frontiers | Frontiers in Earth Science

TYPE Review
PUBLISHED 16 August 2022
DOI 10.3389/feart.2022.946732

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Quaternary Science, Geomorphology and Paleoenvironment, a section of the journal Frontiers in Earth Science

RECEIVED 17 May 2022
ACCEPTED 14 July 2022
PUBLISHED 16 August 2022

CITATION
Reyes O, Méndez C, San Román M, Belmar C and Nuevo-Delaunay A (2022), Biogeographic barriers in the circulation and interaction of hunter-gatherer marine fishers: The role of the Taitao Peninsula and the Gulf of Penas (~ 47°S) in the differentiation of the cultural trajectories of West Patagonia. *Front. Earth Sci.* 10:946732. doi: 10.3389/feart.2022.946732

Biogeographic barriers in the circulation and interaction of hunter-gatherer marine fishers: The role of the Taitao Peninsula and the Gulf of Penas (~ 47°S) in the differentiation of the cultural trajectories of West Patagonia

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Archaeological research on the settlement of the Patagonian archipelago in the extreme South of South America by groups of hunter-gatherers, fishers or canoeists involves both an understanding of the various modes of subsistence and the possible flows of goods and human interactions that could have occurred from the middle Holocene in this extensive territory. Therefore, the study of how the geographical barriers occurring in Western Patagonia operated is fundamental because it allows to evaluate and discuss not only the characteristics and particularities of the occupation of the archipelagic territory but also its role in the circulation and contact of canoe populations, their relevance in the settlement and occupation of the Patagonian archipelago and their possible impact on the differentiation of the cultural trajectories of the canoe groups that inhabited it. We review and discuss the archaeological record of the areas adjacent to the geographical barrier formed by the Taitao Peninsula and the Northeastern and Southern coast of the Gulf of Penas (47°S) in West Patagonia. This extensive geographical area acted as a permeable barrier, conditioning, over time, maritime mobility and circulation routes, channeling or limiting the access and contact between the canoe groups on both sides.

KEYWORDS

West Patagonian channels, Holocene, biogeographic barriers, marine hunter-gatherer-fishers, cultural trajectories

1 Introduction

In this Review, we discuss the archaeological evidence surveyed in the areas adjacent to the Taitao Peninsula/Gulf of Penas (47°S), both in the Chonos archipelago to the North (Porter, 1993; Stern and Curry, 1995; Reyes et al., 2007; Reyes et al., 2015; Reyes et al., 2019a; Reyes et al., 2019b; Reyes, 2020) and in the central archipelagos that extend toward the Southern portion of the Patagonian archipelago (Laming-Emperaire, 1972; Curry, 1991; Legoupil and Sellier, 2004; Legoupil et al., 2007; San Román and Morello, 2007) (Figure 1). We evaluate the differences of the archaeological record that indicate the continuities and divergences observed in the cultural trajectories of these Patagonian canoe groups (*sensu* Fitzhugh, 1997) and the particular conditions for human circulation. For this reason, and to circumscribe the discussion, we tangentially approach part of the archaeological discussion of the dynamics of human occupation in the geographical extremes of the Patagonian archipelago. A future stage of research includes the archaeological characterization of this extensive continental and insular territory through surveys and archaeological excavations, testing the concepts and discussions of this Review.

When considering the concept of geographic barriers with regard to hunter-gatherers (e.g., Veth, 1989; Rockman and Steele, 2003; Borrero, 2004; Borrero, 2018; Barberena, 2008; Friesen and O'Rourke, 2019) and their influence on archaeological characteristics and on the geographic distribution of human occupations, we do not assume that this barrier is insurmountable nor that the mere presence *defines* the occupation of a territory and its cultural trajectories (David and Thomas, 2016). Rather, we consider that such barriers correspond to interpretations of distributional limits of specific processes (Rosen, 1988). The used spaces are defined qualitatively and quantitatively according to the presence of these barriers and the temporal context in which they could or could not be overcome (e.g., Neme and Gil, 2008; Borrero and Borrazzo, 2011; McNiven, 2015; Lovis and Whallon, 2016; Barberena et al., 2017; Franco et al., 2018) in interactions with the environment and with regard to the structure of available resources (Kelly, 1983; Kelly, 1995; Binford, 1990, Binford, 2001; Bailey, 2004). In this case, the study of these barriers lies in understanding how marine fisher hunter-gatherers innovate to overcome such barriers and what subsistence and technological strategies were used and since when (e.g., Llagostera, 1982; Mandryk, 1993; Erlandson, 2001; Legoupil et al., 2011; Orquera et al., 2011; San Román, 2016; Zangrando et al., 2016) and how they define limits or not in the distribution of the archaeological record on multiple temporal and spatial scales (*sensu* Foley, 1981; Dincauze, 2000). In addition, such studies allow identifying particularities with respect to adjacent areas that are equally occupied, in what is understood as a hierarchy in the human use of various occupied spaces (Borrero, 1989; Borrero, 1994; Belardi, 2003; Borrero, 2004; Keegan et al., 2008), understanding archaeological sites as "distributed long-term observation networks of the past", making it possible to record the conditions of ecosystems and their period of time during human interactions (Sandweiss et al., 2020: 8276).

The movement of human groups can be understood through the flow of materials and resources (Gamble, 1999). Stable isotopes analysis inform on the dietary composition of individuals (e.g., Zangrando et al., 2004; Borrero and Barberena, 2006; Barberena, 2008). These movements consider routes built under social and technological variables (Gamble, 1996; Gamble, 1999; Pallo, 2011; Pallo and Borrero, 2015) in addition to biogeographic variables that allow or limit access to other regions (Borrero and Borrazzo, 2011; Borrero, 2018) or discourage access (Cameron and Tomka, 1993; Mandryk, 1993). However, we understand the settlement of a region as a concept that integrates different moments, including the initial occupation of an unpopulated area by human groups (Borrero, 2004). These moments can be understood as phases that are characterized by different articulations between settlement systems and types of sites, mobility, subsistence, and technology, among other operational parameters, which allow us to discern a human process of occupation of a given space. This model is also based on the logic of maintaining active social networks (Whallon, 2006) and a hierarchy of spaces within a landscape (*sensu* Belardi, 2003) related to the concrete distribution of usable resources within the habitat of a human group (e.g., Binford, 1980; Binford, 1982; Kelly, 1983; Kelly, 1995; Erlandson, 2001; Fitzpatrick et al., 2016). In this way, the spaces used depend on this pattern of distribution, on the mobility of resources, and the biogeographic characteristics of an area (Butzer, 1971; McNiven, 2015; Borrero, 2018), in a process of continuous settlement (Borrero, 1989-90; Borrero, 1999; Borrero, 2004; Borrero and Franco, 1997) and where groups that occupy the same region may show a greater probability of sharing similar cultural traits with each other than with groups that live more distant (Miller-Atkins and Premo, 2018).

This extensive biogeographic barrier formed by the Taitao Peninsula and the Gulf of Penas also defines the coastal maritime circulation of human groups. This would be from and to the North and South of the Patagonian channels, in complex navigation crossings influenced by cold fronts associated with the Southern Westerlies system that bring precipitation to Southernmost western part of South America (Garreaud et al., 2013) and the low bathymetries that cause intense and permanent waves with Pacific groundswells. Navigation with canoes and portages or "Indian steps", that reduce distances and risks between extensive marine areas (Borrero, 1997; Prieto et al., 2000; Coppinger, 2007; Legoupil et al., 2011; Pallo, 2011; Reyes, 2020), undoubtedly constitute subsistence strategies that address geographical barriers (e.g., García, 1889; Byron, 1901). These technological solutions and logistical displacements enabled the transfer and contact of groups while maintaining active social

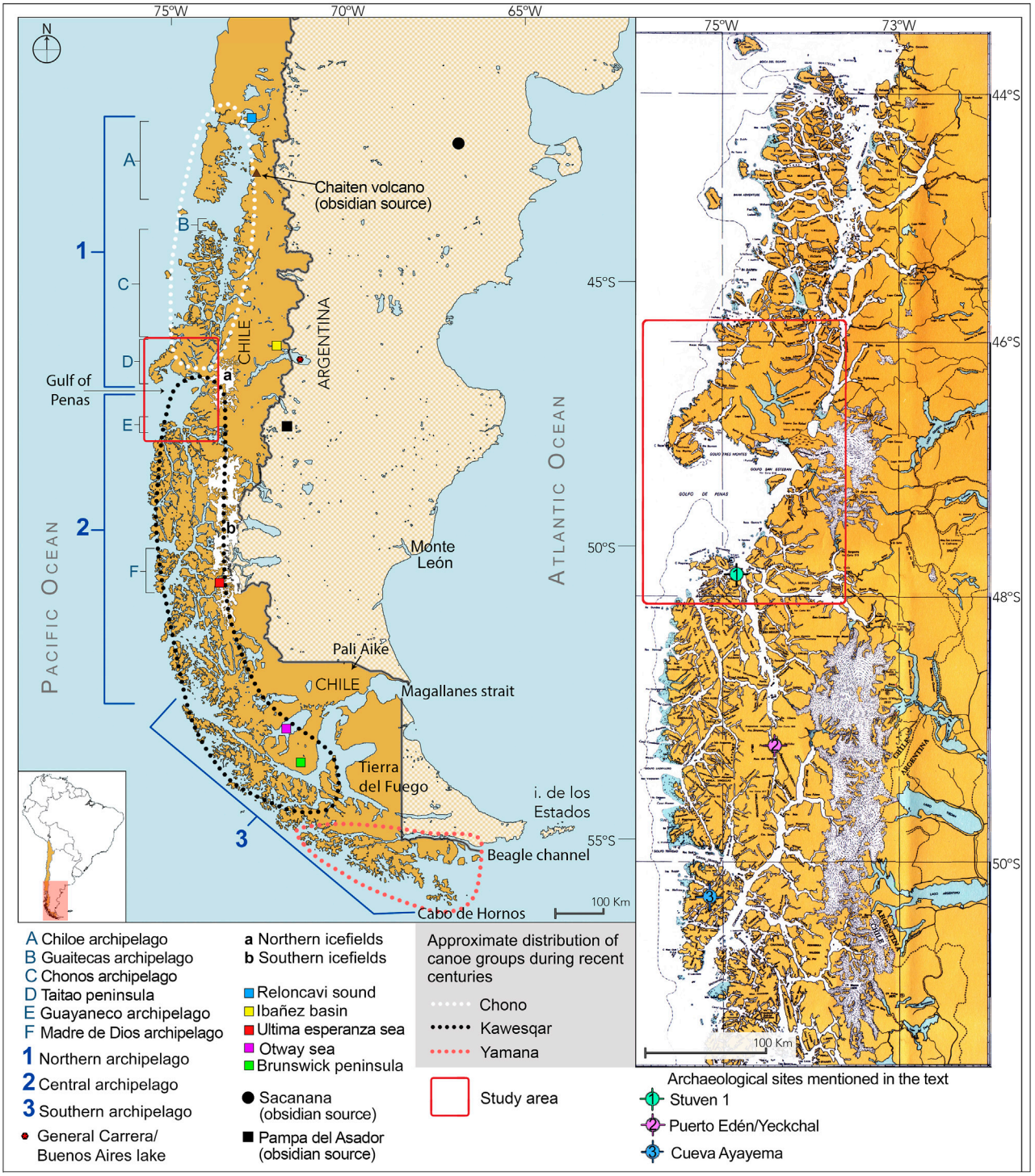

FIGURE 1
West Patagonia. Principal geographical features and archaeological sites mentioned in the text.

networks (*sensu* Whallon, 2006) as well as the flow of goods and information (e.g., Gamble, 1996; Borrero and Barberena, 2006; Pallo and Borrero, 2015). However, in this barrier, the use and articulation of its space has not yet been investigated. Different themes can be addressed, such as the functionality of the types of archaeological sites and their geographic distribution, the

material records, differences in settlement patterns, the presence of indicators of extended family units (i.e., distribution of the bioanthropological record, such as the ossuaries, Reyes, 2020), and evidence for the selective transfer of raw materials, techno-typological and subsistence changes and continuities (distinctions in the artifactual and archaeofaunal records and those in fauna and human isotope values, among others), along with an essential set of dates that define the intensity of human occupation (Erlandson and Moss, 1999; Steele, 2010; Williams, 2012) and the evaluation of the preservation of the material record in areas with active coastal edges (Waters and Kuehn, 1996; Bailey and Flemming, 2008; Reyes et al., 2016; Reyes et al., 2018). Consequently, we understand that cultural transmission depends on the degree of connection between different groups and is affected both by the degree, strength and directionality of those interactions as well as by their spatial distribution (Whallon, 2006; Miller-Atkins and Premo, 2018).

