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Continuity and discontinuity in the human use of the north coast of Santa Cruz (Patagonia Argentina) through its radiocarbon record

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ABSTRACT

In this paper, the analysis of a radiocarbon database of the North Coast of Santa Cruz (central Patagonia, Argentina), is presented. Dated archaeological samples were obtained from 56 different types of archaeological sites (open-air -residential sites and burials-, and also rock shelters). The objective of this paper is assessing the continuities and discontinuities in the chronological signal of the area and identifying tendencies along the Holocene. The database currently contains 75 radiocarbon dates falling between ca. 8000 and 300 BP. The radiocarbon data base provides information on the chronological, spatial and contextual variability of the archaeological record of North Coast of Santa Cruz. By means of different analysis of sum of probabilities, we present three different chronological moments of human use of the coast and intermediate zone can be identified. A first moment is represented by early evidence of settlement during Middle Holocene. A second moment corresponds to a hiatus between ca. 5800 and ca. 3900 BP without archaeological evidence. Finally, a third moment is where an increasing of chronological signal occurred, related to greater artifactual variability and an increase in the intensity of human settlement in the Patagonian region. The causes that could have influenced in the discontinuity of the chronological signal of the study area, and the characteristics of the different moments identified are discussed.

1. Introduction

In this paper, an updated ^{14}C dataset from the Northern Coast of Santa Cruz (NCSC) is presented. These data was obtained through the research carried out within the last years with the aim of defining the chronological span of the human occupation of the coastal area, and the immediate hinterland. We will discuss this database aiming to identify chronological tendencies in the human use of the NCSC during the Holocene. Changes and continuities in the chronological signal and their relationship with the archaeological record of the NCSC will be presented and analysed.

The NCSC is situated in northeast Santa Cruz province (Central Patagonia, Argentina). It includes the intermediate zone, which is characterized by limited archaeological information, between the Atlantic coast and the central Deseado massif. The archaeological surveys in the NCSC were initiated around 1990, and during the last decade much work have been done, reaching more knowledge through intensive stratigraphic excavations and the incorporation of different lines of analysis, such as information from new surficial sites (Zubimendi, 2010), rock shelters (Ambrústolo, 2011), and human burials (Zilio et al., 2013a).

2. Regional setting

The Patagonian region is the southernmost continental portion of the world and was the last continental crust colonized by humans, approximately 12 or 13 thousand years ago (Borrero, 2008; Franco et al., 2010; Brook et al., 2014). In a general characterization, this region can be differentiated as two main areas: the Andean Cordillera and the vast plateau and steppe-like plains running from the west to the Atlantic sea coast. Nowadays, the Andean Cordillera demarcates the Argentine–Chilean frontier and configures a major divide between the Pacific slope to the west and the Atlantic slope to the east.

The peopling of this vast territory was a process of gradual intensity. The first evidence of human presence (during Pleistocene–Holocene transition) was registered on the river valleys crossing the Santa Cruz plateau, and shortly after that, on the

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southern edge of the continent, in the Chilean Magallanes region (Borrero, 2008; Méndez Melgar, 2013). Later occupations (Early Holocene) were registered all along the area bordering the Andes (Borrero, 2001). For this period, direct evidence of the human exploitation of marine resources on the coast from around 7400 years ago were reported (Castro et al., 2007; Gómez Otero, 2007:135; Ambrústolo et al., 2011). In the late Holocene, there was a significant population growth, though densities remained low, and the use of the whole territory became evident. This occupation process ended in the late 19th Century with an abrupt population decline of the native Patagonian inhabitants as a result of the violent expansion of the Argentinian State (Borrero, 2001).

Throughout the millennia, Patagonian hunters–gatherers focussed their subsistence and economy mainly on guanaco (*Lama guanicoe*), and, to a lesser degree, other species including Patagonian ostrich or choique (*Rhea pennata*), and huemul (*Hippocamelus bisulcus*) in the Andes (Miotti, 1989). They supplemented their diet with vegetables, and in certain coastal and fluvial areas, with molluscs (Zubimendi et al., 2005; Gómez Otero, 2007). These human groups had a varied lithic technology, making use of high-quality raw materials available in the territory, and they manufactured various bone artifacts. Ceramic technology was adopted very late, about 2000 years ago (Borrero, 2001; Gómez Otero, 2007; Schuster, 2014).

2.1. NCSC archaeological area

The NCSC project includes an area of 420 km of coast, from the limit between Chubut and Santa Cruz provinces in the north, and Laura Bay to the south. For analytical reasons, the territory that lies approximately 30 km inland from the coastline has been included in this archaeological area (Castro et al., 2003; see Fig. 1). The environmental features of the latter are similar to those from the inland Patagonian plateau (Zubimendi, 2010). The climate is arid to semiarid with average temperatures between 17° and 4 °C. Rain is concentrated in the winter months with an average of 200 mm yearly. Wind blows from the west, generating evaporation and transpiration, which results in extreme dryness (Soto and Vázquez, 2000). The terrestrial vegetation belongs to the Andean–Patagonian Province (Cuadra and Oliva, 1996), characterized by an arbustive-graminous steppe with grass-like coirones (*Stipa humilis* and *S. speciosa*) interrupted by mata negra bushes (*Verbena tridens*). Although there are no paleoclimate data of the NCSC, information from the central Deseado massif (~100 km west) is available. During the Middle Holocene, a warmer period with fluctuations in effective humidity was recorded. A climatic change occurred from moderate weather conditions to more arid between 5000 and 3750 BP, with the establishment of modern climatic conditions since then (e.g. De Porras et al., 2009).

The littoral of the NCSC can be divided in three different zones according to geomorphological characteristics (Codignotto, 2000). Northward, the San Jorge gulf has wide cobble and sandy beaches, mostly related to intertidal surfaces of smooth inclination formed by sedimentary rock (commonly known as “restingas” by local inhabitants). This environment offers a diverse marine fauna, especially molluscs. The coast between Blanco cape and Puerto Deseado city shows extensive Holocene beach ridges, and narrow beaches of cobblestones without intertidal surfaces. The southern coast (from Puerto Deseado city to Laura bay) exposes an irregular littoral with inlets and off-shore islands, small sandy beaches interspersed with porphyrytic outcrops belonging to the Bahia Laura Formation, especially in Oso Marino, Nodales, and Laura bays. Those outcrops define salient points, and small capes or points as Azopardo, Medanosa and Mercedes, which influence the configuration of intertidal surfaces rich in marine resources

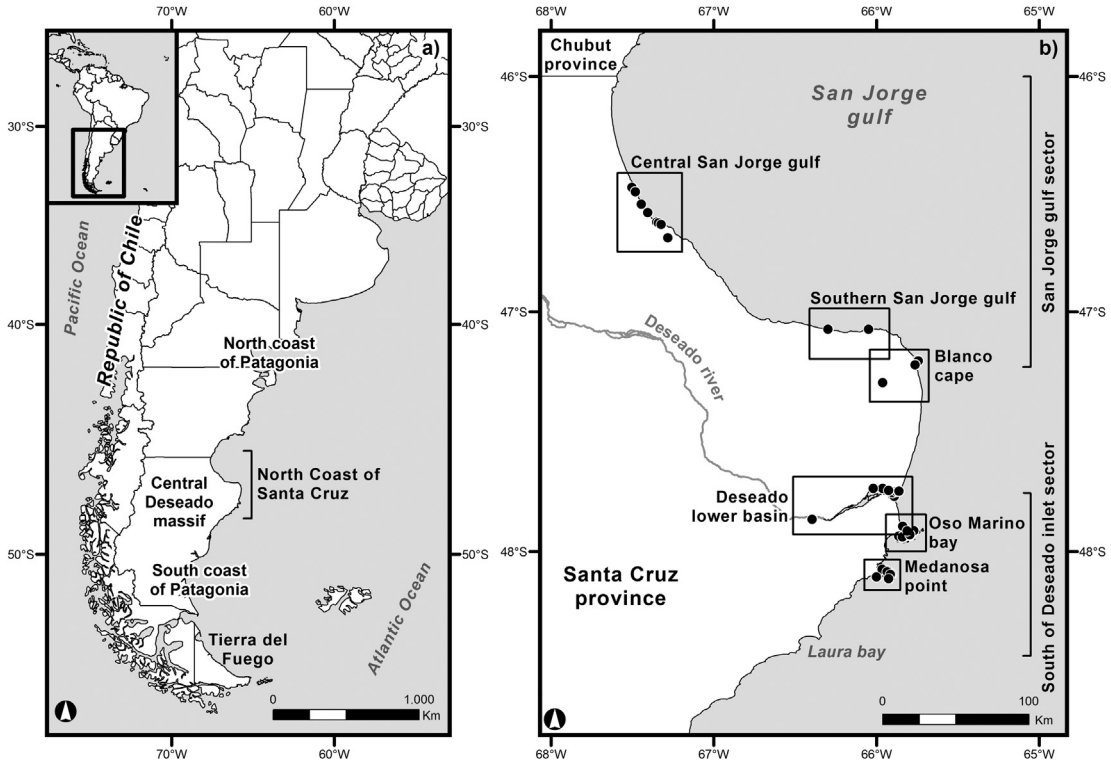

Fig. 1. a) Relative position of the north coast of Santa Cruz (NCSC) study area; b) sampled ^{14}C dated sites within archaeological localities.

(especially molluscs). There are alternating sandy beaches and cliffs to the north and south of these capes.

During the Holocene, the coastal shoreline changed due to the relative change of the sea level, which varies between 4 and 10 m, and by accretion and erosion processes. The most noteworthy geological process that affected the Patagonian coast during the Holocene was the last maximum marine transgression that occurred nearly 7000 BP (Codignotto, 1987; Rutter et al., 1989; Codignotto et al., 1992; Gonzáles Bonorino et al., 1999; Vilas et al., 1999; Rostami et al., 2000; Pedoja et al., 2010; Ponce et al., 2011). This change would have affected human settlements on certain coastal areas at different times in the Holocene (e.g. Gómez Otero et al., 1998; Castro et al., 2011; Favier Dubois and Kokot, 2011; Favier Dubois, 2013).

The intermediate zone comprises a high plateau of nearly 300 m above sea level in the southwest of the NCSC, and a plateau flank, formed by gentle slopes towards the sea. These latter are crossed by *cañadones* (Patagonian name for valleys or small canyons which were formed by temporary streams) and also some small temporary lagoons (Zubimendi, 2010). There are no paleolandscape or paleoclimatic studies in the intermediate zone.

The geomorphological variability of this coast correlates with a variation in availability of marine resources. Within marine mammals, there are two sea lion species (*Otaria flavescens* and *Arctocephalus australis*; Carrara, 1952; Schiavini et al., 1999). Among sea birds, there are several species of cormorants (*Phalacrocorax* sp.) and Magellanic penguins (*Spheniscus magellanicus*). On the intertidal surfaces known as "restingas", extensive banks of invertebrate fauna are exposed, especially molluscs (Aguirre and Farinati, 1997) such as Nacella (=*Patinigera*) sp. and mussels (*Mytilus edulis* and *Aulacomya atra*), which were economically important for the local hunter–gatherers. Large snails (*Adelomelon ferrusacii*, *A. magellanica*) and clams (*Leukoma antiqua*) are also available (Zubimendi et al., 2005; Zubimendi, 2012; Hammond and Zubimendi, 2013). The terrestrial fauna does not differ from those from the inland plateau of central Patagonia: most common are the guanacos (*L. guanicoe*), mara or patagonic hare (*Dolichotis patagonum*), and choique (*R. pennata*).

The change in the intertidal area during the Holocene would have caused differences in the availability and accessibility of sea food resources exploited by Patagonian hunter–gatherer societies. For instance, they might have had an influence on the formation and disappearance of abrasion platforms with shoals of molluscs, and also on the conditions that would favour the formation of pinniped colonies, such as cliffs coastal or boulder beaches with ready access to deep water (Borella, 2007). There are studies that show a decline in pinniped colonies in historical times during the first decades of the 20th century (Carrara, 1952; Schiavini et al., 1999).

3. Archaeological record of the NCSC

During investigations in recent years, a distributional pattern in the archaeological record was identified. This pattern was interpreted as the result of coastal hunter–gatherer groups that heavily exploited the marine resources available on the coast during the Late Holocene (Castro et al., 2003; Zubimendi et al., 2004; Moreno, 2009). These data were obtained through studies done mainly on shell middens in which bone remains were associated to charcoal hearths and lithic artifacts. The largest concentrations of shell middens are related to the most productive coastal areas, with colonies of pinnipeds and molluscs. According to density, distribution, type of archaeological sites and coastal geomorphology along NCSC, different Archaeological Sectors were defined (Fig. 1):

- *San Jorge gulf*: in this sector, the distribution of resources (marine and terrestrial fauna and lithic raw material) seems to have affected the spatial pattern of the archaeological record. Although the coastal archaeological record is not dense, most of the shell middens are along this sector. Statistically, the archaeological record has been defined of low archaeological density along the shoreline (Castro et al., 2003; Zubimendi et al., 2005). Different types of human burials have also been identified (Zubimendi et al., 2011a; Zilio et al., 2013b).
- *South of Deseado inlet*: The archaeological record shows an intensive but different use of the coast according to littoral geomorphologic variability. The human settlement concentration might have been stronger on Medanosa point, Oso Marino and Nodales bays. High concentrations of human burials have been registered, but only in a few specific places (Castro and Moreno, 2000; Zilio et al., 2011, 2013a).

Between Blanco cape and the lower Deseado basin, only some scattered cultural remains have been identified (Castro et al., 2003; Moreno, 2009; Zubimendi, 2010). In the last five years, intensive archaeological research has been carried out in the lower Deseado basin. This sector offers a combination of open-sea, inlet, riverine environments, and adjacent hinterland with high productivity of marine and terrestrial resources. A great number of rock shelters and important marine and terrestrial faunal resources are present. The archaeological record in the intermediate zone and rock shelters reflects a lower use of space than in the coastal zone (Zubimendi, 2010; Ambrústolo, 2011).

4. Material and methods

For the NCSC, 75 radiocarbon dates have been obtained, all from different types of archaeological sites and materials (Table 1). The dates were calibrated and plotted using OxCal 4.2.3 (Bronk Ramsey, 2009); with the calibration curve ShCal13.14c (Hogg et al., 2013, 2 sigma, 95.4% probability). In the case of mollusc shells, the dates were corrected according to the value of reservoir effect of 400 years for the global marine average (Stuiver and Braziunas, 1993) as the local value is unknown. Reservoir effects show a significant range of values, derived from latitudinal effect but primarily by local effects (Cordero et al., 2003; Favier Dubois, 2013).

For the analysis of the radiocarbon dates, we use the sum of probabilities. This statistical tool generates a distribution of the probability by the combination of the median of all the radiocarbon distributions. The sum of probabilities is considered an adequate estimator for the chronological distribution of the dated samples. It also allows the identification of hiatuses (Stuiver and Reimer, 1993; Rubinos Pérez, 2003; Bronk Ramsey, 2009). Although it has been widely used for the identification of human occupation tendencies in the past (Williams, 2012), we do not use this tool to estimate human paleo-demographies. In this sense, we want to advance in the knowledge of the changes in the momentum of human presence in certain parts of the area, in accordance with a general model of Patagonian peopling (Borrero, 2001).

Following the recommendations of Williams (2012), no taphonomic correction was applied to the sums of probability. Although the sample presented is smaller than recommended by several authors (for instance, Surovell et al., 2009; Williams, 2012), the results can provide some general trends in the changes in the chronological signal (Erlandson and Moss, 1999), and ultimately, in relation to the changes among hunter–gatherer populations.

All radiocarbon dates have background information which is presented in Table 1, as: archaeological sector and locality; name of the site; description of archaeological site type; ^{14}C years date, corrected in the case of marine samples; ^{14}C cal year with 2-sigma

Table 1
Radiocarbon dates from the NCSC. The number of archaeological sites corresponds with those in Figs. 2–7.

