


# The dugout canoe from São Tomé and Príncipe Islands: from the tree to the sea


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## Abstract

The aim of this article and the research mission that originated the work described here is to evaluate the scientific potential of the maritime cultural heritage of São Tomé and Príncipe. Based on the available data, only one article on the archaeological potential of the islands has been published, in 2022. The work presented here focuses on the study of São Toméan canoes, documenting and understanding their manufacturing process from the cutting of the tree to their use on the water. Therefore, this work has more to do with ethnography than with nautical and maritime archaeology in its genesis. The symbiosis between these disciplines arises from the necessity to document traditions, ways of life, and vessels that are rapidly disappearing on a daily basis. The tradition of crafting crafts from trees is disappearing due to the loss of forests and the difficulty in finding suitable trees and species. Additionally, younger generations lack interest in this tradition, and fibreglass has been introduced as an alternative. This study aims to analyze and compare an almost forgotten island reality that struggles to survive.

## Keywords

Shipbuilding

Fishing and Heritage

Maritime Communities

Local practices and traditions

Ethnoarchaeology

West Africa



# 1. Introduction

The conception of this paper began with a field mission conducted in February 2020 for the CONCHA project. This project is a staff exchange initiative funded by the European Community and is based on CHAM – Centre for the Humanities, Portugal. It is also a satellite project of the UNESCO Chair 'Ocean's Cultural Heritage' at the NOVA University of Lisbon.

The expedition aimed to evaluate the scientific potential of São Tomé and Príncipe's maritime heritage. Until 2022, no archaeological fieldwork had been conducted in the nation, and no articles had been written on the subject in the last 50 years, except for the recently published piece in *World Archaeology* by Mitchell and Lunn-Rockliffe (2021). We have attempted to enhance the study of the canoes in São Tomé and Príncipe by documenting and understanding their manufacturing process, from the initial tree cutting to their use in various aquatic contexts. This article focuses on the experiences and observations made during the mission, highlighting the daily life of communities living on the border between land and sea. The beach serves as a meeting point for different ecosystems, including people, animals, flora, canoes, tools, and needs.

## 1.1 Geographical context

The São Tomé and Príncipe archipelago is located partially on the equator line, in the Gulf of Guinea within the Atlantic Ocean (Fig. 1). It consists of two major islands, São Tomé and Príncipe, as well as several islets (Rolas, Cabras, Santana, Pedras Tinhosas, Sete Pedras, Pedra Galé, Bombom, Caroço, and Mosteiros), all formed by volcanic activity. The archipelago is part of a northeast-southwest volcanic belt that starts south of Lake Chad and extends through the central part of this gulf. The main elevation line of São Tomé runs north-south and includes the mountains of São Tomé (2024 m), Pinheiro (1613 m) and Calvário (1326 m). On the island of Príncipe, the relief is less pronounced, with peaks such as Príncipe (948 m) and Mencerne (935 m) (Frade and Correia da Costa, 1956:31–33). The country has a total area of 1001 km<sup>2</sup>, with São Tomé covering 859 km<sup>2</sup> and Príncipe covering 142 km<sup>2</sup>. The population of São Tomé and Príncipe is approximately 197,700 inhabitants, according to the most recent census conducted in 2017 (INE STP – NIS).

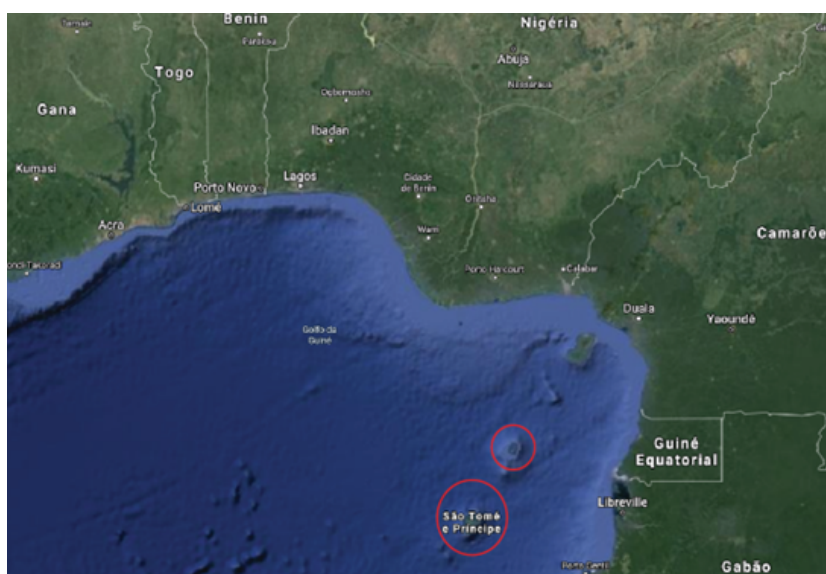


Fig 1. Geographic location of the islands of São Tomé and Príncipe in the Gulf of Guinea.

Both islands are located in the equatorial depression and are therefore affected by periodic pulsations that result in two main types of climate. From October to May, there is a season of heavy rainfall, often accompanied by violent thunderstorms and high temperatures. From June to September, there is a dry period known as the *gravana*. This period is characterised by stable and highly humid air masses, which produce light rainfall when they encounter orographic barriers (Frade and Correia da Costa, 1956:33–34). São Tomé and Príncipe is located within an area of low pressure and air convergence. The average air temperature near the coast is 26°C, but it drops to 14°C at an altitude of 1500 m. During the rainy season, the southern part of each island receives more rainfall than the northern part due to exposure to prevailing winds (Agência Geral do Ultramar, 1964:12–15).

The climate and soil quality are conducive to the growth of vegetation, resulting in authentic 'tropical gardens'. The natural wealth of the archipelago lies in its vegetation cover, which is a consequence of the favourable climatic conditions <sup>[1]</sup>. The islands of São Tomé and Príncipe, like the other islands of the Gulf of Guinea, have an exuberant forest cover due to the abundance of water. Both islands have a dense hydrographic network, considering their small territory. The islanders commonly refer to rivers and streams as 'águas' (waters) (Agência Geral do Ultramar, 1964:8–11).

## 1.2. The dugout canoes in the context of West Africa and the *canoas* <sup>[2]</sup> of São Tomé

The islands of São Tomé and Príncipe were discovered by Pêro de Escobar and João de Santarém in 1470. São Tomé Island was discovered on 21st December, 1470, and a few days later, on 17th January 1471, they reached the island of Príncipe. Settlement on the islands began in the mid-1480s, and by the start of the next century, the population had reached approximately 10,000 souls. According to scholars Carlos Benigno Cruz (1975) and Carlos Espírito Santo (1979), the Angolares inhabited the southeastern region of the island of São Tomé before the arrival of the Portuguese. Archaeological remains found on the neighbouring Fernando Pó Island (present-day Bioko Island, Equatorial Guinea), recovered before the arrival of Portuguese colonisers, suggest the possibility that São Tomé was also inhabited in pre-colonial times. However, there is no proof or indication of prior habitation on either São Tomé or Príncipe islands (Ambrósio, 1984:7; Seibert, 2004:52). In contrast, the Portuguese faced resistance during their occupation of the Canary Islands, which led the Crown to abandon its efforts in territories already inhabited by Africans and instead focus on developing the unoccupied islands (Henriques, 2000:24).

