[**M:**RESEARCH]

The International Journal of Nautical Archaeology (2012) 41.1: 158-170

doi: 10.1111/j. 1095-9270.201100314.x

THE INTERNATIONAL JOURNAL OF NAUTICAL ARCHAEOLOGY

2O12

Sailing a Sinhalese Outrigger Log boat

Gerald Grainge

2 Finglesham Farm Barns, Marley Lane, Finglesham, Deal, CT14 ONF, England,

GeraldGrainge@googlemail. com

The traditional outrigger logboats of Sri Lanka, many destroyed in the 2004 tsunami, have largely been replaced by fibreglass clones. Among the many traditional variants, the prawn logboats of Negombo, with their unique spritsail rig, are the subject of this study. An account of crew-drills is offered, based on personal observation, together with a description of its rig, data on its performance under sail and an examination of its stability characteristics.

Key words: Sri Lanka, logboats, outrigger, spritsail, sailing performance, stability.

A visit to Negombo, Sri Lanka (Fig. 1), in January 2010 brought me the opportunity of sailing on a sprit-sailed *issaň-oru* (prawn boat) (Fig. 2) of the type described by Gerhard Kapitän (2009: 80-93). This allows me to supplement Kapitän’s record and to revise my own contribution to that volume (2009: 178-81), in particular my assessment of the windward ability of the *issaň-oru* and the drill its crew use for going about. The *issaň-oru* has a single outrigger and is a genuine double-ender, changing ends as it comes about. With the outrigger always to windward, it sails equally well on either tack, delivering a performance in terms of speed through the water and of windward ability not far short of that of modern small cruising yachts.

Although each end of the hull serves alternately as bow and stern, the rig itself is not double-ended and must be turned inside-out when changing from tack to tack. My experience leads me to suggest that the terminology adopted for Kapitän’s account should be modified.

First, the term ‘conventional bow’ is virtually meaningless (Hornell, 1943: 40-1; Kapitän, 2009: 80, 119). As one changes from tack to tack there is no sense that one might be sailing backwards. Secondly, the terms ‘tacking’ and ‘gybing’ are inappropriate; the manoeuvre taking the logboat from one tack to the other—changing ends in the process—is the same as that taking it from one gybe to the other (Fig. 3). The same manoeuvre is used by Pacific outrigger craft and is termed by Doran (1974: 130-40) and after him Lewis (1994: 61-2) as ‘shunting’; Lewis goes so far as to describe it as ‘yet another Austronesian contribution to seagoing, being distributed symmetrically about Indonesia—west to Ceylon and Madagascar and, east throughout Micronesia, Melanesia and Polynesia’ (1994, 66; for a contrary view see Vitharana, 1992: 14-6). Lewis also notes that ‘shunting’ is mentioned by Pliny the Elder c.AD 75 (Nat. Hist. VI, xxiv, 82), and that Strabo c.AD 25 (Geogr. XV, i, xv) mentions ‘an outrigger ship of apparently Indonesian origin’, but fails to mention that both are describing craft from Taprobane, thought to be Sri Lanka. The strong probability of separate evolution along parallel lines is not acknowledged.

Perhaps, rather than ‘shunting’, we might prefer to speak of ‘coming (or going) about’. Other terms we need to reconsider are ‘after/forward sprit’ and ‘after/ forward outrigger boom’. As we shall see, the ‘forward sprit’ is always forward and is best termed the ‘mast’ with the other retaining the designation ‘sprit’; the stay controlling the head of the sprit should be appropriately termed ‘vang’. As the logboat goes about, each outrigger boom is alternately ‘forward’ and ‘after’. Structurally, one of them is closely linked to the mast as the main component of the rig and is best described as the ‘main outrigger boom’, with the other as ‘secondary outrigger boom’.

The central element of the rig comprises the mast and the main outrigger boom, located amidships. The mast—a bamboo spar—is slung in a rope grommet from the inboard end of the main outrigger boom. A shroud from the outboard end of the outrigger boom stays the mast from windward; a boltrope sewn into the luff of the sail serves as a forestay, while the rake of the mast is controlled by permanently-rigged backstays—one from the masthead to each end of the hull; there is some slack in them to allow the rake of the mast to be adjusted as the logboat goes about (Fig. 4). A feature not recorded in Kapitän’s drawings and not discernible in any of his photographs was observed on the logboat on which I sailed—a short leeward shroud made fast by a rolling hitch some 4 ft. (1.2 m) up the mast and lashed to the leeward end of the main outrigger boom (Fig. 5). In my original analysis of this rig

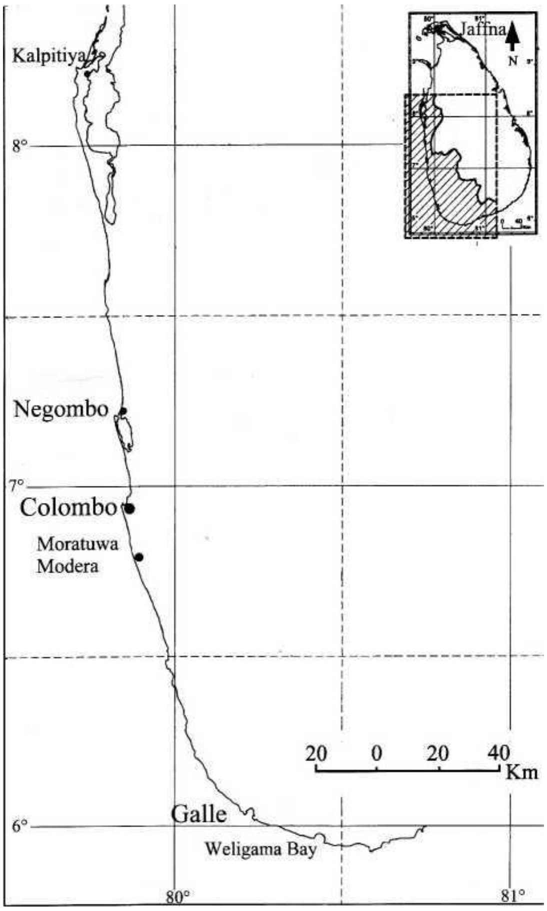


Figure 1. Map of south-west Sri Lanka, showing places named in the text. Kapitän (2009: 74) recorded sprit-sailed oru along the coast between Kalpitiya and Moratuwa Modera. (Gerald Grainge).

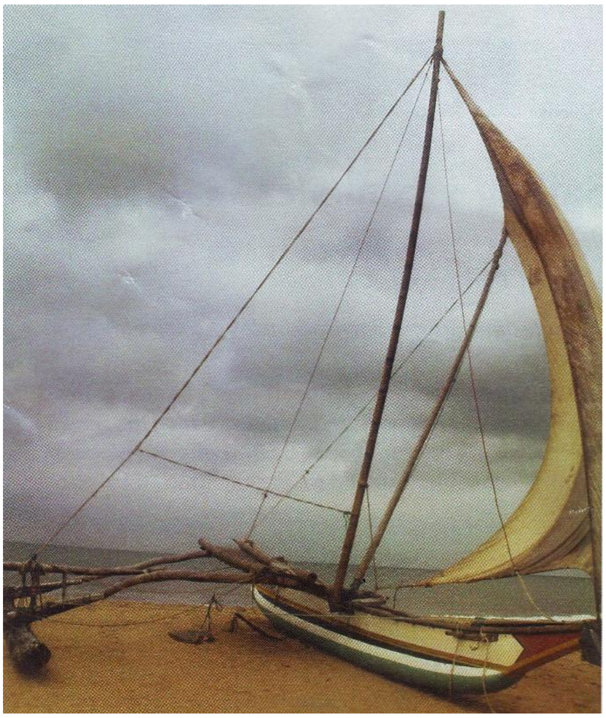
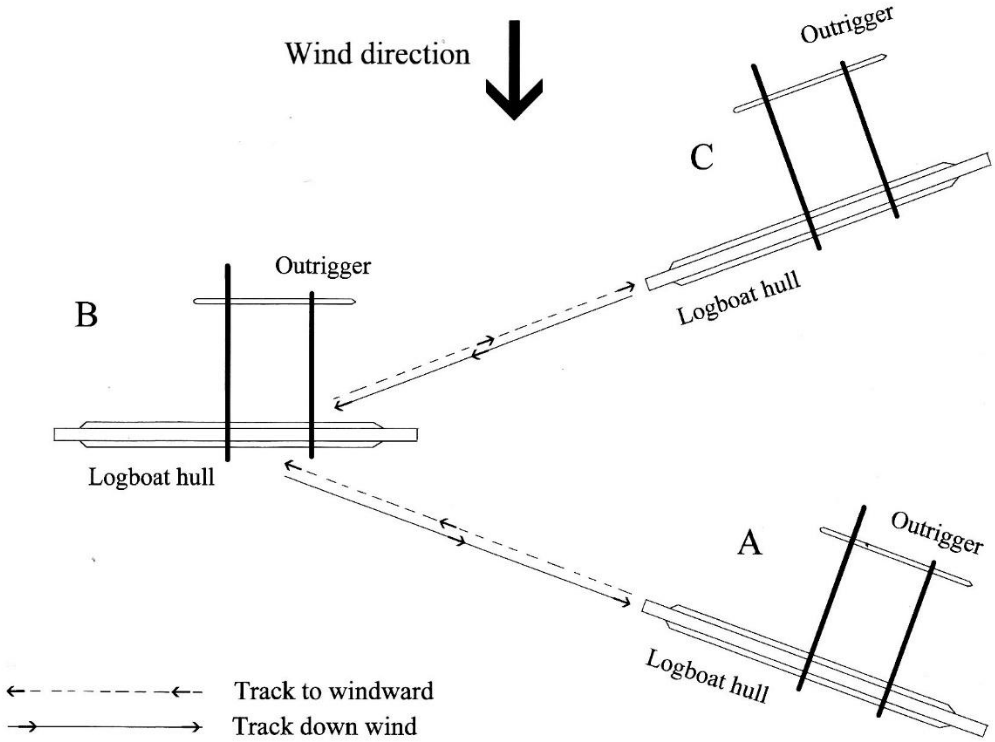


Figure 2. The *issaň-oru* owned by Mohamed Husain and used for the trials recorded here. She is rigged for the starboard tack, having sailed ashore on that tack All the main features of the rig are visible, including the lazy backstay not shown in Fig. 4. (Gerald Grainge)

(2009: 179), I pointed out that the absence of such a shroud meant that the rig would collapse if it were taken aback. I did not observe this feature on the few other logboats 1 saw; without it the risk of the collapse of the rig will always be present when close-hauled. The crew slackened off this shroud when not required—when rigged it impedes their movement as they pass between the mast and sprit; they explained that it was used when the wind was fluctuating in direction. They also rigged it when the *oru* was left with the mast stepped overnight.

