Landscape archaeology in coastal areas: technology and subsistence among prehistoric populations

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Duas tecnologias pesqueiras foram identificadas junto aos grupos sambaquieiros do Complexo Lagunar de Saquarema, RJ: a tecnologia dos espinhos de peixe trabalhados e das pontas ósseas. Essas tecnologias estavam relacionadas à aquisição de recursos ictiológicos específicos, sendo os espinhos relacionados à pesca da espécie *Micropogonias furnieri* (Desmarest) e as pontas à pesca dos representantes da família Ariidae. A tecnologia mais antiga refere-se aos espinhos trabalhados, que se mantiveram predominantes entre 6.726 anos cal AP e 3.699 anos cal AP, enquanto a tecnologia de pontas ósseas foi predominante a partir de 3.699 anos cal AP. Consideramos que estas mudanças quantitativas no consumo de recursos aquáticos estejam relacionadas aos fatores de ordem ambiental que ocasionaram variações no ecossistema de mangue, durante o Holoceno tardio.

Palavras-chave: arqueologia da paisagem; meios de subsistencia; tecnologia

Two distinct fishing technologies were identified among the *sambaqui* population of the Saquarema Lagoonal Complex, in the Brazilian state of Rio de Janeiro: bone point technology and worked/modified fish rays and spines. These technologies were related to the acquisition of specific fish resources; worked spines were used in the capture of *Micropogonias furnieri* (Desmarest) and bone points used for fishing specimens of the Ariidae family. Worked spines represent the older technology, which was predominant between 6,726 cal. years BP and 3,699 cal. years BP, while the bone point technology was dominant after 3,699 years BP. We believe this quantitative change in the consumption of aquatic resources was related to environmental factors that caused variations in the mangrove ecosystem during the late Holocene.
Key words: landscape archaeology; subsistence resources; technology

1. INTRODUCTION

Material culture, through its understanding of societies as open systems, plays a fundamental role in understanding processes of maintenance and change. Exogenous and endogenous factors must be considered as engines of these processes [1].

Regarding the fisher-gatherers society of the Saquarema Lagoonal Complex, endogenous factors could not be mapped in a detailed manner as forces of sociocultural change. Although we believe that such factors occurred, the influences of an extremely successful tradition camouflaged obvious traces of change. Also, rare studies associate endogenous factors with processes of sociocultural change in egalitarian systems, in which status is usually determined by sex or age.

Exogenous factors, such as environmental change and inter-group contact, were considered relevant elements promoting change in the sociocultural system of fisher-gatherers from the Saquarema Lagoonal system. These were analyzed through multivariate analysis.

In regards to environmental changes, the model proposed in this paper tried to go beyond the perspectives derived from ecological functionalism and neo-evolutionism connected with processual archaeology, in which sociocultural changes are equated to adaptive responses. Our study relativizes the role of adaptation in the process of sociocultural change. By opposing Binfordian neo-evolutionism, it was possible to advance our understanding of socio-environmental interactions, in which different factors, not solely ecological, were considered in the study of change [2]. This perspective shares the opinion that not all aspects of a sociocultural system are affected by environmental factors. While subsistence and technological subsystems are directly influenced by ecological factors, the social and ideological structures are more resilient.

This study confirms that conjuncture changes were noticeable in subsistence resources and in the fishing technologies of fisher-gatherer groups of the Saquarema Lagoonal Complex, which were strongly influenced by variations in humidity indices throughout the late Holocene.

2. MATERIAL AND METHODS

The Saquarema Lagoonal Complex, our study area, is located in Saquarema city, within the Lagos region of Rio de Janeiro state, Brazil. The research goal was to understand sociocultural changes observed in prehistoric groups that inhabited the region between 7,000 and 1,500 cal. years BP.

In this project, we used the PAST Paleontological Statistics software package for education, version 2.02 for multivariate analyses [3]. Also, we calibrated radiocarbon dates available in the literature [4] with the Calib – Radiocarbon Calibration Program, version 6.2 [5], providing better resolution for the chronological data.

A systematic analysis of the available literature for the study area indicated the presence of twenty four archaeological sites distributed in the Saquarena Lagoonal Complex. The results indicated two distinct sets of information: first, some data had a generic character, being the result of unsystematic research done in the area during the 1940's and 1960's; the other data were obtained by systematic research developed during the 1980's.