Dugout canoes are perhaps the most basic form of craft shipbuilding. The hull is created by hollowing out the inside of a trunk, with the bow and stern typically ending in a beak that is almost identical (Smith, 1970:515). The tradition of building dugout canoes along the West African coast dates back thousands of years, with archaeological evidence dating back at least 8000 years <sup>[3]</sup>. The origin of mass or industrial construction of dugout canoes on the West African coast is widely acknowledged to have begun in the 12th century among the Fanti people in the central/western region of present-day Ghana (Sheves, 1991:49). The earliest references to African canoes were made during the contact between Europeans (Portuguese) and Africans. According to Smith (1970:515), these crafts were already known for their versatility in travelling on rivers, lakes, and the sea, a characteristic that remains true today <sup>[4]</sup> <sup>[5]</sup>.

European descriptions of the African coast from the 15th to the 18th centuries contain references to canoes of various types and sizes <sup>[6]</sup> <sup>[7]</sup>. The largest canoes were built for the lagoons and large rivers where the waters were calmer. According to Smith (1970:518), there are references to canoes as long as 25m that could carry up to 100 men, although this may be an exaggeration. Canoes are constructed in various locations throughout the Gulf of Guinea, including rivers, tributaries, and waterways such as the Niger and Benin Rivers, as well as on beaches in countries such as Ghana and Nigeria (Smith, 1970:520; Sheves, 1991:49–50). Oars are the preferred method of propulsion for these canoes. In certain

lagoons with very low water levels, a stick is used to push the canoe. West African canoes were constructed using a method that remained largely unchanged for thousands of years, as evidenced by contemporary bibliography and iconography. This method was passed down through generations empirically.

For centuries, canoes have played a crucial role in the politics and economy of the West African coast. They were instrumental in the development of several urban settlements along the Niger River and the lakes of the Songai Empire during the 15th and 16th centuries (Smith, 1970:521). Even before the arrival of the Portuguese on the West African coast in the 15th century, a highly complex trade network existed on the coast and rivers. The West African coastal region had a long-distance trading system that led to the formation of states such as the Hausa, Nupe, Igala, Yoruba, and Kingdom of Benin (Thornton, 1992:19).

Upon the arrival of the Europeans, new trade routes emerged for slaves, gold, *malagueta*, and ivory. These routes took advantage of pre-existing networks, and dugout canoes continued to play a fundamental role (Alagoa, 1970:319; Meide, 2002:12–13). Dugout canoes in Africa and beyond were primarily used for transporting goods and slaves between European merchant ships anchored off the coast and their warehouses on land<sup>[8]</sup>. It is important to note that in the Gulf of Guinea area, slaves had complete control over the supply of slaves to the ships (Ward, 1958:88). Canoes were also used for transporting captains, sailors, missionaries, and soldiers between different points on the coast and between coastal areas and the interior via rivers. Several paragraphs in different *Regimentos* discussed canoes and their use (Gutkind, 1989:339–376).

In São Tomé and Príncipe, as well as in other similar cases, such as Cape Verde, society comprises people from diverse backgrounds, including Portugal, other distant countries, the coast of the Gulf of Guinea, and the west coast of Africa. The populations brought to this territory against their will were forced to work in agriculture, cultivating crops such as sugar, cocoa, and coffee (Silva, 2014:555). The process involved the importation of people, who brought with them new cultures, perspectives, and technical knowledge. As a result, these populations not only enriched technical production but also the culture of Santomean itself, establishing a new cultural identity in the territory.

The exportation of slaves to the Americas brought the models of dugout canoes found along the West African coast. Additionally, these canoes were also present in São Tomé e Príncipe, from where many slaves journeyed to the New World. As a result, American canoe types were influenced by this transfer of knowledge, which occurred from the mid-15th century onwards and was carried by the slaves who crossed the Atlantic. Dugout canoes were already built by indigenous peoples in the American continent prior to the arrival of Europeans, although the designs varied. The canoes found in the Americas are the result of a combination of shipbuilding customs involving Indigenous peoples, African slaves, and native Europeans from coastal areas. Additionally, it is probable that Europeans also contributed to the mix, as some dugout canoes still existed in Europe during that time (Harris, 1997:20–22).

In this context of strong commercial flows, especially of slaves from various regions of the West African coast, mainly from the Gulf of Guinea, and in view of the above, it is likely that the transfer and/or migration of the technical knowledge of dugout canoe construction, which had existed for centuries in its places of origin, was the vehicle. This theory, which to our knowledge is the most robust, reinforces the idea that the São Tomé archipelago was uninhabited when the Portuguese arrived in 1470. However, there are other, less likely hypotheses for the origin of the construction of the Santomean dugout canoes. On the one hand, it could have been the simple necessity of the first waves of people to arrive on the island and the availability of natural resources. On the other hand, assuming that the islands were already inhabited, for which there is no historical-archaeological evidence, probably by people coming from somewhere on the west coast of Africa, they could have taken their knowledge of the continent with them.

## 2. The archaeological record and methodology

To the best of our knowledge, this work is completely unprecedented in the field of nautical and maritime heritage in the archipelago. The focus of this work is on ethno-archaeology and memory preservation, rather than purely archaeological research.

The record of craftsmanship aimed to present the dugout canoe as an everyday object, focusing on its physical characteristics, construction sequences, and repair methods. Two dugout canoes were recorded during the mission: one on the island of São Tomé in Porto Alegre, and the other in the town of Santo António on the island of Príncipe. The recording of the dugout canoes was conducted in three phases: identification and selection of the canoe, obtaining permission and access to the canoe, and the actual recording process. The recording process mainly involved photogrammetry, detailed photography, and direct measurements (Fig. 2). The time spent recording each canoe varied depending on its size and external factors, such as the number of people passing by the location of the recording or environmental conditions like sunlight or rain. Each canoe was named based on its IMAP-STP<sup>[9]</sup> registration code.



Fig 2. Photogrammetric record of a dugout canoe under construction, in Porto Alegre. (Photo: J. B.)

The photogrammetry used to capture the two canoes was based on the principle of image overlap, with at least 70 to 80% overlap. The aim was to record all the details of the boats with maximum quality and in the shortest possible time. Therefore, the first step was to take a series of photographs, around 700 for the Porto Alegre canoe and around 250 for Santo Antonio, from different angles, without leaving any blank spaces. The primary benefit of photogrammetry is the speed of capturing photos, while post-processing can be time-consuming, depending on the computer's quality and the number of photos taken. Post-processing involves editing the photos, as in our case, using Agisoft Metashape software, and creating orthophotos, which are then vectorised using AutoCad software. For the Porto Alegre canoe, post-processing and vectorization tasks took approximately 40 hours, while for the Santo António canoe, it took around 25 hours.



The photographs were processed and vectorised, and a three-dimensional scale model of each canoe was created, along with an animation, to provide a more comprehensive understanding of the craft and for scientific dissemination purposes. The information will be sent to the fishermen and organisations such as the NGO MARAPA (Mar, Ambiente e Pesca Artesanal) for their use. Our aim is to communicate the value of the communal object of daily use, which is a finite, easily destroyed, and non-renewable resource. We believe that our contribution to the realization of the fundamental role of heritage in understanding the past is significant. Our efforts have raised awareness of this important issue.

