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HUMAN PREDATION AND NATURAL HISTORY OF HUEMUL (CERVIDAE; *HIPPOCAMELUS BISULCUS* MOLINA) IN PATAGONIA: A ZOOARCHAEOLOGICAL ANALYSIS

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We use published zooarchaeological evidence to discuss the various hypotheses concerning the past distribution of huemuls in Patagonia, southern South America. We then use these data to evaluate the interactions between this cervid and hunter-gatherers during the Holocene. The zooarchaeological record shows that huemul mainly inhabited forested and forest–steppe ecotonal environments during the Holocene. Huemul were hunted in exceptional circumstances during the early occupation of Patagonia. Its presence in the zooarchaeological record of South Patagonia increases after 9500 BP and is more frequent after 2200 BP. However, the taxonomic contribution of the species' bone remains to the archaeological record is always low. The few assemblages where there are a high number of huemul bones would have been the result of opportunistic hunting episodes. This in turn suggests that hunting of huemul had little or no influence on the animal's regional distribution over time. However, the progressively greater human presence in some forested areas towards the end of the Holocene could have affected huemul populations at the local scale. The zooarchaeological information presented in this paper illustrates interspecific and long-term relationships and, hence, could serve as essential information in future management strategies for huemul in Argentina and Chile.

Keywords: *zooarchaeology,* Hippocamelus bisulcus, *Patagonia, chorology, conservation biology*

En este trabajo se utiliza la evidencia zooarqueológica publicada con el fin de discutir las hipótesis propuestas en la bibliografía sobre la distribución pasada del huemul en Patagonia, sur de Sudamérica. Se evalúa si las interacciones entre este cérvido y las poblaciones de cazadores recolectores del Holoceno incidieron de alguna manera sobre los primeros. Los resultados muestran que el huemul no fue incluido como presa desde los primeros momentos de ocupación de un área. Su representación zooarqueológica aumenta en los depósitos de Patagonia Sur a partir de 9.500 y son sensiblemente más abundantes para 2.200 años AP. Sin embargo, la contribución taxonómica de la especie al registro zooarqueológico es siempre baja. El registro zooarqueológico es concordante con una distribución pasada en la que los ambientes boscosos y el ecotono bosque-estepa serían los dominantes para esta especie. Los escasos registros en los que hay mayor frecuencia de restos de la especie corresponderían a eventos de caza oportunista, por lo que se sugiere que la predación de los cazadores recolectores habría tenido escasa o nula influencia sobre la distribución de la especie a una escala regional. La información zooarqueológica presentada ilustra las relaciones interespecíficas en el largo plazo y, por lo tanto, constituye una herramienta esencial para enriquecer las estrategias de manejo futuras para la especie en Argentina y Chile.

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Introduction

Understanding animal natural history is essential for making sound management and conservation decisions (Frazier 2007; Lyman and Cannon 2004; Wolverton and Lyman 2012). As a result, archaeologists, historians, biologists, and ecologists strive to estimate past species distribution, changes in habitat, and the role of human populations in relation to these attributes. The zooarchaeological record can tease out long-term trends in these patterns that cover timescales beyond the reach of ecological studies or can reveal more specific events than those recorded in historical sources. This makes zooarchaeological studies a valuable asset for biological conservation (e.g., Braje and Rick 2011; Frazier 2007, 2010; Kay and Simmons 2002; Lyman and Cannon 2004; Rick and Erlandson 2008; Wolverton and Lyman 2012).

During the last decade, zooarchaeologists working in Patagonia have contributed to this large literature on conservation zooarchaeology. Specially, they have studied the impact of human populations on regional fauna, the distribution of particular species, and their morphological changes through time (Cruz 2001; Cruz et al. 2015; L'Heureux 2008; Scartascini and Volpedo 2013; Zangrando and Martinoli 2011). One such animal that has been the focus of biological and conservation studies in Patagonia is the cervid, huemul (*Hippocamelus bisulcus*, Molina) (e.g., Flueck and Smith-Flueck 2012; Vila et al. 2005). Huemul is endemic to the sub-Antarctic forests of Argentina and Chile (Cabrera 1957; Díaz 1993, 2000; Serret 2001; Vila et al. 2006). Since the arrival of Europeans in South America, its historical range has been reduced by half (Vila et al. 2005, 2006) due to habitat destruction and increased hunting pressure (Serret 2001; Smith-Flueck 2000). As a result, in 1996, several organizations placed huemul on the endangered list, including the *International Union for the Conservation of Nature* (IUCN 2014), the *Regional Patagonian Assessing Council for Wild Fauna* (CARPFS 1995), the Red Book of Endangered Mammals of Argentina (Díaz and Ojeda 2000), and the Red Book of Terrestrial Vertebrates of Chile (Glade 1988). It is the only South American cervid that is considered to be endangered and its numbers are waning (IUCN 2014). In Argentina, Federal Law 24.702/96 declared them a "natural treasure"; this represents the highest degree of legal protection that a species can have. This cervid is also listed in the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (Appendix 1, CITES 2013) and the *Convention on Conservation of Migratory Species of Wild Animals* (Appendix 1, CMS 2012), since it normally moves between Argentina and Chile. The endangered status of the huemul has triggered a strong interest in understanding its biology and especially its interaction with humans as a way to improve huemul management decisions and its conservation (e.g., Aldridge 1988; Frid 1994; Marín et al. 2013; Povilitis 1978; Smith-Flueck and Flueck 2001).

The conservation and management plans for the huemul in Argentina (2002) and Chile (2008-2012) explicitly recognize the importance of understanding the historical distribution of the huemul. In particular, the plans note the importance of comparing this historical information to modern huemul distributions and the location of their present-day optimal habitat. As is stated in the conservation and management plan in Argentina (Plan Nacional 2002), overlap between these data

could potentially allow us to identify areas suitable for huemuls and thereby determine and evaluate the possible causes behind the local extinction of subpopulations. Furthermore, this long-term analysis will also provide data useful for huemul rescue, translocation, and re-introduction (Plan Nacional 2002).

Fifteen years of zooarchaeological investigations in Patagonia have revealed a range of information about huemul ecology and human use throughout the Holocene. In general, it has been demonstrated that Patagonian hunter-gatherers relied on a limited number of medium-large ungulate species, including the huemul, in the context of an overall low diversity of medium-large ungulates (Redford and Eisenberg 1992). During the Holocene, the guanaco (*Lama guanicoe* Müller), an ungulate of the camelid family (averaging 80-100 kg), and pinnipeds (averaging 50-300 kg; *Otaria flavescens* Shaw and *Arctocephalus australis* Zimmermann) were the main prey for Patagonian hunters (Borrero 1999, 2013; Muñoz 2011). Other prey included the lesser rhea (*Rhea pennata* D'Orbigny), a flightless bird of the Ratites family (averaging 17-27 kg).

Typically, zooarchaeological analyses have focused on the local level, with the goal of understanding the hunting of huemul (e.g., De Nigris 2004a, 2004b; Fernández 2008, 2010; Legoupil 2000; Mena 1992; San Román et al. 2002). Some specific methodological tools have also been developed as an aid to understanding the dietary contribution of huemul as represented in the zooarchaeological record (Belardi and Gómez Otero 1998). A number of studies discuss the huemul zooarchaeological evidence within a conservation framework, with contributions from taphonomy (Fernández and Forlano 2009) and isotope ecology (Barberena et al. 2011; Méndez et al. 2014; Tessone et al. 2014). Finally, several hypotheses dealing with huemul historical distribution have been offered by researchers (Díaz 2000; Flueck and Smith-Flueck 2012; Serret 2001; Vila et al. 2005), with the aim of improving management decisions.

In this article, we analyze previously published information on huemul remains found in archaeological and paleontological contexts across Patagonia. This analysis is directed toward evaluating competing hypotheses about huemul past distribution. In particular, we analyze spatial and temporal fluctuations in this cervid's distribution and explore huemul/hunter-gatherer interactions during the Holocene. Our results indicate that huemul contribution to human subsistence in Patagonia was minimal during that time period, that there is no hunting pressure and/or overkill evidence and, therefore, hunter-gatherer predation did not impinge on the species' past distribution. By providing a long-term and spatially explicit record of huemul distribution, this analysis has the potential to contribute to information essential to modern huemul management, as it is required by national conservation agencies of Argentina and Chile (Plan Nacional 2002; Plan Nacional 2008-2012).

The Huemul

The South American deer genus *Hippocamelus* is comprised of two species, the taruca, sometimes called the North Andean huemul (*Hippocamelus antisensis* Ď'Orbigny), and the South Andean huemul, or simply, the huemul. The huemul is a medium-sized deer with short legs and a stocky build (Figure 1). Males have small antlers, usually only two points per unit, which are cast annually. Males

Figure 1. Female (top) and male (bottom) *Hippocamelus bisulcus* (Photo: Eduardo Ramilo; Composition: Ana Forlano; Location: Female, Los Glaciares National Park, Argentina, Male, Lago Cochrane National Reserve, Chile).

reach a height of 80-90 cm at the shoulders, and weigh up to 90 kg. Females are more slender and lighter in weight (up to 80 kg) than males. The huemul undertakes altitudinal displacements according to the annual seasons. It is normally a browser, although it can also graze. Huemuls are found generally alone or in groups of two or three individuals. Solitary individuals are more frequently observed than groups of two (male and female couples or a female with a fawn) and three individuals. Nevertheless, on some occasions they are in groups of up to seven. Smaller groups tend to occupy the denser forested areas (Povilitis 1978; Redford and Eisenberg 1992; Vila et al. 2010).

Nowadays this cervid has a wide latitudinal distribution extending along the length of the Patagonian Andes. Huemuls inhabit the forest and forest-steppe ecotone and the forested coasts of the Pacific Ocean (Vila et al. 2006). In Chile, they are found as an isolated population located in the Nevados de Chillán (approximately at 36° 50′ S), and then more or less continually between 40° S and the Magellan Strait (53° 50′ S). In Argentina, the northern limit of the species is located in the Neuquén Province (40° 9′ S), while to the south they are found in the Santa Cruz Province (50° 73′ S) (Vila et al. 2006:265). The easternmost limit of the huemul is Cerro Alegre in the Río Negro Province (71° 22′ W) (APN-SIB 2014). Huemul populations number between 1000 and 2000 individuals spread across 101 fragmented subpopulations (Vila et al. 2006) with an average density of 1.25 deer/km² (Díaz and Smith-Flueck 2000).

