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11 Birds in maritime hunter-gatherers subsistence: case studies from Southern Patagonia and the Aleutian Islands

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Abstract

Hunter-gatherer populations living in maritime environments often share common traits and characteristics; amongst these is the exploitation of rich marine resources. In circumpolar zones, the availability of edible plant food is very low, and the dependence on marine animal resources is subsequently high. Numerous species of cetaceans, pinnipeds, birds, fish, and marine invertebrates contributed to the diets of archaic hunter-gatherers in different proportions. This paper presents and investigates the contribution of birds to maritime economies in Southern Patagonia and the Aleutian Islands. The sites examined range from 7500 years BP to pre-contact times.

A comparison of avian exploitation strategies in these two areas identified several trends: 1) that birds are seldom the primary food source (estimated by comparison with the other taxa identified at the sites), but are nevertheless systematically present in the assemblages; 2) the range of hunted species is relatively limited in Southern Patagonia and shows little variation through time whereas it is broader in the Aleutian Islands with some temporal variations; 3) the majority of the species identified are coastal or pelagic, often gregarious, and still very common today.

Key words

Maritime hunter-gatherer economies, seabirds, Patagonia, Aleutian Islands

Introduction

Hunter-gatherer populations living in maritime environments share a number of common constraints amongst which is the availability of important marine resources. Even in similar latitudes resources are less numerous in insular environments than they are in continental zones

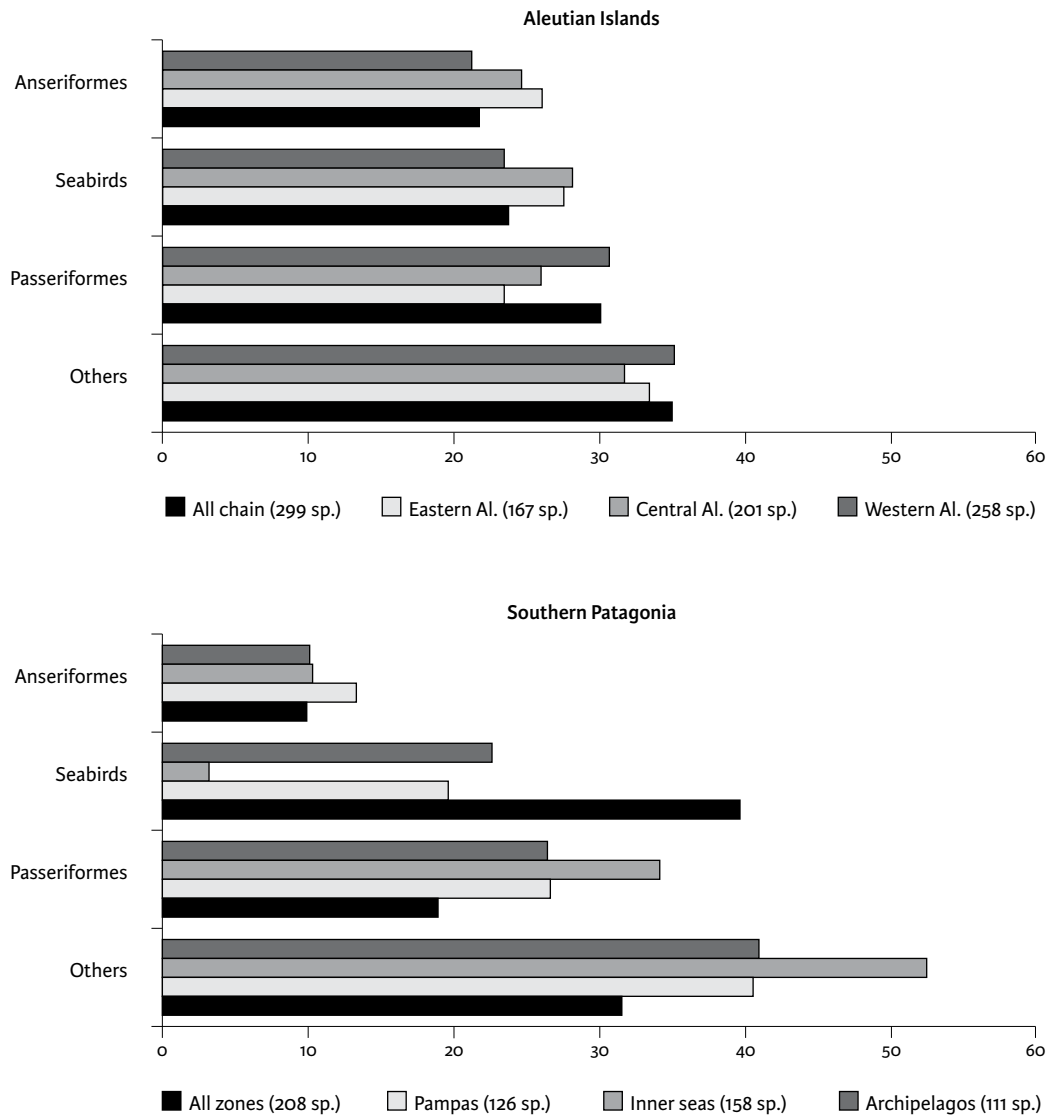
mainly because terrestrial animals are limited. In circumpolar zones plant resources suitable for consumption are very few, and even if present, only form a minor part of the diet. Consequently, insular human groups from the past relied heavily on the sea and its animal products: cetaceans, pinnipeds, seabirds, fish, and marine invertebrates. We may ask what was the place of these various taxa in the human diet, and in particular what was the role of birds? This paper brings a modest contribution to the topic by focusing on the exploitation of birds in two groups of islands surrounded by cold waters, with long term human settlements: Southern Patagonia and the Aleutian Islands. Located at either end of the American continent, at similar latitudes, the Aleutian chain and the archipelagos of Southern Patagonia are two sets of islands with common physical, climatic, faunal, and, to a lesser extent, floral features.