In addition to the physical archaeological record, our methodology also involved collecting ethnographic data through informal interviews with local fishermen and dugout canoe builders. We conducted semi-structured interviews, which allowed for both closed-ended questions and open discourse, enabling the sharing of experiences. It was more of a conversation than an interview. The purpose of the interaction was to comprehend the process of constructing canoes that are still produced today, from selecting the tree to launching it into the water. Additionally, several supplementary questions were asked, including the type of fishing that is practiced, when and how it is done, the species of fish that are caught, and the role of women in the entire process.

### 2.1. The santomean dugout canoes and their process of construction

The design of a craft has two fundamental requirements: firstly, it must be capable of floating under all conditions in which it is to be used; secondly, it must be able to move efficiently and in a controlled manner, whether by human power, paddles, or wind through sails (Muckelroy, 1978:216).

The first step in the construction of any boat, after the actual decision to build it, is the conception of the architectural design, which always has an architectural dimension (hull shape and structure) and a technical dimension (means of propulsion and steering). These two dimensions must be adapted to the function of the boat, to the conditions in which it will sail and, above all, to the owner's possibilities. The architectural system can be divided into 5 main groups: natural or artificial floats, crafts made from animal skins, crafts made from tree bark, crafts made from a single hollowed-out tree trunk, or even crafts made by joining several planks and/or elements together. From these architectural groups, countless solutions are possible, depending on cultural and environmental factors (Pomey, 2011, pp. 28–29).

The realisation stage is the second stage, during which the raw materials, primarily wood in the case of canoes, are acquired and transformed into finished pieces for use on the craft. The technical level of the builders becomes apparent during this stage, as the way in which a log is cut or a piece is sharpened reveals the degree of technicality and ultimately affects the performance of the craft (Pomey, 2011:31).

The construction of a vessel's various components is the final and most crucial phase. It is worth noting that in traditional construction, such as in São Tomé and Príncipe, the line between the design and construction phases is almost imperceptible, as all information is empirical in the builder's mind. Constructing a canoe necessitates a well-defined design principle, as the dimensional limits are established from the outset by the tree trunk. However, there are several design processes that can be followed within this design principle. The simplest process involves removing almost 80% of the inside of a log and sanding the outside to form a hull.

In shipbuilding, there are three techniques: reduction, construction, and transformation. Reduction involves reducing the volume of the raw material, such as hollowing out a log to make a dugout or logboat. Construction involves joining several elements together, such as nailing hull planks to frames. Transformation involves changing the shape of the raw

material without adding or subtracting elements, such as widening a part of a canoe or bending a plank (McGrail, 1998:6–9; 2001:7–8).

Dugout canoes are still widely used today, particularly in less developed countries such as São Tomé and Príncipe, as well as within ethnographic communities. In many parts of the world, prehistory has continued until recently, and some groups are currently in a state of development within this historical period. By studying these groups, their techniques, and traditions, it is possible to recover a great deal of knowledge (Muckelroy, 1978:127; McGrail, 2001:432). Currently, there are still numerous examples of hand-powered or sail boats that maintain the characteristics of the past. However, they are quickly being replaced by fibreglass boats with motors. It is important to document these vessels from an ethnographic perspective as they are an integral part of everyday life in the 21st century. This documentation allows for the acquisition of vital information (Smith, 1970:516). This documentation can be used as a basis for reverse research into the history of navigation in each region. It should be supplemented by documentary and iconographic sources (McGrail, 2001:432).

Systematic studies of traditional crafts have been very focused on the technological description, classification, and geographical distribution of boats, neglecting important aspects related to the communities in which they are located. The call for more integrated studies, in which the social context plays a central role, has led to a series of works that are now international references (Blue, 1997; McGrail, 2001; Vermonden, 2003; Ransley, 2009).

The process of transforming Santomean canoes involves felling the tree, transforming the trunk (as shown in Fig. 3), transporting it, and sharpening or finishing it. However, not all of these stages are always carried out scrupulously. Sometimes, the trunk is transformed at the place where it was felled, while in other cases, it is transformed near the place where it will be placed in the water.



Fig 3. We were able to witness the initial phase of cutting and building a dugout canoe in Quimpo, São Tomé. (Photo: G.L.)

The process of finding a suitable tree involves considering the desired species, its dimensions, suitability for the intended purpose, and accessibility for handling and transport. Once a tree is selected, it is felled, which always carries

some risk. Therefore, clients are typically accompanied during this stage. The cutting down of trees is traditionally planned according to the lunar cycle. The optimal time for felling is three days after the full moon or three days before the new moon, as this helps to prevent worms from growing latter in the wood <sup>[10]</sup>. The lunar cycle and tides play a significant role in regulating the movements of the Santomean population, influencing many aspects of their lives. Prior to felling the tree, it is essential to conduct a thorough analysis of its circumference, trunk and branch positioning, as well as the designated falling area and optimal transportation route. The tree trunk must fall in the correct position to facilitate movement, which will determine the dimensions and feasibility of the canoe from the outset.

The canoes are constructed using trees of specific sizes and species that are found in the region. To identify the tree species used in canoe construction in São Tomé and Príncipe, the first step is to match the creole or Portuguese name with the English translation and then the scientific name. The following table (Table 1) lists the preferred and most commonly used woods for canoe construction in São Tomé and Príncipe.

Table 1. Tree species most used in the construction of dugout canoes in São Tomé and Príncipe.

Creoule/Portuguese	English	Scientific name
<i>Ocá/Mafumeira</i>	Samauma	<i>Ceiba pentandra guineensis</i>
<i>Acácia</i>	Acacia	<i>Albizzia molucana</i>
<i>Fruta-pão</i>	Bread fruit tree	<i>Artocarpus incisa</i>
<i>Gôgô (creoule)</i>	African crabwood	<i>Carapa procera</i>
<i>Cedro cheiroso</i>	Cedar	<i>Cedrela odorata</i>
<i>Amoreira</i>	Mulberry tree	<i>Chlorophora excelsa</i>
<i>Jaqueira</i>	Jackfruit	<i>Artocarpus heterophyllus</i>

The main wood used by Santomé canoe builders is the *ocá* trunk, which can grow up to 25 metres in height and can be used to construct up to four canoes. However, after two years, the *ocá* trunks begin to crack and must be either abandoned or reused. In such cases, new trunks are used to replace the old ones, which will last for another two years. The lifespan of a Santomé canoe varies depending on the type of wood used and the environment in which it is used. Typically, a canoe used in fresh water (such as a river, lake, or mangrove) lasts for 2–3 years. However, if the canoe is constructed with high-quality, hard wood, it can last up to 15 years. However, if the canoe is intended for use in saltwater, its lifespan will be significantly reduced due to the increased wear and tear caused by the combination of salt and sun. In the Gulf of Guinea area, there are frequent mentions of the use of *ocá* or *mafumeira* in constructing canoes. However, this use is more related to spiritual beliefs than practicality or physical properties. The natives believe that these trees are inhabited by the spirits of the trees (Smith, 1970:520; Nuno, 1974:32; Bolster, 1997:49).