Hypotheses about Huemul Historical Distribution

Several researchers have proposed hypotheses about huemul historical distribution based on historical data compiled from reports, chronicles, and narratives by travellers, explorers, and naturalists who visited the Patagonian coasts and hinterland from the mid-sixteenth century onward. Díaz (1990, 1993, 2000) undertook an exhaustive recompilation of this historical information, augmenting it with archaeological data. She proposed two scenarios for the huemul's historical distribution that, with slight variations, have been discussed for the last 25 years. The first one stated that huemuls were originally found throughout all of Patagonia before retreating to the Andean area under pressure from a number of factors that acted in isolation or in combination with other pressures (ecological changes, predation, and the establishment of ranching). The second scenario points out that huemuls inhabited the Andean forests and only occasionally came down to the Atlantic coast, traversing areas inhospitable for the species through river valley corridors (Díaz 1993, 2000). Díaz stated that given the information at hand when this review was done it was not possible to choose between these two scenarios (Díaz 1990, 1993, 2000).

Based on more recent historical data and also oral testimonies and archaeological data, Serret (2001) argues for a more restricted modern distribution than that in the past. He suggests that prior to European colonization of Argentina, the transitional environment between forest and steppe was an optimal habitat for huemuls and that it was there that the largest populations of these animals existed. He posits that their displacement towards the forest occurred as a consequence of the advance of ranching and urbanization.

Vila et al. (2005) also suggested two scenarios for past huemul distribution based on National Parks Administration (Argentina) records, toponyms, and data from more than 70 archaeological sites. The first scenario includes arid Patagonia among the places where huemuls lived, although the authors contend that this may overestimate their range. The second scenario includes the forest and ecotonal areas and suggests the possibility of huemuls entering the arid regions of Argentina via ravines and hydrographic basins. Finally, the most recent proposal about huemul historical distribution (Flueck and Smith-Flueck 2012) suggests huemuls originally occupied the steppe, and from there were displaced towards the forest by the arrival of humans during the Pleistocene-Holocene transition. According to these authors, hunting pressure on the species was so high that it led to the huemul's virtual extinction from the steppe well before the arrival of European colonists.

Methods

We collated a zooarchaeological database of published information on huemul remains from Argentina and Chile up to 2012. A comprehensive search was conducted on published journal articles and books as well as other bibliographic resources available in Argentina and Chile. Given that the lowest levels of some of the archaeological sites included paleontological material, the database includes a few huemul remains from contexts with no associated human activity. The database includes information on site location, chronology, modern-day environment, and the relative and absolute abundance of huemul remains (NISP [Number of Identified Specimens], and MNI [Minimum Number of Individuals]). We also included entries for Cervidae when the authors stated that these remains were probably huemul.

The database includes all vertebrate remains except rodents. We excluded rodents because these bones are not usually the product of human consumption and because they are not included in many of the published faunal lists. In addition, the incorporation of rodents into the comparative analysis would artificially diminish the relationship between huemuls and the other represented species. We also excluded larger taxonomic categories such as mammals, even when the authors divided them by size (e.g., small, medium, and large mammals), because our aim is to compare the huemul's importance in relation to other species. Finally, given that the samples come from different types of archaeological sites, we considered each stratigraphic unit or deposit with huemul remains as an individual assemblage. In this way, every unit was analyzed independently, even if they came from the same site.

The results of our study are presented in two regional blocks that divided Patagonia in two across the 45° S parallel; this cut coincides with the Northern Patagonian Ice Field in Chile. This partition is justified by the fact that there are different precipitation regimes north and south of this line. The north has Mediterranean characteristics with seasonal rains, while the south has an isohydric regime (Veblen et al. 1996), in which precipitation is distributed across the whole year.

Table 1. Chronological periods used in the analysis of huemul remains compiled data (all uncalibrated dates).

Period	Acronym	Chronology (years BP)
Early Holocene 1	EH1	11,700-9950
Early Holocene 2	EH2	9949-8200
Middle Holocene 1	MH1	8199-6200
Middle Holocene 2	MH2	6199-4200
Late Holocene 1	LH1	4199-2200
Late Holocene 2	LH2	2199 to the present

The modern environmental context of the archaeological sites includes three different ecosystems: forest, steppe, and forest-steppe ecotone. Although it would have been preferable to include paleo-environmental information, few of the articles provided these data. Since paleo-environmental studies suggest that the forest-steppe ecotone fluctuations that took place since the end of the Pleistocene in Patagonia have to be studied at the local or basin level (e.g., Iglesias et al. 2012), we avoid the use of general paleo-environmental reconstructions. In those cases for which the article does not provide data concerning the modern environment, we located the site on Google Earth to determine current landscape conditions.

We divided the Holocene following Walker et al. (2012), with the addition of subdivisions that permitted a better understanding of possible temporal variations (Table 1). When the published chronology of a given deposit covers more than one of these divisions (e.g., "Holocene" or "6900 to present") then it was excluded for the purposes of the chronological analysis although it was considered in the analysis of taxonomic abundance. Within sites, an undated context between two dated contexts was assigned to the interface between the former and latter periods. This was done on four contexts from the Cerro Casa de Piedra 7 site. In four other contexts (Punta Eugenia 2, Caleta Alonso, Martín Pescador 2, Puesto La Sal) the chronological marker was based on the height of the site above sea level, following the criteria established by the authors (San Román et al. 2002).

Results

Spatial Distribution of Deposits with Huemul Remains

According to the analysis of the published data, huemul remains in the archaeological sites are distributed between 38° 53′ S and 53° 37′ S, covering approximately 1640 km (Figures 2 and 3). We identified a total of 74 archaeological sites with huemul remains, which can be divided into 113 different contexts. Of these, 18 sites (26 contexts) correspond to Northern Patagonia (NISP = 306; Figure 2; Table 2). There is spatial continuity in huemul records from 40° 19′ S through to 43° S (Figure 2). These sites are located in the Patagonian Andean forest or in its steppe ecotone. In some of these sites, the huemul was the most highly represented species (e.g., Cerro Pintado and Paredón Lanfré). South of the 43° S parallel there was an approximately 200 km gap in the records until approximately 44° 42′ S, representing a virtual vacuum

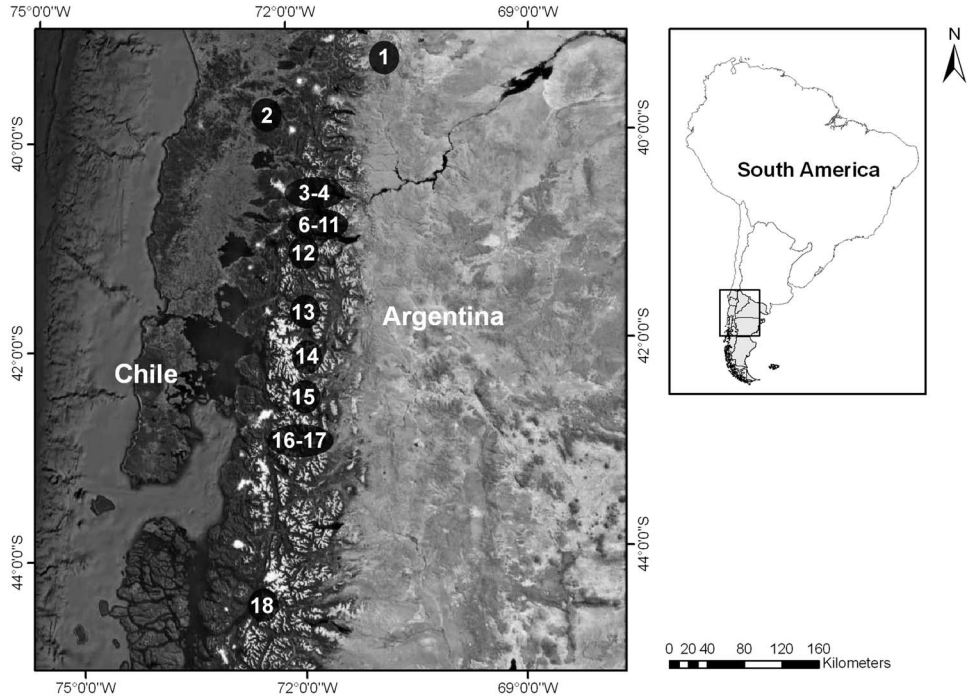

Figure 2. Huemul remains in Northern Patagonia. Site distribution data taken from Table 2.

from a zooarchaeological perspective. In Southern Patagonia the number of huemul contexts is 87 from 56 sites (total NISP = 2510; Table 3). Between 48° S and 51° 30′ S, huemul remains are again absent in archaeological contexts – with the exception of the P35 site, an outlier on the Atlantic coast – which coincided with the Southern Patagonian Ice Field (Figure 3).

Archaeological sites with huemul remains in Northern Patagonia were located exclusively in what is now forest or the forest-steppe ecotone (72% and 28% respectively; Figure 4). In Southern Patagonia, about half of the sites are located in the forest (52%) and 21% are on the forest-steppe ecotone. Two-thirds of the sites located in the forest were alongside or close to the seacoast (24 of 37 sites). There were also 15 sites located in the steppe (27%; Figure 4). Some of these latter sites were relatively close to the present-day forest-steppe ecotone (Figure 3, Map numbers 25, 26, 27, 31, 32, 41, 44, 60, and 65) and some were more than 100 km from the edge of the modern forest (Figure 3, Map numbers 23, 28, 35, 62, 63, and 64).

There are clear differences in the spatial distribution and frequency of huemul specimens between Northern and Southern Patagonia (Tables 2 and 3). Southern Patagonia has more assemblages, a higher total of NISP, and is represented in more diverse environments. Nevertheless, the differences in archaeological visibility, site sampling strategies, bone preservation, and environment between the two regions make it difficult to explain this pattern only in terms of hunter-gatherer behavior.

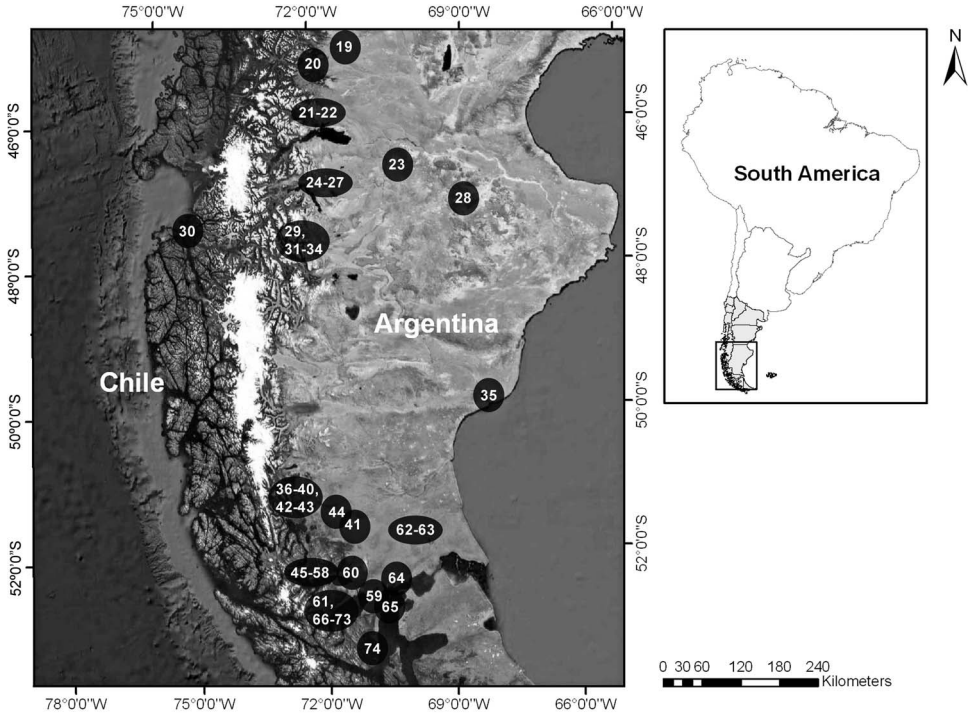

Figure 3. Huemul remains in Southern Patagonia. Site distribution data taken from Table 3.