FIGURE 2
Coastal modelling by the ice sheet of the Last Glacial Maximum. Steep coasts and fjords can be observed throughout the West Patagonia. The ground rises hundreds of meters and the sea bed descends to similar depths. View mainland coast area to the South of the Gulf of Penas.

2 Regional overview

2.1 Geography

A complex network of channels, fjords and hundreds of islands called West Patagonia extends along the Pacific coast of the South American region (e.g., Steffen, 1944; Bird, 1946; Bird, 1988; Emperaire, 1963). This area, extending ~1,600 km in North–South longitude (~41°–56°S), includes ~50,000 km of coastline in an approximate area of 240,000 km^2 (cf. Bird, 1988; Camus, 2001). Traditionally, it is subdivided into three large macroregions (*sensu* Dincauze, 2000) corresponding to marine and coastal biogeographic districts, limited by biogeographic and ecological barriers that prevent, restrict and/or filter the passage, development and/or access of various species (Viviani, 1979; Camus, 2001; Sievers and Silva, 2006; Velásquez et al., 2016). These limits are not absolute, producing areas of biota transitions and overlaps, conferring characteristics of a biogeographic barrier (Ferro and Morrone, 2014). Thus, the Northern archipelago extends from the Reloncaví basin to the Taitao Peninsula (41°30′–46°50′S), the central portion of the Patagonian channels extends from the Taitao Peninsula/Gulf of Penas to the western entrance of the Strait of Magellan (46°50′–52°30′S), and the southern end (52°30′–55°30′S) of this extensive archipelagic system projects to Cape Horn (Figure 1).

The Northern and central archipelagos are separated by the extensive geographical barrier of the Taitao Peninsula and the Gulf of Penas, covering an area of ~15,000 km^2 and more than ~1,200 km of Pacific coastline, channels and inland estuaries, which delimit the periglacial marine environment closest to the equatorial line of the planet (Stuardo and Valdovinos, 1992). This territory is located to the West of the Andes Mountains and was intensely shaped by Quaternary glacier action with the consequent formation of a series of islands, channels and fjords. The abrupt topography includes slopes of hundreds of meters, in the fjords and channels (Figure 2). During the Last Glacial Maximum, the advances and retreats of large glaciers shaped the landscapes (Aniya, 1999; Heusser, 2002; Glasser and Ghiglione, 2009; Davies et al., 2020). The coastline shifts are associated with changes in global sea level, and with the vertical deformation caused by isostatic glacial rebound and the subduction of the South American plate (Milne et al., 2005; Lange et al., 2008; Dietrich et al., 2010). This region also has an active subduction zone dominated by tectonic plates known as the *Chilean Triple Junction* (the Nazca, South American and Antarctic plates) and large tectonic faults that converge in the Taitao Peninsula (46°–47° S; Lange et al., 2008; Ramos, 2005). These are responsible for major earthquakes and tsunamis, which continually modify the coast (Plafker and Savage, 1970; Vargas et al., 2013). Finally, natural phenomena, such big storms, also modify the coastlines through erosion or by incorporating new sedimentary material (Morton et al., 2007).

The paleoenvironmental information obtained from the record on the Taitao Peninsula (Lumley and Switsur, 1993; Mássaferro and Brooks, 2002), shows warm, dry conditions between 11,000 and 8000 years cal. BP, and wet conditions between 8000 and 4,000 years cal. BP. The most remarkable change is the decline of *Pilgerodendron uviferum* (Ciprés de las Guaitecas) and *Weinmannia trichosperma* (Tenío) and the expansion of the Podocarpaceae and *Nothofagus* spp. Around 2,700 years cal. BP. This shift indicates an increase in precipitations and/or a fall in temperatures in the area and may be linked to the neoglacial activity (Davies et al., 2020).

Other pollen records from the same archipelago (Haberle et al., 2000; Haberle and Bennett, 2004), show the expansion of *Tepualia stipularis* (Tepú) and *Weinmannia trichosperma* between approximately 12,000 and 7,000 years cal. BP, which has been interpreted as a warm, dry episode. The present floral assembly of *Nothofagus*, *Pilgerodendron* and *Tepualia* is thought to have formed around 7,000 years cal. BP, suggesting an increase in precipitation in the area. There are also brief expansions of thermophilous taxa during the Mid and Late Holocene, suggesting warmer, drier moments in this basically colder, wetter period.

The region's climate is typically oceanic with a strong influence of the westerly winds, which cause significant precipitation (>4,000 mm per year) to the West of the Andes. Temperatures are strongly influenced by the sea. The annual average temperatures are approximately ~10°C. This climate is classified as temperate with oceanic influence (Luebert and Pliscoff, 2006; Garreaud et al., 2013). In the Andean range, where the highest elevations in the region are found (>1,000 masl), there is a reduction in mean annual temperatures, resulting in the persistence of large expanses of ice, remnants of the last glacial period. The largest of these are the Northern (4,200 km^2) and Southern (13,000 km^2) Ice Fields (Aniya, 1999; Heusser, 2002; Davies et al., 2020).

The regional vegetation is controlled by precipitation and temperature gradients that change with latitude and altitude. It is dominated by *Nothofagus*, *Weinmannia*, and conifers forming the temperate rainforest of the interior area of the fjords, which is typical of cold and humid regimes. Coastal areas between 45° and 51° S, are characterized by temperate *Donatia* and *Oreobolus* coastal peatland (Luebert and Pliscoff, 2006).

The rich fauna in the study area is represented by a diversity of sea mammals: 18 species of cetaceans, two pinnipeds, two seals, and two mustelids (Aguayo et al., 2006; Zamorano et al., 2010), in addition to 22 species of mollusks (bivalves and gastropods), crustaceans and echinoderms (Osorio and Reid, 2004), 29 species of fish (Navarro and Pequeño, 1979), and 46 species of birds (Vuilleumier, 1985). In contrast, the terrestrial fauna on the islands is scarce (small rodents). On the continental coastline there are two species of deer, the *pudu* (*Pudu pudu*) and the *huemul* (*Hippocamelus bisulcus*) (González et al., 2009).

2.2 Ethnohistory and ethnography

These biogeographic areas also coincide with cultural differences within indigenous groups separated by this barrier (Figure 1), especially linguistic and technological distinctions (e.g., use of different boats) observed by 16th and 18th century chroniclers and expeditions (Goicueta, 1879; García, 1889; Byron, 1901; Bibar, 1966) and by 19th-20th century ethnographic studies about the distribution of the canoe groups known ethnohistorically as *Chono* (Northern archipelago) and *Kawésqar* (central archipelago) (e.g., Skottsberg, 1913; Cooper, 1917; Cooper, 1946; Hammerly, 1952; Emperaire, 1963). The *Chono* were the first of the indigenous groups, generically identified as canoeists, to disappear as a culture toward the 18th century. There are very few written and material records (García, 1889; Cooper, 1917; Emperaire, 1963). The *Kawésqar*, on the other hand, although suffering cultural transformations, still remain as a community in different parts of the Patagonian archipelago (Skottsberg, 1913; Cooper, 1917; Cooper, 1946; Latcham, 1930; Bird, 1946; Hammerly, 1952; Emperaire, 1963; Laming-Emperaire, 1972; Casamiquela, 1973; Gusinde, 1982; Medina, 1984; Quiroz and Olivares, 1988; Aguilera, 2008; Aguilera, 2011). For sea travel, the *Chono* used a canoe made of three boards sown together called a *Dalca*, very different from the vessels used by the *Kawésqar*, i.e., tree bark canoes (Cooper, 1917; Latcham, 1930; Medina, 1984). Later studies propose that the canoe was probably a technology derived from Huilliche territory, from further North, since these forest-dwelling groups were specialists in the use of wood; and that later spread to the Chonos Archipelago (Medina, 1984). After European contact and the forced migrations of many Chono (Urbina, 2016; Urbina et al., 2020), or their flee to safer areas south of the Taitao Peninsula (47°S), the *dalca* would have gradually replaced the bark canoe used by Kawésqar groups (Cooper, 1917; Latcham, 1930; Lothrop, 1932; Finterbusch, 1934; Medina, 1984). For both groups, linguistic and subsistence differences led historians and ethnographers to classify them as different canoe groups of the extreme South of South America (Goicueta, 1879; García, 1889; Byron, 1901; Skottsberg, 1913; Cooper, 1917; Cooper, 1946; Hammerly, 1952; Emperaire, 1963; Casamiquela, 1973; Gusinde, 1982). From the first chroniclers, the idea was installed that the Taitao Peninsula and its Southern area, the dreaded Gulf of Penas (~46°50′S), constituted a geographical barrier in which indigenous canoe groups entered, mainly when serving as guides and navigators or when fleeing European dominance (García, 1889; Byron, 1901; Emperaire, 1963; Urbina, 2010; Urbina, 2016; Martinic, 2013; Álvarez et al., 2015). Undoubtedly, this traditional ethnographic division is not a monolithic classification; in its construction underlies biases in the accounts and observations in a dynamic post-European contact border (Orquera and Piano, 1995; Álvarez, 2002; Urbina et al., 2020).

2.3 Archaeological framework

The Northern Patagonian archipelago (~41°30′-46°50′S) includes the Reloncaví basin, the Chiloé archipelago and its adjacent continental edge, and the Guaitecas and Chonos archipelagos. Although there is evidence from the Late Pleistocene that indicates the use of coastal resources by

hunter-gatherer groups (Dillehay et al., 2008), the first indications of human occupations by canoe hunter-gatherer groups in the Reloncaví area to the North and in Chiloé are ~6,400 cal years BP (Gaete et al., 2004; Gaete and Navarro, 2004; Ocampo and Rivas, 2004; Quiroz and Sánchez, 2004; Legoupil, 2005; Rivas and Ocampo, 2010; Campbell and Quiroz, 2015; Massone et al., 2016; Sierralta et al., 2019; Sierralta et al., 2021; Reyes et al., 2020; Munita et al., 2021; Rebolledo et al., 2021). The archaeological record of the transition to the late Holocene and even historical times is characterized by an increase in the number of archaeological sites and the diversity of deposits and site types, such as large multicomponent monticular shell middens, deposits with ceramic materials, fishing corrals, funerary sites and sites with paintings and rock carvings (Bird, 1988; Ladrón de Guevara et al., 2003; Munita, 2007; Sáez, 2008; Álvarez et al., 2008; Flores et al., 2010; Rodríguez et al., 2010; Flores and Correa, 2011; Mena et al., 2011; Munita et al., 2011; Labarca et al., 2016; Labarca et al., 2021; Reyes et al., 2020).

