

# Painted fish, eaten fish: Artistic and archaeofaunal representations in Tierra del Fuego, Southern South America

Dánae Fiore\*, Atilio Francisco J. Zangrando

CONICET-AIAIUBA, Rivadavia 1379 11, "F" C.P. (1033), Buenos Aires, Argentina

Received 19 September 2005; revision received 30 December 2005

Available online 14 February 2006

---

## Abstract

This paper presents a case-study of the management of fish species—particularly patagonian blennies (*Eleginops maclovinus*)—in subsistence and ceremonial-artistic activities in the Beagle Channel area. Archaeological and ethnographic records representative of the XVI to early XX centuries are integrated and analysed with the aim of discussing the existence of a dietary avoidance of certain potentially high-yield species, possibly as a result of ceremonial activities. Ecological, taphonomic, and technological aspects are analysed, showing that their influence in the archaeofaunal patterns have been minimal. The biases of the ethnographic records about fishing and body painting activities are also taken into consideration, and the information provided by them is considered accordingly. The results are discussed in the light of a series of expectations derived from the optimality theory models. Some of the advantages and limitations of these models are in turn pointed out.

© 2006 Elsevier Inc. All rights reserved.

**Keywords:** Optimisation; Dietary avoidance; Ichthyofauna; Body painting; Tierra del Fuego

---

## Theoretical framework and aims of this paper

The main aim of this paper is to present the analysis of fish management processes in subsistence and artistic activities in the Beagle Channel region (Tierra del Fuego, Southern South America), and to discuss the implications of the results in relation to the principles of optimality theory in archaeology. In particular, the case of the patagonian blennie (*Eleginops maclovinus*) will be addressed here, due to the high resolution of archaeological and ethno-

graphic evidence regarding this species. In addition, the discussion of expectations derived from an optimal foraging framework will also include a comparative assessment of the rest of the species found in the Beagle Channel region.

The zooarchaeological analyses based on optimality principles are grounded on the premise that the intensity of exploitation of different dietary resources varies in relation to ecological conditions. Such studies are oriented towards explaining food procurement in terms of variations among nutritional values, frequency of encounter, and/or capture/processing costs (Bettinger, 1991; Kelly, 1995; Smith, 1983; Smith and Winterhalder, 1992; Winterhalder and Smith, 1981). Recently these

---

\* Corresponding author. Fax: 541148238645.

E-mail address: [danae\\_fiore@yahoo.es](mailto:danae_fiore@yahoo.es) (D. Fiore).

principles have been applied to archaeological cases worldwide, including the analysis of optimal use of fish resources (Broughton, 1997; Butler, 2000, 2001; Nagaoka, 2002). We consider that these analytical schemes are useful structures to characterise and assess observed patterns of behaviour, and that they form a valid starting point for understanding the archaeofaunal record. For this reason, part of this paper is structured along these criteria. Nevertheless, these models are based on a formalist theory of economy which conceives decision-making as a mainly rational and profit-oriented activity (Burling, 1976, cf. Godelier, 1976). Therefore, they define the importance of a resource in terms of their contribution to the diet without taking into account other factors as possible sources of variation in foraging behaviour. There are a number of examples in ethnographic records from various regions, of social<sup>1</sup> and/or ideological<sup>2</sup> factors that condition in a significant manner the management of specific resources (for example Kelly, 1995; Levi-Strauss, 1962; Schwabe, 1988 in Malainey et al., 2001; Politis and Martínez, 1996; Tambiah, 1969). But unfortunately we know very little about the way in which such processes worked in hunter–gatherer societies of the past. Because certain frameworks do not consider it necessary, or due to the reduced archaeological visibility of certain social and ideological aspects of human action, the efforts invested in the identification and analysis of the dynamics of these mechanisms have been little. We agree with Politis and Saunders (2002, p. 126) in that “archaeologists should be prepared to encounter the “anomalies” of unusual patterning of faunal remains and the “inexplicable” absences of available prey, and to acknowledge

*that they might be explained....*” The frequent analytical bias in relation to the characterization of ideological factors present in activities related to the procurement, consumption and disposal of faunal pieces is based on a usually implicit conception that associates the diet of a social group almost exclusively with its economy, while its ideology is associated with other kinds of activities, such as the creation of art or the celebration of ceremonies (Álvarez and Fiore, 1993; Fiore, 1996; García Canciani, 1986; Layton, 1989; Nielsen, 1995). As a consequence, the possibilities of analysing the ideological factors implied in the development of a human group’s diet are not fully explored.

In spite of their different degree of archaeological visibility, ideological, social, and economic factors are present in any sphere of human activity, from religion to subsistence. In this latter case, it is difficult to assess the social and/or ideological importance of a faunal resource only in terms of its bone remains, and therefore it requires the integration of the archaeofaunal evidence with other sources of information: stable isotopes, capture techniques, consumption techniques, artistic expressions, etc. Several authors have demonstrated that each one of these independent lines of analysis can provide information about different ideological, social, economic, and ecological aspects that characterise the management of a specific resource by a human group (Jochim, 1983; Mithen, 1988; Taçon, 1988). The analysis of these different sources of information can generate complementary data which can shed light on the existence of patterns of behaviour that are difficult to interpret from only one kind of material. This perspective guides the present paper. The case study that will be analysed here is focused on the multiple factors that determined the management of fish by hunter–gatherer societies that inhabited the Beagle Channel region. The aim is to identify patterns of use in the ichthyofauna species in two activities: (a) the handling of fish as a source of subsistence and (b) their use as referents in the construction of body painting designs. The Beagle Channel region is located at the uttermost end of the South American continent (54°35′ Lat. S, between 66°30′ and 70° Long. W, Fig. 1). It has been inhabited by hunter–gatherer groups at least since 7000 years BP. In historical times the region was occupied by an indigenous group that named itself *Yamana*.

The analysis developed in this paper is based on ecological, archaeological, ethnographic, and histor-

<sup>1</sup> Social factors can be considered as those relative to the relationships constructed between two or more individuals and/or two or more groups, which characterise their position within a larger group, and therefore their action possibilities (e.g., to exercise power, to generate consensus, to be coerced, etc.). Such relationships and processes allow people to produce and reproduce habits. Some of the variables that can be included in this characterisation are: the gender and age of people, their access to material resources and information, the roles played by them within a group in different social practices, etc (Lumbreras, 1984; McGuire, 1992; Nielsen, 1995, among others).

<sup>2</sup> Ideological or ideational factors can be characterised as the set of concepts and values (both rational and affective) present in the thoughts, perceptions and practices of a human group. They feedback, continuing and/or changing social structures, through social practice (ibid). This broad definition of the term is not restricted to the notion of “false consciousness” (Marx, 1971 [1859]), although it includes it.

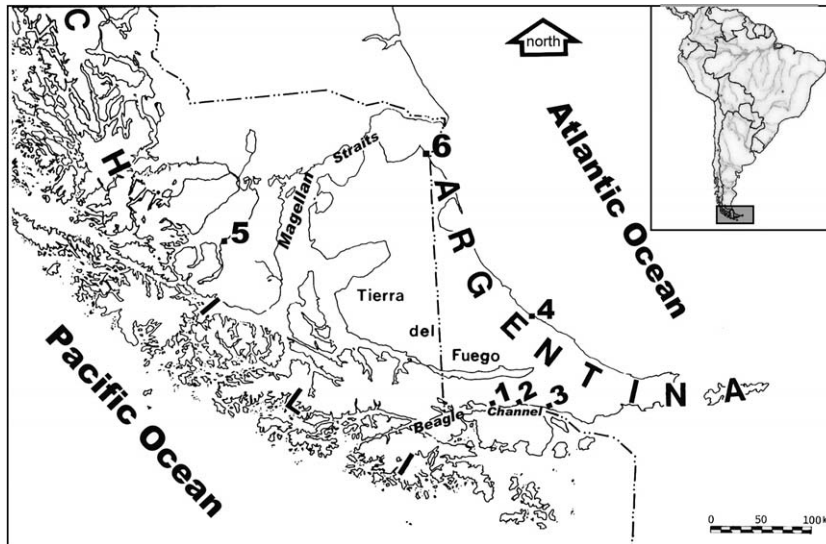


Fig. 1. Tierra del Fuego, Southern South America. Archaeological sites: 1, Lancha Packewaia, Túnel I, Túnel VII; 2, Shamakush I and Shamakush X; 3, Imiwaia I; 4, Punta María II; 5, Punta Baja; and 6, Punta Catalina 3.

ical information. First, a series of expectations about the patterns of exploitation of ichthyofauna resources are developed. These are defined from different ecological aspects (distribution, seasonality, ethology, and nutritional values), which are then contrasted with the information provided by the rest of the sources. To do so, the results of ichthyoarchaeological studies of sites from the XVII to the XX century are presented. These analyses provide information about which fish resources were exploited during the period of contact between Fuegian aborigines and European travellers and colonizers.

Second, an analysis of the representation of fish in body painting designs is presented. These were worn during the *kina*, a male initiation ceremony. Such analysis is based on written and visual ethnographic sources and generates information about which species were represented in the paintings, while shedding light on their importance in the ideological, social, and economic factors involved in these practices. Finally, the results of these analyses are contrasted with the expectations mentioned above.

### Archaeological expectations

Taking into account the perspective commented above, the following expectations can be formulated in relation to the fishing activities. The fish species found in the archaeofaunal record can be those of high

potential yield,<sup>3</sup> coinciding with the optimality principles, and/or those of lower potential yield, responding to behaviours which do not seek optimality of benefits obtained by reducing costs. In both cases, other factors different than the exclusively economic would be playing a role in the situation. Yet these factors are usually easier to recognise when optimisation has not been pursued as a goal by the human agents in the past, because they can be distinguished as different from the optimisation patterns. These include social and/or ideological factors that may have oriented the resource selection generating consumption restrictions in relation to the resources supply.