Faced with these results, in which some fundamental attributes to the development of the research were unsatisfactory both quantitatively and qualitatively, we opted to undertake field research to revisit some sites described in the literature, with the goal of complementing the existing gaps and evaluating sites likely to be subjected to testing, thus improving our sample. Our investigation also used information available in the archaeological sites catalogue organized by the Institute of the Historical and Artistic National Heritage (Instituto de Patrimônio Histórico e Artístico Nacional – IPHAN). This revealed a gap in archaeological surveys: only three sites were registered after research done at the end of the 1960's. We revisited eighteen of the twenty-four sites described within the region, of which only fifteen were registered at IPHAN. During the 2003 field season, seven sites could not be located and four new sites were identified (Ilha dos Macacos, Itaúnas, Mombaça I, and Ponta dos Anjos).

Therefore, the multivariate analysis associated secondary data (from the literature) and primary data (analysis of archaeological materials recovered from the investigated sites). Considering all the limits and possibilities of sample selection, twelve were chosen from the total of twenty-seven archaeological sites identified in the literature and surveys: Saquarema, Pontinha, Beirada, Moa, Jaconé, Manitiba I, Itaúnas, Mombaça I, Saco, Madressilva, Bravo, and Ilha dos Macacos (figure 1). These twelve sites provided thirty four stratigraphical layers, the analytical units for this study (table 1).

Hierarchical cluster analyses of ten attributes and sixty-six variables allowed systematization of information for the 34 layers identified in our sample of twelve sites, through the analysis of ten attributes and sixty six variables. Multivariate analysis of the 34 layers resulted in identification of two sets (figure 2). Within these two sets, three variables were analyzed (fish and mollusk resources and bone artifacts), with the goal of demonstrating the relationship between environmental change and quantitative variations in aquatic resources and fishing technology. For the variables regarding fish and mollusk resources, we determined the attributes referring to their species and/or families identified in the samples.

Technological variation in bone artifact assemblage related to the presence of two types of artifact: modified fish spines and bone points. The worked fish spines are made from dorsal and anal fin spines of fish not yet identified. The use of grinding (an abrasive technique), in the posterior and anterior ends of the spine and rays, smoothed the bones' natural curvature and augmented their marrow channel, resulting in a beveled shape identified as "needles" in the archaeological literature, because the resulting shape is similar[6,7,8,9].

Most of the bone points were made from long bones of mammals and birds. Although this type of artifact can be characterized by the presence of either one or two sharp extremities, no distinction was made between these objects in the sample, both being considered based on the

definition of point proposed in the available literature [4]. Bone points were manufactured by cutting bone to extract the epiphyses, followed by grinding to achieve the desired final shape [8].