The sail is not quite rectangular, the luff (leading edge) being 12-18 inches (30-45 cm) longer than the leach (trailing edge). A stout boltrope is stitched into the head, the luff and the foot of the sail and a lighter one into the leach. The boltrope at the foot of the sail extends some way beyond the clew and is permanently bent to the sheet. Sail-area may be increased in light winds by hoisting a small triangular sail on a light halyard rigged through a block at the head of the sprit, but there is no provision for reducing sail (Fig. 4). I asked Mohamed Husain, on whose logboat we sailed, about heavy-weather management. He confirmed Hornell's report that fishermen describe the wind-force in terms of the number of men sent onto the outrigger (Hornell, 1943: 42), but otherwise offered little more than saying that when the monsoon set in he would sail straight for the shore. However, his crew were heard to describe - in Sinhala - seeing a kind of 'whirlwind' approaching one day when they were in the company of other boats; they all lowered their sails as they would otherwise have capsized. With no sails hoisted they felt they were not in any danger (pers. comm. Somasiri Devendra).

In his description of the method of raising sail, Kapitän (2009: 80) follows Hornell (1943: 41): the top ends of the mast and the sprit are pushed into loops at the upper corners of the sail and the sail is raised 'by the united efforts of the crew'. While some such method must be employed in the case of the sprit-rigged *hadi-oru*, which Kapitän's photographic record shows putting out to sea from Moratuwa Modera before raising sail (2009: 82, 93), this is not quite what I observed of the issaň-oru just north of Negombo. These craft sail off the beach with the sail already set and back onto the beach without handing it. Overnight the sail, mast and sprit are lowered. In the case of Mohamed's logboat, however, the crew



it lies broadside onto the wind while the crew reverses the rig and sail to change tack; at C it is now picking up speed close-hauled on the port tack. The same drill is used to change gybe when sailing downwind: at C the logboat can be taken as sailing downwind with the wind on the starboard quarter (it might of course be sailing with the wind full astern); at B it lies broadside on to the wind while the crew reverse the rig and sail, to sail downwind on the opposite gybe; at A it is now picking up speed with the wind on the port quarter. Throughout the operation the outrigger is kept to windward. (Gerald Grainge)

left the mast stepped overnight, with the sail furled on the forestay/ bolt rope; the foot of the sprit was unshipped from its cup-shaped support, but left lashed to the after upper corner of the sail, thus resting diagonally with the head halfway up the forestay and the foot resting at the other end of the hull (Fig. 5). During the day the sail is left set. All that is necessary before the crew launch their logboat into the water is to see that the rig is adjusted to the point of sailing required to leave the beach—if the logboat has just been sailed onto the beach, this will mean reversing the rig. The drive of the sail assists in launching the *oru* and in recovering it on its return to the beach.

Going about requires the following steps (Fig. 6): the logboat is laid broadside to the wind, with the outrigger to windward; the sheet is loosened off and passed outboard of the sprit, back round it (between the mast and the sprit) and then outboard again to be belayed at what will be the new trailing end of the hull; the vang is passed to leeward outboard of everything and made fast at the new trailing end; the tack of the sail is let off and the sail is hauled by the tack (or by the sheet, if the crew have let the tack fly) between the mast and the sprit and tacked down at the new leading end of the hull. This brings the mast-rake forward by reference to the new direction of sailing; the vang and the backstay are bowsed down; the leeboards are adjusted and the sheet is hardened in as required for the new point of sailing. The helmsman takes control of the rudder with a removable curved tiller thrust into the hole at the top of the leeboard (Fig. 7).

The process of going about takes rather longer than either tacking or gybing on a fore-and-aft-rigged yacht. A video clip I made of the process recorded a time of some two minutes, though it is fair to say that I did observe from the shore an oru going about in something closer to one minute. Vitharana (1992: 53) noted that ‘every rope is pulled and tightened around a piece of rounded wood’. The big sails of these craft will transfer a considerable load to sheet and backstay, a load which will increase exponentially with increases in wind strength. I was interested to learn how the crew manage this load without winches of any kind. Observation showed that the only ropes which have to be made fast under tension are the vang, the backstay and the sheet. As Fig. 6c-d shows, the crew achieve this by using their body weight—in the case of the sheet by standing on it and taking up the slack so created. Furthermore, the effort required in the case of the vang and backstay is reduced by hauling them in before the sail is fully sheeted in.

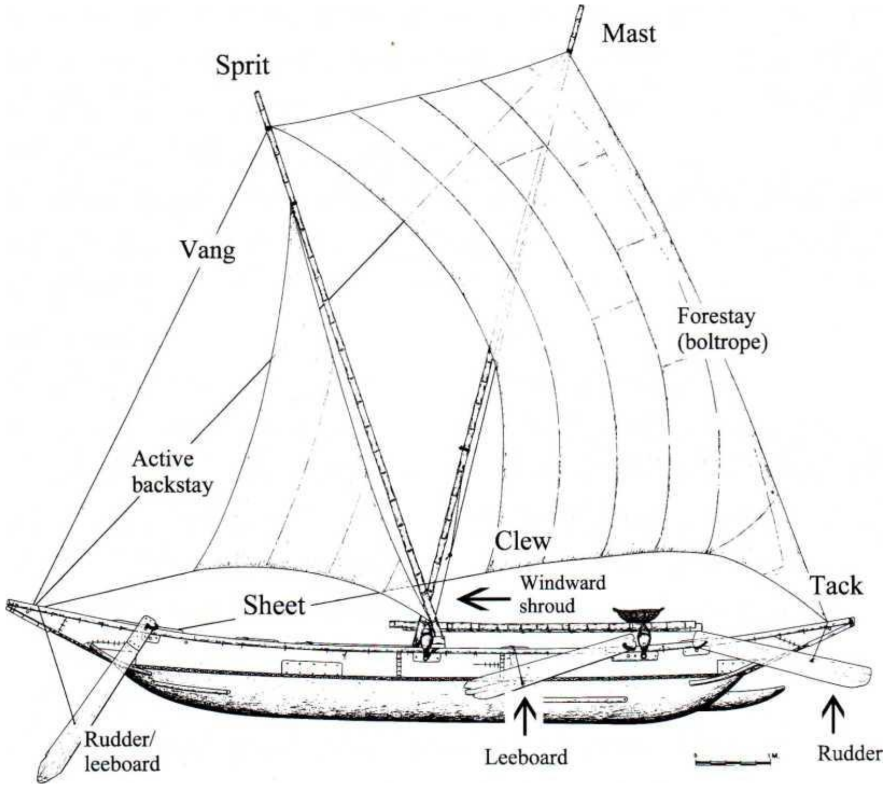


Figure 4. Detail of the rig of an *issaň-oru* from leeward. The logboat is on the port tack, sailing from left to right. The windward shroud running to the windward end of the main outrigger boom is just discernible beside the mast. The lazy backstay running from the head of the mast to the current bow is not shown; the sheet is incorrectly shown running inside the sprit and the triangular after-sail. The rudder/leeboard is shown lowered to the position required to act as rudder on this tack; on this tack the leeboard would also be lowered, not raised as shown. On the other hand the rudder at the current bow would be raised as shown; it would be lowered on the starboard tack. (Gerald Grainge, adapted from Kapitän, 2009, drawing 23b)

Wooden pegs driven transversely through the wash- strakes serve as cleats to secure the running rigging (Fig. 8a). Those at the ends of the hull—one each—curve upwards towards the windward side. Four or five feet (1.2-1.5 m) inboard of the end away from the outrigger are two stout straight pegs, while at the other end the secondary outrigger boom does duty for one of them, the other being a foot or so (c. 30 cm) closer to the end. The transverse peg under the outrigger boom plays no part in belaying the running rigging, serving as a secure point to which the outrigger boom is lashed (Kapitän, 2009; 164).

The tack of the sail and the vang are belayed outside the hull to windward at their respective end of the hull, the rope being taken under and back over the hull and lashed with a couple of half hitches outside the hull on the windward side of the peg (Fig. 8b, d). The backstay is passed under the peg at the end of the hull and under the next forward one to be secured again with a couple of half hitches on the windward side of the peg outside the hull (Fig. 8b). The sheet is made fast with a slip- hitch on the secondary outrigger boom or on the foremost of the pegs at the other end of the hull, as the tack requires (Fig. 8c).

The *issaň-oru* is described as having three leeboards, rigged on the leeward side of the hull; the function and location of each seems to be influenced by the configuration of the outrigger. Because the main outrigger boom forms with the mast the central element of a reversible rig, it is necessarily located amidships, with the outrigger configured asymmetrically opposite one end of the hull rather than the other. By tradition the outrigger of the sprit-rigged oru is towards the left when looking at the oru from windward. This asymmetrical configuration results in a displacement of the centre of lateral resistance towards the end of the hull opposite the outrigger (Fig. 9). This displacement means that on the port tack the forward leeboard needs to be further aft than on the starboard tack. This is achieved by having a second dedicated leeboard at the outrigger end of the hull, leaving the other to be used as a dedicated rudder (Fig. 4). It is to be noted that the large *issaň-oru* from Negombo are unique in having this third leeboard. The sprit-sailed *thora-oru* and the *hadi-oru* have two only, as do the lateen-rigged *palu- oru* and *bala-oru* from the Weligama Bay area. These craft too are double-enders, and like the *issaň-oru* also have asymmetrically arranged outriggers; it is not clear why they have not adopted the third leeboard.