The Aleutian Islands

At nearly 1800 km in length, the Aleutian Islands form the longest archipelago of small islands in the world. There are over 300 islands and islets, stretching in an arc from the Peninsula of Alaska (163°03'W) to Attu (172°28'E), the last island in American waters. The chain, extending from 55°03'N to 51°13'N, forms a bridge between Asia and America, and separates the North Pacific Ocean from the Bering Sea. The islands are divided into five groups: the Fox Islands and the Islands of Four Mountains in the Eastern Aleutians, the Andreanof and the Rat Islands in the Central Aleutians, and the Near Islands in the Western Aleutians. Our research takes place in the Western and Central Aleutians.

The climate is cool, wet, and maritime, characterised by severe storms and strong winds. The vegetation is classified as oceanic boreal heath, and the islands are treeless. There are no indigenous terrestrial mammals found beyond

Figure 1. Taxonomic composition of the present avifauna of the various zones of the Aleutian Islands and southern Patagonia. Seabirds = Procellariiformes, Phalacrocoracidae, Laridae, Stercorariidae, Alcidae.



those first few islands adjacent to the Alaska Peninsula, but the waters that surround the islands are among the richest in the world. They contain an abundance of zooplankton, some 245 fish species, 17 species of cetaceans, four species of pinnipeds, and one species of sea otter (Collins *et al.*, 1945; Merrit & Fuller, 1977; Murie, 1959; Schumacher *et al.*, 2005; Sekora, 1973). A recent study of the Aleutian avifauna (Gibson & Byrd, 2007) has recorded 299 species and subspecies, belonging to 18 orders and 45 families, of which 57 species (53%) breed in the islands. The Aleutians were recorded by the Europeans for the first time during the second expedition of Kamchatka led by Vitus Bering in 1741 (Müller, 1986). At that time, there were semi-permanent villages on virtually all of the islands, which controlled a given territory and could accommodate several hundred people, living

in semi-subterranean houses. The population estimates for 1741 range from 12 000 to 16 000 individuals (Black, 1984; Laughlin, 1980; Liapunova, 1996; Veniaminov, 1984).

In the Eastern Aleutians, human settlement extends back some 9000 years, with a gradual settlement in the west, where the oldest sites date to 3000 years BP (Dumond, 2001; West *et al.*, 2007).

Southern Patagonia

Patagonia covers a large area extending from Chiloe Island on the Pacific side (41°40' S) and the Rio Negro on the Atlantic side (42° S), to the Cape Horn (55° 58' S; 67° 17' W). The southern portion of this area is characterized by two very distinct environments and an intermediate zone. To the east, the pampas, covered by glacial deposits, presents a smooth relief, a dry climate, and poor

vegetation. The wildlife is mainly terrestrial, with a very limited number of mammal taxa. Prior to the arrival of the Europeans, the predominant large mammal was the guanaco (*Lama guanicoe* [Müller, 1776]). To the west, the foothills of the Southern Cordillera dive into the Pacific Ocean and form the archipelagos of southern Patagonia and Tierra del Fuego, stretching for nearly 1600 km. Here the rainfall is very high, the vegetation up to 400 to 500 m above sea level is exceedingly dense, and wildlife is essentially marine. Between these two regions, in the central area of the Strait of Magellan, a set of ancient glacial lakes became connected with the sea during the Holocene. This region contains the inland seas of Otway, Skyring, and Ultima Esperanza. The area has intermediate climate and vegetation, and the fauna is both terrestrial and marine. Our investigations take place in the last two zones.

Marine fauna in Southern Patagonia is represented by some 11 species of cetaceans, five species of pinnipeds, and two species of sea otter (Sielfeld, 1983). Various studies of the Patagonian avifauna (Clark, 1986; Harris, 2008; Humphrey *et al.*, 1970; Venegas, 1994; Venegas & Jory, 1979) have identified 208 species and subspecies, belonging to 19 orders and 48 families, with 39 endemic species. In 1520, Magellan opened a path between the Atlantic Ocean and the Pacific Ocean. Following this, numerous expeditions took place in southern Patagonia, but the contact between the navigators and the natives was too ephemeral to provide the Europeans with a detailed understanding of the local populations' lifestyles. Early visitors called the natives they met in the archipelagos "canoe Indians" since they were travelling in fragile bark boats, and briefly described them as constant nomads, living in small family units in rudimentary huts. They rapidly characterized these nomads of the sea as shellfish eaters, and often ranked them amongst the most primitive people on earth (Darwin, 1985; Empereire, 1955; Gusinde, 1986, 1991; Hyades & Deniker, 1882-1883; Lothrop, 1928; Orquera & Piana, 1999a). Here in Southern Patagonia, the earliest evidence for maritime cultures dates to the sixth millennium BP (Legoupil, 1993-1994, 2003; Orquera & Piana, 1999b).

