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HISTORICAL TIMBERS OF TRADITIONAL RAFTS FROM ALONG THE COAST OF PERNAMBUCO, NORTHEAST BRAZIL

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ABSTRACT

Rafts constitute an eminent cultural symbol of the fishing communities of the northeast coast of Brazil. This study aimed to describe the use of forest resoures for rafts by identifying the wood used in the construction of rafts housed in the collection of National Sea Museum, Santa Catarina, Brazil. Wood samples were acquired with an increment auger for standard histological preparation for the study of wood anatomy. The species was identified as Apeiba tibourbou (Malvaceae), known locally as pau-jangada, which possesses low density wood that is lightweight and highly buoyant. Knowledge regarding the raw materials used in traditional boats not only contributes to information on patrimonial assets, but also helps in understanding the relationships between societies and forests in the production of material culture.

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INTRODUCTION

Between the 17th and 20th centuries, Brazil was characterized by sea communities located along the coast from the northeast to the state of São Paulo, and for whom fishing was a means of survival (Cunha and Rougeulle, 1989). In 1888, rafts were commonly found along the coast from *Todos os Santos* bay (state of Bahia) to the state of Ceará, as they were practically the only means of transport and fishing available in the region (Cascudo, 1964). Being distant from industrialization, and lacking access to more advanced information and technologies, these communities developed boats and crafts aimed for subsistence fishing (Diegues, 2004) using resources obtained from the Atlantic Forest, with which they seemed to have an intimate relationship (Silva, 2004). The culture of these sea-going peoples suggests the existence of a cultural sphere that encompassed their relationship with their craft, knowledge passed on orally over generations and specific knowledge about fishing, climate and location. In addition to marine life, these fishing communities worshiped the sea with ceremonies and festivals with dances and songs linked to the world of the sea (Diegues, 2004). In addition to fishing, other activities of the *jangadeiros* included the felling of trees of the forest to serve their daily life and naval carpentry (Silva, 2004). In this way, fishing culture was permeated by an extensive sea-forest knowledge that provides insight into the

cultural complexity of the production of traditional boats along the Brazilian coast. Northeastern rafts are traditional boats derived from primitive rafts and represent, in the characteristics of their construction and structural components, historical cultural artifacts. According to Cascudo, (1964), the bases of these rafts are formed by the union of tree trunks, being able to vary in size and form to connect them. The mast was made of several wood segments tied together with secular mooringtechniques and to which the sail was fixed by a type of bolt and boom that allowed it to be raised and lowered. The rafts exhibited morphological diversity, varying in number and size of the trunks composing the base, the number of masts and the different types of sails used. The most common rafts consisted of six sticks, which were held together with nails and metal pieces (Cascudo, 1964). Ethnographic records clearly explain the dependence that communities of *jangadeiros* and *caiçaras* had on the sea and its fish, as well as the cultural practices related to the construction of rafts for fishing off the coast of northeastern Brazil. By 1859-1860 there was a total of 710 rafts and a contingent of 751 fishermen registered with the port authority of the state of Pernambuco, most of which were black Africans (Silva, 2004). In spite of this, the boatless raft, formed by two or more sticks, has been found along the northeast coast in places inhabited by *Tupinambás* since the 17th century, suggesting its indigenous origin. Africans and Europeans contributed to this cultural tradition by introducing the triangular sail, oar and master bank, elements previously unknown to the indigenous peoples (Silva, 2004). However, there are no records in the scientific literature regarding the species of wood used in the production of these rafts, which represents a significant gap in the knowledge of the relationship established between these fishermen and the forest as a source of raw material. The present study aimed to identify and describe the wood used in the construction of these northeastern rafts, with the intention of better understanding the relationship with, and use of, forest resources in naval carpentry in the Northeast Region of Brazil.