As an auxiliary means of propulsion the *issaň-oru* carries three oars stowed lashed down across the outrigger booms, to be used only when the wind fails. In use they are slung in rope grommets on the leeward gunwale (Fig. 10); quite how the *oru* can be steered straight with three oars on the side opposite the outriggers was not clear to me. The three crewmen have quite distinct roles. The two posted at each end of the *oru* are alternately helmsman and foredeck hand. The third and most junior is stationed amidships, responsible for passing sheet, vang and sail from one end of the logboat to the other when going about and looking after the sheet. He may well be the first to be sent out onto the outrigger as the wind rises (Fig. 11). I was told by Mohamed Husain that no one member of the crew was in charge as skipper; observation showed that they worked as a team.

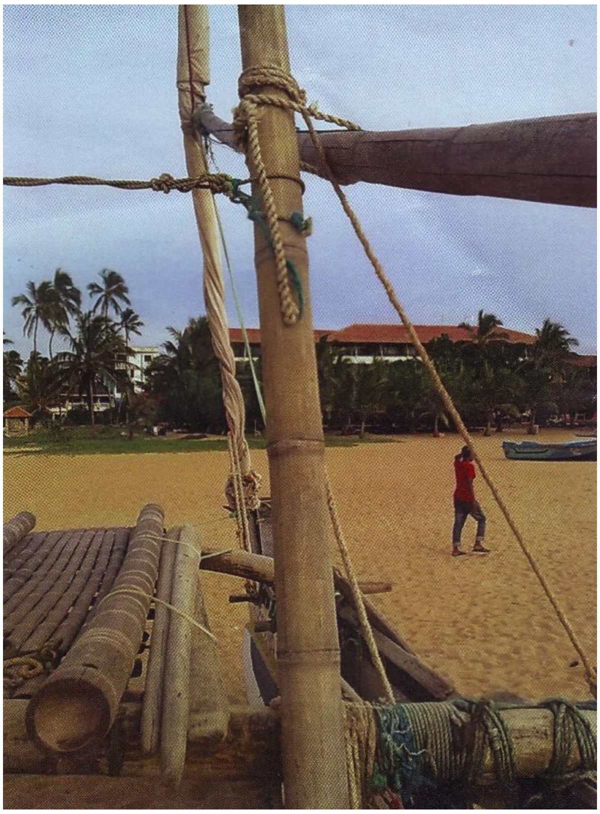


Figure 5. The removable leeward shroud. Also shown is the way this crew left the sail furled overnight, and the bamboo platform on which gear can be stowed and on which passengers are invited to sit. (Gerald Grainge)

Hornell commented that the space between the washstrakes was so narrow that one could usually accommodate only one leg inside the hull (1943: 40). Narrow indeed it is and the normal posture of the helmsman is to sit at the trailing end of the hull with one leg outside the hull, holding the rudder-blade between his big and second toe, but crewmen do stand and move between the washstrakes with both legs inside the hull. Hornell (1943: 42) also noted the practice of keeping the sail ‘continuously wet with water splashed skilfully upwards by means of a long-bodied and very narrow, scoop-shaped bailer’, to ‘make the best of whatever breeze there may be’. I observed this being done, but only when the logboat was close-hauled, a point of sailing on which sail-shape is most critical. A speculation that keeping the sail wet would tighten up the natural fibres of which the sail was made, so that it would keep an aerodynamically efficient shape, would not be misplaced. One crewman used a bailer which answered Hornell’s description (Fig. 12); another used a plastic bottle from which the bottom had been cut out.

Using a hand-held GPS and a hand-held anemometer, I was able to record some performance data for the oru (Table 1). The wind was north to north-easterly 6 to 9 knots (Force 3 occasionally dropping to the top end of Force 2). On various points of sailing, from hard on the wind to running downwind, speeds in the range of 4-6 knots were recorded,

Figure 6. Going about. From top left clockwise: a) having brought the sheet inboard of the sprit, this crewman is gathering it up to pass it back outboard of the sprit to the crewman in the foreground; b) the tack of the sail has been released and the crewman is hauling the sail by the sheet towards the new fore end; c) this crewman is using his body-weight to bowse down the backstay; d) the oru is now picking up speed close-hauled on the starboard tack and the crewman is stamping down on the sheet to bring it under the leeward end of the main outrigger boom where a notch has been cut to receive it. (Gerald Grainge)

Such data, recorded on one occasion over a period of some three hours, must be treated with caution. Hand-held instruments are not without their imprecisions. Wind direction was estimated by eye, using a tell-tale attached to the windward shroud. In addition it was not possible to make an assessment of leeway (although the leeboards suggest that it would not be significant) or to allow for tidal currents, if any. Moreover, there could be no allowance for the fact that the logboat was carrying four passengers, rather more than the usual load. In spite of this the overall impression is of a capable sailing craft.

Hornell reported that these craft are can ‘easily reach 8 or even 9 knots’ (1943: 43). With a waterline length of 23' 10" (7.3 m), this *oru* has a theoretical maximum displacement speed of some 6.5 knots (McGrail, 1987: 196). This maximum can be exceeded if the hull planes and Dr Ray Wijewardene has insisted that these *oru* are indeed capable of planning (pers.comm)[2]. To plane the hull needs an underwater profile which will lift the hull out of the water at speed; this the *oru* hull does not seem to have. However, as McGrail and Corlett have pointed out:

> A boat of fine form with a volumetric coefficient $\leq 2 \times 10^{-3}$ can be driven at very high speeds without excessive squat or wave making: it will not be planing, although it will have the appearance of doing so. With a monohull under sail this condition is normally only attainable when running, although a twin-hull form, where stability is supplied by the two hulls, may also achieve these very high speeds when reaching (McGrail and Corlett, 1977: 352).

The volumetric coefficient is defined as the displacement volume divided by the waterline length cubed (in other words, expressed as a proportion of the volume of a cube, the edges of which are equal to the waterline length). From Kapitän's scale-drawing of an *issaň-oru* (2009: 84) the waterline length may be taken as 8 m, the waterline beam as 0.3 m and the draught as 0.18 m; this would give a displacement volume in the order of 0.7 m3 and a volumetric coefficient in the order of 0.0014, well below the threshold offered by McGrail and Corlett. Theoretically, then, we may accept that the sprit-rigged *oru* are capable of speeds in the range suggested by Hornell, but that such speeds will be achieved only under exceptional conditions.

A feature so far not explained in the literature is the extension of the *kadise* beyond the outrigger float (Fig. 11). This is the stout horizontal timber lashed on top of the main outrigger boom. Kapitän, Vitharana and Flornell note that, with the lifeline strung breast-high between the mast and the windward shroud, this enables crewmen to climb out onto the outrigger boom to counter the heeling effect of the wind, but they do not explain why it is extended beyond the outrigger itself (Hornell, 1943: 41-2; Vitharana, 1992: 36; Kapitän, 2009: 80). At the end of this extension is a hole through which a line is rigged, both ends of which are belayed at the inboard end of the main outrigger boom. The purpose of this line is to control one end of the prawn trawl net, the other being made fast to whichever is the forward end at the time. The trawl net is kept on the sea-bed by two heavy weights. I had arranged to have a second outing to record the process of shooting the net, trawling and retrieving it, but that did not happen.

Just minutes into that second outing, the *oru* capsized. We had the same three crewmen, but instead of four passengers we had but two, neither of whom had volunteered to ride on the outrigger. Wind-strength I would judge to be a little more than on the first occasion, again from the north/north-east. The crew were just hardening up, close-hauled on the starboard tack, when the wind-strength increased and the outrigger started rising out of the water. The *oru* rapidly ended up, as capsized twin-hulled craft must, upside down. The experience led me to believe that stability is a crucial factor in the management of sailing *oru*.

Figure 7. With the *oru* on the port tack the helmsman controls it with a curved tiller thrust into the rudder/leeboard. (reproduced by kind permission of Mihiri Devendra)

Figure 13 shows the centre of gravity (G) and the centre of buoyancy when upright (B) of a monohull (I have chosen the cross-section of a Sinhalese seine- netting barge, a ma-dal-paru)' B' represents the centre of buoyancy at the angle of heel shown. The line BM through G is the vertical centreline of the vessel when upright. The point on this line intersected by a vertical line through B' is termed the metacentre (M) and GM is the metacentric height. GZ is the righting lever. As long as this is positive, in other words as long as M is above G, the hull will recover from heeling. For this to happen, G need not be below B, but it must be below M. The cross-section of a monohull will normally be designed so that, as it heels, B' will continue to move outboard up to considerable angles of heel.

These concepts can be applied to an assessment of the stability of the sprit-sailed oru. Figure 14a shows such a craft sailing upright. B1 is the centre of buoyancy of the main hull; B2 that of the outrigger. From the dimensions measured from Kapitän’s scale- drawing, one may estimate that the ratio of the displacement of the outrigger to that of the main hull is 1:2.3—1:2.4. This would indicate that the combined centre of buoyancy (B) of the outrigger logboat is located some 30% of the distance from B1 to B2. This is the centreline of the oru and G, the centre of gravity, will be located above it.

In Fig. 14b the *oru* is heeled to 15°. Once the outrigger float is out of the water the centre of buoyancy will move immediately to B1. The metacentric height (GM) is considerable and the righting lever (GZ) provides a substantial reserve of stability. However, as the angle of heel increases, B1 cannot move further outboard and that reserve of stability will be rapidly exhausted. Figure 14c shows the *oru* heeled to 55°. M is now below G and the righting lever is negative. Nothing can prevent capsize and, as is always the case with multi-hulls, the *oru* will find a new state of stability upside down. It cannot be recovered from that state without being first brought ashore. In our case the *oru* was towed, inverted, into shallow water close to the shore. The crew, and other helpers, standing on the sea-bed, were then able to right it by lifting the outrigger and passing it over the main hull, an operation simply not possible when afloat.

Just how rapidly the reserve of stability will run out is seen in Fig. 15, showing GZ against angles of heel for the double-sprit *oru*, compared with a typical modern monohull yacht. For the *oru* resistance to heeling is initially very large, but thereafter diminishes rapidly, reaching a point of vanishing stability at c.55°. For the monohull, by contrast, the righting lever (GZ) increases with increasing angles of heel, reaching a maximum perhaps in the range of 40°-70° of heel and continues to have a significant positive value at angles in excess of 90°. This means that the monohull will recover from a B1 knockdown (a yachting term for a broach which lays the yacht with its mast parallel to the water surface—unpleasant, but survivable—unlike the rare B2 knockdown which ends with the yacht upside down, in a position of inverted stability from which it cannot recover).