Chronological Distribution of Huemul Remains

Huemul remains are recorded from the Pleistocene-Holocene transition to historic times (Figure 5). In Northern Patagonia, the human exploitation of the huemul dates back to the beginning of the Holocene at El Trébol site (Table 2, code 12.3), while in Southern Patagonia, huemul remains are recorded before human presence, as the bones recovered in carnivore dens of Late Pleistocene and EH1 age show (Borrero et al. 1997; Labarca et al. 2008; Martin 2013; Nami and Menegaz 1991). The first evidence of huemul and human presence in Southern Patagonia corresponds to the EH2 chronological period, and was recorded at the Cerro Casa de Piedra 7 (De Nigris et al. 2010) and Cueva Baño Nuevo 1 (Velásquez and Mena 2006) archaeological sites, both located in modern forest-steppe ecotone. In this region there are remains from MH1, a time interlude for which there are no huemul remains in Northern Patagonia. The escalation in the number of sites with huemul remains during the LH2 follows the general increase in the number of archaeological sites during this period (Borrero 1994-95). In Northern Patagonia, this increase was also associated with comparatively more frequent use of the forest, a trend observed for the last 1700 yrs BP (Fernández et al. 2013).

Taxonomic Abundance

The quantitative data of huemul remains recovered from the archaeological contexts is incomplete. In Northern Patagonia, almost a third of the records do

not present quantitative data, while in Southern Patagonia, 14% of the records are not quantified. This initial bias, which derives from the archaeological research trajectories developed in each area, influences the comparative analyses between both of these regions of Patagonia.

Nevertheless, on the basis of the quantitative data available, it is possible to establish that the taxonomic contribution of huemul remains in the zooarchaeological record of Northern and Southern Patagonia is low. The majority of the contexts contains few huemul specimens ($N < 40$), and thus represents a small proportion of the total NISP (Tables 2 and 3). In Northern Patagonia (Figure 6), more than half of the records ($N = 11$) display a huemul %NISP of less than 17%. Small sample sizes account for huemul remains exceeding 17% of the assemblage composition (general NISP < 100, $N = 6$). In Southern Patagonia, huemul contribution to the total NISP is less than 20% in the majority of the records (Figure 7). A similar pattern is seen in the MNI from both areas (Tables 2 and 3). Exceptional bone assemblages dominated by huemul remains (Table 2, code 15.2 and Table 3, codes 21.1 and 21.2) were interpreted as reflecting the differential availability of ungulates (Fernández 2008; Mena 1992; Velásquez and Trejo 2005).

Discussion

The regional zooarchaeological analysis addressed here allows us to reconsider the extant hypotheses about huemul past distribution. Analysis of the Patagonian zooarchaeological record across the whole of the Holocene shows that the huemul distribution did not include the arid steppe, supporting the second scenario proposed by Vila et al. (2005). The location of archaeological contexts with huemul remains highlights the importance of the forest and ecotones in the past distribution of huemuls. For example, huemul remains are present across the whole sequence of human occupation of the CCP7 site (Map number 34), except for the very beginning of this occupation (*c*. 10,000 yrs BP), when pollen records indicate a grassy steppe environment (Mancini 2007). This zooarchaeological pattern is consistent with the modern distribution of huemuls (Peri et al. 2013; Vila et al. 2006) and with the isotopic signals that indicate its use of open forest ecotones (Barberena et al. 2011; Méndez et al. 2014; Tessone et al. 2014). We suggest that the few huemul remains discovered far from the forest in Southern Patagonia can be explained by human transportation of antlers and skulls. The antler recovered on the Atlantic coast, at the mouth of the Santa Cruz River, at the P35 archaeological site (Cruz et al. 2010), is a good example of this. Its isotopic signal of $\delta^{15}N$ +0.34 is similar to those registered for the open forest huemuls (Tessone et al. 2014).

Aside from these cases of human transport, one could argue that the huemul remains that might have been left on the steppe were not preserved (Flueck and Smith-Flueck 2012). However, this seems not to be the case, because huemul bone characteristics (size, morphology and mineral density) are similar to those of guanacos, and this species is represented by hundreds of specimens in nearly all the archaeological sites in Patagonia, both in Argentina and Chile (Emperaire et al. 1963; De Nigris 2004a; Fernández 2010). Therefore, the absence of huemul

Table 2. Huemul remains found in Northern Patagonia archaeological sites.

Map number	Unit (Site.Level)	Archaeological site	Provenience	Modern environment	Chronology (years BP)	Huemul NISP	Huemul MNI	General NISP	Reference
1	1	Alero IV del Tromen	Neuquén, AR	Ecotone	3890±200 4180±530 4460±130	1	1	219	Perrota and Pereda 1987
2	2	Marifilo 1	X Región, CH	Forest	1410±50 AD	5	1	183	Velásquez and Adán 2004
3	3	Cueva Parque Diana	Neuquén, AR	Forest	580±70 730±80	6	2	16	Pérez and Batres 2008
4	4.1	Lago Meliquina	Neuquén, AR	Forest	730±80 750±50	5	2	10	Pérez and Batres 2008
4	4.2	Lago Meliquina	Neuquén, AR	Forest	920±60	9	2	16	Pérez and Batres 2008
5	5.1	Alero Lariviére	Neuquén, AR	Forest	2760±80	Present	ND	ND	Silveira 1999
5	5.2	Alero Lariviére	Neuquén, AR	Forest	780±50	Present	ND	ND	Silveira 1999
6	6	Alero Las Mellizas	Neuquén, AR	Forest	590±90	Present	ND	ND	Silveira 1982
7	7.1	Alero Los Cipreses	Neuquén, AR	Forest	2890±100 3490±80	Present	ND	22	Silveira 1996
7	7.2	Alero Los Cipreses	Neuquén, AR	Forest	840±90 1510±90	Present	ND	104	Silveira 1996
8	8	Alero Cicuta	Neuquén, AR	Ecotone	1080±50 1370±55	1	1	13	Silveira 1999
9	9.1	Traful I	Neuquén, AR	Ecotone	2230±40 2720±40	9	1	278	Cordero 2010
9	9.2	Traful I	Neuquén, AR	Ecotone	6030±115 6240±60	2	1	1606	Cordero 2010
10	10	Valle Encantado 1	Río Negro, AR	Ecotone	ND	Present	ND	ND	Hajduk and Albornoz 1999
11	11.1	Cuyín Manzano	Neuquén, AR	Forest	ND	Present	ND	ND	Ceballos 1982
11	11.2	Cuyín Manzano	Neuquén, AR	Forest	Historical times	Present	ND	ND	Ceballos 1982
12	12.1	Alero El Trébol	Río Negro, AR	Forest	ND	39	ND	308	Lezcano et al. 2010
12	12.2	Alero El Trébol	Río Negro, AR	Forest	5620±80 5731±70 5863±83	19	1	299	Lezcano et al. 2010
12	12.3	Alero El Trébol	Río Negro, AR	Forest	10,570±130 10,600±100 10,640±120	12	2	317	Hajduk et al. 2012
13	13	Paredón Lanfré	Río Negro, AR	Forest	330±50 to 1570±60	22	1	135	Unpublished data

Table 2. Continued.

Map number	Unit (Site.Level)	Archaeological site	Provenience	Modern environment	Chronology (years BP)	Huemul NISP	Huemul MNI	General NISP	Reference
14	14	Risco de Azócar 1	Chubut, AR	Forest	820±60 to 1690±60	20	1	93	Podestá et al. 2007
15	15.1	Cerro Pintado	Chubut, AR	Forest	680±60 to 1870±80	3	1	31	Fernández 2008
15	15.2	Cerro Pintado	Chubut, AR	Forest	680±60 to 1870±80	108	3	133	Fernández 2008
16	16	Sendero de Interpretación	Chubut, AR	Forest	400±40 to 1670±80	5	1	73	Arrigoni and Fernández 2004
17	17	Alero del Shamán	Chubut, AR	Forest	1460±40 to 3040±90	13	1	56	Fernández 2011
18	18	Alero El Toro	XI Región, CH	Forest	2460±40 2480±40 2560±90	27	2	42	Mena et al. 2004

Notes: AR = Argentina; CH = Chile; ND = no data available; AD = Anno Domini.

Table 3. Huemul remains found in Southern Patagonia archaeological sites.

Map number	Unit (Site.Level)	Archaeological site	Provenience	Modern environment	Chronology (years BP)	Huemul NISP	Huemul MNI	General NISP	Reference
19	19.1	Cueva Baño Nuevo 1	XI Región, CH	Forest	3000 to 5000	Present	1	137	Velásquez and Mena 2006
19	19.2	Cueva Baño Nuevo 1	XI Región, CH	Forest	5000 to 8000	Present	1	85	Velásquez and Mena 2006
19	19.3	Cueva Baño Nuevo 1	XI Región, CH	Forest	8000 to 9500	Present	1	31	Velásquez and Mena 2006
20	20	Lomo del Dragón Bajo	XI Región, CH	Forest	6980±30	1	1	1	Méndez et al. 2013
21	21.1	Alero Fontana	XI Región, CH	Forest	2110±60 4830±60	205	1	261	Mena 1992; Velásquez and Trejo 2005
21	21.2	Alero Fontana	XI Región, CH	Forest	340±50 460±90 500±110 690±100	1429	15	1462	Mena 1992; Velásquez and Trejo 2005
22	22.1	Alero Las Guanacas	XI Región, CH	Ecotone	13,275±30	5	1	540	Labarca et al. 2008
22	22.2	Alero Las Guanacas	XI Región, CH	Ecotone	5340±190	32	3	488	Fuentes Mucherl and Mena Larraín 2010
22	22.3	Alero Las Guanacas	XI Región, CH	Ecotone	450±70	38	6	211	Fuentes Mucherl and Mena Larraín 2010
23	23	Cueva Grande del Arroyo Feo	Santa Cruz, AR	Steppe	1660±50	1	1	1002	Silveira 1979
24	24	Alero Gianella	XI Región, CH	Ecotone	ND	9	1	747	Fuentes Mucherl et al. 2012
25	25.1	Entrada Baker	XI Región, CH	Steppe	2120±40 2580±50	Present	1	439	Mena and Jackson 1991
25	25.2	Entrada Baker	XI Región, CH	Steppe	230±70 390±50	Present	1	880	Mena and Jackson 1991
26	26	Cerro Cuadrado	Santa Cruz, AR	Steppe	2080±20	2	1	216	De Nigris and Tecce 2013
27	27	Estancia Pueyrredón 2	Santa Cruz, AR	Steppe	4900±30	1	1	354	De Nigris and Tecce 2013
28	28	Los Toldos Cueva 3	Santa Cruz, AR	Steppe	ND	1	1	13	Cardich and Miotti 1983
29	29	Alero Gorra de Vasco	Santa Cruz, AR	Ecotone	360±60	3	1	269	Rindel 2008
30	30.1	Stuven 1	XI Región, CH	Forest	ND	7	ND	603	Legoupil et al. 2007
30	30.2	Stuven 1	XI Región, CH	Forest	ND	9	ND	992	Legoupil et al. 2007
30	30.3	Stuven 1	XI Región, CH	Forest	ND	3	ND	814	Legoupil et al. 2007
30	30.4	Stuven 1	XI Región, CH	Forest	ND	1	1	329	Legoupil et al. 2007

Table 3. Continued.

