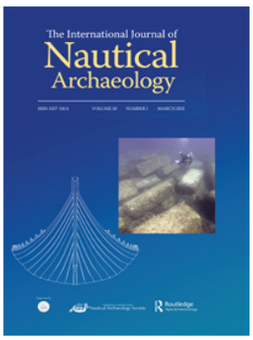

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Contemporary Wooden Watercraft of the Zanzibar Channel, Tanzania: Type and Technology, Continuity and Innovation

John P. Cooper [a], Lucy Blue [b], Alessandro Ghidoni [a] and Elgidius B. Ichumbaki [c]

[a]Institute of Arab & Islamic Studies, University of Exeter, Exeter, United Kingdom; [b]Centre for Maritime Archaeology, Department of Archaeology, University of Southampton, Southampton; [c]Department of Archaeology and Heritage Studies, University of Dar Es Salaam, Dar Es Salaam, Tanzania

ABSTRACT
This article documents and presents the range of wooden fishing and cargo-carrying watercraft in use in the contemporary Zanzibar Channel, Tanzania. The work is based on surveys conducted in 2018 on Unguja, the principal island of the Zanzibar archipelago, and in 2019–2020 in Bagamoyo, mainland Tanzania, and its immediate environs. The authors present a broad typology of the principal wooden vessel types in the form of 3D photogrammetric models, orthographic views, and photographs. The principal construction features and uses of each type are presented and the state of play of contemporary wooden-boat construction in this part of East Africa discussed.

KEYWORDS
Zanzibar; Bagamoyo; dhow; wooden watercraft; boatbuilding; fishing

A broad range of wooden watercraft continue to be found today on the Zanzibar Channel, Tanzania, with a vibrant carpentry tradition able to draw upon Tanzania's rich forestry resources. Many, though by no means all, continue to be propelled by the settee sail that is conventional for the region, while more recent watercraft innovations, such as the *ngwanda* and *boti la mtando* fishing craft, have come about in response to the increasing accessibility of the outboard engine (Breuille & Grima, 2014, p. 14).[1] Wooden cargo vessels also continue to ply these waters, including large sailing *mashua*s – backed up with outboard motors – that carry timber and foodstuffs between mainland Tanzania and Unguja, the principal island of the Zanzibar archipelago. Somewhat rarer are the larger sailing *jahazi* and inboard-engined *bumu* – cargo vessels that generally put in only at deeper-water ports such as Dar Es Salaam and Zanzibar's Stone Town.

The aim of this article is to document and characterize this diverse array of wooden watercraft. This process includes, in most cases, recording their structure, largely through 3D photogrammetry and resulting orthographic presentations and 3D PDFs, as well as identifying their place in the fishing and/or cargo economy, and their commonly given Swahili names. We also assess the socio-economic foundations of the watercraft economy and, briefly, assess the pressures that will determine the fate of these vessels into the future. Noting the many changes affecting the makers and users of contemporary wooden watercraft, one harbour manager on Unguja told us: 'They should be documented, so that people in 100 years' time can see what the place was like'.[2]

Research Background and Objectives

This article constitutes one part of the outputs of three seasons of fieldwork conducted on the shores of the Zanzibar Channel between 2018 and 2020. Collectively, the seasons took the authors to sites mainly on the west coast of Unguja, and to the waterfront of the town of Bagamoyo, and its nearby villages of Mlingotini, Mbegani, and Kaole, all on the mainland in the Bagamoyo District of Pwani region (Figure 1).

Since the principal objective of this article is to document the wood-based watercraft types of the Zanzibar Channel, the social, economic, and cultural setting of these vessels within the lives of the people who make, use, and depend on them is somewhat backgrounded: other publications – on individual builders and construction processes, and on maritime heritage issues – are also in preparation, and should go some way to addressing these aspects of social life, although we can never pretend expertise in the lives of others. What we do offer, for several of these craft, is the first-ever detailed academic documentation of maritime technologies upon which so many livelihoods depend, and which are often objects in the abstract of so many fisheries and development policy documents. We also discuss the uses to which these wooden craft are put, and reflect on the factors that

CONTACT John P. Cooper j.p.cooper@exeter.ac.uk Institute of Arab & Islamic Studies, University of Exeter, Stocker Road, Exeter, Devon, EX4 4ND, UK

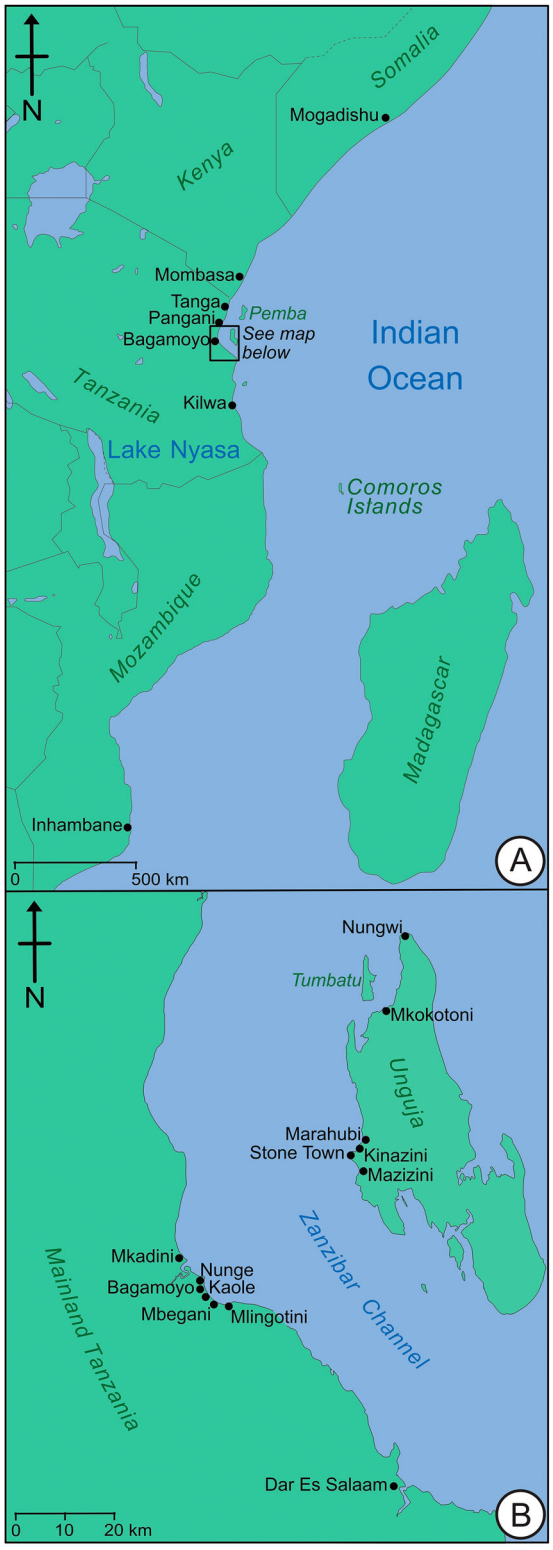

Figure 1. (A) Map of East Africa with inset (B) showing the area of the Zanzibar Channel and locations mentioned in the text (Image: John P. Cooper).

have conspired to keep them functioning within the small-scale maritime economy.

Methodology

Rapid advances in the quality, cost, and accessibility of 3D photogrammetry as a recording method in the past decade have had a transformative effect on what relatively short ethnographic or archaeological field seasons – constrained by time, funding, and distance – can achieve in terms of the detailed survey and documentation of material culture (Douglass et al., 2015). For the purposes of the present article – although not for those of the underlying research projects as a whole – 3D photogrammetry forms a key data-gathering technique. The speedy and relatively discreet use of a digital camera in the field enabled nine photogrammetry surveys of *in situ* watercraft to be conducted, among other activities, enabling the relatively detailed documentation of eight discrete vessel types, in a manner not previously achieved in Indian Ocean nautical field surveys. These were conducted using a Nikon D3100 digital SLR or a Sony Cyber-shot DSC-RX100 II compact camera – and the results processed using Metashape Pro photogrammetry software.[3] This enables the creation of 3D point clouds and mesh and photorealistic models of the watercraft, some of which are presented as supplementary materials alongside this article; the orthographic views of the vessels presented here are also derived from them.

The centrality of 3D photogrammetry in producing the visual record in this article does not gainsay the role that more conventional ethnographic enquiry played in developing our understanding of the craft. Our appreciation of their history, use, and socio-economic context grew through interview of, and observational engagement with, a number of boatbuilders and users in coastal Unguja, Bagamoyo, and Mlingotini who generously shared their expertise with us. Access to informants was sometimes cultivated through the existing networks established by those of the authors, as well as other colleagues and collaborators, who were already established in the locale, and sometimes through walk-up self-introductions where we saw nautical activities under way. In both scenarios, our interviewees often facilitated further contacts with knowledgeable people, in a snowballing fashion. Interviews were semi-structured, and recorded through note taking and sometimes, where permission was granted, through audio or video recording. Participation was always voluntary, and based on informed consent: interviews, observation and, in some cases, our participation were guided by the principles of the 'art of listening' that is gaining recognition in archaeological and heritage field studies (Schmidt, 2016, p. 84; also see Schmidt & Kehoe, 2019 and papers therein).

Biological species identifications in this article – principally trees and fish – have been made by comparing Swahili terms we gathered through interview with published literature linking those terms with scientific names. No direct material analysis or species identification was conducted. Timber identifications

draw chiefly upon the works of Mbuya et al. (1994), Weiss (1973) and Aldrick (1990, noting Walsh's (1992) caveats), while those of fish draw upon Frankl (2002), Thyresson et al. (2013) and Moshy and Bryceson (2016, p. 4).

East African Watercraft in Academic Writings

European colonialism has cast a long shadow over Western academia's treatment of the nautical technological heritage of Sub-Saharan Africa. The principal impact has been the omission of this heritage from the scholarly record, the result of a dearth of outsider scholarly curiosity – and sometimes, indeed, scorn – for the indigenous technical knowledge and practice of this vast region, and a failure to engage with indigenous knowledge. François-Edmond Pâris, one of the first European practitioners of what subsequently developed into the discipline of maritime ethnography, denigrates 'the peoples of Africa' in the opening paragraph of the very brief Africa section of his 1841 *Essai sur la Construction Navale des Peuples Extra-Européens* in a manner that does not merit repetition. 'It is therefore not surprising', he continues with breathtaking contra-factuality, 'that, among them, seafaring remained a complete naught' (Pâris, 1841, p. 1.6).[4] James Hornell, a prolific nautical ethnographer of the Indian Ocean and elsewhere, sustains this disdain for African nautical capabilities into the twentieth century, even when venturing to write about African boatbuilding crafts (1943, pp. 10, 17, 22–23). What is certainly not surprising is that such impaired scholarly perspectives have left a want of publications on the subject: some 160 years after Pâris' *Essai*, Seán McGrail's landmark (2001) synthesis of global nautical archaeological research, *Boats of the World*, still could not assemble from the scholarly canon a section on Africa other than (ancient) Egypt.

Where Western scholarly interest has alighted on East Africa's nautical practice, it has often been in pursuit of 'exotic' technologies, such as outriggers and sewn construction, which were then interpreted within a diffusionist schema. It is for precisely this reason that, of all the vessel types discussed in this article, it is the double-outrigger *ngalawa* that has attracted the greatest attention (Haddon, 1918, p. 49; Hornell, 1920, p. 134, 1943, pp. 22–23, 1944a, pp. 3–4, 1944b, pp. 170, 181–185; Morgan, 1940, p. 28; Prins, 1959, pp. 207–209; Robinson, 1937, pp. 65–67, 69–70; Warrington Smyth, 1906, p. 315).[5] Likewise, outsiders have often approached the existence of quite large sewn vessels in East Africa into the twentieth century – most famously the *mtepe* and *dau la mtepe* – as a local manifestation of a wider western Indian Ocean tradition, with origins elsewhere (Hornell, 1941, pp. 65–66, 1942, pp. 35–36; Lydekker, 1919, pp. 90–91; Prins, 1959, pp. 210–213). In any case, the existence of these and other substantial studies on East Africa's sewn-boat technologies (Adams, 1985; Gilbert, 1998; Prins, 1965, pp. 120–128, 1982, 1986, pp. 64–92), together with Abdul Sheriff et al.'s *mtepe*-reconstruction project (Sheriff et al., 2006), throws into relief the lacunae elsewhere that this article seeks to address: the relative lack of work on ostensibly-more-mundane dugout and nailed-plank boats of the region.

Another vein of nautical research in East Africa has focused on the monsoon-driven 'dhow trade' – the movement of larger, ocean-going cargo sailing vessels between the region, Arabia and South Asia. John Jewell's works on the dhows seen at Mombasa, Kenya, (1969, updated 1976) are primarily a typology of large sailing vessels visiting the port from Arabia and India: the only contemporary indigenous vessels they mention are a variety of coasting 'dhow' from Lamu plus, historically, the *dau la mtepe* (1969, pp. 68–71, 76–77, 1976, pp. 82–89). Important works, such as Esmond and Chryssee Martin's *Cargoes of the East* (1978), Abul Sheriff's *Dhow Cultures of the Indian Ocean* (2010) and Gilbert's *Dhows and the Colonial Economy of Zanzibar, 1860–1970* (2004), focus more on the economic and cultural aspects of this ocean-wide trade: smaller local watercraft are mentioned only in passing, if at all, and none of these works engage with the intricacies of type.