Sector	Locality	Archaeological site	Type of archaeological site		^{14}C years BP[a]	Cal years BP (mean)	Lab. code	Dated material	Reference
San Jorge gulf	Central San Jorge gulf	1. Puerto Caleta Paula	Open-air burial (chenque)		1040 ± 60	1053 (888) 768	LP2695	Bone (*Homo sapiens sapiens*)	Zilio, 2013
		2. Sitio Heupel	Open-air burial (chenque)		730 ± 60	722 (631) 555	LP2393	Bone (*Homo sapiens sapiens*)	Zubimendi et al., 2011a
		3. El Zanjón 1 (sample 1)	Open-air burial (on pit)		2130 ± 90	2320 (2084) 1878	LP2443	Bone (*Homo sapiens sapiens*)	Zubimendi et al., 2011a
		4. El Zanjón 2 (sample 1)	Open-air burial (on pit)		2250 ± 60	2347 (2215) 2060	LP2461	Bone (*Homo sapiens sapiens*)	Zubimendi et al., 2011a
		5. Cañadón del Algarrobo	Open-air burial (indeterminate type)		2300 ± 50	2355 (2253) 2150	LP2689	Bone (*Homo sapiens sapiens*)	Zilio et al., 2013b
		6. Palo Alto	Open-air residential site (shell midden of low density)		(690 ± 90)	732 (619) 513	LP2280	Shells (*Nacella magellanica*)	Zubimendi et al., 2010
		7. Palo Caído	Open-air residential site (shell midden of low density)		(560 ± 60)	649 (545) 473	LP2275	Shells (*Nacella magellanica*)	Zubimendi et al., 2010
		8. Cantera Morales 2	Open-air burial (in sand dune)		1820 ± 60	1835 (1698) 1545	LP2692	Bone (*Homo sapiens sapiens*)	Zilio et al., 2013b
		9. Bahía Lángara 1	Open-air burial (chenque)		320 ± 50	487 (360) 154	LP2713	Bone (*Homo sapiens sapiens*)	Zilio, 2013
		10. Sitio Moreno	Open-air residential site	Level 1	2720 ± 50	2920 (2801) 2729	LP-206	Charcoal (disperse)	Moreno and Castro, 1995
			(shell midden of medium density)	Level 3	3290 ± 90	3696 (3481) 3318	1063cSM	Charcoal (disperse)	
		11. Bahía Lángara 5	Open-air burial (indeterminate type)		2170 ± 50	2307 (2133) 2003	LP2705	Bone (*Homo sapiens sapiens*)	Zilio et al., 2013b
		12. Bahía Lángara 2	Open-air burial (indeterminate type)		1820 ± 60	1835 (1698) 1545	LP2700	Bone (*Homo sapiens sapiens*)	Zilio et al., 2013b
	Southern San Jorge gulf	13. Cañadón del Duraznillo	Open-air burial (chenque)		640 ± 50	658 (594) 529	LP2668	Bone (*Homo sapiens sapiens*)	Zilio et al., 2013b
		14. CaboTres Puntas 1	Open-air residential site (shell midden of low density)		6060 ± 70	5904 (5735) 5591	AA13663	Charcoal (disperse)	Castro and Moreno, 1996–1997
		15. CaboTres Puntas (3)	Open-air residential site (shell midden of low density)		5480 ± 80	6398 (6211) 6002	LP1647	Charcoal (disperse)	Zubimendi et al., 2005
		16. CaboTres Puntas (2)	Open-air residential site (shell midden of low density)		5420 ± 80	7155 (6871) 6671	LP1692	Shells (indeterminate)	Zubimendi et al., 2005
	Blanco cape	17. El Piche	Open-air residential site (shell midden of medium density)		1850 ± 90	1987 (1736) 1535	LP2027	Charcoal (disperse)	Zubimendi 2010
		18. Cabo Blanco 1	Open-air residential site (shell midden of high density)	Lower level	1700 ± 30	1698 (1565) 1475	Beta 134598	Bone (*Lama guanicoe*)	Moreno, 2009
				Upper level	1420 ± 50	1362 (1283) 11,874	Beta 134597	Bone (*Lama guanicoe*)	
		19. Cabo Blanco 2	Open-air residential site (shell midden of high density)	Lower level	3310 ± 50	3614 (3498) 3380	LP-992	Bone (*Lama guanicoe*)	
				Upper level	960 ± 60	935 (831) 722	Beta 134599	Bone (*Lama guanicoe*)	
		20. Laguna del Telégrafo	Open-air residential site (shell midden of medium density)		2380 ± 60	2699 (2400) 2160	LP1677	Charcoal (disperse)	Castro et al., 2007
		21. La Estrella	Open-air residential site (low density)		690 ± 70	720 (613) 529	LP2096	Bone (*Lama guanicoe*)	Zubimendi, 2010
Lower Deseado basin	Northern margin of Deseado inlet	22. Cueva del Indio	Residential site on rock shelter (cave)		(1680 ± 25)	2081 (1992) 1926	Unknown	Shells (*Nacella magellanica*)	Unpublished
		23. Cueva de los Leones	Residential site on rock shelter (cave)		(480 ± 30)	534 (495) 454	Unknown	Shells (*Nacella magellanica*)	Unpublished
		24. SitioCarsa	Open-air burial (in sand dune)		1740 ± 60	1741 (1613) 1431	LP2088	Bone (*Homo sapiens sapiens*)	Unpublished
		25. Sitio UNPA	Open-air residential site (shell midden of low density)		970 ± 50	926 (840) 741	LP2891	Charcoal (disperse)	Unpublished
					690 ± 70	720 (613) 529	LP2896	Charcoal (disperse)	
		26. Conchero 1	Open-air residential site (shell midden of low density)		(476 ± 59)	551 (432) 325	Unknown	Shells (*Mytilus edulis*)	Unpublished
		27. Cañadón Gimenez	Open-air residential site (shell midden of low density)		1070 ± 70	1067 (925) 773	LP1800	Shells (indeterminate)	Moreno and Videla 2008
		28. Cañadón del Puerto	Open-air residential site (shell midden of low density)		(1040 ± 40)	962 (885) 800	LP1298	Shells (indeterminate)	Iantanos, 2003
		29. CañadónTorcidoAlero 4	Residential site on rock shelter (overhang)	Heart 1	1690 ± 90	1709 (1550) 1377	LP-2908	Charcoal (heart)	Unpublished
				Bone	2760 ± 70	2999 (2841) 2732	LP-2762	Bone (*Lama guanicoe*)	
		30. Pa02/19	Open-air residential site (shell midden of low density)		(800 ± 40)	746 (693) 574	Unknown	Shells (indeterminate)	Schellmann and Radtke, 2010
					(1437 ± 49)	1264 (1110) 978	Unknown	Shells (indeterminate)	
	Deseado river	31. Cueva Marsicano	Residential site on rock shelter (cave)	Heart 1	6853 ± 48	7749 (7650) 7573	AA80415	Charcoal (heart)	Unpublished
				Heart 2	6684 ± 48	7589 (7521) 7434	AA80414	Charcoal (heart)	

	Southern margin of Deseado inlet	32. Puerto Jenkins 2	Open-air residential site (shell midden of high density)		690 ± 60	682 (612) 536	LP2630	Charcoal (disperse)	Hammond and Zubimendi 2013
		33. Punta Guanaco 91	Open-air residential site (shell midden of medium density)		2280 ± 70	2362 (2235) 2020	LP1694	Bone (*Lama guanicoe*)	Castro et al., 2007
		34. Punta Guanaco 97	Open-air residential site (shell midden of medium density)		1480 ± 70	1522 (1349) 1186	LP1648	Charcoal (disperse)	Castro et al., 2007
South of Deseado inlet	Oso Marino bay	35. La Cantera	Open-air residential site (shell midden of medium density)		1170 ± 60	1179 (1040) 929	LP2041	Charcoal (disperse)	Zubimendi, 2010
		36. Alero El Oriental	Residential site on rock shelter (overhang)	Lower level	6930 ± 100	7934 (7741) 7577	LP-2318	Charcoal (heart)	Ambrústolo et al., 2011
				Middle level	5150 ± 80	6170 (5843) 5646	LP-2311	Charcoal (heart)	
					5860 ± 90	6850 (6623) 6407	LP-2310	Charcoal (heart)	
					5810 ± 110	6831 (6575) 6312	LP-2218	Charcoal (heart)	
				Upper level	1530 ± 60	1519 (1390 = 1299)	LP-2267	Charcoal (heart)	
		37. Playa del Negro	Open-air residential site (shell midden of medium density)		1450 ± 60	1416 (1315) 1185	LP2682	Charcoal (disperse)	Unpublished
		38. Cueva del Negro	Residential site on rock shelter (overhang)	Outer zone	1730 ± 80	1813 (1599) 1408	LP-2071	Bone (Pinnipedia)	Zubimendi et al., 2011b
					1390 ± 70	1368 (1245) 1076	LP-2320	Charcoal (heart)	
					1290 ± 50	1280 (1166) 1059	LP-2279	Bone (Pinnipedia)	
					1220 ± 80	1270 (1096) 938	LP-2047	Bone (Pinnipedia)	
					1170 ± 110	1274 (1048) 803	LP-2290	Bone (*Rhea Americana*)	
			Residential site on rock shelter (cave)	Inner zone	1340 ± 60	1303 (1204) 1072	LP-2065	Bone (*Lama guanicoe*)	
		39. Punta Norte, Sur (burial 2)	Open-air burial (chenque)		770 ± 60	747 (663) 559	LP-2558	Bone (*Homo sapiens sapiens*)	Zilio et al., 2013b
		40. Playa Castillo (burial 37)	Open-air burial (chenque)		730 ± 60	722 (631) 555	LP-2523	Bone (*Homo sapiens sapiens*)	Zilio et al., 2013b
		41. Las Hormigas	Open-air residential site (shell midden of medium density)		370 ± 40	488 (395) 312	LP-2504	Charcoal (disperse)	Hammond and Zubimendi, 2013
		42. Peñón Azopardo	Residential site on rock shelter (overhang)		1690 ± 60	1704 (1550) 1410	LP2560	Charcoal (heart)	Unpublished
		43. Los Albatros	Open-air residential site (shell midden of medium density)	Grid 1	(1070 ± 80)	1091 (928) 742	LP-2012	Shells (*Nacella magellanica*)	Zubimendi and Hammond, 2009
				Grid 2	(1040 ± 80)	1060 (895) 741	LP-2067	Shells (*Nacella magellanica*)	
		44. Médano Alto	Open-air residential site (shell midden of medium density)		5790 ± 80	6740 (6548) 6324	LP1579	Charcoal (disperse)	Zubimendi et al., 2005
		45. Médano Alto Oeste	Open-air burial (in sand dune)		1570 ± 50	1528 (1422) 1317	LP2551	Bone (*Homo sapiens sapiens*)	Unpublished
		46. Sitio 112	Open-air residential site (shell midden of high density)		2770 ± 60	2965 (2843) 2745	LP2541	Charcoal (disperse)	Hammond and Zubimendi, 2013
	Medanosa point	47. Médanos del Canal 196	Open-air residential site (shell midden of high density)		2280 ± 70	2362 (2235) 2020	LP1522	Charcoal (disperse)	Zubimendi et al., 2005
		48. Sitio 160	Open-air residential site (shell midden of high density)		370 ± 50	492 (395) 306	LP2507	Charcoal (disperse)	Hammond and Zubimendi, 2013
		49. Médano 3	Open-air residential site (shell midden of high density)		2240 ± 80	2350 (2198) 2010	LP1532	Charcoal (disperse)	Zubimendi et al., 2005
		50. Médano 1	Open-air residential site (shell midden of high density)	Lower level	6300 ± 90	7416 (7157) 6946	LP-1544	Charcoal (disperse)	Zubimendi et al., 2005
				Upper lever	2390 ± 90	2716 (2428) 2157	LP-1536	Charcoal (disperse)	
					2140 ± 60	2305 (2095) 1927	LP-2501	Charcoal (disperse)	Hammond and Zubimendi, 2013
		51. Punta Buque 1	Open-air residential site (shell midden of high density)		1070 ± 60	1059 (924) 797	LP2724	Charcoal (disperse)	Unpublished
		52. Shag	Open-air burial (indeterminate type)		2620 ± 70	2846 (2636) 2383	LP2755	Bone (*Homo sapiens sapiens*)	Unpublished
		53. Médano 4 Baliza	Open-air residential site (shell midden of high density)		920 ± 40	555 (517) 473	LP1344	Shells (*Nacella magellanica*)	Zubimendi et al., 2005
		54. Puesto Baliza 2	Open-air residential site (shell midden of medium density)		1290 ± 60	1292 (1162) 995	LP2732	Charcoal (disperse)	Unpublished
		55. El Amanecer	Open-air burial (in sand dune)		2850 ± 60	3076 (2923) 2766	LP2747	Bone (*Homo sapiens sapiens*)	Unpublished
		56. Campo de Chenques	Open-air burial (chenque)		830 ± 60	898 (717) 570	LP2778	Bone (*Homo sapiens sapiens*)	Zilio, 2013

[a] Between brackets, radiocarbon dates with marine correction of 400 years (Stuiver and Braziunas, 1993).

range and the intercept year in parentheses; laboratory code; type of dated sample; and bibliographic references. The archaeological sites registered in NCSC have been classified according to two variables: functionality (residential sites and human burials) and location (open-air sites and rock shelters). Three types of archaeological sites were registered in NCSC (see Table 2). In the case of residential activities sites, other information is presented in Table 3: presence of shells, bones of different marine and terrestrial fauna (p.e. *L. guanicoe*, pinnipeds, seabirds, and fish bones), lithic material (debitage, cores, bifacial tools and grinding tools), ceramics sherds, and other artifacts.

Table 2
Classification of types of sites registered in the NCSC used in this paper.

		Functionality	
		Residential activities	Human burials
Location	Open-air sites	Lithic scatters of different archaeological density,[a] in surface and stratigraphy in open-air places, most of them with shell remains (shell middens), while bone remains are scarce	Different types of human burials located in stratigraphy in open-air places (p.e. on sand dunes, chenques)
	Rock shelter	Lithic scatters in stratigraphy inside caves or overhangs, where hearths and bones are found, in some cases, also marine resources (shells or bones of marine taxa)	–

[a] In the case of shell midden, the density is considered in two ways: 1) qualitative, based on the amount of shells observed in surface (Castro et al., 2003), or 2) quantitative, using values of shells per m^2 on surface samples (Zubimendi et al., 2004, 2005) or dm^3 from stratigraphic excavations (Zubimendi, 2012; Hammond and Zubimendi, 2013; among others).

4.1. Radiocarbon database

The radiocarbon samples were obtained from 56 archaeological sites, with a mean of 1.34 dates per site (Table 1). Only six radiocarbon dates have been obtained by researchers outside the NCSC Archaeological Project. Almost all the samples ($n = 73$; 97.3%) were processed using the conventional ^{14}C dating method.

Considering the samples' geographical distribution (Table 4), most came from South of Deseado inlet (45%), especially from the archaeological locality of Oso Marino bay (25%). From the San Jorge gulf, 24 radiocarbon dates have been obtained (32%), and from the lower Deseado basin 17 dates (23%). Distribution of the sites is shown in Figs. 2–7, where the numbers of sites correspond to those in Table 1.

In the study area, different types of archaeological sites have been identified (Table 5), and radiocarbon samples were obtained from all types of archaeological sites. Shell middens are the most abundant (52%) type of archaeological sites in the area (Castro et al., 2003; Zubimendi et al., 2004). Shell middens of different sizes and densities have been dated; in some cases there is more than one sample from one site (for example, UNPA and Los Albatros sites), in other cases, different levels of a stratigraphic sequence have been dated (for example, Sitio Moreno and Cabo Blanco 1). Nevertheless, most shell middens seem to correspond to only one occupational event (Zubimendi, 2012; Hammond and Zubimendi, 2013; Hammond, 2013a).

There is only one open-air site, which is not a shell midden, with chronological information (1.3%; Zubimendi, 2010). Dates from rock shelters (24%) came from caves and overhangs. In such contexts, radiocarbon dates have been based in stratigraphic sequences, especially in Cueva del Negro (Zubimendi et al., 2011b) and Alero El Oriental (Ambrústolo et al., 2011).

The radiocarbon dates of human bones (22.6%) come from different types of burial structures (Table 4): in pits, in sand dunes, and the structures commonly called *chenques* (Zubimendi et al., 2011a; Zilio, 2013; Zilio et al., 2013b). Chenque is a type of burial consisting of a pile of stones arranged on the ground, on hills or small elevations and with aged between 1500 and 200 BP (Zilio, 2013). The human remains analyzed in this paper come from samples deposited in the museums of the nearby towns (Museo del Hombre y su Entorno of the Caleta Olivia city and Museo Municipal Mario Brozoski of Puerto Deseado city); or from rescue excavations carried out at request of these institutions from burials at imminent risk of destruction (see Salceda et al. 1999–2001; Castro et al., 2009; Zubimendi et al., 2011a,b; Zilio et al., 2013b).