Archaeological investigations carried out on the Chonos archipelago (~43°50′-46°50′S), immediately North of the Taitao Peninsula/Gulf of Penas, revealed initial occupations at ~ 6,200 cal years BP (Porter, 1993; Reyes et al., 2016; Reyes et al., 2019a). These contexts formed by marine hunter-gatherers, recorded until ~4,200 cal years BP, are of an exploratory and specialized nature. They are mediated by deep occupational hiatuses associated with important coastal remodeling processes (Reyes et al., 2018). Entering the third millennium, there was a relative increase in the intensity of occupation by these canoe groups (such as the records of the first shell midden sites) and in their distribution throughout the archipelago. Later, we observed a *peak* of occupation around ~1,300 cal years BP, with a greater number and variety of archaeological sites [e.g., shell midden camps, ossuaries (formed by the funeral arrangement of bodies on the surface and inside of rocky shelters, deposited synchronously or at different temporal moments, Reyes et al., 2015), and sighting points]. In a regional context of marginal occupation in terms of the frequency/density of the archaeological record (Borrero, 2004), it represents a discontinuous occupation over time (Reyes et al., 2019a; Reyes, 2020).

In the Chonos archipelago, we evaluated the influence of the multiple geographical barriers that appear toward the east as *a continuous barrier* and that would have influenced the hierarchy in the human use of occupied spaces (Borrero and Franco, 1997; Borrero, 1999; Borrero, 2004; Belardi, 2003). The marine distances that separate this archipelago from the continental edge and the Andean massif and the dense montane forests, volcanoes and ice fields that flank it from the rest of the continent led us to implement theoretical and methodological designs that allowed us to postulate that these are poorly permeable barriers with regard to the possibility of contact by land with extra-Andean or steppe terrestrial hunter-gatherer groups (Méndez and Reyes, 2008; Reyes et al., 2009). This situation does occurs in the North geographical extremes (Reloncaví basin area) and South (Strait of Magellan and Tierra del Fuego) of the extensive Patagonian archipelago (e.g., Borrero, 1997; Gaete et al., 2004; Zangrando et al., 2009; Morello et al., 2012; Morello et al., 2015). In fact, the lack of evidence of contact between marine and terrestrial hunter-gatherer groups, both in the Andean forests and in the steppe and archipelago, can be interpreted as a product of the effective action of the various geographical barriers. This is confirmed through the distribution and differentiation of technotypological criteria and artifactual assemblages, circulation of lithic raw materials (e.g., grey porphyritic obsidian source from the Chaitén volcano, Pampa del Asador, and Sacanana) and the archaeofaunal record recovered from excavated contexts. These barriers hindered contact and human circulation in an East–West direction in this region throughout the Holocene, with two cultural spheres that until now are configured as completely separate, with circuits of mobility and contact in a general North–South direction (Reyes et al., 2007; Reyes et al., 2009; Reyes et al., 2015; Reyes et al., 2019a; Méndez and Reyes, 2008; Méndez et al., 2018; Reyes, 2020).

Another line of evidence corresponds to the bioanthropological information of human remains from the steppe and the archipelago. DNA analyses suggest that population flow independently with respect to the Pacific fringe and the extra-Andean steppe (Moraga et al., 2009; De la Fuente et al., 2018; Nakatsuka et al., 2020). Furthermore, the information from the craniometric analyses on human remains recovered from the Chonos archipelago shows very little affinity with the groups East of the Andes, less than 140 km East–West, and a greater biological affinity with various groups along the Pacific coast (Kuzminsky et al., 2018). Finally, the human diet patterns inferred from the comparisons of δ^{15} N and δ^{13} Ccol values indicate subsistence modes with high specificity, coastal occupations with marine diets and inland groups with terrestrial diets (Méndez et al., 2014; Reyes et al., 2019b). This supports other lines of evidence regarding the influence of biogeographic barriers in the marked segregation of two cultural traditions of marine and terrestrial hunter-gatherers. In the middle course of the Ibáñez River valley in Aisén (General Carrera Lake area/ Buenos Aires), the occupations of terrestrial hunter-gatherers detected in the montane deciduous forest are noticeably reduced toward the west, with no deep material record in the forest and in the mountain foothills (García and Mena, 2016). Nuevo-Delaunay et al. (2022) argue that the presence of a Western limit of occupations of terrestrial hunters, toward the foothills of the Northern Ice Field, practically creating a dead end to the West.

To the South of the Taitao Peninsula and the Gulf of Penas (~47°S), the central portion of the extensive Patagonian archipelago extends for more than 600 km and is largely isolated from the continental territory by the presence of

TABLE 1 Descriptive statistics of the $\delta^{15}N$ and $\delta^{13}Ccol$ values of the canoe groups that inhabited the Patagonian archipelago. References used: Alfonso-Durrruty et al., 2015; Barberena 2002; Borrero et al., 2001; Kochi 2017; Panarello et al., 2006; Reyes et al., 2019b, 2022; Tafuri et al., 2017; Tessone et al., 2003; Yesner et al., 2003.

Region	Southern archipelago		Central archipelago		Northern archipelago (de los chonos)		Northern archipelago (de chiloé)	
	$\delta^{13}C$	$\delta^{15}N$	$\delta^{13}C$	$\delta^{15}N$	$\delta^{13}C$	$\delta^{15}N$	$\delta^{13}C$	$\delta^{15}N$
N	14	14	5	5	36	36	17	17
Media	−12,9	17,2	−12,8	17,6	−11,4	17,2	−11,4	18,7
Standard deviation	2,2	2,5	1,4	1,6	0,9	0,9	1,4	1,7
Minimum	−18,5	10,6	−14,1	15,8	−13,9	15,3	−16,0	13
Maximum	−11,1	19,2	−10,6	20,0	−9,3	18,8	−9,2	20,3

another extensive barrier, the Southern Ice Field. In this area, archaeological studies are even scarcer and more dispersed than elsewhere. There are records of the 1741 shipwreck of the frigate *Wager* in the Guayaneco archipelago (Byron, 1901; Carabias, 2009) and the excavation of a shell midden at the Northern entrance of the Messier channel at the Stuven one site on the homonymous island, ~2,200 years BP, with an important artifactual and archaeofaunal record (Legoupil et al., 2007). Then, 150 km farther South, a series of sites, mainly shell middens, were identified near Puerto Edén (Emperaire, 1963; Bird, 1988), dated post 1,800 years BP. These sites have been discussed in the framework of the evaluation of ethnographic observations on the mobility and settlement patterns of canoe groups in this area (Curry, 1991). Adjacent to Puerto Edén is the Yekchal site, a shell midden that accounts for an important archaeofaunal complex and a burial that dates to ~1,000 cal years BP (San Román and Morello, 2007; De la Fuente et al., 2018). Finally, 150 km South of Puerto Edén, funerary caves and rock art are recorded on the Madre de Dios archipelago (Jaillet et al., 2009; Sepúlveda, 2011). Among these sites, the Ayayema Cave burial stands out, with human skeletons dating to ~4,500 years BP (Legoupil and Sellier, 2004), corresponding to the oldest records of an indigenous presence in the central portion of the Patagonian channels and whose evidence of ancient DNA would indicate different population flow (Nakatsuka et al., 2020).

The area of the central archipelago has been the subject of regional analyses of the presence, distribution and density of the archaeological record. It has been characterized as "taphonomically active" (Borrero, 2014), requiring the necessary integration of environmental dynamics with the presence and interpretation of the material record. It is "marginal", in terms of the evaluation of the frequency and density of the archaeological record in a territory occupied/exploited discontinuously (Borrero, 2004). It is also defined as an "empty zone" (Laming-Emperaire, 1972), in terms of the spatial distribution with respect to the intensity of occupations in the Southern archipelagos, and as a "circulation route" (Borrero, 1982; Pallo, 2011), in terms of the availability of resources and/or the technological feasibility of access to certain locations permanently or seasonally (e.g., Bailey and Parkington, 1988; Ames, 2002).

3 Discussion

3.1 Variations in the canoe subsistence patterns on either side of the Taitao Peninsula and the Gulf of Penas

The archaeological investigations carried out North and South of the Taitao Peninsula/Gulf of Penas record unravel the subsistence patterns of these canoe groups, specifically with respect to the technological, archaeofaunal and bioanthropological assemblages recovered (Curry, 1991; Legoupil and Sellier, 2004; Legoupil et al., 2007; Reyes et al., 2007; Reyes et al., 2015; Reyes et al., 2016; San Román and Morello, 2007; Christensen, 2016; Reyes, 2020).

δ^{15} N and δ^{13} Ccol analyses of human remains from the Patagonian archipelago (Borrero et al., 2001; Barberena, 2002; Tessone et al., 2003; Yesner et al., 2003; Zangrando et al., 2004; Panarello et al., 2006; Alfonso-Durrruty et al., 2015; Kochi, 2017; Tafuri et al., 2017; Reyes et al., 2019b) revealed statistically significant differences (Mann–Whitney p=0,000,008) in the spectrum of marine diets between canoe groups to the North and South of the Taitao Peninsula/Gulf of Penas (Table 1) that, beyond the ecological diversity and local availability of resources, obey diverse cultural trajectories with respect to the subsistence patterns defined in the late Holocene for these canoe groups (Reyes et al., 2019b; Reyes et al., 2022). Thus, in the Chonos archipelago, terrestrial fauna did not provide a relevant contribution to the diet; in contrast, the isotopic values for human osteological assemblages south of Taitao indicate a relevant role of huemul (*Hippocamelus bisulcus*) in the diet.

The recovered archaeofaunal assemblages also indicate an important difference with respect to the consumption of this terrestrial mammal, very present in contexts South of the Taitao Peninsula/Gulf of Penas (e.g., Emperaire, 1963; Curry, 1991; Legoupil et al., 2007; San Román and Morello, 2007; Fernández et al., 2016) and poorly represented to the North, in the Chonos archipelago, even though they are biogeographically available (Reyes et al., 2019a; Reyes, 2020). Similarly, greater consumption of marine mammals (Otariidae) has been documented in archaeological sites in Southern Taitao Peninsula/Gulf of Penas (Curry, 1991; Orquera and Piana, 1999; Legoupil et al., 2007; San Román and Morello, 2007; San Román, 2010; Tivoli and Zangrando, 2011) compared to the archaeofaunal assemblages excavated to the North of this barrier, where this resource is not common (Reyes et al., 2019b). At the macroregional scale, bioindicators of subsistence (human isotope values and archaeofaunal assemblages) have revealed evident differences for both areas on either side of the barrier. These data indicate differences in the spectrum of marine diets among the different groups of hunter-gatherer fishers throughout the Patagonian archipelago, probably obeying both the ecological diversity present in this extensive territory and diverse cultural trajectories in relation to patterns of subsistence and the consumption of wildlife resources.