A step towards identifying some variety in the region's indigenous craft, albeit from earlier times, was taken by Garlake and Garlake (1963) in their analysis of ship and boat engravings from the region. But it was A.H.J. Prins who took the path to a more engaged perspective on contemporary East African nautical practice in his pioneering 1965 anthropological work, *Sailing from Lamu*, which investigates the maritime lives of the people of that archipelago. Watercraft technologies are not his focus *per se*, but Prins does undertake a short textual survey of the variety of fishing and cargo vessels to be found at Lamu (1965, pp. 73–86) – briefly citing the *mtumbwi*, *ngalawa*, *hori, mashua*, and *dau* discussed below – while going into some detail on the sailing Lamu *jahazi*, a flat-bottomed '*dau la mataruma*' not found in our research area, and the historic sewn *mtepe* (1965, pp. 87–128). Rose de Leeuwe's subsequent work (2004, 2005, 2006) on the boatbuilders of Nungwi, at the northern tip of Unguja, brings new levels of detail to the study of at least some of the vessel types found today in the Zanzibar Channel: her detailing of the construction of a sailing *mashua* fishing boat – a type documented below – is particularly relevant to this article. Finally, we note Falck's 2014 article, in this journal, on boats and boatbuilding in Dar Es Salaam and on Unguja. While Falck does dedicate a section to dugouts generally, he focuses primarily on the

ngalawa, mentioning other types only in passing; equally, his discussion of plank-built vessels is dedicated largely to following the construction of a transom-sterned 'dhow' [*sic*], again at Nungwi, rather than assessing variety. It is this particular lacuna around type and variety in the Zanzibar Channel that we in turn seek to address.

Contemporary Watercraft and Their Economic Functions

The vast majority of wooden watercraft operating in the Zanzibar Channel today are small fishing boats operating in relatively shallow waters. Most fishers continue to use the sail, out of economic necessity rather than choice. The majority of those who can afford a boat use a dugout *ngalawa* (Sw. pl. *ngalawa*), although some use the dugout *mtumbwi* (Sw. pl. *mitumbwi*).[6] Medium-sized, plank-built fishing craft such as the *mchoro* (Sw. pl. *michoro*) and in some cases the *mashua* (Sw. pl. *mashua*), together with the larger *mtumbwi*s, continue to rely on sail, although the *mashua* and some of these *mtumbwi*s often combine sail with outboard engine power. The gradual adoption of the outboard engine – by those who can afford it – has meanwhile become key to the expansion of seine-netting fishing practices. This is conducted from larger *mtumbwi*s, and has also contributed to the emergence of two new vessel types: the sail-less *ngwanda* and *boti la mtando*, which usually work in concert in purse-seine netting around the fishing banks of the Channel. Sail-only vessels depend principally on varieties of gill or tangle netting. Fish traps (*dema*) are set from larger *mtumbwi*s and some *ngalawa*s in areas of sea grass and near reefs, while the owners of some *ngalawa*s, smaller *mtumbwi*s, and the so-called *mitumbwi ya Nyasa* ('(Lake) Nyasa *mtumbwi*s) fish by long-line.

A further group of larger wooden watercraft continue to operate in the coastal cargo trade, mostly linking the main islands of Zanzibar to each other and with the mainland. For the most part, these operate on a contracting basis, carrying timber, eucalyptus poles and foodstuffs to the islands, and returning – at least on the Unguja-to-Bagamoyo run – with hundreds of 20-litre containers of cooking oil and other products. The cargo-carrying *mashua*, with its relatively broad beam and shallow draught, is the most widespread of these, being able to put into shallow roadsteads such as that of Bagamoyo where the larger *jahazi* and *bumu* cannot venture. The latter are restricted to operating through bigger ports such as Dar Es Salaam and Stone Town, Unguja. Tourism has come to play a further role in the economy of contemporary watercraft, particularly on Unguja. The plank-built *ngwanda*, developed for the outboard engine, has proved useful for day-tripping, for example to sandbanks and reefs for snorkelling or diving, and has been adapted with seating, awnings and small sun decks. Tourist outings on *ngalawa*s and other sailing vessels tend to be on a more *ad hoc* basis but do take place. Meanwhile the 'instagrammability' of the aesthetic of the region's sailing vessels delivers financial benefits to international tourist operators – and social media companies – that local people never see.

The Watercraft

The following is a type-by-type overview of the principal wooden vessels of the Zanzibar Channel encountered during the 2018–2020 surveys. We begin with dugout vessels, and move on to plank-built craft, not to imply an evolutionary progression from one to the other, but to reflect the fact that these two broad groups of vessels are built by different builders, who usually specialize in one or the other. In establishing what constitutes a 'type' and its name, we have been guided by the insights of the local fishers and builders we interviewed: we admit, below, the limits of our understanding where we are aware of them, but are also cognizant that a far greater expertise resides within that community than we could glean during our relatively short exposure. Our hope is that community members can recognize their knowledge in our attempt to represent it. It also should be caveated that informants might, legitimately, use more than one name in referring to the same vessel type, depending on their individual preference. Meanwhile, generic words such as *chombo* (pl. *vyombo*), meaning 'vessel', can apply to any marine craft; the term *boti* (pl. *maboti*), derived from the English 'boat' likewise has a broad application, particularly referencing motorized craft. Finally, the word *dau* – a cognate of the English 'dhow' – might be used for any vessel with a raking prow, regardless of its construction method or other features.[7] Its usefulness to outsiders in distinguishing an individual type is therefore limited (*cf.* Falck, 2014, pp. 167–171). Meanwhile it should be observed that the very nature of artisanal building allows for ongoing variety, improvisation, experimentation, and individuality of expression that a static and potentially reifying typology inherently fails to embrace: we came across several unique 'outliers' during our surveys that conform to none of the broad types we outline.

Dugouts

A relatively ready supply of substantial trees in the coastal hinterlands – in recent times chiefly mango (*mwembe*; *Mangifera indica* [Aldrick, 1990, p. 18; Mbuya et al., 1994, p. 41]) and cashew (*mkorosho*; *Anacardium occidentale* [Mbuya et al., 1994, p. 39])

– allow boat carvers on Unguja and around Bagamoyo to construct a variety of robust dugouts – simple or extended – at relatively accessible cost for inshore fishing using net, line, or trap. These are detailed below, broadly in decreasing order of frequency of occurrence. By far the most prevalent is the *ngalawa*, with its characteristic double outrigger, lobed *kasama* bow timber (discussed below) and settee sail. The second-most common is the *mtumbwi*, an extended logboat usually propelled by an outboard motor, though sometimes still by sail. Other logboat types exist in much fewer number. A small quantity of monoxylic 'Nyasa *mtumbwis*' in Bagamoyo and the nearby Mlingotini Lagoon are used by migrant fishers from Lake Nyasa, and we also saw a handful of examples of what we tentatively identify as *horis*. Finally, the remarkable dugout *mashua ndogo* – a skeuomorph of a transom-sterned, plank-built vessel – challenges easy definitions of plank-versus-dugout construction and raises interesting questions around build concept.

At no point did we meet a maker (*fundi*, pl. *mafundi*) of dugouts who had also built a plank-based vessel – one built around a keel, framing timbers, and bent planks – nor a builder of plank vessels who said they had built a dugout. The two skill sets are so distinct from each other as to normally reside discretely with separate individuals. Indeed, while a *fundi* of plank-built boats talks of 'building' (*kuunda*) a boat, a *fundi* of dugouts speaks of 'carving' (*kuchonga*).[8] Within dugout makers, we met individuals of long experience who had carved only *mtumbwis*,[9] some who had carved only a small number of *ngalawas*, and one who was a carver of the *mtumbwi*, *ngalawa*, and *mashua ndogo*.[10] Moreover, while the plank-boat builders we met all had learned their skills from an older practitioner, we met at least one, exceptionally skilled, dugout maker – Mzee (Mr) Alalae Mohamed – who was self-taught.

We now outline the principal characteristics and uses of the dugout vessels of the Zanzibar Channel.

Ngalawa (pl. *Ngalawa*)

A relatively low-cost vessel that is accessible to all but the poorest fishers, the *ngalawa* is easily the most numerous fishing craft of the Zanzibar Channel, with a distribution that historically has extended far to the north and south of the area that is the focus of this research (Falck, 2014; Haddon, 1918, p. 49; Hatchell, 1961; Hornell, 1920, p. 134; 1944a, pp. 3–4, 1944b, p. 170, 181–185; Ichumbaki et al., 2022; Morgan, 1940, p. 28; Prins, 1959, pp. 207–209, 1965, pp. 80–81; Robinson, 1937, pp. 65–67, 69–70; Warrington Smyth, 1906, p. 315; Wenban-Smith, 1963). The vessel comprises an extended logboat with double outrigger and, in most cases, a settee sail – although a small proportion are supplemented by outboard motor (Figures 2 and 3). *Ngalawas* range in size from less than 4 m in length to around 9 m, with most somewhere in the middle of this range. In contrast to the *mtumbwi*'s flat bottom, the *ngalawa* hull has a U-shaped cross section that means the hull topples easily on shore unless supported by its outriggers. The sides of the hull comprise slab-like plank extensions, while its characteristic bow is formed by attaching an additional bow timber (*kasama*) that fulfils two

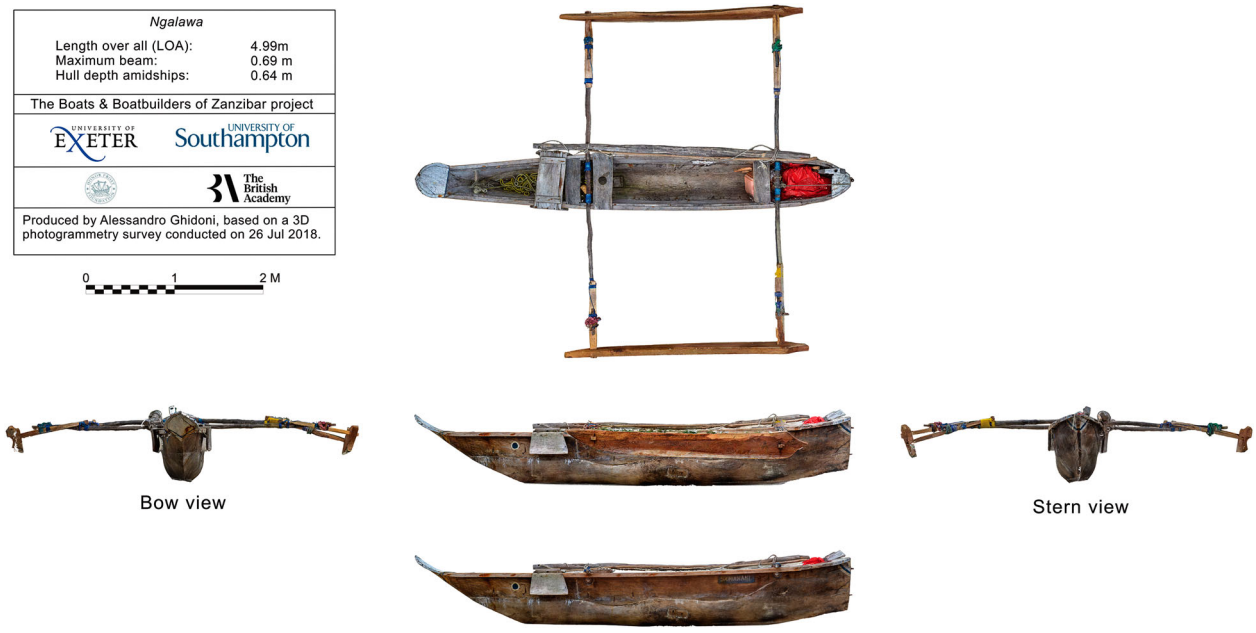

Figure 2. Orthographic views of a *ngalawa* recorded at Marahubi, Unguja, in July 2018, based on a 3D photogrammetry survey (Image: Alessandro Ghidoni).

Figure 3. *Ngalawas* at Bagamoyo: (A) under sail in March 2020, with – unusually – an outboard motor as back-up; (B) crew and helpers hauling out after a fishing trip, August 2019; (C) *ngalawa* paddles, August 2019; (D) a hull lacking the *ngalawa*'s signature fore-wash-strake (*kasama*), February 2020. The red arrows indicate the lobed *kasama* bow timber (Images: John P. Cooper; Lucy Blue).

principal roles. Its main, lower portion forms a horizontally set "V" shape that raises the sheer line of the hull at the bow, continuing forward the work of the side-extension planks. Meanwhile an upward-raking tongue-like lobe protruding forward from it acts as a shield against wash (Figure 3A-B). At the stern, the *ngalawa*'s hull converges to a narrow, straight, almost-vertical face on to which a centre-rudder is hung.

Existing literature might be interpreted as suggesting a growth in the use and spread in distribution of the *ngalawa* since the early twentieth century. Prins (1959, pp. 205–206) places the greatest concentration in his time in the Zanzibar archipelago, saying they were also common in Dar Es Salaam. However, he adds that the vessel was scarce, or even absent, on the Tanzanian mainland coastal around Bagamoyo, Pangani, and Tanga. This is clearly not the case now: statistics from the 2018 Marine Frame Survey, released to the authors by Bagamoyo District Council, show that there were then 187 'outrigger canoes' – that is, *ngalawas* – registered in the town, and we counted more than 120 on Bagamoyo's beach one day in August 2019. This apparent growth runs counter to periodic scholarly predictions of imminent demise (Falck, 2014, p. 172; Hatchell, 1961, p. 211; Morgan, 1940, p. 27).