The fish species represented in the paintings can be the same or different than those found in the archaeofaunal record.

If they are the same

- (1) both of high potential yield
- (2) both of low potential yield

there would exist a reinforcement of the behavioural pattern of fish management in both spheres (subsistence and art).

If they are different

<sup>3</sup> The potential yield of a species is defined here as the result of the interaction between the following variables: calories/fats, weight, size, biomass, distribution, ethology, and seasonality (these criteria have been proposed and used by Smith, 1983; Smith and Winterhalder, 1992; Broughton, 1997, among others).

- (3) species of high potential yield in diet and low potential yield in art
- (4) species of low potential yield in diet and high potential yield in art

there would be a conceptual complement (both rational and affective) between the selectivity of species in diet and in art. Case “3” would imply a dietary optimisation complemented by an artistic representation of non-optimal resources, which may be important for the society from social and/or ideological standpoints. Contrarily, case “4” would imply a lack of dietary optimisation, which, interestingly, would be complemented by the artistic representation of non-consumed species of high potential dietary value. In this latter case, if such absence is not due to availability limitations, taphonomic or technical factors, it could be suggested that the lack of dietary consumption of species of high potential yield would have been influenced by its importance in the artistic sphere and in the social and ideological realm of the aboriginal group.

### The environment

The Beagle Channel is approximately 180 km long and between 4 and 7 km wide. It separates Isla Grande de Tierra del Fuego from the rest of the Fuegian archipelago. Its environment is characterised by an abundant variety of faunal taxa. The shores and the sea are inhabited by important populations of cetaceans, southern sea lions, guanacos, fish, birds, and molluscs. This taxa diversity is spread in a relatively homogeneous way in the whole region. The plant species distribution is also even. Between sea level and up to 600 m of altitude, the woods of *Nothofagus* (*N. betuloides* and *N. pumilio*) predominate. Near to the forested areas grow different bush species as well as an important quantity of herbs and creeping plants. Kelp grow in shallow sea waters (*Macrocystis pyrifera*—“*cachiyuyo*” being the common term in Spanish); these are generally associated to the sea rocky bottoms. These algae are used as shelters by invertebrate species and fish, forming a specific ecosystem (Lloris and Rucabado, 1991; Moreno and Jara, 1984). The Beagle Channel waters present a low salinity level (32‰) and a mean annual temperature of 6.5 °C.

### Ichthyofauna variability and conditions for fish procurement

The ichthyofauna of the Beagle Channel is abundant although not diverse (Lloris and Rucabado,

1991). The species can be divided in two patches: coastal and pelagic.<sup>4</sup> Most of the species present in the first patch belong to the *Nototheniidae* Family (usually called “rock fish” and belonging to the *Perciformes* order), in which small sized species predominate. Among the *Nototheniidae*, the patagonian blennie (*E. maclovinus*) is the biggest littoral species (2200 g) and also the one with highest biomass in the Beagle Channel (López et al., 1996). This species is strictly coastal (Gosztonyi, 1981). The *Nototheniidae* can be fished all year round, although patagonian blennies are more abundant between October and April. Other *Nototheniidae* species include: magellanic rock fish (*Paranotothenia magellanica*), which weigh up to 850 g, and different species of rock fish (*Patagonotothen* sp.), which do not exceed 200 g (Rae quoted in Orquera and Piana, 1999a).

Other species inhabit more specific microenvironments in the coastal patch. Rock eels (*Austrolycus depressiceps*) and other species of the Zoarcidae family live under the rocks and crevasses. Such eel-shaped fish can reach 57 cm and weigh 0.5 kg (pers. com. San Román to Orquera and Piana, 1999a). Also the channels bullfish (*Cottoperca gobio*) inhabit rocky underwater strata. The silversides (*Austroatherina nigricans*) are found in the brackish waters near creek mouths, and can reach 22 cm.

The ichthyofauna from the pelagic patch is constituted by numerous families, presenting a greater diversity than the coastal families in morphology and ethology. First, size variability in these fish is notorious: the size range goes from the southern cods (*Genypterus blacodes*), hackes (*Merlucciidae* sp.), and barracoutas (*Thyrstites atun*), which can exceed 1 m in length, to the sardines (*Clupeidae* sp.), which do not exceed 18 cm (Lloris and Rucabado, 1991). Although they belong to this patch, some species, like barracoutas, occasionally approach the shores (Bellisio et al., 1979). This also happens with species such as sardines (*Clupeidae* sp.) and tailed hackes (*Macruronus magellanicus*), which frequently end up in massive beachings. These latter species present a well defined seasonality, entering the Beagle Channel between December and April (Lloris and Rucabado, 1991; López et al., 1996). Instead, other taxa present in deeper waters inhabit the Beagle Channel all year round, including southern cods (*G. blacodes*) and brotolas (*Salilota australis*). The

<sup>4</sup> Pelagic patches clusters fish species that usually inhabit far from shore.

Table 1  
Ecological and nutritional information of Beagle Channel fish species

Taxa	Maximum length (cm)	Maximum weight (kg)	Depth distribution (m)	Availability in Beagle Channel	Gregarious behaviour
Tailed hake ( <i>Macruronus magellanicus</i> )	70	3.20	0.5–110	December–April	Yes
Magellanic rock fish ( <i>Paranotothenia magellanica</i> )	43	0.85	0–30	All year round	No
Rock fish ( <i>Patagonotothen</i> sp.)	25	0.20	0–30	All year round	No
Patagonian blennie ( <i>Eleginops maclovinus</i> )	60	2.20	0–20	All year round	No
Barracouta ( <i>Thyrstites atun</i> )	103	4.40	Unknown	Unknown	Yes
Rock eel ( <i>Austrolycus depressiceps</i> )	57	0.50	0–6	All year round	No
Silverside ( <i>Austroatherina nigricans</i> )	22	Unknown	0–10	All year round	Yes
Sardine ( <i>Clupeidae</i> sp.)	18	0.14	0–10	December–April	Yes
Brotola ( <i>Salilota australis</i> )	79	4.5	10–110	All year round	No
Channel bullfish ( <i>Cottoperca gobio</i> )	Unknown	Unknown	0–20	All year round	No
Southern cod ( <i>Genypterus blacodes</i> )	138	12.50	10–110	All year round	No

Data quoted from Lloris and Rucabado (1991); López et al. (1996).

exploitation of this patch requires the use of canoes, which are profusely documented in the historic-ethnographic records (Orquera and Piana, 1999b).

The seasonal distribution and abundance of the fish species can condition, to a greater or lesser extent, the procurement activities carried out by hunter–gatherer groups. Shoals of sardines, hackes and barracoutas are seasonal: sardines and various hacke species—all of which are gregarious—usually reach the Beagle Channel only during the first months of the year (Lloris and Rucabado, 1991; López et al., 1996). In such occasions, great beachings can happen in shores of low angularity.<sup>5</sup> Therefore, these species may probably have had a high rank in the resources hierarchy, which was maybe only surpassed by the finding of beached cetaceans. Obtaining fish under these circumstances generates high benefits since the activity is reinforced by very low risks and procurement costs. Nevertheless, the predictability of these seasonal fish is lower when compared to other fish species of the Beagle Channel: the existence of beachings and the shoals productivity vary from one year to the next.

In both patches the Beagle Channel fish present very varied ethological and availability patterns (Table 1). The lack of gregarious habits in many species, specially the *Nototheniidae*, implies that the

specimens need to be captured individually. In such circumstances, the patagonian blennie, which is a species of considerable size, strictly coastal (Gosztonyi, 1981), available all year round, and highly abundant (Lloris and Rucabado, 1991; López et al., 1996), represents high rates of encounter in relation to other fish species. The individual capture of hackes and barracoutas could also have generated important benefits, but the presence of both species only happens during a few months. The southern cods can also reach important sizes but the adult specimens only inhabit deep waters (Angelescu and Prenski, 1987).

In addition to the previous resource classification, it is also possible to discriminate two fish groups according to their nutritional values (Fig. 2): (A) “high yield species,” and (B) “low yield species.” Group A includes barracoutas, hackes, and patagonian blennies; group B includes magellanic rock fish, rock fish, and sardines. There are no available data regarding the nutritional values of rock eels, channel bullfish, and silversides, but considering their weight and size, these species can be included in group B. According to the optimality theory perspective, the group A species are those which would generate the greater benefits, and therefore, would be the most exploited. Nevertheless, this ranking has been constructed based on the preferences implied by the procurement of individual specimens. Yet other factors can influence the choice of a forager (Madsen and Schmitt, 1998). The gregarious habits of species such as sardines and silversides would generate a benefit due to their high yield per time unit during the procurement. Such benefit would be higher than that obtained with rock fish, rock eels or channel bullfish. As a consequence, sardines and silversides

<sup>5</sup> A sardine beaching yielding a total of 200 kg biomass has been recorded in the Beagle Channel (López et al., 1996). The importance of beachings has also been recorded in the ethnohistorical sources. Some mention that in such occasions the quantity of food that could be obtained was so great that it generated the gathering of several families (Gusinde, 1986, p. 793; Orquera and Piana, 1999b, p.155 and 160–161).

