat.

Weights of skeletal muscles of important prey species (*Spheniscus magellanicus*, *Phalacrocorax* spp., and *Tachyeres* spp.) were obtained by weighing skinned and gutted fresh specimens and later weighing the dry skeletons after they were fully cleaned by maceration. Single-variable regressions then were done on meat weights versus each of three predictor variables: humerus length, femur length, and tarsometatarsus length. These data enable estimation of the nutritive value provided by each of these species.

RESULTS

Identification to species was accomplished for a total of 1183 avian bones (coracoids, humeri, femora, tibiotarsi, and tarsometatarsi) from a minimum of 177 individuals of 20 species from the Lancha Packewaia archaeological site (Appendix). The number of bones for each species from each radiocarbon age, as well as undated but identified bones, MNI for each age, and percent MNI comprised by each species for each age are given in the Appendix. In addition to the identified bones, considerable fragmentary avian material was unidentifiable. Number of identifiable specimens (NISP), MNI, total numbers of species, and Shannon-Wiener functions for

Table 2. Percent MNIs for each species for the two major time periods, Shannon-Weiner Information Measures, and tests of statistical differences between the two periods in representation of the two most abundant avian species and groups.

Species	4215–4020 ybp	1590–280 ybp	P^a
% MNI			
Spheniscus magellanicus	20.0	36.7	*
Eudyptes chrysocome	1.0	1.3	—
Diomedea melanophris	3.2	7.6	—
Macronectes giganteus	2.1	1.3	—
Fulmarus glacialoides	3.2	2.5	—
cf. *Daption capense*	1.0	0.0	—
Puffinus gravis	2.1	1.3^b	—
Puffinus griseus	3.2	0.0	—
Phalacrocorax magellanicus	4.2	5.1	—
Phalacrocorax atriceps	44.2	29.1	*
Phalacrocorax bransfieldensis	7.4	5.1	—
Phalacrocorax brasilianus	0.0	2.5	—
Tachyeres pteneres	2.1	0.0	—
Tachyeres patachonicus	2.1	1.3	—
Milvago chimango	1.0	0.0	—
Larus dominicanus	2.1	2.5	—
Sterna hirundinacea	0.0	1.3	—
Enicognathus ferrugineus	1.0	1.3	—
Tyto alba	0.0	1.3	—
Total Procellariiformes	14.7	12.6^b	ns
Total marine littoral	86.2	86.2	ns
Total medium-large	86.0	90.0	ns
Total NISP	608	487	—
Total MNI	95	79	—
Total number of species	16	15	—
Shannon-Wiener Function	1.93	1.90	—

[a] *G*-test of independence: * = $P \leq 0.05$.

[b] Not including 11 undated *P. gravis* elements known to be from Recent Component because MNI not calculable.

the Ancient and Recent components of Lancha Packewaia are very similar (Table 2). Shannon-Wiener functions showed that both components had avifaunas of moderate diversity. However, there are significantly fewer *Spheniscus magellanicus* in the Ancient Component than in the Recent Component, and the reverse is true for *Phalacrocorax atriceps*. The percent MNI of the archaeoavifauna comprised by the Procellariiformes does not differ between the two components, nor does the proportion comprised

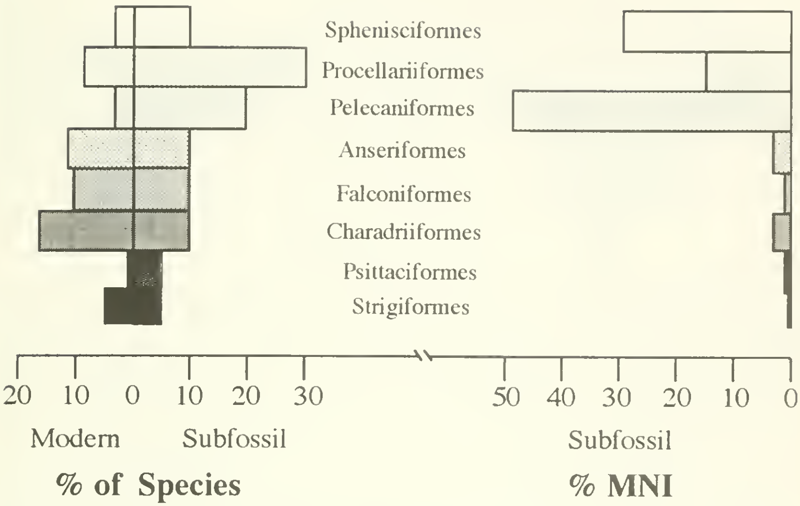

Fig. 2. Percent representation of each avian order at Lancha Packewaia. Orders unrepresented in the Lancha Packewaia archaeoavifauna were included in the calculations of the modern avifauna but are not shown in the figure.

of littoral species or that of birds in the medium-large size class (Table 2).

Cormorants (Pelecaniformes) constitute the greatest percent MNI in the Lancha Packewaia archaeoavifauna, followed by *Spheniscus magellanicus* and then by the pooled procellariiform species (Fig. 2). Procellariiformes are the most speciose group at Lancha Packewaia, followed by cormorants. All regularly occurring species of these orders together comprise less than 15% of the species in the modern Beagle Channel avifauna (Fig. 2). Marine littoral species comprise the greatest percent MNI and percentage of species in the archaeoavifauna, as well as the greatest percentage of species in the modern Beagle Channel avifauna (Fig. 3). It should be noted that all species in the "pelagic" group also regularly occur near shore owing to the narrowness of the Beagle Channel. Strictly freshwater species are absent at Lancha Packewaia, and landbirds that do not frequent the marine littoral zone are underrepresented (Fig. 3). In terms of size classes, the greatest percent MNI and the largest number of species by 20% at Lancha Packewaia are composed of medium-large species; this indicates a strong bias in the sample toward medium-large birds considering the low number of species of this size class in the modern Beagle Channel avifauna (Fig. 4). Medium-sized birds comprise very little of the percent MNI, but the percentage of species of this size class represented in the archaeoavifauna is approximately the same as that in the modern Beagle Channel avifauna (Fig. 4).

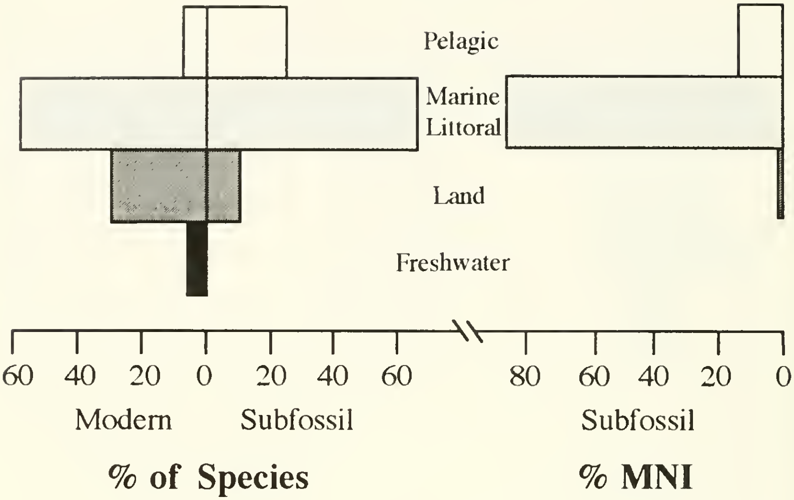

Fig. 3. Percent representation of birds of each habitat grouping from Lancha Packewaia. The 'pelagic' group includes all procellariiformes except *Macronectes*, and the 'littoral' group includes the two species of caracaras and *Macronectes* as well as more typical marine littoral species.

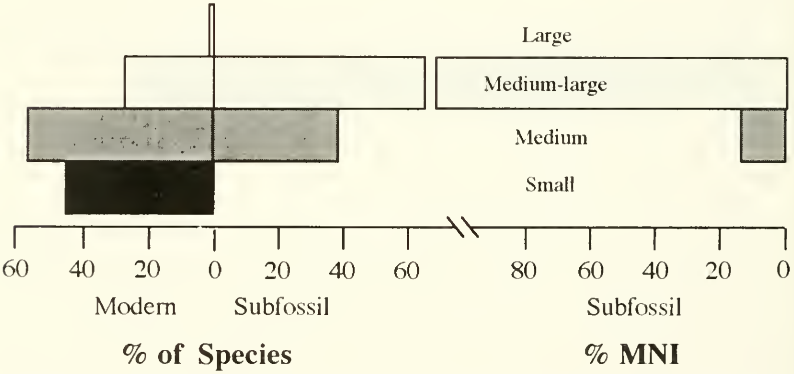

Fig. 4. Percent representation of birds of each size class at Lancha Packewaia.