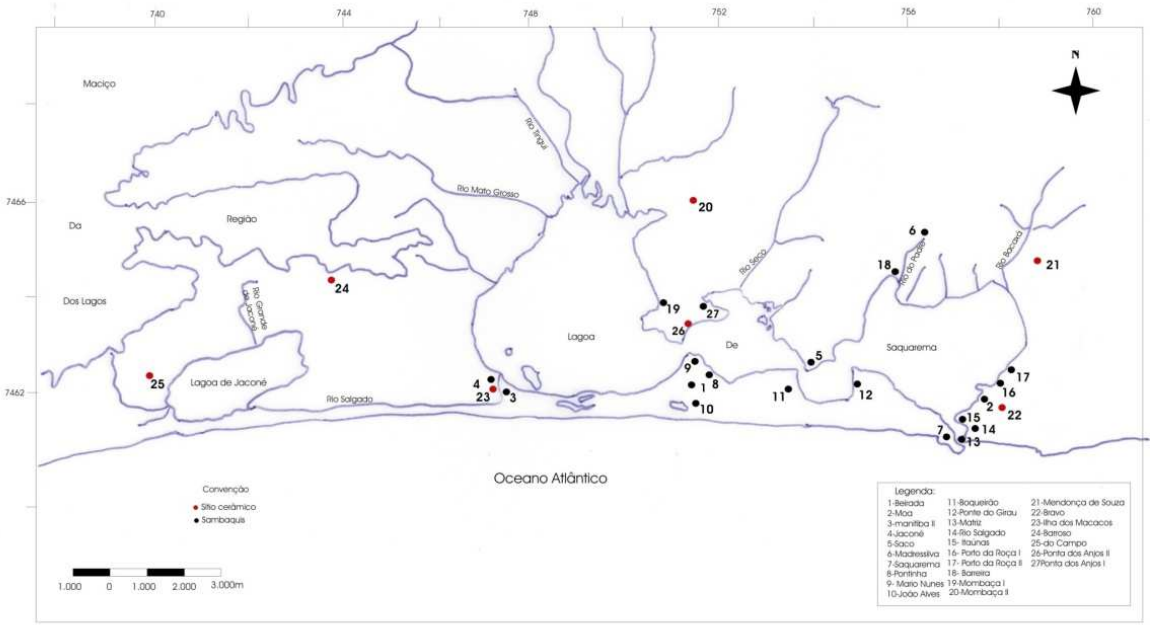

Figure 1: Map showing the distribution of archaeological sites in the Saquarema Lagoonal Complex. Source: Pages IBGE 23-Z-B-VI-3 and SF-2-B-V-4. Scale 1:50,000.

Table 1: Attributes and variables used in multivariate analyses.

Attributes	**Variáables**	
1) Matrix	1- Mineral-organic	3-Mineral-organic with shell lenses and/or pockets
	2- Shell	4-Indeterminate
2) Mollusk components	*1-A. brasiliana*	*6-L. pectinata/A. brasiliana*
	2-Ostrea sp	*7-Mytilidae/ L. pectinata*
	3-L. Pectinata	*8-Thais haemastona/ Mytilidae*
	4-Ostrea/ A. brasiliana	9-Absent
	5-*Mytilidae*	10-Indeterminate
3) Fish components	1- Ariidae	3- Ariidae/ Scianidae
	2-Scianidae	4-Absent
		5-Indeterminate
4) Lithic assemblage	1- Flaked	4-Indeterminate
	2 -Worked Cobbles	5-Absent
	3 - Flaked and cobbles	
5) Worked bone assemblage	1- Points	3- Points and spines
	2- Worked fish spines	4-Indeterminate
		5-Absent
6) Ceramics	1- Una tradition	5-Tupinambá/Neobrazilian tradition
	2-Tupinambá tradition	6-Indeterminate
	3-Neobrazilian tradition	7-Absent
	4-Una/Neobrazilian tradition	
7) Chronology	1-5,000 to 4,000 cal. years BP	5-3,599 to 3,300 cal. years BP
	2-3,999 to 3,800 cal. years BP	6-3,300 to 2,000 cal. years BP
	3-3,799 to 3,700 cal. years BP	7-1,999 a 1,500 cal. years BP
	4-3,699 to 3,600 cal. years BP	8-Post 1,499 cal. years BP
		9-Indeterminate
8) Dominant burials	1-Primary/Secondary Cremations	4-Secondary within crematory hearths
	2-Non cremated Primary/Secundary	5- In urns
	3-Secondary with bone manipulation	6- Absent
		7-Indeterminate