Interviewees most commonly reported locally sourced mango as the timber used for the main log, extension planks, outrigger floats and thwarts of the *ngalawa*,[11] with lighter cashew used for the *kasama* bow timber. This use of a lighter timber forward, in combination with the carving of the log with the bolus set aft, allows the vessel to sit in the water with a slightly elevated bow, and hence perform better in choppy conditions. Mzee Alalae Mohamed cited other trees as highly valued for construction of the main *ngalawa* log, but hard to source.[12] These included *mkungu* (*Terminalia catappa* [Mbuya et al., 1994, p. 40]), *mkenge pori* (a variety of *Albizia* [Mbuya et al., 1994, p. 39]), *mjani mpana* (literally, 'broad leaf'), and *mg'ong'o* (marula [*Sclerocarya birrea* subsp. *Caffra*] [Mbuya et al., 1994, p. 40]).[13]

A detailed record of the construction of the *ngalawa* has recently been made by Ichumbaki et al. (2022). Initial rough shaping of the main log is nowadays normally done using a chainsaw, with the carver supervising and directing its operator: previously, an axe (*shoka ya kukatia*) and/or adze (*shoka ya kuchonngea*) would have been used at this stage. After rough shaping, these and related hand tools are then used to reduce the log to its final U-shaped cross section and achieve the ultimate surface quality.[14] The *kasama* bow timber (Figures 2 and 3A-B) is carved from a

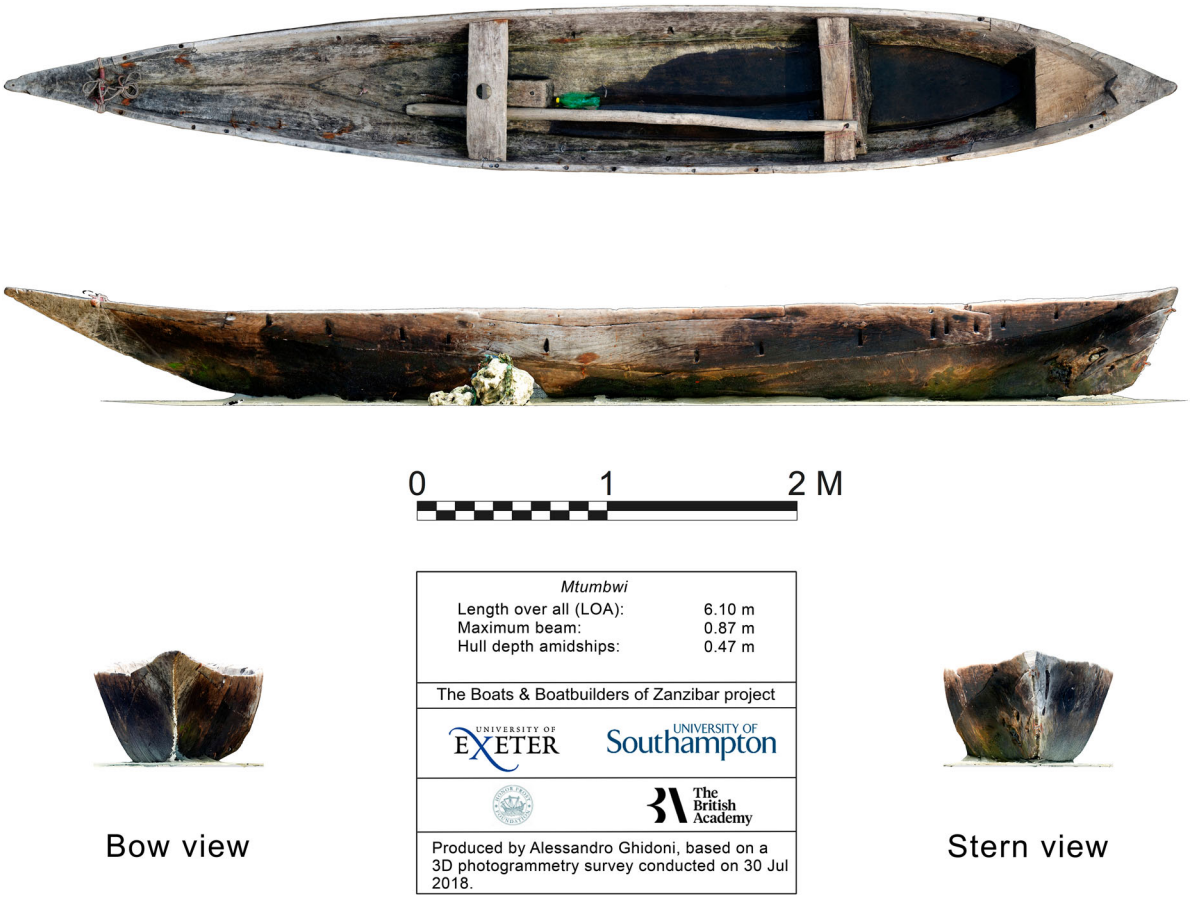

Figure 4. Orthographic views of a *mtumbwi* recorded at Marahubi, Unguja, in July 2018, based on 3D photogrammetry survey (Image: John P. Cooper and Alessandro Ghidoni).

separate log and fixed to the hull. This and the extension planks are fixed to the dugout section by means of nails driven obliquely and downward from the upper timber into the lower without the point re-emerging. Some of the nails are driven from inboard, and others from outboard. Such obliquely driven nails are called *misumari ya kushona*, or 'stitching nails' in Swahili.[15] Where required, the seams are caulked using a locally bought caulking material (*kalafati*) comprising raw cotton (*pamba*) treated with coconut oil (*mafuta ya nazi*).

Despite the general homogeneity in terms of characteristics, if not size, of the *ngalawa* as an understood vessel type, some structural variation does occur along margins. The principal of these is the absence, among a small number of vessels, of the lobe of the *kasama* bow timber: instead, the *kasama* – still separate – is carved to a simple point (Figure 3(D)). Some vessels with this simplified *kasama* are used without sail and instead only paddled: they therefore operate further inshore, and are not prone to the same degree of wash that would occasion the need for a *kasama*: a small number are sailed, nevertheless, and we must put this down to preference. One experienced carver attributed a temporal dimension to this variety, proposing that the lobed *kasama* was an innovation that had come with the conversion of the *ngalawa* to sail.[16] That this is a recent innovation is perhaps born out in the literature: the few published images in scholarly literature from before 1960 encountered during the course of this research show no evidence of the *kasama*, whether on rigged vessels (Madon & Gundevia, 1952, facing p. 92; Morgan, 1940, figs. 1–2, 29, 30, plates between pp. 30 and 31) or otherwise (Forbes-Watson, 1952, pp. 21, 29; Haddon, 1918, figs. 1–2; Hornell, 1944b, p. 174, pl. 1, pl. 3; Madon & Gundevia, 1952, facing p. 58; Warrington Smyth, 1906, p. 315).[17] The earliest published image we found is from Hatchell (1961, p. 210). That said, a pair of photo albums held at the Bait al-Zubair in Oman contain photographs of *ngalawa*s that do have *kasama*s dating from between the 1930s and 1960s (Alessandro Ghidoni, pers. obs.). Meanwhile, on Unguja and at Bagamoyo we occasionally saw a small *mtumbwi* – a vessel that which has no *kasama* – with added outrigger.

With few exceptions, the outrigger of the *ngalawa* comprises two roundwood booms lashed onto two dedicated beams set within the hull. From the booms, two lashed stanchions slope obliquely down to the heavy plank floats which, since they are set onto the stanchions at 90°, sit oblique in the water. This boom configuration is typical of the central Swahili coast (Falck, 2014, pp. 163–164; *cf.* Haddon, 1918, pl. D; Hatchell, 1961, pp. 213–214; Hornell, 1920,

Figure 5. *Mtumbwi* construction features: (A) A recently completed 12 m-long vessel at Bagamoyo, March 2020, with a mast step and lateen rig stored inside, and a small wooden plate forward of the rudder indicating it can also take an outboard motor; (B) note the flat bottom and 'false' inner stem and stern features on this *mtumbwi* at Mlingotini, August 2019; (C) a carver at Marahubi, Unguja, trims a new extension plank while repairing a *mtumbwi*, July 2018; (D) the *c*.60 mm-thick base of a broken *mtumbwi* at Kaole, August 2019—note the dowel hole; (E) 'stitching nails' used to affix the extension planks to the base, Marahubi, Unguja, August 2019 (Images: John P. Cooper).

Figure 6. *Mtumbwi*s in use: (A) carrying crates of tomatoes up a creek at Kinazini, Unguja; (B) returning with fish traps at Mkokotoni, Unguja, (C) ring-netting off an inshore reef at Bagamoyo; (D) long-line fish hooks arrayed on an inwhale at Marahubi, Unguja (Images: John P. Cooper; Alessandro Ghidoni; Lucy Blue).

p. 138, 1944b, p. 174; Morgan, 1940, plate facing page 30), and contrasts with a configuration reported from northern Kenya and in northern Mozambique, where the stanchions are (or were at the time of these publications) set at 90° to the booms, with the float flat on the water (Haddon, 1918, pl. D, figs 1–2; Hornell, 1920, p. 138, 1944b, pp. 170–173; Von Luschan, 1897, plate XXVII, fig. 2g).

Overwhelmingly, the *ngalawa* is propelled using a settee rig, and is steered using a centre-rudder attached by gudgeons and pintles. Its large expanse of sail relative to hull size means it can sail in light winds, close to the wind (although it is prone to leeway) and reach high speeds in strong winds (Hatchell, 1961, pp. 211, 215; Ichumbaki et al., 2022; Morgan, 1940, pp. 33–36; Wenban-Smith, 1963, p. 166). Although adaptation to outboard motor is a practice of long standing (Hatchell, 1961, p. 215; Wenban-Smith, 1963, p. 166), fishers rarely do it, largely because of cost. Paddles (Figure 3C) and punting poles are used for close manoeuvring.

Fishers use the *ngalawa* for a variety of types of net and line fishing depending on season. One of these is gill netting, using nets that vary in length between 350–1000 m and in depth from 1.6–3 m. When the season is promising for larger fish, fishers use multi-hook long lines (*zurumati* or *kaputi*) or single hooks (*mshipi*, pl. *mishipi*). Some fishers also use *ngalawa* to set and monitor *dema* fish traps (*cf.* Prins, 1965,

Figure 7. Orthographic views of a Lake Nyasa *mtumbwi* recorded at Bagamoyo in March 2020, based on a 3D photogrammetry survey (Image: Makanani Bell, John P. Cooper and Alessandro Ghidoni).

p. 81).[18] Fishers might at any time run out a speculative fishing line while travelling to and from their fishing grounds. In the prawn season, at the end of the *kaskasi* (northerly) monsoon, they sometimes use their vessel simply as a means of reaching estuarine shallows, where they disembark and use a fine (3.5 m x 3.5 m) hand-held net to catch small prawns (*dagaa kamba* or *kamba kochi*).

*Ngalawa*s are generally hauled out above the high-water mark after use, to protect the hull from marine boring organisms – a process that requires the crew to call on peers for assistance (Figure 3B). However, they may be left moored in the shallows of the intertidal zone to allow an early departure on a rising tide.

Mtumbwi (pl. *Mitumbwi*)

The *mtumbwi* (Figures 4 and 5), also referred to as a *dau*, is an extended dugout that typically varies in length from barely 3 m to over 13 m, although one carver of 20 years' experience in Unguja told us that vessels of 40 ft (19 m) with a 6 ft (1.8 m) beam were possible, given the right tree.[19] The vessel is characterized by a flat bottom with square chine, a raking prow, often with a 'false' stempost carved inboard (Figure 5B), broad extension planks (Figures 4 and 5C), a V-shaped bow timber that extends the dugout forward (Figure 5A), and, on many examples, a massive unreduced block in the stern that acts as a seating position for the helmsman and helps weight the stern and elevate the prow (Figures 4 and 5C, E): as with the *ngalawa*, this aft weighting is also aided by the fact that the stern is formed from the lower end of the tree trunk.

Like the *ngalawa*, the *mtumbwi* is normally made from mango wood, but other possible trees include jackfruit (*mfenesi*; *Artocarpus heterophyllus* [Mbuya et al., 1994, pp. 39, 108–109; Aldrick, 1990, p. 18]) and iroko (*mvule*; *Milicia excelsa* [Aldrick, 1990, pp. 17–18; Dale & Greenway, 1961, pp. 309–311; Martin & Martin, 1978, p. 122; Mbuya et al., 1994, pp. 41, 342–343; Walsh, 1992, p. 135; Weiss, 1973, p. 181]).[20] One carver on Unguja told us in 2018 that a tree would typically cost TZS 600,000–1,000,000 (USD 260–440) to buy, and would normally come from a farmer or government-owned forests. He said that a small

Figure 8. Lake Nyasa *mtumbwi*s (*vuwatu*) (A) on the shore at Milingotini; (B) at Milingotini showing extensive use of yellow-polythene repair patchwork; (C) long-line fishhooks arrayed on the gunwhale of a boat at Bagamoyo, February 2020 (Images: John P. Cooper; Lucy Blue; Sinyati R. Mark).

mtumbwi might sell for TZS 800,000–1 million (USD 350–440), and a large one for TZS 7 mn–10 mn (USD 3,080–4,400). Construction of a smaller vessel would typically take 15 days with two assistants, he said.[21] Larger vessels tend to come from Unguja rather than the mainland, due to the greater availability of large trees there.[22]

The reduction and construction process for the *mtumbwi* broadly follows that of the *ngalawa* outlined above. Like the *ngalawa*, it has extension planks and a bow timber that raises the sheer forward, but it is without the prominent wash lobe. The final thickness of the hull depends on the overall size of the vessel: the remnants of a sizeable *mtumbwi* at Kaole village outside Bagamoyo had a base that was almost 60 mm thick (Figure 5D).

Many *mtumbwi*s have carved mast steps (Figure 5C), but today owners of larger vessels – particularly those practising seine netting – often use an outboard engine secured to a wooden mounting block that is nailed to the stern (Figures 5A and 6A-B) and sometimes further secured with large brackets fashioned from steel re-bars. When sailed, the *mtumbwi* uses a settee rig and sternpost-mounted centre rudder (Figures 5A and 6B) and is called *mtumbwi wa tanga* ('*mtumbwi* of sail') or *mtumbwi wa kutwika* ('*mtumbwi* of rigging'). The mast (*mlingoti*) of the mtumbwi is typically made of mvule or *mkaratusi* (eucalyptus); the yard (*fulomali*) from these or bamboo (*mwanzi*); and the sail (*tanga*) is cotton. Smaller vessels are propelled using a paddle or punting pole (*pondo*); informants also say that the *mtumbwi* could be rowed, although we never saw this.

With careful maintenance, a *mtumbwi* might be expected to last 15–17 years, a carver and user from Marahubi, Unguja, told us.[23] The hull is not normally treated with a protective coating, even though the vessel – unlike the dugout *ngalawa* (below) – is normally left in the water for extended periods. Instead, the crew strand their vessel on a monthly basis and burn palm branches around its outer hull in order to kill marine boring organisms.