The process of log conversion involves three phases: marking and general cutting, detailed cutting and shaping, and excavating/hollowing the interior of the log. During the first stage, the builder marks the outline of the canoe on the log using an axe as a guide (Fig. 4a and 4b). The canoes are designed with their base coinciding with the central part of the trunk for increased durability and stability. Occasionally, however, some parts are carved into the softer sapwood, which may lead to deterioration (see Fig. 4c and 4d). The subsequent stage differs somewhat from the previous one. Before the advent of chainsaws, the upper part of the trunk was cut several times with an axe (see Fig. 5e). The cuts were made up to the point where the bark ends and the sapwood begins. The remaining parts between the cuts were then removed (see Fig. 5f).



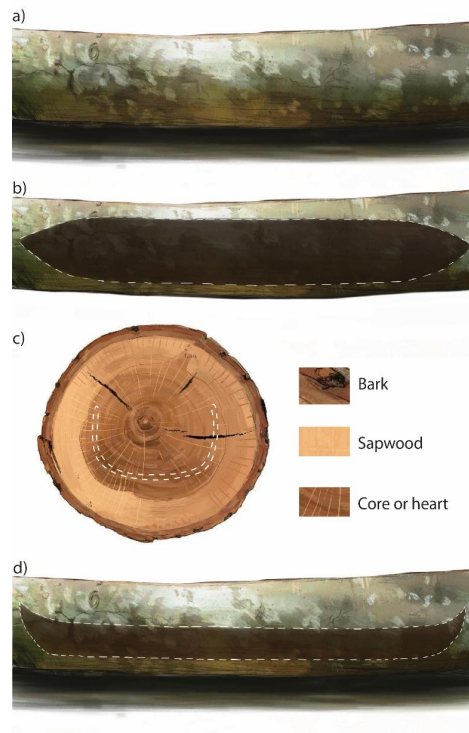


Fig 4. Carving sequece: a) Tree trunk ready for carving; b) and d) Outlined of the canoe made by an axe; c) Schematic of the biological composition of a log, with the shape of the future canoe highlighted. (Illustration: M.V)

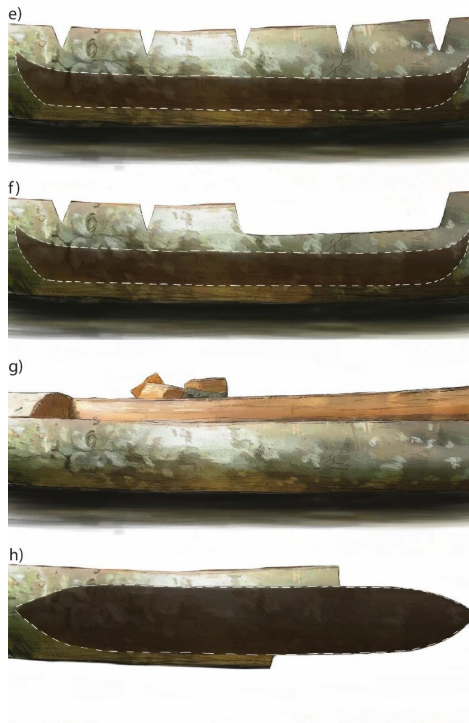


Fig 5. Carving sequece (continuation): e) Cuts made with an axe on the top part of the trunk; f) Removal of the parts left between the blows of the axe; g) and h) General shape of the canoe, first without and then with the stern and the bow edges already carved. (Illustration: M.V)

During the second stage, the outermost parts of the hull are removed, resulting in a double bow or stern shape (Fig. 5g and 5h). It is crucial to maintain the central axis of the boat to achieve optimal performance on the water. Carvers typically rely on their eyes and the axe handle to ensure the central axis remains aligned while carving the log. The tree's anatomy is also taken into consideration during the carving process. The stern is carved near the base of the naturally wider trunk, while the bow is carved near the top.

The third and final stage involves excavating or hollowing out the trunk using axes and hoes. Nowadays, chainsaws are also used to remove less delicate parts of the trunk. During the boat-building process, the craftsmen shape the vessel using axes and hoes, before switching to a planer and gouge to create a concave hull. Throughout the thinning process, the thickness of the hull is constantly checked and corrected by hand, with a typical dugout canoe being around 4cm thick. Occasionally, holes are drilled into the hull to check the thickness. The holes are subsequently utilised for the ropes used in transportation and are ultimately concealed, typically with a distinct type of wood from that used in the boat.

Finally, the canoe should be turned on its side to allow for carving of the outer parts closer to the bottom of the craft. Ropes can be tied to trees to secure it or it can simply be leaned against a tree. Some builders choose to transport the canoe at this stage, while others do so at the end of the process and before carving. The decision depends on the builder and the logistics they can provide.

The canoe is finished either on the beach of the village or in the village itself, depending on whether it was transported partially cut or not. The hull is thinned and smoothed using an axe, hoe, planer, and gouge. In general, these operations affect the outer part of the hull more than the inner part, as the outer part is practically finished in the forest. The thickness of the hull is constantly checked as it is carved by hand. Next, the canoe is laid on its side at approximately 45° to both sides, and the area of curvature between the edge and the bottom is sanded. The bottom is then thinned out by turning the boat over again, this time at approximately 90° to both sides. The area subjected to the most wear and tear, both at sea and on land when being towed, should always be thicker than the edges. Next, it is essential to improve the bow and stern, ensuring that the axis is centred. This area should also be a little thicker and stronger than the sides, as it is also subject to a lot of wear and tear. Finally, the canoe is turned upside down and the entire outside surface is smoothed with a planer.

The materials used for canoe repairs are typically sourced from the surrounding village or town. Repairs are necessary due to natural wear and tear or accidents. Generally, repairs involve filling and reinforcing cracks or, as a last resort, replacing parts of the hull with new wood. There are various methods for making repairs, but the most common involves creating wooden moulds and reinforcing them with tar. The standard method for repairing cracks is to apply tar or use small metal patches secured with iron nails. However, plastic pieces and white glue are becoming more prevalent.

Our research indicates that traditional canoe building is rapidly declining, and few individuals are willing to fell trees in remote areas. Transportation time can vary depending on the size of the craft, number of workers, and logistical and environmental conditions. In the past, canoes were transported using the traditional log-laying method, where the canoe moves forward as logs are placed and removed in a watercourse close to the felling or construction site. Nowadays, motorised vehicles are hired for this purpose (Smith, 1970, p. 520). Finally, the last step is to launch the canoe into the sea, which is always celebrated with a big party including music and dancing (Lima, 1968–75, p. 171).

Although dugout canoes in São Tomé can vary in size, there are three standard sizes: the smallest is between 3.5 and 5 metres long, the medium is between 8 and 10 metres, and the large is around 15 metres, but can reach 20 metres <sup>[11]</sup>. The height of the bow can also vary depending on whether it is built to sail further from the coast and face harsher sea conditions or designed to operate close to shore, in rivers and/or mangroves. Although owners have discretion, there have been cases of canoes being strengthened or extended by placing a plank or series of small strips above the hull to increase load capacity. This creates true extended dugout canoes (Fig. 6).