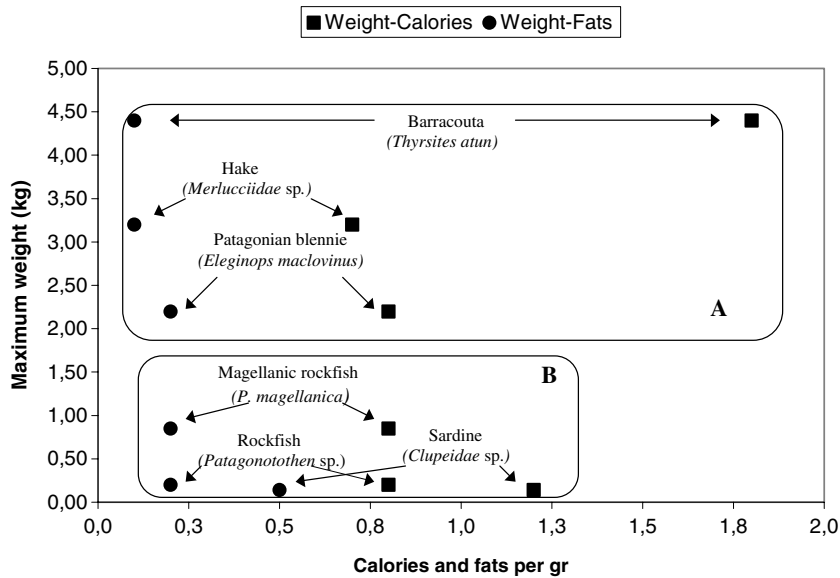


Fig. 2. Nutritional values of the fish species represented in the archaeological record. (Calories and fats values quoted from Juan-Muns I Plans (1992) and Rick and Erlandson (2000).)

will be considered here as integrating the “high yield species” group (A).<sup>6</sup>

### The fish in the Beagle Channel archaeological sequence

A subsistence dependant on the exploitation of littoral resources is evidenced in the Beagle Channel along a chronological sequence of starting approximately 6500 years BP (Orquera and Piana, 1999a). The Second Component of Túnel I site (with radiocarbon dates between  $6.470 \pm 110$  AP -Beta 21969- and  $4.590 \pm 130$  AP -AC 833-) and the lower layers of shell-middens in site Imiwaia I ( $5.872 \pm 147$  AP -AC1397-) constitute the earliest known evidence of this kind of subsistence. In both assemblages, technology is dominated by side-scrapers, end-scrapers, harpoon points, awls made with bird bones, and cobbles with pecked grooves. With a later chronology, the Early Component of Lancha Packewaia site ( $4.020 \pm 70$  AP -CSIC 306-) evidences a raise in the guanacos consumption, and contains flaked stone projectile points, which were almost absent in earlier assemblages.

The most recent layers of Lancha Packewaia site constitute its Late Component ( $1.590 \pm 50$  BP (CSIC 312) and  $280 \pm 85$  BP (MC 1064)). Shamakush I

( $1.020 \pm 100$  AP) and Shamakush × ( $500 \pm 100$  AP) sites also have dates within this range. Túnel VII and Lanashuaia sites are even more recent, since their dates correspond to the last 200 years.

Although the relative abundance of fish varies between the different archaeological sites, no qualitative changes among the assemblages have been observed. Pelagic and coastal species appear along the entire sequence. Ichthyoarchaeological studies carried out in Túnel I and Imiwaia I sites show a spatial variability in fish exploitation around 6000 BP, since the intensity of this activity changed according to the microenvironment conditions<sup>7</sup> (Zangrando, 2003). It was also noted that the importance of ichthyofauna resources in the human diet was higher during the summer, and that the tailed hackes and sardines were the most consumed species.

The studies by Juan-Muns I Plans (1992, 1996) on Túnel VII site showed a predominance of nototheniids, especially magellanic rock fish and rock fish. They also revealed a strong contrast between the great density of fish remains in this recent site and other earlier archaeological assemblages. Juan-Muns I Plans (1992) suggested hypothetically an important increase

<sup>6</sup> The silversides are not evenly but punctually distributed in the environment, hence their availability is somewhat more restricted.

<sup>7</sup> The studies carried out in the region showed that the frequency of fish bone remains in the lower shell-middens of site Imiwaia I is much higher than those in the contemporaneous layer D of Túnel I site. In the former assemblage the density is  $1211.7$  specimens/m<sup>3</sup> while in the latter assemblage it is  $338.9$  specimens/m<sup>3</sup>.

in fish consumption versus a decrease of maritime mammals in the aborigine's diet. Nevertheless, recent excavations carried out in Imiwaia I site indicated that fish resources were also very abundant in early shell-midden deposits, dating nearly to 6000 years BP. In summary, the higher concentrations of ichthyofauna remains are found in the early and recent ends of the archaeological sequence (the lower shell-middens of Imiwaia I, and layer B of Túnel VII), while in the contemporaneous sites the fish-remains densities are noticeably lower (Orquera and Piana, 1999a).

### **Ichthyofaunal analysis: relative abundance, differential decay, and fishing technologies**

In this paper, we discuss the information about the ichthyofauna assemblages from four archaeological sites located in different microenvironments of the Beagle Channel region. Túnel VII and Lancha Packewaia are located on a rocky shore environment with abrupt slopes, while Lanashuaia and Imiwaia I are located in a littoral space with smooth slants and a muddy underwater substrate. This microenvironmental variability helps in assessing whether microenvironment was a relevant variable in the formation of the archaeofaunal records. The four sites are structurally similar, since they are mainly constituted by shell-middens and are located in coastal fringes, near the shores.

In spite of the fact that in the Beagle Channel region there is evidence of human occupation since 7000 years BP, and evidence of maritime exploitation since 6200 years BP, in this paper we will only consider the sites with recent chronologies, ranging from 280 years BP to the present (see Table 2). This temporal restriction facilitates the comparison of the archaeological evidence with the ethnographic and historical information.

The collection methods used to recover the ichthyofauna material were similar in all the assemblages: 2 mm sieves were used to sift the archaeological remains; a sampling technique which allows to measure the density of finds in relation to the excavated

volume was also used (described by Orquera and Piana, 2000). These sampling techniques were used to find a representative sample of the different species that integrated the ichthyofauna assemblages.

The ichthyoarchaeological samples are in a good conservation state. Almost all the bone elements of the different species are represented, which facilitated their taxonomic identification. The bones which have a higher diagnostic value for the calculation of the taxonomic abundance measurements are: the mandible bones, palatines, quadrates, hyomandibulars, ceratohyal–epihyals, opercle complexes, vertebrae, and otoliths (although the latter are not frequent in the studied assemblages).

A total of 11,595 specimens have been analysed: 6658 from Imiwaia I layer B, 2278 from Lancha Packewaia layer B, and 2659 from Túnel VII. Out of the total sample, 5076 specimens were identified at taxonomic level. We also consider in this paper the results from previous analyses by Juan-Muns I Plans (1992) for Túnel VII and ichthyofaunal determinations made for Lanashuaia site (Piana et al., 2000), resulting in a total of 7039 specimens identified at taxonomic level.

Considering the general results obtained for the different sites (Tables 3 and 4), it is noticeable that the most represented species is the barracouta. This is coincident with the expectations established above, since this species presents the highest ranking among the fish resources. Instead, other pelagic species that can generate high yields, like the tailed hakes and sardines, are scarcely represented. The low predictability of these species can explain this pattern to some extent. Fish that inhabit in shallow waters, like rock eels, channel bullfish and silversides, are scarcely represented. The low representations of rock eels and channel bullfish are concordant with our expectations, since these species constitute resources of low potential yield. Contrary to this situation, a higher representation of silversides was expected, mainly when considering the gregarious habits of this species.

Table 2  
Chronology of archaeological sites of the Beagle Channel region

Site	Layer	Material	Radiocarbon age	Code	Reference
Túnel VII	B	Charcoal	100 ± 45 BP	AC 871	Orquera and Piana (1999a)
Lancha Packewaia	B	Charcoal	280 ± 85 BP	MC 1064	Orquera and Piana (1999a)
	B	Charcoal	280 ± 85 BP	MC 1062	
Imiwaia I	B	Charcoal	154 ± 70 BP	AC 1579	Orquera and Piana pers. com.
Lanashuaia	C	Charcoal	Recent	No code published	Piana et al. (2000)

Table 3  
NISP and NISP% of fish species per site

Species	Túnel VII				Lanashuaia (2)		Lancha Packewaia		Imiwaia I (layer B)		Totals	
	Subunits (1)		Sampling column		NISP	NISP%	NISP	NISP%	NISP	NISP%	NISP	NISP%
	NISP	NISP%	NISP	NISP%								
Tailed hake ( <i>Macruronus magellanicus</i> )	133	9.61	70	5.04	95	16.44	2	0.15	27	1.13	327	4.60
Hake ( <i>Merluccius</i> sp.)	0	0.00	1	0.07	0	0.00	0	0.00	48	2.00	49	0.70
Hake ( <i>Merlucciidae</i> sp.)	0	0.00	65	4.68	0	0.00	6	0.47	17	0.72	88	1.20
Magellanic rock fish ( <i>Paranotothenia magellanica</i> )	438	31.62	842	60.58	32	5.54	716		149	6.23	2177	30.90
Rock fish ( <i>Patagonotothen</i> sp.)	359	25.92	301	21.65	4	0.69	434	33.51	25	1.05	1123	16.00
Patagonian blennie ( <i>Eleginops maclovinus</i> )	0	0.00	0	0.00	1	0.17	0	0.00	2	0.08	3	0.04
Nototheniid ( <i>Nototheniidae</i> sp.)	0	0.00	69	4.96	39	6.75	73	5.64	6	0.25	187	2.65
Barracouta ( <i>Thyrstites atun</i> )	0	0.00	0	0.00	332	57.44	0	0.00	2043	85.45	2375	33.74
Gempylidae ( <i>Gempylidae</i> sp.)	6	0.43	0	0.00	46	7.96	0	0.00	0	0.00	52	0.73
Channel bullfish ( <i>Cottoperca gobio</i> )	0	0.00	10	0.72	0	0.00	7	0.54	0	0.00	17	0.24
Rock eel ( <i>Austrolycus</i> sp.)	0	0.00	0	0.00	0	0.00	0	0.00	8	0.33	8	0.11
Silverside ( <i>Austroatherina nigricans</i> )	0	0.00	0	0.00	0	0.00	0	0.00	1	0.04	1	0.01
Sardine ( <i>Clupeidae</i> sp.)	449	32.42	32	2.30	29	5.01	57	4.40	65	2.72	632	8.98
Totals	1385		1390		578		1295		2391		7039	

Key: (1) after Juan-Muns I Plans (1992); (2) after Piana et al. (2000).