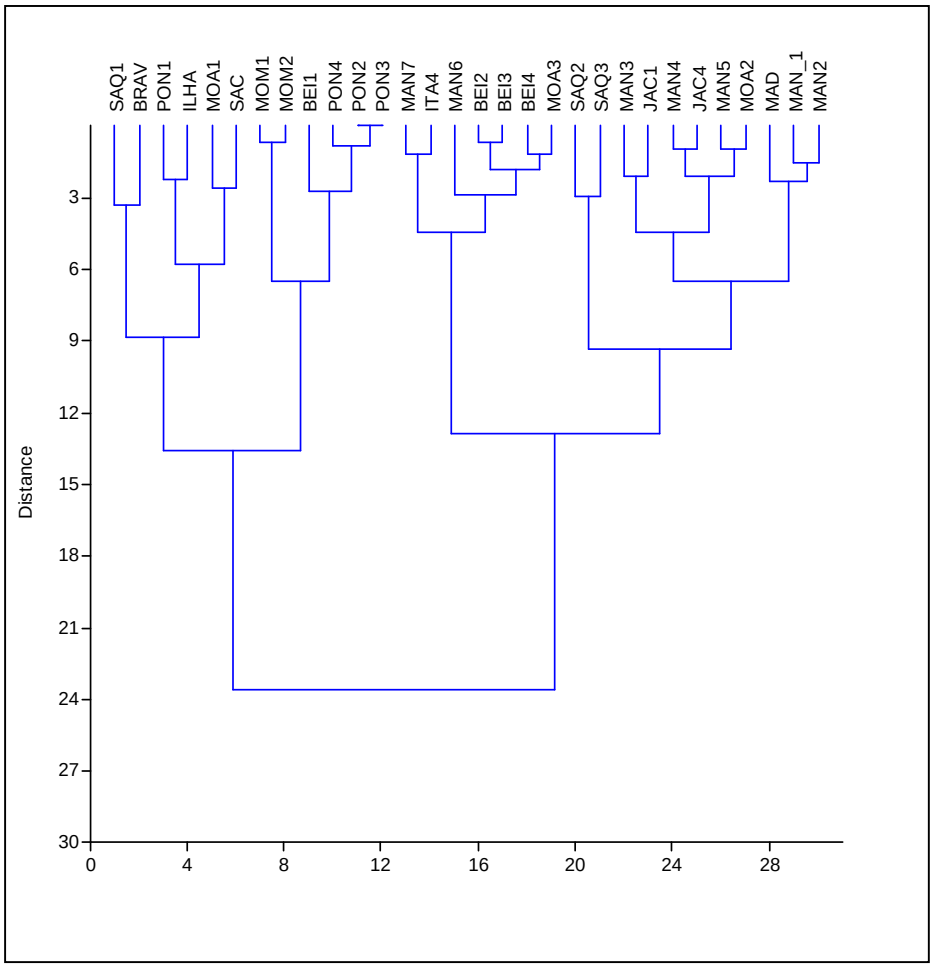

Figure 2: Dendrogram: SAQ1 – Layer I from Saquarema shellmound; SAQ2 – Layer II from Saquarema shellmound; SAQ3 – Layer III from Saquarema shellmound; BRAV- Bravo site; PONT1- Layer I from Pontinha shellmound; PONT2- Layer II from Pontinha shellmound; PONT3- Layer III from Pontinha shellmound; PONT4- Layer IV from Pontinha shellmound; ILHA- Ilha dos Macacos site; MOA1- Layer I from Moa shellmound; MOA2- Layer II from Moa shellmound; MOA3- Layer III from Moa shellmound; SAC- Saco shellmound; MOM1 - Layer I from Mombaça shellmounds; MOM2 - Layer II from Mombaça shellmound; BEI1- Layer I from Beirada shellmound; BEI2- Layer II from Beirada shellmound; BEI3- Layer III from Beirada shellmound; BEI4- Layer IV from Beirada shellmound; MAD – Madressilva shellmound; ITA4– Layer IV from Itaúnas shellmound; JAC1- Layer I from Jaconé shellmound; JAC4- Layer IV from Jaconé shellmound; MAN_1- Layer I from Manitiba shellmound; MAN2- Layer II from Manitiba shellmound; MAN3- Layer III from Manitiba shellmound; MAN4- Layer IV from Manitiba shellmound; MAN5- Layer V from Manitiba shellmound; MAN6- Layer VI from Manitiba shellmound; MAN7- Layer VII from Manitiba shellmound.

3. RESULTS AND DISCUSSION

The cluster analysis showed the existence of two large groups: group A is older and is formed by the sites of Itaúnas, Manitiba, Beirada, Mombaça, Jaconé, Madressilva and Moa (layers II and III). This first group was interpreted as representing the original or generating units, in other words, fisher-gatherer groups or sambaqui builders. Group B is more recent and is composed of Pontinha, Saquarema, Ilha dos Macacos, Bravo, Saco, and Moa (layer I), these sites are seen as new sociocultural units, either the ones that maintained traces related to the original groups – a fisher-gatherer economy – or those identified as new groups that do not present characteristics associated with the original populations, being represented by groups with agriculture and ceramics.

