Quaternary International 373 (2015) 82–95

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Human use of birds and fish in marine settings of southern Patagonia and Tierra del Fuego in the Holocene: A first macro-regional approach

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ARTICLE INFO

Article history:
Available online 18 December 2014

Keywords:
Zooarchaeology
Bird and fish remains
Southern Patagonia
Tierra del Fuego
Middle and late Holocene

ABSTRACT

This paper presents a review of the zooarchaeological representations of birds and fish in coastal archaeological sites of southern Patagonia and Tierra del Fuego (47°–55°S). The spatial and temporal variations of this faunal record are assessed in order to understand their contribution in human subsistence in different geographic and cultural settings between 6500 and 100 BP. Spatially, the importance of birds and fish in human subsistence was similar between the Pacific and Atlantic coasts along the Holocene, although differences in taxonomic compositions of bird bone assemblages are observed among regions. Temporally, the analysis suggests an increase in bird hunting in the considered area in the last 3000 years, while an intensification of fishing activities can be proposed for the archipelagic area for that time period.

1. Introduction

In the southernmost part of America, a diverse and continuous use of bird and fish resources by hunter–gatherer–fishers took place during the Holocene. These resources performed key roles in subsistence (e.g. Lefèvre, 1989a, 1989b, 1992, 1993–1994, 1997a, 1997b; Legoupil, 1997, 2000; Orquera and Piana, 1999a, 2009; Zangrando, 2003, 2009a, 2009b; Torres, 2009; Tivoli, 2010a, 2010b, 2014), as well as providing various raw materials for technology (e.g. Orquera and Piana, 1986–1987; Legoupil, 1997, 2000; Scheinsohn, 1997, 2010; Tivoli, 2013). However, the variability in the use of these resources in broad spatial scales and in long-term is poorly known, and previous analyses were limited to certain sectors (Tivoli and Zangrando, 2011; Santiago and Vázquez, 2012). In this paper, a review of the zooarchaeological representations of birds and fish in coastal archaeological sites of southern Patagonia and Tierra del Fuego is presented (Fig. 1). The spatial and temporal variability of bird and fish bone remains is analysed between 47° and 55° S, and 6500 and 100 BP. Relative abundance and taxonomic compositions of these resources are assessed in order to understand their contribution in human subsistence in different geographic and cultural settings in the coasts of southern Patagonia and Tierra del Fuego.

2. Current distribution and abundance of seabirds and fish in southern Patagonia and Tierra del Fuego

The coasts of southern Patagonia and Tierra del Fuego are included in two marine ecological zones: the Patagonian cold estuarine zone and the Patagonian tidal zone (Fig. 1; Acha et al., 2004). These zones are characterized by high primary and secondary production, which allows important food availability (e.g. fish) transferring the energy to higher trophic levels (seabirds, marine mammals). The Patagonia cold estuarine zone extends along the South Pacific and Atlantic coasts, encompassing the southern tip of South America from Chiloé to south of San Jorge Gulf. The Patagonian tidal zone includes the Patagonian coasts from Peninsula Valdés to Peninsula Mitre (Tierra del Fuego). Both zones are part of the biogeographic Magellanic Province. Breeding colonies of seabirds and pinnipeds need high quantities of food and this condition is presented in those zones. Acha et al. (2004) have suggested that a good visual correlation exists between bird colonies and marine fronts.

The Pacific coast and the tip of South America are characterized by strong winds and heavy precipitation (approximately 2500 mm

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http://dx.doi.org/10.1016/j.quaint.2014.11.047
1040-6182/