Statically, the *oru* offers immediate and considerable resistance to heeling; whereas the crewman clambering aboard the monohull may cause an immediate list, the *oru* will barely register his arrival. But sailing vessels do not operate in a static environment—as well as other things, they respond to aerodynamic forces. As the sailing monohull responds to the wind, it heels until it reaches equilibrium between the aerodynamic heeling force and the righting lever; the former reduces in value as the craft heels, while the latter increases (as any sailing craft heels to the wind, the aerodynamic heeling force decreases with the angle of heel—sailing when heeled reduces the effective sail area).

In the case of the sailing oru, as the aerodynamic heeling force reduces with increasing angles of heel, so does the righting lever. This means that in practice the *oru* must not be allowed to heel to the wind; once the outrigger float comes out of the water, capsize is

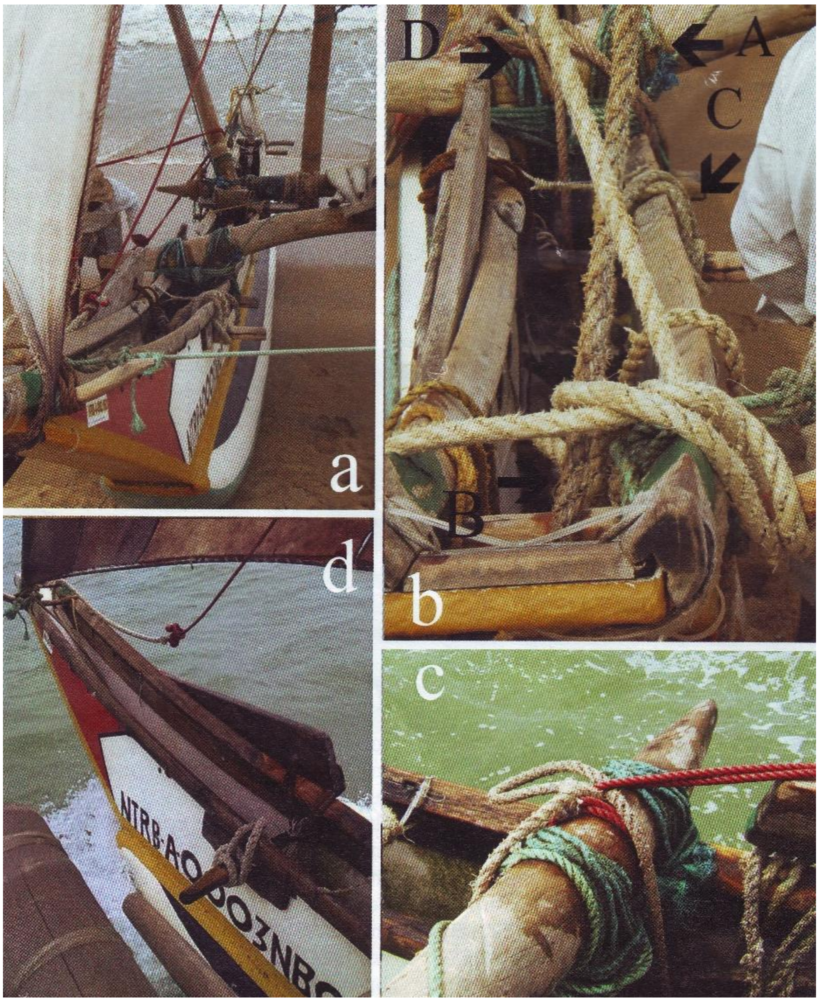


Figure 8. From top left clockwise: a) the transverse pegs serving as cleats to secure the running rigging; b) the backstay (A, B and C) and the vang D; c) the sheet is made fast to the secondary outrigger boom with a slip hitch; d) the sail is tacked down to the bow; also shown is the lazy backstay, (a-b Mihiri Devendra, c-d Gerald Grainge)

inevitable. This must have important consequences for the management of the *oru* under sail. Anticipation is everything. Crewmen must be sent out on to the outrigger before, not when the strength of the wind requires it. The slip-hitch shown in Fig. 8c will allow the sheet to be eased rapidly in an emergency. Moreover the danger of capsize is greatest when hard on the wind. Studies of three aerofoils (sail-profiles) showed that for one of them the aerodynamic heeling force was three times as great in an apparent wind 60° off the bow as in an apparent beam wind; and for the other two four times as great (Marchaj, 1964: 130-1; Grainge, 2002: 118).

The limits of the stability of the *issaň-oru* are a direct consequence of the evolution of its present form through the millennia, resulting from many anonymous modifications, both large and small. It started with a simple paddled or poled logboat of a type which still exists on the rivers and inland waters of Sri Lanka, which derives its stability from the addition of a single outrigger (Kapitän, 2009: 56-65, 168). At some stage a sail was added; this inevitably meant that stability was to some degree compromised. Because the Sinhalese tradition was so firmly rooted in the single-outrigger logboat, it did not, as did other traditions, see an evolution from the logboat to the planked hull into which the boat- builder could build stability without an external device such as the outrigger. For that reason there was no option but to accept the stability compromise as an issue to be managed by the crew, rather than the boatbuilder; although it must be managed with care, to judge by the long history of the type, it is an issue which the crews have learnt to live with.

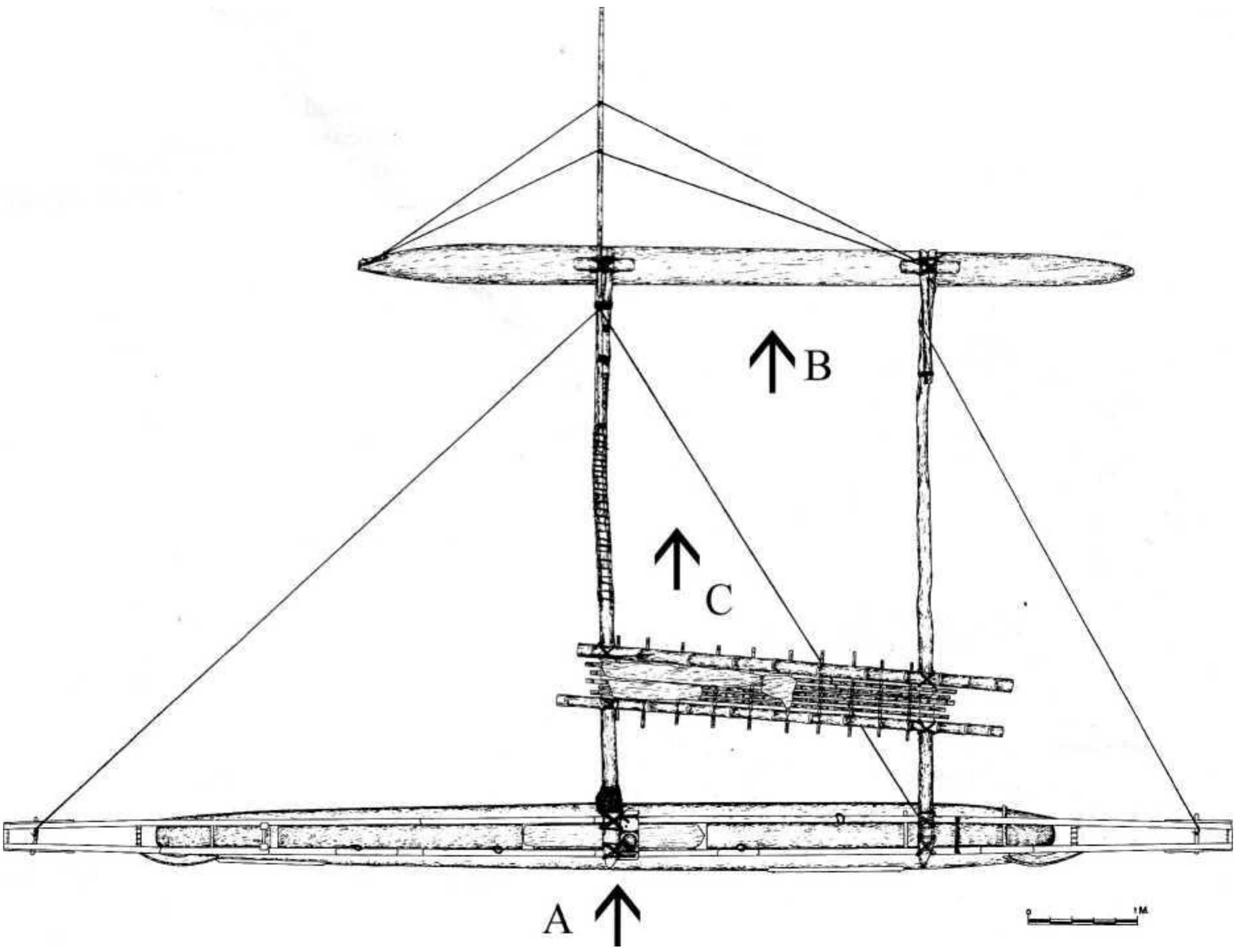


Figure 9. Displacement of the centre of lateral resistance (CLR) caused by the asymmetric configuration of the outrigger: A, CLR of main logboat hull; B, CLR of outrigger; C, combined CLR of main logboat hull and outrigger. This displacement towards the outrigger end of the hull applies on both the port and starboard tack. The drawing does not show the effect of the leeboards and assumes that CLR is located at the midpoint of the longitudinal cross-section of the hull and of the outrigger; in practice it is located forward of the midpoint.