SYSTEMATIC ACCOUNTS

Spheniscus magellanicus (J. R. Forster)
Magellanic Penguin

Material.—Because of the large number of specimens of this species, only complete or nearly complete elements are listed. Coracoids: complete right, 119–120, 124–127, 133–134, 136, 138–140; complete left, 83, 85, 87, 92, 94–95, 99, 101, 105, 108–109. Humeri: complete right, 51, 54–57, 59–65, 68–76, 365, 491; complete left, 10–17, 19–23, 27–28, 32–36, 38–40, 43, 364. Femora: complete right, 238–245, 250–252, 254–255, 258, 283–288, 290, 495; complete left, 229–235, 264, 266–268, 275, 277, 279–282, 497–498. Tibiotarsi: complete right, 144–145, 162–165, 167, 171–172, 178, 181, 502–503; complete left, 150–156, 182–183, 186–187, 195. Tarsometatarsi: complete right, 197–198, 200–204, 206, 222–226, 499–500; complete left, 209–218, 227–228, 501. See Appendix.

Measurements.—See Table 3.

Remarks.—Elements of *Spheniscus magellanicus* were distinguished from those of both the Rockhopper Penguin, *Eudyptes chrysocome,* and the Macaroni Penguin, *E. chrysolophus,* based on the following characters: (1) on *S. magellanicus* the brachial tuberosity of the coracoid is much lengthened medially; (2) the pneumatic fossa of its humerus is more heavily rimmed, because the distal edge of the median crest is more extensive and not as concave; and (3) the medial hypotarsal crest of its tarsometatarsus extends farther posteriorly and is more strongly defined. Large specimens of *S. magellanicus* were distinguished from *E. chrysolophus* by *S. magellanicus* having the capital groove of the humerus not continuous with the pneumatic fossa and not bordered proximally by a definite ridge, and by the anterior edge of the proximal third of the tibiotarsus shaft being rounded or ridged, rather than flattened. Small *S. magellanicus* were distinguished from *E. chrysocome* based on the following characters. In *S. magellanicus,* the humerus shaft is more curved. The internal condyle of the tibiotarsus forms slightly greater than a half-circle on medial view, and

Table 3. Summary statistics for measurements of *Spheniscus magellanicus* from Lancha Packewaia.

Measurement	$\bar{x}$	SD	n	Range
Coracoid length	78.8	2.37	17	74.7–82.8
Humerus length	73.5	2.54	40	67.8–77.9
Humerus proximal breadth	21.1	0.83	41	19.3–22.6
Humerus distal breadth	19.8	1.06	32	17.1–21.8
Femur length	79.0	2.73	32	71.5–84.2
Femur proximal breadth	17.6	0.79	30	15.9–19.1
Femur distal breadth	15.1	0.67	29	13.3–16.1
Tibiotarsus length	121.6	4.10	16	114.0–128.3
Tibiotarsus proximal breadth	12.2	0.58	22	11.4–13.2
Tibiotarsus distal breadth	14.0	0.50	24	12.4–14.8
Tarsometatarsus length	34.4	1.14	31	32.7–36.8
Tarsometatarsus proximal breadth	15.9	0.43	28	14.9–16.7
Tarsometatarsus distal breadth	20.3	0.52	23	19.2–21.1

the outer cnemial crest is more extensive distally; the distal portion of the tibiotarsus shaft is less twisted. The trochanteric ridge of the femur is narrower and more produced anteriorly. Very large *S. magellanicus* were distinguished from the more distantly related (O'Hara, 1989) Chinstrap Penguin, *Pygoscelis antarcticus*, by the following characters. In *S. magellanicus*, the head of the coracoid is more rectangular and less rounded from humeral view, the procoracoid is less medially produced, and adults have a fenestrate lamella on the medial margin of the coracoid (usually lacking in *P. antarcticus;* Zusi, 1975; O'Hara, 1989). There is no strong laterally projecting triangular lateral edge of the distal third of the humerus shaft. The obdurator ridge on the femur is narrow, rather than being thick and rounded; there is no strong concavity on the medial edge of the femur shaft immediately proximal to the popliteal area. The attachment surface of the outer cnemial crest of the tibiotarsus does not form a wide oval; the inner cnemial crest is only slightly convex on lateral view. The internal condyle of the tibiotarsus is narrower and less rectangular, and the anterior edge of the proximal third of the tibiotarsus shaft is more rounded. The medial hypotarsal crest of the tarsometatarsus is much better defined. Other species of penguins at least occasionally found in the Fuegian region are much larger than are any of those represented at Lancha Packewaia.

Spheniscus magellanicus was the second most abundant bird species in the archaeoavifauna, with 290 bones from a minimum of 48 individuals comprising 19–100% of the total MNI for each radiocarbon-dated layer (Appendix). The Ancient Component contains a significantly lower proportion of this species than does the Recent Component (Table 2).

A humerus (LP 177) and a tarsometatarsus (LP 221) of *Spheniscus magellanicus* from this midden clearly represent very incompletely ossified juveniles. Many other specimens of this species from Lancha Packewaia are immature individuals at later stages of development; few are full adults. Most of the tarsometatarsi are from immatures; only five were definitely from fully ossified birds (LP 198, 212, 216, 223, 500). Also, most humeri are from immature birds; from the 280 ± 85 layer, for example, 24 of the humeri were from immatures, while only seven were from fully ossified birds (LP 14–15, 22–23, 70, 76, 78) comparable in degree of ossification to 20 *S. magellanicus* specimens considered adults (based on their lack of the Bursa of Fabricius and/or enlarged gonads) collected at a breeding colony at Puerto Deseado, Santa Cruz Province, Argentina.

Eudyptes chrysocome (Forster)
Rockhopper Penguin

Material.—Humeri: complete right, 80 (juvenile), 686 (juvenile). Tibiotarsus: complete right, 180. See Appendix.

Measurements.—Humeri: lengths, 58.1, 58.8; proximal breadths, 17.9, 18.2; distal breadths, 16.1, 16.4. Tibiotarsus: distal breadth, 12.5.

Remarks.—The characters used to distinguish specimens of this species from small *Spheniscus magellanicus* are given in the previous species account.

Diomedea melanophris Temminck
Black-browed Albatross

Material.—Coracoids: cranial right, 667; incomplete right, 305, 412, 669; incomplete left, 306, 316, 414; sternal right, 668; sternal left, 411. Humeri: proximal right, 7 (juvenile), 682–684; proximal left, 2–3, 679–680; incomplete right, 407; incomplete left, 1, 410, 677; distal right, 8–9, 681; distal left, 4–6, 386, 678. Femora: complete right, 309–310; complete left, 307–308, 311, 672–673, 689; incomplete left, 312; distal left, 313. Tibiotarsi: complete left, 304; proximal right, 299, 301; proximal left, 674; incomplete right, 675; incomplete left, 302–303, 416; distal right, 300; distal left, 676. Tarsometatarsi: complete right, 670; complete left, 292–293; incomplete left, 387, 671; distal right, 296; distal left, 294. See Appendix.

Measurements.—Humeri: proximal breadths, 36.3, 37.2; distal breadths, 19.6, 20.1 (2), 20.5, 21.2, 21.6, 22.2, 22.4. Femora: lengths, 77.1, 78.8, 83.0, 83.5; proximal breadths, 15.9, 16.0, 16.3, 17.3, 17.4, 17.7; distal breadths, 17.0, 17.2, 18.0, 18.3, 18.5, 18.6. Tibiotarsi: proximal breadths, 14.3 (2), 14.5 (2); distal breadth, 16.1. Tarsometatarsi: lengths, 81.1, 84.5, 87.6; proximal breadths, 17.2, 17.3; distal breadths, 16.7, 17.1, 17.5, 18.3, 24.0, 24.9.