Table 4  
MNI and MNI% of fish species per site

Species	Túnel VII		Lancha Packewaia		Imiwaia I (layer B)	
	MNI	MNI%	MNI	MNI%	MNI	MNI%
Tailed hake ( <i>Macruronus magellanicus</i> )	5	8.92	1	2.13	1	2.28
Hake ( <i>Merlucciidae</i> sp.)	2	3.57	1	2.13	3	6.84
Magellanic rock fish ( <i>Paranotothenia magellanica</i> )	21	37.50	18	38.30	5	11.27
Rock fish ( <i>Patagonotothen</i> sp.)	15	26.79	11	23.40	1	2.28
Patagonian blennie ( <i>Eleginops maclovinus</i> )	0	0.00	0	0.00	1	2.28
Nototheniid ( <i>Nototheniidae</i> sp.)	9	16.07	11	23.40	1	2.28
Barracouta ( <i>Thyrstites atun</i> )	0	0.00	0	0.00	28	63.65
Channel bullfish ( <i>Cottoperca gobio</i> )	1	1.79	1	2.13	0	0.00
Rock eel ( <i>Austrolycus</i> sp.)	0	0.00	0	0.00	1	2.28
Silverside ( <i>Austroatherina nigricans</i> )	0	0.00	0	0.00	1	2.28
Sardine ( <i>Clupeidae</i> sp.)	3	5.36	4	8.51	2	4.56

Among the nototheniids the most represented species is the magellanic rock fish, followed in order of importance by the rock fish. These species belong to group B and therefore were not expected to appear so frequently in the archaeological record. Totally contrary to the optimality expectations, the patagonian blennie (a group A species) is represented only by three bone elements over a total of 7039 specimens identified at taxonomic level. This coincides with the observations carried

out by Estevez et al. (2001), who had noted the low frequency of the species in the archaeological record. This is particularly interesting, since this is the species of higher biomass in the Beagle Channel. It is also available all year-round, hence its absence cannot be explained by seasonal variations. Moreover, the patagonian blennie presents the highest potential yield rates among the fish resources that form part of the coastal patch, since it clearly exceeds the magellanic rock fish and rock



fish in size and weight. In addition, none of the *Nototheniidae* Family species has gregarious habits, therefore there are no potential differences related to the possible benefits produced by capturing one species or the other. In summary, the analysis based on the optimality theory concepts cannot explain the absence of patagonian blennies from the archaeological record.

Other factors different from those discussed above could also have influenced the absence of such species. The differential action of post-depositional processes over the remains of different species may have influenced the ichthyoarchaeological record. Previous studies have demonstrated that the morphological indexes and bone densities of fish show clear inter-species differences, hence different expectations about the conservations of such species can be generated (Butler and Chatters, 1994; Falabella et al., 1994; Nicholson, 1992). The higher the morphological index or the bone density of a species, the higher are the probabilities that such species will be represented in the archaeological record. To assess the assemblages under study, we used the average values proposed by Falabella et al. (1994) for hakes, barracoutas, patagonian blennies, sardines, and silversides. The analysis of bone densities and relative abundance (NISP%) of the five species mentioned above shows that there is no correlation between these variables in the different taxa ( $r_s = 0.05$ ,  $P > 0.10$ ). The same happens when calculating the relation between the morphological index and relative abundance (NISP%) of the same species ( $r_s = 0.23$ ,  $P > 0.10$ ). Since barracoutas could be considered an outlier in the sample, this species was eliminated and the test was recalculated. The new results still indicate that there are no strong correlations between these variables (bone densities and NISP%:  $r_s = 0.54$ ,  $P > 0.10$ ; morphological index and NISP%:  $r_s = -0.41$ ,  $P > 0.10$ ). In fact, species such as barracoutas, which are highly represented in the archaeological record, present lower morphological indexes and bone densities than species which are poorly represented, like patagonian blennies (Figs. 3 and 4). In conclusion, the assessment of the morphological indexes and bone densities indicates that the absence from the archaeological record of species such as patagonian blennies cannot be related to a differential decay among the species.

It could also be suggested that the absence of these fish could be related to technological limita-

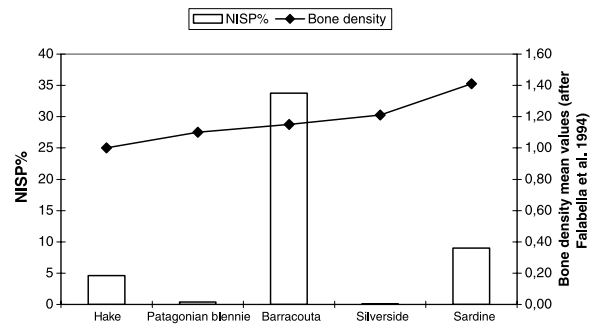


Fig. 3. Comparison between bone densities and NISP% of the fish species represented in the archaeological record.

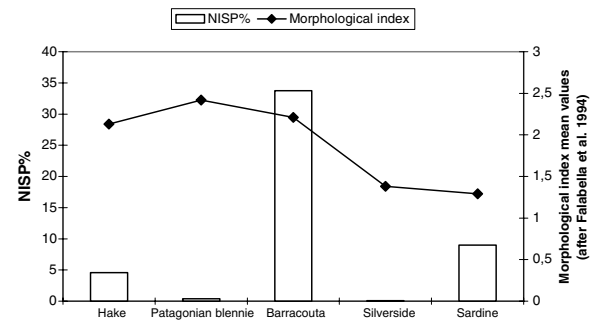


Fig. 4. Comparison between morphological indexes and NISP% of the fish species represented in the archaeological record.

tions. First, the species diversity (in terms of their body size and patch distribution) represented in the archaeofaunal record hint towards the existence of very varied fishing activities patterns and techniques. Nevertheless, archaeological evidence is ambiguous in relation to fishing techniques: multibarbed harpoons and lithic spheroids have potentially different functions which are difficult to discern (e.g., multibarbed harpoons may have been used to fish and to capture birds (Gusinde, 1986 [1937]: p. 461; Hyades and Deniker, 1891, p. 353; Lothrop, 1928, p. 150); while lithic spheroids may have been used as net weights or line weights). In spite of this, in the early assemblages (ca. 6200–4000 BP), where the evidence is restricted to the same artefacts, the patagonian blennie remains are present in variable frequencies (Zangrando, 2003, p. 112), which suggests that this resource may have been exploited with these techniques.

Second, there is abundant ethnographic information concerning Yamana fishing techniques (Orquera and Piana, 1999b). These included the use of

- (a) multibarbed harpoons: used mainly in offshore patches (from a canoe) to fish hakes and bar-

- racoutas (Bridges, 1867–1889, 1933, p. 80; Gusinde, 1986, p. 534 (II); Martial, 1888, p. 195; Lothrop, 1928, p. 34 and 150; Snow, 1857, p. 12, and others); used in onshore patches to capture rock eels (Bridges, 1947, pp. 99–100);
- (b) fishing lines: used in onshore patches by women (Bridges, 1867–1889; Darwin, 1845, p. 236; Fitz-Roy, 1839, p. 428; among others); there are no explicit references to which species were captured through this technique;
- (c) pole fences: built in narrow coves, using rocks and wood poles; fish got trapped inside and were caught by hand, hit with rods or harpooned; there is only one quotation that states that silversides and patagonian blennies could be captured with this technique (Bridges, 1947, p. 99);
- (d) fishing baskets: used in offshore patches to capture sardines (Bridges, 1867–1889; Hyades, 1885, p. 530; Martial, 1888, p. 195, and others).

Taking into account that at least one technique (pole fences) was ethnographically documented as a viable means to capture patagonian blennies, and that two other techniques (multibarbed harpoons and fishing lines) were potentially available to capture coastal fish, it seems that one or more of these techniques were available to exploit this species. Moreover, it was pointed that “a ton or more fish might be taken at once” using pole fences (Bridges, 1947, p. 99), which hints towards the high potential benefits entailed by this technique even if its display was costly. Given the high availability of the patagonian blennie in the region, even if this resource would require such a specific catching technique, it would be expectable to find traces of its use in the archaeological record. Yet up to the moment no pole fences have been archaeologically recorded in the Beagle Channel region, although they have been found in adjacent regions (Legoupil, 2000). In addition to this, the archaeological evidence indicates that in earlier times the patagonian blennies were indeed captured, which suggests that at least the ancient Beagle Channel populations did handle some effective technique for this task. Thus, the integration between archaeological and ethnographic evidence indicates that the inhabitants of this region had knowledge about appropriate fishing techniques to capture patagonian blennies, but were not applying them in practice. Therefore, there seems to be no basis to argue that the lack of patagonian blennies in the archaeological record was a consequence of technical limitations.

In sum, we suggest that ecological factors (patch choice, species size and weight, biomass, seasonality, gregarious habits, etc.), taphonomic and technical factors cannot account for the absence of group A species, particularly the patagonian blennies. Therefore, other lines of evidence may provide relevant information to shed light on this problem.

### Fish representations in body paintings

The use of body painting by the Yamana has been documented by 32 first-hand observers (voyagers, missionaries and ethnographers) in 54 written sources. The earliest of these dates from the XVII century, while the latest ones were written in the first decades of the XX century. The contents of these documents were systematically analysed and compared to establish whether they corroborate, complete or contradict each other, as well as to search for their potential biases related to the background and interests of the observers, their length of stay and of contact with the aborigines, the language they spoke, whether they interviewed informants, etc. (Fiore, 2002, 2004). This helped in assessing the documents relevance, accuracy and reliability as sources of information about the Yamana body painting practices.