MATERIALS AND METHODS

The cultural objects of this study are typical boats of the *jangadeira* communities distributed along the central and northeastern coast of Brazil. The studied rafts (Table 1, Figure 1) belong to the National Sea Museum, a reference institution for naval heritage preservation in Latin America located in São Francisco do Sul, Santa Catarina, Brazil. Samples of the extremely fragile wood were taken with Pressler sensor so as not to visibly damage the museum pieces. Histological slides were prepared according to standard methods commonly used in the study of wood anatomy (Johansen, 1940). The samples were softened in glycerine water, hand-cut with razor blade, stained with an aqueous solution of astra blue-safranin (Bukatsch, 1972), mounted in synthetic resin (Vasconcelos*et al.*,2006) and deposited in the reference wood and slide collection of the of the Universidade da Região de Joinville(JOIw) (Melo Júnior *et al*., 2014). Anatomical descriptions are based on the terminology proposed by the IAWA Committee (1989). Wood was identified by comparisons with samples of the reference collection of JOIw and using the Inside Wood database (Wheeler, 2011). Information on wood density was obtained from the literature, and data on the geographical distribution of the taxa identified were taken from the Species List of Brazilian Flora (BFG, 2015).

RESULTS

Only one species was identified among the wood used in the construction of the study rafts, the tree *Apeiba tibourbou* Aubl. (Malvaceae), popularly known as *pau-jangada*. The species is described and its anatomy illustrated below, which corroborates the description from the Inside Wood database (Wheeler, 2011).

Growth rings: Distinct, marked by thick-walled and radially flattened latewood fibres.

Vessels: Diffuse porosityand arrangement; radial multiples of 2-4, solitary andrare clusters; vessel frequency ≤ 5 /mm²; tangential diameter from 115,45 to 189,75µm (155,91 ± 17,22); length from 75,23 to 535,18µm (199,12 ± 110,76), including reduced appendage at one end; perforation plates simple; intervessel pits alternate, anddiminute (≤ 4 µm); vessel-ray pits similar to intervessel pits.

Table 1. Characteristics of the northeastern rafts studied in the collection of the National Sea Museum, São Francisco do Sul, Santa Catarina, Brazil

Traits	Raft A	Raft B	Raft C
Region of origin	northeastern coast	northeastern coast	northeastern coast
Museum registration	MNM.I.090	MNM.I.038	MNM.I.093
Raft name	Elianas	without	without
Description	board raft, two masts and two sail seats, one half-nautical and one in the stern	raft of sticks, with a mast one-third ahead, bowsprit, master's seat, and steering wheel	raft of sticks and government helm, presents pins joining the sticks
Length (cm)	433	580	490
Opening (cm)	163	130	140
Boat head (cm)	32	20	15
Contour (cm)	214	170	145
Activity	fishing and transport	fishing and transport	fishing and transport
Propulsion type	rowing and sailing	rowing and sailing	rowing and sailing
Navigation area	open sea	open sea	open sea

Fibres: With simple to minutely bordered pits, non-septate, length from 254,598 to 1093, 62µm (765,22 ± 275,05); thin walled from 1,71 to 5,179µm (3,17 ± 0,79).

Axial parenchyma: apotracheal diffuse, diffuse-in-aggregates; scanty paratracheal, vasicentric; in narrow bands or lines up to three cells wide; unlignified parenchyma; strands of 5-8 cells.

Rays: (1--) 3-4 (5--) seriate; heterocellular with body cells procumbent, and 2-4 rows of upright and/or square marginal cells; aggregate rays present; rays of two sizes; 7 – 51 cells tall; ranging from 4 to 12 rays/mm.

Mineral inclusions: Prismatic crystals in all ray cells, and chambered axial parenchyma cells.