(Gerald Grainge, adapted from Kapitän, 2009, drawing 23a)

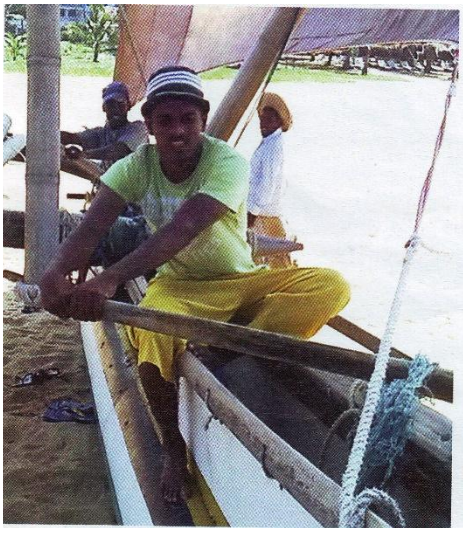


Figure 10. These crewmen demonstrate the oars; note the blue grommet secured inside the hull from which the oar is slung. (Gerald Grainge)

Without further discussion with local fishermen, it is not possible to describe what other precautions might be used in practice to avoid capsize; though sailing in moderate weather outside the monsoon season is the accepted practice. An obvious measure to ensure the safety of the crew and possibly the salvage of the *oru* after capsize is sailing in company, as the logboats of the Negombo prawn fishing fleet do, and it is notable that this fleet appears to operate within three miles or so of the shore. Somasiri Devendra has confirmed that *oru* always sail in company, leaving at the same time for the same fishing grounds. He also recalls asking how a capsized *oru* would be salvaged and being told that the outrigger would be cut away and the hull towed home.

A point worth considering is whether sailing *oru* customarily go further offshore than the three miles or so of the Negombo fleet. Hornell reported that craft like these 'commonly sail from 20 to 25 miles from land on the outward run' (1943; 42-3). He was writing about the closely related sprit-sailed logboats used for trolling for kingfish (*thora*-*oru*). The process involves sailing at speed trailing a line with a hook hidden by 'a ragged tuft of white cloth or a strip of snowy coconut flesh'. The fish snaps at the bright fast moving object and is hooked.[3] Hornell's report about the distance sailed offshore appears to be confirmed, but may simply be repeated, by the Dictionary of the World's Watercraft (s. v. *oruwa*), with its figure

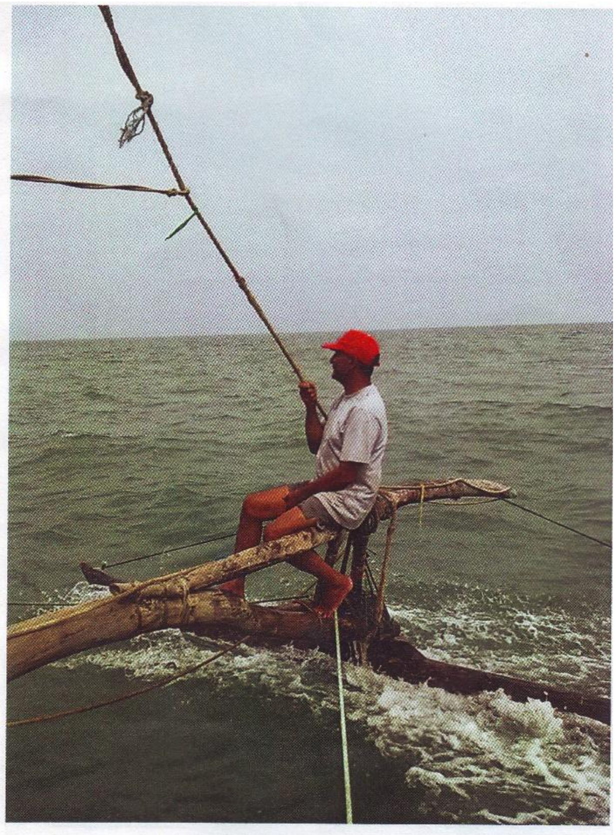


Figure 11. Tuanie Ismail demonstrates how crewmen climb out onto the main outrigger boom to maintain stability. The timber on which he is sitting and which extends beyond the outrigger is the *kadise*. (reproduced by kind permission of Mihiri Devendra)

of 40km (Mohamed Husain told me that he had sailed to Jaffna, a coasting voyage of some 150 nautical miles, but this is not quite the same as going even 20 miles offshore). However, independent confirmation does appear in Appendix A of the 1867 Report of Commissioners... into the Sea-Fisheries of Ceylon. Describing the process of trolling for kingfish and similar species, it states: 'The boats that start in the morning continue out at sea till or 4 o'clock, and those that start at midnight till 12 or 1 o'clock, and return ashore.' Assuming a single run out and return within the period stated, each of some six hours, this would imply reaching a distance offshore of some 24 nautical miles, if the average speed is 4 knots. Capsize at that distance offshore, with no possibility of recovery, would be lethal. Only the close presence of other vessels might provide a possibility of rescue for the crew, but the logboat would in all likelihood be lost.

In almost every respect, Mohamed Husain's *issaň-oru* is a traditional outrigger logboat. Its hull, however, is made from glass-reinforced plastic (GRP), though traditional materials are used for the rest of its construction. The great majority of the traditional craft recorded by Kapitän were destroyed in the 2004 tsunami. They have been replaced by glass-fibre clones. Figure 16 shows GRP versions of a seine-fishing barge.

Figure 12. The 'narrow, scoop-shaped bailer' described by Homell. (Gerald Grainge)

Table 1. *Sailing a Sinhalese outrigger logboat (performance data recorded on 18 January 2010)*

Boat speed (knots)	True wind direction (° clockwise from bow, '—' indicates port tack/gybe)	VMG close-hauled (knots)	Tack
5.7	74	1.6	Starboard tack
4.3	77	1.0	Starboard tack
4.8	130	—	Starboard tack
4.3	134	—	Starboard tack
4.8	161	—	Starboard gybe
5.6	162	—	Starboard gybe
4.3	180	—	Starboard gybe
4.8	180	—	Starboard gybe
3.9	−180	—	Port gybe
3.9	−180	—	Port gybe
4.8	−162	—	Port gybe
4.8	−160	—	Port gybe
5.2	−145	—	Port tack
4.8	−142	—	Port tack
5.2	−74	1.4	Port tack
4.3	−70	1.5	Port tack

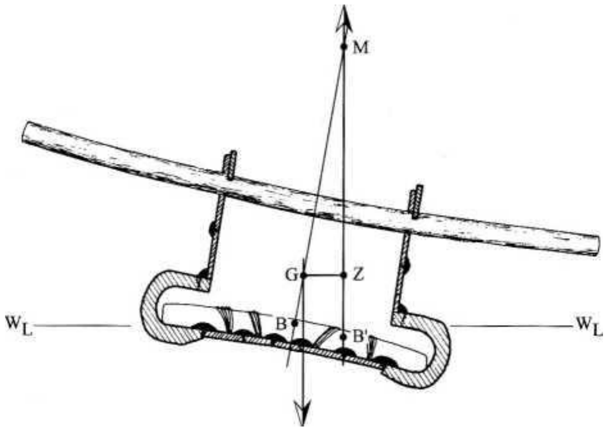


Figure 13. Righting forces in a monohull ma-dal-paru. (Gerald Grainge, adapted from Kapitän, 2009, drawing 40)

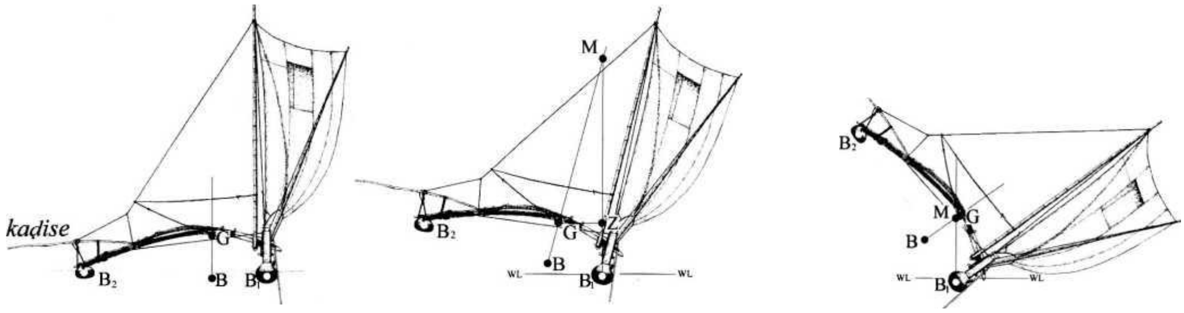


Figure 14. a) The oru upright; b) the oru heeled to 15°; c) the oru heeled to 55°. (Gerald Grainge, adapted from Kapitän, 2009, drawing 24c)

(mā-däl-pāru) and a *podi-oru* (little *oru*). In the case of Mohamed's logboat the whole of the hull plus the washstrakes have been cloned in glass-fibre. Other examples have not gone that far; Fig. 17 shows a logboat where the use of glass-fibre has been limited to reproducing the hollowed out log, with washstrakes of the traditional wood stitched to it in the traditional manner.

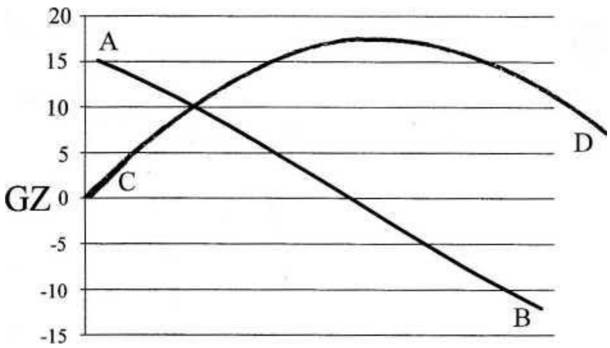


Figure 15. The stability curve of an issaň-oru (A-B) compared with that of a monohull yacht (C-D). Values of GZ are notional only. (Gerald Grainge)

Generally boatbuilders have not yet taken advantage of glass-fibre technology to introduce what might be thought to be desirable modifications, for example broadening out the topsides of the *oru* hull so as to create a U-shaped cross-section and thus give the crew more room. One exception observed was that the glass- fibre washstrakes at each end of the logboat hull of Mohamed's *issaň-oru* were curved in the horizontal plane away from the outrigger side with the effect of bringing the forestay/boltrope and the backstay onto the centreline of the hull (Fig. 8a); this feature is not apparent in any of the images published by Kapitän in 2009 and its advantage is not clear. (A photograph in an earlier article does appear to show such a curve (Kapitän, 1987: 140, fig. 4). In a limited excursion south to Galle we observed very few other exceptions to this cultural conservatism, for example, a glass-fibre *oru* with a truncated stern to take an outboard engine,

Figure 16. A *mā-däl-pāru* and a *podi-oru* with hulls of glass-fibre. (Gerald Grainge)

Figure 17. In this oru the use of glass-fibre has been limited to reproducing the hollowed out log; the washstrakes of wood are stitched to the GRP 'log' in the traditional manner, (reproduced by kind permission of Rear Admiral Terence Sundaram)

a modification which Kapitän had originally noted in *vallam-oru* with traditional hulls created from a hollowed-out log (2009: 48-53). We also observed, apart from the use of GRP, one other departure from the use of traditional materials in the *podi-oru* shown in Fig. 16: the use of stainless-steel tubes, rather than wooden pegs, to which the outrigger booms were lashed (Fig. 18).