In regards to the nature of samples (Table 6), most dates were made on charcoals, mainly dispersed charcoal from shell midden lenses, and defined hearths from rock shelter sites. There are 13 dates from mollusc shells, mostly from the gastropod *Nacella magellanica*, and one from the mussel *M. edulis*.

5. Results

The sum of probabilities of dates from NCSC was made in order to differentiate changes in the chronological signal of human presence (Fig. 8). In this regard, three main temporary moments or time intervals were defined: one corresponding to Middle Holocene, with dates between ca. 8000 and ca. 5800 cal BP ($n = 11$; 14.6%), a hiatus with no evidence of occupation between ca. 5800 and ca. 3900 cal BP, and a third set of dates from the late Holocene, between ca. 3900 and ca. 300 cal BP ($n = 64$; 85.4%). Chronological variations were also observed in relation to types of sites (Fig. 9). Open-air sites and rock shelters share similar chronological ranges, and burials date from ca. 3100 cal BP until historic times. There are no chronological differences between the three sectors of the NCSC (Fig. 10).

5.1. First occupations

Eleven radiocarbon dates correspond to Middle Holocene times, which represent the earliest human signal identified in the NCSC. One date of ca. 8000 cal BP comes from Alero El Oriental, a small overhang located 1.5 km from the modern coastline. This is the earliest radiocarbon date of the NCSC, and is one of the earlier evidences of occupation in the Patagonian coast (Ambrústolo et al., 2011). Other sites, including Cueva Marsicano and Médano Alto, or archaeological localities such as Medanosa point and Tres Puntas cape (Castro et al., 2007), were dated at ca. 8000–7000 cal BP.

Radiocarbon data of the Middle Holocene is derived from different site types: open-air sites (all of them shell middens; $n = 5$), with high and low densities, and rock shelters ($n = 6$, but from 2 sites). Evidence of exploitation of marine resources was recorded in shell middens (Zubimendi et al., 2005; Castro et al., 2007, 2011), and also in Alero El Oriental. In this last case, mollusc shells and bones of pinnipeds were identified in low densities (Ambrústolo et al., 2011). This would suggest that during the Middle Holocene, the coast and its resources (mainly molluscs) have been exploited by hunter–gatherers who occupied the area.

There is no evidence of previous human occupation to this time, although according to various studies, during the Pleistocene–Holocene transition and prior to the mid-Holocene transgressive maximum at ca. 8000 cal BP, the Atlantic coast would have been several kilometres eastward from its current position (Codignotto et al., 1992; Schellmann and Radtke, 2010; Ponce et al., 2011). Therefore, the evidence of coastal occupations could be

Table 3
Structure, economical resources remains and artifacts related to archaeological sites with contextual information from NCSC. The number of archaeological sites corresponds with those in Table 1 and Figs. 2–7.

Archaeological site	Type of site		Shells	Guanaco bones	Pinnipeds bones	Seabirds bones	Fish bones	Lithic scatters	Bifaces	Other lithic artifacts	Grinding tools	Ceramics sherds	Other artifacts	References
6. Palo Alto	Unicomponent shell midden		x	x	x			x	x		x	x	Shell bead	Zubimendi et al., 2010
7. Palo Caído	Unicomponent shell midden		x	x	x			x	x		x	x		Zubimendi, 2010
10. Sitio Moreno	Multicomponent shell midden	Level 1	x				x	x		x				Moreno and Castro, 1995
		Level 3	x					x						
14. CaboTresPuntas 1	Unicomponent shell midden		x					x						Castro and Moreno 1996–1997
17. El Piche	Unicomponent shell midden		x			x		x		x			Engraved stone	Trola et al., 2007
18. Cabo Blanco 1	Unicomponent shell midden		x		x	x		x				x	stone mace	Moreno et al., 1998
19. Cabo Blanco 2	Unicomponent shell midden		x		x	x		x	x	x			stone mace	Castro et al., 2000
20. Laguna del Telégrafo	Unicomponent shell midden		x		x	x		x					Leather knot	Trola et al., 2007
21. La Estrella 1	¿Unicomponent open-air site?			x				x						Zubimendi, 2010
25. Sitio UNPA	Unicomponent shell midden		x					x						Unpublished
27. Cañadón Giménez	Multicomponent shell midden		x	x	x			x				x		Moreno and Videla, 2008
29. Cañadón Torcido 4	¿Unicomponent overhang?		x	x				x		x			Bone awl	Unpublished
32. Puerto Jenkins 2	Unicomponent shell midden		x	x		x		x	x					Hammond and Zubimendi, 2013
35. La Cantera	Unicomponent shell midden		x					x		x				Ambrústolo, 2011
36. Alero El Oriental	Multicomponent overhang	Lower level	x		x			x						Ambrústolo et al., 2011
		Upper level		x				x		x				
38. Cueva del Negro	Unicomponent shell midden in cave		x		x	x	x	x	x		x		Harpoons heads, bone retouchers, bone atlatl hooks, stone mace, bone awl, human jaws, shell beads	Beretta et al., 2013; Zubimendi et al., 2011b
41. Las Hormigas	Unicomponent shell midden		x	x	x			x	x				Iron	Hammond, 2013b
43. Los Albatros	Unicomponent shell midden		x		x	x		x	x		x		Shell beads	Zubimendi and Hammond, 2009
44. Médano Alto	Unicomponent shell midden		x					x						Zubimendi et al., 2005
46. Sitio 112	Unicomponent shell midden		x	x				x					Human jaw	Hammond and Zubimendi, 2013
48. Sitio 160	Unicomponent shell midden		x	x				x	x			x		Hammond and Zubimendi, 2013
50. Medano 1	Multicomponent shell midden	Lower level	No data											Zubimendi et al., 2005
		Upper level	x	x	x		x	x						Hammond and Zubimendi, 2013

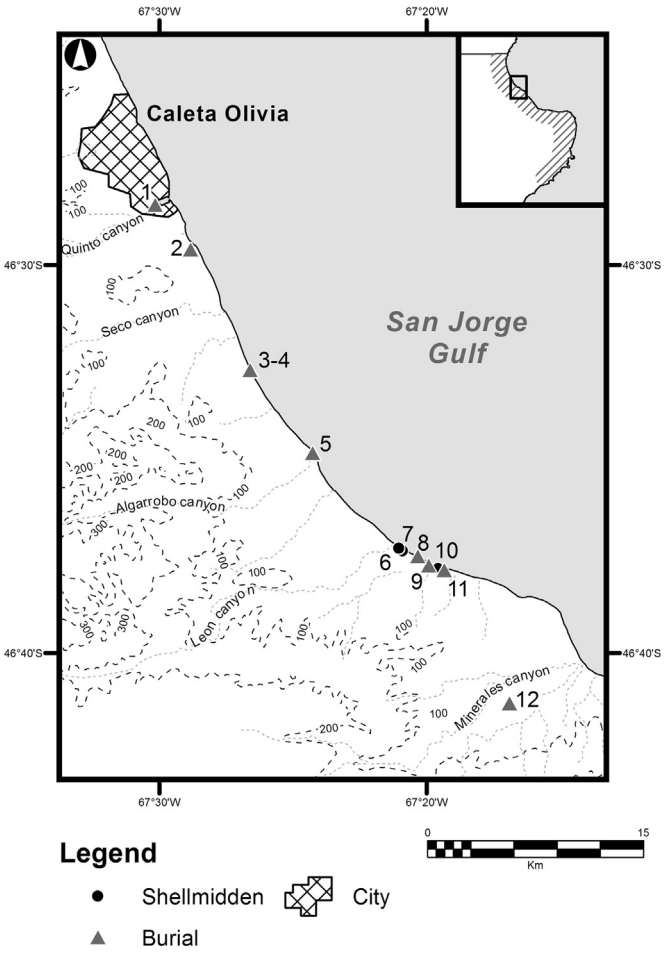

Fig. 2. Radiocarbon samples from Central San Jorge gulf archaeological locality.

under the sea today, or have been destroyed by erosion of the advancing sea (Bailey and Milner, 2002; Favier Dubois, 2013).

In order to compare the human occupation during middle Holocene in other areas of Patagonic coast and inland, the sum of radiocarbon dates probabilities from the northern coast (Rio Negro and Chubut Province) is shown in Fig. 11; the southern coast (South of Santa Cruz Province); and the central Deseado massif of Patagonia in the west (for their location, see Fig. 1; the radiocarbon dates considered are presented in Table 7). First evidences of Patagonian coastal occupation are found in the north, coincident with oldest dates of the NCSC (Gómez Otero, 2007). For Northern Patagonia, a hiatus between 6400 and 8000 cal BP have been detected, and the archaeological signal seems to be stronger for the middle Holocene than for the Late Holocene (Favier Dubois and Kokot, 2011; Favier Dubois and Scartascini, 2012). At the southern coast of Patagonia, the human occupation seems to begin in Late Holocene, about 2000 years later than in the study area and north Patagonia. The central Deseado massif was one of the earliest zones to be peopled in late Pleistocene, but there is no evidence, direct or indirect, of the use or exploitation of marine resources during Late Pleistocene or Early Holocene (Miotti, 1989). This strong chronological signal may reflect research orientation bias and a higher visibility, or preservation level of the early archaeological record in rock shelters (Rubinos Pérez, 2003; Prates et al., 2013). Earlier signal of human occupation, as in central Deseado massif, does not appear in NCSC. This could be related to sea level changes during the Pleistocene–Holocene transition.

5.2. Chronological hiatus between 5800 and 3900 BP

The chronological sequence of the NCSC shows a hiatus of 1900 cal years in which no archaeological signal was recorded. This chronological gap could be interpreted as an evidence of non-use of the coast and its resources as well as to other causes, for instance: influence of environmental changes with impact on economic resources, producing a displacement of humans to other areas, such as the northern or southern coast or the hinterland in the west; destruction of the archaeological record by geomorphological changes, such as the Middle Holocene marine transgression; or by a bias in the sampling analysis or in the calibration of the ^{14}C curve. According to paleoclimatic data of the central Deseado massif, there was a climatic change from temperate climate conditions to a more

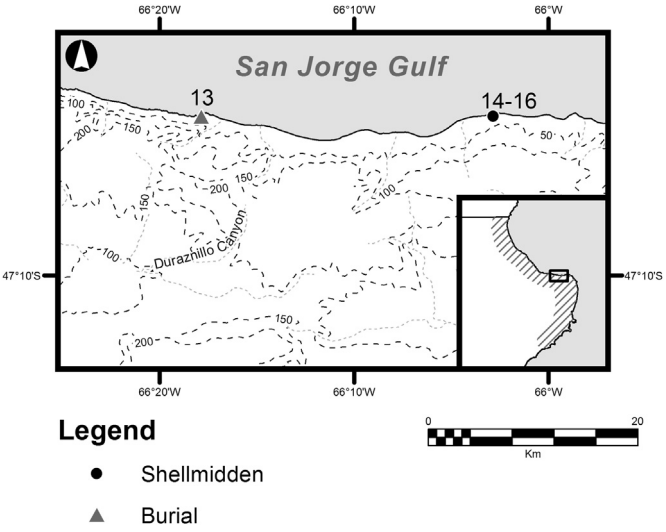

Fig. 3. Radiocarbon samples from Southern San Jorge gulf archaeological locality.

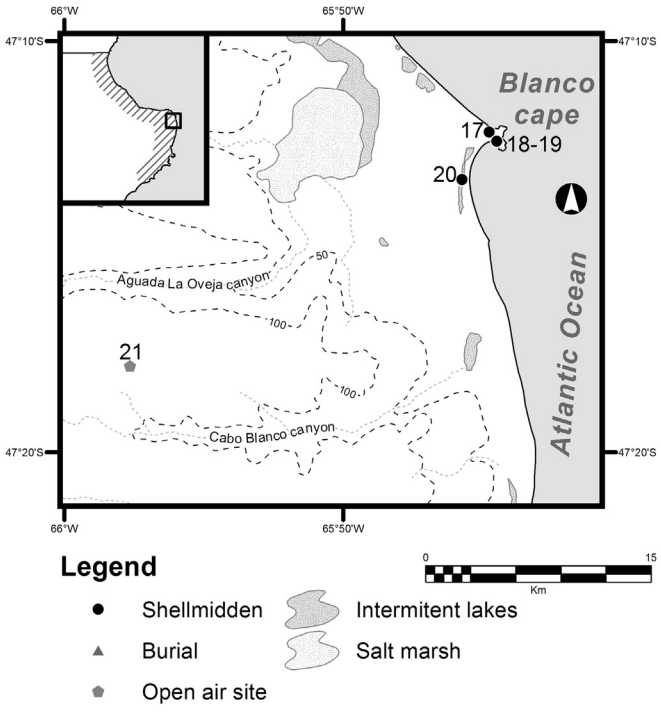

Fig. 4. Radiocarbon samples from Blanco cape archaeological locality.

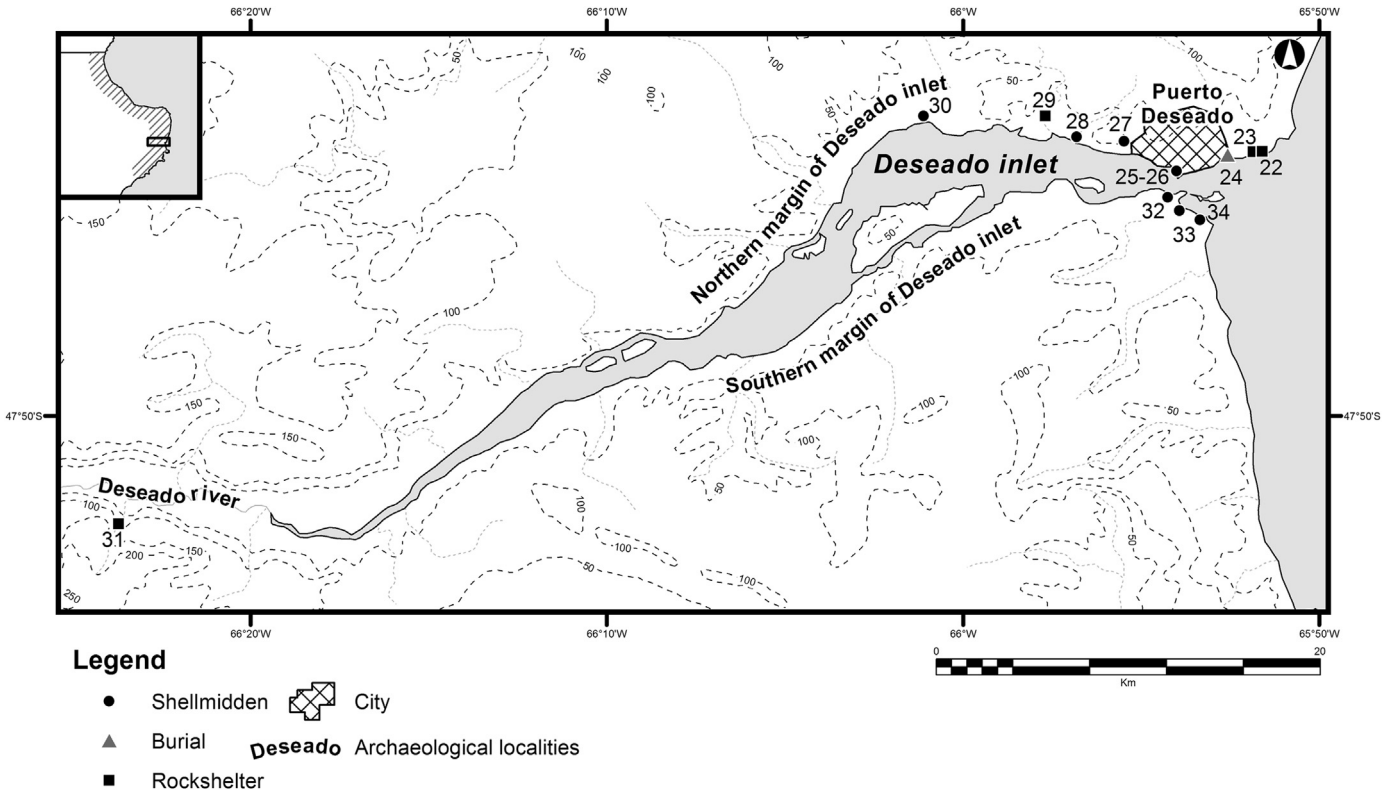

Fig. 5. Radiocarbon samples from Lower basin of Deseado river sector, with the northern and southern margin of Deseado inlet and Deseado river archaeological localities.

arid climate (similar to modern climate) between 5000 and 3750 BP (De Porras et al., 2009). Those changes could have been the cause of a lesser availability of fresh water in an environment traditionally scarce in fresh water sources in the NCSC. Meanwhile, the central Deseado massif shows a stronger archaeological signal (Miotti, 2008).