Remarks.—Elements of *Diomedea melanophris* were distinguished from those of its congener, the Gray-headed Albatross (*D. chrysostoma*) as follows. In the coracoid of *D. melanophris*, the lateral edge of the coracohumeral surface forms a tighter semicircle from humeral view. In the humerus, the ectepicondylar process is more nearly rectangular and is not as narrow proximally. No characters were found which enabled discrimination of the femora, tibiotarsi, and tarsometatarsi of these two species of *Diomedea*. Several characters distinguish elements of *D. melanophris* from those of the Light-mantled Sooty Albatross, *Phoebetria palpebrata*, large individuals of which overlap in size with the smallest *D. melanophris*. In *D. melanophris*, the coracoid shaft is longer, and the internal side of the furcular facet is strongly ridged on the sternal edge. The distal edge of the bicipital crest of the humerus is more deeply undercut; the most lateral prominence of the deltoid crest is more attenuate and extensive, and the ectepicondyle is longer. The subtrochanteric fossa of the femur is slightly deeper, and the proximal end of the iliotrochanteric impression is more distinctly curved. In the tibiotarsus the groove for the peroneus profundus is shallow, the inner cnemial crest larger and more extensive anteriorly, the outer cnemial crest more extensive laterodistally, and the anterior portion of the internal condyle more rounded on medial view. In the tarsometatarsus, the lateral prominence of the external cotyla is more laterally produced and the anterodistal border of the lateral cotyla less deeply undercut; the accessory distal foramen (intertrochlear tendinal opening of Chandler, 1990) is located within the opening of the major distal foramen. The anterior metatarsal groove is deeply furrowed immediately proximal to the distal foramen; the lateral trochlea is nearly circular from lateral view, and the medial hypotarsal crest is more produced posteriorly. None of the albatross remains at Lancha Packewaia is as large as the great albatrosses, *D. epomophora* and *D. exulans*, or the Shy Albatross, *D. cauta*.

Despite the considerable variation in size and morphology that prompted Saxon (1979) to list five species of albatrosses, all albatross remains from Lancha Packewaia that are sufficiently well preserved for specific identification represent *Diomedea melanophris*. The same is true of the numerous albatross remains from Túnel I (Humphrey and Rasmussen, unpubl. data). Because of the lack of definite evidence of other species, Lancha Packewaia albatross material that cannot be diagnosed to species is referred to *D. melanophris*. LP 7 is a juvenile, but we cannot discern whether it was of pre- or postfledging age.

Macronectes giganteus (Gmelin)
Southern Giant-Petrel

Material.—Femora: complete right, 315 (juvenile); complete left, 314 (juvenile). Tibiotarsi: nearly complete right, 297 (juvenile); nearly complete left, 298 (juvenile). Tarsometatarsi: incomplete right, 295 (juvenile); incomplete left, 415. See Appendix.

Measurements.—Femora: lengths, 92.3, 92.4; proximal breadths, 19.2, 19.4; distal breadths, 19.0, 19.3. Tibiotarsi: proximal breadths, 17.3, 17.8; distal breadths, 17.0, 17.5. Tarsometatarsus: distal breadth, 19.3.

Remarks.—These remains are assumed to be *Macronectes giganteus* based on the present abundance of this species in the Beagle Channel and the fact that the Northern Giant-Petrel, *M. halli*, has not been definitely recorded in the vicinity (Clark, 1986). Four of five elements are from nearly completely ossified immatures, presumably of postfledging age, and the fifth, LP 415, is too fragmentary to allow age determination.

Fulmarus glacialoides (Stephens)
Antarctic Fulmar

Material.—Coracoids: incomplete right, 404; incomplete left, 339, 403, 405, 406. Humeri: nearly complete left, 637; proximal right, 638; proximal left, 327, 639, 640; incomplete right, 328; distal left, 330, 641, 642, 643. Femora: complete right, 354; complete left, 644; proximal right, 645. Tibiotarsi: complete right, 648; complete left, 646; proximal right, 341; incomplete right, 391, 647. Tarsometatarsi: complete right, 401, 402; complete left, 358. See Appendix.

Measurements.—Humeri: length, 110.7; proximal breadth, 17.5; distal breadths, 12.5, 12.8, 12.9 (2). Femora: lengths, 43.1, 46.9; proximal breadths, 9.1, 9.7; distal breadths, 8.5, 9.1. Tibiotarsi: length, 90.5; proximal breadths, 6.4, 6.8. 7.1; distal breadths, 7.3 (2). Tarsometatarsi: lengths, 50.9, 51.3, 51.7; proximal breadths, 8.7, 8.9, 9.1; distal breadths, 8.4, 8.8, 9.0.

Remarks.—Specimens of this species can be readily distinguished from the Greater Shearwater, *Puffinus gravis*, and the Sooty Shearwater, *P. griseus*, by the following characters. The coracoid shaft of *Fulmarus glacialoides* is shorter and the furcular facet is truncate. Both the shaft and the distal end of the humerus are unflattened, and the bicipital crest is less extensive internodistally. The internal tuberosity of the humerus is smaller and shorter. The femur shaft is straight (Kuroda, 1954). The tibiotarsus shaft is thinner and the cnemial crest is much less proximally produced. The tarsometatarsus is shorter and less laterally compressed, particularly in the distal end so the trochleae are more widely separated. *Fulmarus glacialoides* is consistently larger than the Cape Petrel, *Daption capense*.

cf. *Daption capense* (Linné)
Cape Petrel

Material.—Coracoid: incomplete left, 398. See Appendix.

Remarks.—This coracoid is considerably smaller than in either species of *Puffinus*, somewhat smaller than *Fulmarus glacialoides*, and is similar in size to *Daption capense*. LP 398 is fragmentary, and cannot be assigned with certainty to this species; however, several diagnostic elements of *D. capense*, a common post-breeding wanderer to the region, were found at the Túnel I site (Humphrey and Rasmussen, unpubl. data).

Puffinus gravis (O'Reilly)
Greater Shearwater

Material.—Humeri: proximal right, 320, 333, 661; proximal left, 660, 662; incomplete right, 396; incomplete left, 326; distal right, 329; distal left, 331, 663–664. Femora: complete left, 390; incomplete left, 352, 650. Tibiotarsi: complete right, 651; complete left, 389; incomplete right, 652; incomplete left, 345, 347–348, 653. Tarsometatarsi: complete right, 654–657; complete left, 658; distal right, 359; distal left, 659. See Appendix.

Measurements.—Humeri: proximal breadths, 18.4, 19.1, 19.2, 19.3, 19.5. Femora: length, 40.8; proximal breadths, 9.4, 9.6; distal breadths, 9.7 (2). Tibiotarsi: length, 103.8; proximal breadths, 7.3, 7.5, 7.6, 7.7, 7.8, 7.9, 8.2; distal breadths, 7.5, 7.9, 8.0 (3), 8.1, 8.2. Tarsometatarsi: lengths, 57.1, 58.2, 58.4, 58.6, 59.4; proximal breadths, 8.5, 8.6, 9.1; distal breadths, 8.0, 8.2, 8.3, 8.5 (2), 8.6 (2).

Remarks.—This species can be distinguished from *Fulmarus glacialoides* by the characters listed in the account of *F. glacialoides. Puffinus gravis* can be distinguished from *P. griseus* by the following characters. The humerus of *P. gravis* has a much less flattened shaft (Kuroda, 1954) and distal end. The femora of the two species are similarly curved, but the central portion of the shaft of *P. gravis* is not as thickened medially in lateral aspect. The tibiotarsus is longer and heavier, and the tarsometatarsus is heavier, less flattened mediolaterally (Kuroda, 1954), and has the distal end less compressed.

Puffinus griseus (Gmelin)
Sooty Shearwater

Material.—Humeri: proximal right, 321, 323; proximal left, 322, 324; distal right, 649; distal left, 325. Femur: complete left, 353. Tarsometatarsi: complete right, 360, 361; incomplete left, 362. See Appendix.

Measurements.—Humeri: proximal breadth, 18.8; distal breadths, 14.3, 14.8. Femur: length, 41.4; proximal breadth, 10.9; distal breadth, 10.3. Tarsometatarsi: lengths, 55.2, 57.4; proximal breadths, 8.1, 8.3; distal breadths, 7.3, 7.9 (2).

Remarks.—This species can be distinguished from *Fulmarus glacialoides* and *Puffinus gravis* by the characters listed under those species accounts.

Puffinus species

Material.—Coracoid: incomplete left, 399. Tibiotarsi: incomplete right, 397, 665; proximal right, 666; distal right, 346. See Appendix.

Measurements.—Tibiotarsus: proximal breadth, 8.1; distal breadth, 7.8.

Remarks.—This material cannot be identified to species and may be either *Puffinus griseus* or *P. gravis.*

Phalacrocorax magellanicus (Gmelin)
Rock Shag

Material.—Coracoids: complete left, 1255; incomplete right, 1184, 1186, 1224, 1241; incomplete left, 1294, 1323. Humeri: complete right, 1355; complete left, 1350; proximal right, 1573; proximal left, 1416, 1427, 1436 (juvenile), 1570; incomplete right, 1560, 1569; distal left, 1445, 1458, 1480. Femora: complete right, 5008, 5105, 5143; proximal left, 5030. Tibiotarsus: proximal right, 5321; proximal left, 528, 5154; distal right, 546, 5170, 5221, 5246; distal left, 5214, 5229, 5281, 5322. Tarsometatarsi: complete right, 1147, 1516; complete left, 1005; incomplete right, 1058, 1099 (juvenile referred to this species), 1109, 1158; incomplete left, 1005, 1110. See Appendix.