Geographically, these two groups of islands show similarities, but also present a major difference: one is a group of entangled islands, close to a continental mass, an imbricate archipelago, while the other is an archipelago in chain, like a necklace of land in the middle of the ocean.

The studied assemblages (table 1)

Until the 1980's in Southern Patagonia and the 1990's for the Western and Central Aleutian Islands, both regions were archaeologically quite poorly documented. Access was limited and the logistics needed to conduct archaeological work were challenging. As a result knowledge of archaeological settlements and their distribution was patchy. In 1991, the Western Aleutians Archaeological and Paleobiological Program¹, co-directed by D. Corbett (US Fish & Wildlife Service), D. Siegel-Causey and D. West (University of Kansas Museum of Natural History), and the author initiated a series of surveys to locate, map and eventually conduct excavations on islands or portions of islands in the Western, and then the Central Aleutians (Corbett *et al.*, 1997, 2010; Lefèvre *et al.*, 2001; West *et al.*, 2007). Ancient Aleutian villages usually consist of a series of depressions (sometimes up to several hundred) excavated into the ground, varying in length from 0.5 m to over 50 m, and representing semi-subterranean houses, storage pits, and burials. When these houses were abandoned, their frames (made of driftwood or whale bones) were removed or collapsed. These may have been reused for a later house built on the same site or a nearby location. The deposits therefore often consist of a palimpsest of layers, and a "village" may have been occupied for several centuries or millennia. These surveys have improved the knowledge of the past history of the Aleutian archipelago and enriched the archaeological map of the region. The small test pits dug to collect organic samples for radiocarbon dating have allowed the construction of a time frame for the human colonization.

¹ *The Western Aleutian Archaeological and Paleobiological Project (1991-2003) was financed by the National Geographic Society (grant 4943-92), the Office of Polar Programs of the National Science Foundation (grants OPP-9614472 and OPP-0091875), the Institut Français pour la Recherche et la Technologie Polaires (grant 301). The Central Aleutian Archaeological and Paleobiological Project (2005-2008) was financed by the Office of Polar Programs of the National Science Foundation (grant 0353065). Additional support was provided by the Aleutian Islands Maritime Refuge and the Biology and Archaeology branch of the US Fish and Wildlife Service, the Kansas University Biodiversity Research Center, the Centre national de la recherche scientifique (CNRS), the Muséum national d'histoire naturelle (MNHN), and the Aleut Corporation.*

Table 1. Characteristics of studied assemblages. Data from Corbett *et al.*, 1997; Lefèvre *et al.*, 2001; Legoupil, 1989, 1991, 1993, 1994, 1997, 2003, 2008; Legoupil & San Román, 2007; Ortiz-Tronconso, 1979; West *et al.*, 1999.

	Approximate total surface	Area excavated	Range of site occupation	NISP Vertebrates	NISP Birds
Aleutian sites					
<i>Western Aleutians</i>					
Buldir Island - KIS-008 - Pit 1	± 6000 m ²	1 m ²	15th-17th centuries AD	3990	1180
Buldir Island - KIS-008 - Pit 2	± 6000 m ²	0.5 m ²	8th-15th centuries AD	4832	2084
Shemya Island - ATU-003	± 7000 m ² ?	1 m ²	1st millenium AD	1146	751
Shemya Island - ATU-021	?	2 m ²	1st-5th centuries AD	1811	927
Shemya Island - ATU-022	± 9500 m ² ?	12 m ²	1st millenium AD	223	1240
Shemya Island - ATU-061	?	4 m ²	1st millenium BC	1546	326
<i>Central Aleutians</i>					
Adak Island - ADK-011 - Feature 1	± 6000 m ² ?	6 m ²	1st millenium AD	6566	105
Adak Island - ADK-011 - Feature 2	± 6000 m ² ?	4 m ²	2nd millenium AD	569	213
Patagonian sites					
<i>Seno Skyring</i>					
Seno Skyring 6	25-30 m ²	± 0.5 m ²	1st millenium AD?	46	44
Seno Skyring 3	± 75 m ²	± 0.5 m ²	1st millenium AD	2547	2443
Seno Skyring 24	± 100 m ²	± 0.5 m ²	1st millenium AD ?	82	82
Seno Skyring 49a	± 200 m ² ?	± 0.5 m ²	1st millenium AD	133	33
Seno Skyring 29	≥ 35 m ²	± 0.5 m ²	3rd millenium BC	131	48
Seno Skyring 25	?	± 0.5 m ²	1st millenium AD ?	80	73
Seno Skyring 26	± 180 m ² ?	± 0.5 m ²	2nd millenium BC	122	58
Seno Skyring 33	10 m ² ?	± 0.5 m ²	1st millenium AD?	101	17
Seno Skyring 14	± 120 m ²	± 0.5 m ²	1st millenium AD	647	471
Seno Skyring 12	± 40 m ²	± 0.5 m ²	1st millenium AD	27	27
Seno Skyring 11	± 70 m ²	± 0.5 m ²	1st millenium AD	56	39
Seno Skyring 16	50-70 m ²	± 0.5 m ²	1st millenium AD?	126	72
<i>Seno Otway and Fitz-Roy Channel</i>					
Ponsonby - Phase B	250-300 m ²	± 50 m ²	3rd millenium BC	1154	45
Ponsonby - Phase B1	250-300 m ²	± 50 m ²	3rd millenium BC	1617	556
Ponsonby - Phase B2	250-300 m ²	± 50 m ²	3rd millenium BC	4839	1174
Ponsonby - Phase C	250-300 m ²	± 50 m ²	3rd-4th millenium BC	2828	99
Ponsonby - Phase D	250-300 m ²	± 13 m ²	6th-5th millenium BC	417	44
Punta Baja	> 100 m ² ?	91 m ²	17th century AD	11954	3545
Bahía Colorada	± 100 m ²	97 m ²	4th millenium BC	6926	1716
<i>Cape Horn Archipelago</i>					
Bayly 1	± 1000 m ²	± 1 m ²	1st millenium AD	722	557
Grandi 1	± 1000 m ²	1 m ²	4th millenium BC	209	52
Bertrand 1	± 100 m ²	1 m ²	1st millenium AD	10	4
Herschel 1 - Surface	± 50 m ²	± 0.5 m ²	1st-2nd millenium AD?	504	314
Herschel 1 - Test pit	± 50 m ²	2 m ²	1st-2nd millenium AD?	877	807
Herschel 3	± 60 m ²	± 0.5 m ²	1st-2nd millenium AD?	467	366
Herschel 4	25-30 m ²	± 0.5 m ²	1st-2nd millenium AD?	709	585
Wollaston 7	± 120 m ²	± 0.5 m ²	1st-2nd millenium AD?	940	841
Wollaston 8	± 50 m ²	± 0.5 m ²	1st-2nd millenium AD?	306	283
<i>Strait of Magellan</i>					
Bahía Buena	?	32 m ²	4th millenium BC	?	4822
Punta Santa Ana	?	29 m ²	4th millenium BC	?	612
Dawson 3	≥ 100 m ²	± 3 m ²	2nd millenium BC	1920	375
Dawson 16	≥ 100 m ²	1.5 m ²	1st millenium BC?	253	152
Offing 1	30-100 m ²	± 3 m ²	1st millenium BC?	270	68
Offing 2	≥ 100 m ²	0.5 m ²	1st millenium BC?	461	261
Wickham 1	30-100 m ²	1 m ²	1st millenium BC?	58	25
Wickham 2	≥ 100 m ²	± 1 m ²	1st millenium BC?	82	38