These texts, as well as 98 photographs and drawings of painted individuals and painting tools, provide information about the appearance of the designs, the age and gender of the wearers, the portions of the body that were painted, etc. The designs were simple but varied, and mostly consisted of combinations of dots, lines and grounds of plain colour. The colours generally used were red, white and black. The first two were usually obtained from clay, lime, ochre, “ferruginous” concretions and other unspecified sediments; in some cases blood was also used (Bridges, 1867–1889; Darwin, 1845, p. 230; Fitz-Roy, 1839, p. 177; Gusinde, 1986, pp. 1336–1337; Koppers, 1997, p. 102 [1924]; Martial, 1888, p. 188; Weddell, 1825, p. 175; etc.). Black was obtained from wood charcoal (Bridges, 1885, p. 332; Gusinde, 1986, p. 1346). These colouring substances could be used directly, but they were usually mixed and diluted with grease, oil, saliva or water. Some pigments or mixtures were also ground, and/or heated with fire. The paint was usually applied using the fingers and hands, though in some occasions a rod was used as a painting tool (Bridges, 1897 MS; Fitz-Roy, 1839, p. 177; Gusinde, 1986, p. 413, 1336, 1443, etc.).

Body painting was worn by the Yamana in a great number of situations, ranging from everyday occasions to special ceremonies. Among the latter, the *kina* was a ceremony through which the male youngsters were initiated to adulthood. The existence of this ceremony was firstly reported by Bridges (1897), a British Anglican missionary who spent several decades in Yamana territory, had very frequent contact with them and knew their language.<sup>8</sup> The *kina* was later documented by ethnographers Gusinde (1986, p. 1307)<sup>9</sup> and Koppers (1997), who fostered its celebration to observe it in 1922. It was celebrated in Puerto Mejillones, Navarino Island (Gusinde, 1986, p. 1302). The observations lasted for four days (Koppers, 1997, pp. 101–118), although Gusinde was told that in ancient times the ceremony lasted at least for some weeks, and could even last for four months (Gusinde, 1986, p. 1293). In 1922 the *kina* had not been celebrated for about 30 years,<sup>10</sup> hence part of this tradition seemed to have been lost by then. This was due not only to the long time spent without celebrating it, but also to the deep acculturation suffered by the Yamana through the European presence in their territory. Regarding the visual records, 12 photographs (published by Gusinde, 1986 and Koppers, 1997) document *kina* scenes and spirits representations, while other six photographs (published by Gusinde, 1986; Koppers, 1997; Lothrop, 1928; Olivarez and Quiroz, 1987–1988) document some of the painted masks.

The *kina* was based in a myth of origin which stated that in ancient times there existed a female supremacy, and that women suppressed the men by

disguising themselves as spirits, wearing body paintings and masks (Fig. 5). According to this myth, the women's hoax was later discovered and since then the men carried out a similar secret male ceremony to control them. To do so, the men gathered in a special ceremonial hut and painted their bodies and wore masks decorated with matching designs to represent a long series of spirits. Through these representations, justified by the myth of origin, they intended to control the women by scaring them. For this reason, the painting process happened secretly, inside of the big hut, out of the sight of the women. The Yamana women acted mostly as the audience of this ceremony, and showed fear during the spirits apparitions. Yet they seem to have known that these were not authentic spirits. Moreover, at least in modern times, a few women were invited to participate in the *kina*, and were thus initiated to the "secret" about the masked men's imposture (Gusinde, 1986; Koppers, 1997).

The texts by Bridges, Koppers, and Gusinde provide information about the existence of 47 spirits. While Koppers's and Bridges's descriptions are very brief, and refer only to a few spirits, Gusinde's are much more thorough. Yet Gusinde (1986, p. 1351) admitted that there were other spirits that were not represented in the 1922 *kina* celebration (the little information available about these is quoted from Bridges, 1933). Therefore, the sample we are dealing with is not complete and is limited by the restrictions mentioned above; hence the data analysis is unavoidably partial. Yet in spite of these biases, some interesting observations can be drawn from the available information.

Each spirit represented a different referent (mostly animals, although some entirely mythical beings were also represented). The representation was achieved by painting a specific design on the man's body and mask, which helped in the visual identification of each spirit. Yet when the ceremony was observed by Gusinde and Koppers, the apparitions were also announced in a loud voice (Gusinde, 1986, p. 1337). The spirits represented the following referents: seven fish (six correspond to existing species, one is mythical), 10 other sea animals (including whales, dolphins, penguins, and sea lions the two latter are partially terrestrial animals), 15 birds (including falcon, eagle, goose, duck, albatross, etc.), one terrestrial animal (a fly); 12 spirits have no known referent and one has a mythical referent (not an animal). Of these, the analysis will focus on the spirits designs representing

<sup>8</sup> Bridges (1933) wrote the first and most complete dictionary of Yamana language (Yamana-English).

<sup>9</sup> Gusinde was an Austrian ethnographer who made four field trips to Tierra del Fuego, between 1918 and 1923, and wrote the longest ethnographic accounts about the Fuegian societies (Gusinde, 1982, 1986). His theoretical framework was mainly based on cultural-relativist and culture-historic concepts, while he was a strong antievolutionist. His vast work includes some oversimplifying statements which did not acknowledge all the acculturation changes undergone by the Fuegians, while incorporating some of the information he had read about their past habits his own observations, as well as assuming that what he had observed in the present could be stretched towards the past as an unchanged habit. In spite of these biases, Gusinde provided some of the most thorough records of several aspects of the Fuegian cultures, including their body paintings. Koppers accompanied M. Gusinde in his third field trip. He wrote a much shorter account of his observations, though these are very straightforward, and are quite reliable particularly due to the lack of generalisations which are sometimes found in Gusinde's work.

<sup>10</sup> The previous *kina* celebration had taken place around 1892.

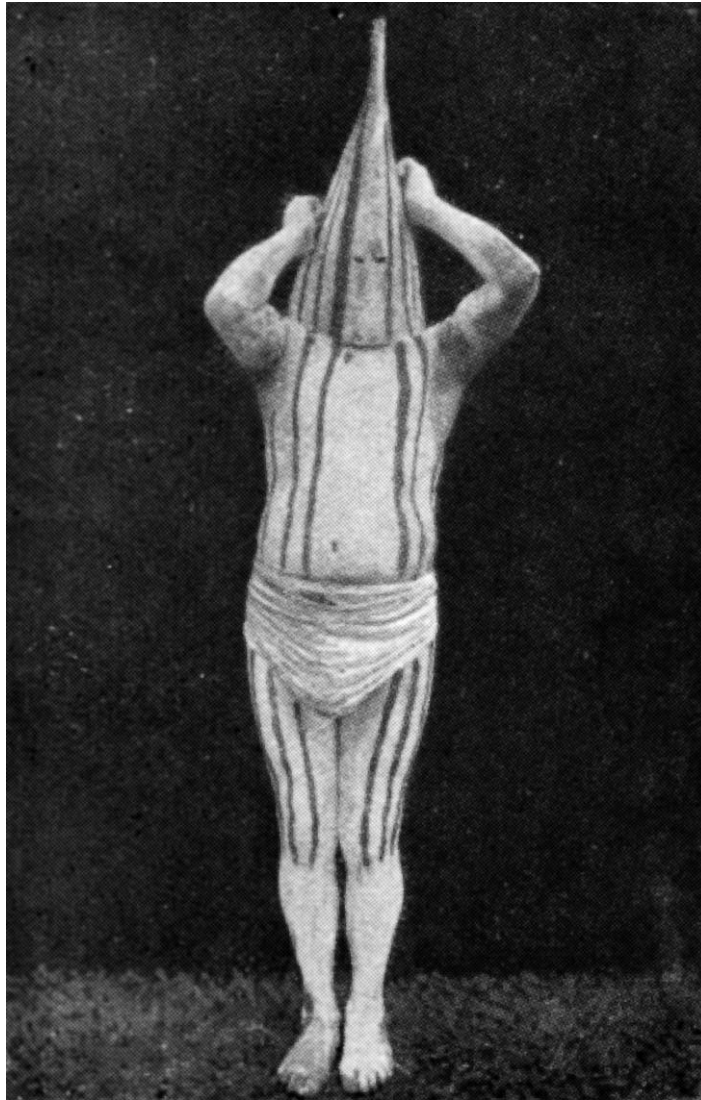


Fig. 5. Yamana man wearing body painting and mask, representing a spirit (from Koppers, 1924: Fig. XVa).

fish. Out of the seven spirits representing fish, five have been identified by their common name and four of these with their scientific name (Gusinde, 1986); one (Kalampasa-yaka) has been identified as a fish named with a Yamana term, but no other details are provided; and the last one (Wongoaleaka) corresponds to the representation of a mythical being shaped like a fish (Table 5). None of the painted designs seems to bear any direct resemblance to the actual appearance of the fish which were represented (Fiore, 2002, pp. 331–337). Although the ethnographic identification of some of the fish species is controversial (see Discussion), the only *kina* fish species that has been straightforwardly identi-

fied both by its common name and scientific name is the patagonian blennie (*E. maclovinus*).

Body painting was thus essential to this ceremony in so far as it was used to disguise the men's identities and construct the spirits representations through which they expected to control the women. Such practice was of crucial importance for the reproduction of the Yamana social structure, because it generated and justified the existence of age and gender divisions. It had deep ideological and social implications, since it contributed to the construction of social roles and relationships (adults–youngsters, initiated–initiated-non-initiated, male–female, etc.) which went beyond the celebration of the ceremony and lasted

through everyday life. Besides these effects, the representation of certain referents may have had other social, ideological and economic implications within the Yamana society.