These differences are also evident when comparing the technological assemblages recorded on both sides of the Taitao Peninsula/Gulf of Penas. The bone industry in the Chonos archipelago, after excavating/probing 16 archaeological sites (14.18 m^2 total), is practically nil, with only a pair of bone awl have been found (Reyes et al., 2007; Reyes, 2020). In contrast, in the south of the Taitao Peninsula/Gulf of Penas, the archaeological record indicates great technofunctional diversity that includes awls, wedges and harpoons, among other artifacts (Legoupil et al., 2007; San Román and Morello, 2007; Christensen, 2016; San Román, 2018) that indicate various domestic and hunting activities. At the Stuven one site, instruments made from cetaceans and huemuls are recorded (Legoupil et al., 2007). Bone harpoons, are not found in the Chonos archipelago, except for a vague mention in Guaitecas (Barros, 1931), being documented thus far at a very low frequency (N = 5) in only some contexts of Reloncaví in the Northern archipelago (Gaete et al., 2004; Munita et al., 2021). These few harpoons differ greatly from those recorded in practically all the sites South of the Taitao Peninsula/Gulf of Penas (Christensen, 2016).

Regarding the lithic assemblages, we also observed differences. The material culture of the hunter-gatherer fishers of the Chonos archipelago did not exhibit major variations throughout its temporal sequence (~6,200–300 cal years BP, Reyes et al., 2019a). It was characterized by the use of bifacial tools, stone axes and net weights (Porter, 1993; Reyes et al., 2007; Reyes et al., 2015; Reyes et al., 2016). The raw materials used show extensive ranges of mobility/exchange along 600 km of the northern archipelago and part of the southern coast of Chile. This is evidenced from the distribution of grey porphyritic obsidian from the Chaitén volcano throughout the Chono sites. None of these knapped artifacts (lanceolate lithic heads and lithic axes) nor the grey porphyritic obsidian are reported in the excavated contexts of the central archipelagos, from the South of the Taitao Peninsula/Gulf of Penas to Ultima Esperanza, in Magallanes (Morello et al., 2002; Legoupil et al., 2007; San Román et al., 2016). The Chaitén obsidian, however, has an extensive geographic "jump," being very scarcely identified at some sites in Monte León, on the Atlantic coast, and in the border volcanic zone of Pali Aike, both in Argentina. Its dispersion covers over 1,400 km (Stern et al., 2012; Stern, 2018). Regarding the lithic points, a similar geographical "jump" also occurs; beyond the Chonos archipelago, they are found in the Strait of Magellan/Otway Sea (Morello et al., 2002; Legoupil, 2003; San Román, 2005) and the Beagle Channel (Orquera et al., 1977) mostly associated with dates close to ~5,000–4000 BP. Some researchers propose that these are technological and subsistence elements used as defense against a second cultural group ("Ponsonby tradition" Legoupil and Pigeot, 2009) that would occupy the inland seas at least between 5,000–4,000 years BP and possibly into the next millennium (Morello et al., 2002; Morello et al., 2004). Technological and temporal similarities with the northern Chiloé/Reloncaví Basin (Díaz and Garreton, 1972; Gaete et al., 2004; Gaete and Navarro, 2004; Ocampo and Rivas, 2004; Munita, 2007; Reyes et al., 2020; Munita et al., 2021; Rebolledo et al., 2021; Sierralta et al., 2021) presumed a northern influence that would differ from the earliest contexts of maritime adaptation recorded in the middle Holocene in Fuego-Patagonia (Morello et al., 2015; San Román et al., 2016), defined as the Englefield Culture (between ~6,500 and 5,000 years BP; Emperaire et al., 1961; Ortiz Troncoso, 1975; Legoupil, 1997; San Román, 2005, San Roman, 2010). In contrast, from the north coast of the Beagle Channel, the presence of such elements is explained as the diffusion of technological innovation, without population replacement or migration (Piana and Orquera, 2007; Orquera et al., 2011). Both positions, however, suggest technological projection from the northern archipelago to the south during the middle Holocene. In this discussion, recent ancient DNA analysis in human remains from Fuego-Patagonia propose the arrival of new groups that carry a different stone tool assemblage in the Western Archipelago and Beagle Channel regions that between ~5,500 and 3,100 bp. There would be an, interruption of the use of green obsidian and the presence of large biface projectile points (Nakatsuka et al., 2020).

We observe differences at the macroscale level. Since the late Holocene, hunting activities, diet and subsistence patterns

indicate particularities in the strategies for the supply and utilization of faunistic resources on both sides of the Taitao Peninsula/Gulf of Penas. It could be argued that taphonomic factors and dissimilar archaeological records produce bias; however, these are taken into account and discussed in the investigations carried out on both sides. Another plausible explanation, according to the known archaeological record and the close relationship of hunter-gatherers with their environment (e.g., Kelly, 1995; Binford, 2001), is that faunal variability can originate from the same canoe groups and that the material record responds rather to the biogeographic distribution and local availability of resources and raw materials. Such an explanation, however, does not fully justify the differences in the presence and/or absence of lithic and bone technological components, beyond their frequency, and the differentiated marine diets (isotope values) among the human groups sampled on both sides of this barrier.

The archaeological documentation evaluated indicates that the Taitao Peninsula/Gulf of Penas is a geographical barrier that, although permeable, effectively influenced the differentiation of cultural trajectories of hunter-gatherer fishers who inhabited either side of this barrier. Therefore, subsequent ethnographic distinctions (especially linguistic and technological) referred to a process of differentiation that had undoubtedly began centuries before. It is hoped that with this evaluation at hand, the further archaeological studies to be carried out in the area will be able to characterize the various material assemblages. Obviously, this effort will need to take into account the diversity and intensity of canoe people occupations that could have formed these contexts over time and also be able to understand at what point in time of the chronological sequence archaeological contexts began to differentiate the cultural trajectories of either side of the Taitao Peninsula and the Gulf of Penas.

Author contributions

OR designed the research; OR, CM, MS, CB, and AN-D. wrote the paper.

Funding

This research was funded by ANID-FONDECYT 1210045; ANID-Regional R20F0002.

Acknowledgments

We acknowledge to Corporación Nacional Forestal (CONAF XI Región).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Aguayo, A., Acevedo, J., and Vargas, R. (2006). Diversidad de mamíferos marinos en las aguas del Archipiélago de los Chonos. *Cienc. Tecnol. del Mar* 29 (2), 129–145.

Aguilera, O. E. (2008). Escenario en los relatos de viaje kawésqar. *Onomázein* 18, 49–74. doi:10.7764/onomazein.18.02

Aguilera, O. E. (2011). Los relatos de viaje kawésqar, su estructura y referencia de personas. *Magallania* 39, 119–145. doi:10.4067/S0718-22442011000100008

Alfonso-Durrruty, M. P., Giles, B. T., Misarti, N., San Roman, M., and Morello, F. (2015). Antiquity and geographic distribution of cranial modification among the prehistoric groups of Fuego-Patagonia, Chile. *Am. J. Phys. Anthropol.* 158, 607–623. doi:10.1002/ajpa.22832

Álvarez, A. R., Munita, D., Fredes, J., and Mera, C. R. (2008). *Corrales de Pesca en Chiloé*. Valdivia, Chile: Imprenta América.

Álvarez, R., Navarro, M., Saavedra, G., and Donoso, C. (2015). Referencias exploratorias sobre el lago Presidente Ríos, para sortear el Istmo de Ofqui, Península de Taitao, Región de Aysén. *Magallania (Punta Arenas)* 43, 91–101. doi:10.4067/S0718-22442015000100006

Álvarez, R. (2002). Reflexiones en torno a las identidades de las poblaciones canoeras, situadas entre los 44° y 48° de latitud sur, denominadas "Chonos". *An. Inst. Patagon.* 30, 79–86.

Ames, K. M. (2002). "Going by boat," in *Beyond foraging and collecting: Evolutionary change in hunter-gatherer settlement systems*. Editors B. Fitzhugh and J. Habu (Boston, MA: Springer), 19–52.

Aniya, M. (1999). Recent glacier variations of the Hielos Patagónicos, South America and their contribution to sea-level change. *Arct. Antarct. Alp. Res.* 31 (2), 165–173. doi:10.1080/15230430.1999.12003293

Bailey, G. N., and Flemming, N. C. (2008). Archaeology of the continental shelf: Marine resources, submerged landscapes and underwater archaeology. *Quat. Sci. Rev.* 27, 2153–2165. doi:10.1016/j.quascirev.2008.08.012

Bailey, G., and Parkington, J. (1988). *The archaeology of prehistoric coastlines*. Cambridge, NY: Cambridge University Press.

Bailey, G. (2004). World prehistory from the margins: The role of coastlines in human evolution. *J. Interdiscip. Stud. Hist. Archaeol.* 1, 39–50.

Barberena, R. (2008). *Arqueología y Biogeografía Humana en Patagonia Meridional*. Buenos Aires, AR: Sociedad Argentina de Antropologia.

Barberena, R. (2002). *Los Límites del Mar: Isótopos Estables en Patagonia Meridional*. Buenos Aires, AR: Sociedad Argentina de Antropologia.

Barberena, R., Villanueva, G. R., Lucero, G., Fernández, M. V., Rughini, A. A., and Sosa, P. (2017). Espacios internodales en Patagonia septentrional: Biogeografía, información y mecanismos sociales de interacción. *Estud. Atacam.*, 0–75. doi:10.4067/S0718-10432017005000006

Barros, A. (1931). "Chonos," in *Aborígenes australes de América*. Editors A. Barros and E. Armstrong (Santiago: Chile Lord Cochrane), 57–59.

Belardi, J. (2003). "Paisajes arqueológicos: Un estudio comparativo de diferentes ambientes patagónicos,". Doctoral thesis (Buenos Aires, AR: Universidad Nacional de Buenos Aires).

Bibar, G. (1966). *Crónica y Relación Copiosa y Verdadera de los Reynos de Chile*. Santiago, Chile: JT Medina Historical and Bibliographic Fund.

Constructing Frames of Reference Binford, L. (2001). *An analytical method for archaeological theory building using ethnographic and environmental data sets*. California, CA: University of California Press.

Binford, L. R. (1990). Mobility, housing, and environment: A comparative study. *J. Anthropol. Res.* 46, 119–152. doi:10.1086/jar.46.2.3630069

Binford, L. R. (1982). The archaeology of place. *J. Anthropol. Archaeol.* 1, 5–31. doi:10.1016/0278-4165(82)90006-X

Binford, L. R. (1980). Willow smoke and dogs' tails: Hunter-gatherer settlement systems and archaeological site formation. *Am. Antiq.* 45, 4–20. doi:10.2307/279653

Bird, J. (1946). "The archaeology of Patagonia," in *Handbook of South American Indians*. Editor J. Steward (Washington, DC: Smithsonian Institutio), 17–24.

Bird, J. (1988). *Travels and archaeology in south Chile*. Iowa City, IA: University of Iowa Press.

Borrero, L. A. (1994). Arqueología de la Patagonia. Palimpsesto. *Rev. Arqueol.* 4, 9–69.