Map number	Unit (Site.Level)	Archaeological site	Provenience	Modern environment	Chronology (years BP)	Huemul NISP	Huemul MNI	General NISP	Reference
30	30.5	Stuven 1	XI Región, CH	Forest	2225±45 to 1970±60	1	1	88	Legoupil et al. 2007
31	31	Alero Dirección Obligatoria	Santa Cruz, AR	Steppe	240±50 390±110 770±60	1	1	550	Rindel 2008
32	32.1	Alero Destacamento Guardaparque	Santa Cruz, AR	Steppe	5570±230 6700±80	5	1	434	Rindel 2008
32	32.2	Alero Destacamento Guardaparque	Santa Cruz, AR	Steppe	2830±60 3340±70	4	1	424	Rindel 2008
33	33.1	Cerro Casa de Piedra Cueva 5	Santa Cruz, AR	Ecotone	2550±50 2805±105	8	1	280	De Nigris 2007
33	33.2	Cerro Casa de Piedra Cueva 5	Santa Cruz, AR	Ecotone	2740±105	48	2	1026	De Nigris 2007
33	33.3	Cerro Casa de Piedra Cueva 5	Santa Cruz, AR	Ecotone	4330±120 4735±160 4850±110 4930±160	27	1	712	De Nigris 2007
33	33.4	Cerro Casa de Piedra Cueva 5	Santa Cruz, AR	Ecotone	6540±110	40	2	370	De Nigris 2007
34	34.1	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	3480±70 3460±71	33	2	786	De Nigris 2004a
34	34.2	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	4270±90	31	2	465	De Nigris 2004a
34	34.3	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	ND	6	1	649	De Nigris 2004a
34	34.4	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	5120±80 5320±90 3970±80	71	1	1870	De Nigris 2004a
34	34.5	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	6150±105	13	1	504	De Nigris 2004a
34	34.6	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	5310±100	30	1	758	De Nigris 2004a
34	34.7	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	5610±110 3920±80	9	1	301	De Nigris 2004a

Table 3. Continued.

Map number	Unit (Site.Level)	Archaeological site	Provenience	Modern environment	Chronology (years BP)	Huemul NISP	Huemul MNI	General NISP	Reference
34	34.8	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	7060±105	13	1	309	De Nigris 2004a
34	34.9	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	ND	4	1	196	De Nigris 2004a
34	34.10	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	8380±120	27	2	617	De Nigris 2004a
34	34.11	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	ND	55	2	946	De Nigris 2004a
34	34.12	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	8300±115	26	1	722	De Nigris 2004a
34	34.13	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	ND	33	2	835	De Nigris 2004a
34	34.14	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	ND	5	1	294	De Nigris 2004a
34	34.15	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	9730±100	14	1	856	De Nigris et al. 2010
34	34.16	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	8920±200	10	1	684	De Nigris et al. 2010
34	34.17	Cerro Casa de Piedra Cueva 7	Santa Cruz, AR	Ecotone	9100±150 9640±190 9390±40	4	1	653	De Nigris et al. 2010
35	35	P35	Santa Cruz, AR	Steppe	1150±30	1	ND	ND	Cruz et al. 2010
36	36	Dos Herraduras 1	XII Región, CH	Ecotone	2870±62 2915±115	Present	ND	ND	Borrero 1980
37	37	Dos Herraduras 2	XII Región, CH	Ecotone	2870±62	Present	ND	ND	Borrero and Massone 1994
38	38	Dos Herraduras 3	XII Región, CH	Ecotone	2530±70 2575±115	2	ND	33	Muñoz 1997
39	39	Cueva del Milodón	XII Región, CH	Ecotone	2556±45	Present	ND	ND	Borrero 1980
40	40	Alero Quemado	XII Región, CH	Ecotone	ND	85	3	258	Sierpe et al. 2009
41	41	Little Hill	Santa Cruz, AR	Steppe	ND	1	1	1	Carballo Marina et al. 2008

Table 3. Continued.

Map number	Unit (Site.Level)	Archaeological site	Provenience	Modern environment	Chronology (years BP)	Huemul NISP	Huemul MNI	General NISP	Reference
42	42	Cueva Lago Sofía 4	XII Región, CH	Ecotone	11,590±100 to 13,400±90	8	ND	710	Borrero et al. 1997
43	43	Cueva del Medio	XII Región, CH	Ecotone	Late Pleistocene (before 12,400 BP)	2	1	14	Nami and Menegaz 1991
44	44	Laguna Cóndor	Santa Cruz, AR	Steppe	ND	Present	ND	ND	Borrero and Borrazzo 2011
45	45	Skyring 3	XII Región, CH	Forest	1290±100	4	ND	2596	Legoupil 2000
46	46	Skyring 6	XII Región, CH	Forest	ND	1	1	46	Legoupil 2000
47	47	Skyring 14	XII Región, CH	Forest	1215±70	4	ND	653	Legoupil 2000
48	48	Skyring 15	XII Región, CH	Forest	ND	1	ND	129	Legoupil 2000
49	49	Skyring 16	XII Región, CH	Forest	ND	4	ND	129	Legoupil 2000
50	50	Skyring 24	XII Región, CH	Forest	ND	8	ND	212	Legoupil 2000
51	51	Skyring 25	XII Región, CH	Forest	ND	2	ND	80	Legoupil 2000
52	52	Skyring 26	XII Región, CH	Forest	3970±60	2	ND	4	Legoupil 2000
53	53	Skyring 28	XII Región, CH	Forest	ND	1	ND	4	Legoupil 2000
54	54	Skyring 32	XII Región, CH	Forest	ND	2	ND	34	Legoupil 2000
55	55	Skyring 34	XII Región, CH	Forest	ND	2	ND	64	Legoupil 2000
56	56	Skyring 35	XII Región, CH	Forest	ND	2	ND	7	Legoupil 2000
57	57	Skyring 42	XII Región, CH	Forest	ND	1	ND	6	Legoupil 2000
58	58	Skyring 49a	XII Región, CH	Forest	1040±50	17	ND	133	Legoupil 2000
59	59	Bahía Laredo - Cabo Negro	XII Región, CH	Forest	ND	Present	ND	ND	Prieto 1988
60	60	Río Verde 1	XII Región, CH	Steppe	280±60	2	ND	627	San Román et al. 2002
61	61	Punta Eugenia 2	XII Región, CH	Forest	ND	4	ND	62	San Román et al. 2002
62	62.1	Cueva Fell	XII Región, CH	Steppe	6560±115 6740±130 8180±135	1	1	292	Emperaire et al. 1963
62	62.2	Cueva Fell	XII Región, CH	Steppe	ND	2	1	188	Emperaire et al. 1963
63	63	Cueva de los Chingues	XII Región, CH	Steppe	11,210±50	Present	ND	ND	Martin 2013
64	64	San Gregorio 10	XII Región, CH	Steppe	ND	1	1	ND	Massone 1984

Table 3. Continued.

Map number	Unit (Site.Level)	Archaeological site	Provenience	Modern environment	Chronology (years BP)	Huemul NISP	Huemul MNI	General NISP	Reference
65	65	Isla Isabel	XII Región, CH	Steppe	ND	Present	ND	ND	Borrero and Borrazzo 2011
66	66	Caleta Alonso 2	XII Región, CH	Forest	ND	1	1	98	San Román et al. 2002
67	67	Caleta Eros 2	XII Región, CH	Forest	ND	10	ND	24	San Román et al. 2002
68	68	Pizzulic 2	XII Región, CH	Forest	5945±45 to 6200±40	4	ND	3515	San Román Bontes 2013
69	69	Pizzulic 4	XII Región, CH	Forest	985±45 to 1340±30	1	ND	270	San Román Bontes 2013
70	70	Bahía Colorada	XII Región, CH	Forest	5500	1	1	6072	Legoupil 1997
71	71	Martín Pescador 2	XII Región, CH	Forest	ND	6	ND	100	San Román et al. 2002
72	72	Río Caleta 2	XII Región, CH	Forest	110±40	28	ND	34	San Román et al. 2002
73	73	Puesto La Sal	XII Región, CH	Forest	ND	1	1	1	San Román et al. 2002
74	74	Punta Santa Ana 3	XII Región, CH	Forest	ND	33	ND	4226	Morello et al. 2012

Notes: AR = Argentina; CH = Chile; ND = no data available.

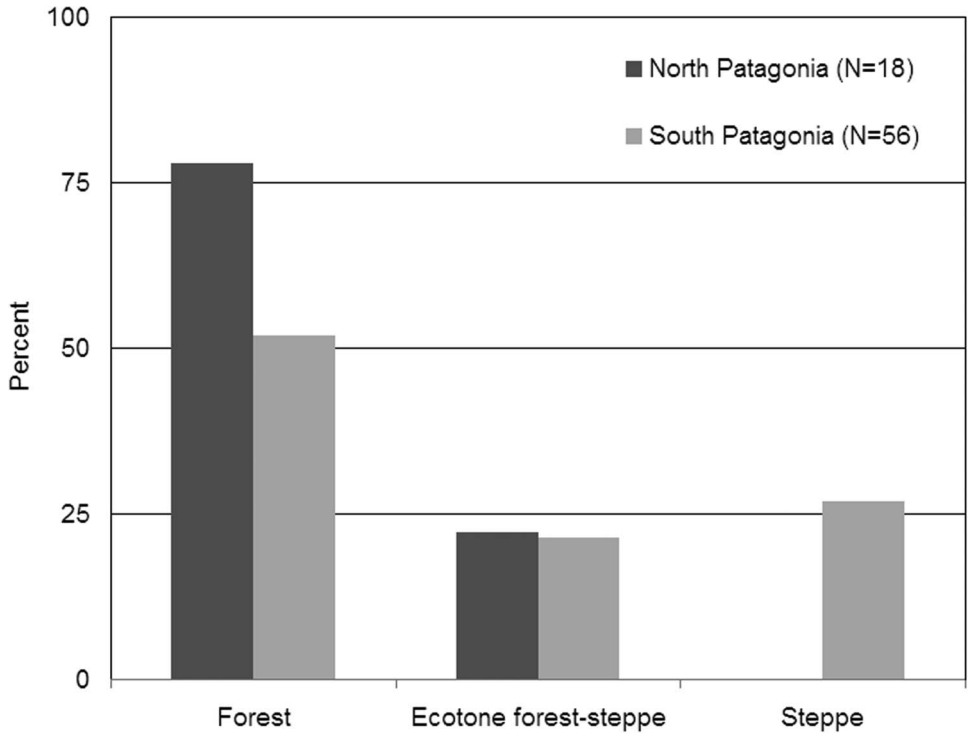

Figure 4. Frequency of archaeological sites with huemul remains according to present-day environment.

remains in steppe archaeological deposits can only be attributed to the absence of huemuls from arid Patagonia in the past.