## Discussion

The ethnographic data regarding the *kina* fish species offer inconclusive identifications of four species (diodon, herring/sardine? small salmon and sea trout/silverside?).<sup>11</sup> A fifth straightforward and non-controversial identification is that of the Haimus-yaka spirit, which represented a patagonian

<sup>11</sup> Gusinde asserted that Suna-yaka represented a *Diodon* (Gusinde, 1986, p. 1349), but this species was/is not present in the Beagle Channel. On the other hand, according to Hyades and Deniker (1891, p. 2), the native name “suna” referred to a magellanic rock fish. Due to this discrepancy in the information, we prefer not to make any inferences related to this spirit.

Also according to Gusinde, Ilësci-yaka spirit represented a herring (*Clupea pectinatal*; Gusinde, 1986, p. 1349). This fish is not found in the Beagle Channel, though sardines (*Spratus fueguensis*), which are of the same family (*Clupidae*), are found in the region. If the referent was in fact the herring, this might indicate that the scope of fish symbolised by the spirits designs was broader than those found in the Beagle Channel waters. If it represented a sardine, which is more feasible, it should be noted that this species is little represented in the archaeological record of the XVII–XX centuries, while in the early archaeofaunal remains (6000–4000 years BP) this was an abundant species. Considering that at present the sardines enter the Beagle Channel between January and April, these differences could be explained by seasonal variations in the sites occupations. This is coherent with the low representation of hakes, which are available in the region in the same months than the sardines. Since the seasonality factor cannot be ruled out, the inference about a potential selectivity of sardines influenced by socio-ideological factors cannot be entirely maintained.

Gusinde stated that Lepalus-yaka spirit represented a small salmon, but no scientific name was provided by the author (ibid). According to this author, Imakai-yaka represented a sea trout (ibid), but the scientific name he provided (*Atherinichthys*) does not correspond to this fish, but to the silverside. Since the trouts and the silversides are morphologically different, either the scientific name or the identification of the spirit’s referent-fish provided by Gusinde are incorrect. The salmon and the trout are exotic species in the region, which were only recently introduced by Western locals to exploit them economically. Therefore, it is likely that this datum is mistaken due to a bias from the (European) observer. In spite of the fact that the silverside has gregarious behaviour, which can generate high benefits through its capture, it is almost not present in the archaeological record. Only one historical source presents information about its capture, which seems not to have been very frequent (Bridges, 1947, p. 95). Nevertheless, we cannot make a straightforward inference linking the bias in its capture exclusively or mainly to social or ideological factors, since its low frequency of encounter in the environment would not favour its exploitation.

blennie (*Eleginus maclovinus*; Gusinde, 1986, p. 1349). This is a high-ranking species due to availability and size, and yet has hardly been found in the archaeological record. As noted above, there is only one ethnographic reference to the capture of patagonian blennies by the Yamana, in which Bridges (1947, p. 95) indicates that they were obtained making pole fences, in which they were trapped and afterwards fished with harpoons or simply struck by hand. Considering the great number of written sources which include relevant data about the Yamana subsistence (see Orquera and Piana, 1999b), it is remarkable that this technique and this species are mentioned in so few occasions. This suggests that they were actually not frequent in the area.

In opposition to this, in other regions of the Magellan-Fuegian area the most frequently represented species in the ichthyofauna record is the patagonian blennie (site Punta María II [1230 ± 50 BP and 1750–1950 AD] in the Atlantic coast [Campan, 1992]; site Punta Baja [280 ± 70 BP] in Brunswick Peninsula, Otway Sound [Legoupil, 1989]; site Punta Catalina 3, north of Isla Grande de Tierra del Fuego [2370–2320 calibrated radiocarbon years BP [Massone and Torres, 2004]). Interestingly, pole fences have been identified in these regions (Legoupil, 2000, p. 106), while there is no documentation of any representation of spirits concerning this species.

In spite of the fact that the patagonian blennie was available in waters near the Beagle Channel shores, it was not captured. Nevertheless, fish with similar ethology (other nototheniids) and of similar size (channel bullfish, brotola, etc.) to the patagonian blennie were captured. Also, the ichthyofaunal analysis has revealed that fish from the same coastal patch were frequently exploited, which rules out the possibility of patch choice as a limiting factor in the consumption of the patagonian blennie. In addition, the fact that, within the coastal patch, the samples under analysis include a similar range of species in spite of being found in different microenvironments, suggests that these ecological conditions were not limiting the consumption of a certain species.

Ethnographic data indicate that the nototheniids were captured with fish lines and the barracoutas with harpoons, which entails that the Yamana handled fishing technologies that could have also been efficient to capture patagonian blennies. Moreover, considering the diversity of species that

Table 5  
Kina spirits representing fish referents

Spirit name	Referent in English and Spanish	Scientific name of referent	Documented by	Body painting design
Suna-yaka	Diodon ( <i>diodón</i> )	<i>Diodontidae</i>	G 1986: 1349	Red transversal line across the mouth. Multiple semi-circles representing scales, over the whole body
Ilësci-yaka	Herring ( <i>arenque</i> )	<i>Clupea pectinatal</i>	G 1986: 1349	White ground over the whole body, black band from the armpits to the ankles
Imakai-yaka	Sea trout ( <i>trucha de mar</i> )	<i>Atherinichthys</i> Common name for scientific name: atherine ( <i>pejerrey</i> )	G 1986: 1349	Many white short vertical lines over the whole body and mask
Lepalus-yaka	Small salmon ( <i>pequeño salmón</i> )	No name provided	G 1986: 1349	Many red short vertical lines. White mask
Haimus-yaka	Patagonian blennie ( <i>róbalo</i> )	<i>Eleginops maclovinus</i>	G 1986: 1349 B 1933	White vertical lines from neck through chest up to stomach. Some black vertical lines from the armpits down
Kalampasa-yaka	(Kalampasa fish)	No name provided	G 1986: 1349 B 1933: 178	White ground over the whole body, over which many small red semi-circles are painted, representing scales. White mask with red thick line across the mouth
Wongoaleaka	(Shape of fish; son of a whale)	Mythical animal	G 1986: 1345	White ground over the whole body, over which many small red semi-circles are painted, representing scales. No mask, foliage head band

Data quoted from Gusinde (1986) and Bridges (1933). Key: G, Gusinde; B, Bridges.

were captured and the lack of specialisation, the exclusion of the patagonian blennie is even more conspicuous. As a consequence, there are no reasons to suppose that there existed limitations related neither to the availability nor to the technology to capture this species.

In summary, our analyses suggest that there seem not to have existed any ecological, economic, taphonomic or technological limitations to explain the exclusion of the patagonian blennie from the rest of the fish resources. It can therefore be suggested that the reason of such exclusion may have been based on other factors. Social factors may have been involved: the agents that operated in the fishing activities were women, while the *kina* ceremony was dominated by men, who were to an extent empowered over the women. Ideological factors may also have influenced the situation: the mythical contents of the *kina* ceremony contributed to justify such domination. This ethnographically observed pattern is coincident with the data provided by the contemporaneous archaeological

record. In fact, the patagonian blennie is a high potential yield species, yet the proportions it reflects in the actual diet are practically inexistent in contemporaneous assemblages and considerably low in earlier assemblages.

Contrasting with this situation, the species that seem not to have been represented in the body painting designs include the magellanic rock fish, rock fish and barracoutas, which are highly represented in the archaeological record. The tailed hackes, channel bullfish and rock eels are also not represented in the paintings, and are scarcely represented in the archaeofanual record. Moreover, both species of high potential yield and low potential yield which constituted part of the Yamana diet are not represented in the *kina* body paintings. Therefore, the fact that these species are not included in the paintings repertoire does not seem to have been affected neither by their frequency of consumption (evidenced by their NISP and MNI), nor by their high or low potential yield.

In relation to the expectations developed in the introduction of this paper (see Table 6 below), the first two (1 and 2) are entirely rejected, since the analysis demonstrates that the same fish species are not represented in the subsistence and art spheres. Expectations number 3 and 4 have been partially verified: the presence of *different* species in the archaeological and artistic records has been recorded, but not with the dichotomic distribution in which they were initially set out. While the archaeological record includes fish species of high and low potential yield, the art record includes at least one uncontroversial species of high potential yield (see Tables 6 and 7). What is remarkable is that this latter species is poorly represented in the archaeofaunal record.

The ethnographic information indicates that fishing near the shores, were the nototheniids are available, was an exclusively female activity (Table 8). Taking into account (a) the nature of the *kina* ceremony, in which men intended to control the women through the embodiment of spirits, including some which represented fish, and (b) the fact that women were the only agents in charge of fishing near the shores, a sexual division of labour can be identified both in fishing and ceremonial activities. It is striking that the patagonian blennie, a species repre-

sented in a mainly male-dominated ceremony, was not captured during a clearly female-dominated subsistence activity. As a consequence, this evidence suggests that the effects of the *kina* might have continued once the ceremony had ended: the dynamics of male domination and power over the female gender produced through the ritual, may have had later effects over the women's actions in other spheres of activity, such as fish procurement, instigating (intentionally or unintentionally) the avoidance of certain species.