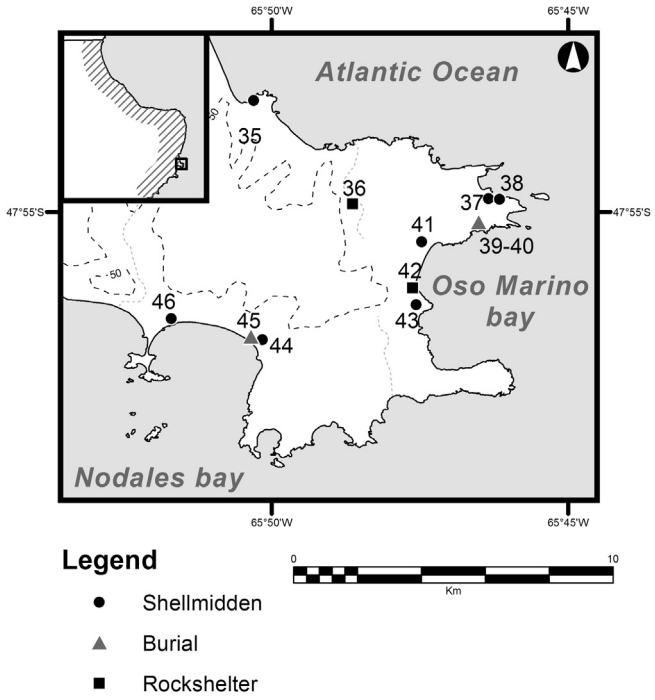

Fig. 6. Radiocarbon samples from Oso Marino bay archaeological locality.

In relation to the second alternative, on open marine littorals the destruction of archaeological sites could have been stronger during Middle Holocene times, as a consequence of erosion, especially during the period of sea level stability, between 6800 and 3800 BP on Solano bay (Chubut province, north of NCSC) (Codignotto et al., 1990). During this period, the Middle Holocene coastline could have been impacted by erosive processes, destroying the possible evidence of human settlements in some sectors of the NCSC. This could be an explanation for the chronological hiatus observed in open marine littorals (sensu Favier Dubois, 2013), but not for the total NCSC. We believe that the mentioned hiatus is not the result of methodological statistical bias, because the number of ^{14}C dates, their spatial distribution and types of sites sampled could be considered significant. The duration of the hiatus has no correlation with a calibration curve bias (Williams, 2012).

Analysing the chronological sequences defined at other areas around NCSC (northern coast of Patagonia, south of Patagonia and central Deseado Massif), some hiatuses can be observed (Fig. 11). Nevertheless, those hiatus are not synchronous to the one identified at the NCSC. The human occupation of the southernmost coast of Patagonia seems to begin around 6000 cal BP with a very weak chronological signal, following several small hiatuses between ca. 4500 and ca. 2500 cal BP. Since ca. 2000 cal BP a strong chronological signal is recorded (Caracotche et al., 2005; Barberena, 2008; Muñoz et al., 2009). In the northern coast of Patagonia, the human occupation seems to have begun sometime before than in NCSC, with a decrease in the chronological signal in concordance to the hiatus identified in the study area (Eugenio and Aldazabal, 2004; Gómez Otero, 2007; Favier Dubois, 2013; Martinez et al., 2013). In the central Deseado massif, a hiatus is observed between ca. 8000 and ca. 6500 cal BP, followed by a strong signal during the times of

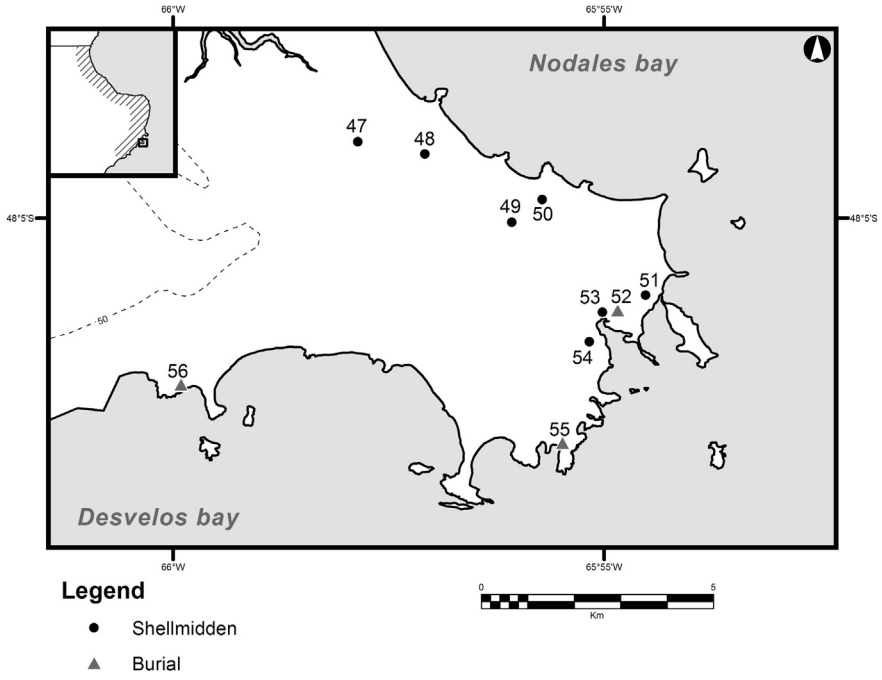

Fig. 7. Radiocarbon samples from Medanosa point archaeological locality.

the NCSC hiatus (see Rubinos Pérez, 2003; Miotti, 2008); no clear explanations have been provided for this.

5.3. Late Holocene occupations

During the Late Holocene, the stronger archaeological signal is clear at 3900 cal BP in the NCSC, with a peak between ca. 2000 and ca. 500 cal BP. After that, a sharp decline occurs at ca. 300 cal BP (Fig. 8). This pattern is similar to those defined for the surrounding coastal areas of Patagonia, although at Northern Patagonia a more continuous signal is clear since the Middle Holocene. In the southern Patagonian coast, the signal strongly increases after 2000 cal BP (Fig. 11).

Chronological data has been obtained from different archaeological sites (Fig. 9): open-air sites ($n = 35$), rock shelters ($n = 12$), and human burials ($n = 17$). The archaeological record from shell middens, which constitutes the most representative type of sites, defines them as multiple activities sites. Most of the shell middens dated in Late Holocene have a high density of mollusc shells and debitage (Zubimendi, 2012; Hammond and Zubimendi, 2013; Hammond, 2013a).

The distribution of dates during the Late Holocene in some localities (e.g., Central San Jorge bay, Blanco cape, Oso Marino bay, and Medanosa point; see Table 1; Zubimendi et al., 2004, 2005; Zubimendi, 2010), and sites (e.g., Sitio Moreno, Cabo Blanco 2 and Médano 1) indicates that several occupation events of the same places have been recorded. In shell middens (Table 2), specialized technology has been found, indicating the use of marine resources, including bone harpoon heads, "rompecráneos" (a kind of stone mace for hunting sea mammals; see Moreno et al., 2000), with

Table 4
Radiocarbon dates from NCSC, archaeological sectors and localities.

Archaeological sector	Archaeological localities	Number of radiocarbon dates	Number of sites
San Jorge gulf	Central San Jorge gulf	13 (17.3%)	12 (21.4%)
	Southern San Jorge gulf	4 (5.3%)	4 (7.1%)
	Blanco cape	7 (9.3%)	5 (8.9%)
	Total San Jorge gulf	**24 (32%)**	**21 (37.5%)**
Lower Deseado basin	Northern margin of Deseado inlet	12 (16%)	9 (16.1%)
	Deseado river	2 (2.7%)	1 (1.8%)
	Southern margin of Deseado inlet	3 (4%)	3 (5.4%)
	Total Lower Deseado basin	**17 (22.7%)**	**13 (23.2%)**
South of Deseado inlet	Oso Marino bay	22 (29.3%)	12 (21.4%)
	Medanosa point	12 (16%)	10 (17.9%)
	Total South of Deseado inlet	**34 (45.3%)**	**22 (39.3%)**
Total CNSC		**75**	**56**

Table 5
Archaeological site's type dated from NCSC.

Type of archaeological site			Number of radiocarbon dates	Number of sites
Open-air	Residential	Low density lithic scatter	1 (1.3%)	1 (1.8%)
		Low density shell midden	8 (10.7%)	7 (12.5%)
		Medium density shell midden	12 (16%)	10 (17.9%)
		High density shell midden	15 (20%)	11 (19.6%)
		No data	4 (5.3%)	3 (5.4%)
		Total	**40 (53.3%)**	**32 (57.1%)**
	Human burials	*Chenque* type	5 (6.7%)	5 (8.9%)
		In dune	3 (4%)	3 (5.4%)
		In pits	2 (2.7%)	2 (3.6%)
		Indeterminate	1 (1.3%)	1 (1.8%)
		No data	6 (8%)	6 (10.6%)
		Total	**17 (22.7%)**	**17 (30.4%)**
Rock shelters	Overhangs		8 (10.7%)	3 (5.4%)
	Caves		10 (13.3%)	4 (7.1%)
	Total		**18 (24%)**	**7 (12.5%)**
Total CNSC			**75**	**56**

Table 6
Material type dated from NCSC.

Type of material	Description	Number of radiocarbon dates	Number of sites
Charcoal	Hearts	10 (13.3%)	5
	Scattered charcoals	23 (30.7%)	19
	Total	**33 (44%)**	–
Bones	*Lama guanicoe*	8 (10.7%)	8
	Rhea pennata	1 (1.3%)	1
	Pinnípedia	3 (4%)	1
	Homo sapiens	17 (22.7%)	17
	Total	**29 (38.7%)**	–
Shells	*Nacella magellanica*	8 (10.7%)	6
	Mytilus edulis	1 (1.3%)	1
	Indeterminate shells	4 (5.3%)	3
	Total	**13 (17.3%)**	–
Total CNSC		**75**	–

chronologies of ca. 1600 to ca. 1200 cal BP (Beretta et al., 2013). Pottery shreds, dated between ca. 1200 and ca. 300 cal BP (Moreno and Videla, 2008; Hammond and Zubimendi, 2013), and grinding tools, dated between ca. 1600 and ca. 500 cal BP, have been found in shell middens, and shell artifacts (especially shell beads) in sites dated between ca. 1600 and ca. 600 cal BP have been found (Zubimendi et al., 2011b). All of these findings are similar and penecontemporary to many others in other areas of Patagonia (p.e., Borrero, 2001; Gómez Otero, 2007; Cassiodoro, 2011).

In contrast to open-air sites, rock shelters reflect a lower density and variability of archaeological record (Table 1). In these sites, animal bones are scarce, perhaps related to a sporadic use of terrestrial fauna, and only in a few rock shelter sites have small concentrations of shells been found. The site structure and the lithic record suggest a low intensity use of the rock shelters as logistic loci for multiple activities (Ambrústolo, 2011; Ambrústolo et al., 2011).

The increase of the chronological signal in Late Holocene littoral and the emergence of a specialized marine technology suggest a more intensive human use of the NCSC, and probably for longer periods. At the same time, the intermediate zone shows a lower intensity of use of specific land and resources (Zubimendi, 2010; Ambrústolo, 2011; Ambrústolo et al., 2011). The increased of chronological signals and specialized technologies have been observed in most of Patagonia during the Late Holocene, which was interpreted as the product of stronger social exchange networks (involving different types of raw materials, handcrafts and meanings; Borrero, 2001; Gómez Otero, 2007; Barberena, 2008; among others).

In regards to funerary practices, two different periods can be defined along the Late Holocene (Fig. 12). The first one, between ca. 3000 and ca. 1500 cal BP, has different types of burials (on sand dunes [$n = 4$] and in pits [$n = 2$]). The second one, between ca. 1000 and ca. 300 cal BP, has "chenques" as the only type of burial (Zilio, 2013; Zilio et al., 2013a).

Some radiocarbon dates, from open-air sites and human burial, show a continuity of hunter gatherers settlement in the NCSC after Hispanic-aboriginal contact. This is also reflected in one case in the material record of Las Hormigas site (Hammond, 2013b).

6. Final considerations

Based on the ^{14}C radiocarbon database of the NCSC, a discontinuous chronological signal is observed over the Holocene. The oldest human signal begins ca. 8000 cal BP, showing an occupation continuity of about 2000 years, followed by an archaeological silence between ca. 5800 and ca. 3900 cal BP. Later, the chronological signal indicates a continuity of human occupation from ca. 3900 until ca. 300 cal BP, but with some changes in the archaeological record.

The lack of evidence for the Pleistocene–Holocene transition could be the result of different processes: destruction of coastal sites; low preservation/visibility of the archaeological record, especially in the case of the shell middens located in the coastline. In consequence, the probability to find archaeological remains from these periods is biased in favour of sites located in the hinterland, especially rock shelters (Ambrústolo, 2011).

The earlier human signal for the NCSC were dated in the Middle Holocene and comes from several archaeological localities (a similar trend has been observed in northern Patagonian coast; Gómez Otero, 2007). Most of those initial occupations show the exploitation of marine resources, but less intensively than in Late Holocene.

Although the chronological hiatus between ca. 5800 and ca. 3900 BP remains as an unresolved issue, it is probably due to sampling and preservation biases. There is a probability that this hiatus was the result of several different biases. Moreover, some biases may be related to the radiocarbon techniques and the calibrated curve, although we cannot know the impact of these variables in this case. Future work must be done in all these directions to find the reason for the lack of human

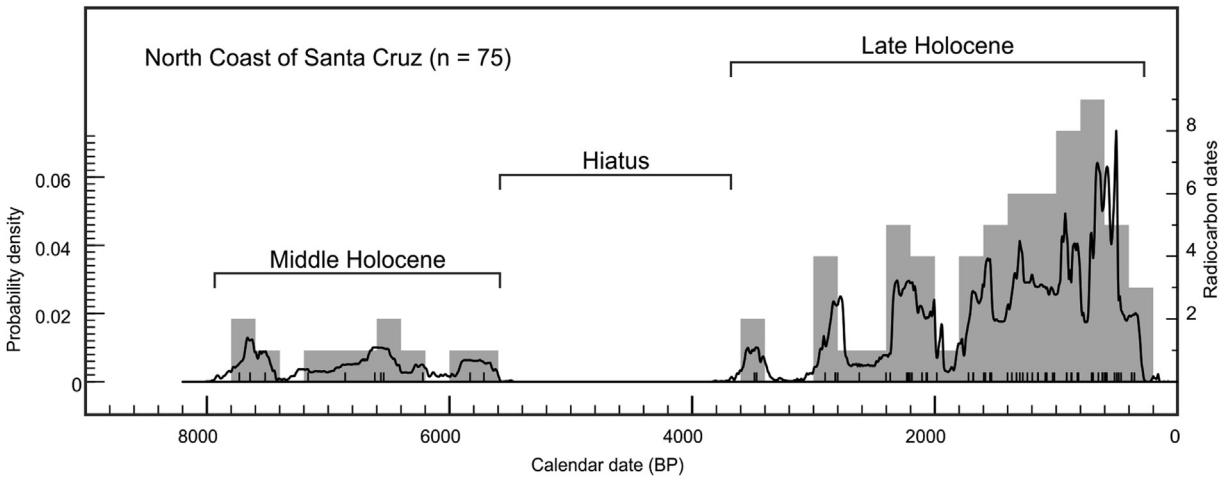

Fig. 8. Sum of probabilities of NCSC radiocarbon dates (OxCal v4.2.3, Bronk Ramsey, 2009). In grey the number of mean radiocarbon dates for 500 interval cal. year.