Although informants confirmed that a larger *mtumbwi* could comfortably traverse the Zanzibar Channel, fishers largely use these craft in relatively shallow waters, often close to reefs or sand banks. The type of fishing done largely depends on the motive power of the vessel. Crews using sail-rigged vessels to net-fish deploy gill nets (*kimia*) that are up to 1 km long and 3 ft (0.91 m) deep, much like the nets widely used on *ngalawa*s. The net is set at night, and gathered in the morning, and may be set a second time thereafter, tide permitting. One young *mtumbwi* fisher in Bagamoyo reported his typical catch as comprising African sea catfish (*hongwe*; *Arius africanus*), butterfly fish (*kipeopeo*; *Chaetodontidae*), tongue sole (gao-gao; *Paraplagusia* sp.), Indian mackerel (*kibua*; *Rastrelliger kanagurta*) ngangari, cornetfish (*msusa*; *Fistulariide* sp.), barracuda (*msusa mzia*; *Sphyraenidae* sp.), as well as occasionally prawn, and conger and moray

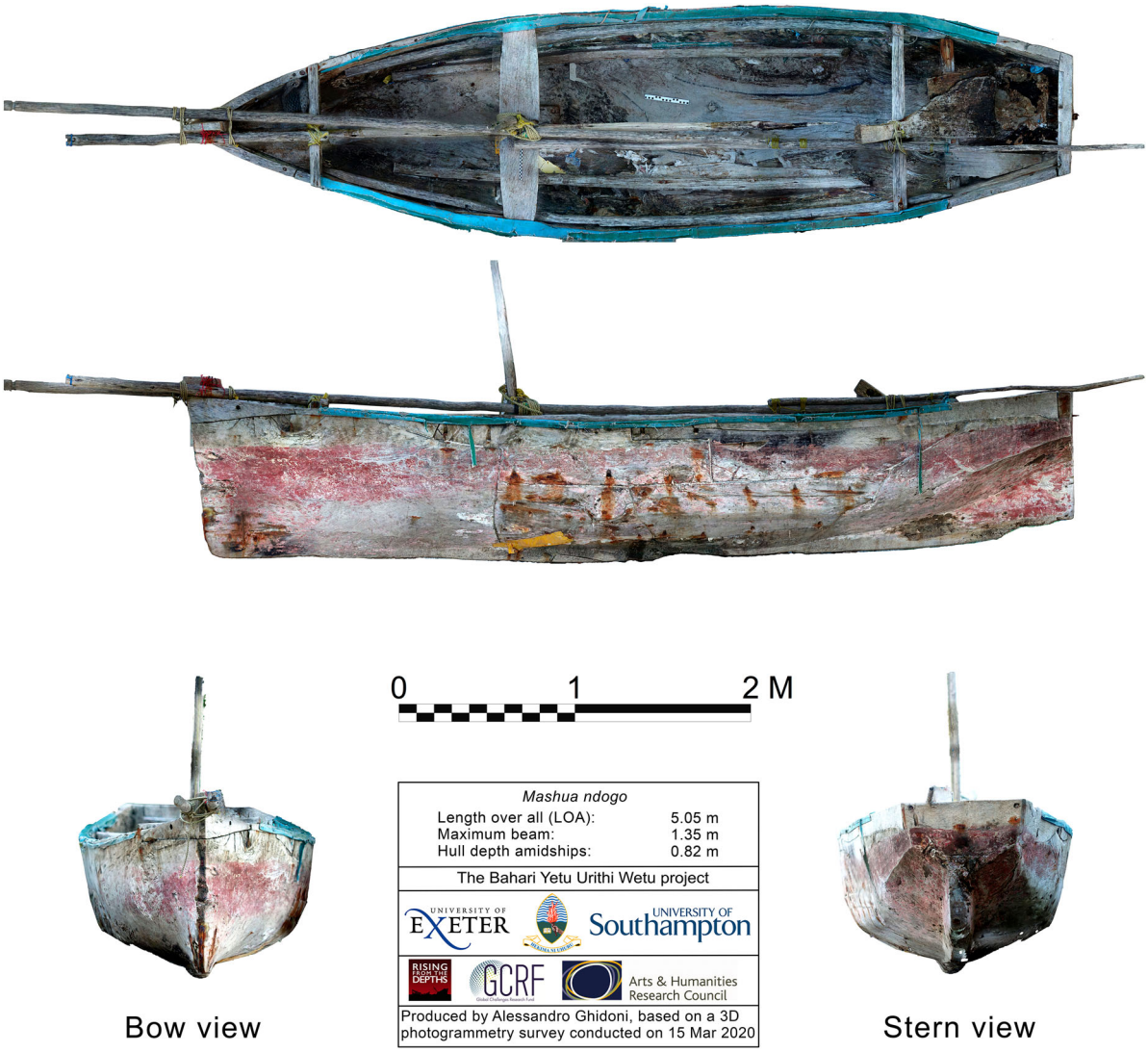

Figure 9. Orthographic views of a *mashua ndogo* recorded at Bagamoyo in March 2020, based on a 3D photogrammetry survey (Image: John P. Cooper and Alessandro Ghidoni).

(*mkunga*; *Congridae* sp. and *Muraenidae* sp.).[24] Where the vessel is fitted with an outboard engine – usually 15 hp – crews practise seine netting with a net that is typically 3 m deep, and can be 100–150 m long (Figure 6C).[25] The crew in this case typically ranges between seven and 16 people, depending on vessel size. A spotter standing on the prow looks out for shoals of fish, and on seeing one leaps into the water as the first end of the net is dropped in the water. As the boat circles, the spotter slaps the water to scare the fish into the net. Up to seven crew members jump into the water to monitor and arrange the net as the circle closes. Once a full circle is made, the crew remaining on board haul in the net.

To a lesser extent, the *mtumbwi* is also used to transport fish traps (*dema,* pl. *madema*) to and from sites in the sea grass and close to reefs, with crews of four or so (Figure 6B), while solo or pairs of fishers use the smallest examples for long lining in a manner similar to the Nyasa *mtumbwi* (Figure 6D). The *mtumbwi* might also be used to carry small cargoes along rivers and mangrove creeks (Figure 6A).

Lake Nyasa *Mtumbwi* (*Mtumbwi wa Nyasa*; pl. *Mitumbwi ya Nyasa*)

The Nyasa *mtumbwi* is a small, simple dugout with highly rounded cross section and significant tumblehome that originates in Lake Nyasa (also known as Lake Malawi) in southern Tanzania, where it is known in the Kisi language as *vuwatu* (Figures 7 and 8).[26] The vessel is found today in small numbers in Bagamoyo and the nearby Mlingotini Lagoon as a result of the seasonal migration of its Kisi makers and users, together with their skills, from Lake Nyasa to the sea for the purposes of inshore line and net fishing.[27] The fishers also move between locations along the coast, following reports of good fishing: three men we spoke to, each with their own dugout, had come to Bagamoyo from Dar Es Salaam three months earlier, and expected to return there 'once done'.[28]

The men had carved their vessels on the coast, rather than transporting them there from Lake Nyasa. They normally make the craft from a single

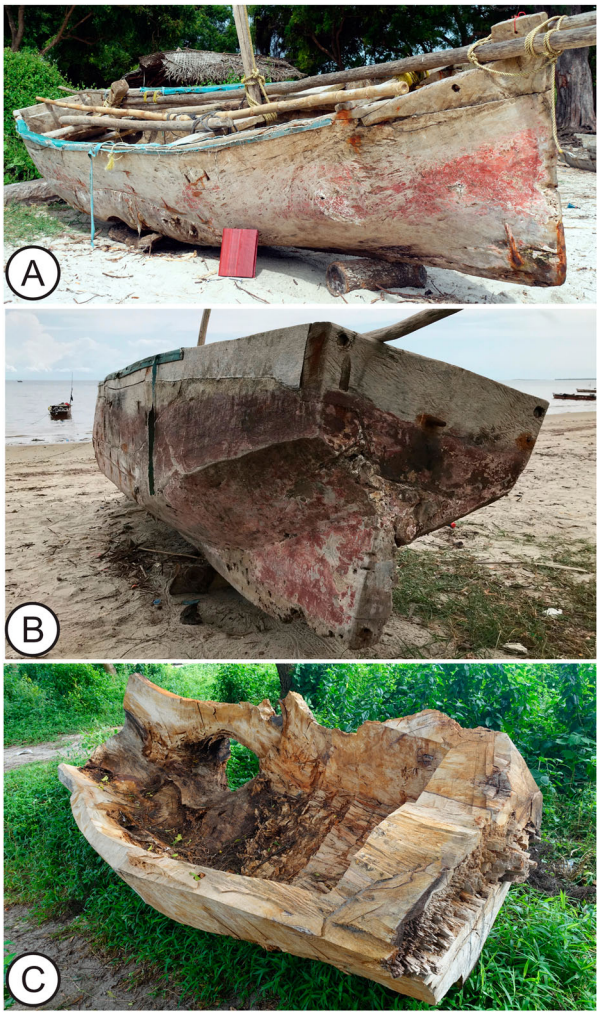

Figure 10. A *mashua ndogo*, Bagamoyo beach, March 2020: (A) the hull, hauled out for extensive repair (the notebook is A5 size); (B) the stern, showing damage by marine boring organisms; (C); a section of partially shaped mango log intended as the replacement stern (Images: John P. Cooper; Lucy Blue).

log (*gogo*) of mango or cashew wood. The vessel takes around a week to make, and can last 5–6 years. No preservative is used on the hull – which is almost always hauled out after use – and repairs are usually made by securing patches of scrap plastic over the damage with closely-spaced tacks (Figure 8B). The vessel is propelled by an elegantly carved paddle (*kafi* (sing.); *makafi* [pl.]). Lightweight, roundwood beams set in the bow and stern are used for hauling out and tying off. Despite the dugout's cramped size, a solo boatman we interviewed said he uses up to seven long lines, each 100 m in length, with 700 hooks per line: these are baited and embedded with fastidious care in a dense array on the outboard stern quarter, ready for deployment (Figure 4). The men said they catch a variety of fish species, depending on the season, but mostly grouper (*chewa*; *Serranidae* Sp.) and jacks (*kolekole*; *Carangidae* Sp.). We also observed a small net in a vessel moored in the sheltered waters of the Milingotini Lagoon (Figure 8A).

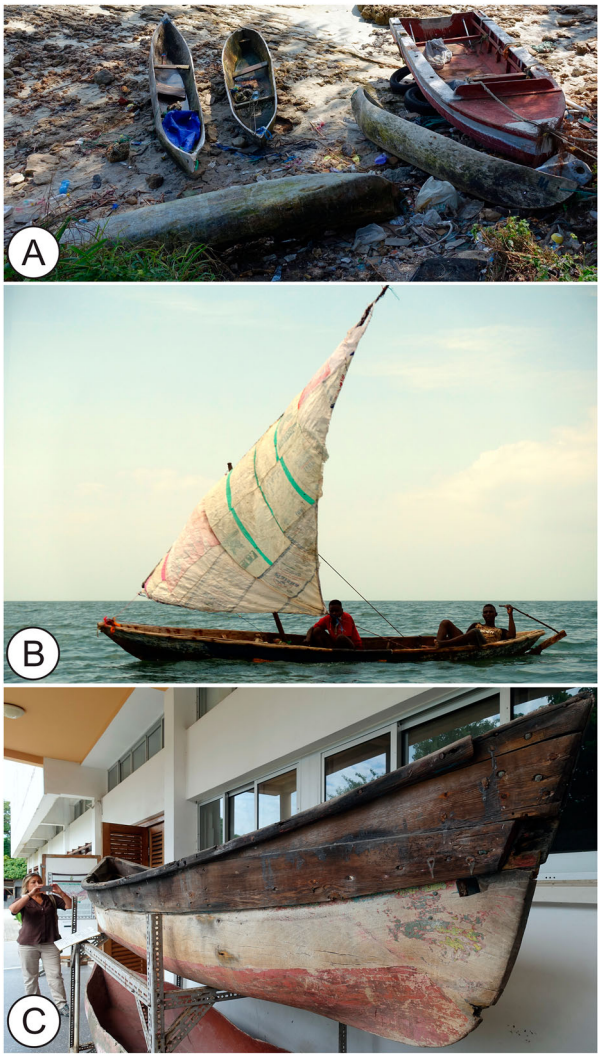

Figure 11. The *hori*? (A) possible horis on the foreshore at Stonetown, Unguja, July 2018; (B) a possible *hori* under sail off Mkadini, August 2019; (C) a Malabari *hūrī* in the Dar Es Salaam National Museum, July 2018. It probably arrived in East Africa via the monsoon trade – its plank extensions suggest adaptations made in Yemen (Blue and Cooper, forthcoming) or Oman (Images: John P. Cooper).