How far the use of modern materials will impact on the evolution of traditional Sri Lankan craft cannot be foretold. What seems clear is that the prawn-fishing logboats of Negombo with their unique rig are superbly adapted to their function and as such are the ultimate expression of traditional technology. Modern technology may encourage the use of advanced materials such as stainless-steel fittings, aluminium spars or Dacron sails, even modern winches, but it is hard to see any major structural innovation. The traditional sprit rig simply would not work on anything other than an outrigger double-ended craft. But one advantage of GRP is its durability, considerably more than the 25-year life ascribed by Vitharana to the traditional logboat hull (1992: 39; 2009: 175).

Figure 18. In this podi-oru the anchorage for the outrigger boom is a stainless-steel tube rather than the traditional wooden peg. (Gerald Grainge)

Notes

1. Pliny writes that 'the ships have prows at either end, in order that it may not be necessary to tack while navigating the narrow passages of the channel'. The translation of the passage from Strabo which Lewis appears to have in mind, referring to 'vessels ... built with prows at each end', depends on an emendation of Strabo's text by Meineke in his critical edition; he added the word (prows) to bring Strabo's account into closer accord with Pliny's (1852: 3, 961; Jones, 1917: 7, 22-3). With or without Meineke's emendation the passage is obscure; Jones' translation (without it) 'they are built without belly bolts on either side' is even less likely to describe outrigger ships of 'apparently Indonesian origin'; the fact is that neither Pliny nor Strabo mentions outriggers.
2. Dr Wijewardene competed in the Finn class in the 1968 Olympics (Mexico) and has experience of sailing

the sprit-sailed oru.

3. The process is the same as mackerel spinning, using a hook on a spinner (a shiny piece of metal designed to shimmer as it is pulled through the water), undertaken with rod and line from the shore, or trailing a line behind a moving boat.

Acknowledgements

Thanks are due to Mohamed Husain and his crew for taking us out on their issah-oru, to Tuanie Ismail for arranging this with Mohamed and to Dr Ray Wijewardene for his welcome advice by email. I am also grateful to Somasiri Devendra for his continuing advice, support and friendship. Above all to my wife Christine who encouraged me to go to Sri Lanka and who cheerfully endured the capsize.

References

Dictionary of the World’s Watercraft: from Aak to Zumbra, 2001. London.

Doran, E. J., 1974, ‘Outrigger Ages’, Journal of the Polynesian Society 83, 130 40.

Grainge, G.,2002, The Roman Channel Crossing of AD 43: the constraints on Claudius's naval strategy. BAR Brit. Ser. 332, Oxford.

Grainge, G., 2009, Thoughts on the sailing qualities of the oru—and some afterthoughts, in G. Kapitän, Records of Traditional Watercraft from South and West Sri Lanka. NAS Monograph No. 2, Oxford.

Hornell, J., 1943, The Fishing and Coastal Craft of Ceylon, Mariner’s Mirror 29.1, 40-53.

Jones, H. L., 1917, The Geography of Strabo, 8 vols. London and New York.

Kapitän, G., 1987, Records of native craft in Sri Lanka—I: the single outrigger fishing canoe oruwa. Part 1. Sailing oru, IJNA 16, 135 -117.

Kapitän, G., 2009, Records of Traditional Watercraft from South and West Sri Lanka. NAS Monograph No. 2, Oxford.

Lewis, D., 1994, We, the Navigators: the Ancient Art of Landfinding in the Pacific (2nd edn). Honolulu HI.

McGrail, S., 1987, Ancient Boats in NW Europe: the Archaeology of Water Transport to AD 1500. London and New York.

McGrail, S. and Corlett,-.E., 1977, High speed capabilities of ancient boats, IJN A 6, 352-3.

Marchaj, C. A., 1964, Sailing Theory and Practice. London.

Meineke, J. A. F. A. 1852, Strabonis Geographica, 3 vols. Leipzig.

Report of Commissioners Appointed to Inquire into the Sea-Fisheries of Ceylon, 1867, Royal Asiatic Society Library, Colombo, Ref. Section 639.2 SL CEY and 003908.

Vitharana, V., 1992, The Oru and the Yatra. Dehiwala, Sri Lanka.

Vitharana, V., 2009, The making of an oru in Sri Lanka, in G. Kapitän, Records of Traditional Watercraft from South and West Sri Lanka. NAS Monograph No. 2, Oxford.

The Oru and the Yātrā
An Appreciation

The single outrigger logboat (*oru*) is the traditional watercraft of the Sinhala people. Although often briefly described or mentioned in passing in the scholarly literature of the twentieth century and earlier, it was not until 1992 that it was the subject of an extended research study in Vini Vitharana‟s *The Oru and the Yātrā*. Over six chapters Vitharana discusses the distribution and the history of outrigger craft (whether single or double outrigger) not only in Sri Lanka, but elsewhere, describes the way the Sinhalese *oru* are built, catalogues the types of *oru* and their distribution around the coastline and along the inland waterways of Sri Lanka and assesses the cultural significance of the *oru* for the Sinhala people. He adds a final chapter on the *maha oru* (big *oru*) or *yātrā*, the plank-built outrigger cargo ship, the last example of which was wrecked in the Maldives in 1930.

Vitharana‟s inspiration is rooted in his boyhood memories of his coastal village home, where he was drawn to the sea by the sight of "the little grey canoes with billowing triangular sails, darting over its surface towards an unknown horizon" (Fig. 1) and where, in the evenings "when the canoes could not sail out to sea", he "sat on them with a book to read or a passage to memorize" – a charming image of the schoolboy finding a congenial spot to do his homework; one wonders if his attention did not on occasion wander from book to boat. This fascination with the *oru* first found expression in his research in a few pages of his 1966 doctoral thesis at the University of Ceylon, seeds which flowered a quarter of a century later in *The Oru and the Yātrā*.

Fig. 1 'Little grey canoes with billowing triangular sails ... ' Photo: G. Kapitän (2009, photo 140)

In his study of the *oru*, Vitharana brings to bear his wide learning and his many research interests; in particular, his great knowledge of Sinhala language and literature shines through. He offers his reader seventeen pages of glossaries, detailing the Sinhala names for the various types of *oru*, the technical terms for component parts of the *oru* and associated gear, names of fish, winds, ocean drifts and currents, and the Sinhala and scientific names of the various types of wood used in the construction of the *oru*. He draws on Sinhala folk-songs to illustrate the cultural significance of the *oru* for the Sinhala people and memories of the now almost forgotten *yātrā*. He traces the references to the *oru* in the *Mahāva sa*, the *Pūjāvaliya*, the *Rājāvaliya* and other Sinhala literary works, concluding that an event in the first-century AD reign of Maha Dhatika Maha Naga, when the King ordered an offshore waterborne illumination, amounts to the earliest literary evidence of the *oru*.

He opens with a review of previous studies of the *oru*, whether brief references or more extended accounts. These include a list of technical terms published by K.G. de Silva in the *Siṅhala Ñānādarśaya* of 1907–8, an article published by J.P. Lewis in *Times of Ceylon Christmas Number* of 1914 and the account of the *oru* in James Hornell"s *Water Transport* of 1946. Some of these studies are found wanting. For example, Raghavan in his 1961 *Karāva of Ceylon* specifies standard dimensions for length of the outrigger, its circumference and the distance between it and the hull. No such standard dimensions exist and later in his book Vitharana demonstrates this by recording the various differing dimensions of a number of individual craft.
The 1974 *Sinhala Encyclopaedia* comes in for special criticism. It does not have an article devoted specifically to the *oru*. The article on the *oruva hā angula* ("the *oru* and the double canoe") restricts the range of the *oru* to the inland waterways and appears to be wholly ignorant of the many hundreds of these craft on the beaches and on the sea around Sri Lanka.

An early chapter is devoted to a discussion of the global distribution of the outrigger canoe, not only in the Indian Ocean, but also taking in the outrigger craft of the Pacific Islands. Vitharana justifiably on grounds of chronology resists a suggestion by Hornell (1946, 258–9, 264) and Wijesekara (1949, 45, 145 footnote 1) that the cultural affinities, which seem to exist between the Sinhala people and the dwellers of the Pacific region, are to be attributed to an infiltration from the Pacific Islands into Sri Lanka at some unspecified period in unrecorded history; he remarks that parallel cultural developments can and do occur among peoples living in isolation from each other. The evidence suggests to him that the single outrigger canoe has been known to the Sinhala people for a least two millennia and that it very probably spread westwards from Sri Lanka to the southern coasts of India and eastwards to the Andaman islands. He concludes that the single outrigger canoe – the *oru* – is most likely an artefact indigenous to Sri Lanka.

In a chapter on the history of the *oru* in Sri Lanka Vitharana traces references to it in chronicles and other literary works and in folk poetry Here he discusses the proposition that the first-century AD ceremony ordered by King Maha Dathika Maha Naga, involving the setting up an offshore illumination around the coast, provides the earliest mention of the *oru*. The earliest account of this ceremony, in the sixth-century *Mahāvamsa*, gives few details and does not specify the use of *oru* or indeed what craft were used. It is not until the thirteenth-century *Pūjāvaliya* that we have the elaboration that the illuminations were mounted on *oru*, a detail confirmed by the even later seventeenth-century *Rājāvaliya*. On their own, these references do not amount to clinching evidence that the *oru* existed in Sri Lanka as a cultural artefact at the turn of the Christian era. Nor do they require us, as Vitharana accepts, to understand the term *oru* in its earliest appearances as designating the single outrigger dugout canoe, as we envisage the *oru* today. However, Vitharana makes the telling point that early references to other types of watercraft, such as the *angula* (double canoe) and the *pahura* (raft), imply that the differentiation in the use of these terms and of the term *oru* goes back to the earliest times and that they designated much the same types of craft then as they do today.