Measurements.—Coracoid: length, 63.2. Humeri: lengths, 116.9, 120.0; proximal breadths, 19.6, 19.7, 20.0, 20.2, 20.7, 21.0, 21.1; distal breadths, 12.9 (2), 13.2, 13.3, 14.5. Femora: lengths, 53.7, 56.3, 57.6; proximal breadths, 13.0, 14.4, 15.7, 15.8; distal breadths, 14.7, 15.5, 17.1. Tibiotarsus: distal breadth, 9.9. Tarsometatarsi: lengths, 50.3, 51.8, 53.2, 54.0, 53.9; proximal breadths, 11.2, 11.7, 12.2; distal breadths, 13.0, 13.9, 14.0, 14.3.

Remarks.—*Phalacrocorax magellanicus* is smaller than the smallest *P. atriceps*, and is about the size of *P. brasilianus. Phalacrocorax magellanicus* can be differentiated from this latter species by the characters of Siegel-Causey (1988). LP 1099 is a juvenile, which appears to have been prefledging, as it is less ossified than *P. atriceps* known to be recently fledged. LP 1436 was probably postfledging, based on the same comparative material.

Phalacrocorax atriceps (King)
Imperial Shag

Material.—Because of the abundance of specimens of this species at Lancha Packewaia, only complete or nearly complete specimens from the right side are listed. Only the tarsometatarsi and femora of *Phalacrocorax bransfieldensis* can be distinguished from those of *P. atriceps;* thus the coracoids, humeri, and tibiotarsi listed here may include a few specimens of the former species. Coracoids: nearly complete right, 1177–1183; 1185, 1187–1206, 1225, 1231–1240, 1242–1247, 1329–1331. Humeri: complete right, 1354, 1356–1357, 1359, 1360. Femora: complete right, 5004, 5009–5010, 5016, 5020, 5025–5027, 5032, 5034, 5036, 5040, 5042, 5047, 5049, 5058, 5063–5064, 5068, 5073, 5086, 5089, 5097, 5101–5103, 5110, 5113, 5122–5123, 5128, 5130, 5132–5133. Tibiotarsi: nearly complete right, 5147, 5150–5151, 5160, 5162–5163, 5173, 5177, 5179, 5192, 5194, 5197, 5210–5211, 5216, 5239, 5242, 5258, 5262, 5266, 5268, 5273, 5275–5276, 5280, 5285, 5288, 5291, 5299–5300, 5319, 5331. Tarsometatarsi: complete right, 1131, 1136–1137, 1143, 1146, 1148–1149, 1151–1156, 1159–1162, 1165–1167, 1172–1175. See Appendix.

Measurements.—See Table 4.

Remarks.—Many bones of this species appear similar to those of known juveniles, but because of wear, this cannot be determined for certain. A few definite juvenile bones of this species were present at Lancha Packewaia; of these, LP 1023 was probably about fledging age, and LP 1071 and 1607 appear to have been prefledging.

Phalacrocorax bransfieldensis Murphy
Antarctic Shag

Material.—Coracoid: nearly complete right, 690. Femur: complete right, 1692–1694, 5006, 5046, 5056, 5059; complete left, 1691, 5003, 5018, 5065–5066, 5081; distal right, 5093. Tarsometatarsus: complete right, 1139, 1150, 1163; complete left, 1006, 1008, 1019–1020, 1022, 1031–1032; proximal right, 1042; distal right, 1075, 1079, 1082. See Appendix.

Measurements.—Femur: lengths, 58.7, 61.6, 63.1, 63.6, 63.8, 65.0, 65.3, 65.6, 65.9, 66.0, 66.4, 66.5, 67.1; proximal breadths, 17.1, 17.9, 18.0, 18.8, 19.4, 19.9; distal breadths, 18.1 (2), 18.4, 18.5, 18.7, 19.3 (2), 19.5. Tarsometatarsus: lengths, 62.8, 65.5, 65.9, 66.1, 67.0, 67.8, 68.1, 68.2, 68.7, 70.2.

Remarks.—The specimens assigned to this species were identified by D. Siegel-Causey, who used the characters of Siegel-Causey and Lefèvre (1989). Only tarsometatarsi and femora were considered distinguishable from those of *Phalacrocorax atriceps*.

Phalacrocorax brasilianus (Gmelin)
Neotropic Cormorant

Material.—Humeri: complete right, 1353 (juvenile), 1358. See Appendix.

Measurements.—Humeri: length, 134.8; proximal breadths, 24.1, 24.4; distal breadth, 14.8.

Remarks.—The Fuegian race *Phalacrocorax brasilianus hornensis*, which is similar in size to *Phalacrocorax magellanicus*, was identified by

Table 4. Summary statistics for measurements of *Phalacrocorax atriceps* and cf. *P. atriceps* from Lancha Packewaia, *P. atriceps* from Ushuaia Bay, *P. bransfieldensis* from Antarctica, and *P.* small form from Lago Yehuin. Measurements given as mean ± standard deviation, *n* [males:females (remainder unsexed)]; range.

Measurement	Lancha Packewaia	Ushuaia Bay	Antarctica	Lago Yehuin
Humerus length	143.8 ± 5.62, 21; 134.2–155.5	145.0 ± 5.18, 37 (12:24); 135.2–156.3	157.0 ± 5.04, 6 (4:2); 149.6–163.2	135.9 ± 5.40, 15 (7:8); 123.7–145.3
Femur Length	61.0 ± 3.01, 92; 54.3–67.3	61.3 ± 2.94, 38 (13:24); 54.9–66.9	67.2 ± 2.58, 12 (6:5); 63.3–69.4	57.3 ± 1.84, 15 (7:8); 53.0–60.0
Femur proximal breadth	16.9 ± 0.98, 106; 14.6–19.9	17.1 ± 0.82, 38 (13:24); 15.5–18.8	18.4 ± 0.72, 12 (6:5); 17.4–19.7	16.0 ± 0.66, 15 (7:8); 14.9–17.1
Femur distal breadth	17.4 ± 0.90, 109; 15.4–19.5	17.8 ± 0.81, 38 (13:24); 15.5–19.3	19.2 ± 0.64, 12 (6:5); 18.4–20.0	16.3 ± 0.53, 15 (7:8); 15.4–16.8
Tarsometatarsus length	63.7 ± 2.83, 67; 58.4–70.2	64.1 ± 2.51, 33 (10:22); 59.0–68.9	65.3 ± 2.05, 11 (3:3); 62.5–68.1	60.3 ± 2.28, 15 (7:8); 56.4–64.4
Tarsometatarsus proximal breadth	14.2 ± 0.79, 67; 12.4–16.0	14.3 ± 0.71, 35 (10:22); 12.9–16.0	15.2 ± 0.51, 11 (3:3); 14.3–15.8	13.3 ± 0.56, 15 (7:8); 12.5–14.1

characters given in Siegel-Causey (1988). LP 1353 shows a degree of ossification corresponding to that of recently fledged *P. atriceps.*

Tachyeres pteneres
Magellanic Flightless Steamer-Duck

Material.—Coracoid: nearly complete left, 334 (referred). Humeri: complete right, 319; incomplete left, 388, 395. Femora: complete right, 636; distal right, 356 (referred). Tibiotarsi: incomplete left, 342, 343. See Appendix.

Measurements.—Humerus: proximal breadth, 30.0; distal breadth, 20.1. Femur: length, 84.9; distal breadth, 19.1. Tibiotarsus: proximal breadth, 23.0.

Remarks.—This species was distinguished from the smaller Flying Steamer-Duck, *Tachyeres patachonicus,* on the basis of size, and from *Chloephaga* species by the characters of Woolfenden (1961) and Livezey (1986b).

Tachyeres patachonicus (King)
Flying Steamer-Duck

Material.—Coracoids: complete right, 336; complete left, 335. Humerus: incomplete right, 318. Femur: incomplete left, 357 (juvenile; referred). Tarsometatarsus: incomplete right, 394. See Appendix.

Measurements.—Coracoid: length, 72.9. Humerus: proximal breadth, 27.0.

Remarks.—A juvenile femur referred to this genus lacks ossified terminae; the shaft is more curved from external view than in adults of small species of *Chloephaga*. Because of its questionable allocation, this individual is not included in the computations, but the presence of a juvenile tadornine at the site provides additional evidence of human use in the breeding season.

Polyborus plancus (J. F. Miller)
Crested Caracara

Material.—Tibiotarsus: complete right, LP 687. Synsacrum: incomplete, LP 688. See Appendix.

Measurements.—Tibiotarsus: length, 120.1; proximal breadth, 16.1; distal breadth, 13.0.