The inhabitants of the sites included in group A were found with fish specimens from the Scianidae family; the species *Micropogonias furnieri* (Desmarest) was their main fishing resource. The fishing technique for this species seems to be associated with the manufacture of worked fish spines, and the multivariate analysis points to a direct relationship between the prevalence of *Micropogonias furnieri* specimens and the commonness of this technology in all archaeological layers in sites from this group. This fishing technology was predominant between 6,726/6,356 and 3,699/3,600 cal. years BP among human occupations of the Saquarema Lagoonal Complex. It was closely associated with the conspicuous collection of mollusks captured in mangrove environments (figure 3).

The occupations of sites from group B, which occurred between 3,699/3,600 and 1,500 cal. years BP, included specimens from the Ariidae family as their main source of fish resources, with the exception of sites with presence of ceramic making groups. This quantitative change in the frequency of fish resources was directly accompanied by changes in the bone assemblage technology: the frequency of worked fish spines abruptly decreases, while at the same time there is a rapid increase of bone points (figure 4, figure 5). In agreement with the quantitative shift in the consumption of fish and fishing technology, mollusk resources also had quantitative and qualitative changes, although in a more gradual fashion. Species such as *Anomalocardia brasiliana* (Gmelin) that are commonly found in lagoon bottoms saw their numbers increase from 3,699/3,600 years BP, in opposition to the diminishing quantities of mollusks captured in mangrove areas, such as specimens from the genus Ostrea and the species *Lucina pectinata* (Gmelin).

The change identified in the collection of mollusk resources brought as a consequence a shift in the matrix composition of the sambaquis: a slow substitution of the shell matrix for one that can be characterized as mineral-organic. In this matrix, black in color, the *A. brasiliana* and other mollusks' shells were distributed in lenses and/or pockets located within the black sediment.

We associate this quantitative shift in the diet and, consequently, in the fishing technology, to environmentally-related factors, notably the variation in humidity indices that occurred during the mid- and late Holocene periods. Thus, during the occupation of Itaúnas site, between 6,726 and 6,356 cal. years BP, the humidity indices supported maintenance of the lagoon opening and the freshwater input from the rivers that flowed into it, allowing the formation of mangrove areas and abundant populations of Scianidae specimens and mollusks from the genus Ostrea, along with *L. pectinata*.

The setting described above would be modified when the Saquarema Lagoonal Complex was reoccupied, after a hiatus of approximately 1,300 years that we are associating with an increase in sea level. The reoccupation of this region with the settlement of sambaqui groups in Manitiba I shell mound, between 4,980 and 4,700 cal. years BP (layer VII), seems to indicate a short period of diminishing indices of humidity with the possible closure of the lagoon and decline in salinity levels. At the same time, the dominance of family Ariidae fish specimens is observed, along with an increase in bone point technology. Later, in a short period between 4,700 and 4,300 cal. Years BP (layer VI of the Manitiba I site), we notice a new decrease in frequencies of these items and an increase in the number of *M. furnieri* and worked fish spines.

In the subsequent period, between 4,700 and 3,763 cal. Years ago, the construction of Beirada sambaqui (layers IV to I) and other sambaquis from group A reiterated the prevalence of fish from the genus Micropogonias, the worked spine technology, and the predominance of mollusks from the mangrove habitat, influenced by a new increase in the humidity indices and extension of the mangrove.

This environmental setting of increased precipitation, better aeration of the Saquarema lagoon, and the presence of mangroves seems to have lasted until 3,600 cal. Years BP, when it is possible to observe the beginning of a period of gradual decrease in the availability of Micropogonias fish and an increase in fish from the family Ariidae. This shift also influenced the availability of mangrove and estuarine mollusks (such as *Ostrea* sp. and *L. pectinata*), causing an abrupt reduction of these resources and amplification in the numbers of *A. brasiliana*, mollusks that prefer areas with muddy and sandy-muddy bottoms.

Again, environmental factors related to the decrease in precipitation, due to the intensification of semi-arid conditions, would have influenced changes in the availability of aquatic resources, most notably mollusks that grow in mangrove areas. This hypothesis can be supported through research completed by Taysaco-Ortega [10], who proposed the existence of five episodes of reinforcement of semi-arid conditions in the Lagos region (3,600-3,500 BP; 3,100-3,000 BP; 2,200-2,000 BP; 1,200-1,100 BP; and 600-500 BP), along with two episodes of strong precipitation (2,300-2,100 BP and 700-600 BP).