Data compiled here indicate that Holocene hunter-gatherers did not have an impact on the past distribution of huemuls. The zooarchaeological data show that huemuls were not prey for humans at the beginning of the human colonization of Patagonia. The site of Marifilo 1, located in the Valdivian forest, on the shores of Calafquén Lake, has a record of human occupation from ca. 10,200 yrs BP. At this site huemul remains are only recorded in Late Holocene levels, dated between ca. 800-1500 yrs BP (Table 2, code 2). Similarly, at Última Esperanza, huemul remains are clearly identified in the Late Holocene level of the Dos Herraduras 3 (Table 3, code 38) archaeological site (Muñoz 1997), even though human occupation of the area dates back to the Pleistocene-Holocene transition and includes the consumption of a great diversity of faunal resources of different sizes and behaviors (Nami 1987). Until now, the lower level of the El Trébol site (Table 2, code 12.3) is the only exception to this pattern. In other words, although the paleontological records show that huemuls were present at the time of initial human colonization, the zooarchaeological record demonstrates that in some areas it was only hunted during the Late Holocene. On this basis, and contrary to Flueck and Smith-Flueck (2012), we confirm that there was no over-hunting of

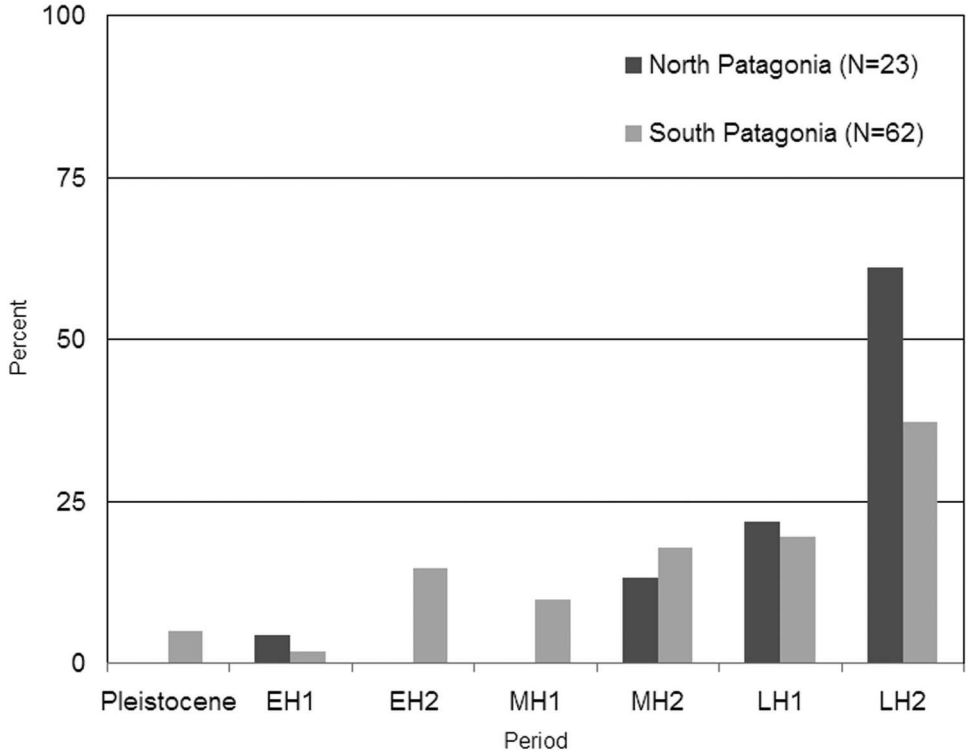

Figure 5. Comparison of percent abundance of huemul remains through time in North and South Patagonia sites. Time spans acronyms from Table 1. Chronological contexts from Tables 2 and 3.

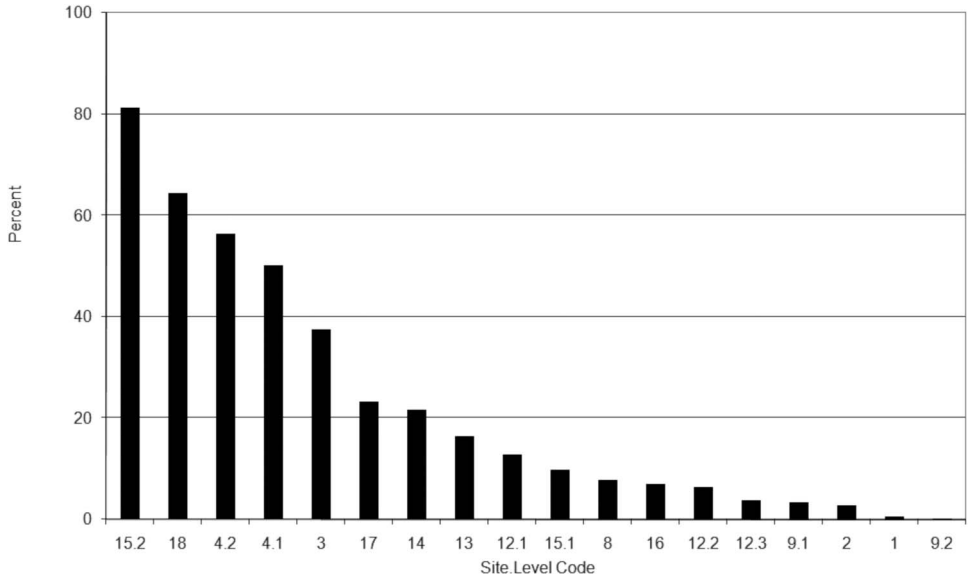

Figure 6. Percent of NISP huemul remains relative to the general NISP for Northern Patagonia zooarchaeological deposits (N=18). Records with huemul remains (x-axis) and general NISP taken from Table 2.

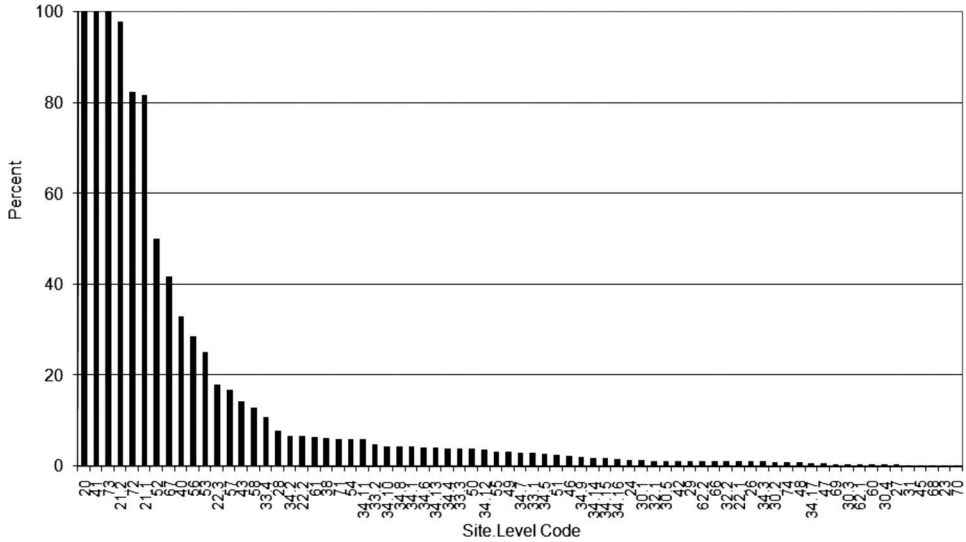

Figure 7. Percent of NISP huemul remains relative to the general NISP for Southern Patagonia zooarchaeological deposits (N=73). Records with huemul remains (x-axis) and general NISP taken from Table 3.

huemul by hunter-gatherer populations in arid steppe Patagonia. Although huemul records are more abundant during the LH2 (2200 yrs BP) in both areas of Patagonia, their place in human subsistence seems to have always been marginal.

Furthermore, the few records displaying a higher number of huemul remains could be explained by means of opportunistic hunting events, as is the case at Alero Fontana, located in the forest along the shore of a small lake (Mena 1992). Bodies of water are important in the anti-predator behavior of the huemul (Fernández and Forlano 2009), so this site was the ideal locus for hunting and processing this animal.

To conclude, predation by hunter-gatherers would have had little or no influence on the distribution of this species on a regional scale. Nevertheless, it is possible that the increasing human presence in certain forested areas during the last 2000 years might have affected huemul populations at a local scale. As Serret (2001) and Smith-Flueck (2000) state, it is only from the end of the nineteenth century that human populations started exerting increasing pressure on huemul numbers, both through hunting and modification of their habitat.

Conclusions

This paper demonstrates that the zooarchaeological record of Patagonia is a valuable tool for understanding the natural history of the huemul. As stated previously, the endangered status of huemuls has prompted a strong interest in its interaction with humans to improve huemul management decisions and conservation (e.g., Aldridge 1988; Frid 1994; Marín et al. 2013; Povilitis 1978; Smith-Flueck and Flueck 2001). The zooarchaeological record analyzed here

helps not only to explore the variation of the species' historical distribution, but also to explore more specific aspects, such as the evolution of interspecific relationships and the resulting possible impacts on animal populations. As Lyman (2012) clearly states, models built upon these kinds of data are the key foundations to propose more realistic ecological restoration benchmarks. Analyses such as the one presented in this paper will support huemul management decisions, particularly those related with environmental variability, isolation of local populations, extinctions, and re-introductions. In other words, the resulting knowledge is not only of benefit for archaeologists studying long term human-animal interactions, but also to those who are dedicated to this species' management and conservation in Argentina and Chile (Plan Nacional 2002; Plan Nacional 2008-2012). The diachronic and spatial evidence serves to show that the distribution of the huemul throughout the Holocene was similar to that reconstructed for the historical periods that are associated with the Patagonian Andean Forest and the forest-steppe ecotone.