Remarks.—This undated material is included because it is the only representation of this species from Lancha Packewaia. The synsacrum, which was not included in computations of NISP or MNI, was identified as *Polyborus plancus* based on the greater width of the ischium and the narrower ilium than in 10 specimens of the Striated Caracara, *Phalcoboenus australis*. The tibiotarsus resembles that of *P. plancus* and differs from that of *P. australis* in that it is longer than that of *P. australis;* the fibular crest is less extensive distally; and the proximal portion of the tendinal bridge is symmetrical. The White-throated Caracara, *Phalcoboenus albogularis*, is considerably smaller than the large subspecies of the Crested Caracara, *P. plancus plancus*, found in Tierra del Fuego.

Milvago chimango (Vieillot)
Chimango Caracara

Material.—Humerus: incomplete left, 332. Femur: incomplete left, 351. See Appendix.

Measurements.—Femur: distal breadth, 10.3.

Remarks.—The elements of *Milvago chimango* are much smaller than those of *Polyborus plancus* or either species of *Phalcoboenus*.

Larus dominicanus (Lichtenstein)
Kelp Gull

Material.—Coracoids: complete right, 632; complete left, 633; cranial left, 337; incomplete left, 338, 631. Humerus: distal left, 635. Femur: distal right, 630. Tibiotarsus: proximal left, 393. See Appendix.

Measurements.—Coracoids: lengths, 52.5, 52.9. Femur: distal breadth, 13.2.

Remarks.—All elements of this species are much larger than those of the Brown-hooded Gull, *Larus maculipennis*, and somewhat larger than those of the Dolphin Gull, *L. scoresbii*.

Sterna hirundinacea Lesson
South American Tern

Material.—Humerus: distal right, 317. See Appendix.

Measurements.—Humerus: distal breadth, 9.1.

Remarks.—This humerus is identified as being from *Sterna hirundinacea* based on its slightly larger size than those of the other species of *Sterna* that are known or hypothetical visitors to the area, as well as on relative abundance. It is smaller than any of the gull species found in Tierra del Fuego.

Enicognathus ferrugineus P. L. S. Miller
Austral Parakeet

Material.—Humerus: incomplete right, 400. Femora: complete right, 350; complete left, 349 (juvenile). Tibiotarsus: complete left, 344 (juvenile). See Appendix.

Measurements.—Humerus: proximal breadth, 11.4.

Tyto alba (Scopoli)
Barn Owl

Material.—Tibiotarsus: proximal right, 340. See Appendix.

MEAT WEIGHTS

The standard regression equation

$$y = a + bx$$

is used for prediction of the amount of meat (y) in grams obtained from each individual bird. Using a given midden specimen (or the mean of a species), for example, a *Phalacrocorax atriceps* of femur length $x = 61.0$ mm, substitute the a and b values provided in Table 5:

$$y = -2002.76 + 48.96(61.0) = 983.80 \text{ g}$$

Because meat weights of *P. magellanicus* are uncorrelated with length of any of the three predictor elements, mean meat weight can simply be taken as representative of the entire population.

DISCUSSION

SPHENISCIDAE

Currently, *Spheniscus magellanicus* nests about 40 km east of Lancha Packewaia, at Isla Martillo, in Archipiélago Gable (Clark, 1986); during the summer, the species is found in the Beagle Channel near Ushuaia in small (but increasing, fide Orquera, in litt.) numbers. However, a colony of this species existed on Península Ushuaia until about 1940 when the airport was built there. Humans living at Lancha Packewaia may have utilized the colony at Península Ushuaia or another now defunct colony or molting area, at which birds would also be largely helpless. Bridges (1949) stated that in autumn, large numbers of penguins are said to enter the Beagle

Table 5. Summary statistics for meat weights (in grams) of selected bird species and results of regressions with three predictor variables. M = male, F = female, *n* = sample size.

	Meat weight (g)				Humerus length			Femur length			Tarsometatarsus length		
Species	*n*M/*n*F	Mean	SD	Range	r	a	b	r	a	b	r	a	b
Spheniscus magellanicus	17/8	1596.4	316.7	988–2240	0.71^c	–3611.9	72.3	0.69^c	–2328.8	52.5	0.78^c	–4182.1	174.9
Phalacrocorax atriceps	8/17	912.0	163.4	666–1283	0.63^c	–1051.1	13.6	0.80^c	–2002.7	48.9	0.65^c	–1575.3	38.4
P. bransfieldensis	1/0	—	—	1172	—	—	—	—	—	—	—	—	—
P. magellanicus	3/16	554.2	64.4	420–739	0.09^a	318.5	2.0	0.03^a	496.0	1.1	–0.01^a	592.8	–0.7
P. brasilianus	7/11	611.6	89.2	472–768	0.80^c	–1454.5	16.4	0.75^c	–913.8	30.4	0.60^c	–1395.2	37.6
Tachyeres patachonicus	5/3	1182.1	287.8	762–1512	0.81^b	–2804.4	32.9	0.82^b	–2769.4	53.8	0.81^b	–2522.5	60.2
T. pteneres	3/2	2322.6	428.8	1865–2764	0.71^a	–5302.4	59.5	0.70^a	–4423.5	76.2	0.84^a	–5131.6	103.8

a = $P > 0.05$; b = $P \leq 0.05$; c = $P \leq 0.01$.

Channel following shoals of sprat, and that the Yámana speared them from canoes. The presence of a few young juvenile specimens of *S. magellanicus* at Lancha Packewaia does not necessarily mean that they were taken at colonies, because young penguins often disperse widely from the natal area. Most of the penguins from the Recent Component of Lancha Packewaia appear to have been nonbreeding immatures, but most of those from the Ancient Component are too worn for age determination. Juvenile *S. magellanicus* return to their natal colonies at the end of their first year, while still in juvenal plumage (Scolaro, 1980), and adult-plumaged nonbreeding immatures also return every year and attempt to obtain territories (Scolaro, 1978) until females begin to breed at 4 yr of age and males at 5 (Scolaro, 1987). Incompletely ossified birds would be expected to be in the minority at any breeding colony. Perhaps the majority of penguins that enter the Beagle Channel are juveniles and immatures. The lower proportion of *S. magellanicus* utilized during the Ancient Component (Table 2) than in the Recent does not suggest a greater dependency by humans on land birds during the former, as the difference was compensated for by the relatively greater proportion of *Phalacrocorax atriceps* in the Ancient Component.

At Túnel I, as at Lancha Packewaia, *Spheniscus magellanicus* was found in large numbers and was second in abundance only to *Phalacrocorax atriceps* (Humphrey and Rasmussen, unpubl. data), but *S. magellanicus* comprised only from 0–9.4% of MNI at seven archaeological sites on Seno Otway, Península Brunswick, and the Atlantic coast of Tierra del Fuego (Lefèvre, 1989), and it also occurred in an archaeological site at Rey Don Felipe, on Península Brunswick (Ortiz-Troncoso, 1971a).

Eudyptes chrysocome nests colonially on Isla de los Estados, islands of Cape Horn, and at the western end of the Strait of Magellan (Clark, 1986) and was found breeding at Bahía Oso Marino, Santa Cruz Province, Argentina, in 1985 by M. Oliva Day (Serra, 1986). The presence of juveniles of *E. chrysocome* in the Lancha Packewaia archaeoavifauna does not demonstrate that the species bred in the immediate vicinity, as juveniles wander widely at sea (Müller-Schwarze, 1984). We know of no records of *E. chrysocome* from the Beagle Channel, but it is a straggler through much of the Fuegian region, and occurs north to Uruguay in the austral winter (Carpi, 1984). A slightly oiled adult-plumaged *E. chrysocome* was found on the beach at Estancía La Violeta on 8 February 1986, on the north-east Atlantic coast of Tierra del Fuego (P. C. Rasmussen and N. López, pers. observ.). Very few *E. chrysocome* were found at the San Pablo and Punta María middens on the Atlantic coast of Tierra del Fuego (Lefèvre, 1989), but larger numbers occurred at Túnel I (Humphrey and Rasmussen, unpubl. data). These numerous remains at Túnel I, together with those at Lancha Packewaia, suggest either that *E. chrysocome* was more common as a nonbreeder or that, in the past, it bred nearer to the Beagle Channel than it now does.