Table 2. Present avifauna of the Aleutian Islands and southern Patagonia: list of orders and number of species (established from Clark, 1986; Gibson & Byrd, 2007; Humphrey *et al.*, 1970; Sekora, 1973; Venegas & Jory, 1979; Venegas 1994).

Orders	Aleutian Islands (18 orders)			Southern Patagonia (19 orders)		
	Nb sp	% sp. / total	% sp. / total without Passeriformes	Nb sp	% sp. / total	% sp. / total without Passeriformes
Rheiformes	none			1	0,5	0,7
Tinamiformes	none			2	1,0	1,3
Sphenisciformes	none			7	3,4	4,6
Gaviiformes	5	1,7	2,4	none		
Podicipediformes	2	0,7	0,9	4	1,9	2,6
Procellariiformes	11	3,7	5,2	27	13,0	17,6
Pelecaniformes	3	1,0	1,4	5	2,4	3,3
Ciconiiformes	7	2,3	3,3	8	3,8	5,2
Anseriformes	49	16,4	23,1	21	10,1	13,7
Falconiformes	15	5,0	7,1	16	7,7	10,5
Galliformes	5	1,7	2,4	none		
Gruiformes	2	0,7	0,9	5	2,4	3,3
Charadriiformes	102	34,1	48,1	41	19,7	26,8
Columbiformes	1	0,3	0,5	3	1,4	2,0
Psittaciformes	none			1	0,5	0,7
Cuculiformes	2	0,7	0,9	none		
Strigiformes	3	1,0	1,4	6	2,9	3,9
Caprimulgiformes	1	0,3	0,5	1	0,5	0,7
Apodiformes	2	0,7	0,9	1	0,5	0,7
Coraciiformes	1	0,3	0,5	1	0,5	0,7
Piciformes	1	0,3	0,5	3	1,4	2,0
Passeriformes	87	29,1		55	26,4	
Total species	299			208		

However, the samples collected during these works represent only a tiny portion of the sites and a minute episode of their history.

Starting in the late seventies, work conducted in Southern Patagonia by the French Archaeological Mission², directed by Dr D. Legoupil (CNRS), produced valuable data: a large portion of the territory of the nomadic canoe Indians was surveyed (Legoupil, 1993-1994, 2000, 2008; Legoupil & San Román, 2007), and three sites were excavated almost in their entirety (Legoupil, 1989, 1997, 2003). In general, Patagonian maritime sites are smaller than Aleutian ones. Located on marine terraces close to the shore, they consist of one or more shell middens; the remains of kitchen refuse from short but repeated stays of these permanently moving groups. Three sites excavated on a large scale (Punta Baja, Bahía Colorada and Ponsonby), plus two additional sites (Punta Santa

Ana and Bahía Buena) excavated by the Chilean archaeologist O. Ortiz-Troncoso (1979) provided well dated faunal assemblages, from clear contexts. Although the samples collected during surveys come from limited test pits, and their time of occupation is approximate, they nevertheless also provide large series of data.