Dugout '*Mashua Ndogo*' (pl. *Mashua Ndogo*)

A relatively rare, but structurally remarkable, vessel created by the reduction of logs is the *mashua ndogo* – literally, 'small *mashua*'. The term *mashua* is a cognate of the Arabic *mashuwwa* (ماشوّة) the term used for a type of cargo and fishing vessel found in the Arabian-Persian Gulf (Agius, 2002, p. 97, 2005, pp. 103–104, 2008, p. 252), and also of *machwa*, a fishing and cargo vessel found in northwest India (Hornell, 1946, pp. 202–203). But those vessels are all planked. In contrast, the *mashua ndogo* comprises a single mango log, or otherwise two logs of particularly large girth joined end to end, one shaped to form the forward portion of the hull, and the other the aft portion (Figures 9 and 10). The sides of the hull are then built up extensively – from around the turn of the bilge, amidships – using extension planking and

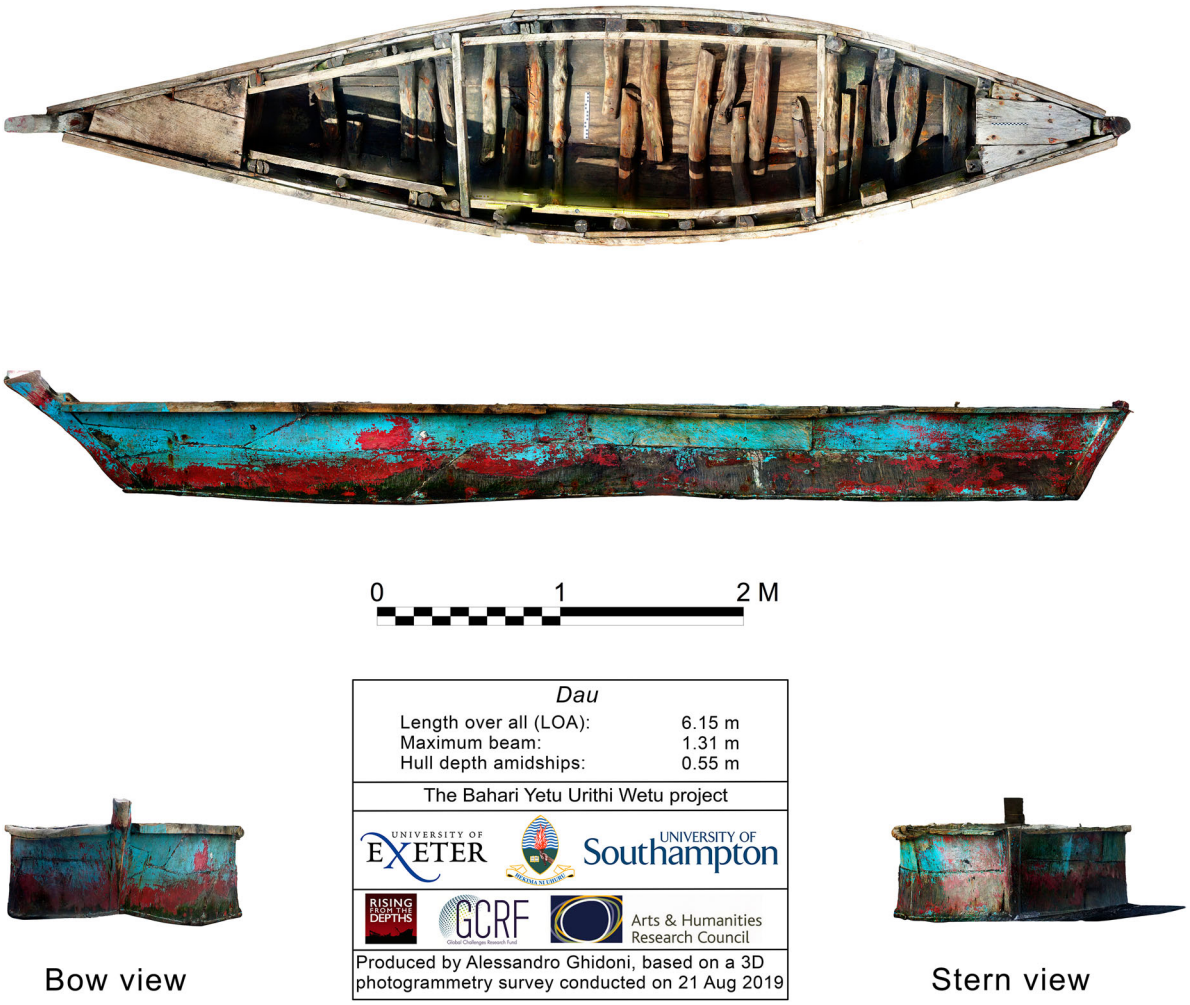

Figure 12. Orthographic views of a small, plank-built *dau*, recorded at Mlingotini, August 2019, based on a 3D photogrammetry survey (Image: John P. Cooper, Sinyati R. Paul and Philip C.M. Maligisu).

graving pieces. Extension timbers also raise the sheer line forward and aft, as well the transom stern. The whole is done following essentially a shell-based conception. The resulting vessel is a skeuomorph of a plank-built *mashua*, complete with transom stern, raking prow, and carved representation of a keel.

Based on appearance alone, one might in fact argue for inclusion of the *mashua ndogo* as a plank-built boat rather than a dugout – much as Blue et al. (2017, pp. 189–190) do for a version of the *hūrī* in Kerala. This perspective is supported by the use of more than one log in forming the hull and the fact that a large portion of the sides of the hull, particularly amidships, comprise an irregular assemblage of planking timbers. However, we include it here as a dugout in part because its making is to a significant extent based on reducing and hollowing the log(s) to achieve the desired hull shape (McGrail, 1985, pp. 292–297, 1987, pp. 6–7). However, our principal reason is that these vessels are built by makers specializing exclusively in carving dugouts – such as the *ngalawa* and *mtumbwi* – rather than plank vessels. Moreover, the techniques required to build the vessel belong to the dugout-carver's skill set: shaping the main log(s) and extension planks by reduction using axe and adze, and fixing the extension planking using the same 'sewing nails' (*cf.* above) used on other dugouts.

The *mashua ndogo* is rare – we encountered only two, one each in Bagamoyo and Mlingotini – because of the size of tree needed and particular skills required in joining the logs, but also because it is considerably more expensive to make than other dugouts. Its large interior allows a crew of up to four, with space for a repurposed fridge to be used as a storage box, and for larger fishing gear than could be carried by a *ngalawa* and most *mtumbwi*s. It may be this type of vessel that Weiss (1973, p. 178) briefly mentions as found in the Dar Es Salaam area in his discussion of timbers used in boatbuilding. It is found also at Nunge, a locale just north of Bagamoyo, and also on Pemba, according to the only maker of it we met – Mzee Alalae Mohamed. Mzee Alalae saw his first *mashua ndogo*, from Pemba, in 1996: he copied it – untutored – and went on to make around 15 in response to ongoing demand. The most difficult part, he said, is aligning the two halves of the hull: when carving each half, he leaves a large amount of unreduced timber along

Figure 13. A small, plank-built *dau* in the Mlingotini lagoon, August 2019 (Image: John P. Cooper).

the faying surface that will abut the other half, thus giving himself a broad margin of error when the two are presented to one another. It is only when the bow and stern sections are aligned to his satisfaction that he proceeds to reduce the timber around the butted faying surfaces to the ultimate thickness. Meanwhile, the requirement for framing timbers in the *mashua ndogo* – if any – depends very much on the configuration of planking required to achieve the hull shape. While a vessel we saw in Bagamoyo had no frames, another in Mlingotini had several.

The *Hori* Question

The word *hori* (pl. *hori*) is a further term that fishers in the Zanzibar Channel use for a type of dugout vessel. In our surveys we did encounter simple dugouts that were different in appearance from the other types described here, and there might well be candidates for the name. However, we were unable to verify this with informants. In Stone Town, Unguja, we encountered three in a secluded section of foreshore (Figure 11A) on a beach: their curved prow profile and painter holes redolent of Malabari *hūrī*s (Blue et al., 2017). We also met two young fishers using a similar boat off Mkadini, just north of Bagamoyo (Figure 11B). One informant at Mlingotini offered the term simply as an alternative name for the Nyasa *mtumbwi*.[29] Another on Unguja described the *hori* as one of three types of dugout to be found on the island, saying it was used as a tender on larger vessels such as the *dau* and the *jahazi*.

Both the name *hori* and this description of it as a ship's tender are indeed redolent of the Malabari *hūrī*, a dugout that was formerly widely distributed around the western Indian Ocean as a result of monsoon-driven trade, which brought Indian and Arabian vessels to East Africa (Agius, 2002, pp. 119–121; Blue et al., 2017; Bowen, 1952, pp. 197–201; Jansen van Rensburg, 2010; Prados, 1996, pp. 93–98). Moreover, an example of just such a *hūrī* is held at the Dar Es Salaam National Museum, reflecting its former presence in the region (Figure 11C). Haddon's brief early-twentieth-century description of a *hori* also fits this identification, although he is mistaken in

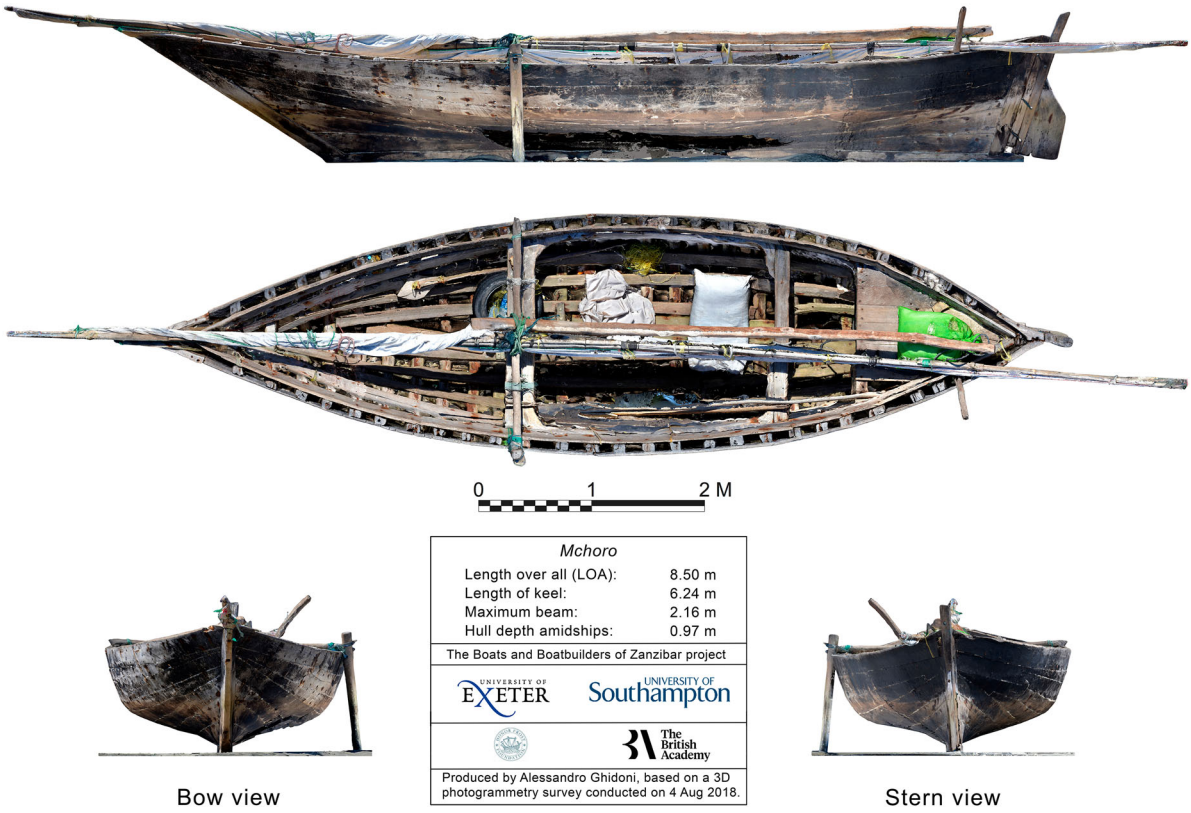

Figure 14. Orthographic views of a double-ended, plank-built *mchoro* fishing boat, recorded at Mazizini, Unguja, in August 2018, based on a 3D photogrammetry survey (Image: Alessandro Ghidoni).

saying (1918, p. 52) that these were made in the Persian Gulf.

Plank-built Vessels

The plank-built vessels of the Zanzibar Channel are constructed in accordance with a carvel-planking method common to many parts of the western Indian Ocean that, for brevity, we call the clenched-nail tradition after the principal plank-fixing method (Agius, 2002, pp. 139–145; Facey, 1979, pp. 156–161; al-Hijji, 2001, pp. 44–76).[30] Builders used only hand tools in the boatyards we visited. Broadly, a keel is laid and rabbeted, and raking stem and stem posts jointed to it and likewise rabbeted to accommodate the hood ends. The garboard planking is then heated over fire and shaped to achieve the desired longitudinal twist. Its lower edges are reduced to accommodate to the keel rabbet, while the hood ends are fitted into the post rabbets and also nailed. The first of the floor timbers are then fitted, and the subsequent two-or-so strakes added. Around four pairs of half frames are then fitted along the length of the keel, braced by temporary horizontal timbers (cross-spawls) placed across the top of the frame pairs: these function as moulds, and usually do not become permanent. As more planking is added, secured by clenched nails to the framing, more framing sets are installed, yielding an alternating sequence of half-frame pairs followed by a floor with two futtocks. Where vessels are transom-sterned, the stern hood ends are attached to the transom framing. Stringers provide longitudinal stiffening – there is no keelson – with the highest of these also acting as a shelf for beams that brace the hull laterally. Decking varies according to vessel type.

Timbers

Plank-boat builders draw on a different range of timbers for their construction than do dugout carvers. For the keel, builders frequently use Afrormosia (*mwanga*; *Pericopsis angolensis* [*cf. Mbanga/muvanga* in Mbuya et al., 1994, pp. 38, 382–383]),[31] and sometimes *mvinje* (*Casuarina* Sp.; Mbuya et al., 1994, p. 41, 166–171; Dale & Greenway, 1961, p. 130).[32] Builders today cannot easily access the red-listed African teak[33] (*mninga*; *Pterocarpus angolensis* [Mbuya et al., 1994, p. 40, 422–423; Weiss, 1973, p. 181]) – a favoured planking timber – since conservation regulations make it rare and expensive (Barstow & Timberlake, 2018).[34] Instead, they use mnondo (*mtondo(ro)*; *Julbernardia globiflora* [Mbuya et al., 1994, pp. 41, 306–307]), sometimes for the entire hull, or just for upper planking if better options can be found for below the waterline.[35] Planking can also be sourced from mango and varieties of eucalyptus (*mkaratusi* [Mbuya et al., 1994, pp. 39, 252–261]) although builders consider the latter

Figure 15. The double-ended *mchoro* fishing boat: (A) crew setting their nets near Stone Town, Unguja; (B) propped in the intertidal zone, Mazazini, Unguja (Images: Alessandro Ghidoni).

inferior because of its heavy weight.[36] An experienced builder at Kinazini, Unguja, used a mixture of reddish looking-glass mangrove (*msikundazi*; *Heritiera littoralis* [Dale & Greenway, 1961, pp. 548–549; Weiss, 1973, p. 181]) and yellowish *mkurungu* (*Pterocarpus chrysothrix* [Mbuya et al., 1994, p. 31, 214; Phiri et al., 2015]) for the planking of a *ngwanda* (see below) we saw him building in 2018.