PROCELLARIIFORMES

Diomedea melanophris is by far the most common albatross in Tierra del Fuego throughout the year (Humphrey et al., 1970; Barros, 1971; Adams and Templeton, 1979). *Phoebetria palpebrata* also occurs in the eastern Beagle Channel, and *D. chrysostoma* occurs uncommonly in more open Fuegian waters (Clark, 1986). The nearest breeding grounds of *D. melanophris* are Isla de los Estados and islands of the Cape Horn Archipelago (Clark, 1986), and fledged immature *D. melanophris* are common in the Beagle Channel (Humphrey and Rasmussen, pers. observ.). *Diomedea melanophris* was more common at Lancha Packewaia than were all other species except *Spheniscus magellanicus* and *Phalacrocorax atriceps*, and it must be regarded as more than an incidental prey. *Diomedea melanophris* is attracted to boats (Harper and Kinsky, 1978), and like penguins and seals, was said to follow the large shoals of sprats in the Beagle Channel in autumn (Bridges, 1949). *Diomedea melanophris* was common at the Túnel I site (Humphrey and Rasmussen, unpubl. data), and was found at the Punta María site on the Atlantic coast of Tierra del Fuego. Other species of the genus were identified from four other Fuego-Patagonian archaeological sites (Lefèvre, 1989).

Macronectes giganteus is readily attracted to fishing and marine hunting activities, as well as to accumulations of garbage. We classified this species as marine littoral in habitat because it spends a great deal of time foraging and resting along beaches (Reynolds, 1935). Among Fuegian procellariiformes, this species is by far the most commonly seen on the coast (Canevari et al., 1991). This species was a rather rare prey item of the Fuegians despite its abundance in the region, presumably because of its unpalatability. The nearest known nesting area of *M. giganteus* is Isla de los Estados (Clark, 1986). It also nests in Chubut Province, Argentina (Humphrey and Livezey, 1983), but it is a very common nonbreeding species throughout the Beagle Channel. Most individuals we have seen in the Beagle Channel during the summer are immatures (Humphrey and Rasmussen, pers. observ.). Several bones of this species were found at Túnel I (Humphrey and Rasmussen, unpubl. data) and at Punta Baja and Bahía Buena (Lefèvre, 1989).

The presence of several individuals (from four ages) of *Fulmarus glacialoides* in the Lancha Packewaia archaeoavifauna indicates that the site was used during the austral nonbreeding season, March through November (Humphrey et al., 1970). *Fulmarus glacialoides* is a common winter visitor to the Beagle Channel, breeding in Antarctic and outlying subantarctic islands (Blake, 1977). This species is a scavenger and is attracted to fishing activities (Harrison, 1983). It was certainly more than an incidental prey to inhabitants of Túnel I, where it was the most common procellariiform species by a considerable margin (Humphrey and

Rasmussen, unpubl. data). Therefore, it is surprising that only one individual of *F. glacialoides* (found at Punta Baja) was recorded from seven other Fuego-Patagonian coastal archaeological sites (Lefèvre, 1989).

Daption capense is common in open waters and straits in the Fuegian region when not breeding (Clark, 1986). It is readily attracted to offal and can be caught on baited hooks, but is undesirable as food (Harper and Kinsky, 1978).

Puffinus gravis now is rare in Fuegian waters (Cooke and Mills, 1972; Clark 1986), with few definite records from the Beagle Channel. It is known to breed no closer than the Falkland Islands, and there only in very small numbers (Woods, 1975). Numerous sightings of *P. gravis* around Isla de los Estados could signal the presence of a colony, however (Watson, 1971). Surprisingly, *P. gravis* is represented by many more elements at Lancha Packewaia than is the Sooty Shearwater, *P. griseus*, which is presently abundant in Tierra del Fuego, while the reverse situation is found at the nearby Túnel I midden (Humphrey and Rasmussen, unpubl. data). A nesting colony of *P. gravis* may have existed nearer to Lancha Packewaia than the Falkland Islands around 4000 ybp, although none of the *P. gravis* bones from Lancha Packewaia is from juveniles. Alternately, migration routes for *P. gravis* may have shifted, or formerly the species may have been more abundant in its breeding grounds at the Falkland Islands. The abundance of *P. gravis* material at Lancha Packewaia cannot be the result of a single wreck event, as it is represented in at least three dated layers. The species was not recorded from middens at Península Brunswick, Seno Otway, or the Atlantic coast of Tierra del Fuego (Lefèvre, 1989).

Breeding colonies of *Puffinus griseus* exist on several nearby island groups, and nonbreeding birds are common all year (Clark, 1986). They are readily attracted to lights at Isla de los Estados (Castellanos, 1935), as well as to fishing activities. Both *P. gravis* and *P. griseus* might have been attracted to campfires along the beaches or to cormorant collecting activities by torchlight.

PHALACROCORACIDAE

Phalacrocorax magellanicus is common in the Beagle Channel (Clark, 1986); however, it is not represented in the Lancha Packewaia midden by large numbers. It nests and roosts in relatively small numbers on steeper cliffs and rocks (Murphy, 1936) than those preferred by the highly colonial *P. atriceps*, which in Tierra del Fuego nests on flat islands. Therefore, *P. magellanicus* probably was much less accessible to the Fuegians than was *P. atriceps*. This, combined with its smaller size (Table 4), makes it less profitable, and seems to explain its infrequent and apparently incidental capture rates. The presence of an apparently prefledging juvenile suggests that this species was captured at colonies, possibly in connection with capture of *P. atriceps*.

Phalacrocorax atriceps nests and roosts in large numbers on flat islands in the Beagle Channel, and it is easily the most abundant avian species in the Lancha Packewaia archaeological site. The presence of juvenile bones confirms that *P. atriceps* bred prehistorically in the Lancha Packewaia area and also suggests that at least some were collected at colonies by torchlight as described by Bridges (1949). A small number of prefledging juveniles also were present in the nearby Túnel I midden (Humphrey and Rasmussen, unpubl. data).

The King Shag (*Phalacrocorax "albiventer"*) morph (Devillers and Terschuren, 1978; Rasmussen, 1991) presently comprises more than 99% of the population in the Beagle Channel, but as that morph is osteologically indistinguishable from the "Blue-eyed" morph (Siegel-Causey, 1988; Rasmussen, 1991), the relative abundances of the two morphs in the past cannot now be determined from the midden material.

The blue-eyed shags from lagos Yehuin and Fagnano, in central Tierra del Fuego, are considerably smaller than are those from the Beagle Channel, although coastal females are similar in size to freshwater males (Table 4). The lake shags represent an undescribed taxon which differs in cranial morphology from coastal *Phalacrocorax atriceps* (Rasmussen and Humphrey, MS). This small form might be expected to be present in the Beagle Channel during the nonbreeding season, but because of the overlap in size between the forms this cannot be demonstrated for remains from Lancha Packewaia. No elements referred to *P. atriceps* from Lancha Packewaia are so small as to be indisputably distinguished from females of the freshwater taxon.

As at Lancha Packewaia, *Phalacrocorax atriceps* was much the most abundant bird species at Túnel I (Humphrey and Rasmussen, unpubl. data), and the species comprises from 12–100% of total MNI from middens on Seno Otway, Península Brunswick, and the Atlantic coast of Tierra del Fuego (Lefèvre, 1989). One specimen also was recovered from Fell's Cave, in inland Magallanes Province, Chile (Humphrey et al., 1993).

It seems likely that the midden specimens identified as *Phalacrocorax bransfieldensis* are from wintering individuals, although one individual of this species was recorded in the Beagle Channel in summer (Siegel-Causey and Lefèvre, 1989).

The poor representation of *Phalacrocorax brasilianus* in the Lancha Packewaia archaeoavifauna probably reflects the fact that in the Fuegian Archipelago, this species nests in trees (Philippi et al., 1954; Clark, 1986). It is local in its Fuegian range, nesting on Isla Gable (Clark, 1986) and Isla Hoste (Adams and Templeton, 1979), and it may not have nested in the vicinity of Lancha Packewaia, although one of the two specimens was probably a postfledging juvenile.

TADORNINI

Tachyeres pteneres is abundant year-round in the Beagle Channel, breeding on rocky shores of islands (Humphrey et al., 1970). Despite its flightlessness, this species can escape by steaming, but the Fuegians used ingenious methods for capturing them (Bridges, 1949). Several bones of this species were found at Túnel I (Humphrey and Rasmussen, unpubl. data), and it comprised up to 8.3% of the MNI at four sites on Seno Otway and Península Brunswick (Lefèvre, 1989).

Tachyeres patachonicus is common in the Beagle Channel, but less so than is *T. pteneres*. The former species flies well, except for young and molting birds and some permanently flightless large males (Humphrey and Livezey, 1982). Although usually flighted, *T. patachonicus* could be captured by the same methods as was *T. pteneres*. One individual of *T. patachonicus* was found in a Holocene anthropogenic deposit at Fell's Cave (Humphrey et al., 1993), and a few bones have been found at Túnel I (Humphrey and Rasmussen, unpubl. data).