These archaeological investigations conducted in both zones during the last three decades have greatly improved knowledge of the geographical distribution of sites and the chronological framework of human occupation. In both cases, the archaeological sites are complex and the faunal assemblages studied here often lack a precise context. They therefore do not provide as detailed and reliable a basis as hoped for comparing bird exploitation in these two regions, but nevertheless help us understand the maritime economies of prehistoric hunters-fishers-gatherers.

² The Mission archéologique française is financed by the French Ministère des Affaires étrangères, the CNRS, the MNHN. Additional support is provided by the Instituto de la Patagonia.

Figure 2. Proportions of the various vertebrate taxa in Aleutian sites and southern Patagonia sites (data from Lefèvre *et al.*, 1997, 2006, 2010, in press; Legoupil, 1989, 1993-1994, 1997, 2000, 2003; Legoupil & San Román, 2007).

Mammals ■
 Birds □
 Fish ▒



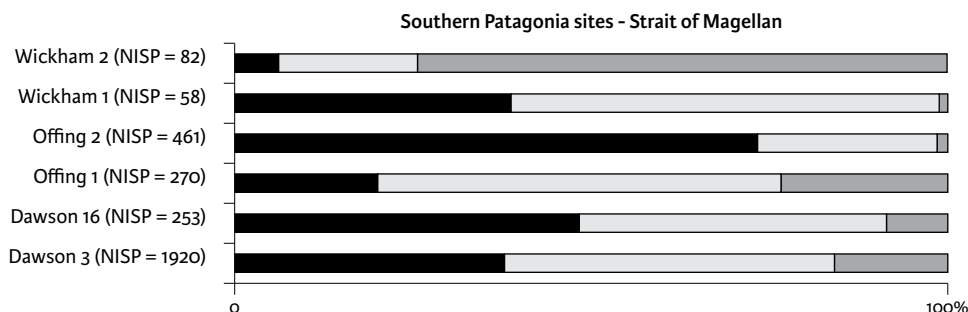


Figure 2. Proportions of the various vertebrate taxa in Aleutian sites and southern Patagonia sites (data from Lefèvre et al., 1997, 2006, 2010, in press; Legoupil, 1989, 1993-1994, 1997, 2000, 2003; Legoupil & San Román, 2007).

Results

The present avifauna

The contemporary avifaunas of the two regions are similar in taxonomic composition. The number of species recorded is higher in the Aleutians (299) than in southern Patagonia (208), but the number of orders is very similar: 18 for the former, and 19 for the latter (table 2). Fifteen orders are common to both regions, and in both cases the Charadriiformes are strongly represented, followed by the Anseriformes in the Aleutians and the Procellariiformes in Patagonia. As stated above, the studied areas display regional variations, which are reflected in the avifauna and summarized in figure 1. The taxonomic composition differs more between the various geographic zones of Patagonia than it does in the Aleutian chain. In the Aleutians, the number of taxa increases from east to west: this is due to its proximity to Asia and the presence of Asian species. In Southern Patagonia, higher diversity is found in the intermediate zone of the inner seas, with the archipelagos being less diverse. In both cases, when the zones are taken as a whole, geese and ducks, seabirds and passerines represent around 60% of the avifauna.

The archaeological record

The proportion of birds in the assemblages. To evaluate the role of birds in the economy of the human groups under study, the proportion of bird remains is compared to those of the other vertebrate taxa (fig. 2).

In the Aleutian sites (fig. 2a), fish bones are often extremely numerous, with birds in second place. In the two sites where fish are poorly represented (KIS-008 Pit 2 and ADK-011 Feature 2), birds dominate the faunal sample.

In Patagonia, sites excavated in their entirety such as Bahía Colorada or Punta Baja in the Sea of Otway (fig. 2b), or those excavated to a large extent such as Ponsonby in the Fitz-Roy Channel (fig. 2b), and also large sites such as Grandi and Bertrand in the south of Navarino Island (fig. 2c), all show a clear predominance of mammal

remains. Fish are virtually absent and these sites seem specialized in mammal hunting. In the Cape Horn archipelago (fig. 2c), the Seno Skyring (fig. 2d), and the sites recently surveyed in the Strait of Magellan (fig. 2e), birds are dominant in 20 of the 25 sites presented here. Fish remains dominate at only two sites: Skyring 33 and Dawson 3.