The changes in food resources also affected the technology of sambaqui groups, who had to invest more in the production of bone points, decreasing the production of artifacts manufactured on fish spines, the so-called “needles.”

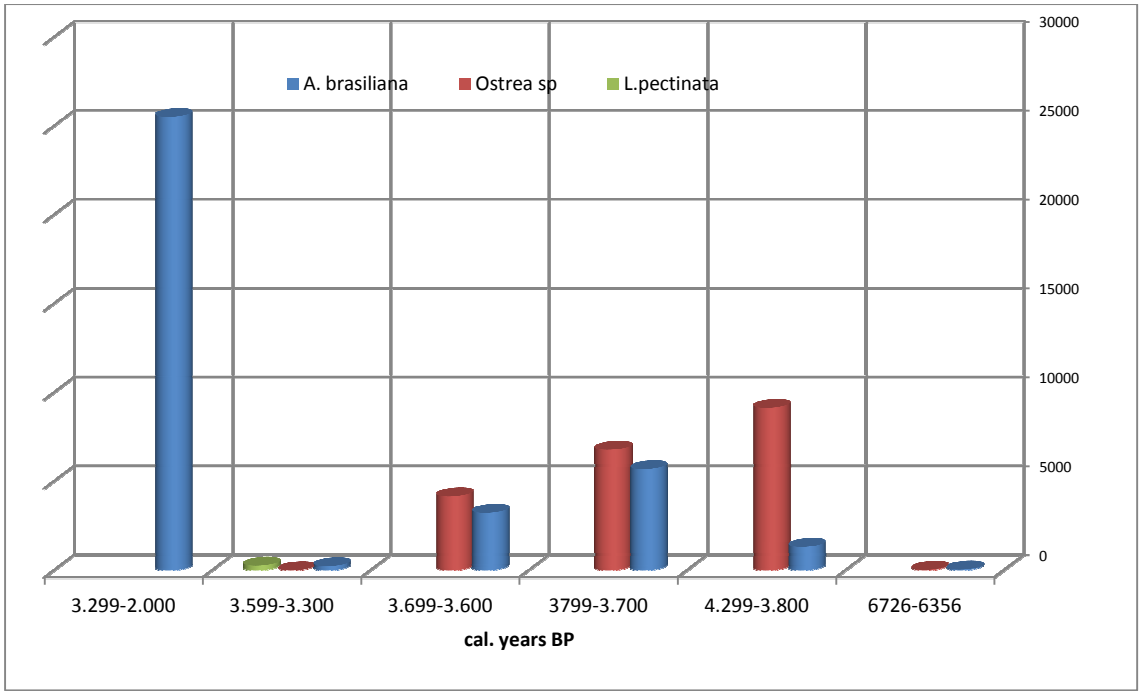

Figure 3: Distribution of mollusk resources according to occupational periods at the Saquarema Lagoonal Complex.