POLYBORINAE

Polyborus plancus is fairly frequent in archaeological sites in southern South America, having been found in the Alero del Diablo rock shelter in Magallanes Province, Chile (Humphrey et al., 1993); at Túnel I (Humphrey and Rasmussen, unpubl. data); at Punta María, on the Atlantic coast of Tierra del Fuego (Lefèvre, 1989); and in the archaeological site Los Toldos, at Cañadon de las Cuevas, Santa Cruz Province, Argentina (Tambussi and Tonni, 1985). This species is common in Tierra del Fuego, especially in open country, and often forages on beaches (Humphrey et al., 1970).

Milvago chimango is another common species that frequently scavenges along beaches and is a commensal of man. This species was represented at Mylodon Cave, Magallanes Province, Chile (Humphrey et al., 1993) by feathers, by numerous bones at Túnel I (Humphrey and Rasmussen, unpubl. data), and by bones at four of seven middens on Seno Otway, Península Brunswick, and the Atlantic coast of Tierra del Fuego (Lefèvre, 1989).

LARIDAE

Larus dominicanus is an abundant species that was probably an incidental prey, although a burned tibiotarsus suggests that they were eaten. This species scavenges in large numbers along coastlines in Tierra del Fuego, regularly attends garbage dumps, and is attracted to boats and fishing and hunting activities. Despite the fact that *L. dominicanus* currently nests on islands in Ushuaia Bay, none of the bones of this species from Lancha Packewaia is from a poorly ossified bird. A small number of elements of this species were found at Túnel I (Humphrey and Rasmussen, unpubl. data). Of five archaeological sites on Seno Otway and Península Brunswick, *L. dominicanus* was found only at Punta Baja, where it comprised only 0.6% MNI; in contrast, at two localities on the Fuegian Atlantic coast, it comprised 27.7–36.5% MNI (Lefèvre, 1989).

Sterna hirundinacea currently nests abundantly on islands in Ushuaia Bay, but the single element of this species from Lancha Packewaia is from an adult. Its presence in the midden probably is a result of incidental capture. *Sterna hirundinacea* was rarely represented at Túnel I (Humphrey and Rasmussen, unpubl. data), but it occurred more commonly at Punta Baja, on Península Brunswick (Lefèvre, 1989).

The Chilean Skua, *Catharacta chilensis*, is one of the few medium–large marine littoral bird species now common in the Beagle Channel that is absent from the Lancha Packewaia midden. In addition, the species is lacking from the Túnel I site (Humphrey and Rasmussen, unpubl. data) and only one bone was found in each of two of the seven middens studied by Lefèvre (1989). The rarity of skuas in Fuegian middens suggests that the absence of bones of the Great Skua, *C. skua*, from middens in Europe, which has been taken as evidence for that species' recent colonization of the Northern Hemisphere (Lloyd et al., 1991), may in fact merely reflect the difficulty of capturing skuas and their unpalatability.

Landbirds

Enicognathus ferrugineus, a common species in *Nothofagus* forest, is attracted to fires (Humphrey and Rasmussen, pers. observ.), a habit that could well have facilitated the birds' capture by humans. The presence of bones of juveniles of this species evidences that humans used the middens during the breeding season. These parrots were captured at their nests and eaten by the Onas (Bridges, 1949). Small numbers of *E. ferrugineus* also occurred in the Túnel I middens (Humphrey and Rasmussen, unpubl. data).

Tyto alba is an uncommon (Clark, 1986), but extremely widespread, species represented by only one bone in the Lancha Packewaia site. Judging by the presence of pellets, *T. alba* was resident during much of the Holocene in two of three caves studied in southern Chile (Humphrey et al., 1993). The presence of small numbers of this species at both Lancha Packewaia and Túnel I (Humphrey and Rasmussen, unpubl. data), however, can best be accounted for by human predation.

Meat Weights

On average, each *Spheniscus magellanicus* provides nearly twice as much meat as does *Phalacrocorax atriceps* (Table 5). Steamer-ducks, especially *Tachyeres pteneres*, also provide a great deal of meat. Larger sample sizes of the two steamer-duck species would almost certainly result in highly significant regressions. *Phalacrocorax magellanicus* and *P. brasilianus* provide considerably less meat per individual than does *P. atriceps*, and the first two species are typically found in less accessible habitats than the flat areas favored by *P. atriceps*. *Phalacrocorax magellanicus* is less sexually dimorphic than are the other cormorants studied here (Rasmussen, 1986), steamer-ducks (Livezey and Humphrey, 1984), or Magellanic Penguins (Scolaro et al., 1983); this may explain the observed lack of correlation between limb length and meat weight.

Seasonality

Few data exist on the timing of breeding, migration, and winter distributions of many birds in Fuego-Patagonia. Nevertheless, the use of the Lancha Packewaia site during the late breeding season is established by the presence of young juvenile bones of *Spheniscus magellanicus*, *Phalacrocorax atriceps*, *P. magellanicus*, cf. *Tachyeres patachonicus*, and *Enicognathus ferrugineus*. In addition, *Sterna hirundinacea* is only present in the Beagle Channel from November through April (Humphrey et al., 1970). The use of the site by humans during the austral autumn is suggested by the occurrence of more completely ossified remains of immatures of two species of penguins, *Diomedea melanophris*, *Macronectes giganteus*, and three species of cormorants, but more data are required on phenology of ossification in these species to establish this. Nonbreeding season (late fall to early spring) use of the middens by humans is established by the occurrence of *Fulmarus glacialoides*, and is suggested by the occurrence of *P. bransfieldensis* (Siegel-Causey and Lefèvre, 1989). Therefore, the bird remains from Lancha Packewaia indicate the likelihood that this site was used more or less year-round by humans.

Correlation of the Avifauna with Climatic History

Many species of birds in Fuego-Patagonia are habitat generalists, such as *Milvago chimango* and *Tyto alba*. However, most of the species found in the Lancha Packewaia middens are either pelagic or littoral species (Fig. 3). All of the Procellariiformes that are considered pelagic herein frequently occur close to shore owing to the narrowness of the Beagle Channel so these species could be considered members of the marine littoral avifauna. *Tachyeres pteneres* seems to require rocky marine coastlines (Madge and Burn, 1988), but *T. patachonicus* is found in a variety of fresh- and saltwater habitats (Weller, 1975). All the marine pelagic and marine littoral species represented in the middens occur on both the Pacific and Atlantic coasts of Patagonia, despite the major climatic and habitat differences inland. The presence of *Phalacrocorax magellanicus* in both the Ancient and Recent components shows that the cliffs the species requires were present during both time periods (as expected because sea-level fluctuations and isostatic earth movement are thought to have caused variations of 5 m locally; Urien, 1966; Rabassa et al., 1990). *Enicognathus ferrugineus* is the only species present at Lancha Packewaia that is restricted to forest (Canevari et al., 1991); its presence during both the Ancient and Recent components is consistent with Heusser's findings (1984; 1989) that dense *Nothofagus* forest has been present in the entire region since at least 5500 ybp. Although Fjeldså and Krabbe (1990) stated that *Tyto alba* does not occur in heavy forest, this owl's habitat preferences in Patagonia are not well enough established to warrant speculation that its presence might be taken as an indication that Lancha Packewaia was an area of light forest. The avifauna of Lancha Packewaia suggests that the habitats present there during both the Ancient and Recent components resembled those found there now. Major climatic change from late glacial steppe to postglacial forest had occurred by 8000 ybp; since then, southern Fuego-Patagonia has experienced only slight fluctuations in precipitation, temperature, and plant species composition of the forests (Auer, 1974; Moore, 1978; Markgraf, 1980; 1983; Heusser, 1983).

The avifauna from the nearby Túnel I site is considerably larger than that of Lancha Packewaia and, thus far, 15 additional species have been identified from there; it includes five more species restricted to forest and one more restricted to rocky coastline, as well as three additional species that now are only visitors from the subantarctic (Humphrey and Rasmussen, unpubl. data). The Túnel I site also extends farther back in time, to 6980 ± 110 ybp, to encompass more pronounced shifts in climate. When the avifaunal analysis from Túnel I is completed, it will be possible to compare species abundance in the Lancha Packewaia palaeoavifauna with the much larger assemblage from this closely adjacent site in an ecologically similar situation. In these comparisons, several of the factors shaping the deposited assemblages will be held constant (Klein and Cruz-Uribe, 1984), and if changes in taxonomic abundance through time at one site are matched at other nearby sites, one may conclude that the observed changes are real (Grayson, 1984). Lefèvre (1989) recorded 22 avian species not found at Lancha Packewaia among remains from seven Fuego-Patagonian archaeological sites.