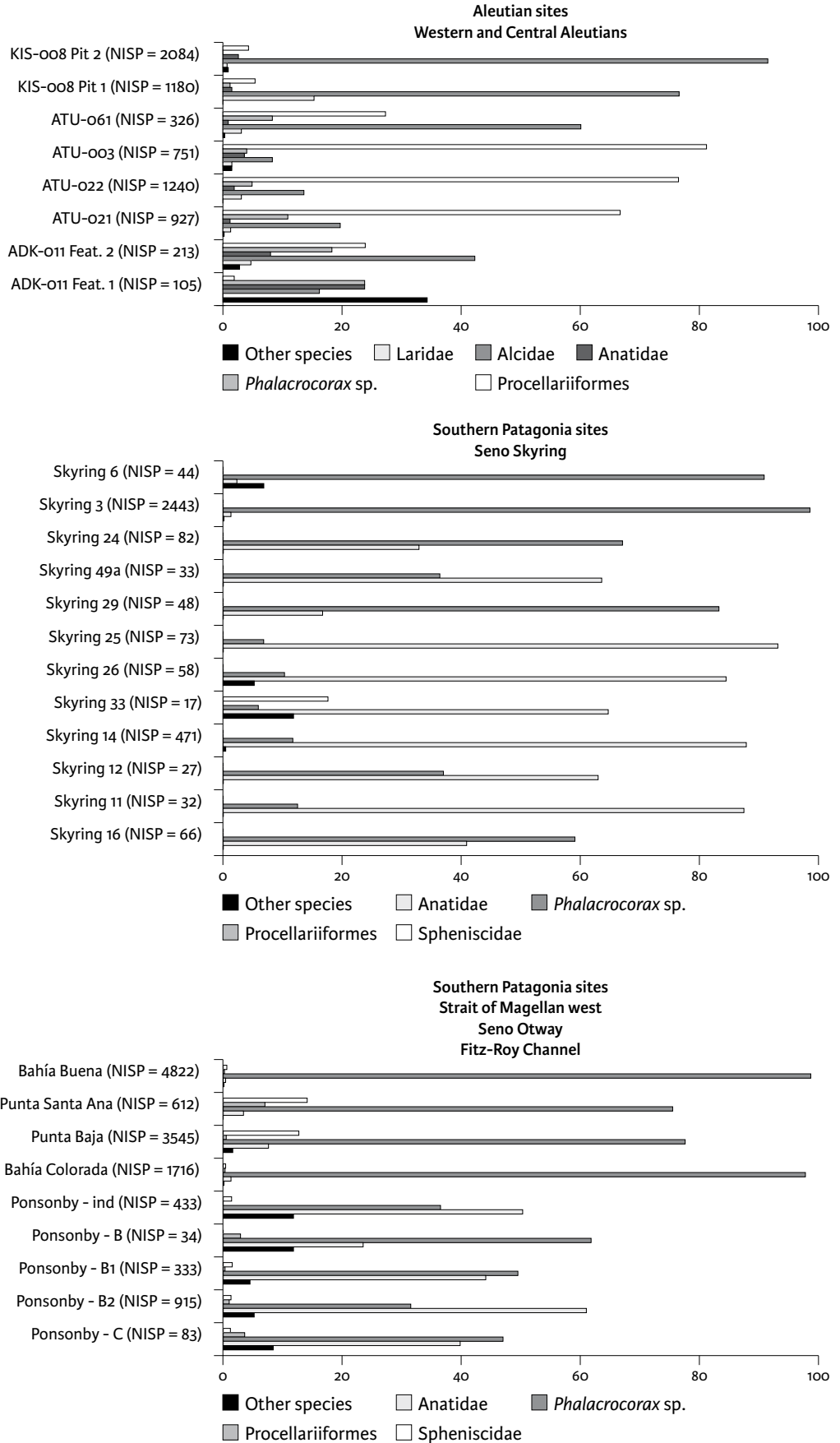
As birds are always present in these assemblages, this suggests that they are a recurrently exploited resource in these environments. However it is difficult to quantify the meat yield of the birds and compare it with other taxa present at the sites. The number of sites examined here is large, but they are often only partially excavated. Furthermore, estimating meat weight or caloric value for different species is subject to numerous approximations. For example, were the whale bones collected as a raw material or should they be considered as kitchen refuse and taken into account when reconstructing the diet of the inhabitants? And if so, how much meat do they provide? Sea lions, for example, may show wide variations in weight depending on their sex or the time of year. As with other marine resources, quantification of the contribution of invertebrates to the human diet is difficult and methods are not always comparable between researchers. This issue will therefore not be discussed here, but one should keep in mind that a single sea lion produces much more meat than a handful of cormorants.

The bird spectra

Fig. 3 presents the species identified in the studied assemblages and their relative proportions.

In the Aleutian sites (fig. 3a), there is almost always one taxon that dominates the assemblages, and makes up more than half of the identified specimens: usually either the Alcids or the Procellariids. One must also note the recurrent presence of gulls (*Larus* sp.) and kittiwakes (*Rissa* sp.). The cormorants (*Phalacrocorax* sp.), although present, do not occupy the dominant position they do in Patagonia. Here, this place is usually taken by the Alcids: auklets (*Aethia* sp.), puffins (*Fratercula* sp.), murrelets (*Uria* sp.), and guillemots (*Cepphus* sp.).

Figure 3. Avian spectrums from Aleutian sites and southern Patagonia sites (data from Lefèvre, 1989a, 1989b, 1991, 1993-1994, 1997a, 1997b; Lefèvre *et al.*, 1997, 2003, 2006, 2010, in press).