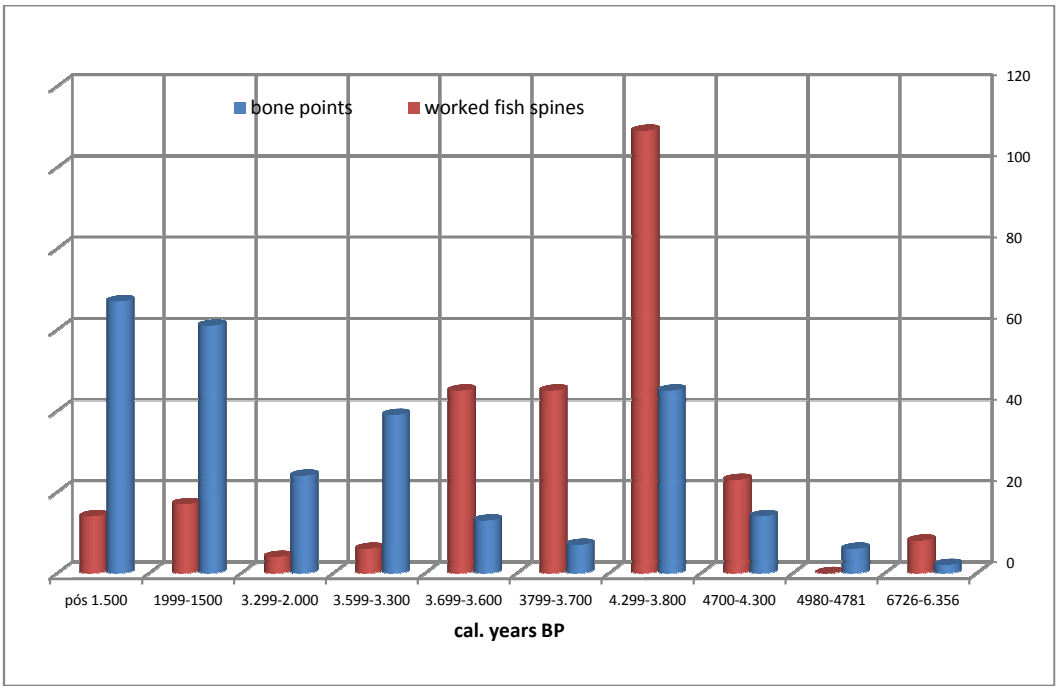

Figure 4: Distribution of bone artifacts according to occupational periods of the Saquarema Lagoonal Complex.

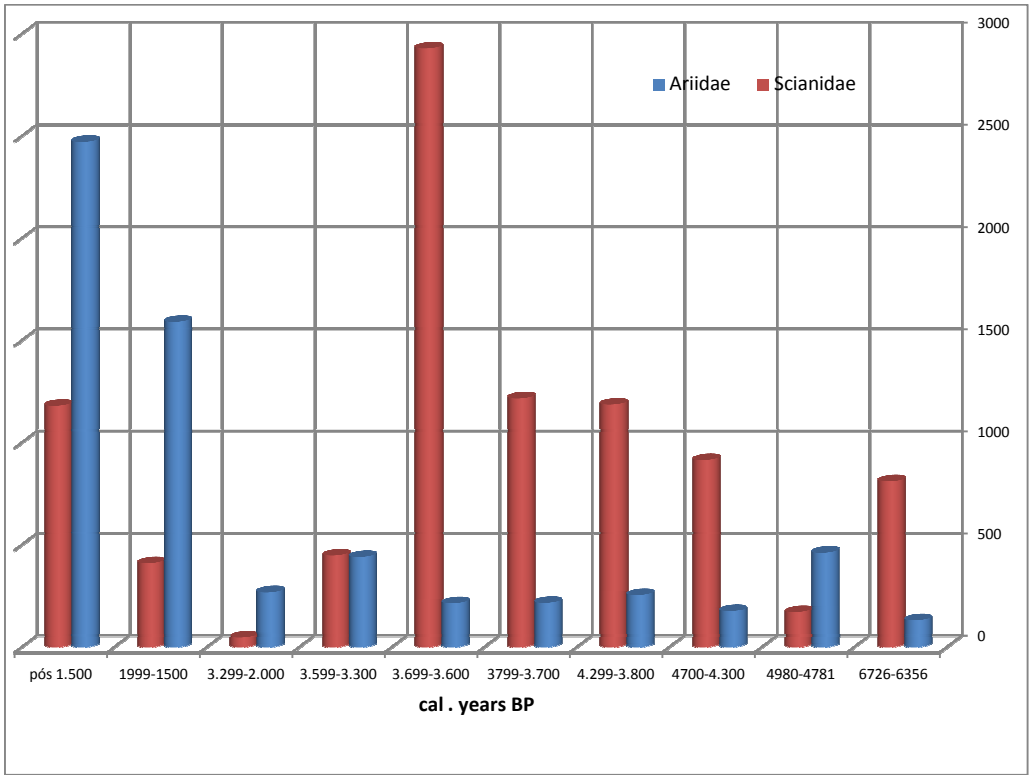

Figure 5: Distribution of fish resources according to the occupational periods of the Saquarema Lagoonal Complex.

4. CONCLUSION

The sambaqui socio-cultural system of the Saquarema Lagoonal Complex remained resilient for approximately 2,300 years, despite internal variations that did not compromise its existence. This only occurred due to maintenance mechanisms related to structures, to the longue durée. Conjuncture changes, possibly related to environmental factors influenced quantitative changes in the aquatic resources and in the fishing technology of fisher-gatherer groups of the Saquarema Lagoonal Complex. These changes however were not accompanied by significant social alterations that could be perceived in the archaeological record.

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