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References Cited

APN-SIB (Administración de Parques Nacionales – Sistema de Información de Biodiversidad) [web page]. 2014. http://www.sib.gov.ar/avianual.php?reino=ANIMALIA&genero=Hippocamelus&especie=bisulcus&anio=2014. Accessed on 09/04/2014.

Aldridge, D. 1988. Proyecto de Conservación del Huemul (*Hippocamelus bisulcus*) en Chile. *Medio Ambiente* 9:109–116.

Arrigoni, G., and P. M. Fernández. 2004. Los Restos Óseos del Alero del Sendero de Interpretación: Integridad, Resolución y Aprovechamiento de los Recursos Faunísticos del Bosque. In *Contra Viento y Marea. Arqueología de Patagonia*, edited by M. T. Civalero, P. M. Fernández, and A. G. Guráieb, pp. 403–415. Sociedad Antropología de Antropología and Instituto Nacional de Antropología y Pensamiento Latinoamericano, Buenos Aires.

Barberena, R., C. Méndez, F. Mena, and O. Reyes. 2011. Endangered Species, Archaeology and Stable Isotopes: Huemul (*Hippocamelus bisulcus*) Isotopic Ecology in Central-Western Patagonia (South America). *Journal of Archaeological Science* 38:2313-2323. DOI: 10.1016/j.jas.2011.04.008.

Belardi, J. B., and J. Gómez-Otero. 1998. Anatomía Económica del Huemul (*Hippocamelus bisulcus*): Una Contribución a la Interpretación de las Evidencias Arqueológicas de su Aprovechamiento en Patagonia. *Anales del Instituto de la Patagonia, Serie Ciencias Humanas* 26: 195–207.

Borrero, L. A. 1980. Arqueología del Seno de la Última Esperanza (Magallanes, Chile). *Actas del Congreso Nacional de Arqueología Uruguaya*, pp. 11–16. Colonia del Sacramento.

Borrero, L. A. 1994-1995. Arqueología de la Patagonia. *Palimpsesto. Revista de Arqueología* 4:9–69.

Borrero, L. A. 1999. The Prehistoric Exploration and Colonization of Fuego-Patagonia. *Journal of World Prehistory* 13:321–355. DOI:10 23/A:1022341730119

Borrero, L. A. 2013. Estrategias de Caza en Fuego-Patagonia. *Comechingonia. Revista de Arqueología* 17:11–26.

Borrero, L. A., and K. Borrazzo. 2011. La Geografía Cultural del Sudoeste de Patagonia Continental. In *Bosques, Montañas y Cazadores. Investigaciones Arqueológicas en Patagonia Meridional*, edited by L. A. Borrero and K. Borrazzo, pp. 7–36. CONICET-IMHICIHU, Buenos Aires, Argentina.

Borrero, L. A., F. M. Martin, and A. Prieto. 1997. La Cueva Lago Sofía 4, Última Esperanza, Chile: Una Madriguera de Felino del Pleistoceno Tardío. *Anales del Instituto de la Patagonia, Serie Ciencias Humanas* 25:103–122.

Borrero, L. A., and M. Massone. 1994. Arqueología de los Aleros de Dos Herraduras, Última Esperanza, Chile. *Revista del Museo de Historia Natural de San Rafael* 14:288–289.

Braje, T., and T. C. Rick, eds. 2011. *Human Impacts on Seals, Sea Lions and Sea Otters. Integrating Archaeology and Ecology in the Northeast Pacific*. University of California Press, Berkeley, CA.

Cabrera, A. 1957. Catálogo de los Mamíferos de América del Sur. *Revista del Museo Argentino de Ciencias Naturales "Bernardino. Rivadavia"* IV:732.

Carballo Marina, F., L, M. Manzi, P. A. Campán, J. B. Belardi, P. Tiberi, A. Manero, and J. L. Sáenz. 2008. Distribución del Registro Arqueológico en la Cuenca del Río Gallegos (Provincia de Santa Cruz): Línea de Base y Aporte a la Preservación del Patrimonio. In *Arqueología del Extremo Sur del Continente Americano. Resultados de nuevos proyectos*, edited by L. A. Borrero and N. V. Franco, pp. 175–225. CONICET, Buenos Aires.

Cardich, A., and L. Miotti. 1983. Recursos Faunísticos en la Economía de los Cazadores-Recolectores de Los Toldos (Provincia de Santa Cruz). *Relaciones de la Sociedad Argentina de Antropología* 16:269–273.

Ceballos, R. 1982. El Sitio Cuyín Manzano. *Serie de Estudios y Documentos* 9:1–66.

Consejo Asesor Regional Patagónico de Fauna Silvestre (CARPFS). 1995. *Recalificación del Estado de Conservación de la Fauna Silvestre Argentina-Región Patagónica*. Consejo Asesor Regional Patagónico de Fauna Silvestre. Secretaría de Recursos Naturales y Ambiente Humano.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). 2003. Appendix I. [web page]. http://www.cites.org/eng/app/appendices.php. Accessed on 10/28/2013.

Convention on the Conservation of Migratory Species of Wild Animals (CMS). 2012. Appendix I. [web page]. http://www.cms.int/sites/default/files/instrument/appendices_e.pdf. Accessed on 07/21/2014.

Cordero, J. A. 2010. Explotación Animal en el Holoceno del Noroeste de la Patagonia Argentina. Cambios Climáticos y Transformaciones del Comportamiento Humano: Una Primera Aproximación. Unpublished Doctoral Dissertation, Facultad de Filosofía y Letras, Universidad de Buenos Aires. Buenos Aires, Argentina.

Cruz, I. 2001. Los Pingüinos Como Presas Durante el Holoceno. Información Biológica, Fósil y Arqueológica para Discutir su Disponibilidad en el Sur de Patagonia. *Archaeofauna* 10:99–112.

Cruz, I., A. S. Muñoz, and M. S. Caracotche. 2010. Un Artefacto en Asta de Huemul (*Hippocamelus bisulcus*) en Depósitos Arqueológicos Costeros. Implicaciones Para la Movilidad Humana y la Distribución de la Especie. *Magallania* 38:289–296.

Cruz, I., A. S. Muñoz; B. Ercolano; C. R. Lemaire, and A. Pretto 2015. Apostaderos de Pinnípedos en Punta Entrada (Santa Cruz, Patagonia Argentina). Explotación Humana e Historia Natural. *Magallania* 43:1–18.

De Nigris, M. E. 2004a. Guanaco and Huemul in Patagonian Hunter-Gatherers Diet. In *Zooarchaeology of South America*, edited by G. L. Mengoni Goñalons, pp. 11–37. British Archaeological Reports, International Series 1298. Archaeopress, Oxford.

De Nigris, M. E. 2004b. *El Consumo en Grupos Cazadores Recolectores. Un Ejemplo Zooarqueológico de Patagonia Meridional*. Sociedad Argentina de Antropología, Buenos Aires.

De Nigris, M. E. 2007. Nuevos Datos, Viejas Colecciones: los Conjuntos Óseos de Cerro Casa de Piedra Cueva 5 (Parque Nacional

Perito Moreno, Santa Cruz). *Intersecciones en Antropología* 8:253–264.

De Nigris, M. E., A. Lacrouts, and S. Tecce. 2010. Nuevos Datos Zooarqueológicos de las Ocupaciones Tempranas de Cerro Casa de Piedra Cueva 7 (Santa Cruz, Argentina). In *Zooarqueología a Principios del Siglo XXI: Aportes Teóricos, Metodológicos y Casos de Estudio*, edited by M. A. Gutiérrez, M. De Nigris, P. M. Fernández, M. Giardina, A. F. Gil, A. Izeta, G. Neme, and H. D. Yacobaccio, pp. 209–217. Ediciones del Espinillo, Buenos Aires.

De Nigris, M, and S. Tecce. 2013. Estudios Zooarqueológicos del Lago Pueyrredón-Cochrane (Santa Cruz, Argentina). In *Tendencias Teórico-Metodológicas y Casos de Estudio en la Arqueología de la Patagonia*, edited by A. F. Zangrando, R. Barberena, A. Gil, G. Neme, M. Giardina, L. Luna, C. Otaola, S. Paulides, L. Salgán, and A. Tivoli, 335–342. Museo de Historia Natural de San Rafael, San Rafael, Argentina.

Díaz, N. I. 1990. *El Huemul: Antecedentes Históricos*. Edipubli S. A., Buenos Aires.

Díaz, N. I. 1993. Changes in the Range Distribution of *Hippocamelus bisulcus* in Patagonia. *Zeitschrift für Säugetierkunde* 58:344–351.

Díaz, N. I. 2000. El Huemul (*Hippocamelus bisulcus* Molina, 1782): Una Perspectiva Histórica. In *El Huemul Patagónico, un Misterioso Cérvido al Borde de la Extinción*, edited by N. I. Díaz and J.M. Smith-Flueck, pp. 1–32. LOLA, Buenos Aires.

Díaz G. B., and R. A. Ojeda eds., 2000. *Libro Rojo de los Mamíferos Amenazados de la Argentina*. SAREM, Buenos Aires.

Díaz, N. I., and J. M. Smith-Flueck, eds. 2000. *El Huemul Patagónico, un Misterioso Cérvido al Borde de la Extinción*. LOLA, Buenos Aires.

Emperaire, J., Laming-Emperaire A., and H. Reichlen. 1963. La Grotte Fell e Autres Sites de la Région Volcanique de la Patagonie Chilienne. *Journal de la Societé des Américanistes* 52:167–254.

Fernández, P. M. 2008. Taphonomy and Zooarchaeology in the Neotropics: A View from Northwestern Patagonian Forest and Steppe. *Quaternary International* 180:63–74. DOI:10.1016/j.quaint.2007.08.012.

Fernández, P. M. 2010. *Cazadores y Presas. 3500 Años de Interacción Entre Seres Humanos y Animales en el Noroeste de Chubut*. Fundación de Historia Natural Félix de Azara, Buenos Aires.

Fernández, P. M. 2011. Análisis Zooarqueológico de los Materiales Óseos Recuperados en el Sitio Alero del Shaman (Parque Nacional Los Alerces). Unpublished technical report to Delegación Regional Patagonia, Administración de Parques Nacionales, Argentina.

Fernández, P. M., and A. I. Forlano. 2009. Tafonomía, Arqueología y Conservación de Especies Silvestres: el Caso de los Huemules (*Hippocamelus bisulcus*) de Lago La Plata (Chubut). In *Arqueología de la Patagonia: Una Mirada Desde el Último Confín*, edited by M. Salemme, F. Santiago, M. Álvarez, E. Piana, M. Vázquez and E. Mansur, pp. 743–758. Editorial Utopías, Ushuaia, Argentina.