Figure 1. Northeastern rafts from the collection of the National Sea Museum, São Francisco do Sul, Santa Catarina, Brazil

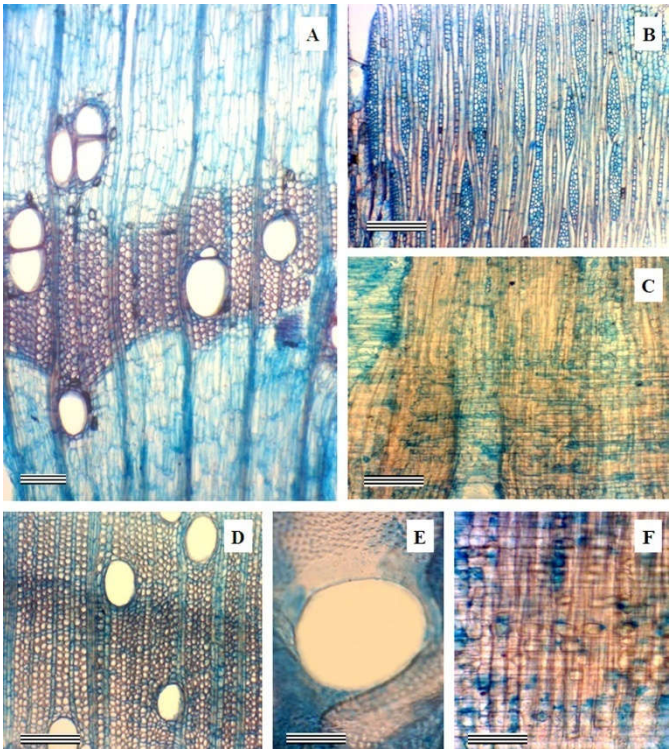

Figure 2. Anatomy of wood of *Apeiba tibourbou* (Malvaceae) used in naval carpentry of northeastern rafts. Wood from raft belonging to the National Museum Sea, São Francisco do Sul, Santa Catarina, Brazil. Legend: A: diffuse porosity and unlignified parenchyma in cross section. B: 3-4 seriate rays in tangential longitudinal section. C: hetecellular rays in radial longitudinal section. D: growth ring marked by thick-walled and radially flattened latewood fibres. E: simple perforate plate. F: prismatic crystals in all ray cells. Scale bars = 100 µm

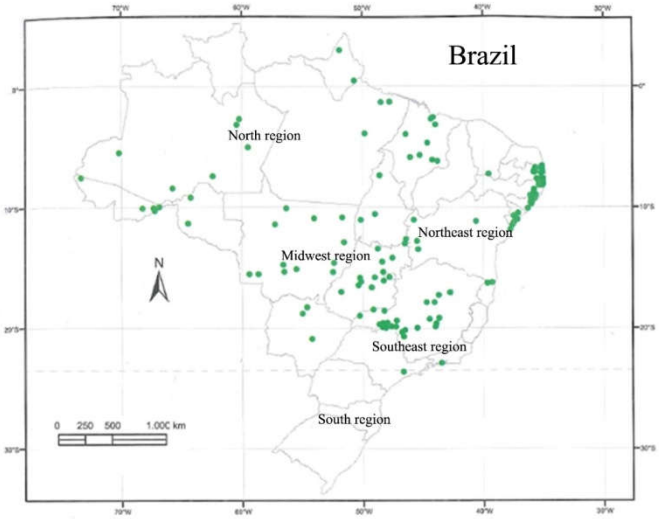

Figure 3. Geographical distribution of *Apeiba tibourbou* - Malvaceae (*pau-jangada*) in Brazil, with emphasis on the Northeast Region (Source: Carvalho, 2010)