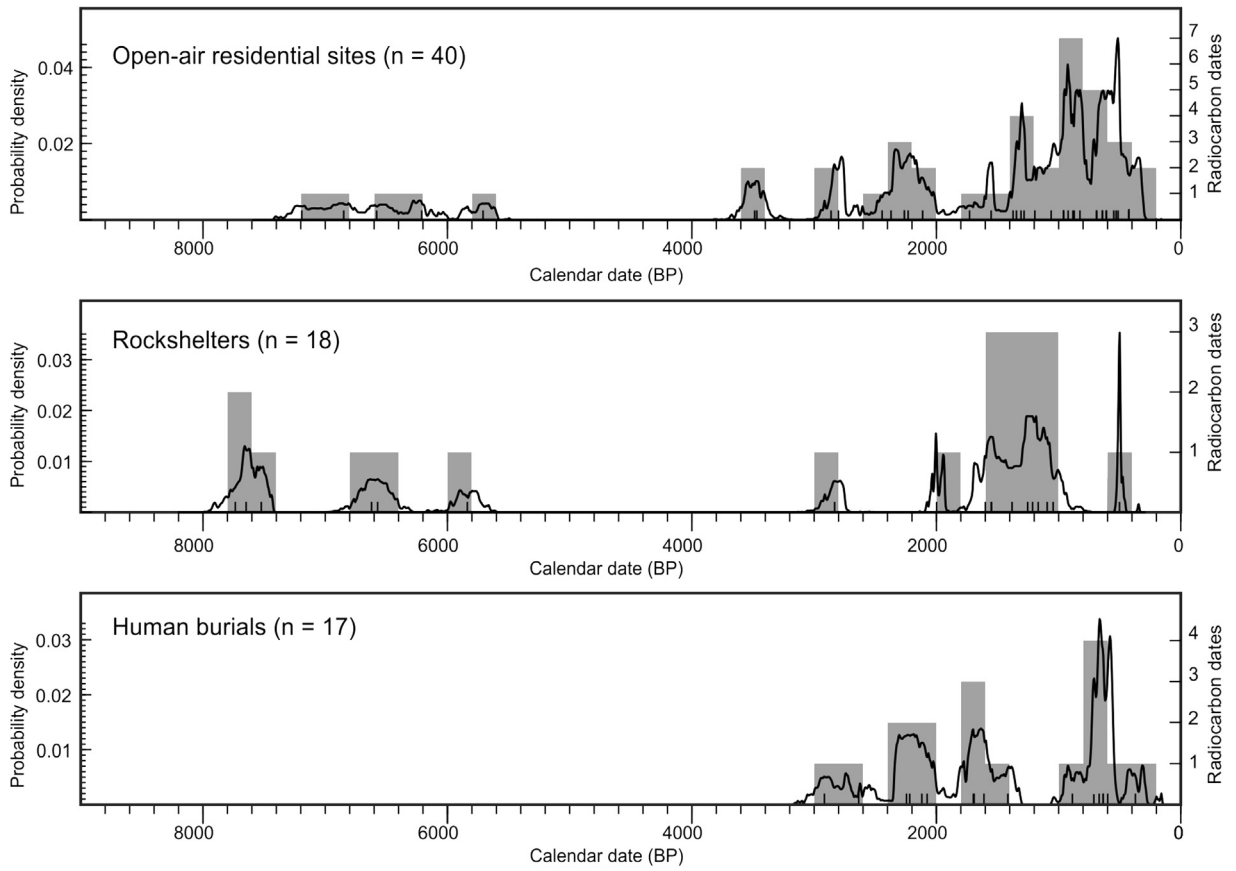

Fig. 9. Sum of probabilities of the north coast of Santa Cruz according to type of archaeological sites (OxCal v4.2.3, Bronk Ramsey, 2009). In grey the number of mean radiocarbon dates for 500 interval cal. year.

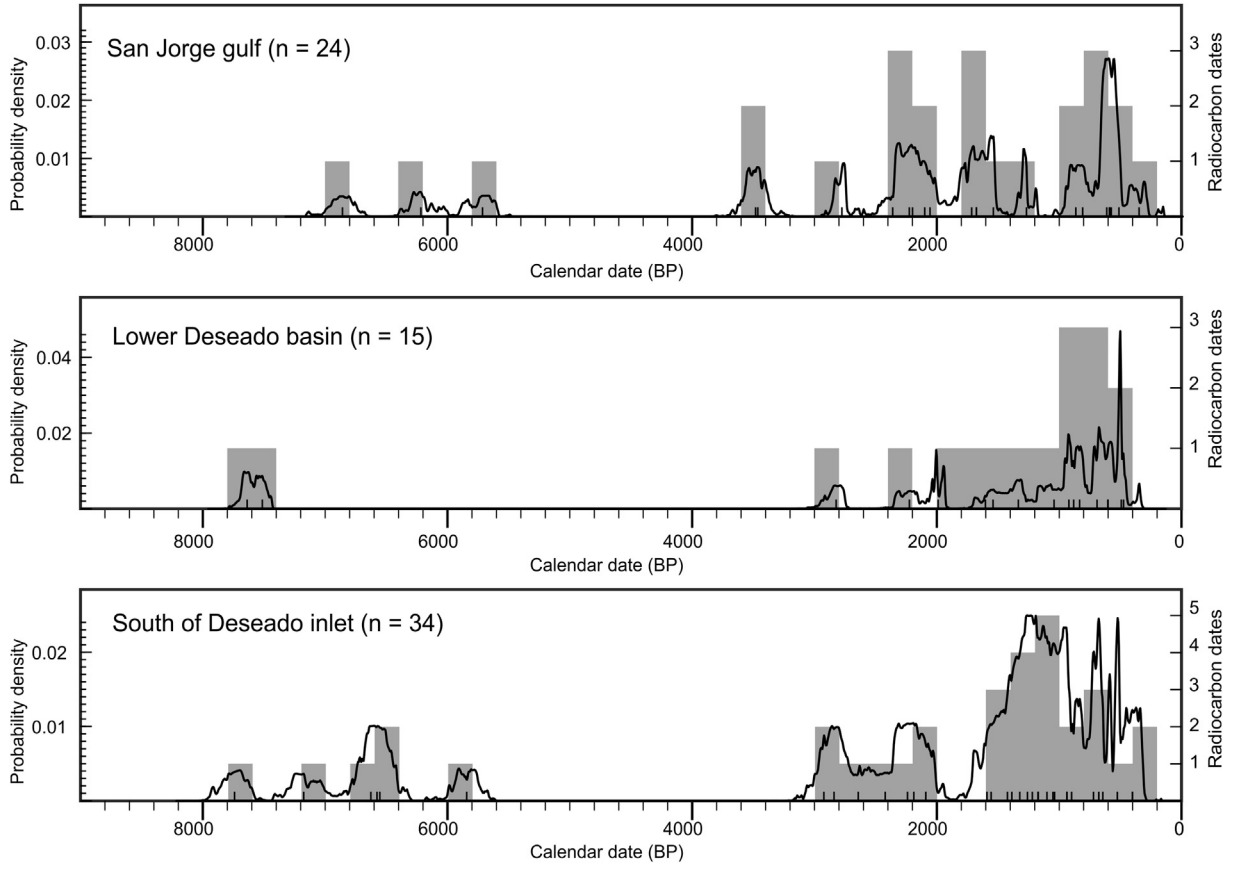

Fig. 10. Sum of probabilities of the north coast of Santa Cruz according to archaeological sectors (OxCal v4.2.3, Bronk Ramsey, 2009). In grey the number of mean radiocarbon dates for 500 interval cal. year.

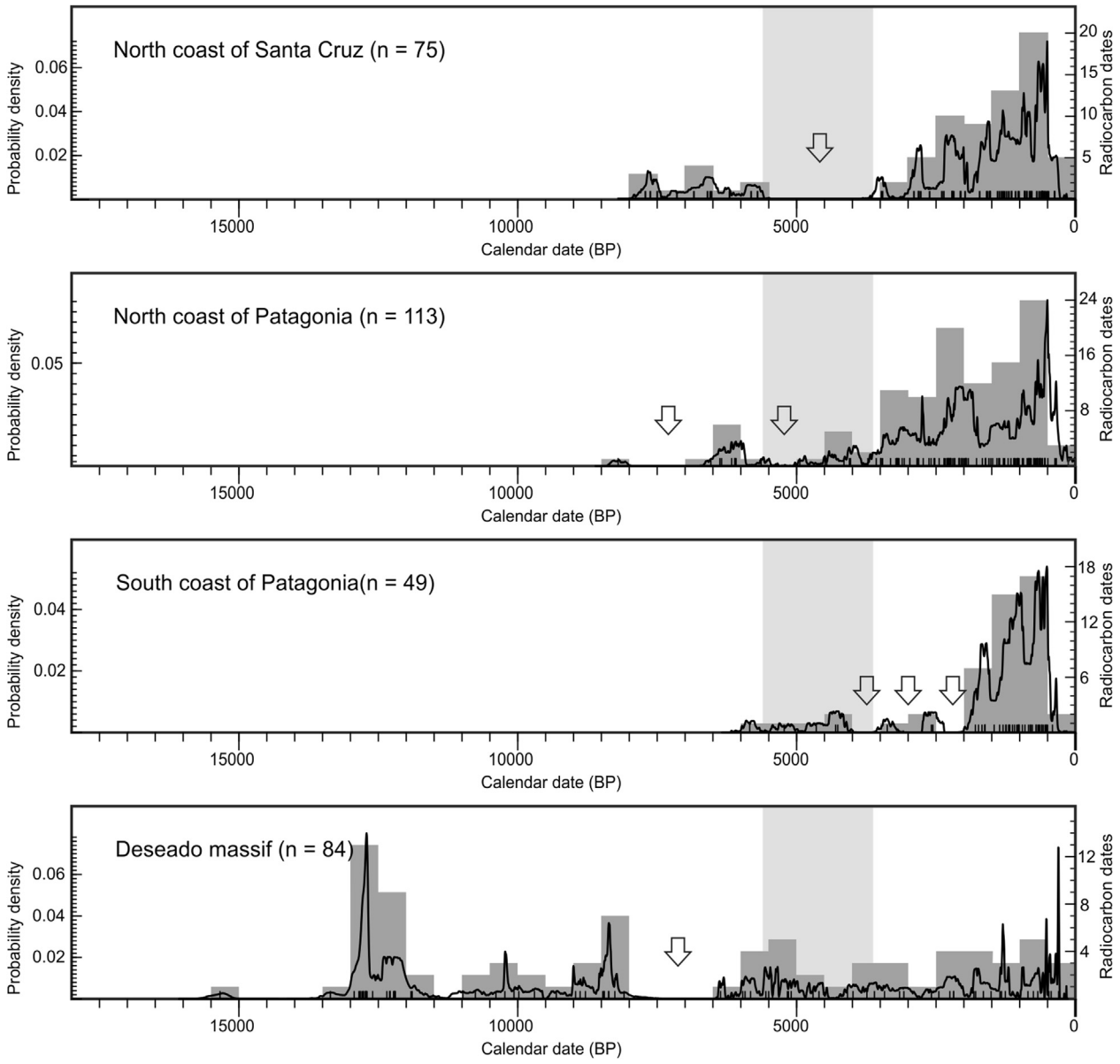

Fig. 11. Comparative sum of probabilities of radiocarbon dates indicated in the text. In dark grey the number of mean radiocarbon dates for 1000 interval cal. year; in light grey the chronological span of the hiatus of the NCSC; the arrows show major hiatus identified.

settlements and archaeological evidence, especially if related to changes in environmental conditions, or unknown internal social causes.

Considering other areas of Patagonia which were referred here for comparative reasons, the evidence of coastal initial peopling is synchronous between NCSC and the Northern Patagonian coast. In all the analysed areas, we observed the presence of hiatuses, but at different periods and amplitudes than in our study area. During the Late Holocene in Patagonia, the continuous increased in the chronological signal seems to be a general phenomenon. During the Late Holocene of the NCSC, this phenomenon could be related to a high redundancy in human coastal occupation in some localities or specific sites (Zubimendi et al., 2005).

Taking into account the material evidence from the archaeological record of open-air sites, rock shelters and burials, we can define the existence of two different periods in the human use of the NCSC during the Late Holocene:

1. *Initial Late Holocene* (from ca. 3900 to ca. 1600 cal BP): settlement evidence has been found mainly at shell middens, but also in some rock shelters. There are different types of human burial (on sand dunes, on pits, and other indeterminate types). The artifactual record seems to present a lesser variability in comparison to later times.
2. *Final Late Holocene* (from ca. 1600 until ca. 300 cal BP): a high density of shell middens is registered. The only rock shelter occupations have been found at Cueva del Negro, which is a site with a dense shell midden inside a cave located only a few meters from the modern shoreline (Zubimendi et al., 2011b). Shell middens from this period have a higher artifactual variability. In particular, some are oriented to the exploitation of marine resources (harpoons head and stone mace for hunt of pinnipeds) and terrestrial plants (grindings tools), along with the introduction of ceramic technology. Since 1000 cal BP, the totality of the human burials of these moments corresponds to

Table 7
Radiocarbon dates from the surroundings areas of NCSC. Radiocarbon dates with marine materials (shells of marine mammals) are presented with marine correction of 400 years (Stuiver and Braziunas, 1993).

Area	Site or locality name and component		Laboratory code	^{14}C	Reference
North coast of Patagonia	Arroyo Verde 1 (sample 1)		LP-1551	7420 ± 90	Gómez Otero, 2007
	Bahía Cracker	Site 4	LP-2324	5390 ± 130	Gómez Otero et al., 2013
		Site 8	LP-2244	5550 ± 80	Gómez Otero et al., 2013
			LP-2037	4890 ± 80	Gómez Otero et al., 2013
	Bahía Creek – Paesani S5		LP-2518	1150 ± 60	Favier Dubois, 2013
	Bahía Final	Site 1	AA-77302	2409 ± 38	Favier Dubois et al., 2009
		Site 11	LP-2606	920 ± 50	Favier Dubois, 2013
		Site 110 Costa	LP-2099	2350 ± 60	Favier Dubois, 2013
		110 paleocliff	AA81729	2988 ± 40	Favier Dubois, 2013
		Site 6 coast	AA-75707	740 ± 40	Favier Dubois et al., 2009
		Site 6 paleocliff	AA-64773	3430 ± 43	Favier Dubois et al., 2009
		Site 10	AA70722	1638 ± 54	Favier Dubois, 2013
	Bahía Rosas	Site 2	AC1712	4000 ± 130	Favier Dubois et al., 2008
		West	LP-2593	3760 ± 80	Favier Dubois et al., 2008
	Bahía Solano	Site I	LP-1463	800 ± 60	Arrigoni et al., 2008
		Site II	LP-1475	1090 ± 70	Arrigoni et al., 2008
		Site 13	I-11795	205 ± 95	Caviglia et al., 1982
		Site 16	I-11794	2954 ± 195	Caviglia et al., 1982
	Bajo de la Quinta	BQLNE (125)	LP-2016	1070 ± 60	Favier Dubois et al., 2009
		BQLNE (126)	AA-81727	942 ± 37	Favier Dubois et al., 2009
		BQLNO (142)	AA-81728	804 ± 37	Favier Dubois et al., 2009
		BQLNO (144)	LP-1926	450 ± 80	Favier Dubois et al., 2009
		Sample 2 (235)	LP-1958	540 ± 80	Favier Dubois et al., 2009
		Sample 3 (80)	LP-1923	1040 ± 60	Favier Dubois et al., 2009
		Sample 1	LP-1878	3000 ± 90	Favier Dubois et al., 2009
		BP (2)	AA-81730	2197 ± 38	
	Barranca de los Concheros				Favier Dubois et al., 2009
		Shell midden 10	AA-74748	2482 ± 49	Favier Dubois et al., 2009
		Shell midden 16	AA64775	1772 ± 36	Favier Dubois et al., 2009
		Shell midden 4	AA-74746	2984 ± 50	Favier Dubois et al., 2009
	Barranca Norte	Burial 1	LP-1530	250 ± 60	Gómez Otero, 2007
		Burial 2	LP-1434	310 ± 70	Gómez Otero, 2007
		Shell midden 1	LP-1413	3290 ± 80	Gómez Otero, 2007
		Hearth 1	LP-1343	1040 ± 70	Gómez Otero, 2007
		Shell midden 2	LP-1504	2960 ± 60	Gómez Otero, 2007
	Bon Le (burial)		LP-849	1400 ± 60	Gómez Otero, 2007
	Calle Tehuelches (burial)		LP-693	2410 ± 50	Gómez Otero, 2007
	Calle Villarino (burial)		LP-839	550 ± 60	Gómez Otero, 2007
	Camarones Nord		n/d	3674 ± 50	Unpublished
	Cinco Esquinas 1	Shell midden	LP-2282	1560 ± 90	Gómez Otero et al., 2010
		Burial	LP-2294	1260 ± 90	Gómez Otero et al., 2010
	Cormoranes	Shell midden 2	LP-989	2110 ± 40	Gómez Otero, 2007
		Hearth 1	LP-1085	4340 ± 70	Gómez Otero, 2007
	El Doradillo 1 (burial)		LP-1425	370 ± 50	Gómez Otero, 2007
	El Golfito (burial)		LP-685	770 ± 50	Gómez Otero, 2007
	El Haras 1		LP-1200	2810 ± 40	Eugenio and Aldazabal, 2004
			LP-1224	3070 ± 70	Eugenio and Aldazabal, 2004
	El Lobito		LP-938	3210 ± 60	Eugenio and Aldazabal, 2004
	El Pedral 3		LP-1680	2050 ± 70	Gómez Otero, 2007
	El Piche 1		LP-1084	1500 ± 40	Eugenio and Aldazabal, 2004
	El Progreso	Shell midden 2	LP-842	1940 ± 60	Gómez Otero, 2007
		Burial	LP-1253	2160 ± 80	Gómez Otero, 2007
	El Riacho	Hearth 1	LP-494	2640 ± 70	Gómez Otero, 2007
		Hearth 2	LP-515	3220 ± 70	Gómez Otero, 2007
		Sample 3	LP-805	2450 ± 60	Gómez Otero, 2007
	Faro San Matías	Sample 2	LP-1877	2910 ± 90	Favier Dubois et al., 2009
		Sample 6	LP-1873	1380 ± 80	