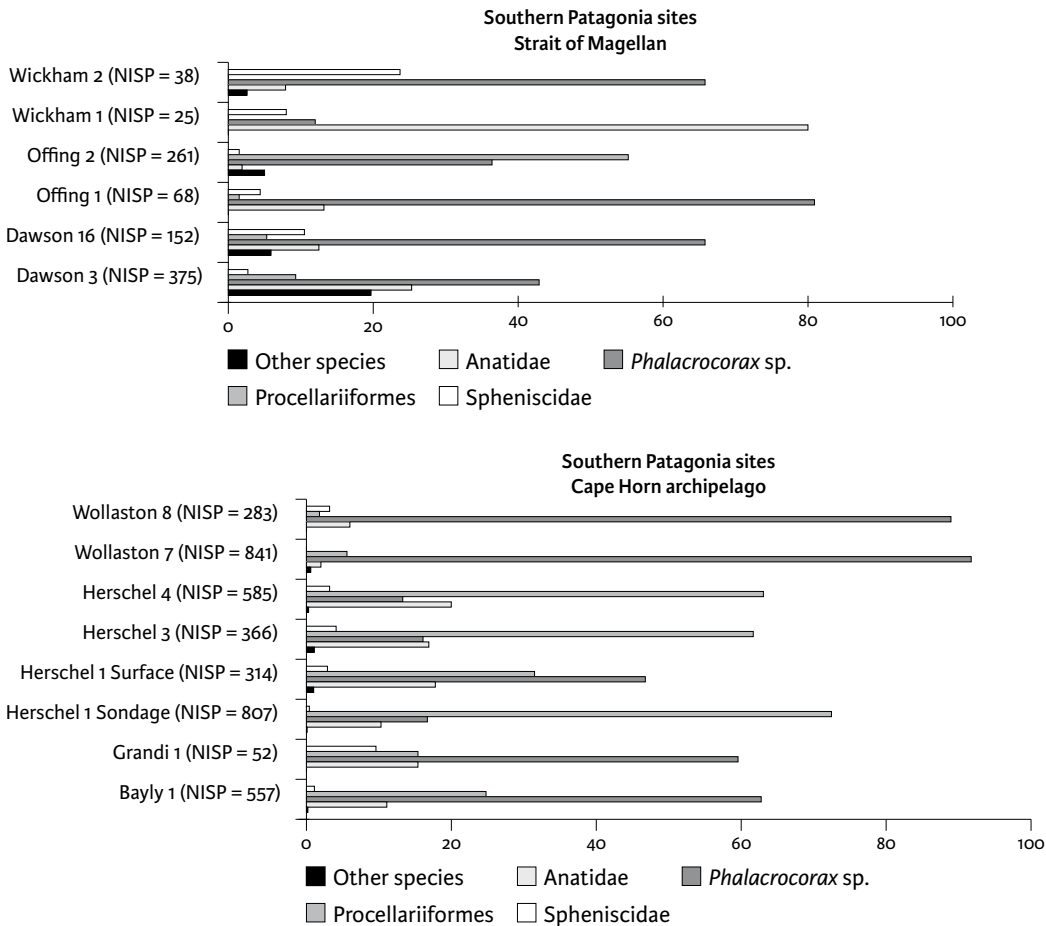


Figure 3. Avian spectrums from Aleutian sites and southern Patagonia sites (data from Lefèvre, 1989a, 1989b, 1991, 1993-1994, 1997a, 1997b; Lefèvre et al., 1997, 2003, 2006, 2010, in press).

In Patagonian sites, there is a similar trend of one strongly represented taxon. In the sites of Seno Skyring (fig. 3b), the predominance of a single species or a family is very clear. These are either cormorants or large ducks, especially steamer ducks (*Tachyeres* sp.). At Ponsonby in the Fitz-Roy Channel (fig. 3c), the dominant species are alternately cormorants and Anatids. In Punta Baja and Bahía Colorada (fig. 3c), there is an overwhelming abundance of cormorants, a trend also found in Punta Santa Ana and Bahía Buena, two sites on the west shore of the Strait of Magellan (fig. 3c). In the recently discovered sites on Dawson island in the Strait of Magellan (fig. 3d), cormorants are dominant, except in Wickham 1 where it is the large Anatids which dominate the sample. One must also note the presence of Procellariids in different sites: albatross (*Diomedea* sp.) at Dawson 3, 16 and 18, and fulmar (*Fulmarus glacialisoides*) in Offing 2. The significant proportion of Procellariids must be noted in four samples from Herschel Island in the Cape Horn archipelago (fig. 3e), where sooty shearwaters (*Puffinus griseus*) constituted more than half the record. On the contrary, the two deposits

studied in Wollaston show a high proportion of cormorants, constituting nearly 90% of the identified specimens. Bayly and Grandi 1, at the south of Navarino island, provide a slightly larger spectrum, especially with the presence of penguins (*Spheniscus magellanicus*).

Discussion

This review of bird exploitation in two groups of maritime hunters-gatherers identified several trends.

Firstly, bird remains are systematically present in the studied assemblages, indicating that they played an important role in these economies throughout the time period considered here. However, the data are often too limited to precisely discuss temporal changes. For the Aleutian assemblages, the areas excavated do not allow us to draw any conclusions regarding the importance of birds compared to other vertebrates. At Punta Baja, Bahía Colorada and Ponsonby, (the three Patagonian sites excavated almost entirely and for which the

other vertebrate data were available), mammals constitute the majority of the faunal remains. The faunal spectra from Bahía Colorada and Punta Baja, distant in time by five millennia, are very similar, and illustrate one aspect of this maritime economy: marine mammals provided some 95% of the estimated calories, but birds represent 25 to 30 % of the remains, demonstrating that the practice of seabird fowling held some significance (Lefèvre, 1989b, 1997a; Legoupil, 1989, 1997). Ponsonby is the only site presenting a rather long chronological sequence, showing an increase in the proportion of bird remains. But all along the sequence, the vast majority of the meat yield is provided by mammals (Lefèvre *et al.*, 2003). In the surveys conducted in the Cape Horn archipelago, the Skyring sea and the Strait of Magellan, birds often constitute the majority of the vertebrates remains (Lefèvre, 1993-1994, 1997b). The presence of young individuals in a number of sites tends to indicate that these may have been seasonal specialized fowling sites, but once again, most assemblages come from limited excavations. Studies in progress in the Strait of Magellan, in particular with the excavation on a large scale of the site of Offing 2, should bring more accurate data in a near future (Legoupil, 2008).