Borrero, L. A., and Barberena, R. (2006). Hunter-gatherer home ranges and marine resources: An archaeological case from southern Patagonia. *Curr. Anthropol.* 47, 855–868. doi:10.1086/507186

Borrero, L. A. (2018). Barreras en la construcción de la arqueología patagónica y más allá. *Bol. Soc. Chil. Arqueol.* 48, 31–41.

Borrero, L. A., and Borrazzo, K. (2011). "La geografía cultural del sudoeste de Patagonia continental," in *Bosques, Montañas y Cazadores. Investigaciones Arqueológicas en Patagonia Meridional*. Editors L. Borrero and K. Borrazzo (Buenos Aires, AR: CONICET-IMHICIHU), 7–36.

Borrero, L. A. (1989). Evolución cultural divergente en la Patagonia austral. *An. Inst. Patagon.* 19, 133–139.

Borrero, L. A., and Franco, N. V. (1997). Early patagonian hunter-gatherers: Subsistence and technology. *J. Anthropol. Res.* 53, 219–239. doi:10.1086/jar.53.2.3631277

Borrero, L. A., Guichon, R. A., Tykot, R., Kelly, J., Iglesias, A. P., and Cárdenas, P. (2001). Dieta a partir de isótopos estables en restos óseos humanos de Patagonia Austral. Estado actual y perspectivas. *An. Inst. Patagon.* 29, 119–127.

Borrero, L. A. (2014). Multi-service taphonomy. Shells, garbage, and floating palimpsests. *Intersecc. Antropol.* 15, 13–20.

Borrero, L. A. (2004). "The archaeozoology of andean "dead ends" in Patagonia: Living near the continental ice cap," in *Colonisation, migration and marginal areas. A zooarchaeological approach*. Editors M. Mondini, S. Muñoz, and S. Wickler (Oakville, CA: Oxbow Books), 55–61.

Borrero, L. A. (1999). The prehistoric exploration and colonization of Fuego-Patagonia. *J. World Prehist.* 13, 321–355. doi:10.1023/A:1022341730119

Borrero, L. (1997). "The origins of ethnographic subsistence patterns in Fuego-Patagonia," in *Patagonia. Natural history, prehistory and ethnography at the uttermost end of the Earth*. Editors C. McEwan, L. Borrero, and A. Prieto (London, UK: British Musem Press), 60–81.

Borrero, L. (1982). Un modelo de ocupación humana de la región del Seno de la Ultima Esperanza (Magallanes, Chile). *Publ. Inst. Antropol.* 38, 155–171.

Butzer, K. (1971). *Environment and archaeology*. Chicago, IL: Aldine-Atherton.

Byron, J. (1901). *Relato del Honorable John Byron Que Contiene una Esposicion de las Grandes Penurias Sufridas por él i Sus Compañeros en la Costa de la Patagonia Desde el Año 1740 Hasta su Arribo a Inglaterra en 174*. Santiago, Chile: Imprenta Cervantes.

Cameron, C. M., and Tomka, S. A. (1993). *Abandonment of settlements and regions: Ethnoarchaeological and archaeological approaches*. Cambridge, NY: Cambridge University Press.

Campbell, R., and Quiroz, D. (2015). Chronological database for southern Chile (35°30'–42° S), ~33000 BP to present: Human implications and archaeological biases. *Quat. Int.* 356, 39–53. doi:10.1016/j.quaint.2014.07.026

Camus, P. A. (2001). Biogeografía marina de Chile continental. *Rev. Chil. Hist. Nat.* 74, 587–617. doi:10.4067/S0716-078X2001000300008

Carabias, D. (2009). *Naufragio de la H.M.S. Wager en la Patagonia. Encuentro de dos Mundos. Santiago, Chile*. FONDART: Consejo Nacional de la Cultura y las Artes.

Casamiquela, R. M. (1973). Alacalufes, canoeros occidentales y pueblos marginales o metamórficos. *Relac. Soc. Argent. Antropol.* 7, 125–143.

Christensen, M. (2016). "La Industria Ósea de los Cazadores-Recolectores: El Caso de los Nómadas Marinos de Patagonia y Tierra del Fuego," in *Colección poblamiento humano de Fuego-Patagonia* (Punta Arenas, Chile: Ediciones Universidad de Magallanes).

Cooper, J. M. (1917). *Analytical and Critical Bibliography of the Tribes of Tierra del Fuego and Adjacent Territory*. Washington, DC: U.S. Government Printing Office.

Cooper, J. M. (1946). "The Chono. Handbook of South American Indians," in *The Marginal Tribes. Editado por J. Steward. Bureau of American Ethnology Bulletin 143* (Washington, DC: Smithsonian Institutional Press), 1.

Coppinger, R. (2007). "Four years in Patagonia & Polynesia," in *The cruise of the alert. September 1878-september 1882* (Ushuaia, AR: Zagier & Urruty).

Curry, P. J. (1991). Distribución de sitios e implicaciones para la movilidad de los canoeros en el canal Messier. *An. Inst. Patagon.* 20, 145–154.

David, B., and Thomas, J. (2016). *Handbook of landscape archaeology*. London, UK: Routledge.

Davies, B. J., Darvill, C. M., Lovell, H., Bendle, J. M., Dowdeswell, J. A., Fabel, D., et al. (2020). The evolution of the Patagonian Ice Sheet from 35 ka to the present day (PATICE). *Earth-Science Rev.* 204, 103152 doi.org/doi:10.1016/j.earscirev.2020.103152

De la Fuente, C., Ávila-Arcos, M. C., Galimany, J., Carpenter, M. L., Homburger, J. R., Blanco, A., et al. (2018). Genomic insights into the origin and diversification of late maritime hunter-gatherers from the Chilean Patagonia. *Proc. Natl. Acad. Sci. U. S. A.* 115, E4006–E4012. doi:10.1073/pnas.1715688115

Díaz, C., and Garreton, M. (1972). "El poblamiento prehispánico del área insular septentrional chilena," in *Actas del VI Congreso Nacional de Arqueología Chilena* (Santiago, Chile: Universidad de Chile), 559–584.

Dietrich, R., Ivins, E., Casassa, G., Lange, H., Wendt, J., and Fritsche, M. (2010). Rapid crustal uplift in Patagonia due to enhanced ice loss. *Earth Planet. Sci. Lett.* 289 (1), 22–29. doi:10.1016/j.epsl.2009.10.021

Dillehay, T. D., Ramírez, C., Pino, M., Collins, M. B., Rossen, J., and Pino-Navarro, J. D. (2008). Monte verde: Seaweed, food, medicine, and the peopling of South America. *Science* 320, 784–786. doi:10.1126/science.1156533

Dincauze, D. (2000). *Environmental archaeology: Principles and practice*. Cambridge, NY: Cambridge University Press.

Emperaire, J., Laming, A., Josien, T., and Humbert, R. (1961). Les gisements des Iles Englefield et Vivian Dans la mer d'Otway Patagonie Australe. *J. Soc. Am.* 50, 7–75. doi:10.3406/jsa.1961.2477

Emperaire, J. (1963). *Los Nómades del Mar*. Santiago, Chile: Ediciones de la Universidad de Chile.

Erlandson, J. M., and Moss, M. L. (1999). The systematic use of radiocarbon dating in archaeological surveys in coastal and other erosional environments. *Am. Antiq.* 64, 431–443. doi:10.2307/2694143

Erlandson, J. M. (2001). The archaeology of aquatic adaptations: Paradigms for a new millennium. *J. Archaeol. Res.* 9, 287–350. doi:10.1023/A:1013062712695

Fernández, P. M., Cruz, I., Belardi, J. B., De Nigris, M., and Muñoz, A. S. (2016). La explotación del huemul (Hippocamelus bisulcus, Molina 1782) en la Patagonia a lo largo del Holoceno. *Magallania (Punta Arenas)* 44, 187–209. doi:10.4067/S0718-22442016000100011

Ferro, I., and Morrone, J. J. (2014). Biogeographical transition zones: A search for conceptual synthesis. *Biol. J. Linn. Soc. Lond.* 113, 1–12. doi:10.1111/bij.12333

Finterbusch, C. (1934). Las dalcas de Chiloé y los chilotes. *Rev. Chil. Hist. Geogr.* LXXV (82), 412–433.

Fitzhugh, W. W. (1997). Biogeographical archaeology in the eastern north American arctic. *Hum. Ecol.* 25, 385–418. doi:10.1023/A:1021819509181

Fitzpatrick, S. M., Thompson, V. D., Poteate, A. S., Napolitano, M. F., and Erlandson, J. M. (2016). Marginalization of the margins: The importance of smaller islands in human prehistory. *J. Isl. Coast. Archaeol.* 11, 155–170. doi:10.1080/15564894.2016.1192568

Flores, C., Broitman, B., and Rivas, P. (2010). "Changes in the subsistence strategy of prehistoric intertidal gathering: The pre-ceramic and ceramic coastal hunter-gatherers of Reloncaví sound, Chile," in *Comparative perspectives on the archaeology of coastal south America*. Editors R. E. Cutright, E. López-Hurtado, and A. J. Martín (Lima: Peru: Center for Comparative ArchaeologyUniversity of Pittsburgh, Universidad Católica del Perú, Ministerio de Cultura del Ecuador), 63–76.

Flores, C., and Correa, I. (2011). "Explotación de ambientes costeros, intensificación de recursos y transformaciones culturales en la transición Holoceno medio a Holoceno tardío en la costa de los canales patagónico

septentrionales, Chile," in *Actas XVII congreso nacional de Arqueología Argentina* (Argentina: AR: Universidad Nacional de Cuyo), 321–326.

Foley, R. (1981). "Off-site archaeology: An alternative approach for the short-sited," in *Pattern of the past—studies in honour of david clarke*. Editors I. Hodder, G. Issac, and N. Hammond (Cambridge, NY: Cambridge University Press), 157–183.

Franco, N., Borrero, L., Brook, G., and Mancini, M. (2018). "Changes in the technological organization and human use of space in Southern Patagonia (Argentina) during the Late Holocene," in *Lithic technological organization and paleoenvironmental change*. Editors E. Robinson and F. Sellet (Oxford, NY: Springer), 301–320.

Friesen, T. M., and O'Rourke, M. J. E. (2019). Biogeographic barriers and coastal erosion: Understanding the lack of interaction between the eastern and western regions of the north American arctic. *World Archaeol.* 51, 484–501. doi:10.1080/00438243.2019.1705179

Gaete, N., Navarro, X., Constantinescu, F., Mera, C., Selles, D., Solari, M. E., et al. (2004). Una mirada al modo de vida canoero del mar interior desde Piedra Azul. *Chungará (Arica)* 36, 333–346. doi:10.4067/S0717-73562004000300035

Gaete, N., and Navarro, X. (2004). "Estrategias de vida de canoeros cazadores pescadores recolectores del seno de Reloncaví. Entre el bosque siempreverde y el mar interior. Región de Los Lagos, Chile," in *Contra viento y marea. Arqueología de Patagonia*. Editors M. Civalero, P. Fernández, and A. Guráieb (Buenos Aires, AR: Inapl y Sociedad Argentina de Antropología), 217–235.)

Gamble, C. (1996). "Making tracks. Hominid networks and the evolution of the social landscape," in *The archaeology of human ancestry. Power, sex and tradition*. Editors J. Steele and S. Shennan (London and New York, NY: Routledge), 253–277.