Fig 6. Detail photo of several wooden strips placed on top of each other for the purpose of increasing the load capacity of the canoe, in Santo António do Príncipe. (Photo: G.L.)

In addition to the dimensional differences, there are also minor variations. For example, the bow is higher and tapered to improve performance in the water, while the stern is lower and wider and can be tapered or cut to form a small straight stern panel. This variant is relatively recent in São Tomé and Príncipe and is linked to the introduction of outboard engines in the archipelago in the early 1970s (Lima, 1968–75:171). Double-bow dugout canoes rely solely on oars and sails for propulsion, whereas transom canoes can be fitted with a motor. It is worth noting that all the transom canoes we have seen only use the outboard motor, with two wooden oars included as part of the craft's safety equipment. The majority of Santomé fishermen use the motor to propel their canoes, although due to the high cost of purchasing and maintaining one, approximately 40% rely solely on paddles. In these cases, sailors even use sails made of burlap, reused flour sacks, or, more recently, plastic. These sails are hoisted on masts fixed by a simple system consisting of a heel pin at the bottom of the boat and a board that serves a double function: as a mast hole and a bench or support (Fig. 7). The oars must be made of strong and durable wood, with *viro* <sup>[12]</sup> being the most valued and commonly used species. The process is similar to making a dugout canoe. First, mark the shape and size of the oar on the trunk of a tree. Then, pull it out of the trunk like a plank. Begin with the paddle, followed by rounding the shaft with sandpaper or tools such as an axe and a hoe.





Fig 7. Detail photo where the system of hoisting the mast of a dugout canoe can be observed. (Photo: J.B)

The fishermen of Santome, who are typically the poorest, acquire dugout canoes in various ways due to economic difficulties. The ways of acquiring a canoe include purchasing it and paying all expenses to the builder, exchanging favours with the builder and those he hires, paying certain expenses and exchanging favours with workers who also help with less technical tasks, forming small cooperatives that acquire a community canoe, and organizing themselves into a kind of company that works together. The last option is more commonly observed on the island of Príncipe due to difficulties encountered in paying for the motor and its maintenance. In situations where a family is unable to cover the expenses, the cooperatives already present in the communities provide support, ensuring their sustenance.

During our visit to Príncipe, we gained insight into the daily challenges faced by local fishermen due to the island's double insularity. One of the major difficulties they encounter is obtaining supplies, which makes it extremely challenging for them to repair their engines when they break down. We visited the largest boat engine repair shop in Príncipe and observed that the mechanic had around 50 broken engines, all of which were missing one or two small parts. When some individuals travel to Nigeria or Angola, they may find a large black market for these types of parts. However, the prices are often too high for local fishermen to afford. In most cases, repairing an engine can take several months, and in some cases, it may not be possible at all. Regarding the issue of supplying the island of Príncipe, it is worth noting that fuel is often unavailable. Sometimes fishermen venture too far from shore and encounter engine problems or other issues that prevent them from returning. This problem is compounded by the fact that most fishermen do not have a localization system, such as GPS, making it difficult to rescue them. In response, MARAPA launched the WACA project in 2022, which aims to enhance the ability of coastal communities in the archipelago to adapt to climate change. GPS equipment has been distributed to fishermen to improve safety at sea. Several training and awareness campaigns have also been conducted (source: <https://marapastp.org/single-projeto.html?key=3#>).

Dugout canoes commonly used in rivers and mangroves are equipped with a quant to pull the boat away from the shore. The quant is typically used when the fisherman is standing at the stern. It is also used in this position when transporting people, as seen with the gondolas in Venice.

Some specimens feature a transverse piece of wood attached to the sides at the bow and stern. This appears to function as a handle for fishermen to pull and drag the canoe when navigating through mangroves or rivers. It is important to note that this information was gathered through interviews and has not been directly observed. In Colombia, a small boat called the *azotadoras* is used for harvesting and transporting rice, as well as collecting sugar cane juice from hand mills (Fuquen, 2014:121–122; 208–210).

Based on our direct observations, records, and interviews, Santomé dugout canoes typically measure between 5 and 12 meters in length, approximately 90 centimeters in width, and 35 to 65 centimeters in depth. For instance, the canoe registered in Porto Alegre (Fig. 8) measured 8.93 meters in length, 1.05 to 1.10 meters in width at the midship, and narrowed towards the ends – 51.2 centimeters at the bow and 72.9 centimeters at the stern – with a depth of 78.6 centimeters at the midship. In other words, this canoe is considered medium-sized according to the Santomean empirical classification.

The canoe was still under construction and not yet finished. The builder mentioned that he had been carving it for over 8 months, as he is a carpenter. However, he did this as a bonus and because his father was a canoe builder. This situation appears to be increasingly common in São Tomé society, where the traditional art of canoe building is gradually disappearing. On the inner starboard side, there are two improvised patches made from parts of oars to cover cracks that have appeared due to prolonged exposure without finishing.

The typology appears to be type A- $\frac{1}{5}$ -C (Arnold, 1996:11), but the true shape when finished is uncertain. A number of axe and hoe marks were observed throughout the craft, particularly in the areas of the bow, stern, and both sides near the bottom. These marks correspond to the third phase of the carving sequence, which involves emptying the trunk while shaping the vessel (Fig. 9).