Table 7 (*continued*)

Area	Site or locality name and component		Laboratory code	^{14}C	Reference
					Favier Dubois et al., 2009
		Mont I.	LP-2352	1680 ± 90	Favier Dubois, 2013
		Mont. II	LP-2358	1630 ± 70	Favier Dubois, 2013
		S10	LP-2092	2210 ± 40	Favier Dubois, 2013
	Flechero del 39		LP-1022	2640 ± 40	Gómez Otero, 2007
	Isla del Jabali		LP-1150	2040 ± 70	Sanguinetti de Bórmida, 1999
	La Armonía		LP-969	470 ± 45	Gómez Otero, 2007
			LP-1001	460 ± 40	Gómez Otero, 2007
	La Eloisa – conchero		LP-1168	1340 ± 40	Sanguinetti de Bórmida, 1999
	La Serranita	S2 – Site A	LP-1138	5300 ± 50	Eugenio and Aldazabal, 2004
			LP-1155	5310 ± 70	Eugenio and Aldazabal, 2004
			LP-1154	5320 ± 60	Eugenio and Aldazabal, 2004
		S2 – Site D	LP-1162	3690 ± 50	Eugenio and Aldazabal, 2004
	Las Lisas 1 – shell midden 1		LP-862	380 ± 70	Gómez Otero, 2007
			LP-875	2140 ± 50	Gómez Otero, 2007
			LP-868	2600 ± 60	Gómez Otero, 2007
	Las Olas	Site 1 – Piche 4	LP-1163	1960 ± 40	Eugenio and Aldazabal, 2004
		Site 2	LP-1058	2810 ± 50	Eugenio and Aldazabal, 2004
		Site 5 Sur Aux	LP-1158	570 ± 40	Eugenio and Aldazabal, 2004
		Site 11	LP-1058	2890 ± 60	Aldazabal et al., 2011
	Las Ollas 1		LP-819	610 ± 60	Gómez Otero, 2007
			LP-834	640 ± 60	Gómez Otero, 2007
	Los Abanicos 1		LP-889	380 ± 60	Gómez Otero, 2007
	Los Cangrejales Sur	Site 4	LP-1861	1980 ± 60	Gómez Otero et al., 2009
			LP-1858	2040 ± 90	Gómez Otero et al., 2009
			LP-1845	2120 ± 40	Gómez Otero et al., 2009
			LP-1879	2290 ± 80	Gómez Otero et al., 2009
		Site 5	LP-1911	590 ± 70	Gómez Otero et al., 2009
			LP-1908	640 ± 80	

Table 7 (*continued*)

Area	Site or locality name and component		Laboratory code	^{14}C	Reference
			LP-1892	840 ± 60	Gómez Otero et al., 2009
			LP-1880	2190 ± 90	Gómez Otero et al., 2009
		Site 6	LP-1826	1490 ± 70	Gómez Otero et al., 2009
	Lote 39		LP-1019	1900 ± 70	Gómez Otero, 2007
	Mar Grande		LP-2588	1930 ± 80	Favier Dubois, 2013
	Paesani – sector 1		AC-1710	1100 ± 90	Favier Dubois et al., 2008
	Playa del Pozo (burial)		LP-651	1540 ± 50	Gómez Otero, 2007
	Promontorio Belén 2		LP-2562	5750 ± 70	Favier Dubois, 2013
	Puerto Pirámide (burial)		LP-1527	1200 ± 70	Gómez Otero, 2007
	Punta Cuevas 2 (burial)		LP-1424	2640 ± 50	Gómez Otero, 2007
	Punta Delgada (burial)		LP-1219	2010 ± 50	Gómez Otero, 2007
	Punta Este 1		LP-1494	2200 ± 70	Gómez Otero, 2007
	Punta Flecha		LP-1597	3190 ± 70	Gómez Otero, 2007
	Punta León (burial)		LP-678	1050 ± 50	Gómez Otero, 2007
	Punta Pardelas – shell midden 2		LP-1570	5580 ± 90	Gómez Otero, 2007
	Restinga Ali		LP-511	770 ± 60	Arrigoni et al., 2008
	Rincón de Elizalde	Site 1, shell midden 9	LP-1507	2170 ± 80	Gómez Otero, 2007
		Site 1, shell midden 1	LP-1348	2220 ± 70	Gómez Otero, 2007
		Site 5, shell midden 1	LP-1352	470 ± 60	Gómez Otero, 2007
	Saco Viejo	1	LP-1898	2000 ± 70	Favier Dubois et al., 2009
		Cas S1	LP-2513	2170 ± 70	Favier Dubois, 2013
		H S2	LP-2511	1940 ± 70	Favier Dubois, 2013
		H	AA-81724	417 ± 40	Favier Dubois, 2013
			AA-81725	484 ± 36	Favier Dubois, 2013
		S1	LP-2229	1630 ± 70	Favier Dubois, 2013
	San Román 2		LP-1646	1020 ± 60	Gómez Otero, 2007
	Sitio Lobos (burial)		LP-1416	1290 ± 100	Gómez Otero, 2007
	Sitio Petroquímica I		LP-1149	2250 ± 60	Bonomo et al., 2006

(*continued on next page*)

Table 7 (*continued*)

Area	Site or locality name and component		Laboratory code	^{14}C	Reference
South coast of Patagonia	Cabo Vírgenes	Site 1	AC-1523	1380 ± 180	Borrero and Franco, 2005
		Site 2	GX-25276-G	1050 ± 70	Borrero and Franco, 2005
		Site 6	GX-25772	1190 ± 60	L'Heureux and Franco, 2002
			Beta-144998	1170 ± 50	L'Heureux and Franco, 2002
		Site 20	AA-86453	1256 ± 50	Belardi et al., 2011
			AA-86454	733 ± 47	Belardi et al., 2011
	Cañadón de los Mejillones	Sample	AA-83477	1224 ± 37	Franco et al., 2010
		Profile	AA-83478	478 ± 38	Franco et al., 2010
	La Mina	Site 1	LP-1470	770 ± 60	García-Herbst, 2006
		Site 4	LP-1477	1850 ± 70	García-Herbst, 2006
		Site 5	LP-1482	540 ± 60	García-Herbst, 2006
		Site 13	LP-1488	1500 ± 70	García-Herbst, 2006
		Site 17	LP-1498	520 ± 70	García-Herbst, 2006
	Laguna El Mosquito		LP-1635	3890 ± 70	Carballo Marina, 2007
			LP-1643	3920 ± 70	Carballo Marina, 2007
	P.N.M.L.	CCH 1	LP-1850	810 ± 60	Muñoz et al., 2009
			LP-1539	5150 ± 90	Caracotche et al., 2005
		CCH 2	LP-1523	1160 ± 70	Caracotche et al., 2005
		CCH 3	LP-1545	4160 ± 80	Caracotche et al., 2005
		CCH 4	LP-1515	930 ± 60	Caracotche et al., 2005
			LP-1555	1300 ± 60	Caracotche et al., 2005
			LP-1609	1320 ± 60	Caracotche et al., 2005
			LP-1583	1380 ± 50	Caracotche et al., 2005
			LP-1565	1430 ± 70	Caracotche et al., 2005
		CCH 5	GX-33091	1900 ± 90	Muñoz et al., 2009
		CL 1	GX-33151	970 ± 100	Cruz et al., 2011
		Restinga N	AC-1733	620 ± 200	Borrero et al., 2008
		SIT 6	LP-1526	650 ± 75	Caracotche et al., 2005
		Rincón del Buque	AA74919	830 ± 42	Suby et al., 2009
	Playa Grande		LP-157	1800 ± 80	Figini et al., 1990
	Puerto San Julián	Site 2	LP-1529	4610 ± 90	García-Herbst, 2006
			LP-1521	2510 ± 50	García-Herbst, 2006
	Punta Bustamante	Site 1	LP-160	3200 ± 80	Gómez Otero et al., 1998
		RUD02-FOI	LP-187	2550 ± 50	Mansur, 2008
			LP-454	890 ± 90	

Table 7 (*continued*)

Area	Site or locality name and component		Laboratory code	^{14}C	Reference
		HST01-AM			Mansur, 2008
			LP-479	750 ± 70	Mansur, 2008
	Punta Entrada	PE3	AA74920	1748 ± 45	Suby et al., 2009
		PE4	UGAMMS3598	400 ± 30	Suby et al., 2009
		Point 35	LP-1844	570 ± 50	Muñoz et al., 2009
			UGAMS-02946	1150 ± 30	Muñoz et al., 2009
			LP-1791	1310 ± 70	Muñoz et al., 2009
		Point 37	LP-1827	1138 ± 70	Muñoz et al., 2009
		Point 68	LP-1848	1088 ± 50	Muñoz et al., 2009
		Point 96	GX-33090	930 ± 100	Muñoz et al., 2009
			LP-1806	1750 ± 80	Muñoz et al., 2009
			GX-33219	1750 ± 110	Cruz et al., 2011
		Point 133	GX-33095	1600 ± 90	Muñoz et al., 2009
		Shell midden	AA-76791	698 ± 33	Franco, 2008
Deseado massif	Alero El Verano		I-13797	8960 ± 140	Rubinos Pérez, 2003
	Casa del Minero 1		LP-1552	5190 ± 80	Frank, 2011
			AA-45705	10,250 ± 110	Frank, 2011
			AA-37208	10,967 ± 55	Rubinos Pérez, 2003
			AA-37207	10,999 ± 55	Rubinos Pérez, 2003
	Cerro Tres Tetas		LP-770	830 ± 60	Rubinos Pérez, 2003
			LP-1180	1340 ± 50	Rubinos Pérez, 2003
			LP-1187	1740 ± 60	Rubinos Pérez, 2003
			LP-431	2190 ± 70	Rubinos Pérez, 2003
			LP-538	5220 ± 70	Rubinos Pérez, 2003
			OxA-8527	10,390 ± 70	Rubinos Pérez, 2003
			LP-781	10,850 ± 150	Rubinos Pérez, 2003
			AA39366	10,853 ± 70	Magnin, 2010
			OxA-9244	10,915 ± 65	Rubinos Pérez, 2003
			AA39368	11,015 ± 66	Magnin, 2010
			AA-22233	11,100 ± 150	Rubinos Pérez, 2003
			LP-525	11,560 ± 140	Rubinos Pérez, 2003
	Chenque El Sargento		AA-65180	727 ± 48	Magnin, 2010
	Cueva de La Hacienda		OX-23753	2250 ± 70	Magnin, 2010
	Cueva de la Mesada de la Maria Quebrada		Beta-135964	4500 ± 40	Rubinos Pérez, 2003
			Beta-135963	9090 ± 40	Rubinos Pérez, 2003
	Cueva de la Ventana de la Maria Quebrada		AA-35237	7665 ± 75	Rubinos Pérez, 2003
			Beta-135965	7970 ± 40	Rubinos Pérez, 2003
	Cueva Maripe		AA65176	1078 ± 40	Magnin, 2010

Table 7 (*continued*)

Area	Site or locality name and component		Laboratory code	^{14}C	Reference
			LP1497	3210 ± 60	Magnin, 2010
			AA65181	4113 ± 39	Magnin, 2010
			AA65173	5084 ± 49	Magnin, 2010
			AA65177	7703 ± 47	Magnin, 2010
			AA65174	8333 ± 63	Magnin, 2010
			AA65178	8762 ± 50	Magnin, 2010
			AA65179	8992 ± 65	Magnin, 2010
			AA65175	9518 ± 64	Magnin, 2010
	Cueva Mora		AA85461	3678 ± 65	Magnin, 2010
	Cueva Moreno		OS-2375	3000 ± 110	Magnin, 2010
	Cueva Tunel		AA-81417	4177 ± 43	Frank, 2011
			AA-81423	5577 ± 44	Frank, 2011
			AA-71148	10,400 ± 100	Frank, 2011
			AA-71147	10,408 ± 59	Frank, 2011
			LP-1965	10,420 ± 180	Frank, 2011
			AA-82496	10,510 ± 100	Frank, 2011
	La Gruta	Cave 1	UGAMS-7541	400 ± 21	Franco et al., 2010
			AA-83475	1452 ± 38	Franco et al., 2010
			AA-83474	1888 ± 39	Franco et al., 2010
			AA-84226	3487 ± 38	Franco et al., 2010
			AA-83476	1829 ± 47	Franco et al., 2010
			AA-84225	10,477 ± 56	Franco et al., 2010
			UGAMS-7540	8090 ± 30	Mancini et al., 2013
			AA-76792	10,656 ± 54	Franco et al., 2010
			UGAMS-7538	10,790 ± 30	Franco et al., 2010
			AA-84224	10,845 ± 61	Franco et al., 2010
			AA-84223	10,840 ± 62	Franco et al., 2010
		Cave 2	UGAMS-9113	7560 ± 30	Franco et al., 2013
		Cave 3	UGAMS-13609	530 ± 20	Brook et al., 2014
			UGAMS-13610	390 ± 20	Brook et al., 2014
			UGAMS-12430	290 ± 20	Brook et al., 2014
			UGAMS-12429	290 ± 20	Brook et al., 2014
	La Martita		AC-603	1620 ± 90	Rubinos Pérez, 2003
			AC-604	2190 ± 115	Rubinos Pérez, 2003
			I-11904	4475 ± 95	Rubinos Pérez, 2003
			CSIC-505	4520 ± 50	Rubinos Pérez, 2003
			CSIC-506	8050 ± 90	Rubinos Pérez, 2003
	La Quinta		AA85460	939 ± 59	Magnin, 2010
	Las Cuevas 2		n/d	2510 ± 110	Magnin, 2010
			n/d	2940 ± 90	Magnin, 2010
	Los Toldos	Cave 1	Beta-183024	1410 ± 40	De Porras et al., 2007
		Cave 3	LP-136	4850 ± 50	Rubinos Pérez, 2003
		Cave 13	LP-1524	3750 ± 80	De Porras et al., 2007
			LP-1516	2390 ± 80	De Porras et al., 2007
			Beta-183025	3380 ± 40	De Porras et al., 2007
	Piedra Museo		NSRL-11167	7470 ± 140	Rubinos Pérez, 2003
			LP-450	7670 ± 110	Rubinos Pérez, 2003
			LP-949	9230 ± 105	Rubinos Pérez, 2003
			LP-859	9710 ± 105	Rubinos Pérez, 2003
			LP-800	10,260 ± 110	Rubinos Pérez, 2003
			AA-8428	10,400 ± 80	Rubinos Pérez, 2003
			GrA-9837	10,470 ± 60	Rubinos Pérez, 2003
			OxA-9249	10,470 ± 65	Rubinos Pérez, 2003
			OxA-8528	10,925 ± 65	Rubinos Pérez, 2003
			AA-27950	11,000 ± 65	Rubinos Pérez, 2003
			AA-20125	12,890 ± 90	Rubinos Pérez, 2003
	Viuda Quenzana 8		UGAMS-9111	4770 ± 25	Franco et al., 2013
			UGAMS-9112	4740 ± 25	Franco et al., 2013

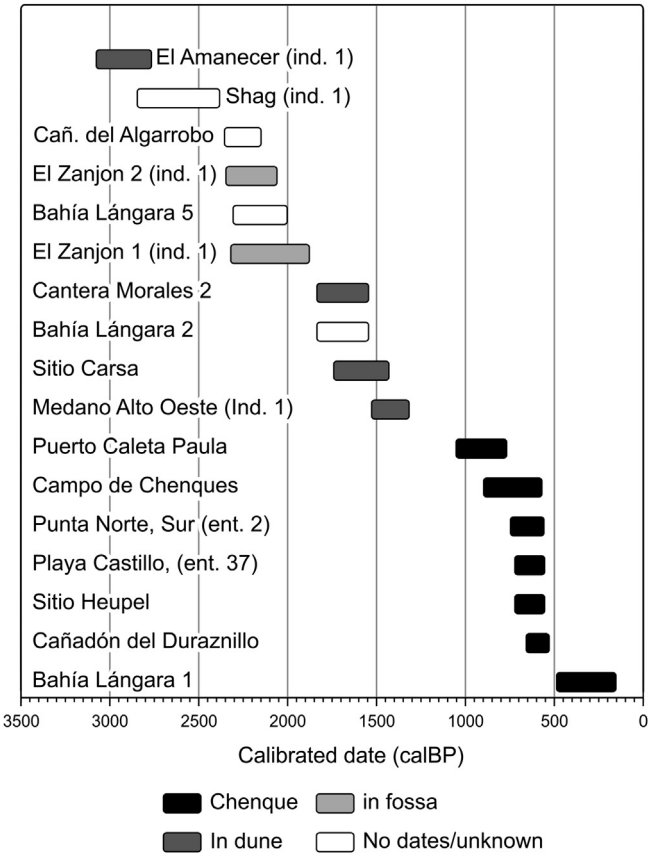

Fig. 12. Radiocarbon dates and type of human burials in the NCSC, blocks represents the amplitude of the calibrated radiocarbon date.