Gamble, C. (1999). *The palaeolithic societies of europe*. Cambridge, UK: Cambridge University Press.

García, C., and Mena, F. (2016). ¿ La frontera del oeste?: Prospecciones arqueológicas en el bosque montano del extremo Occidental del valle medio del río Ibáñez (Andes patagónicos, Chile). *Intersecc. Antropol.* 17, 49–61.

García, J. (1889). Diario del viaje y la navegación hechos por el padre José Joseph García de la Compañía de Jesús, desde su misión de Cailin, en Chiloé. *Anu. Hidrogr. Mar. Chile* 14, 3–42.

Garreaud, R., Lopez, P., Minvielle, M., and Rojas, M. (2013). Large-scale control on the Patagonian climate. *J. Clim.* 26, 215–230. doi:10.1175/JCLI-D-12-00001.1

Glasser, N. F., and Ghiglione, M. (2009). Structural, tectonic and glaciological controls on the evolution of fjord landscapes. *Geomorphology* 105 (3-4), 291–302. doi:10.1016/j.geomorph.2008.10.007

Goicueta, M. (1879). *Derrotero y viaje de Juan Ladrillero*, 32. Sevillafjs: Archivo General de IndiasFondo Patronato, 51–144v.

González, G., Torres-Mura, J., and Muñoz-Pedreros, A. (2009). "Orden artiodactyla," in *Mamíferos de Chile*. Editors A. Muñoz-Pedreros and J. Yañez (Valdivia: CEA Ediciones), 231–250.

Gusinde, M. (1982). *Los Indios de Tierra del Fuego*. Buenos Aires, AR: Centro Argentino de Etnología Americana.

Haberle, S., Szeicz, J., and Bennett, K. (2000). Late Holocene vegetation dynamics and lake geochemistry at laguna miranda, región XI, Chile. *Rev. Chil. Hist. Nat.* 73, 655–669. doi:10.4067/s0716-078x2000000400010

Hammerly, D. D. (1952). Los pueblos Canoeros de Fuegopatagonia y los límites del hábitat Alakaluf. *RUNA* 5, 134–170. doi:10.34096/runa.v5i0.4772

Heusser, C. J. (2002). On glaciation of the southern Andes with special reference to the Peninsula de Taitao and adjacent Andean cordillera (46o30'S). *J. South Am. Earth Sci.* 15, 577–589. doi:10.1016/s0895-9811(02)00076-7

Jaillet, S., Fage, L. H., Maire, R., and Tourte, B. (2009). Découverte d'une grotte ornée dans l'archipel de Patagonie chilienne: La grotte du Pacifique. *Spelunca Mém.* 34, 173–183.

Keegan, W. F., Fitzpatrick, S. M., Sealey, K. S., LeFebvre, M. J., and Sinelli, P. T. (2008). The role of small islands in marine subsistence strategies: Case studies from the caribbean. *Hum. Ecol.* 36, 635–654. doi:10.1007/s10745-008-9188-z

Kelly, R. L. (1983). Hunter-gatherer mobility strategies. *J. Anthropol. Res.* 39, 277–306. doi:10.1086/jar.39.3.3629672

Kelly, R. (1995). *The foraging spectrum: Diversity in hunter - gatherer lifeways*. Washington, DC/London, UK: Smithsonian Institutional Press.

Kochi, S. (2017). Paleodietas en cazadores-recolectores del canal Beagle durante el Holoceno tardío. *Intersecc. Antropol.* 18, 329–339.

Kuzminsky, S. C., Báez, O. R., Arriaza, B., Méndez, C., Standen, V. G., San Román, M., et al. (2018). Investigating cranial morphological variation of early human skeletal remains from Chile: A 3D geometric morphometric approach. *Am. J. Phys. Anthropol.* 165, 223–237. doi:10.1002/ajpa.23344

Labarca, R., Calás, E., Letelier, J., Alloway, B., and Holmberg, K. (2021). Arqueología en el Morro Vilcún (Comuna de Chaitén, Región de Los Lagos, Chile): síntesis y perspectivas. *Bol. Soc. Chil. Arqueol. Número Espec.*, 499–520.

Labarca, R., Mena, F., Prieto, A., Dupradou, T., and Silva, E. (2016). Investigaciones arqueológicas en torno a los primeros registros de arte rupestre en Morro Vilcún. *Bol. Mus. Chil. Arte Precolomb.* 21, 65–80. doi:10.4067/S0718-68942016000200005

Ladrón de Guevara, B., Gaete, N., and Morales, S. (2003). El patrimonio como fundamento para el desarrollo del capital social: El caso de un sitio arqueológico y puntilla tenglo. *Conserva Rev. del Cent. Nac. Conserv. Restauración* 7, 5–22.

Laming-Emperaire, A. (1972). Los sitios arqueológicos de Patagonia Occidental. *An. Inst. Patagon.* 3, 87–96.

Lange, D., Cembrano, J., Rietbrock, A., Haberland, C., Dahm, T., and Bataille, K. (2008). First seismic record for intra-arc strike-slip tectonics along the Liquiñe-Ofqui fault zone at the obliquely convergent plate margin of the southern Andes. *Tectonophysics* 455 (1), 14–24. doi:10.1016/j.tecto.2008.04.014

Latcham, R. (1930). La dalca de Chiloé y los canales patagónicos. *Bol. Mus. Nac. Chile* 13, 63–72.

Legoupil, D. (1997). *Bahía colorada (île d'Englefield): Les premiers chasseurs de Mammifères marines de Patagonie australe*. Paris, France: Éditions Recherche sur les Civilisations.

Legoupil, D., Béarez, P., Lefèvre, C., San Román, M., and Torres, J. (2011). Estrategias de subsistencia de cazadores recolectores de Isla dawson (estrecho de Magallames) durante la segunda mitad del holoceno: Primeras aproximaciones. *Magallania (Punta Arenas)* 39, 153–164. doi:10.4067/S0718-22442011000200011

Legoupil, D., Bearez, P., Lepetz, S., San Román, M., and Salas, K. (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*. Editors F. Morello, M. Martinic, A. Prieto, and G. Bahamonde (Punta Arenas, Chile: Ediciones CEQUA), 279–294.

Legoupil, D. (2003). *Cazadores-Recolectores de Ponsonby (Patagonia austral) y su Paleoambiente Desde VI al III Milenio A.C.* Punta Arenas, Chile: University of Magallanes.

Legoupil, D., and Pigeot, N. (2009). Les grandes pointes foliacées du type «ponsonby»: Un traceur culturel en patagonie australe. *jsa.* 95, 7–32. doi:10.4000/jsa.10941

Legoupil, D. (2005). Recolectores de moluscos tempranos en el sureste de la isla de Chiloé: Una primera mirada. *Magallania (Punta Arenas)* 33, 51–61. doi:10.4067/S0718-22442005000100004

Legoupil, D., and Sellier, P. (2004). La sepultura de la Cueva Ayayema (Isla Madre de Dios, archipiélagos occidentales de Patagonia). *Magallania* 32, 115–124.

Llagostera, A. (1982). "Tres dimensiones en la conquista prehistórica del mar: Un aporte para el estudio de las formaciones pescadoras de la costa surandina," in *Actas del VIII Congreso Nacional de Arqueología Chilena* (Santiago, Chile: Kultrún), 217–245.

Lothrop, S. (1932). Aboriginal navigation off the west coast of South America. *J. R. Anthropol. Inst. G. B. Irel.* 62, 229–256. doi:10.2307/2843956

Lovis, W., and Whallon, R. (2016). *Marking the land. Hunter-gatherer creation of meaning in their environment*. London, UK: Routledge.

Luebert, F., and Pliscoff, P. (2006). *Sinopsis bioclimática y vegetacional de Chile*. Santiago: Editorial Universitaria.

Lumley, S., and Switsur, R. (1993). Late quaternary chronology of the Taitao Peninsula, southern Chile. *J. Quat. Sci.* 8 (2), 161–165. doi:10.1002/jqs.3390080208

Mandryk, C. A. S. (1993). Hunter-gatherer social costs and the nonviability of submarginal environments. *J. Anthropol. Res.* 49, 39–71. doi:10.1086/jar.49.1.3630629

Martinic, M. (2013). Apertura del istmo de Ofqui: Historia de una quimera consideraciones sobre la vigencia de sus razones. *Magallania (Punta Arenas)* 41, 5–50. doi:10.4067/S0718-22442013000200001

Massaferro, J., and Brooks, S. (2002). Response of chironomids to late quaternary environmental change in the Taitao Peninsula, southern Chile. *J. Quat. Sci.* 17 (2), 101–111. doi:10.1002/jqs.671

Massone, M., Morello, F., Borrero, L., Legoupil, D., Mena, F., Prieto, A., et al. (2016). "Cazadores-recolectores en la Patagonia Chilena desde 11.000 años a.p. a la colonización Occidental," in *Prehistoria en Chile*. Editors F. Falabella, M. Uribe, L. Sanhueza, C. Aldunate, and J. Hidalgo (Santiago, Chile: Edit. Universitaria).

McNiven, I. (2015). Ascendancy of the Tudulgal, central Torres Strait: Socio-political manipulation and domination of an archipelago polity. *J. Anthropol. Archaeol.* 39, 164–180. doi:10.1016/j.jaa.2015.04.003

Medina, A. (1984). Embarcaciones chilenas precolombinas La Dalca de Chiloé. *Rev. Chil. Antropol.* 4, 121–138.

Mena, F., González, E., and Labarca, R. (2011). Primeros registros de arte rupestre en el litoral de Patagonia Septentrional Chilena. *Magallania (Punta Arenas)* 39, 303–307. doi:10.4067/S0718-22442011000200021

Méndez, C. A., and Reyes, O. R. (2008). Late Holocene human occupation of the patagonian forests: A case study in the Cisnes river basin. *Antiquity* 82, 560–570. doi:10.1017/S0003598X00097222

Méndez, C., Barberena, R., Reyes, O., and Delaunay, A. N. (2014). Isotopic ecology and human diets in the forest–steppe ecotone, Aisén region, Central-Western Patagonia, Chile. *Int. J. Osteoarchaeol.* 24, 187–201. doi:10.1002/oa.2337

Méndez, C., Stern, C. R., Delaunay, A. N., Reyes, O., Gutiérrez, F., and Mena, F. (2018). Spatial and temporal distributions of exotic and local obsidians in central western Patagonia, southernmost south America. *Quat. Int.* 468, 155–168. doi:10.1016/j.quaint.2017.08.062

Miller-Atkins, G., and Premo, L. S. (2018). Time-averaging and the spatial scale of regional cultural differentiation in archaeological assemblages. *STAR Sci. Technol. Archaeol. Res.* 4, 12–27. doi:10.1080/20548923.2018.1504490

Milne, G., Long, A. J., and Bassett, S. (2005). Modelling Holocene relative sea level observations from the Caribbean and South America. *Quat. Sci. Rev.* 24 (10–11), 1183–1202. doi:10.1016/j.quascirev.2004.10.005

Moraga, M., Aspillaga, E., and Mena, F. (2009). Search for founder mitochondrial lineages in Holocene human remains in Patagonia. *Am. J. Phys. Anthropol.* 48, 193.