Fernández, P. M., M. Carballido Calatayud, C. Bellelli, and M. M Podestá. 2013. Tiempo de Cazadores. Cronología de las Ocupaciones Humanas en el Valle del Río Manso inferior (Río Negro). In *Tendencias Teórico-Metodológicas y Casos de Estudio en la Arqueología de Patagonia*, edited by A. F. Zangrando, R. Barberena, A. Gil, G. Neme, M. Giardina, L. Luna, C. Otaola, S. Paulides, L. Salgán, and A. Tivoli, pp. 167–175. Buenos Aires: Museo de Historia Natural de San Rafael, Sociedad Argentina de Antropología e Instituto Nacional de Antropología y Pensamiento Latinoamericano.

Flueck, W. T., and J. A. M. Smith-Flueck. 2012. Huemul Heresies: Beliefs in Search of Supporting Data. 1. Historical and Zooarchaeological Considerations. *Animal Production Science* 52:685–693. DOI: 10.1071/AN11344.

Frazier, J. 2007. Sustainable Use of Wildlife: The View from Archaeozoology. *Journal for Nature Conservation* 15:163–173. DOI:10.1016/j.jnc.2007.08.001.

Frazier, J. 2010. The Call of the Wild. In *The Archaeology of Anthropogenic Environments*, edited by R. M. Dean, 341–369. Occasional Paper No. 37, Center for Archaeological Investigations, University at Carbondale, Southern Illinois.

Frid, A. 1994. Observations on Habitat Use and Social Organization of a Huemul *Hippocamelus bisulcus* Coastal Population in Chile. *Biological Conservation* 67:13–19. DOI: 10.1016/0006-3207(94)90003-5.

Fuentes Mucherl, F., and F. Mena Larraín. 2010. Estacionalidad y Movilidad en Cazadores-Recolectores: el Caso de Cueva Las Guanacas (Valle del Río Ibáñez, Aisén, Chile). *Werkén* 13:359–370.

Fuentes Mucherl, F., F. Mena, J. Blanco, and C. Contreras. 2012. Excavaciones en Alero

Gianella, Curso Medio del Valle de Chacabuco (Andes Centro Patagónicos). *Magallania* 40:259–265.

Glade, A. A., ed. 1988. *Libro Rojo de los Vertebrados Terrestres de Chile*. Corporación Nacional Forestal (CONAF), Santiago de Chile.

Hajduk, A., and A. Albornoz. 1999. El Sitio Valle Encantado 1. Su Vinculación con Otros Sitios: Un Esbozo de la Problemática Local Diversa del Nahuel Huapi. In *Soplando en el Viento. Actas de las Terceras Jornadas de Arqueología de la Patagonia*, pp. 371–391. Universidad Nacional del Comahue e Instituto Nacional de Antropología y Pensamiento Latinoamericano Neuquén-Buenos Aires.

Hajduk, A., A. Albornoz, M. Lezcano, and P. Arias Cabral. 2012. The First Occupations of the El Trébol Site during the Pleistocene-Holocene Transition (Nahuel Huapi Lake, Patagonia, Argentina). In *SOUTHBOUND Late Pleistocene Peopling of Latin America. Current Research in the Pleistocene, Special Edition*, edited by L. Miotti, M. Salemme, N. Flegenheimer and T. Goebel, pp. 117–120. Texas A&M University, Texas.

Iglesias, V., C. Whitlock, M. M. Bianchi, G., Villarosa, and V. Outes. 2012. Holocene Climate Variability and Environmental History at the Patagonian Forest/Steppe Ecotone: Lago Mosquito (42°29′37.89′′S, 71°24′14.57′′W) and Laguna del Cóndor (42°20′47.22′′S, 71°17′07.62′′W). *The Holocene* 22:1297–1307. DOI: 10.1177/0959683611427330.

International Union for Conservation of Nature (IUCN). 2014. IUCN Red List of Threatened Animals [web page]. http://www.iucnredlist.org/search. Accessed on 09/03/2014.

Kay, C., and R. Simmons, eds. 2002. *Wilderness and Political Ecology. Aboriginal Influences and the Original State of Nature*. The University of Utah Press, Salt Lake City, UT.

Labarca, R., F. Fuentes, and F. Mena. 2008. Los Conjuntos Faunísticos Pleistocénicos de Cueva Las Guanacas (Región de Aisén, Patagonia chilena): Alcances Taxonómicos y Tafonómicos. *Magallania* 36:123–142.

Legoupil, D. 1997. Bahia Colorada (ile d'Englefield). *Les Premières Chasseurs de Mammifères Marins de Patagonie Australe*. Ministère des Affaires Etrangères, Editions Recherche sur les Civilisations, Paris.

Legoupil, D. 2000. El Sistema Socioeconómico de los Nómades del Mar de Skyring (Archipiélago de Patagonia). *Anales del Instituto de la Patagonia, Serie Ciencias Humanas* 28:81–119.

Legoupil, D. P. Bearez, S. Lepetz, M. San Roman, and K. Salas. 2007. De la Pesca a la Caza: Evolución Económica del Sitio Stuven 1, al Sur del Golfo de Penas. In *Arqueología de Fuego-Patagonia. Levantando Piedras, Desenterrando Huesos… y Develando Arcanos*, edited by F. Morello, M. Martinic, A. Prieto and G. Bahamonde, pp. 279–294. Ediciones CEQUA, Punta Arenas, Chile.

Lezcano, M. J., A. Hajduk, and A. M. Albornoz. 2010. El Menú a la Carta en el Bosque ¿Entrada o Plato Fuerte?: Una Perspectiva Comparada Desde la Zooarqueología del Sitio El Trébol (Lago Nahuel Huapi, Pcia. de Río Negro). In *Zooarqueología a Principios del Siglo XXI: Aportes Teóricos, Metodológicos y Casos de Estudio*, edited by M. A. Gutiérrez, M. De Nigris, P. M. Fernández, M. Giardina, A. F. Gil, A. Izeta, G. Neme and H. D. Yacobaccio, pp. 243–257. Ediciones del Espinillo, Buenos Aires.

L'Heureux, G. L. 2008. *El Estudio Arqueológico del Proceso Coevolutivo Entre las Poblaciones Humanas y las Poblaciones de Guanaco en Patagonia Meridional y Norte de Tierra del Fuego*. British Archaeological Reports, International Series 1751. Archaeopress, Oxford.

Lyman R. L. 2012. Applied Zooarchaeology: History, Value and Use. In *Conservation Biology and Applied Zooarchaeology*, edited by Steve Wolverton and R. Lee Lyman, pp. 208–232. The University of Arizona Press, Tucson, AZ.

Lyman R. L., and K. P. Cannon, eds. 2004. *Zooarchaeology and Conservation Biology*. The University of Utah Press. Salt Lake City, UT.

Mancini, M. V. 2007. Cambios Paleoambientales en el Ecotono Bosque-Estepa: Análisis del Sitio Cerro Casa de Piedra 7, Santa Cruz (Argentina). In *Arqueología de Fuego-Patagonia. Levantando Piedras, Desenterrando Huesos...y Develando Arcanos*, edited by F. Morello, M. Martinic, A. Prieto and G. Bahamonde, pp. 89–93. Ediciones CEQUA. Punta Arenas, Chile.

Martin, F. M. 2013. *Tafonomía y Paleoecología de la Transición Pleistoceno-Holoceno en Fuego Patagonia. Interacción entre Humanos y Carnívoros y su Importancia como Agentes de Formación del Registro Fósil*. Ediciones de la Universidad de Magallanes, Punta Arenas, Chile.

Marín, J. C., V. Varas, A. R. Vila, R. López, P. Orozco-terWenge, and P. Corti. 2013. Refugia in Patagonian Fjords and the Eastern Andes during the Last Glacial Maximum Revealed by Huemul (*Hippocamelus bisulcus*) Phylogeographical Patterns and Genetic Diversity. *Journal of Biogeography* 40:2285–2298. DOI:10.1111/jbi.12161.

Massone, M. 1984. Paraderos Tehuelches y Prototehuelches en la Costa del Estrecho de Magallanes (Una Aproximación Teórica y Metodológica). *Anales del Instituto de la Patagonia, Serie Ciencias Sociales* 15:27–42.

Mena, F. 1992. Mandíbulas y Maxilares: Un Primer Acercamiento a los Conjuntos Arqueofaunísticos del Alero Fontana (RI-22; XI Región). *Boletín del Museo Nacional de Historia Natural de Chile* 43:179–191.

Mena, F., and D. Jackson. 1991. Tecnología y Subsistencia en Alero Entrada Baker, Región de Aysén, Chile. *Anales del Instituto de la Patagonia, Serie Ciencias Sociales* 20:169–203.

Mena, F., H. Velásquez, V. Trejo, and J. C. Torres-Mura. 2004. Aproximaciones Zooarqueológicas al Pasado de Aysén Continental (Patagonia Central Chilena). In *Zooarchaeology of South America*, edited by G. L. Mengoni Goñalons, pp. 99–120. British Archaeological Reports, International Series 1298. Archaeopress, Oxford.

Méndez M., C., R. Barberena, O. Reyes B., and A. Nuevo Delaunay. 2014. Isotopic Ecology and Human Diets in the Forest–Steppe Ecotone, Aisén Region, Central-Western Patagonia, Chile. *International Journal of Osteoarchaeology* 24:187–201. DOI: 10.1002/oa.2337.

Méndez M., C., O. Reyes B., V. Trejo, and A. Nuevo Delaunay. 2013. Ocupación Humana de Alto Río Simpson, Aisén (Margen Occidental de la Estepa de Patagonia Central) Como Caso Para Medir la Intensidad de Uso de Espacios. In *Tendencias Teórico-Metodológicas y Casos de Estudio en la Arqueología de Patagonia*, edited by A. F. Zangrando, R. Barberena, A. Gil, G. Neme, M. Giardina, L. Luna, C. Otaola, S. Paulides, L. Salgán and A. Tivoli, pp. 193–201. Museo de Historia Natural de San Rafael, Sociedad Argentina de Antropología e Instituto Nacional de Antropología y Pensamiento Latinoamericano. Buenos Aires.

Morello, F., J. Torres, I. Martínez, K. Rodríguez, M. Arroyo-Kalin, C. French, V. Sierpe, and M. San Román. 2012. Arqueología de la Punta Santa Ana: Reconstrucción de Secuencias de Ocupación de Cazadores-Recolectores Marinos del Estrecho de Magallanes, Patagonia Austral, Chile. *Magallania* 40:129–149.

Muñoz, A. S. 1997. Explotación y Procesamiento de Ungulados en Patagonia Meridional y Tierra del Fuego. *Anales del Instituto de la Patagonia, Serie Ciencias Sociales* 25:201–222.

Muñoz, A. S. 2011. Human-Pinniped Relationships in Southern Patagonia. Current Issues and Future Research Agenda. In *Trekking the Shore: Changing Coastlines and the Antiquity of Coastal Settlement*, edited by N. F. Bicho, J. A. Haws and L. G. Davis. pp. 305–332. Springer, New York.

Nami, H. G. 1987. Cueva del Medio: Perspectivas Arqueológicas para la Patagonia Austral. *Anales del Instituto de la Patagonia, Serie Ciencias Sociales* 17:71–106.