"chenques", a type of human burial that at this time was widespread all over Patagonia (Zilio, 2013).

The increase of chronological signal during the Late Holocene and especially during the last 1500 years would be related to a cultural context of hunter–gatherers undergoing important organizational changes, including an increase in social interaction, the development and consolidation of extensive regional scale exchange networks of goods and ideas, and also a higher complementarity between groups (Borrero, 2001; Gómez Otero, 2007; Martinez et al., 2013).

Although we do not have a large radiocarbon database, we were able to bring into consideration and contrast different lines of evidence in the study area, and also generate a stage to bring up the discussion of changes in the human occupation of the NCSC. This is particularly interesting in the case of the existence of a period of time where there is no evidence of use of the area. Moreover, this analysis allowed us to differentiate two different periods during the Late Holocene, relating them to an increase of human occupations and a higher artifactual variability in the archaeological record. More research in the area and the analysis of other lines of evidence would allow us to adjust what we have here suggested.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.quaint.2014.09.035.

References

Aguirre, M.L., Farinati, E.A., 1997. Paleobiogeografía de las faunas de moluscos marinos del neógeno y cuaternario del atlántico sudoccidental. Revista de la Sociedad Geológica de España 12, 93–112.
Aldazabal, V., Eugenio, E., Silveira, M., 2011. Arqueología del sector costero al sur de Bahía de San Blas: sitio las Olas. Revista Estudios Marítimos y Sociales 4, 9–19.
Ambrústolo, P., 2011. Estudio de las estrategias de aprovisionamiento y utilización de los recursos líricos por grupos cazadores recolectores en la Costa Norte de Santa Cruz (Patagonia Argentina) (Ph.D. thesis). Universidad Nacional de La Plata, Argentina.
Ambrústolo, P., Zubimendi, M.A., Ciampagna, L., Trola, V., 2011. Alero el Oriental: evidencias de las primeras ocupaciones de la Costa Norte de Santa Cruz (Patagonia, argentina). Werken 14, 9–22.
Arrigoni, G., Andrieu, M., Bañados, C., 2008. Arqueología de cazadores-recolectores prehistóricos en la costa central del Golfo San Jorge. In: Cruz, I., Caracotche, M.S. (Eds.), Arqueología de la Costa Patagónica. Perspectivas para la conservación. Universidad Nacional de la Patagonia Austral, Río Gallegos, pp. 91–108.
Bailey, G., Milner, N., 2002. Coastal hunter-gatherers and social evolution: marginal or central? Before Farming 4 (1), 129–150.
Barberena, R., 2008. Arqueología y biogeografía humana en Patagonia meridional. Sociedad Argentina de Antropología, Buenos Aires.
Belardi, J.B., Carballo Marina, F., L'Heureux, G.L., 2011. Nuevos resultados arqueológicos en Cabo Vírgenes (Santa Cruz, Argentina): el sitio Cabo Vírgenes 20. Magallania 39 (2), 279–292.
Beretta, M., Zubimendi, M.A., Ciampagna, M.L., Ambrústolo, P., Castro, A.S., 2013. Puntas de arpón en la costa norte de Santa Cruz: primeros estudios de piezas recuperadas en estratigrafía en el sitio Cueva del Negro. Magallania 41 (1), 263–273.
Borella, F., 2007. ¿Dónde están los lobos en la costa atlántica de norpatagonia? Explorando vías para resolver el registro arqueofaunístico. Werken 9, 97–114.
Bonomo, N., Vega, M., Bongiovanni, V., Lanata, J.L., Arrigoni, G., 2006. Estudios en la Factibilidad en la Detección de Concheros Mediante. In: Osella, A., Lanata, J.L. (Eds.), Arqueogeofísica. Una metodología interdisciplinaria para explorar el pasado. Fundación Felix de Azara y Universidad Maimónides, Buenos Aires, pp. 131–146.
Borrero, L.A., 2001. El poblamiento de la Patagonia. Toldos, milodones y volcanes. Emecé, Buenos Aires.
Borrero, L.A., 2008. Early occupations in the Southern Cone. In: Silverman, H., Isbell, W.H. (Eds.), Handbook of South American Indians. Springer, New York, pp. 59–77.
Borrero, L.A., Franco, N.V., 2005. Arqueología de Cabo Vírgenes, Provincia de Santa Cruz. In: Actas del XIII Congreso Nacional de Arqueología Argentina. Cordoba, vol. 4, pp. 29–36.
Borrero, L.A., Franco, N., Barberena, R., Borella, F., Campan, P., Carballo Marina, F., Cruz, I., Favier Dubois, C., Guichón, R.A., L'Heureux, G.L., Mancini, V., Manzi, L., Martin, F.B., 2008. Arqueología en Cabo Vírgenes y Cañadón Gap. In: Cruz, I., Caracotche, M.S. (Eds.), Arqueología de la Costa Patagónica. Perspectivas para la conservación. Universidad Nacional de la Patagonia Austral, Río Gallegos, pp. 213–227.
Brook, G.A., Franco, N.V., Ambrústolo, P., Mancini, M.V., Wang, L., Fernández, P.M., 2014. Evidence of the earliest humans in the Southern Deseado Massif (Patagonia, Argentina), Mylodontidae, and changes in water availability. Quaternary International (in press).
Bronk Ramsey, C., 2009. Bayesian analysis of radiocarbon dates. Radiocarbon 51 (1), 337–360.
Caracotche, M.S., Cruz, I., Espinosa, S., Carballo, F., Belardi, J.B., 2005. Rescate arqueológico en el Parque Nacional Monte León (Santa Cruz, Argentina). Magallania 33 (2), 143–163.
Carballo Marina, F., 2007. La cuenca superior del río Santa Cruz: las poblaciones humanas y el uso del espacio (Ph.D. thesis). Universidad Nacional de La Plata, Argentina.
Carrara, I.S., 1952. Lobos marinos, pingüinos y guaneras de las costas del litoral marítimo e islas adyacentes de la República Argentina. Technical report of Cátedra de Higiene e Industrias. Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata, Argentina.
Cassiodoro, G., 2011. Movilidad y uso del espacio de cazadores-recolectores del Holoceno tardío: estudio de la variabilidad del registro tecnológico en distintos ambientes del noroeste de la provincia de Santa Cruz (Argentina). In: British Archaeological Reports S2259 South American Archaeology Series 13.
Castro, A., Moreno, J.E., 1996–1997. Un sitio del Holoceno medio en la Costa Norte de Santa Cruz. Palimpsesto. Revista de Arqueología 5, 135–137.
Castro, A., Moreno, J.E., 2000. Noticia sobre enterratorios humanos en la costa Norte de Santa Cruz -Patagonia- Argentina. Anales del Instituto de la Patagonia, Serie Ciencias Humanas 28, 225–232.
Castro, A., Moreno, J.E., Martinelli, K., Pepe, F., 2000. Restos faunísticos, artefactos líticos: más información sobre la costa norte de Santa Cruz. Desde el país de los Gigantes. Perspectivas arqueológicas en Patagonia. Universidad Nacional de la Patagonia Austral, Río Gallegos, Santa Cruz, Argentina, volume II, pp. 531–551.
Castro, A., Moreno, J.E., Andolfo, M.A., Giménez, R., Peña, P., Mazzitelli, L., Zubimendi, M.A., Ambrústolo, P., 2003. Análisis distribucionales en la costa de Santa Cruz (Patagonia Argentina): alcances y resultados. Magallania 31, 69–94.
Castro, A., Moreno, J.E., Zubimendi, M.A., Andolfo, M.A., Videla, B., Ambrústolo, P., Mazzitelli, L., Bogan, S., 2007. Cronología de la ocupación humana en la Costa Norte de Santa Cruz: Actualización de datos radiocarbónicos. In: Morillo, F., Martinic, M., Prieto, A., Bahamonde, G. (Eds.), Arqueología de Fuego-Patagonia. Levantando piedras, desenterrando huesos... y develando arcanos. Ediciones CEQUA, Punta Arenas, Chile, pp. 527–539.
Castro, A., Salceda, S., Plischuk, M., Desántolo, B., 2009. Bioarqueología de rescate: sitio Carsa (Costa Norte de Santa Cruz, Argentina). In: Salemme, M., Santiago, F., Alvarez, M., Piana, E., Vázquez, M., Mansur, M.E. (Eds.), Arqueología de Patagonia: una mirada desde el último confín. Editorial Utopías, pp. 629–638.
Castro, A., Zubimendi, M.A., Ambrústolo, P., 2011. The importance of the archaeological record in the discussion of variation processes on the seacoasts during the Holocene: the case of the northern coast of Santa Cruz-Patagonia, Argentina. Quaternary International 245 (1), 111–121.
Caviglia, S.E., Borrero, L.A., García, L. Casiraghi, Horwitz, V., 1982. Nuevos sitios arqueológicos para la región de Bahía Solano (Chubut). In: Actas VII Congreso Nacional de Arqueología, San Luis.
Codignotto, J.O., 1987. Cuaternario marino entre Tierra del Fuego y Buenos Aires. Revista de la Asociación Geológica Argentina XLII (1–2), 208–212.
Codignotto, J.O., 2000. La costa de la Provincia de Santa Cruz. In: García, A., Mazzoni, E. (Eds.), El gran libro de la Provincia de Santa Cruz. Milenio Ediciones y Alfa Centro Literario, Madrid, pp. 171–187.
Codignotto, J.O., Césari, O., Beros, C.A., 1990. Morfocronología secuencial evolutiva holocena en bahía Solano, Chubut. Revista de la Asociación Geológica Argentina 45 (3–4), 205–212.
Codignotto, J.O., Kokot, R., Marcomini, S.C., 1992. Neotectonism and sea level changes in the coastal zone of Argentina. Journal of Coastal Research 8 (1), 125–133.
Cordero, R.B., Panarello, H., Lanzelotti, S., Favier Dubois, C.M., 2003. Radiocarbon age offsets between living organisms from the marine and continental reservoir in coastal localities of Patagonia (Argentina). Radiocarbon 45 (1), 9–15.

Cruz, I., Muñoz, S., Lobbia, P., 2011. La explotación de recursos marinos en la costa de Patagonia continental: Los restos de vertebrados en depósitos de Punta Entrada y Monte León (Santa Cruz, Argentina). Revista de Estudios Marítimos y Sociales 4, 31–41.

Cuadra, D., Oliva, G., 1996. Ambientes naturales de la provincia de Santa Cruz. Espacios 6, 22–27.

De Porras, M.E., Mancini, M.V., Prieto, A.R., 2007. Cambios de la vegetación del cañadón de Los Toldos (Santa Cruz) durante el Holoceno medio-tardío en relación con las variaciones climáticas y las ocupaciones humanas. In: Morello, F., Martinic, M., Prieto, A., Bahamonde, G. (Eds.), Arqueología de Fuego-Patagonia. Levantando piedras, desenterrando huesos... y develando arcanos. Ediciones CEQUA, Punta Arenas, pp. 53–60.

De Porras, E., Mancini, M.V., Prieto, A.R., 2009. Vegetation changes and human occupation in the Patagonian steppe, Argentina, during the late Holocene. Vegetation History and Archaeobotany 18, 235–244.

Erlandson, J.M., Moss, M.L., 1999. The systematic use of radiocarbon dating in archaeological surveys in coastal and other erosional environments. American Antiquity 64 (3), 431–443.

Eugenio, E.O., Aldazabal, V.B., 2004. Los cazadores recolectores del litoral marítimo del área de Bahía de San Blas, Provincia de Buenos Aires. In: Civalero, M., Fernández, P., Guráieb, A. (Eds.), Contra Viento y Marea. Arqueología de Patagonia. INAPL y SAA, Buenos Aires, pp. 687–700.

Favier Dubois, C.M., 2013. Hacia una cronología del uso del espacio en la costa norte del golfo San Matías (Río Negro, Argentina): sesgos geológicos e indicadores temporales. In: Zangrando, A.F., Barberena, R., Gil, A., Neme, G., Giardina, M., Luna, L., Otaola, C., Paulides, S., Salgán, L., Tívoli, A. (Eds.), Tendencias teórico metodológicas y casos de estudio en la Arqueología de la Patagonia. Museo de Historia Natural de San Rafael, San Rafael, Mendoza, Argentina, pp. 87–96.

Favier Dubois, C., Borella, F., Manzi, L., Cardillo, M., Lanzellotti, S., Scartescini, F., Carolina, M., Borges Vaz, E., 2008. Aproximación regional al registro arqueológico de la costa rionegrina. In: Cruz, I., Caracotche, M.S. (Eds.), Arqueología de la Costa Patagónica. Perspectivas para la conservación. Universidad Nacional de la Patagonia Austral, Río Gallegos, pp. 50–68.

Favier Dubois, C., Borella, F., Tykot, R., 2009. Explorando tendencias en el uso humano del espacio y los recursos en el litoral rionegriono (Argentina) durante el Holoceno medio y tardío. In: Salemme, M., Santiago, F., Álvarez, M., Piana, E., Vázquez, M., Mansur, E. (Eds.), Arqueología de la Patagonia - Una mirada desde el último confín. Editorial Utopías, Ushuaia, pp. 985–997.

Favier Dubois, C.M., Kokot, R., 2011. Changing scenarios in Bajo de la Quinta (San Matías Gulf, Northern Patagonia, Argentina): impact of geomorphologic processes in subsistence and human use of coastal habitats. Quaternary International 245, 103–110.

Favier Dubois, C.M., Scartascini, F.L., 2012. Intensive fishery scenarios on the North Patagonian coast (Río Negro, Argentina) during the Mid-Holocene. Quaternary International 256, 62–70.

Figini, A., Carbonari, J.E., Huarte, R.A., 1990. Museo de la Plata Radiocarbon Measurements II. Radiocarbon 32 (2), 197–208.

Franco, N.V., 2008. La estructura tecnológica regional y la comprensión de la movilidad humana: tendencias en la cuenca del río Santa Cruz. In: Borrero, L.A., Franco, N.V. (Eds.), Arqueología del Extremo Sur del Continente Americano. Resultados de nuestros proyectos. Editorial Dunken, Buenos Aires, pp. 119–154.

Franco, N.V., Martucci, M., Ambrústolo, P., Brook, G., Mancini, M.V., Cirigliano, N., 2010. Ocupaciones humanas correspondientes a la transición pleistoceno-holoceno al sur del macizo del Deseado: el área de La Gruta (Provincia de Santa Cruz, Argentina). Relaciones de la Sociedad Argentina de Antropología XXXV, 301–308.

Franco, N.V., Ambrústolo, P., Acevedo, A., Cirigliano, N., Vommaro, M., 2013. Prospecciones en el sur del Macizo del Deseado (provincia de Santa Cruz). Los casos de La Gruta y Viuda Quenzana. In: Zangrando, A.F., Barberena, R., Gil, A., Neme, G., Giardina, M., Luna, L., Otaola, C., Paulides, S., Salgán, L., Tívoli, A. (Eds.), Tendencias teórico metodológicas y casos de estudio en la Arqueología de la Patagonia. Museo de Historia Natural de San Rafael, San Rafael, Mendoza, Argentina, pp. 371–378.