Although the relative proportions of Magellanic Penguins and Imperial Shags in the Ancient and Recent components of Lancha Packewaia differ, both species are abundantly represented during both periods. The avifaunas of the two components are remarkably similar, with landbirds being very rare in either component. Also, most of the bird species represented were marine littoral or pelagic, in contrast to the avifauna recovered from deposits at Mylodon Cave and the nearby Alero del Diablo, Magallanes Province, Chile (Humphrey et al., 1993). These caves, despite being near marine habitats, totally lack marine bird species. Most of the species represented at Lancha Packewaia probably would also have been available near Mylodon Cave and vice versa; thus, their absence in some deposits may reflect differences in human foraging habits.

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APPENDIX

NISP and MNI for each element (COR = coracoid, HUM = humerus, FEM = femur, TIB = tibiotarsus, and TAR = tarsometatarsus), species, and radiocarbon age for Lancha Packewaia. Undated and equivocally dated specimens are not included in MNI (except where no overlap is possible). % MNI per age is percent for each age over entire avifauna.

Species	Element NISP					Per age		
Age	COR	HUM	FEM	TIB	TAR	NISP	MNI	% MNI
Spheniscus magellanicus								
4215 ± 305	24	22	16	14	6	82	11	18.6
4020 ± 70	9	12	15	10	3	49	8	22.2
1590 ± 50	5	2	1	0	3	11	4	50.0
1120 ± 50	0	1	1	4	0	6	2	22.2
1080 ± 100	2	0	0	0	0	2	1	25.0
ca. 1000	1	1	1	1	0	4	—	—
455 ± 85	0	3	1	0	1	5	2	50.0
410 ± 75	1	0	1	2	0	4	2	100.0
ca. 400	1	1	1	0	2	5	—	—
280 ± 85	25	31	25	23	8	112	18	36.7
280 ± 85 or 470 ± 50	3	3	1	3	0	10	—	—
Totals	71	76	63	57	23	290	48	27.1

Appendix. Continued.

Species	Element NISP					Per age		
Age	COR	HUM	FEM	TIB	TAR	NISP	MNI	% MNI
Eudyptes chrysocome								
4215 ± 305	0	0	0	1	0	1	1	1.7
1080 ± 100	0	1	0	0	0	1	1	25.0
Undated	0	1	0	0	0	1	0	—
Totals	0	2	0	1	0	3	2	1.1
Diomedea melanophris								
4215 ± 305	2	3	1	0	1	7	2	3.4
4020 ± 70	0	1	1	0	1	3	1	2.8
1590 ± 50	1	0	0	2	0	3	1	12.5
1120 ± 50	2	2	1	3	1	9	2	22.2
1080 ± 100	0	1	0	0	0	1	1	25.0
ca. 1000	2	0	1	1	0	4	—	—
455 ± 85	0	1	0	0	0	1	1	25.0
ca. 400	0	1	1	1	0	3	—	—
280 ± 85	1	2	2	0	1	6	1	2.0
280 ± 85 or 470 ± 50	0	0	1	0	1	2	—	—
Undated	1	8	3	3	3	18	—	—
Totals	9	19	11	10	8	57	9	5.1
Macronectes giganteus								
4215 ± 305	0	0	0	0	1	1	1	1.7
4020 ± 70	0	0	0	0	1	1	1	2.8
280 ± 85	0	0	2	2	0	4	1	2.0
Totals	0	0	2	2	2	6	3	1.7
Fulmarus glacialoides								
4215 ± 305	2	1	0	0	2	5	2	3.4
4020 ± 70	1	1	0	0	1	3	1	2.8
1590 ± 50	1	0	0	0	0	1	1	12.5
280 ± 85	0	0	1	1	0	2	1	2.0
Undated	1	8	2	4	0	15	—	—
Totals	5	10	3	5	3	26	5	2.8

Appendix. Continued.

Species	Element NISP					Per age		
Age	COR	HUM	FEM	TIB	TAR	NISP	MNI	% MNI
cf. *Daption capense*								
4215 ± 305	1	0	0	0	0	1	1	1.7
Total	1	0	0	0	0	1	1	0.6
Puffinus gravis								
4215 ± 305	0	2	1	1	0	4	1	1.7
4020 ± 70	0	1	0	0	0	1	1	2.8
280 ± 85	0	1	1	1	1	4	1	2.0
Undated	0	7	1	5	6	19[a]	—	—
Totals	0	11	3	7	7	28	5[b]	2.8
Puffinus griseus								
4215 ± 305	0	1	0	0	0	1	1	1.7
4020 ± 70	0	2	1	0	3	6	2	5.5
Undated	0	3	0	0	0	3	—	—
Totals	0	6	1	0	3	10	3	1.7
Phalacrocorax magellanicus								
4215 ± 305	0	3	0	6	3	12	3	5.1
4020 ± 70	0	0	0	1	0	1	1	2.8
1080 ± 100	1	0	0	0	0	1	1	25.0
ca. 1000	0	2	0	0	0	2	1[b]	50.0
280 ± 85	2	3	2	2	2	11	2	4.1
Undated	3	4	2	2	3	14	—	—
Totals	6	12	4	11	8	41	8	4.5
Phalacrocorax atriceps[c]								
4215 ± 305	57	43	46	68	56	270	29	49.1
4020 ± 70	23	36	26	39	18	142	13	36.1
1590 ± 50	3	3	2	4	0	12	1	12.5
1120 ± 50	5	4	3	2	1	15	2	22.2
1080 ± 100	4	0	0	0	0	4	0	—
455 ± 85	3	1	2	0	0	6	1	25.0
410 ± 75	4	7	0	0	0	11	0	—
ca. 400	0	0	3	5	3	11	1	100.0
280 ± 85	30	41	36	46	34	187	18	36.7
280 ± 85 or 470 ± 50	0	0	1	1	0	2	—	—
Totals	129	135	119	165	112	660	65	36.7[c]

Appendix. Continued.

Species Age	Element NISP					Per age		
	COR	HUM	FEM	TIB	TAR	NISP	MNI	% MNI
Phalacrocorax bransfieldensis[c]								
4215 ± 305	—	—	1	—	6	7	3	5.1
4020 ± 70	—	—	7	—	3	10	4	11.1
ca. 1000	—	—	0	—	1	1	1	50.0
280 ± 85	—	—	6	—	4	10	3	6.1
Undated	1	—	0	—	1	2	—	—
TOTALS	1	—	14	—	15	30	11	6.2
Phalacrocorax brasilianus								
280 ± 85	0	2	0	0	0	2	2	4.1
TOTALS	0	2	0	0	0	2	2	1.1
Tachyeres pteneres								
4215 ± 305	0	2	0	1	0	3	1	1.7
4020 ± 70	0	0	0	1	0	1	1	2.8
Undated	1	1	2	0	0	4	—	—
TOTALS	1	3	2	2	0	8	2	1.1
Tachyeres patachonicus								
4215 ± 305	1	0	0	0	0	1	1	1.7
4020 ± 70	1	0	0	0	0	1	1	2.8
280 ± 85	0	1	0	0	0	1	1	2.0
Undated	0	0	0	0	1	1	—	—
TOTALS	2	1	0	0	1	4	3	1.7
Polyborus plancus								
Undated	0	0	0	1	0	1	1	—
TOTAL	0	0	0	1	0	1	1	0.6
Milvago chimango								
4020 ± 50	0	1	1	0	0	2	1	2.8
TOTALS	0	1	1	0	0	2	1	0.6

Appendix. Continued.

Species Age	Element NISP					Per age		
	COR	HUM	FEM	TIB	TAR	NISP	MNI	% MNI
Larus dominicanus								
4215 ± 305	2	0	0	0	0	2	2	3.4
1590 ± 50	1	0	0	0	0	1	1	12.5
280 ± 85	0	0	1	0	0	1	1	2.0
Undated	2	1	0	1	0	4	—	—
Totals	5	1	1	1	0	8	4	2.2
Sterna hirundinacea								
1120 ± 50	0	1	0	0	0	1	1	11.1
Total	0	1	0	0	0	1	1	0.6
Enicognathus ferrugineus								
4020 ± 70	0	1	0	0	0	1	1	2.8
1120 ± 50	0	0	1	1	0	2	1	11.1
ca. 1000	0	0	1	0	0	1	—	—
Totals	0	1	2	1	0	4	2	1.1
Tyto alba								
1120 ± 50	0	0	0	1	0	1	1	11.1
Total	0	0	0	1	0	1	1	0.6
Totals	230	281	226	264	182	1183	177	—

[a] Includes 11 elements known to be from Recent Component.

[b] Undated or imprecisely dated MNI > total MNI from dated periods.

[c] Femur and tarsometatarsus were the only elements considered diagnostic for this species. Coracoid, humerus, and tibiotarsus may include specimens of *Phalacrocorax bransfieldensis*, so were not used in calculation of MNIs.