### Concluding remarks

The exploitation of ichthyofauna resources of the Beagle Channel archaeological record has been assessed following the optimality model criteria. Part of the predictions generated through such model were not verified, and the model does not offer an alternative hypothesis to interpret such results. This entails that the optimality criteria are not enough to explain every aspect of the human behaviour in fishing activities. Mechanisms other than optimisation may have influenced on such behaviour, hence they need to be taken into consideration. This means that “prey scarcity, variable meat yields, predictability of movements, and body-weight—the definitive criteria of cost-benefit analyses—all retain the potential to influence the decision to avoid the exploitation of a given animal. Nevertheless ... such potential causes need to be demonstrated on a case by case basis, not assumed to be generally true.” (Politis and Saunders, 2002, p. 126). Consequently, we agree with the idea that it is necessary to consider the optimality framework as a relevant model to assess the archaeological record, and not as an explanatory structure which generates

Table 6  
Synthesis of expectations and results

Expectation	Archaeofaunal record	Body art record
1	High potential yield	High potential yield
2	Low potential yield	Low potential yield
3	High potential yield	Low potential yield
4	Low potential yield	High potential yield
Case study result	High + low potential yield	High potential yield

Table 7  
Artistic and archaeofaunal representations and potential yield of fish species in the Beagle Channel region

Species	Ranking group	Expected archaeofaunal representation	actual archaeofaunal representation NISP%	Body art representation
Tailed hacke ( <i>Macruronus magellanicus</i> )	A	High	4.60	No
Hacke ( <i>Merluccius</i> sp.)	A	High	0.70	No
Hacke ( <i>Merlucciidae</i> sp.)	A	High	1.20	No
Magellanic rock fish ( <i>Paranotothenia magellanica</i> )	B	Low	30.90	No
Rock fish ( <i>Patagonotothen</i> sp.)	B	Low	16.00	No
Patagonian blennie ( <i>Eleginops maclovinus</i> )	A	High	0.04	Yes
Barracouta ( <i>Thyrstites atun</i> )	A	High	33.74	No
Channel bullfish ( <i>Cottoperca gobio</i> )	B	Low	0.24	No
Rock eel ( <i>Austrolycus</i> sp.)	B	Low	0.11	No
Silverside ( <i>Austroatherina nigricans</i> )	A	High	0.01	Yes

Table 8

Data about coastal fishing activities in historical and ethnographic texts (after Orquera and Piana, 1999b, p. 156)

Reference	Algae “forests”	Women	Canoes	Fishing lines
Webster (1834, vol. I, pp. 182–183)		Yes	Yes	Yes
Fitz-Roy (1839a, p. 428)	Yes			Yes
Fitz-Roy (1839b, p. 178)	Yes			
Fitz-Roy (1839b, p. 185)		Yes	Yes	
Fitz-Roy (1839b, p. 224)		Yes	Yes	
Darwin (1839, p. 236)		Yes	Yes	Yes
Colvocoresses (1852)	Yes			
Williams (in Hamilton 1854, p. 159)	Yes	Yes	Yes	
Ellis (1857, p. 183)	Yes	Yes	Yes	
Gardiner (in Goodall and C. 1995, p. 169)		Yes	Yes	
G.P. Despard (VP 1859, p. 127)		Yes	Yes	Yes
Stirling (VSA 1864, p. 194)	Yes		Yes	
Stirling (SAMM 1868, p. 150)	Yes	Yes	Yes	
T. Bridges (1867–1889)	Yes	Yes	Yes	Yes
T. Bridges (1867–1889)		Yes	Yes	
T. Bridges (1867–1889)		Yes	Yes	
T. Bridges (1867–1889)		Yes		Yes
T. Bridges (1867–1889)	Yes			Yes
T. Bridges (1933, p. 456)		Yes	Yes	
Hyades (1884d, p. 567)	Yes	Yes	Yes	
Hyades (1885b, p. 528)	Yes	Yes	Yes	Yes
Hyades and Deniker (1891, p. 350)		Yes	Yes	
Hyades and Deniker (1891, pp. 370–371)	Yes	Yes	Yes	Yes
Martial (1881, p. 195)	Yes		Yes	Yes
Spears (1895, pp. 60–61)		Yes	Yes	Yes
Payró (1898, p. 223)		Yes		Yes
Lothrop (1928a, p. 159)	Yes	Yes	Yes	Yes
Gusinde (1937, p. 530)	Yes	Yes	Yes	Yes
Gusinde (1937, p. 528, 534, 652, 870)		Yes		Yes
L. Bridges (1947, p. 95)	Yes	Yes	Yes	Yes

Key: VP (Voice of Pitty for South America), VSA (Voice for South America); SAMM (South American Missionary Magazine).

laws about human behaviour (Shennan, 2002; Smith, 1983; Winterhalder and Smith, 1992).

If, in the case under study, optimisation does not explain the absence of a specific high potential yield resource: it is necessary to incorporate other lines of evidence (art, ceremonies) and to analyse other factors, such as social and ideological aspects of subsistence. It is in the integration of such lines of evidence and factors where a more thorough understanding of the dynamics of a specific activity-like the management of ichthyic resources in fishing and art can be achieved.

The avoidance of consumption of a resource of high potential yield, like the patagonian blennie, coincides with the definition of a “taboo,” as proposed by Ross (1978) and Politis and Saunders (2002) among others, which refers to the “restriction,” “prohibition” or “avoidance” of a certain resource. In this case, the idea that this might constitute a “taboo” is reinforced by the fact that the

avoidance of patagonian blennie consumption seems to have stemmed from probably implicit prescriptions generated by the male actions in the ceremonial sphere of the Yamana society. Moreover, even if there existed a technological limitation which had some influence in the capture of the patagonian blennie, it is clear that there existed a discrepancy in its treatment between the diet and ceremonial art spheres. In turn this suggests that its avoidance was not exclusively economic but also ideologically constructed.

As noted above, there existed gender differences both in the subsistence-fishing and the ceremonial-*kina* spheres. This agrees with the differences in the treatment of the patagonian blennie, since it was not consumed but was represented in the *kina* body paintings. Such differences do not imply the presence of contradictions between both spheres, but rather they seem to reflect a dynamic that integrated them in the management of the same resource. Dietary



avoidance and lack of optimisation by female social agents in subsistence activities seem to have stemmed at least partially from visual representation and its use as an empowering mechanism by male social agents in the *kina* ceremony.

### Acknowledgments

We are very grateful to Luis Orquera and Stephen Shennan for their comments on our theses and to them and Augusto Tessone and Angélica Tívoli for their input on drafts of this paper. We are also grateful to two anonymous reviewers for their helpful comments and suggestions. Dánae Fiore's Ph.D. was generously funded by scholarships from University College London, The Council of Vice-Chancellors and Principals of the UK, and Fundación Antorchas (Argentina). Atilio Francisco Zangrando is completing his Ph.D. at Universidad de Buenos Aires with a CONICET scholarship. The authors are exclusively responsible for the contents of this paper.

### References

- Álvarez, M., Fiore, D., 1993. La arqueología como ciencia social: apuntes para un enfoque teórico—epistemológico. *Boletín de Antropología Americana* 27, 21–38.
- Angelescu, V., Prenski, L., 1987. Ecología trófica de la merluza común del Mar Argentino (*Merlucciidae*, *Merluccius hubbsi*). Parte 2. Dinámica de la alimentación analizada sobre la base de las condiciones ambientales, la estructura y las evaluaciones de los efectivos en su área de distribución. *Contribución INIDEP* 56, 1–205.
- Bellisio, N., López, R., Torno, A., 1979. Peces marinos patagónicos. Ministerio de Economía, Subsecretaría de Pesca, Buenos Aires.
- Bettinger, R., 1991. *Hunter–Gatherers: Archaeological and Evolutionary Theory*. Plenum Press, New York.
- Bridges, T., 1867–1889. Letters and fragments of his personal diary, *South American Missionary Magazine* I to XXIV.
- Bridges, T., 1885. Extract of a letter addressed to Prof. Flower. *The Journal of the Anthropological Institute of Great Britain and Ireland* XIV, 288–289.
- Bridges, T., 1897. An account of Tierra del Fuego (Fireland), its natives and their languages. Document held in the Royal Geographical Society. Copy held by R.N.P de Goodall, Harberton, Tierra del Fuego. MS.
- Bridges, T. 1933. Yamana–English dictionary. Manuscript finished around 1879. F. Hestremann & M. Gusinde. Mödling.
- Bridges, L., 1947. *Uttermost Part of the Earth*. Hodder, Stronghton, London.
- Broughton, J., 1997. Widening diet breadth, declining foraging efficiency, and prehistoric harvest pressure: ichthyofaunal evidence from the Emeryville Shellmound, California. *Antiquity* 71, 845–862.
- Burling, R., 1976. Teorías de la maximización y el estudio de la Antropología Económica. In: Godelier, M. (Ed.), *Antropología y Economía*. Anagrama, Barcelona, pp. 101–124.
- Butler, V., 2000. Resource depression on the Northwest Coast of North America. *Antiquity* 74, 649–661.
- Butler, V., 2001. Changing fish use on Mangaia, Southern Cook Islands: resource depression and the prey choice model. *International Journal of Osteoarchaeology* 11, 88–100.
- Butler, V., Chatters, J., 1994. The role of bone density in structuring prehistoric salmon bone assemblages. *Journal of Archaeological Science* 21, 413–424.
- Campan, P., 1992. Los restos de peces de Punta María II. *Palimpsesto* 2, 99–106.
- Darwin, C., 1845. *Journal of Researches in Natural History and Geology of the Countries Visited during the Voyage of HMS Beagle Round the World under the Command of Capt. Fitz-Roy (R.N.)*. Henry Colburn, London.
- Estevez, J., Piana, E., Schiavini, A., Juan-Muns, N., 2001. Archaeological analysis of shell middens in the Beagle Channel, Tierra del Fuego Island. *International Journal of Osteoarchaeology* 11, 24–33.
- Falabella, F., M. Loreto, Vargas, R. Meléndez, 1994. Differential preservation and recovery of fish remains in Central Chile. In: Van Neer, W. (Ed.), *Annales du Musée Royal de l'Afrique Centrale, Sciences Zoologiques*, vol. 274. Tervuren, pp. 25–35.
- Fiore, D., 1996. El arte rupestre como producto complejo de procesos económicos e ideológicos: una propuesta de análisis, *Espacio, Tiempo y Forma. Serie I. Prehistoria y Arqueología* 9, 239–259.
- Fiore, D., 2002. *Body painting in Tierra del Fuego. The power of Images in the Uttermost Part of the World*. Unpublished Ph.D. Thesis, Institute of Archaeology, UCL University of London.
- Fiore, D., 2004. *Pieles rojas en el confín del mundo. La valoración de las pinturas corporales en los registros histórico-etnográficos sobre aborígenes de Tierra del Fuego*. *Magallania* 4, 29–52.
- Fitz-Roy, R., 1839. *Proceedings of the second expedition (1831–1836) under the command of captain Robert Fitz-Roy (R.N.)*. In: Colburn, H. (Ed.), *Narrative of the Surveying Voyages of His Majesty's Ships Adventure and Beagle between the Years 1826–1836. vol II*, London.
- García Canclini, N., 1986. *La Producción Simbólica. Teoría y Método en Sociología del Arte. Siglo XXI*, México.
- Godelier, M., 1976. Es posible una antropología económica? In: Godelier, M. (Ed.), *Antropología y Economía*. Anagrama, Barcelona, pp. 279–334.
- Gosztonyi, A., 1981. Resultados de las investigaciones ictiológicas de la campaña Y del B/I “Shinkai Maru” en el Mar Argentino (10/04-09/05/1978). *Contribución INIDEP* 383, 254–266.
- Gusinde, M., 1937. *Die Feuerland-Indianer. Band II: Die Yamana*. Verlag St. Gabriel, Mödling.
- Gusinde, M., 1986. *Los Indios de Tierra del Fuego*. Los Yámana. CAEA, Buenos Aires.
- Hyades, P., 1885. Sur les Fuégiens. *Bulletins de la Société d'Anthropologie de Paris (3rd. Series)*. VII, pp. 616–620.
- Gusinde, M., 1982. *Los Indios de Tierra del Fuego. Los Selk'nam*. CAEA, Buenos Aires.
- Hyades, P., J. Deniker, 1891. *Mission Scientifique du Cap Horn. (1882–1883)*, vol. 7. *Anthropology and Ethnography*, Paris.
- Jochim, M., 1983. Palaeolithic art in ecological perspective. In: Bailey, G. (Ed.), *Hunter–Gatherer Economy in Prehistory*. Cambridge University Press, Cambridge, pp. 212–219.
- Juan-Muns I Plans, N., 1992. La pesca com alternativa per als Yámana, nòmades canoers del Canal Beagle (Tierra del