Morello, F., Borrero, L., Massone, M., Stern, C., García-Herbst, A., McCulloch, R., et al. (2012). Hunter-gatherers, biogeographic barriers and the development of human settlement in Tierra del Fuego. *Antiquity* 86, 71–87. doi:10.1017/S0003598X00062463

Morello, F., San Román, M., and Prieto, A. (2004). "Obsidiana verde en fuego-patagonia: Distribución y estrategias tecnológicas," in *Contra viento y marea. Arqueología de Patagonia*. Editors M. Civalero, M. Fernández, and A. Guráieb (Buenos Aires, AR: Sociedad Argentina de Antropología), 149–166.

Morello, F., San Román, M., and Prieto, A. (2002). Puntas de proyectil lanceoladas en Patagonia meridional y Tierra del Fuego. *An. Inst. Patagon. Ser. Cienc. Hum.* 30, 155–166.

Morello, F., Stern, C., and San Román, M. (2015). Obsidiana verde en Tierra del Fuego y Patagonia: Caracterización, distribución y problemáticas culturales a lo largo del holoceno. *Intersecc. Antropol.* 16, 139–153.

Morton, R., Gelfenbaum, G., and Jaffe, B. E. (2007). Physical criteria for distinguishing sandy tsunami and storm deposits using modern examples. *Sed. Geol.* 200 (3), 184–207. doi:10.1016/j.sedgeo.2007.01.003

Munita, D. (2007). Materias primas líticas en sitios costeros del extremo sur septentrional de Chile. Dispersión y aprovisionamiento. *Bol. Soc. Chil. Arqueol.* 39, 103–112.

Munita, D., Mera, C. R., Alvarez, R., Navarro, X., Valenzuela, C. G., González, J., et al. (2021). Paisajes marítimos arqueológicos en el seno de Reloncaví. El Caso de Bahía Ilque. *Bull. Chil. Soc. Archeol.* 51, 425–463.

Munita, D., Mera, C. R., Arregui, I., and Manneschi, M. (2011). Funebria de grupos canoeros durante el Holoceno tardío en la Región de Los Lagos. El conchal de Yaco Alto1, Calbuco, Chile. *Cazad. Recolectores del Cono Sur* 6, 17–41.

Nakatsuka, N., Luisi, P., Motti, J. M., Salemme, M., Santiago, F., D´Angelo del Campo, M. D., et al. (2020). Ancient genomes in South Patagonia reveal population movements associated with technological shifts and geography. *Nat. Commun.* 11 (1), 3868–3912. doi:10.1038/s41467-020-17656-w

Navarro, J., and Pequeño, G. (1979). Peces litorales de los archipiélagos de Chiloé y los Chonos, Chile. *Rev. Biol. Mar.* 16, 205–309.

Neme, G., and Gil, A. (2008). Biogeografía humana en los Andes meridionales: Tendencias arqueológicas en el sur de Mendoza. *Chungará (Arica)* 40, 5–18.

Nuevo-Delaunay, A., Méndez, C., Reyes, O., Seelenfreund, A., and Belmar, C. (2022). La ocupación humana antigua de los callejones sin salida de los Andes de Patagonia: Midiendo la intensidad de uso del espacio en los márgenes del campo de hielo norte (Aisén, Chile). *Chungará (Arica)*. doi:10.4067/S0717-73562022005000203

Ocampo, C., and Rivas, P. (2004). Poblamiento temprano de los extremos geográficos de los canales patagónicos: Chiloé e isla Navarino 1. *Chungará (Arica)* 36, 317–331. doi:10.4067/S0717-73562004000300034

Orquera, L. A., Legoupil, D., and Piana, E. L. (2011). Littoral adaptation at the southern end of South America. *Quat. Int.* 239, 61–69. doi:10.1016/j.quaint.2011.02.032

Orquera, L. A., and Piana, E. (1999). *Arqueología de la Región del Canal Beagle (Tierra del Fuego, República Argentina)*. Buenos Aires, AR: Sociedad Argentina de Antropología.

Orquera, L. A., and Piano, E. L. (1995). La imagen de los canoeros magallánico-fueguinos: Conceptos y tendencias. *RUNA* 22, 187–245.

Orquera, L., Sala, A., Piana, E., and Tapia, A. (1977). *Lancha packewaia*. Buenos Aires, AR: Editorial Huemul.

Ortiz Troncoso, O. (1975). Los yacimientos de Punta santa ana y bahía buena: Excavaciones y fechados radiocarbónicos. *An. Inst. Patagon. Ser. Cienc. Hum.* 6, 93–122.

Osorio, C., and Reid, D. (2004). Moluscos marinos intermareales y submareales entre la Boca del Guafo y el estero Elefantes, sur de Chile. *Investig. Mar.* 32 (2), 71–89. doi:10.4067/s0717-71782004000200006

Pallo, M. C., and Borrero, L. A. (2015). ¿Intercambio o movilidad?: Una evaluación sobre el uso de escalas de análisis espaciales y curvas de declinación en Patagonia centro-meridional (Argentina). *Lat. Am. Antiq.* 26, 287–303. doi:10.7183/1045-6635.26.3.287

Pallo, M. C. (2011). Condicionamiento de la dinámica ambiental en las decisiones humanas sobre asentamiento y circulación a lo largo del Estrecho de Magallanes durante el Holoceno Tardío. *Magallania (Punta Arenas)* 39, 177–192. doi:10.4067/S0718-22442011000200013

Panarello, H., Zangrando, F., Tessone, A., Kozameh, L., and Testa, N. (2006). Análisis comparativo de paleodietas humanas entre la región del canal Beagle y península Mitre: Perspectivas desde los isótopos estables. *Magallania (Punta Arenas)* 34, 37–46. doi:10.4067/S0718-22442006000200004

Piana, E., and Orquera, L. (2007). "Diferencias regionales y temporales en el litoral sudoccidental de Sudamérica," in *Arqueología de Fuego-Patagonia*. Editors F. Morello, M. Martinic, A. Prieto, and G. Bahamonde (Punta Arenas, Chile: Ediciones CEQUA), 311–326.

Plafker, G., and Savage, J. C. (1970). Mechanism of the Chilean earthquakes of may 21 and 22, 1960. *Geol. Soc. Am. Bull.* 81, 1001–1030. doi:10.1130/0016-7606(1970)81[1001:MOTCEO]2.0.CO;2

Porter, C. (1993). "GUA-010, un sitio costero erosionado en una zona sísmica activa," in *Actas del XII Congreso Nacional de Arqueología Chilena* (Santiago, Chile: Boletín del Museo Regional de la Araucanía), 81–88.

Prieto, A., Chevallay, D., and Ovando, D. (2000). "Los pasos de indios en Patagonia Austral," in *Desde el País de los Gigantes. Perspectivas Arqueológicas en Patagonia*. Editor S. Espinosa (Río Gallegos, AR: Universidad Nacional de la Patagonia Austral), 87–94.

Quiroz, D., and Olivares, J. C. (1988). "Nómades canoeros de la Patagonia septentrional insular: El mundo de don Pedro del Agua," in *Encuentro de Etnohistoriadores, serie nuevo mundo. Cinco siglos*. Editors O. Silva, E. Medina, and E. Téllez (Santiago, Chile: Departamento de Ciencias Históricas, Universidad de Chile), 10–33.

Quiroz, D., and Sánchez, M. (2004). Poblamientos iniciales en la costa septentrional de la Araucanía (6.500-2.000 ap). *Chungara (Arica)* 36, 289–302. doi:10.4067/S0717-73562004000300032

Ramos, V. (2005). Seismic ridge subduction and topography: Foreland deformation in the Patagonian Andes. *Tectonophysics* 399, 73–86. doi:10.1016/j.tecto.2004.12.016

Rebolledo, S., Delgado, A., Kelly, P., Sierralta, S., Bravo, G., Hernández, D., et al. (2021). Chepu 005: Aproximaciones desde el análisis de colecciones a las comunidades cazadoras recolectoras de Chiloé. *Bol. Soc. Chil. Arqueol. Número Espec.*, 465–498.

Reyes, O., Belmar, C., San Román, M., Morello, F., and Urbina, X. (2020). Avances en la secuencia cronológica del mar interior de Chiloé, Patagonia Occidental: Sitios arqueológicos San Juan 1, Tauco 1 y 2. *Magallania (Punta Arenas)* 48, 173–184. doi:10.4067/S0718-22442020000100173

Reyes, O., Méndez, C., Maldonado, A., Velásquez, H., Trejo, V., Cárdenas, M., et al. (2009). Uso del espacio de cazadores recolectores y paleoambiente Holoceno en el valle del río Cisnes, región de Aisén, Chile. *Magallania (Punta Arenas)* 37, 91–107. doi:10.4067/S0718-22442009000200006

Reyes, O., Méndez, C., San Román, M., Cárdenas, P., Velásquez, H., Trejo, V., et al. (2007). Seno Gala 1: Nuevos resultados en la arqueología de los canales septentrionales (~ 44° S, región de Aisén, Chile). *Magallania (Punta Arenas)* 35, 105–119. doi:10.4067/S0718-22442007000200008

Reyes, O., Méndez, C., and San Román, M. (2019a). Cronología de la ocupación humana en los canales septentrionales de Patagonia Occidental, Chile. *Intersecc. Antropol.* 20, 195–210. doi:10.37176/iea.20.2.2019.449

Reyes, O., Méndez, C., San Román, M., and Francois, J. P. (2018). Earthquakes and coastal archaeology: Assessing shoreline shifts on the southernmost pacific coast (Chonos archipelago 43 50′–46 50′ S, Chile, south America). *Quat. Int.* 463, 161–175. doi:10.1016/j.quaint.2016.10.001

Reyes, O., Moraga, M., Méndez, C., and Cherkinsky, A. (2015). Maritime hunter-gatherers in the Chonos archipelago (43 50'–46 50'S), western patagonian channels. *J. Isl. Coast. Archaeol.* 10, 207–231. doi:10.1080/15564894.2014.1001920

Reyes, O., San Román, M., and Morello, F. (2016). "Searching for maritime hunter-gatherer archaeological record in the shifting shorelines of the south pacific coast (Chonos and Guaitecas archipelago, Chile)," in *Marine ventures: Archaeological perspectives on human-sea relations*. (United Kingdom: Equinox Publishing), 137–151.

Reyes, O., Tessone, A., San Román, M., and Méndez, C. (2019b). Dieta e isótopos estables de cazadores recolectores marinos en los canales occidentales de Patagonia, Chile. *Lat. Am. Antiq.* 30, 550–568. doi:10.1017/laq.2019.40

Reyes, O., Tessonne, A., Belmar, C., San Román, M., Morello, F., Moraga, M., et al. (2022). Cambios y continuidades en la subsistencia e interacción entre sociedades cazadoras-recolectoras marinas y agro-alfareras durante el Holoceno tardío en el archipiélago septentrional, Patagonia, Chile. *Lat. Am. Antiq.*, 1–18. doi:10.1017/laq.2022.38

Reyes, O. (2020). *The settlement of the Chonos archipelago, western Patagonia, Chile (the Latin American studies book series)*. Cham, Switzerland: Springer.

Rivas, P., and Ocampo, C. (2010). "La adaptación humana al bosque en la isla de Chiloé. Estrategias adaptativas en el litoral septentrional de los canales patagónicos," in *Actas del XVII Congreso Nacional de Arqueología Chilena* (Valdivia, Chile: Ediciones Kultrún), 1449–1460.