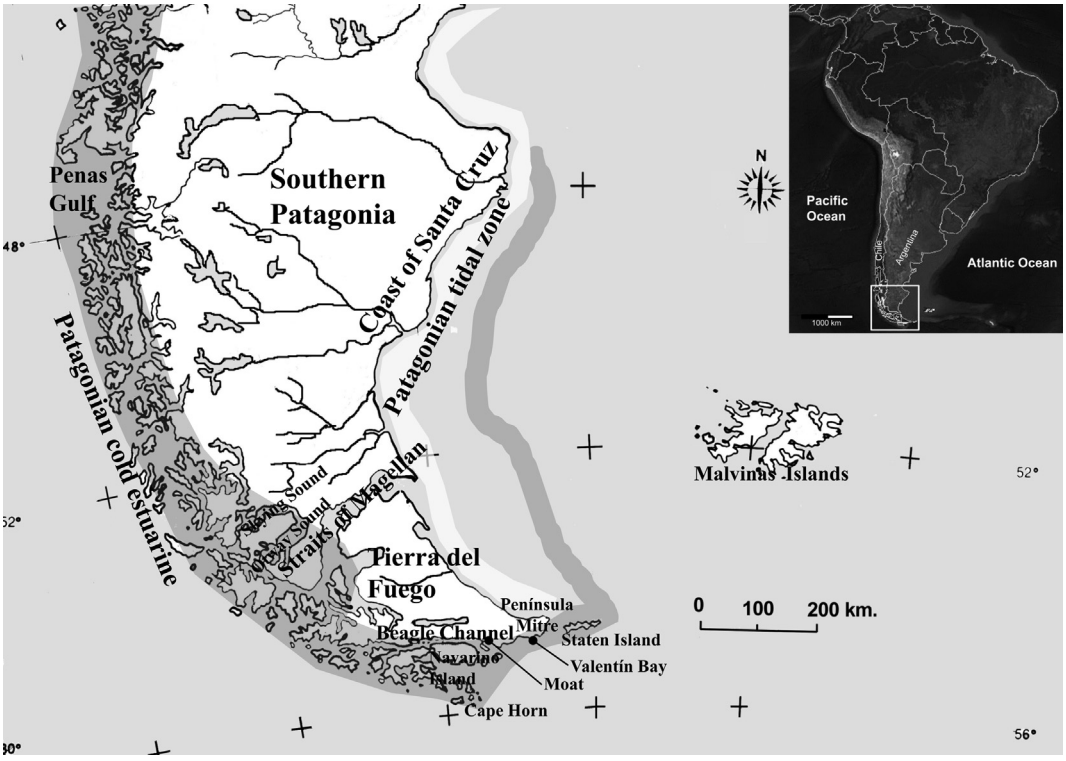

Fig. 1. Map of Southern Patagonia and Tierra del Fuego showing the geographical features and locations mentioned in the text.

per year). The continental runoff is important. The estuarine waters in fjords and channels are relatively poor in alimentary resources, while the oceanic subantartic waters are the main source of nutrients (Silva and Neshiba, 1979). These conditions significantly affect the composition and spatial distribution of some pelagic fish, such as the Fuegian sprat (*Sprattus fuegensis*). A decrease in the richness, abundance and diversity of species is observed with the decreasing of temperature and salinity and the increasing of sedimentation in inland fjords (Hüne and Ojeda, 2012). The Patagonian blennie (*Eleginops maclovinus*) is the species with the largest biomass and distribution in the fjords and channels system (Lloris and Rucabado, 1991), and this species is normally associated with low salinity estuarine areas (Pequeño, 1979). The ichthyofauna of the Archipelago of Tierra del Fuego is characterized by the taxonomic dominance of the Nototheniidae families (mainly belonging to the genus Patagonotothenia) and Zoarcidae (Lloris and Rucabado, 1991; Sielfeld and Vargas, 1999).

Colonies of cormorants are present mainly in fjords and channels (Fig. 2; Garay et al., 2008; Kush and Marín, 2013). Kush and Marín (2013) calculated a population of 5300 of breeding pairs for imperial shags (*Phalacrocorax atriceps*) over 20 colonies, although these authors estimate that the population could be higher. Most breeding sites were detected between Beagle Channel and Nassau Bay, in Cook Bay, and in the NW coast of Dawson Island and Barbara Channel. Four colonies of Magellanic penguins (*Spheniscus magellanicus*) are established in Martillo Island (Beagle Channel), Franklin Bay (Staten Island), Observatorio Island and Goffré Island. Observatorio Island has the higher population with 105,500 breeding pairs, while the other colonies were much smaller (Schiavini et al., 2005). Breeding colonies of Southern Rockhopper penguins (*Eudyptes chrysocome*) were also recorded in Franklin Bay, Diego Ramirez Archipelago, Ildefonso Island and Noir Island (Kirkwood, 2007; Falabella et al., 2009); the colony of Franklin Bay has 166,700 breeding pairs (Schiavini et al., 2005). Breeding colonies of albatrosses and petrels have been reported in offshore and oceanic islands (e.g. Diego Ramirez Archipelago, Ildefonso Island, Diego de Almagro Island). Approximately 20% of the world population (approximately 100,000 breeding pairs) of black-browed albatross (*Thalassarche melanophrys*) inhabited those islands (Robertson et al., 2008). These seabirds use to forage far away from the coasts both in the Atlantic and the Pacific oceans. Although black-browed albatross from colonies of Diego Ramirez and Ildefonso islands may spread over fjords and channels, the areas with higher densities are in outer localities such as Cape Horn and Staten Island (Falabella et al., 2009). Geese (e.g. *Chloephaga picta*) are also abundant in wetlands and forests of southern Patagonia and Tierra del Fuego (Humphrey et al., 1970; Schlatter et al., 2002; Ibarra et al., 2010).

The Atlantic sector has a high production of zooplankton resulting in a significant assemblage of fish and squids (Acha et al., 2004). The fish community of the Southern Patagonia and Tierra del Fuego shelves is mainly composed of pelagic and demersal species such as: *Micromesistius australis*, *Macruronus magellanicus*, *Sprattus fueguensis*, *Genypterus blacodes*, *Merluccius australis*, *Dissostichus eleginoides*, *Salilota australis*, Macrouridae and Notothenia spp (Bezzi et al., 1995). There are, however, few large-scale studies concerning the fish productivity of the area. In the Patagonian tidal zone, the Fuegian sprat (*Sprattus fueguensis*) and hakes (*Merluccius hubbsi* and *Merluccius australis*) are key species of the system: they are the most abundant fish resources providing food to large populations of seabirds and marine mammals (Acha et al., 2004; Alemany et al., 2009). Spawning areas of the Fuegian sprat have been recorded near the Tierra del Fuego coasts (Sánchez et al., 1995). In coastal areas, the Patagonian blennie is the most abundant and most widely distributed species. Diverse species of the Nototheniidae family are also presented in the intertidal and neritic zones (Lloris and Rucabado, 1991).

Cormorant and penguin colonies are particularly abundant on the Atlantic coast (Fig. 2). Three main species of cormorants are