Vitharana cites further evidence for the antiquity of the *oru* from the Roman author, Pliny (*Natural History*, VI, xxiv, 82) and the Greek geographer, Strabo (*Geographica*, XV, i, xv) Pliny‟s text certainly refers to double-ended craft which proceeded with either end forward, as the sailing *oru* does, and on that basis, even though he does not mention outriggers, Pliny may be taken as describing the *oru*. That said, we must accept, as Vitharana does, that these *oru* must have been of some considerable size, given that Pliny describes them as being capable of carrying 3,000 amphoræ, but this does not invalidate, indeed it may be taken as confirmation of smaller craft configured in the same way.

Fig. 2 A pila oru *used for fishing on inland waterways. Photo: G. Kapitän (2009, photo 50)*

Strabo's text is more obscure; its interpretation to refer to double-prowed craft depends on a textual emendation by a nineteenth-century German scholar designed to bring it into line with Pliny‟s text (Grainge, 2011, 13, note 1). For that reason, Strabo should be discounted, but taken on its own Pliny‟s statement that "the ships [of Taprobane] have prows at either end, in order that it may not be necessary to tack while navigating the narrow passages of the channel
" *Navibus utrimque prorae, ne per angustias alvei circumagi sit necesse"* may be taken as good evidence for the antiquity of the *oru*.

.

But if we are to rely on Pliny, if not Strabo, then we can argue that the antiquity of the *oru* goes back further than, as Vitharana claims, to the "dawn of the Christian era". A s good scholars, in their account of Taprobane both name their sources, who almost to a man go back to the late fourth century BC. Three of them Onesicritus, Nearchus and Megasthenes served in the campaigns of Alexander the Great. These are the men who saw the craft with prows at both ends.
The antiquity of the Sinhalese logboat is also evidenced by an ancient artefact, which Vitharana cites, exhibited in the National Museum, Colombo. This is the dugout hull found in the Kelani

river in 1952. Holes drilled in the top edges of the hull may well indicate provision for outrigger booms, but Vitharana does not rule out that this is one of the twin hulls of an *angula* or double canoe. He suggests that it is "likely to be a river transport of the early years of this (i.e. the twentieth) century and before‟. In fact it has been ^{14}C dated by the Weizmann Institute, Israel, to 380 BC ± 100 years (Kapitän, 2009, 168), a dating which nicely coincides with Pliny‟s reference. Kapitän also sees the holes along the top edges of the hull as evidence for outrigger booms; noting similarities with sea-going craft from the Andaman Islands, he offers a possibility that Vitharana would not accept – that "the inhalese people may have migrated *c*. 500 BC from the East Indian island regions to Sri Lanka".

Vitharana does not mention another ancient logboat, excavated from the Kuru River in 1988 (Kapitän, 2009, 168). Now on exhibition at the National Museum, Ratnapura, this has not been dated, but the depth at which it was found under the river bed, 4.6 m, suggests that it must also be of very considerable antiquity.

Vitharana devotes an important chapter to the construction of the *oru*. This encompasses the hollowing out of the basic tree trunk, the sewing of the washstrakes to the upper edges of the hollowed out hull, the method of attaching the outrigger booms and other details such as the grommets for the oars, the securing of the rudder/leeboards and, in the case of the sailing *oru*, the rigging of the mast. The sewing of the washstrakes runs in a "design of two diagonals crossing within a rectangle – an 'envelope-flap design' ", an arrangement which seems to be similar to that observed by Kentley in the construction of the *mā-däl-pāru*, the seine-netting barge recorded on the shores of south-west Sri Lanka (Kentley, 2003, 174). Kentley also noted that this specific method of sewing to fasten planks and washstrakes is shared as "a common technique with several other boat types of the Indian Ocean"; he accepts, however, that this is "a single attribute and not sufficient to place Sri Lanka within a broad Indian Ocean boatbuilding culture" (Kentley, 2003, 180).

The importance of Vitharana"s account of the construction of an *oru* is not to be underrated. With the demise of traditional construction methods and their replacement by the emergence of glass-fibre clones, hastened by the destruction of many traditional craft in the 2004 tsunami, his description attains the status of eye-witness evidence of a technique all too soon to be lost in the oblivion of the past. But it goes further with details of the different types of wood and other natural materials used for the various components of the *oru* and provides what might almost seriously be described as a maintenance schedule, setting out the work to be undertaken at regular intervals. Coconut oil is to be applied to ensure that the hull is waterproof every three or four months and the various lashings, for example, of the outrigger booms, which ensure the stability of the craft and the safety of the crew, must be replaced annually or every eighteen months.

Fig. 3 A west coast oru *with its distinctive double-sprit sail leaving Negombo lagoon to fish for prawns. Photo: G. Kapitän (2009, photo 73)* 5

An account of the various types of *oru* and their distribution round the coasts of Sri Lanka follows next. The smallest are the simple and unsophisticated *pi ā oru* (fig. 2) , "which may be seen being rowed even by a single girl over the shallow and placid waters of a lagoon". On a personal note, on our visit to Sri Lanka in 2010, my wife and I were fascinated to learn from our driver that he owned just such a *pil ā oru*, which he used when off duty for hobby fishing on an inland waterway. The largest are the very sophisticated sea-going *oru* with broad washstrakes and often rigged for sail. The sail types vary with location, the square sail being found principally on the east coast and the lateen sail around the south coast. On the west coast, north and south of Negombo, *oru* are rigged with a rectangular sail flown from two sprits which, unlike the square sail and the lateen, is almost certainly unique to Sri Lanka. Kapitän described this as a "Dutch sprit sail" (Kapitan, 2009, 10; Grainge, 2009, 178–9), but there is nothing Dutch about it. I have sailed on an *oru* rigged with this double-sprit sail and I can attest that it is a life-enhancing experience (Fig. 3).

Vitharana draws on statistics from the 1972 Census of Marine Fisheries to establish the ubiquity of the *oru* around the coast of Sri Lanka. Of the nearly 17,000 traditional fishing craft counted in the census, 42.7% were *oru*, recorded in 12 of the 13 "Divisional Fisheries Extension Officer units". The factors influencing their distribution are, suggests Vitharana, geographical and ethnic. Interruptions in the presence of any fishing craft around the coast correspond obviously enough with gaps in the continuity of human coastal settlements Of more significance is the near total absence of outrigger craft along the coastal stretches northwards from Kalpitiya of the west coast. This is a phenomenon that Hornell had noted:

> No greater contrast can be found in small craft designing than that between the types used on opposite sides of the Gulf of Mannar, south of latitude 9° N. On the Indian, or Tamil, side the catamaran or boat canoe alone are employed; on the Sinhalese side, the outrigger canoe is the national and dominant design, the catamaran being used only in the northern, or non-Sinhalese part of the island and by migrant Tamil fisherman in Colombo, with the dug-out restricted to its proper sphere of usefulness on rivers and inland waters (Hornell, 1943, 40; Fig. 4).2

(2 Later in his paper Hornell makes it clear that by „catamaran" he means the lashed log raft (*kattu-maram*), rather than the twin-hulled craft of western usage (1943, 53).

Vitharana suggests that the „comparatively still waters" of the coastline north of Kalpi iya do not require an outrigger to ensure the stability of a logboat, a point perhaps implied in Hornell"s statement that „the dug-out (*scil.* without outrigger) [is] restricted to its proper sphere of usefulness on rivers and inland waters". The relative calmness of the water here may indeed come into it, but this does not take account of the fact that the *vallam* – the outrigger-less logboat of this stretch of coast – is an "expanded" logboat; this type of logboat achieves

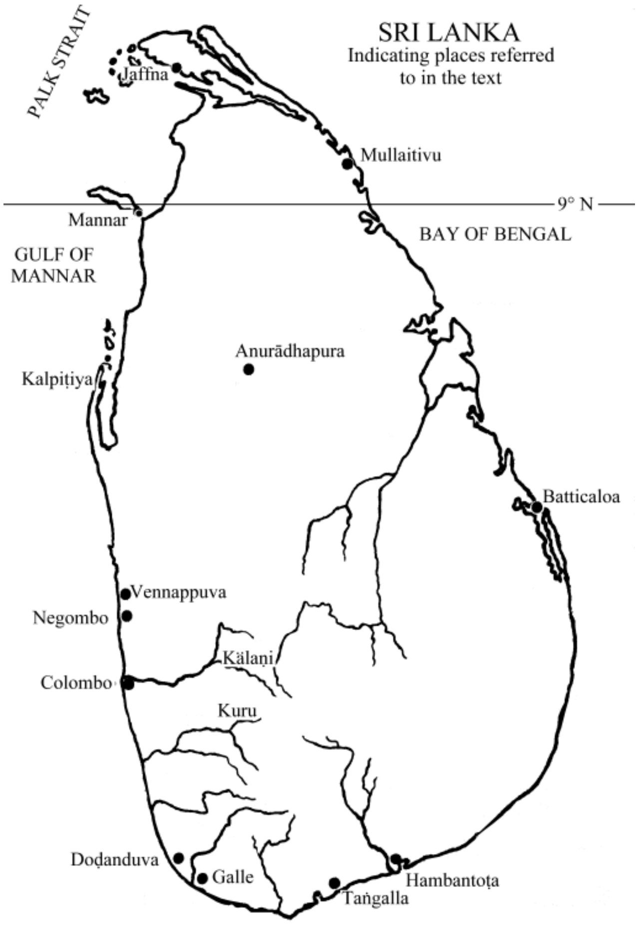


Fig. 4 Map showing places named in the text 6

lateral stability by a process, termed "expansion", in which the sides of the hollowed out log are softened by heat and water and opened out to create a cross-section which is stable without the need for an outrigger (McGrail, 1987, 56, 66–70; 2001, 268–9; Fig. 5).