For framing timbers, boat builders in the past might also have used red mangrove (*mkoko*; *Rhizophora mucronata* [Aldrick, 1990, p. 18; Dale & Greenway, 1961, p. 399; Walsh, 1992, p. 135; Weiss, 1973, p. 181]).[37] However, felling it is now illegal, and the most commonly used wood for framing timbers (*mataruma*, sing. *taruma*) is neem (*mwarubaini*; *Azadirachta indica* [Mbuya et al., 1994, pp. 41, 112–113]); neem is also used for posts and beams.[38] Historically, masts might also have been made from looking-glass mangrove (Dale & Greenway, 1961, pp. 548–549) or *mvinje* (Mbuya et al., 1994, p. 168), while one builder said *mtondo(ro)* is a suitable timber for a yard:[39] bamboo is used for this purpose on smaller vessels.[40]

We now present the main plank-built vessel varieties found in the Zanzibar Channel, beginning with fishing craft, before moving on to cargo vessels.

Figure 16. Orthographic views of a transom-sterned, plank-built *mashua* fishing boat, recorded at Mkokotoni, Unguja, in August 2018, based on a 3D photogrammetry survey (Image: John P. Cooper and Alessandro Ghidoni).

Small, Plank-built *Dau* (pl. *Madau*)

In this particular case, the term *dau* describes a small, flat-bottomed, double-ended and plank-built fishing vessel, about 5–7 m in length, used in sheltered lagoons and estuaries of the Zanzibar Channel (Figures 12 and 13). This *dau* is of a relatively simple and almost kit-like construction. Its flat base comprises three main planks – one central, two lateral – with a further two short planks required amidships to complete the bottom of the beamiest part of the hull. These planks are clench-nailed, from outside to inside, onto a series of half frames formed from grown crooks that are shaped at a 90° angle in order to achieve near-vertical sides for the vessel. The horizontal portion of the half-frame extends well beyond the centre line of the hull, stiffening the base of the hull athwartships in a manner that might otherwise be achieved by floor timbers. Two strakes are then fixed on both sides of the hull, their hood ends nailed to the raking stem and stern posts. Additional top timbers are added to further support the side planking. Once all framing is in place, a single stringer is added on both sides, just below the sheer line, and small decks are added fore and aft.

This *dau* is paddled. It is used for fishing in the shallows in lagoons – for example that of Mlingotini – and particularly for mullet (*mkizi*; *Mugilidae* spp. [Frankl, 2002, pp. 22–23]): in this scenario, two vessels operate in tandem, with three crew in each, deploying a small seine net between them when a shoal is spotted. The fishers paddle their *dau*s quietly, dragging the net behind them, until both boats have passed the shoal: they then turn in towards each other. Once they have encircled the shoal, they drive the fish into the net.[41]

Mchoro (pl. *Michoro*) or *Dau Mchoro*

Double-ended and rigged with a settee sail, the *mchoro* fishing vessel was once a much more common sight in the Zanzibar Channel than it is today (Figures 14 and 15). Its popularity has waned with the appearance of the outboard motor, for which its sharp stern makes it ill-suited: it has gradually been supplanted by the transom-sterned *mashua* or, more commonly, the entirely motorized *ngwanda* (see below).[42] Experienced informants said the vessel qualifies as a *dau* by virtue of its raking prow,[43] although the crew of one Bagamoyo *mchoro* demurred.[44] A vessel we surveyed at Mazizini, Unguja, was 8.5 m long (Figure 14), while De Leeuwe reports vessels of 8.9 and 10.1 m in length. She associates the *mchoro* with a building centre on the island of Tumbatu, although our informants indicated a wider distribution of builders. Two elderly, retired boatbuilders, one in Mlingotini and one in Bagamoyo, both described the *mchoro* as their favourite boat to build, and – for reasons we could not tease out from them – the easiest: 'Because it is!' said one.[45] However a younger builder from Tumbatu, speaking at Mazizini, disagreed: 'You need to squeeze the planks more [on a *mchoro*]: there's no need on a boat with a *chanda* (transom stern), so you finish [building it] quicker'.[46]

The *mchoro* is mainly used for net fishing. Without the manoeuvrability of an engine-powered vessel enabling seine netting, it sets long gill nets with a 9-inch (0.23 m) mesh to catch large pelagic species, particularly ray (*taa*). The crew of a *mchoro* in Bagamoyo[47] explained that they deployed nine nets, end to end, each one being 100 m long: they sail upwind, lower the sail, and pay out the nets as the vessel drifts downwind. The nets are 7 m in drop, and are set at

Figure 17. The fishing *mashua* on Unguja, July 2018: (A) beached at Bububu; (B) a crew working on nets at Mazizini; (C) under sail outside the Dhow Harbour, Stone Town (Images: John P. Cooper; Alessandro Ghidoni).

Figure 18. The motorized fishing ensemble: a *boti la mtando* (left) with two *dingi*s on board, moored alongside three *ngwanda*s. These three vessel types work together in night-time seine fishing (Image: John P. Cooper).

least 10 m below the surface. The crew return to gather the nets after one day.

Mashua (pl. *Mashua*) *or Dau la Chanda* (pl. *Madau ya Chanda*)

About the same length as a *mchoro*, the fishing *mashua* is distinguished by its transom stern (*chanda*), which gives the vessel its alternative name of *dau la chanda* (Figures 16 and 17). The transom gives the *mashua* a larger hull capacity relative to length, and allows for the attachment of an outboard motor, for those who can afford it. De Leeuwe describes the construction of this vessel type in some detail (2004, pp. 25–54, 2005, pp. 109–112). The fishing *mashua* is typically around 9–10 m long, and has a settee rig. Where an outboard motor is attached, it is generally as a supplementary form of propulsion, for when the wind fails. The fact that the *mashua* can be adapted for use of an outboard motor has ensured that more of this variety remain in use than do examples of the *mchoro*. The picture is mixed, however: fishing villages such as Nungwi on Unguja have large fleets, while we only ever saw a handful in Bagamoyo during our research. In any case, it remains distinctly less common overall than newcomers such as the *ngwanda* and *mtando* discussed below. Apart from the transom stern, the *mashua*'s clenched-nail, carvel-built construction is very much like that of the *mchoro*. Fishers using the *mashua* tend to employ a type of net called a *jarife* to catch tuna, jacks and *kambisi* – varieties of trevally and kingfish.[48]

Motorized Fishing Boats

The next three vessels – the *boti la mtando*, *ngwanda*, and diminutive *dingi* – represent a relatively recent innovation in both boatbuilding and fishing method in the Zanzibar Channel (Figure 18). Found on both Unguja and the mainland coast, these vessels draw on the potential of newly available technologies – centrally, the outboard engine and the portable electric generator – to enable new fishing techniques, based around seine-netting and purse-seine netting and the use of artificial light to attract fish at night. Such equipment also place fishers in potential conflict with regulators over fish-stock conservation: some fishers themselves also express concerns about its impact.[49]

All three vessel types work together in night-time fishing. At the centre of operations is a single, large, *boti la mtando* (literally, the 'seine boat'), normally simply referred to as the *mtando* (literally 'seine'). This vessel is motorized and, normally, entirely decked; it is approximately 14–15 m in length and 4 m in beam. It carries a large purse-seine net (*nyavu ya mtando*),[50] one or two small *dingi*, scuba-diving equipment and the catch – as well as a crew of, remarkably, 40–60 men. Operating as satellites to the *mtando* are up to five smaller *ngwanda*s, the main role of which is to attract shoals of fish using electric-light rigs mounted on their sheers. Once a shoal has been attracted, the *mtando* is alerted, and approaches to deploy the net. The small *dingi*s are deployed alongside up to eight scuba divers in order to help set the seine net. If the catch is large, fish are decanted onto this and other

Figure 19. Orthographic views of a plank-built *boti la mtando* fishing boat, recorded at Marahubi, Unguja, in August 2018, based on a 3D photogrammetry survey (Image: Alessandro Ghidoni).

*ngwanda*s for the return to port.[51] The collective effort involved in this form of fishing has given rise to an established system of profit sharing. The catch from a single seine netting is split equally between the *mtando* and the *ngwanda* in question.[52] Within the *mtando*, 15% of the profit goes to the boat owner, 5% to the skipper, and 80% in equal portions to the crew – including, again, the skipper.[53]

Boti la Mtando (pl. *Maboti ya Mtando*) or *Mashua ya Mtando*

The *boti la mtando*, occasionally referred to as *mashua ya mtando*,[54] is again a nailed, carvel-built vessel in the regional construction tradition outlined above, with a low transom stern and a flat sheer that rises slightly forward over a raking bow (Figures 19 and 20). It is an innovation of the last decade or so.[55] It is exclusively motorized, normally taking one or two outboard engines. Broad of beam, it is unique among regional fishing boats in being fully decked, providing a platform for the huge crew and storage of the massive net, scuba gear, and *dingi*(s). Deck hatches are usually offset to the port side, allowing the net to be laid down the centre and starboard – with the floats aft and the foot forward – while maintaining access below to store the catch, unrefrigerated, on a tarpaulin. While on other vessels the tops of frames are exposed at the sheer, in the *mtando* they are encased in lining planking and a caprail to prevent the net from snagging – another diagnostic feature of the type. A *fundi* from Pemba reported that building a *mtando* costs around TZS 45,000,000 (USD 19,450) – excluding the engine – and takes around six weeks.[56] Buying a single engine would add TZS 20,000,000–25,000,000 (USD 8,640–10,800) to the cost.

The size of the *mtando* crew is, as noted, remarkable. We observed a vessel returning with a crew of more than 50: its freeboard was already reduced to

Figure 20. The *boti la mtando*: (A) the full deck acts as platform for gear, crew and *dingi*s (Mbegani, August 2019); (B) readied for departure on the evening tide, Bagamoyo, August 2019; (C) disembarking the large seine net that gives the vessel its name, Bagamoyo, March 2020; (D) with a full complement of crew off Stone Town, Unguja, August 20108 (Images: John P. Cooper, Lucy Blue, Alessandro Ghidoni).

little more than 0.30 m, despite the disappointing catch. Most crewmen are drawn from the general population as low-skilled haulers of the huge seine net, which can measure 360 m long, with a vertical height of 40–50 m. Others have dedicated roles, such as deploying the principal net weights (*kijiwe*) – sandbags, or sometimes old car engines – or scuba diving in order to spot the shoal, signal the deployment of the net, and corral the fish. Limited dive-training opportunities make this latter the most dangerous of jobs, and it is discouraged by fisheries authorities.[57] Commonly caught fish species include tuna (*jodari*), Indian mackerel, and cornetfish, with other catches including the *nguru* (kingfish), and *micheshi/mkule* (spike fish), as well as sardines.[58]

Ngwanda (pl. *Ngwanda*)

Smaller and more slender than the *mtando*, the *ngwanda* is again nailed and carvel-built in the regional tradition (Figures 21 and 22). It is typically *c.*10 m long, with a beam of *c.*2.5 m. It has a low, flat sheer, with a transom stern that accommodates a single, usually 15 hp, outboard motor. Its bow is less raking than the *mtando* – although it, too, can be referred to as a *dau*[59] – and it is normally only decked forward; its caprail incorporates a series of square holes to accommodate electric-lighting rigs. A *ngwanda* without engine cost around TZS 9mn–10mn (USD 3,900–4,300) to buy in 2019; a 40 hp engine would add TZS 7,000,000–8,000,000 (USD 3,000–3,500) to the cost.[60] When operating in support of a *mtando*, the *ngwanda* has no net itself, but might run out a fishing line while waiting for the *mtando* to arrive.[61] The crew is typically up to four people. Equipment on board includes a portable electricity generator to power the lights, and large hand nets on poles for picking out fish on the surface. Particularly on Unguja, the affordances of the *ngwanda* have also enabled a role for it as a leisure boat. Its size, open hull, motorized propulsion and relatively slender lines have made it a popular choice for taking tourists to offshore islands and sandbanks for snorkelling and even scuba diving.