Dugout canoe from Porto Alegre, São Tomé island

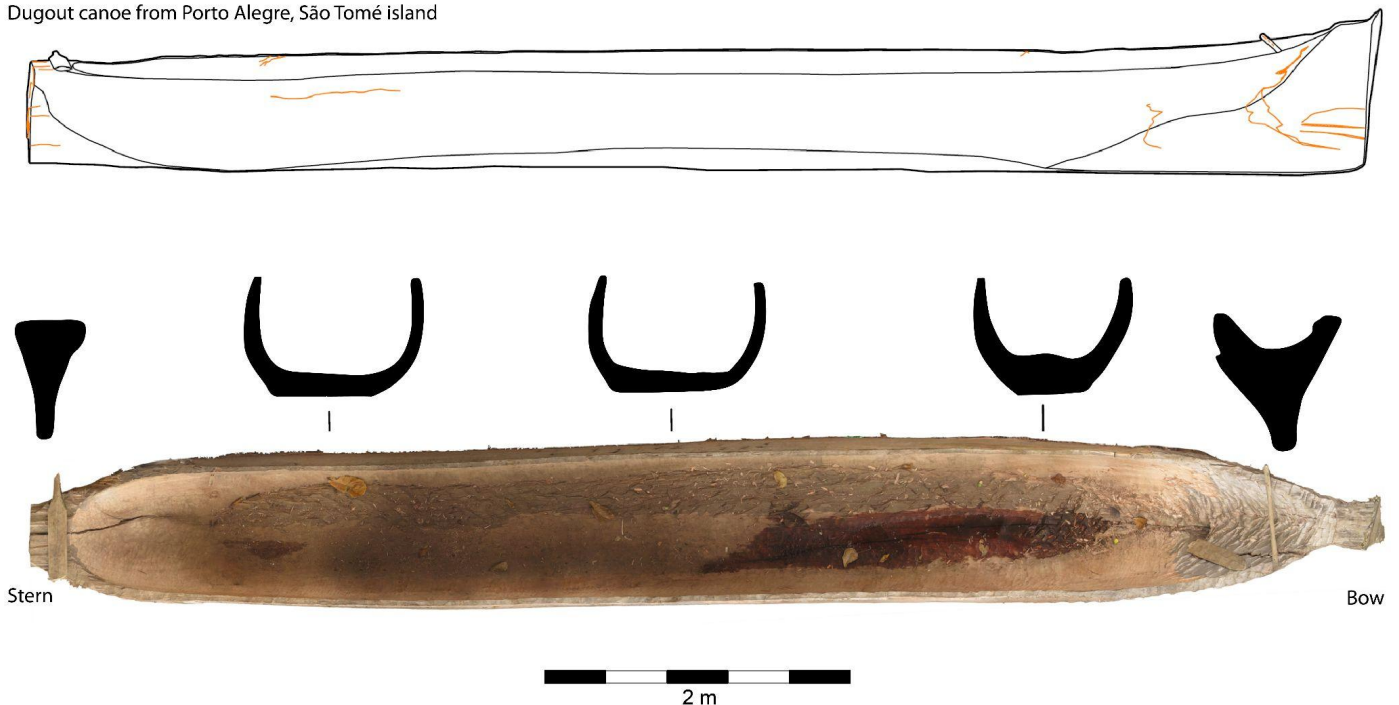


Fig 8. Vectorial and photogrammetric record, with the sections of dugout canoe from Porto Alegre (São Tomé island).





Fig 9. Detail photo of the tool marks made during the carving process of the dugout canoe. (Photo: J.B)

The recorded dugout canoe in Santo António, Príncipe, was smaller (Fig. 10). It measured 5.13 m in length, 63 to 65 cm in width at the midship, narrowing at the ends – 32 cm at the bow and 49 cm at the stern – and 36.5 cm in depth at the centre. According to the empirical division of the Santomean, this canoe is considered small. The owner reported that the canoe was already 8 years old. The vessel's state of preservation was poor, with a large 19 cm hole in the bow, as well as over a dozen patches made of plastic and air chambers stretched and nailed to the hull. Additionally, there was a large hole in the stern, which was covered with a plastic patch. The boat had three benches, fixed from starboard to port, with some nets and fishing ropes underneath. The front bench appeared larger, but there was a reason for this. The fishermen manoeuvre the canoes from the stern and store their catch in the bow. The bench serves as a storage unit, with another plank underneath that closes off the forward area near the bottom. We learned an interesting detail about this canoe: the owner, who used to go out alone or with just one other fisherman, was forced to take on an extra helper, he admitted that it used to be a child. The task assigned to him was to continuously remove water from the bottom of the dugout canoe while it was on routine work on the craft. Smaller canoes typically have a crew of one person, with a maximum of two. On the other hand, larger canoes can accommodate up to ten crew members.

According to Béat Arnold, the typology of the object appears to correspond to type A-1/20 (Arnold, 1996:11), with a gunwale added later in its use. These pieces also reinforced the bulwark area and ensured better fastening of the planks that made up the benches.

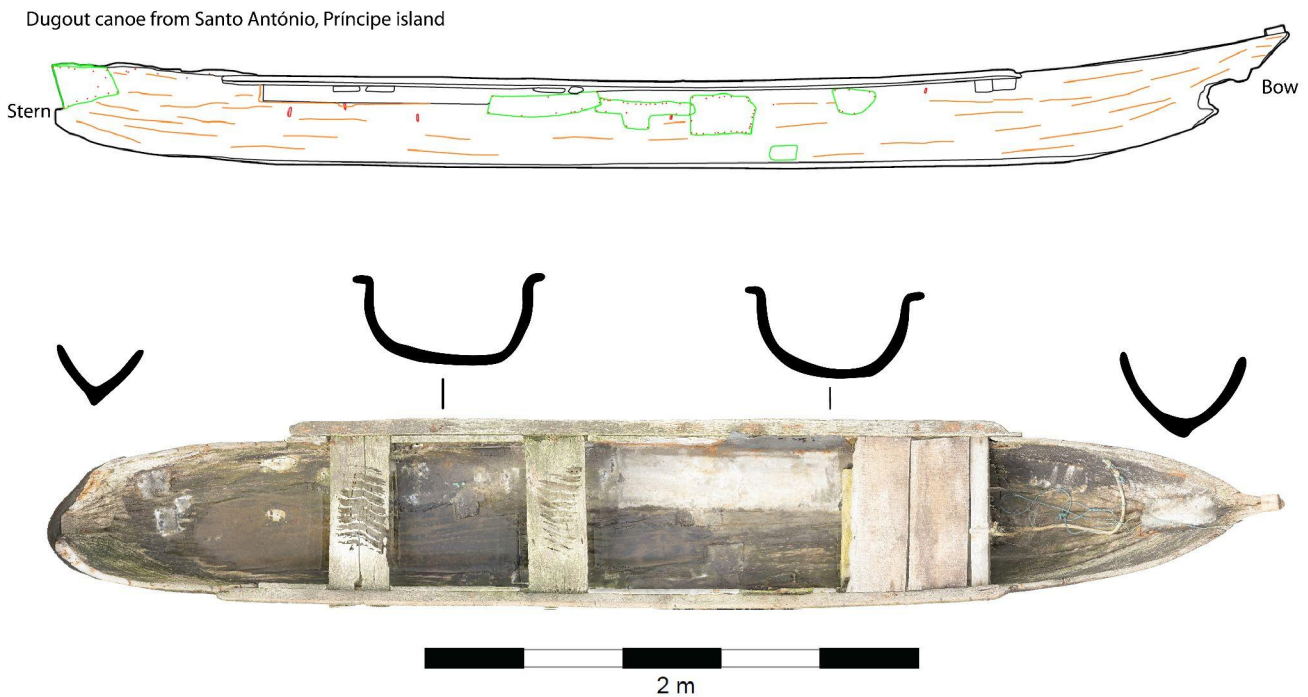


Fig 10. Vectorial and photogrammetric record, with the sections of dugout canoe from Santo António (Príncipe island).

### 3. Santomean dugout canoes as an element of the Maritime Cultural Landscape

Canoes are an essential aspect of life in São Tomé and Príncipe, used and referenced in various situations and contexts. It is important to note that this is an objective evaluation and not a subjective one. Dugout canoes are the primary means of subsistence for approximately half of the population, with the other half dependent on agriculture, including the cultivation and harvesting of fruits and vegetables, and to a lesser extent, livestock. The archipelago's many activities are only possible with the use of canoes. The population of São Tomé and Príncipe has had to find water transport solutions due to the geographical location and natural conditions. These solutions not only link villages but also provide access to fishing and cultivated areas in the forest, where wood is obtained for various activities and hunting is practiced. Currently, most of these journeys are made on foot, or by motorbike or car for those who have the means.