Another general trend identified is that the number of bird taxa in these assemblages is quite small. In about half of the Patagonian sites examined (48%), the number of taxa identified does not exceed three at any one site. A further 40% of the deposits contained four to nine taxa, whilst only 13% of the sites have provided more than 10 taxa, the maximum being 16 identified at Punta Baja (Lefèvre, 1989b). In the Aleutian sites examined here we have a greater diversity, with the number of identified taxa ranging from 17 to 23. This difference is mainly due to the fact that thirteen species of Alcids nest in the Aleutian chain, a dozen of which have been identified in the archaeological fauna. The number of taxa identified in the archaeological sites appears rather limited when compared to the present record of avifauna and represents only 7 to 10 % of the bird diversity.

No major change is observed over time in the taxonomic composition of the Patagonia bird assemblages. The variation of the dominant species does not seem to be linked to a temporal change in the cultural practices, but more probably reflects the bird life in the vicinity of these sites. The four Aleutian assemblages from

Shemya Island, ATU-003, 021, 022, and 061 show a clear inversion in the proportions of the most abundant species. When comparing the site occupied during the first millennium BC, ATU-061, and the three more recent sites, ATU-021, ATU-022, and ATU-003, faunal analysis suggests that early Shemya inhabitants preferred hunting murre, puffins, and auklets, but later hunters preyed on fulmars, shearwaters, and albatrosses. This change in hunting practices may be related to the availability of the various species through time or possibly the evolution of weaponry (Lefèvre *et al.*, 2010), although, again, the data available at the present time are rather limited.

The majority of species identified at the Aleutian and Patagonian sites are, in the main, coastal or pelagic: albatross, fulmars, shearwaters, penguins, cormorants, geese and ducks, gulls, alcids etc., and remain very common in these areas today. In Patagonia, the birds identified are often resident species and therefore, do not provide information on the seasons of occupation for these sites, however, the presence of juvenile bones may help to clarify this issue. For example, samples collected during the surveys conducted in the Seno Skyring (Lefèvre, 1997b) and the Cape Horn archipelago (Lefèvre, 1993-1994) contained a significant proportion of immature bird remains. This provides evidence either for the seasonal occupation of these areas or for the use of fowling and capture methods during the breeding season when hunters would navigate this part of the archipelagos to hunt birds and perhaps collect eggs. Several sites recently surveyed on Dawson Island, in the Strait of Magellan, have also provided a significant proportion of young individuals (study in progress). This area is newly explored and these trends need to be confirmed. This question of the season of occupation of the sites is of lesser importance in the Aleutians, where villages were occupied almost permanently. In addition, the studied samples are much too small when compared to the overall size of the sites to give a meaningful insight on the issue.

Most species identified in the archaeological sites are common in the studied areas, gregarious in nature, and sometimes constitute large colonies where it is easy to obtain a significant number of individuals in a short amount of time, as is the case with the cormorants and the Alcids. The albatrosses, petrels and other Procellariids often gather in large numbers when a school of fish is

present in the zone and could be approached by boat, then harpooned, or caught with a net. The exploitation of these species therefore generally reflects opportunistic hunting, probably carried out not far from settlements, or during sea trips. Some isolated accumulations of a large number of individuals of the same taxa may in fact be the result of a single and fruitful hunting episode.

Conclusion

In conclusion, the archaeological data reveals that the canoe Indians of Patagonia and the Aleutian hunters used a limited number of bird species in a systematic way. They exploited their immediate environment, practicing a relatively opportunistic style of hunting. When marine mammal resources were available, the birds were rarely, if ever, the main source of food, but they were probably part of the daily menu. In the Aleutians, the fish and invertebrates were probably a more stable resource as they were available year round.

This short presentation of seabird exploitation displays their role in the human diet. Their use was not limited to subsistence economies and we would like to briefly mention the fact that, in both cases, birds also provided raw materials for various other purposes. The most common bird bone tools found both in Southern Patagonia and the Aleutian Islands sites are awls, made from humerus, radius or tibiotarsus. For ornamentation purposes long bones, in particular radius, were sawn into pieces to make beads for collars. Ethnographical sources also reveal the use of feathers and skins for ornamentation or clothing. In the Aleutians in particular, the naturalist Steller, during his first encounter with Aleutian natives, noted the high quality of their clothing (Müller, 1986; Steller, 1988; Veniaminov, 1984), and museum collections house remarkable examples of bird skin parkas (Fitzhugh & Crowell, 1988; Varjola, 1990). This aspect of bird use is another rich topic which illustrates the relations between men and birds; it would need a whole distinct paper... for the next ICAZ Bird Working Group Meeting?

Aleutian and Patagonian sites are complex, often inaccessible, vast to excavate and tedious to analyse. Research is continuing and additional work will provide new information for extending and enhancing our knowledge of ancient maritime hunter-gatherers' way of life.

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