Unlike most artisanal watercraft the world over, the *ngwanda* retains an associated invention narrative. A builder in Bagamoyo named its inventor as Makami Omar, a builder from Kilwa who died in 2003: he was the head of a now-inactive Zanzibari boatbuilding organization called *Mafundi wa Ujenzi Boti* (Boatbuilding Technicians) that in the late 1980s started to seek a new boat type that could take advantage of the growing availability of outboard motors. The result was the *ngwanda*, construction of which began around 1989 among a group of builders at Kinazini – including our informant – under Mr Omar's tutorship. Its popularity as a fishing and tourist boat spread.[62] Before the arrival on the scene of the *boti la mtando*, the *ngwanda* used a *jarife* net.[63]

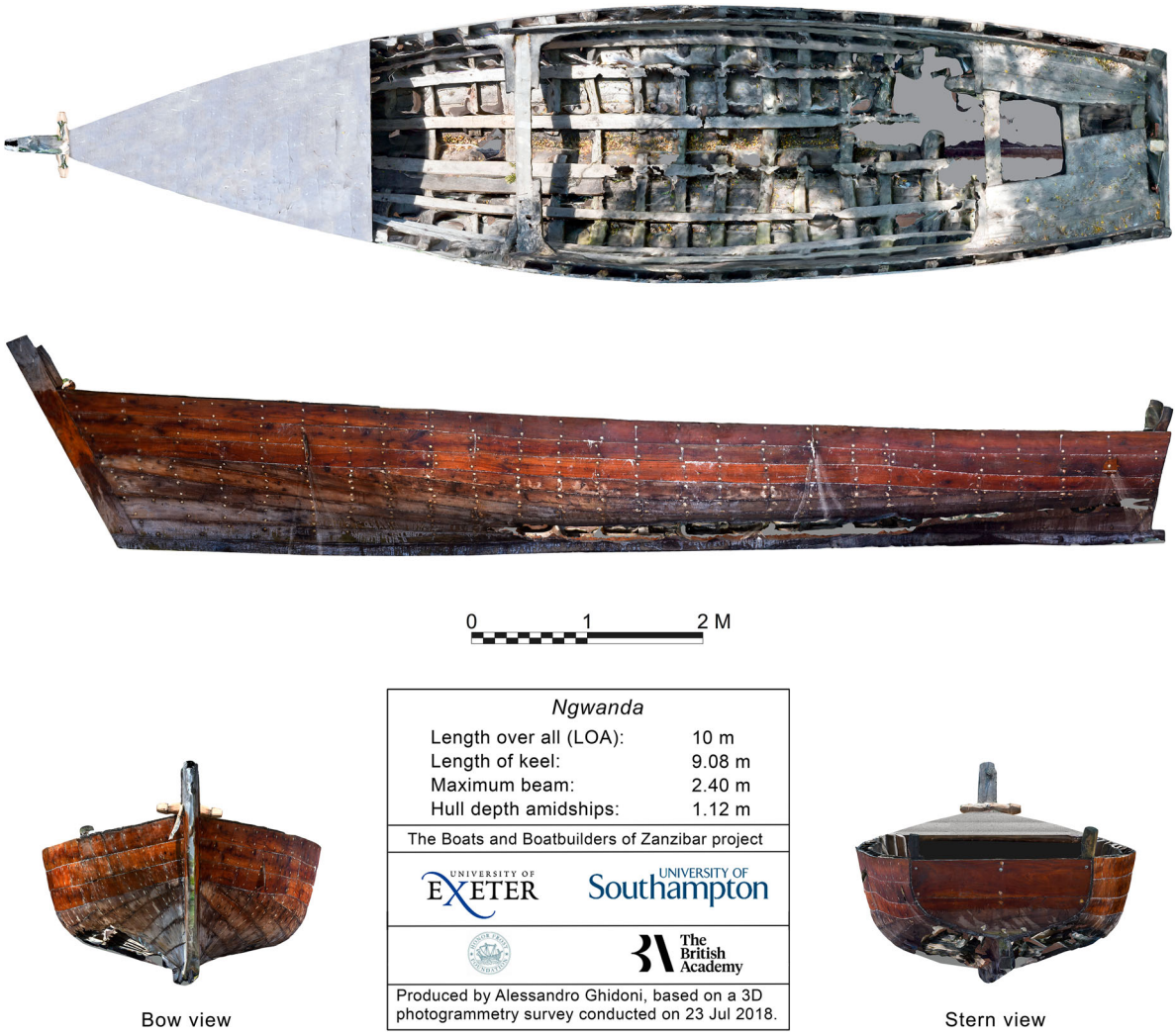

Figure 21. Orthographic views of a plank-built *ngwanda* fishing boat, recorded at Kinazini, Unguja, in July 2018, based on a 3D photogrammetry survey (Image: Alessandro Ghidoni).

Dingi (pl. *Vidingi*)

The third, and most modest, part of the *mtando* fishing triumvirate is the *dingi*. This very small craft is flat-bottomed and transom sterned, often made out of marine plywood, and propelled by paddle or by pulling it along a rope (Figure 23). It generally has a raking stem and machine-cut timbers as framing: the latter comprise sets of straight floors and straight futtocks that meet at the angle of the bilge, with light-weight stringers tying the whole together. Thwarts allow one or two people to sit. The rather rough and variable construction of the dingi reflects the limited outlay required for it to fulfil its role – chiefly helping deploy the *mtando* net and occasional lightering. One or sometimes two are carried on the *boti la mtando* (Figure 18).

Cargo Vessels

The final group of plank-built vessels found today in the Zanzibar Channel are the larger cargo craft, chiefly the *mashua*, *jahazi*, and *bumu*. Radical changes in the political economy of the western Indian Ocean in the mid twentieth century mean that the still-larger vessels that once reached Zanzibar from India and the Arabian-Persian Gulf as part of the wider Indian Ocean monsoon trade – *baghla*s, *ghanja*s, *kotia*s, *būm*s, *badan*s, *sanbūq*s, etc. – have not been seen since the 1960s (Gilbert, 2004, pp. 110–167; Martin & Martin, 1978, pp. 104–108). The region's famous sewn *mtepe* or *dau la mtepe* are even longer gone (Gilbert, 1998; Hatchell, 1961; Hornell, 1941, 1942; Lydekker, 1919; Prins, 1959, 1986, pp. 64–92;). The remaining cargo fleet is involved in an ongoing informal coasting trade in such goods as timber, agricultural produce and foodstuffs, chiefly between the Zanzibar archipelago and mainland ports such as Dar Es Salaam, Bagamoyo, Pemba, and Tanga. Only the *bumu* regularly ranges further, reaching the Comoros Islands, Kenya, and Mozambique. Limitations with respect to access and time compel us to admit to being less confident in understanding the commonly

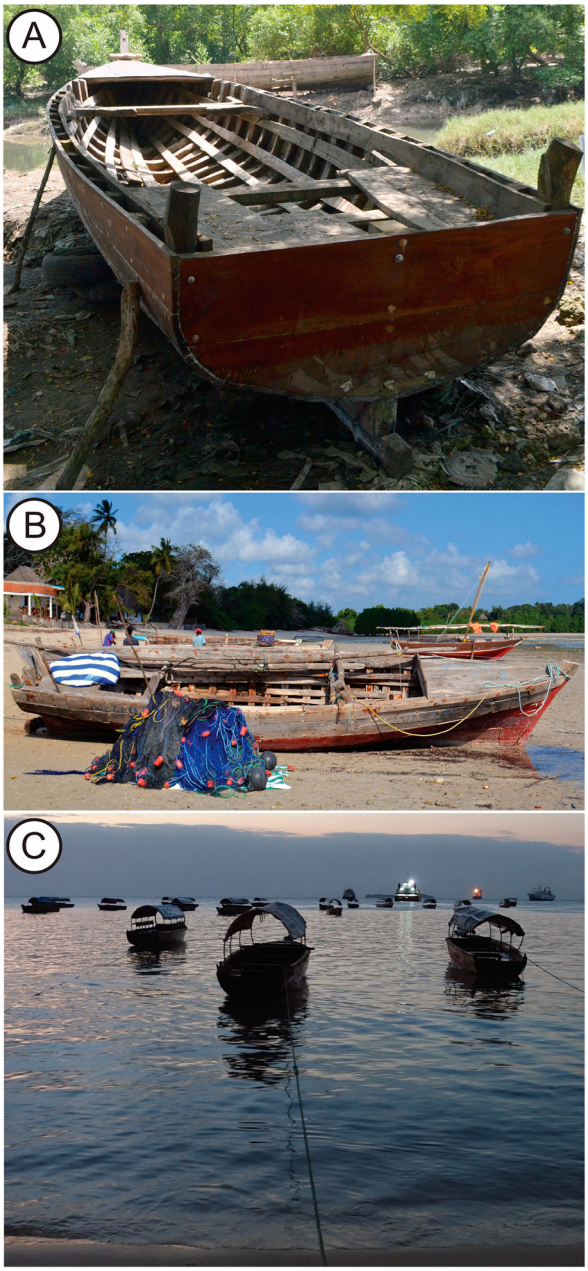

Figure 22. The *ngwanda*, Unguja, August 2018: (A) the low transom stern was developed to accommodate an outboard motor, here at Kinazini; (B) a fishing vessel beached at Mazazini; (C) the type is also a popular tourist boat in Stone Town (Images: John P. Cooper and Alessandro Ghidoni).

used parameters of definition with respect to these remaining craft: further research is certainly needed.

Cargo *Mashua*

The cargo *mashua* is in many respects a scaled-up version of its fishing counterpart, outlined above. Its hull is carvel-built in the predominantly clenched-nail method of the region; it is transom-sterned and open-hulled, with a raking prow, single mast and settee sail, together with an outboard motor or two as backup (Figure 24). Its tonnage ranges between half of that of a typical *jahazi* up to equality with it, while its beamier hull and shallower draught enables it to visit shallow-water, tidal ports that the deeper, narrower *jahazi* cannot. *Mashua*s ply the Zanzibar Channel between the main islands and mainland ports such as Dar Es Salaam, Bagamoyo, Pemba, and Tanga, and only occasionally range further afield—for example to Mombasa or Kilwa. The channel crossing normally takes around three hours, with the crew resorting to the outboard motor only when the wind fails.[64] In Bagamoyo during our research, a section of the beach in front of the customs house dedicated to mooring the *mashua* often had between 15 and 25 vessels loading and unloading, bound for and coming from Unguja: planks, poles, livestock, and vegetables are loaded on the way out; often cooking oil on the return. At low tide, these vessels rest on their bilges. All the *mashua*s visiting Bagamoyo are owned and operated by Zanzibaris.

Jahazi

The contemporary *jahazi* is generally a smaller vessel than its early-to-mid twentieth century forbear, demand for ocean-going vessels having largely evaporated with the end of the monsoon trade. Publications by Prins (1965, p. 114) and Gilbert (2004, pp. 2, 50, 71), among others, characterize the *jahazi* as a settee-rigged cargo vessel with near-vertical stem, bowsprit, carved blue-and-white decorative panel at the prow and matting around the sheer, and we saw a number of vessels at Stone Town and in the Zanzibar Channel that met this description (Figure 25). We also had several discussions with informants in which the term was used to describe larger cargo vessels, with some referring to the near-vertical stem and prominent wales. However, opportunities for direct confirmation were limited: informants in Bagamoyo told us that *jahazi*s never visit there because the roadstead is too shallow; instead they sail between Stone Town, Dar Es Salaam and other deeper-water ports. Some told us – with no example in sight to which we could together refer – that the *jahazi* was simply a larger version of the *mashua*; others that its hull was narrower in the beam and deeper, and others that it had a 'cabin', where a *mashua* did not.

Bumu (pl. Mabumu)

The transom-sterned *bumu* is the largest of the wooden watercraft to be found in the Zanzibar Channel today. The name is clearly a cognate of the Arabic *būm* (بُوم) although it shares with that Arabian-Persian Gulf vessel only that it is a relatively large wooden cargo boat built broadly in the clench-nailed, carvel-built manner of the wider region: it does not have the Gulf *būm*'s characteristic phallic prow and is not

Figure 23. A *dingi*, here being used as the tender for a *boti la mtando*, at Bagamoyo (Image: John P. Cooper).

double-ended; nor is the *bumu* rigged, as the *būm* was traditionally. It contrasts most obviously with our understanding of the *jahazi* in having a raking prow rather than a near-vertical one, and in having no palm matting around its sheer. Such a large vessel as the *bumu* cannot put into Bagamoyo, and the nature of our Unguja fieldwork afforded us limited opportunity to encounter it up close. We did board one vessel being worked on at Kinazini: the builder was raising the sheer line by two strakes and adding a new cabin superstructure – a job of three months (Figure 26). That particular vessel could carry 14 shipping containers, the builder said, and normally sailed between Mombasa, Dar Es Salaam, the Comoros Islands and Mozambique.[65]

Discussion and Conclusion

A series of scholars over the past 80 or so years have foretold the imminent decline and disappearance of some or all of the wooden watercraft plying the waters of East Africa (Falck, 2014, p. 172; Hatchell, 1961, p. 211; Jewell, 1969, p. 94; Morgan, 1940, p. 27). In fairness, they have been correct in some respects: the large ocean-going vessels of the monsoon trade – connecting Somalia, southern Arabia, the Arabia-Persian Gulf and South Asia – have indeed been absent for more than 50 years now (Agius, 2002, pp. 28–29, 2005, p. 123; Gilbert, 2004, pp. 134–167). But for the most part, reports of the impending cessation of East African wooden boatbuilding have been exaggerated. Today's cargo vessels occupy economic and technological niches that offer their operators attractive-enough returns on trade between the ports of the mainland, the Zanzibar archipelago and elsewhere: fulfilling the role of the so-called 'country boats' of earlier times. For the operators of modern cargo *mashua*s and *jahazi*s, continued use of the settee sail – albeit supplemented by outboard motor – functions economically to keep fuel costs down on their regular routes and sustain the viability of their trade.

In contrast, the number of small fishing vessels of the types outlined above remains high. The small-scale artisanal fishing sector is buoyant, largely reflecting population growth, with the resulting

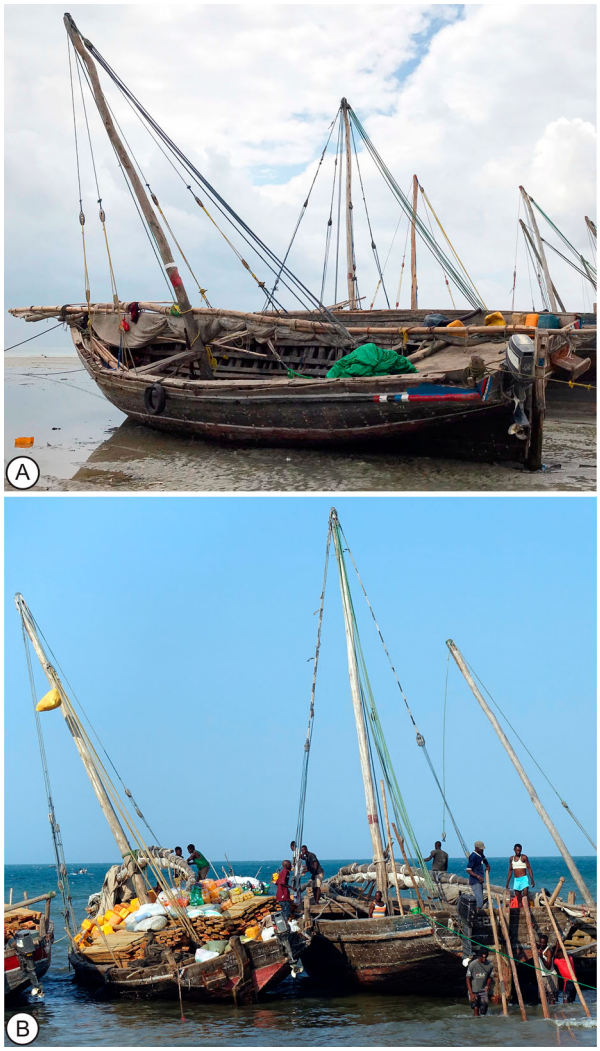

Figure 24. Cargo *mashuas* in Bagamoyo, August 2019. (A) An unladen vessel, showing inner hull structure; (B) a vessel (left) loaded with planks and foodstuffs and another loading with roundwood poles (Images: Lucy Blue and John P. Cooper).