In São Tomé and Príncipe, the only traditional boats are dugout canoes. Hybrid boats, known as *praos*, are also used. *Praos* are constructed using fibreglass or laminated wood panels and have a smaller side overhang attached to the main hull, which provides stability. Some *praos* are equipped with an outboard engine of 15 to 25 hp for added stability (Porriños, 2018:13). Finally, in addition to the boats described above, there are also fibreglass boats which have become ubiquitous in the archipelago. These boats were imported and introduced by MARAPA approximately 20 years ago. One of the prototypes comes from Canada and the other from Japan. In both cases, the use of a stabiliser, locally known as "*balanço*", which is nothing more than an extension of the main boat that gives it more stability, has been adopted. The result is very similar to the canoes used in Polynesia or Indonesia. As far as small boats are concerned, there are no other types of boats, nor is there any distinction between boats used on the river, at sea or in the mangroves, since canoes are versatile enough to meet all needs. Today, in São Tomé and Príncipe, there are practically no canoes on the

island's inland waterways, only in the Malanza mangrove. The community makes an empirical division, logical and simple, which relates the size of the boats to the distance they operate from the coast, being larger the further they are from the coast. The trips are usually short, up to about 2 or 3 miles from the coast, and when they are longer, they are always around the islands, up to a maximum of 30 miles.

Currently, there are more fibreglass boats than dugout canoes in the archipelago. However, the poorer sections of the population still use dugout canoes. In Príncipe, approximately 77% of the vessels are dugout canoes, while only 8% are fibreglass boats (Porriños, 2018:13). Our findings in the fishing communities indicate that the construction of dugout canoes has decreased in recent years for three reasons. Firstly, deforestation is increasing, particularly in areas adjacent to fishing villages and along the coast where fishermen live and work. This is due to the overexploitation of forest resources over the last few decades, primarily for building and repairing dugout canoes, furniture, and houses. In São Tomé, traditional houses are made of wood rather than masonry. Secondly, the younger generation lack of interest in traditional dugout canoe building methods, and, at the same time, a lack of knowledge transmission from older to younger generations. Thirdly, in recent years, government agents and several NGOs have made efforts to promote environmental sustainability (Carvalho, 2019:58), which has yielded some positive results already. The introduction of fibreglass boats, although more expensive, has led to a decrease in the construction of dugout canoes. Fibreglass boats are considered safer, more durable, and have a greater load capacity for both people and goods. This, combined with the effort mentioned, has created a dichotomy as observed<sup>[13]</sup>. Investment in training young people in fibreglass boat workshops was driven by increasing environmental awareness and greater concerns for the safety of fishermen, leading to the effort to introduce fibreglass boats. For these new generations, dugout canoe shipbuilding technology is a thing of the past.

The dugout canoes in São Tomé incorporate multiple taskscapes (Ingold, 1993), including their construction, transformation, uses, functions, and roles. A task landscape is formed by a series of tasks associated with it, just as a landscape is formed by a series of resources associated with it. Dugout canoes serve more than just transportation purposes for Santomans. They are commonly used for fishing, both near the coast and on the high seas, during the day and at night. Additionally, they can be used for transporting goods and people, particularly in the tourism industry. The taskscapes in question include a maritime cultural landscape, as defined by Westerdahl (1992; 2011).

Dugout canoes are used for various tasks and experienced differently by people. Analyzing the tasks performed by the canoes can provide insights into the community that created or transformed them, as well as the environment in which they operate. Dugout canoes connect people to specific tasks and places (Ingold, 1993:172). Before the existence of the road network, canoes provided an essential service in the agriculture of São Tomé and Príncipe. They were used to transport products and people along the coast.

Crafts, like many other things, have a temporal dimension. They are built and undergo wear and tear caused by use and the environment, and may even undergo repairs during their useful life until they become obsolete. It raises the question of whether a craft can still be considered the same when it undergoes repairs and some parts are replaced with new ones.

Ransley (2011) argues that despite no longer fulfilling its primary function, a boat remains a boat. Velásquez (1959) contends that a vessel built in the same manner for decades or centuries carries with it a tradition that unites the present and the past. However, an object can be replaced numerous times and still retain its presence throughout the ages. Each 'reincarnation' carries the image that guided previous generations in its construction (Shils, 1981:81). Crafts serve as



links that connect people to their past, as witnesses to history and change. After the aquatic phase of its life, a dugout canoe from São Tomé and Príncipe can be repurposed as a bench, flowerbed, or storage space (Fig. 11).



Fig 11. Different ends for dugout canoes after their life in the water (Photos: G.L).

In Africa, as well as around the world, canoes serve not only as a means of transportation but also as aesthetic and even cult objects. For the Fanti people in Ghana, canoes are not only a means of subsistence but also a gathering place for storytelling, singing, and community festivals (Coronel, 1979:54–55). The construction and use of canoes hold mystical and spiritual significance. In some countries, there are superstitions, rituals, and amulets associated with this ancient practice<sup>[14]</sup>. Symbolically, canoes, the sea and rivers provide a sense of identity and belonging to a particular community as they shape the landscape and cultural practices (Hoffmann, 2002:120; Oslender 2002:93). Each type of craft indicates the maritime character of a community.

Dugout canoes are constructed and maintained exclusively by men. Fishing is predominantly a male occupation, particularly the sea-based part, with limited female participation. Although historically, some women used to assist their fathers during childhood, and presently, some accompany their husbands, their contributions are often overlooked. However, upon arrival of the catch ashore, female contributions become vital. It is the *palaiês* who transport, sell, clean, preserve, and dry the fish. The fish is smoked by gutting it and leaving it to smoke on a grill for the necessary time, depending on its size. There is an alternative technique that mainly involves drying and salting the fish.

## 4. Conclusions

The purpose of this article is to document the traditional construction process of dugout canoes from the islands of São Tomé and Príncipe, as well as their social significance for contemporary fishing communities. Dugout canoes are used by these communities in various aspects of their daily lives, enabling them to live on the boundary between land and sea.

It can be concluded that the construction of dugout canoes in São Tomé and Príncipe has remained largely unchanged since the 16th century. The shape, design, and size have remained almost the same, with only minor technical changes such as the use of mechanised tools and logistical changes due to the almost complete mechanisation of transport. Additionally, far fewer canoes are now built in the traditional way than in previous decades or centuries. There are four main reasons for this decline. The first reason, which is probably the most significant, is the gradual replacement of traditional dugout canoes with more robust, durable, and profitable fiberglass boats. The second reason is the government's concern for the environment and the sustainability of São Tomé's ecosystem. The third challenge is the difficulty of sourcing high-quality raw materials in close proximity to construction sites. This is a result of decades, if not centuries, of over-exploitation of vegetation cover. Additionally, younger generations appear to have lost interest in learning the techniques of this type of construction. This may be due to a desire to work in other sectors of the economy or because the skill is considered obsolete. Of the three builders we spoke to, only one is sharing his knowledge. It is important to note that the fiberglass boat building workshops are very active, with young students comprising the majority of the workforce. Paradoxically, dugout canoes continue to coexist with modern society due to the persistence of older generations and a few young people who insist on building them. As a result, canoes still dot the landscape, scattered across beaches and fishing communities.