Nami H., and A. Menegaz. 1991. Cueva del Medio: Aportes Para el Conocimiento de la Diversidad Faunística Hacia el Pleistoceno-Holoceno en Patagonia Austral. *Anales del Instituto de la Patagonia, Serie Ciencias Sociales* 20:117–132.

Pérez, A. E., and D. A. Batres. 2008. Los Otros Cazadores. Explotación de Cérvidos en la Localidad Arqueológica Meliquina, Parque Nacional Lanín, República Argentina. In *Zooarqueología hoy. Encuentros Hispano-Argentinos*, edited by J. C. Díez, pp. 89–107. Universidad de Burgos, Burgos, Spain.

Peri, P. L., S. Ormaechea, H. Pastore, and E. Ramilo. 2013. Distribución del Huemul en el Bosque Nativo de Santa Cruz. In *Actas II Jornadas Forestales de Patagonia Sur, 2° Congreso Internacional Agroforestal Patagónico*, pp. 17. Ediciones INTA, El Calafate, Argentina.

Perrota, E., and I. Pereda. 1987. Nuevos Datos Sobre el Alero IV del Tromen (Dto. Picunches, Prov. de Neuquén). In *Comunicaciones. Primeras Jornadas de Arqueología de la Patagonia, Serie Humanidades* 2, pp. 249–258. Gobierno de la Provincia del Chubut, Rawson, Argentina.

Plan Nacional de Conservación y Recuperación del Huemul (*Hippocamelus bisulcus*) en Argentina. 2002. Secretaría de Ambiente y Desarrollo Sustentable de la Nación. [web page]. http://www.ambiente.gov.ar/archivos/web/Phuemul/File/Plan_nacional_huemul.pdf. Accessed on 07/21/2014.

Plan Nacional para la Conservación del Huemul del Sur *Hippocamelus bisulcus*, Molina, 1782, en Chile 2008-2012. Servicio Agrícola y

Ganadero, Corporación Nacional Forestal, Comisión Nacional del Medioambiente, Chile. Available at http://biblioteca.sag.gob.cl/DataFiles/278-2.pdf. Accessed on July 21, 2014.

Podestá, M. M., C. Bellelli, P. Fernández, V. Scheinsohn, M. Carballido Calatayud, A. Forlano, P. Marchione, E. Tropea, A. Vasini, J. Alberti, M. Gallo, and G. Moscovici Vernieri. 2007. Arqueología del Valle del Río Epuyén (El Hoyo, Chubut, Patagonia Argentina). In *Arqueología de Fuego-Patagonia. Levantando Piedras, Desenterrando Huesos...y Develando Arcanos*, edited by F. Morello, M. Martinic, A. Prieto and G. Bahamonde, pp. 427–442. Ediciones CEQUA. Punta Arenas, Chile.

Povilitis, A. 1978. The Chilean Huemul Project - A Case History (1975–76). In *Threatened deer; proceedings of a Working Meeting of the Deer Specialist Group of the Survival Service Commission on the IUCN Threatened Deer Programme and a Dossier on the planning of restoration programmes for threatened mammals with special reference to deer, Longview (USA) 26 Sep - 1 Oct 1977* pp. 109–128. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland.

Prieto, A. 1988. Cazadores-Recolectores del Istmo de Brunswick. *Anales del Instituto de la Patagonia, Serie Ciencias Sociales* 18:113–131.

Redford, K. H., and J. F. Eisenberg. 1992. *Mammals of the Neotropics. The Southern Cone, Volume 2, Chile, Argentina, Uruguay, Paraguay*. The University of Chicago Press, Chicago and London.

Rick, T., and J. M. Earlandson, eds. 2008. *Human Impacts on Ancient Marine Ecosystems: A global Perspective*. University of California Press, Berkeley.

Rindel, D. 2008. Arqueología de Momentos Tardíos en el Noroeste de la Provincia de Santa Cruz (Argentina): Una Perspectiva Faunística. Unpublished Doctoral Dissertation Facultad de Filosofía y Letras, Universidad de Buenos Aires, Buenos Aires, Argentina.

San Román Bontes, M. 2013. Sitios Arqueológicos de la Isla Englefield, Mar de Otway: Nuevas Evidencias de Discontinuidad Cultural en el Proceso de Poblamiento Marítimo de Patagonia Meridional. In *Tendencias Teórico Metodológicas y Casos de Estudio en la Arqueología Patagónica*, edited by A. F. Zangrando, R. Barberena, A. Gil, G. Neme, M. Giardina, L. Luna, C. Otaola, S. Paulides, L. Salgán, and A. Tivoli, pp. 523–534. Museo de Historia Natural de San Rafael, San Rafael, Argentina.

San Román, M., F. Morillo and A. Prieto. 2002. Nuevos Antecedentes Sobre la Explotación de Recursos Faunísticos en el Mar de Otway y Canales Adyacentes. *Anales del Instituto de la Patagonia, Serie Ciencias Humanas* 30: 147–154.

Scartascini F. L., and A.V. Volpedo. 2013. White Croaker (*Micropogonias furnieri*) Paleodistribution in the Southwestern Atlantic Ocean. An Archaeological Perspective. *Journal of Archaeological Science* 40:1059–1066. DOI: 10.1016/j.jas.2012.08.032.

Serret, A. 2001. *El Huemul: Fantasma de la Patagonia*. Zagier & Urruty, Ushuaia, Argentina.

Sierpe V., A. Prieto, C. Huidobro, and C. Stern. 2009. Excavaciones Arqueológicas en el Sitio "Alero Quemado" (Última Esperanza, Magallanes, Chile). *Magallania* 37:177–189.

Silveira, M. J. 1979. Análisis e Interpretación de los Restos Faunísticos de la Cueva Grande del Arroyo Feo. *Relaciones de la Sociedad Argentina de Antropología* 13:229–253.

Silveira, M. 1982. Alero Las Mellizas. *Patagonia Documental* 8:15–23.

Silveira, M. J., 1996. Alero Los Cipreses. En *Arqueología. Solo Patagonia. Ponencias de las Segundas Jornadas de Arqueología de la Patagonia*, edited by J. G. Otero, pp. 107–118. CENPAT-CONICET, Puerto Madryn, Argentina.

Silveira, M. J., 1999. El Alero Lariviére: Un Sitio en el Bosque Septentrional Andino (Departamento Los Lagos, Provincia del Neuquén, Argentina). In *Soplando en el viento. Actas de las III Jornadas de Arqueología de la Patagonia*, pp. 83–92. Universidad Nacional del Comahue and Instituto Nacional de Antropología y Pensamiento Latinoamericano, Neuquén-Buenos Aires.

Smith-Flueck, J. 2000. La Situación Actual del Huemul Patagónico. In *El Huemul Patagónico: un Misterioso Cérvido al Borde de la Extinción*, edited by, N. I. Díaz and J. Smith-Flueck, pp. 67–154. LOLA, Buenos Aires.

Smith-Flueck, J., and W. T. Flueck. 2001. Problemas de Conservación Para una Concentración Inusual de Huemules (*Hippocamelus bisulcus*) en la Zona del Lago La Plata, Provincia de Chubut. *Mastozoología Neotropical* 8:72–83.

Tessone, A., P. M. Fernández, C. Bellelli, and H. Panarello. 2014. $\delta^{13}C$ and $\delta^{15}N$ Characterization of Modern Huemul (*Hippocamelus bi-*

sulcus) from the Patagonian Andean Forest. Scope and Limitations of Their Use as a Geographical Marker. *International Journal of Osteoarchaeology* 24:219–230. DOI: 10.1002/oa.2336.

Veblen, T. T., C. Donoso, T, Kitzberger, and A. J. Robertus. 1996. Ecology of Southern Chilean and Argentinian Nothofagus Forests. In *The Ecology and Biogeography of Nothofagus Forests*, edited by T. T. Veblen, R. S. Hill, and J. Read, pp. 293–353, Yale University Press, New Haven and London.

Velásquez, H., and L. Adán. 2004. Marifilo I: Evidencias Arqueofaunísticas para Entender las Relaciones Hombre y Bosques Templados en los Sistemas Lacustres Cordilleranos del Centro-Sur de Chile. *In Contra Viento y Marea. Arqueología de Patagonia,* edited by M. T. Civalero, P. M. Fernández, and A. G. Guráieb, pp. 507–519. Instituto Nacional de Antropología y Pensamiento Latinoamericano y Sociedad Argentina de Antropología, Buenos Aires.

Velásquez M., H., and F. Mena L. 2006. Distribuciones Óseas de Ungulados en la Cueva Baño Nuevo-1 (XI Región, Chile): Un Primer Acercamiento. *Magallania* 34:91–106.

Velásquez, H., and V. Trejo, 2005. Alero Fontana. Aprovechamiento Específico del Huemul. In *Actas del XVI Congreso Nacional de Arqueología Chilena*, pp. 557–566. Ediciones Escaparate, Concepción.

Vila, A. R., N. I. Díaz, H. Pastore, R. López, and R. Faúndez. 2005. *Distribución Pasada y Actual del Huemul: Escenarios de Cambio Potencial*. Wildlife Conservation Society, Codeff and Fundación Vida Silvestre Argentina technical publication. San Carlos de Bariloche and Concepción, Argentina.

Vila, A. R., R. López, H. Pastore, R. Faúndez, and A. Serret. 2006. Current Distribution and Conservation of the Huemul (*Hippocamelus bisulcus*) in Argentina and Chile. *Mastozoología Neotropical* 13:263–269.

Vila, A. R., C. E. Saucedo Galvez, D. Aldridge, E. Ramilo, and P. Corti González. 2010. South Andean Huemul *Hippocamelus bisulcus* (Molina 1782). In *Neotropical cervidology: Biology and Medicine of Latin American Deer*, edited by J. M. B. Duarte and S. González, pp. 89–100. Jaboticabal, Funep and Gland and IUCN. Brazil and Switzerland.

Walker, M. J., C. M., Berkelhammer., S. Bjorck, L. C. Cwynar, D. A. Fisher, A. J. Long, J. J. Lowe, R. M. Newnham, S. O. Rasmussen, and H. Weiss. 2012. Formal Subdivision of the Holocene Series/Epoch: A Discussion Paper by a Working Group of INTIMATE (Integration of Ice-Core, Marine and Terrestrial Records) and the Subcommission on Quaternary Stratigraphy (International Commission on Stratigraphy). *Journal of Quaternary Science* 27: 649–659. DOI: 10.1002/jqs.2565.

Wolverton, S., and R. L. Lyman. 2012. *Conservation Biology and Applied Zooarchaeology*. The University of Arizona Press, Tucson.

Zangrando, A. F., and M. P. Martinoli. 2011. Fish Ecology, Conservation Biology, and New Insights from the Archaeological Evidence in the Beagle Channel (Tierra del Fuego, Argentina). In *Fish Ecology*, edited by S. P. Dempsey, pp. 131–150. Nova Science Publishers, New York.