Figure 25. Tentatively identified *jahazis* (A) under sail and (b) at anchor at Stone Town, Unguja (Images: John P. Cooper and Alessandro Ghidoni).

falling stocks and soaring catch rates in inshore waters characterized as 'alarming' (Breuille & Grima, 2014, pp. 13–14). Tanzanian fisheries law requires all fishers to be licensed and their boats registered, but it does not limit their numbers or set quota limits on catch (Breuille & Grima, 2014, pp. 34–36). The result, in a country with relatively low rates of food security, has been an increase in individuals entering the sector, and with it a growth in the number of entry-level fishing craft such as the *ngalawa* alongside the growth of seine-net fishing pursued by the *ngwanda* and *boti la mtando* owners. On Unguja in particular, tourism has offered a further opportunity for boatbuilders and operators, supporting the construction of *ngwanda*s and offering additional income streams for some owners of *ngalawa*s and other small craft.

However, what may appear to the outsider – not least the reader of *IJNA* – to constitute a rich nautical heritage worthy of study or even preservation is, more importantly to its practitioners, the regular material culture of quotidian life, driven by economic imperatives above all. While the authors, of course, met fishers, seamen and maritime officials with clear opinions about, and curiosity towards, the historical and cultural dimensions of their watercraft, many expressed an unsentimental willingness to dispense with what they saw as cumbersome and limiting technologies, such as the sail, for more enabling ones, such as the outboard motor, should their personal economic circumstances allow. We detected little sentimentality around the demise of the *mchoro*, for example, except among skilled builders who had once taken a craftsman's pride in executing its double-ended hull. Equally, fishers are well aware of the limitations that the dugout *ngalawa* and *mtumbwi*, for example, place on their fishing range and catch. What keeps all the wooden watercraft of the Zanzibar Channel in play are the material and technical affordances available to their makers and owners, and the economic possibilities they

Figure 26. A cargo *bumu* having its sheer line extended at Kinazini, Unguja, August 2018 (Images: John P. Cooper and Alessandro Ghidoni).

enable. The fate of these craft no doubt depends on such critical factors as national forestry management policies and the price of timber, the economic competitiveness of fibreglass and metal boats (both rarities today), the regional management of fish stocks, and the alternative livelihood opportunities open to an increasingly educated younger generation. It would take a particular nautical luddite to condemn a practitioner's abandonment of the vessels described above in pursuit of a better life.

The extent to which the wooden boatbuilding scene in the Zanzibar Channel can in any case be said to be 'traditional' at all is moot – not least because of the limited archaeological or historical evidence we have to establish its longevity. We conjecture the antiquity of the *mtumbwi* or *ngalawa*, for example, largely because scholars have romanticized their dugout technology as 'ancient' – or even 'primitive' (Bowen, 1952, pp. 198–201; Falck, 2014, p. 162; Hornell, 1920, p. 134, 1944b, p. 172; Morgan, 1940, pp. 27, 28; Robinson, 1937, p. 66; Warrington Smyth, 1906, p. 315), or they have sought to connect the outrigger with some sort of diffusionist history (Haddon, 1918, p. 49; Hornell, 1920, p. 134, 1944a, pp. 3–4, 1944b, pp. 170, 181–185; Morgan, 1940, p. 28; Prins, 1959, pp. 207–209; Robinson, 1937, pp. 65–67, 69–70; Warrington Smyth, 1906, p. 315). We can, equally, say little about the history of nailed-plank boats in the region – particularly smaller ones – much before the late twentieth century. We should not let our imaginations run riot in the absence of evidence that will, in reality, be a long time in the accrual.

What we do have evidence for, in contrast, is change, and the appetite for it should circumstances allow. As we have noted, large local vessels – the *mtepe*, *dau la mtepe*, and even the larger *jahazi*s – have long gone, for a slew of reasons, among them the development of modern transport infrastructure, the end of the mangrove-pole trade, and the changing political economy of the wider Indian Ocean (Agius, 2002, pp. 28–29, 2005, p. 123; Gilbert, 2004, pp. 134–167). Builders and users have taken up newly available propulsion technologies – the outboard and, to a lesser extent, the inboard engine. These, together with new materials for fishing gear, have, as we have seen, facilitated the emergence of new vessel types. New controls on forestry and, in the case of dugouts, the dwindling availability of large trees of certain species, have, meanwhile, changed the timbers people use in making their vessels.

What such change in the recent past alerts us to is that there is reason to think that the deeper, pre-colonial past of the Swahili coast was any less dynamic – and that, at least, it was not static. What this article presents is not, therefore, an exposition of imagined boatbuilding 'traditions' in an ahistorical schema, but principally an overview of contemporary nautical technology and practice. While we hope it does offer bases for comparison between archaeological finds and these ethnographic parallels, our greater hope is that it demonstrates, and indeed celebrates, something of the material culture of the contemporary agents of maritime life in the Zanzibar Channel, and lays the groundwork for a better appreciation of their lives and the challenges they face.

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Supplementary Materials

The research data supporting this publication are openly available from Zenodo, doi:10.5281/zenodo.5831798.

Notes

1. Swahili terms are provided throughout this article in italics; where these are of animals or plants, the scientific name follows, where known.
2. Interviewed 30 July 2018.
3. Formerly Agisoft Photoscan Pro.
4. 'Il n'est donc pas éttonant que la navigation soit restées chez eux dans une nullité complete … '.
5. We discuss this further in Ichumbaki et al. (2022).
6. We provide the Swahili plural of each boat type on first mention, after which we use an anglicized 's' plural for the convenience of readers without knowledge of the language.
7. Boatbuilder, 50s, Bagamoyo, 13 August 2019; retired boatbuilder, 80s, Bagamoyo, 17 August 2019; see also Hornell (1942, p. 27).
8. Dugout maker, 50s, Bagamoyo, 10 August 2019.
9. Builder and user, 45 y.o., interviewed in Marahubi, Unguja, 30 July 2018.
10. Dugout maker, 50s, Bagamoyo, 10 and 11 August 2019, 3 April 2020.
11. *Contra* Falck (2014, p. 165); *ngalawa* carver, Mazizini, Unguja, 4 August 2018; *ngalawa* carver and fisher interviewed 26 October 2019.
12. Carver of a variety of dugouts and a *ngalawa* fisher, interviewed 14 December 2019.
13. For a detailed account of the construction of a *ngalawa* arising from this research see Ichumbaki et al. (2022).
14. For a full account of the construction of a *ngalawa*, see Ichumbaki et al. (2022).
15. Although the actual stitching/sewing of boat timbers using cordage is known as *kufuma*, equivalent to 'weaving' in English.
16. Carver and user, 50s, interviewed in Bagamoyo, 24 February 2020.
17. Morgan (1940, p. 29) gives the same Swahili name to the pointed version of the bow timber.
18. Ngalawa fisher, 52, interviewed 4 March 2020.
19. Builder and user, 45 y.o., interviewed in Marahubi, 30 July 2018.
20. Carver and user, 45 y.o., interviewed in Marahubi, Unguja, 30 July 2018.
21. Carver and user, 45 y.o., interviewed in Marahubi, Unguja, 30 July 2018.
22. *Mtumbwi* owner and captain, Bagamoyo, 16 August 2019.
23. Interviewed 30 July 2018.
24. Interviewed 24 August 2019.
25. Carver and fisher, Marahubi, Unguja, interviewed 30 July 2018; Carver and fisher, Bagamoyo, interviewed 12 March 2020.
26. Kisi fisher, Interviewed in Bagamoyo, 24 February 2020.
27. Kisi fisher, Interviewed in Bagamoyo, 24 February 2020.
28. Interviewed in Bagamoyo, 24 February 2020.
29. Middle-aged fisher, Mlingotini, 14 August 2019.
30. Cooper, Blue and Ghidoni are preparing a detailed account of the construction of a *ngwanda* in Zanzibar, based on their 2018 fieldwork.
31. Boatbuilder from Unguja, 50s, Bagamoyo, 11 August 2019; retired boatbuilder from Mlingotini, 20 August 2019; group of four experienced boatbuilders, Bagamoyo, 9 August 2019.
32. Apprentice boatbuilder from Unguja, 28, interviewed Mlingotini, 8 August 2019.

33. Not to be confused with teak (*Tectona grandis*), which has a distribution around South and South East Asia.
34. Boatbuilder from Tumbatu, early 40s, interviewed at Mazizini, Unguja, 4 August 2018; boatbuilder from Unguja, 50s, Bagamoyo, 11 August 2019; boatbuilder from Pemba, 20s, Bagamoyo, 18 August 2019.
35. Boatbuilder from Unguja, 50s, Bagamoyo, 11 August 2019; boatbuilder from Pemba, 27, Bagamoyo, 18 August 2019; boatbuilder from Tumbatu, early 40s, interviewed Mazizini, Unguja, 4 August 2018.
36. Boatbuilder from Pemba, 20s, Bagamoyo, 7 August 2019; apprentice boatbuilder from Unguja, 20s, Mlingotini, 8 August 2019.
37. Boatbuilder from Unguja, 50s, Bagamoyo, 11 August 2019; Boatbuilder from Tumbatu, early 40s, interviewed Mazizini, 4 August 2018.
38. Builder from Tumbatu, early 40s, interviewed at Mazizini, Unguja, 4 August 2018; boatbuilder from Pemba, 20s, interviewed in Bagamoyo, 7 August 2019; apprentice boatbuilder from Unguja, 20s, interviewed at Mlingotini, 8, August 2019; boatbuilder from Unguja, 50s, interviewed at Bagamoyo, 11 August 2019; boatbuilder from Pemba, 27, interviewed at Bagamoyo, 18 August 2019.
39. Retired boatbuilder from Mlingotini, interviewed 20 August 2019.
40. Mtumbwi builder, Marahubi, Unguja, interviewed 30 July 2018.
41. Middle-aged inshore fisherman, Mlingotini, interviewed 14 August 2019.
42. Plank-boat builder, mid-50s, Bagamoyo, interviewed 17 August 2019; Plank-boat builder, 80s, Bagamoyo, interviewed 17 August 2019; plank-boat builder, 50s, Nungwi, Unguja, 24 July 2018.
43. Plank-boat builder, 80s, Bagamoyo, interviewed 17 August 2019
44. Interviewed 17 August 2019.
45. Interviewed 17 August 2019 in Bagamoyo and 20 August 2019 in Mlingotini.
46. Early 40s, interviewed 4 August 2018.
47. Interviewed 17 August 2019.
48. Port official, Marahubi, Unguja, 26 July 2018.
49. Group of fishers, interviewed 9 August, 2019; *Ngwanda* skipper, 50s, Bagamoyo, 4 March 2020.
50. When used for this type of fishing, the net is referred to as *nyavu ya mtando wa usiku*, or the 'night seine net'; by day, the seine net is known as *nyavu ya mtando wa mchana* or 'day seine net'.
51. Group of fishers, interviewed 9 August, 2019; *Mtando* skipper, Bagamoyo, 16 August 2019; *Ngwanda* skipper, 40s, Bagamoyo, 24 August 2019; *Ngwanda* skipper, 50s, Bagamoyo, 4 March 2020.
52. *Ngwanda* owner, Bagamoyo, interviewed 18 August 2019.
53. *Mtando* skipper, Bagamoyo, interviewed 16 August 2019.
54. For example, by the 33-year-old skipper of such a vessel in Bagamoyo, interviewed 25 August 2019.
55. *Ngwanda* skipper, Bagamoyo, interviewed 4 March 2020.
56. In his twenties, interviewed in Bagamoyo, 7 August 2019.
57. *Boti la mtando* skipper, 30s, Bagamoyo, interviewed 17 August 2019. *Ngwanda* skipper, 40s, Bagamoyo, interviewed 24 August 2019.
58. *Boti la mtando* skipper, 30s, Bagamoyo, interviewed 17 August 2019.
59. *Ngwanda* builder, 50s, Nungwi, Unguja, interviewed 24 July 2018.
60. *Ngwanda* builder, 50s, Bagamoyo, interviewed 11 August 2019.
61. *Ngwanda* skipper, 40s, Bagamoyo, interviewed 24 August 2019; *ngwanda* skipper, 50s, Bagamoyo, 3 March 2020.
62. Plank-boat builder, 50s, Bagamoyo, interviewed 10 August 2019.
63. *Ngwanda* skipper, 50s, Bagamoyo, interviewed 3 March 2020.
64. Cargo *mashua* captain, 30s, interviewed 16 August 2019; cargo *mashua* captain, 50s, Bagamoyo, 3 April, 2020.
65. Interviewed 1 August 2018, Kinazini, Unguja.

ORCID

John P. Cooper http://orcid.org/0000-0003-3144-6710
Lucy Blue http://orcid.org/0000-0003-4202-1582
Alessandro Ghidoni http://orcid.org/0000-0002-3143-8879
Elgidius B. Ichumbaki http://orcid.org/0000-0001-9841-1753

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