Frank, A.D., 2011. Tratamiento térmico y manejo del fuegoen sociedades cazadoras-recolectorasde la Meseta Central de Santa Cruz (Ph.D. thesis). Universidad Nacional de La Plata, Argentina.

García-Herbst, A., 2006. Doctoral Dissertation Improvement Grant: Explaining Ancient Technological Innovation in Southern Argentina. Manuscript.

Gómez Otero, J., 2007. Dieta, uso del espacio y evolución en poblaciones cazadoras-recolectoras de la costa centro-septentrional de Patagonia durante el Holoceno medio y tardío (Ph.D. thesis). Universidad de Buenos Aires, Argentina.

Gómez Otero, J., Lanata, J.L., Prieto, A., 1998. Arqueología de la costa atlántica patagónica. Revista de Arqueología Americana 15, 107–185.

Gómez Otero, J., Weiler, N., Moreno, J.E., 2009. Localidad arqueológica Los Cangrejales Sur: evidencias de ocupaciones humanas y de variaciones en la línea de costa durante el Holoceno tardío. In: Salemme, M., Santiago, F., Álvarez, M., Piana, E., Vázquez, M., Mansur, E. (Eds.), Arqueología de la Patagonia - Una mirada desde el último confín. Editorial Utopias, Ushuaia, pp. 177–186.

Gómez Otero, J., Moreno, E., Schuster, V., 2010. Ocupaciones tardías en el valle inferior de río Chubut: primeros resultados del sitio Cinco Esquinas. In: Actas del XVII Congreso Nacional de Arqueología Argentina, vol. V. Universidad Nacional del Cuyo, Mendoza, pp. 1917–1922.

Gómez Otero, J., Weiler, N., Banegas, A., Moreno, J.E., 2013. Ocupaciones del Holoceno medio en Bahía Cracker, costa atlántica de Patagonia central. In: Zangrando, A.F., Barberena, R., Gil, A., Neme, G., Giardina, M., Luna, L., Otaola, C., Paulides, S., Salgán, L., Tívoli, A. (Eds.), Tendencias teórico metodológicas y casos de estudio en la Arqueología de la Patagonia. Museo de Historia Natural de San Rafael, San Rafael, Mendoza, Argentina, pp. 177–186.

Gonzáles Bonorino, G., Bujalesky, F., Colombo, F., Ferrero, M., 1999. Holocene coastal paleoenvironment in Atlantic Patagonia, Argentina. Journal of South American Earth Sciences 12, 325–331.

Hammond, H., 2013a. Propuesta metodológica para el estudio de conjuntos malacológicos de sitios concheros: su aplicación en la costa norte de Santa Cruz (Patagonia Argentina). La Zaranda de Ideas 9 (2), 77–102.

Hammond, H., 2013b. Procesos de formacion de un conchero en la Bahía del Oso Marino: el caso del sitio Las Hormigas (costa norte de Santa Cruz). In: Analía Castro Esnal, A.C., Funes, M.L., Grosso, M., Kuperszmit, N., Murgo, A., Romero, G. (Eds.), Entre Pasados y Presentes IV. Estudios Contemporáneos en Ciencias Antropológicas. Asociación Amigos del Instituto Nacional de Antropología, Buenos Aires, pp. 613–628.

Hammond, H., Zubimendi, M.A., 2013. Estudio de la composición de sitios concheros en la Costa Norte de Santa Cruz (Patagonia Argentina). In: Zangrando, A.F., Barberena, R., Gil, A., Neme, G., Giardina, M., Luna, L., Otaola, C., Paulides, S., Salgán, L., Tívoli, A. (Eds.), Tendencias teórico metodológicas y casos de estudio en la Arqueología de la Patagonia. Museo de Historia Natural de San Rafael, San Rafael, Mendoza, Argentina, pp. 405–415.

Hogg, A.G., Hua, Q., Blackwell, P.G., Niu, M., Buck, C.E., Guilderson, T.P., Heaton, T.J., Palmer, J.G., Reimer, P.J., Reimer, R.W., Turney, C.S.M., Zimmerman, S.R.H., 2013. SHCal13 southern hemisphere calibration, 0-50.000 cal BP. Radiocarbon 55 (4), 1–15.

L'Heureux, G.L., Franco, N.V., 2002. Ocupaciones Humanas en el área de Cabo Vírgenes (Pcia. de Santa Cruz, Argentina): El sitio Cabo Vírgenes 6. Anales Instituto Patagonia, Serie Ciencias Humanas 30, 183–201.

Iantanos, N., 2003. Dinámica sedimentaria de la ría del Deseado, Provincia de Santa Cruz. (Ph.D. thesis). Universidad Nacional de la Patagonia San Juan Bosco, Comodoro Rivadavia.

Magnin, L., 2010. Distribuciones arqueológicas en la Meseta Central de Santa Cruz Implicancias para los estudios de uso del espacio y movilidad de sociedades cazadoras-recolectoras (Ph.D. thesis). Universidad Nacional de La Plata, Argentina.

Mancini, M.V., Franco, N.V., Brook, G.A., 2013. Palaeoenvironment and early human occupation of southernmost South America (South Patagonia, Argentina). Quaternary International 299, 13–22.

Mansur, M.E., 2008. Arqueología de la zona de Punta Bustamante (Provincia de Santa Cruz, Argentina). In: Cruz, I., Caracotche, M.S. (Eds.), Arqueología de la Costa Patagónica. Perspectivas para la conservación. Universidad Nacional de la Patagonia Austral, Río Gallegos, pp. 161–173.

Martinez, G., Flensborg, G., Bayala, P.D., 2013. Chronology and human settlement in northeastern Patagonia (Argentina): patterns of site destruction, intensity of archaeological signal, and population dynamics. Quaternary International 301, 123–134.

Méndez Melgar, C., 2013. Terminal Pleistocene/early Holocene 14C dates form archaeological sites in Chile: critical chronological issues for the initial peopling of the region. Quaternary International 301, 60–73.

Miotti, L., 1989. Zooarqueología de la meseta central y costa de Santa Cruz. Un enfoque de las estrategias adaptativas aborígenes y los paleoambientes (Ph.D. thesis). Universidad Nacional de La Plata, Argentina.

Miotti, L., 2008. Household and sacred landscapes among Holocene hunter-gatherers of Patagonia's Central Plateau, Argentina. Before Farming 3, 1–21.

Moreno, J.E., 2009. Arqueología e etnohistoria de la Costa Patagónica Central en el Holoceno Tardío. Fondo Editorial Provincial. Secretaría de Cultura del Chubut, Rawson.

Moreno, J.E., Castro, A., 1995. Sitio Moreno: Datos preliminares de un sitio chico en la Costa Norte de Santa Cruz, Argentina. Anales del Instituto de la Patagonia, Serie Ciencias Humanas 23, 143–149.

Moreno, J.E., Castro, A., Martinelli, K., Abello, M.A., 1998. El material faunístico de Cabo Blanco 1. Anales del Instituto de la Patagonia, Serie Ciencias Humanas 26, 169–180.

Moreno, J.E., Castro, A., Pepe, F., 2000. El rompecráneo: Un artefacto probablemente destinado a la caza de pinnípedos en la costa patagónica. Desde el país de los Gigantes. Perspectivas arqueológicas en Patagonia. Universidad Nacional de la Patagonia Austral, Río Gallegos, Santa Cruz, Argentina, volume II, pp. 563–571.

Moreno, J.E., Videla, B., 2008. Rastreando ausencias: la hipótesis del abandono del uso de los recursos marinos en el momento ecuestre en la Patagonia continental. Magallania 36 (2), 91–104.

Muñoz, A.S., Caracotche, M.S., Cruz, I., 2009. Cronología de la costa al sur del río Santa Cruz: nuevas dataciones radiocarbónicas en Punta Entrada y Parque Nacional Monte León (Provincia de Santa Cruz, Argentina). Magallania 37 (1), 19–38.

Pedoja, K., Regard, V., Husson, L., Martinod, J., Guillaume, B., Fucks, E., Iglesias, M., Weill, P., 2010. Uplift of Quaternary shorelines in eastern Patagonia: Darwin revisited. Geomorphology 127, 121–142.

Ponce, J.F., Rabassa, J., Coronato, A., Borromei, A.M., 2011. Palaeogeographical evolution of the Atlantic coast of Pampa and Patagonia from the last glacial maximum to the Middle Holocene. Biological Journal of the Linnean Society 103, 363–379.

Prates, L., Politis, G., Steele, J., 2013. Radiocarbon chronology of the early human occupation of Argentina. Quaternary International 301, 104–122.

Rostami, K., Peltier, W.R., Mangini, A., 2000. Quaternary marine terraces, sea-level changes and uplift history of Patagonia, Argentina: comparisons with predictions of the ICE-4G (VM2) model of the global process of glacial isostatic adjustment. Quaternary Science Reviews 19, 1495–1525.

Rubinos Pérez, A., 2003. Recopilación y análisis de las fechas carbono-14 del Norte de Santa Cruz. In: Aguerre, A. (Ed.), Arqueología y Paleoambiente en la Patagonia Santacruceña Argentina. Ediciones del autor, Buenos Aires, pp. 1–25.

Rutter, N., Schnack, E.J., del Río, J., Fasano, J.L., Isla, F.I., Radtke, U., 1989. Correlation and dating of Quatenary litoral zones along the Patagonian Coast, Argentina. Quaternary Science Reviews 8, 213–234.

Salceda, S., Mendez, M.G., Castro, A., Moreno, J., 1999–2001. Enterratorios indígenas de Patagonia: el caso del sitio Heupel-Caleta Olivia, Santa Cruz (Argentina). Xama 12–14, 161–171.

Sanguinetti de Bórmida, A., 1999. Proyecto Norpatagonia. Arqueología de la costa septentrional. Anales de la Academia Nacional de Ciencias de Buenos Aires 33, 1–35.

Schellmann, G., Radtke, U., 2010. Timing and magnitude of Holocene sea-level changes along the middle and south Patagonian Atlantic coast derived from beach ridge systems, littoral terraces and valley-mouth terraces. Earth-Science Reviews 103, 1–30.

Schiavini, A., Crespo, E.A., Szapkievich, V., 1999. Estado de la población del lobo marino de un pelo (*Otaria flavescens*) en las provincias de Santa Cruz y Tierra del Fuego. Informes Técnicos del Plan de Manejo Integrado de Zona Costera Patagónica 40.

Schuster, V., 2014. La organización tecnológica de la cerámica de cazadores-recolectores. Costa Norte de la provincia del Chubut (Patagonia Argentina). Relaciones de la Sociedad Argentina de Antropología XXXIX (1), 203–231.

Soto, J., Vázquez, M., 2000. Las condiciones climáticas de la Provincia de Santa Cruz. In: García, A., Mazzoni, E. (Eds.), El gran libro de la Provincia de Santa Cruz. Milenio Ediciones y Alfa Centro Literario, Madrid, pp. 98–115.

Stuiver, M., Braziunas, T.F., 1993. Modeling atmospheric ^{14}C influences and ^{14}C ages of marine samples to 10.000 BC. Radiocarbon 35 (1), 137–189.

Stuiver, M., Reimer, P.J., 1993. Extended C-14 data-base and revised calib 3.0 C-14 age calibration program. Radiocarbon 35 (1), 215–230.

Suby, J., Guichón, R., Zangrando, A., 2009. El registro biológico humano de la costa meridional de Santa Cruz. Revista Argentina de Antropología Biológica 11 (1), 109–124.

Surovell, T.A., Byrd Finley, J., Smith, G.M., Branthingham, P.J., Kelly, R., 2009. Correcting temporal frequency distributions for taphonomic bias. Journal of Archaeological Science 36, 1715–1724.

Trola, V., Hammond, H., Aguinaga, M.C., Bogan, S., Ciampagna, M.L., 2007. Análisis preliminar de dos sitios concheros en la localidad arqueológica de Cabo Blanco, Costa Norte de Santa Cruz. In: Actas del XVI Congreso Nacional de Arqueología Argentina (Resúmenes Ampliados), vol. III. Universidad Nacional de Jujuy, Jujuy, Argentina, pp. 665–669.

Vilas, F., Arche, A., Ferrero, M., Isla, F., 1999. Subantarctic macrotidal flats, cheniers and beachs in San Sebastian Bay, Tierra del Fuego, Argentina. Marine Geology 160, 301–326.

Williams, A.N., 2012. The use of summed radiocarbon probability distributions in archaeology: a review of methods. Journal of Archaeological Science 39, 578–589.

Zilio, L., 2013. Chenques en Patagonia centro-meridional: análisis de los patrones de distribución espacio-temporales. Revista de Arqueología Comechingonia 17, 169–186.

Zilio, L., Hammondi, H., Zubimendi, M.A., 2011. Análisis distribucional de estructuras de piedra (probables chenques) en la Costa Norte de Santa Cruz. In: Caggiano, M.A., Sempé, M.C. (Eds.), Simposio Muerte, Sociedad y Cultura. Instituto Municipal de Investigaciones Antropológicas de Chivilcoy, Facultad de Ciencias Naturales y Museo de La Universidad Nacional de La Plata, Chivilcoy, Buenos Aires, pp. 11–28.

Zilio, L., Zubimendi, M.A., Hammond, H., 2013a. Chenques en un paisaje costero: análisis espacial de estructuras de entierro en Punta Medanosa. Anuario de Arqueología 5, 253–267.

Zilio, L., Gordón, F., Béguelin, M., Castro, A., 2013b. Paleodietas humanas en el sur del Golfo San Jorge (provincia de Santa Cruz) a partir del análisis de isótopos estables. Revista Argentina de Antropología Biológica 16 (1), 51–64.

Zubimendi, M.A., 2010. Estrategias de uso del espacio por grupos cazadores recolectores en la Costa Norte de Santa Cruz y su interior inmediato (Ph.D. thesis). Universidad Nacional de La Plata, Argentina.

Zubimendi, M.A., 2012. La variabilidad del registro arqueomalacológico en la costa norte de Santa Cruz (Patagonia Argentina): resultados exploratorios a partir de estudios estratigráficos. Intersecciones en Antropología 13, 359–374.

Zubimendi, M.A., Castro, A., Moreno, J.E., 2004. Una aproximación hacia la definición de modelos de uso de la Costa Norte de Santa Cruz. Magallania 32, 85–98.

Zubimendi, M.A., Castro, A., Moreno, J.E., 2005. El consumo de moluscos en la Costa Norte de Santa Cruz. Intersecciones en Antropología 6, 121–137.

Zubimendi, M.A., Hammond, H., 2009. Análisis de los restos malacológicos en el sitio Los Albatros, bahía del Oso Marino (Provincia de Santa Cruz). In: Salemme, M., Santiago, F., Álvarez, M., Piana, E., Vázquez, M., Mansur, M.E. (Eds.), Arqueología de Patagonia: una mirada desde el último confín. Utopías, Ushuaia, Argentina, pp. 865–877.

Zubimendi, M.A., Mazzitelli, L., Navarro, A., Zilio, L., Hammond, H., 2010. Primeras excavaciones en el sitio Palo Alto, Bahía Lángara, Costa Norte de Santa Cruz. In: Bárcena, J.R., Chiavazza, H. (Eds.), Arqueología Argentina en el Bicentenario de la Revolución de Mayo, vol. V. Facultad de Filosofía y Letras, Universidad Nacional de Cuyo, CONICET, Mendoza, Argentina, pp. 2011–2016.

Zubimendi, M.A., Zilio, L., Hammond, H., Gribaudo, C., 2011a. Rescate arqueológico en la localidad El Zanjón: primeros estudios sobre las prácticas mortuorias en el Golfo San Jorge, Costa Norte de Santa Cruz. In: Caggiano, M.A., Sempé, M.C. (Eds.), Simposio Muerte, Sociedad y Cultura. Universidad Nacional de La Plata, Chivilcoy, pp. 29–43.

Zubimendi, M.A., Ambrústolo, P., Beretta, M., Mazzitelli, L., Ciampagna, M.L., Hammond, H., Zilio, L., Plischuk, M., Castro, A., 2011b. Sitio Cueva del Negro: Un caso de aprovechamiento intensivo de los recursos marinos en la Costa Norte de Santa Cruz (Patagonia Argentina). Revista de Estudios Marítimos y Sociales 4, 51–62.