Rockman, M., and Steele, J. (2003). *Colonization of unfamiliar landscapes: The archaeology of adaptation*. Oxford, UK: Psychology Press.

Rodríguez, M., Aspillaga, E., and Arensburg, B. (2010). "Colecciones esqueletales del archipiélago de Chiloé: Nuevos antecedentes, perspectivas y limitaciones," in *Actas del XVII Congreso Nacional de Arqueología Chilena* (Valdivia, Chile: Sociedad Chilena de Arqueología), 535–546.

Rosen, B. (1988). "Biogeographic patterns: A perceptual overview," in *Analytical biogeography*. Editors A. Myers and P. Giller (London, UK: Chapman & Hall), 23–55.

Sáez, A. (2008). Impacto del contacto hispano-indigena en la salud de la población de Chiloé: Un caso de tuberculosis en el cementerio Puqueldón 1. *Magallania (Punta Arenas)* 36, 167–174. doi:10.4067/S0718-22442008000200012

San Román, B. (2018). *Los Arpones y Armas de Hueso de las Colecciones del Museo Antropológico Martin Gusinde: Tecnología Emblemática de la Interacción Entre Humanos y el Mar en el Confín de América. Colecciones Digitales, Subdirección de Investigación*. Santiago, Chile: DIBAM.

San Román, M. (2010). La explotación de recursos faunísticos en el sitio punta santa ana 1: Estrategias de subsistencia de grupos de cazadores marinos tempranos de Patagonia meridional. *Magallania (Punta Arenas)* 38, 183–198. doi:10.4067/S0718-22442010000100011

San Román, M., and Morello, F. (2007). *Salvataje Arqueológico del Sitio Yekchal (Puerto Edén 1), Provincia de Ultima Esperanza, XII Región de Magallanes y Antártica Chilena, Informe Final De Labores De Salvataje*. Chile: CEHA, Instituto de la Patagonia, UMAG.

San Román, M. (2005). Nuevos hallazgos de sitios de cazadores recolectores marinos tempranos en isla Englefield. *Magallania Punta. Arenas.* 33, 173–176. doi:10.4067/S0718-22442005000200012

San Román, M., Reyes, O., Morello, F., and Torres, J. (2016). "Archaeology of maritime hunter-gatherers from southernmost Patagonia, south America: Discussing timing, changes and cultural traditions during the Holocene," in *Marine ventures - archaeological perspectives on human-sea relations*. (United Kingdom: Equinox eBooks Publishing), 157–174.

Sandweiss, D. H., Andrus, C. F. T., Kelley, A. R., Maasch, K. A., Reitz, E. J., and Roscoe, P. B. (2020). Archaeological climate proxies and the complexities of reconstructing Holocene El Niño in coastal Peru. *Proc. Natl. Acad. Sci. U. S. A.* 117, 8271–8279. doi:10.1073/pnas.1912242117

Sepúlveda, M. A. (2011). Pinturas rupestres y tecnología del color en el extremo sur de Chile. *Magallania* 39, 193–210. doi:10.4067/S0718-22442011000100012

Sierralta, N. S., Canales, S. R., Orellana, A. D., Rodríguez, C. C., Castillo, D. H., and Aedo, G. B. (2021). Variaciones holocénicas en la tecnología lítica de Chepu 005, Isla Grande de Chiloé, archipiélagos patagónicos septentrionales. *Prax. Arqueol.* 3, 11–31. doi:10.53689/pa.v3i1.23

Sierralta, S., Delgado, A., Kelly, P., and Rebolledo, S. (2019). "Cronología absoluta en los canales septentrionales, el mar interior y la costa pacífica austral," in *Actas X jornadas de Arqueología de la Patagonia* (Argentina: Puerto Madryn), 167–179.

Sievers, H. A., and Silva, N. (2006). "Masas de agua y circulación en los canales y fiordos australes," in *Avances en el Conocimiento Oceanográfico de las Aguas Interiores Chilenas, Puerto Montt a Cabo de Hornos*. Editors N. Silva and S. Palma (Valparaíso, Chile: Comité Oceanográfico Nacional—Pontificia Universidad Católica de Valparaíso), 53–58.

Skottsberg, C. (1913). Observations on the natives of the patagonian channel region. *Am. Anthropol.* 15, 578–616. doi:10.1525/aa.1913.15.4.02a00030

Steele, J. (2010). Radiocarbon dates as data: Quantitative strategies for estimating colonization front speeds and event densities. *J. Archaeol. Sci.* 37, 2017–2030. doi:10.1016/j.jas.2010.03.007

Steffen, H. (1944). *Patagonia Occidental: Las cordilleras patagónicas y Sus regiones circundantes*. Santiago, Chile: Universidad de Chile.

Stern, C. R., Caracotche, S., Cruz, I., and Charlin, J. (2012). Obsidiana gris porfírica calco-alcalina del volcán Chaitén en sitios arqueológicos al sur del río Santa Cruz, Patagonia meridional. *Magallania (Punta Arenas)* 40, 137–144. doi:10.4067/S0718-22442012000100008

Stern, C. R., and Curry, P. J. (1995). Obsidiana del sitio Pose Las Conchillas, isla Traiguén (45o30'S), archipiélago de los Chonos, Chile. *An. Inst. Patagon.* 23, 119–124.

Stern, C. R. (2018). Obsidian sources and distribution in Patagonia, southernmost South America. *Quat. Int.* 468, 190–205. doi:10.1016/j.quaint.2017.07.030

Stuardo, J., and Valdovinos, C. (1992). "Barreras, limites faunísticos y provincias biogeoquimicas en Sudamérica austral," in *Oceanografía en Antartida. Chile*. Editors V. A. Gallardo, O. Ferretti, and G. H. I. Moyano (Concepción: Centro EULA, Universidad de Concepción), 443–451.

Tafuri, M. A., Zangrando, A. F., Tessone, A., Kochi, S., Moggi, C. J., Di Vincenzo, F., et al. (2017). Dietary resilience among hunter-gatherers of Tierra del Fuego: Isotopic evidence in a diachronic perspective. *PLoS One* 12, e0175594. doi:10.1371/journal.pone.0175594

Tessone, A., Zangrando, A. F., Valencio, S. A., and Panarello, H. O. (2003). Isótopos estables del carbono en restos óseos humanos de la región del Canal Beagle, Isla Grande de Tierra del Fuego. *Rev. Argent. Antropol. Biol.* 5, 33–43.

Tivoli, A. M., and Zangrando, A. F. (2011). Subsistence variations and landscape use among maritime hunter-gatherers. A zooarchaeological analysis from the Beagle Channel (Tierra del Fuego, Argentina). *J. Archaeol. Sci.* 38, 1148–1156. doi:10.1016/j.jas.2010.12.018

Urbina, X. (2010). La navegación por los canales australes en la Patagonia Occidental insular en los siglos coloniales: La ruta del istmo de Ofqui. *Magallania (Punta Arenas)* 38, 41–67. doi:10.4067/S0718-22442010000200003

Urbina, X., Reyes, O., and Belmar, C. A. (2020). Canoeros en Chiloé: De facilitadores de las navegaciones españolas en los archipiélagos de los Chonos y de Guayaneco, a productores y comerciantes, 1567-1792. *Chungará (Arica)* 52, 0–346. doi:10.4067/S0717-73562020005000702

Urbina, X. (2016). "Traslados de indigenas de los archipiélagos patagónicos occidentales a Chiloé en los siglos XVI, XVII y XVIII," in *América en Diásporas. Esclavitudes y Migraciones Forzadas en Chile y Otras Regiones Americanas (Siglos XVI-XIX)*. Editor J. Valenzuela (Santiago, Chile: Instituto de Historia, Pontificia Universidad Católica de Chile/RiL Editores), 381–411.

Vargas, G., Rebolledo, A., Sepúlveda, A., Lahsen, R., Thiele, B., Townley, C., et al. (2013). Submarine earthquake rupture, active faulting and volcanism along the major Liquiñe-Ofqui Fault Zone and implications for seismic hazard assessment in the Patagonian Andes. *And. Geol.* 40, 141–171.

Velásquez, C., Jaramillo, E., Camus, P. A., Manzano, M., and Sánchez, R. (2016). Biota del intermareal rocoso expuesto de la Isla grande de Chiloé, archipiélago de Chiloé, Chile: Patrones de diversidad e implicancias ecológicas y biogeográficas. *Rev. Biol. Mar. Oceanogr.* 51, 33–50. doi:10.4067/S0718-19572016000100004

Veth, P. (1989). Islands in the interior: A model for the colonization of Australia's arid zone. *Archaeol. Ocean.* 24, 81–92. doi:10.1002/j.1834-4453.1989.tb00217.x

Viviani, C. A. (1979). Ecogeografía del litoral chileno. *Stud. Neotrop. Fauna Environ.* 14, 65–123. doi:10.1080/01650527909360548

Vuilleumier, F. (1985). Forest birds of Patagonia: Ecological geography, speciation, endemism, and faunal history. *Ornithol. Mono.* 36, 255–304. doi:10.2307/40168287

Waters, M. R., and Kuehn, D. D. (1996). The geoarchaeology of place: The effect of geological processes on the preservation and interpretation of the archaeological record. *Am. Antiq.* 61, 483–497. doi:10.2307/281836

Whallon, R. (2006). Social networks and information: non-"utilitarian" mobility among hunter-gatherers. *J. Anthropol. Archaeol.* 25, 259–270. doi:10.1016/j.jaa.2005.11.004

Williams, A. N. (2012). The use of summed radiocarbon probability distributions in archaeology: A review of methods. *J. Archaeol. Sci.* 39, 578–589. doi:10.1016/j.jas.2011.07.014

Yesner, D. R., Torres, M. J. F., Guichon, R. A., and Borrero, L. A. (2003). Stable isotope analysis of human bone and ethnohistoric subsistence patterns in Tierra del Fuego. *J. Anthropol. Archaeol.* 22, 279–291. doi:10.1016/S0278-4165(03)00040-0

Zamorano, J., Gibbons, J., and Capella, J. (2010). Diversity and summer distribution of cetaceans in inlet waters of northern Aisén, Chile. *An. Inst. Patagon.* 38 (1), 151–157. doi:10.4067/S0718-686X2010000100012

Zangrando, A. F., Tivoli, A. M., Bjerck, H. B., Breivik, H. M., Fretheim, S. E., and Piana, E. (2016). "Exploring trajectories towards social complexity: Marine foragers in the archipelagos of Tierra del Fuego and Norway," in *Marine ventures - archaeological perspectives on human-sea relations*. Editor H. B. Bjerck. (United Kingdom: Equinox Publishing), 317–327.

Zangrando, F., Tessone, A., Valencio, S., Panarello, H., Mansur, M., and Salemme, M. (2004). "Isótopos estables y dietas humanas en ambientes costeros," in *Avances en Arqueometría 2003*. Editor R. A. Puerto (España: Universidad de Cádiz), 91–97.

Zangrando, F., Tessone, A., and Vázquez, M. (2009). El uso de espacios marginales en el archipiélago fueguino: Implicaciones de la evidencia arqueológica de Bahía valentín. *Arqueol. Patagon.* 1, 47–62.