The authors attempted to explore the technical, social, economic, and magical-religious aspects of dugout canoes in Africa from their first descriptions to the present day. Taking a macro view of the construction of Santomean dugout canoes, particularly on the West African coast, reveals some differences, but the construction process and general shape remain the same (Froger, 1699:16). The primary distinction lies in the type of wood utilised, which naturally varies from one region to another. These and other particulars are significant not only for differentiating between dugout canoe families, but also, to some extent, for hypothesising about the transmission of technical knowledge. The purpose of this statement is to highlight that a traditional dugout from São Tomé and Príncipe may have slight differences in design, size, and materials compared to one built in another country in the Gulf of Guinea. However, they share many similarities.

The evolution of concepts and techniques is determined by the binomial space-time. Factors such as navigation conditions, available tree types, builders' technical skills, and others contributed to the proliferation of small nuances in the construction of dugout canoes on the West African coast. However, the methods of designing and constructing dugout canoes are certainly very similar because their genesis was the same many centuries ago somewhere on the African continent. The advances in technology and conceptual changes have travelled during the thousands of journeys made between different points of the African coast and from there to the islands of the Gulf of Guinea. Therefore, we plan to replicate this approach in other Gulf countries, including Gabon, Equatorial Guinea, Cameroon, and Nigeria, to confirm or refute the hypothesis of kinship in canoe construction along the Gulf of Guinea coast.

Despite the detail of the contemporary descriptions, there are still many questions to which there are no answers and no scientific basis. Indeed, the ethnographic literature and the scarce iconography of the period in which dugout canoes can be seen may have influenced scholars' thinking and even knowledge about canoe building in general and in Africa in particular. In any case, the evidence suggests that canoes have played an important role in the history of coastal, lake



and riverine communities. Several millennia ago, waterborne transport enabled human expansion and diaspora across the planet. Since then, a wide range of different types of craft, boats and vessels have been used for a variety of activities, including trade, fishing, transport and warfare. Although the construction and use of dugout canoes is now declining, they remain a feature of the coastal landscape of West Africa, mainly due to their use in fishing, the main livelihood of these communities.

Currently, the space available for fishermen, canoes, and life is diminishing. While fibreglass boats are a safer and more durable alternative, they remain more expensive and inaccessible. In communities, families pool their resources to purchase a boat and share the catches. The trees that are most suitable for building dugout canoes have moved further inland, increasing the distance required to reach them and limiting the use of vehicles for transportation. Internal combustion engines have increased transportation distance and safety, but they cannot be repaired locally, and fishermen rely on second-hand imports from Nigeria or Angola. Despite this, they continue to shape the physical and cultural landscape of São Tomé and Príncipe.

Dugout canoes remain ubiquitous in the country, serving as a means of transportation for people and goods on rivers, at sea, and in mangroves. They can be seen resting upside down on beaches, in houses, on balconies, and on roofs. They are often left on beaches when the tide goes out or anchored while fishermen prepare their gear. Over time, they become covered in dirt and weeds and may end up near kitchens or fireplaces. Some are fortunate enough to be repurposed as benches or beds. Dugout canoes in São Tomé and Príncipe are an integral part of society. They are not objects or things, they are beings.

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## Endnotes

1. São Tomé and Príncipe has one of the densest and most biodiverse forests in the world. The island of Príncipe has been a UNESCO World Biosphere Reserve since 2012.
2. The term 'canoe' or 'dugout canoe' is used in this text because it is the word used by the locals.
3. We are referring to the canoe found in 1987 in Dufuna (Nigeria), near the Komadugu River Ghana, close to Lake Chad, by a Fulani herdsman while digging a small well. The archaeological excavations took place between 1989 and 1990 and were carried out by a Nigerian-German team (University of Maiduguri and University of Frankfurt). It was 5m deep, 8.4m long, 50cm wide and 5cm thick. The canoe was found in a sandy and waterlogged sediment, in an anaerobic environment, which maintained its state of preservation. Radiocarbon dating suggests an age of around 8500 years. The canoe is currently preserved and displayed at the Damaturu museum in Yobe State, Nigeria (Adewumi, 2014, pp. 1–12)
4. At Axém, Winneba and also on the coast of Senegal, Barbot documented the use of sails by the natives, which were made of cloth, an idea perhaps copied from the Portuguese, and whose pole and mass would allow limited movement in very strong winds; in 1841, the canoes of Fernando Pó Island used sails made of vegetable fibres attached to reeds; the Yoruba on their lakes used branches with woven palm leaves and were turned as needed (Smith, 1970, p. 519).
5. *As viagens de Luís de Cadamosto, Esmeraldo de Situ Orbis*, Duarte Pacheco Pereira, *Description and Historical Account of the Gold Kingdom of Guine*, de Pieter de Marees, *Description de l'Afrique*, de Olfert Dapper ou ainda *A New and Accurate Description of the Coast of Guinea, Divided into de Gold, the Slave and the Ivory coasts*, de Williams Bosman, among others.
6. Fernandes (?) describes huge canoes in the Sierra Leone River that carried 120 warriors; Hawkins describes painted canoes in the Sherbro region that carried up to 60 people in calm waters; Pacheco Pereira mentions that in the Real River (in the eastern part of the Niger delta) there are canoes carved from a single trunk that can carry 80 men, and Dapper adds that some had kitchens, small storerooms and even sleeping quarters; Barbot mentions that they were between 20 and 25 m long and 2 to 3 m wide, with pointed ends (double bows), with benches for the rowers; some also had a kind of deck made of reeds; engraving by Fo'castles from 1830 in the Niger delta, where 22 men can be seen rowing, two at the bow and two at the stern, and in the middle of the boat there is a small platform with three warriors standing armed. In the upper reaches of the Niger, where there are huge trees, three large logs were occasionally joined together with ropes (Smith, 1970, p. 518).
7. For the island of São Tomé, see Regiment of Dom Manuel to Manuel Pacheco and Baltazar de Castro, dated 16 February 1520 (Brásio, 1952, pp. 431–440). For the island of Príncipe, see "*Ordenação Manuelina sobre o trato, de 28 de Junho de 1514*", which indicates that the island of Príncipe was part of the slave route for supplies (Brásio, 1954, pp. 70–83).
8. The best known case was the slave depot at the castle of Elmina or São Jorge da Mina castle in present-day Ghana (Barbot, 1732, p. 156).
9. Maritime and Port Institute of São Tomé and Príncipe.
10. In a completely different geography, but with the same aim, in Suriname the canoe builders submerge the canoes in the river while they are still partially cut, in order to make the wood more robust and to combat the micro-organisms that usually appear (Price and Price, 1991:411).
11. During our mission we did not see any canoe of these dimensions.
12. We did not find a translation for this type of tree.
13. On the island of Príncipe, in the last decade, several protectionist measures have been adopted, such as the fact that for every tree cut down it is mandatory to plant five; only certain professions can cut down trees (locksmiths, carpenters, shipbuilders, cabinetmakers, and few others). These measures were pushed by the Prince Trust Foundation and the South African company Here Be Dragons (HBD), but the regional government had been pursuing such policies for some time.
14. In Ghana, before the tree is cut down, a libation is made at the base of the trunk, which is meant to please the tree. At the same time, for the natives, trees are living beings that possess spirit and gender. A male tree will give birth to a male canoe, the same for the female gender. The gender of the canoe is also reflected in its behavior, that is, the male canoes are stronger, more resistant, and with them you always catch more fish (Verrips, 2002, pp. 47–48).

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