- Fuego, Argentina). Unpublished Ph.D. Thesis, Departament d'Història de les Societats Pre-capitalistes I d'Antropologia Social, Facultat de Lletres, Universitat Autònoma de Barcelona.
- Juan-Muns I Plans, N., 1996. Aprovechamiento de recursos icticos en Túnel VII (Tierra del Fuego). In: Gómez Otero, J. (Ed.), *Arqueología. Sólo Patagonia*. CENPAT Puerto, Madryn, pp. 89–97.
- Kelly, R., 1995. *The Foraging Spectrum*. Smithsonian Institution Press, Washington and London.
- Koppers, W., 1924. *Unter Feuerland-Indianer eine forschungsreise zu den Sudlichsten bewohner der erde mit M. Gusinde*. Verlag von Strecker und Schröder, Stuttgart.
- Koppers, W., 1997. *Entre los Fueguinos*. Universidad de Magallanes and Programa Chile Austral de la Unión Europea, Punta Arenas.
- Layton, R., 1989. The political use of Australian Aboriginal body painting and its archaeological implications. In: Hodder, I. (Ed.), *The Meanings of Things. Material Culture and Symbolic Expression*. Harper Collins Academic, London, pp. 1–11.
- Legoupil, D., 1989. *Ethno-archéologie dans les archipels de Patagonie: les Nomades Marines de Punta Baja*. Mémoire 84. Editions Recherche sur les Civilisations, Paris.
- Legoupil, D., 2000. El sistema socioeconómico de los nómades del mar de Skyring (archipiélago de Patagonia). *Anales del Instituto de la Patagonia* 28, 81–120.
- Levi-Strauss, C., 1962. *La pensée sauvage*. Librairie Plon, Paris.
- Lloris, D., Rucabado, J., 1991. *Ictiofauna del canal Beagle (Tierra del Fuego): aspectos ecológicos y análisis biogeográfico*. Instituto Español de Oceanografía (Publicación especial no 8), Madrid.
- López, H., García, M., San Román, N., 1996. *Lista Comentada de la Ictiofauna del Canal Beagle, Tierra del Fuego, Argentina*. CADIC, Ushuaia.
- Lothrop, S., 1928. *The Indians of Tierra del Fuego*. Museum of American Indian (Contributions 10), New York.
- Lumbreras, L., 1984. *La arqueología como ciencia social*. Colección Investigaciones Casa de las Américas, La Habana.
- Madsen, D., Schmitt, D., 1998. Mass collecting and the diet breath model: a Great Basin example. *Journal of Archaeological Science* 25, 445–455.
- Malainey, M., Przybylski, R., Sherriff, B., 2001. One person's food: how and why fish avoidance may affect the settlement and subsistence patterns of hunter-gatherers. *American Antiquity* 66 (1), 141–161.
- Massone, M., Torres, J., 2004. Pesas, peces y restos de cetáceos en el campamento de Punta Catalina 3 (2300 años AP). *Magallania* 32, 143–162.
- Martial, L., 1888. *Histoire du voyage. Mission Scientifique du Cap Horn (1882–1883)*. Paris.
- Marx, K., 1971 [1859]. *A Contribution to the Critique of Political Economy*. Lawrence and Wishart, London.
- McGuire, R., 1992. *A Marxist Archaeology*. Academic Press, New York.
- Mithen, S., 1988. To hunt or to paint. *Animals and art in the Upper Palaeolithic*. *Man* 23, 671–695.
- Moreno, C., Jara, H., 1984. Ecological studies on fish fauna associated with *Macrocystis pyrifera* belts in the south of Fueguia Islands, Chile. *Marine Ecology Progress Series* 15, 99–107.
- Nagaoka, L., 2002. The effects of resource depression on foraging efficiency, diet breadth, and patch use in southern New Zealand. *Journal of Anthropological Archaeology* 21, 419–442.
- Nicholson, R., 1992. An assessment of the value of bone density measurements to archaeoichthyological studies. *International Journal of Osteoarchaeology* 2, 139–154.
- Nielsen, A., 1995. Architectural performance and the reproduction of social power. In: Skibo, J., Walker, W., Nielsen, A. (Eds.), *Expanding Archaeology*. University of Utah Press, Salt Lake City, pp. 47–66.
- Olivarez, J., Quiroz, D., 1987–1988. *Martín Gusinde. Cazador de sombras*. Ministerio de Educación Pública, Santiago de Chile.
- Orquera, L., Piana, E., 1999a. *Arqueología de la región del canal Beagle (Tierra del Fuego, República Argentina)*. Sociedad Argentina de Antropología, Buenos Aires.
- Orquera, L., Piana, E., 1999b. *La vida Material y Social de los Yamana*. EUDEBA, Buenos Aires.
- Orquera, L., Piana, E., 2000. *Composición de conchales de la costa del canal Beagle (Tierra del Fuego, República Argentina)—Primera Parte*. *Relaciones* 25, 249–274.
- Piana, E., J. Estévez, A. Vila, 2000. *Lanashuaia: un sitio de caneros del siglo pasado en la costa norte del canal Beagle. Desde el país de los gigantes*. *Perspectivas en arqueología*, 455–469. UNLP, Río Gallegos.
- Politis, G., Martínez, G., 1996. La cacería, el procesamiento de las presas y los tabúes alimenticios. In: Politis, G. (Ed.), *Nukak*. Instituto Amazónico de Investigaciones Científicas Sinchi, Santafé de Bogotá, pp. 231–280.
- Politis, G., Saunders, N., 2002. Archaeological correlates of ideological activity: food taboos and spirit-animals in an amazonian hunter-gatherer society. In: Miracle, P., Milber, N. (Eds.), *Consuming Passions and Patterns of Consumption*. McDonald Institute Monographs, Cambridge, pp. 113–130.
- Rick, T., Erlanson, J.M., 2000. Early holocene fishing strategies on the California coast: evidence from CA-SBA 2057. *Journal of Archaeological Science* 27, 621–633.
- Ross, E.B., 1978. Food taboos, diet, and hunting strategy: the adaptation to animal in Amazon cultural ecology. *Current Anthropology* 19 (1), 1–36.
- Shennan, S., 2002. *Genes, Memes and Human History: Darwinian Archaeology and Cultural Evolution*. Thames and Hudson, London.
- Smith, E., 1983. Anthropological applications of optimal foraging theory: a critical review. *Current Anthropology* 24 (5), 625–651.
- Smith, E.A., Winterhalder, B., 1992. Natural selection and decision making: some fundamental principles. In: Winterhalder, B. (Ed.), *Evolutionary Ecology and Human Behavior*. Aldine De Gruyter, New York, pp. 25–60.
- Snow, W. Parker, 1857. *A two years' cruise off Tierra del Fuego, the Falkland Islands, Patagonia and in the River Plate (a narrative of life in the southern seas)*. London.
- Taçon, P., 1988. Identifying fish species in the recent rock paintings of western Arnhem Land. *Rock Art Research* 5 (1), 3–15.
- Tambiah, S., 1969. Animals are good to think and good to prohibit. *Ethnology* 8, 423–457.
- Weddell, J., 1825. *A voyage towards the South Pole performed in the years 1822–1824 containing... and a visit to Tierra del Fuego with a particular account of the inhabitants*. London.
- Winterhalder, B., Smith, E. (Eds.), 1981. *Hunter-Gatherer Foraging Strategies*. Ethnographic and Archaeological Analyses. The University of Chicago Press, Chicago.

Winterhalder, B., Smith, E.A., 1992. Evolutionary ecology and the social sciences. In: Smith, E., Winterhalder, B. (Eds.), *Evolutionary Ecology and Human Behavior*. Aldine De Gruyter, New York, pp. 3–23.

Zangrando, A., 2003. *Ictioarqueología del Canal Beagle. Explotación de peces y su implicación en la subsistencia humana*. Colección Tesis de Licenciatura. Sociedad Argentina de Antropología, Buenos Aires.