DISCUSSION

The family Malvaceae is essentially Cosmopolitan, but has greater representation in the tropics, particularly tropical America (Takhtajan, 2009). It contains approximately 204 genera and 2,330 species of herbs, shrubs and light wood trees (Llamas, 2003). Among the economic uses of its species, it is worth noting the production of food, fibers and ornamental plants, but with scarce use of *Ochroma pyramidale* (Cav. Ex Lam.) Urb wood (Judd, 2009), a non-endemic species restricted to the northern region of Brazil (BFG, 2015). Of similar lightness, and belonging to the same botanical family, is the wood popularly known as *jangada*, *jangada-macho*, *pau-jangada*, *pau-de-balsa* and *pente-de-macaco*, among other vernacular names (Carvalho, 2010), which corresponds to the species *Apeiba tibourbou*. It is a tree that reaches 20m in height and 60cm in diameter (Paula and Alves, 2007), and grows easily in open forests and on sandy soil with low fertility (Proença *et al*., 2001). It is not endemic to Brazil, and is distributed widely throughout the country (Esteves, 2015), from the Amazon to the states of Minas Gerais and São Paulo (Carvalho, 2010), but absent from the South Region (Figure 3). The wood of *A. tibourbou* is considered pneumatophorous because it possesses a large amount of air in its interior (Paula and Alves, 2007). It has a low density (0.18 g.cm-³ to 0.26 g.cm-3) (Tavares, 1959), due to extensive xylem occupied by areas of non-lignified parenchyma, and is used in construction of small boats used in fishing along the northeastern coast (Corrêa, 1978; Pacheco *et al*., 2007, Corrêa, 2010). In a study carried out with traditional fishermen communities in southern Bahia, the *jangadeiros* emphasized the importance of *A. tibourbou* for raft construction, and attributed a useful duration of 3 years to it (Andrade *et al*., 2016), illustrating its low resistance and durability to weather.

Because of its lightness and buoyancy, the *pau-jangada* wood used as raw material is obtained from the forest by the *jangadeiras* communities. Two other species, *Guettarda viburnoides* Cham. and Schlitdl. (Rubiaceae) and *Anda brasiliensis* Raddi (Euphorbiaceae), called *jangada* and *anda*, respectively, possess similar nautical characteristics, and are also cited as sources of wood for raft construction in Brazil

(Hutter, 1986). Ethnobotanical study carried out with a traditional fishing community in south Bahia state related 13 species belonging to 11 families used by the *jangadeiros* in rafts construction, especially *A. tibourbou* and *Albizia polycephala* (Bent) Killip. Ex Record (Fabaceae) (Andrade *et al*., 2006). Historically, existing lifestyles on the vast Brazilian coastline are articulated with natural traits of distinct regions (Diegues, 1993), which may explain the use of different species in rafts construction in a certain territory or the exclusive use of *A. tibourbou* in another. The use of terrestrial ecosystems forthe development of particular forms of survival by sea man is a confluence of diverse cultural traditions, reflecting the importance of raft as the most developed boat type fromnorthern Bahia coast to the south of Ceará (Silva, 1996).

Not unlike other regions of Brazil, the traditional boats of the Northeast tend to continue to be constructed using the cultural traditions of the territory. Present along the northeastern coast since the 16th century, rafts were used by African slaves for fishing, and acquired their current configuration with sail and rudder from boats used by *peri-peri* Indians, in which they originated (Andrade *et al*., 2016). According to IPHAN (Brazil, 2010), the number of northeastern rafts has decreased since 1950, hypothesizing that this was due to difficulty with finding the correct wood for their manufacture. In the 18th century, extractive activity of timber industries in *Ilheús* captaincy (state of Bahia) processed an extensive amount of forest resources (Dias, 2010), with the unlimited cutting of wood causing a gradual reduction in natural stocks of the species of naval interest and which now remain in a few forest fragments protected by law (Souza, 2013). Despite this, and due to their high cultural importance, the construction and use of these rafts has continued over the years as the simplest form of local fishing (Cascudo, 2015). The *jangadeiros* are essentially maritime fishermen belonging to traditional communities that inhabit the coastal strip between Ceará and southern Bahia (Diegues, 2002). They are characterized by the preservation of their local culture through established relationships with the natural environment where they live, and which serve to meet their basic needs and maintain their practices and traditions (Andrade *et al*., 2016). Thus, these rafts are one of the major symbols of the Northeastern coast, and are identified with the natives of this region who, through their "knowledge and actions" regarding native forest wood, continue to construct this type of vessel and perpetuate this cultural heritage (Cascudo, 2015). The extractive activity of obtaining the wood species functionally compatible with the nautical quality sought by the *jangadeiros* clearly shows, despite the scarcity of forest resources, a rigorous selection of raw material which, in turn, reflects the technological knowledge about wood and maintenance of cultural traditions of the naval heritage.

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