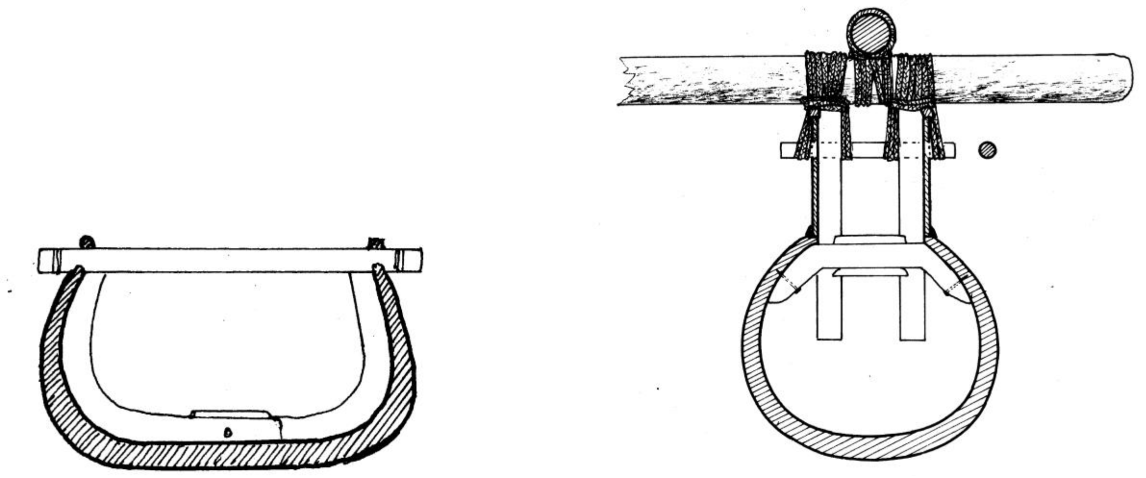


Fig. 5 Cross-section of a vallam *hull with that of an* oru*. The firm bilges of the expanded hull of the* vallam *provide a stability which the* oru *hull cannot without an outrigger. After drawings by Kapitän (2009, drawing 8a and drawing 43)*

In fact ethnicity, as Hornell suggests and as Vitharana concurs, is no doubt the more significant factor. Vitharana notes, for example, that in Mannar, Jaffna and Batticaloa the populations are predominately Tamil, especially in Jaffna where 97.5% of the population was recorded as Tamil. Moreover, in Mannar and Jaffna the entire non-migrant fishing population are Tamils who, if they own an outrigger canoe at all, possess only the elementary *pilā oru*.

The seasonal migration of fishing fleets has an impact on the distribution of the *oru* around the coast. For example, at Mullaitivu – a predominantly Tamil area – the fishermen who use the 148 *oru* recorded here are Sinhalas, some having settled here and others migrating here from March to October from the Negombo/Vennappuva area. One might, in passing, remark that such seasonal migration of fisher folk is not unique to Sri Lanka. Within living memory the herring fishing drifters of British waters followed the herring shoals on their seasonal migration southwards in the North Sea; the fishermen coming south in their drifters and their womenfolk, whose task was to gut and prepare the fish for market, following on land.

Batticaloa on the east coast presents an interesting and revealing case. This, says Vitharana, is "certainly an area where fishermen of all communities meet" In this "Divisional Fisheries Extension Officer unit" there were a large number of *oru* of all types, 2,087 in all in contrast to the 53 craft without outriggers. Even so, in the ethnic mix of fishermen here, Sinhalas appear to be fewer in number than might be supposed from the numerical dominance of the *oru*; while some are permanently settled here, others are migrants from the south and west coast. The ethnic mix is paralleled by a range of maritime environments and types of fishing from the calm and shallow waters of the lagoons and estuaries which are a feature of this area on the one hand, with their opportunities for net-fishing, to the open sea of the Bay of Bengal on the other, offering the brand of deep water fishing in which Sinhalas excel.

Strangely, a few of the very largest *oru* to be found in the Batticaloa area are not used for deep-sea fishing, as one might expect, but for net-fishing in shallow waters; these craft are owned, not by Sinhalas as such craft would be elsewhere, but by Tamil fishermen. In fact it would seem that fishing in the shallow waters here is largely restricted to Tamil fishermen, rather than Sinhalas, using not only these large *oru*, but also the smallest, the *pilā oru*.

What emerges from this is that the use of the *oru* by Tamil fishermen is not typical. Where they have adopted it, it is in its most elementary form – the *pilā oru* – the few of the largest *oru* owned by Tamils in the Batticaloa region being an eccentricity. Rather the *oru* is typically a Sinhalese craft – "a cultural possession of the inhala people" – being used by Sinhala fishermen:

> "in tanks, rivers, lagoons and bays, and in the deep sea even beyond the sight of land in all types of weather, remaining with hardly any structural change for at least the last 2,000 years.‟

So, while fishermen of all communities on the island use the *oru* – in the smaller elementary types and without sail – on inland waters and in the shallow inshore waters, it is the Sinhalas who have exploited this craft as a versatile offshore fishing vessel capable of sailing far out to sea by day or night in all weathers. Vitharana particularly highlights the refined skills of Sinhala fishermen in handling sail and rig to best advantage and the piloting expertise of the *marakkalahe* (captain) in the most adverse conditions offshore.

In his final chapter Vitharana turns to the *yātrā*, the plank-built outrigger cargo ship which plied the coasts of Sri Lanka, the Maldive Islands and the southern shores of India until the early decades of the last century, when it succumbed to the competition first of the steamship and then of the expanding road and rail networks. Unfortunately there is very little artefactual evidence for the *yātrā*, the model from the Kum rakanda Vihara, Dodanduva, now in the National Museum, Colombo, being the notable exception; but it would not be until the year after the publication of *The Oru and the Yātrā* that Tom Vosmer‟s detailed study of this model became available (Vosmer, 1993). Failing such evidence, one is left with what one can glean from documentary and iconographic sources. Again unfortunately, in the case of the *yātrā*, these sources are not always as helpful as they might be. A ninth-century Chinese account of ships from the "Lion Kingdom" may be good evidence for the reach of Sri Lanka trade and the ships involved may well have been *yātrā*; equally they may not. On the other hand the *näv-oru* mentioned in the post-fourteenth-century *Book of Land Marks* (*kada-im-pota*) are perhaps more likely to have been *yātrā*, as may have been the images of outrigger sailing vessels in the sculptured friezes of the Buddhist shrine of Boro Budur in Java. But it is not until the nineteenth and twentieth centuries that literary and iconographic evidence becomes more frequent and more compelling.

Fig. 6 The model yathtra *from the Kumārakanda Vihāra, Dodanduva, now in the National Museum, Colombo*

The most intriguing and enigmatic evidence cited by Vitharana to support the antiquity of the *yātrā* is Pliny (*Natural History*, VI, xxiv, 82) – and Strabo (*Geographica*, XV, i, xv) – whom he had already put forward as evidence of the antiquity of the *oru*. Although we may suppose that Pliny had a copy of Strabo's work on his desk as he wrote, we should discount Strabo for the reasons I have advanced earlier. Even so, Pliny's own evidence is troubling. The craft he describes with prows at each end are substantial cargo carriers capable, as we have seen, of carrying 3,000 amphoræ, not fishing vessels. *Yātrā* of recent times were substantial cargo carriers, but do not have prows at each end; modern *oru* are not substantial load carriers, but do have prows at both ends.

What Pliny actually says is worth considering in detail:

> The sea that lies between the island and the mainland [i.e. India] is full of shallows, not more than six paces in depth;3 but in certain channels it is of such extraordinary depth, that no anchor has ever found a bottom. For this reason it is that the vessels are constructed with prows at either end; so that there may be no necessity for tacking while navigating these channels, which are extremely narrow. The tonnage of these vessels is 3,000 amphoræ.4

(3 Six Roman double paces (a pace = approximately five feet), therefore approximately five fathoms; *cf* 1,000 Roman (double) paces = one Roman mile.
4 mare interest vadosum, senis non amplius altitudinis passibus, sed certis canalibus ita profundum, ut nullae anchorae sidant. ob id navibus utrimque prorae, ne per angustias alvei circumagi sit necesse; magnitudo ad terna milia amphorum.)

It is certainly true that the Palk Strait dividing Sri Lanka from India is shallow; but does it have deep narrow channels such as Pliny describes? Moreover, is the reason for having a prow at each end adequately explained by a need to avoid tacking in narrow channels? The reason, after all, is to keep the outrigger to windward.

All this suggests that somewhere along the line, what Onesicritus and his contemporaries actually observed had to some extent been distorted by the time that Pliny – and Strabo – drew on them to compile their accounts of Taprobane and that must call our confidence in their testimony into question. But the main point remains. Whether Onesicritus, Megasthenes or Nearchus, someone was struck by the strange sight of an unusual craft which did not differentiate between prow and stern. Their failure to mention the outrigger might well be that the resources of Latin and ancient Greek simply did not enable them to do so. If these vessels were indeed *yātrā*, as Vitharana argues that they are „beyond any reasonable doubt", then, as we have argued earlier, this takes their antiquity back the late fourth century BC. But in this case we also must accept that the *yātrā* of that age did indeed have a prow at each end and that, like the *oru* of today, went from one tack to the other by "shunting", i e by keeping the outrigger to windward and switching the prow from one end of the hull to the other (Fig. 7). It would have been entirely in keeping with this that contemporary small sailing craft, the *oru* of the day, would have been sailed in the same way; but we need to accept that at some stage in its long history, the *yātrā* ceased to "shunt", adopted a fixed central rudder and became a craft which proceeded always with the same end forwards.

A clue to why this might have happened, if not when, is provided by Hornell and taken up by Vosmer (Hornell, 1943, 45; Vosmer, 1993, 113). Exploiting the monsoon winds, the *yātrā* sailed north along the west coast of Sri Lanka with the weakening south-west monsoon in September or October, then as the north-east monsoon began to set in, they returned south. Later in the season, the daily alternating sea and land breezes were used – to sail respectively north and south. Sailing in this way would have meant always being on the port tack. In time this made enhancements to the hull and gear of the *yātrā*, such as the fixed central rudder, which would have been incompatible with "shunting", acceptable to its builders and owners,. On the rare occasion when sailing on the starboard tack was required, the *yātrā* would now sail with the outrigger to leeward; in the case of the vessel on which the Kumarakanda Vihara model is based, the rig would be less efficiently configured, for example with mizzen – and possibly mainsail – taken aback (Vosmer, 1993, 113).

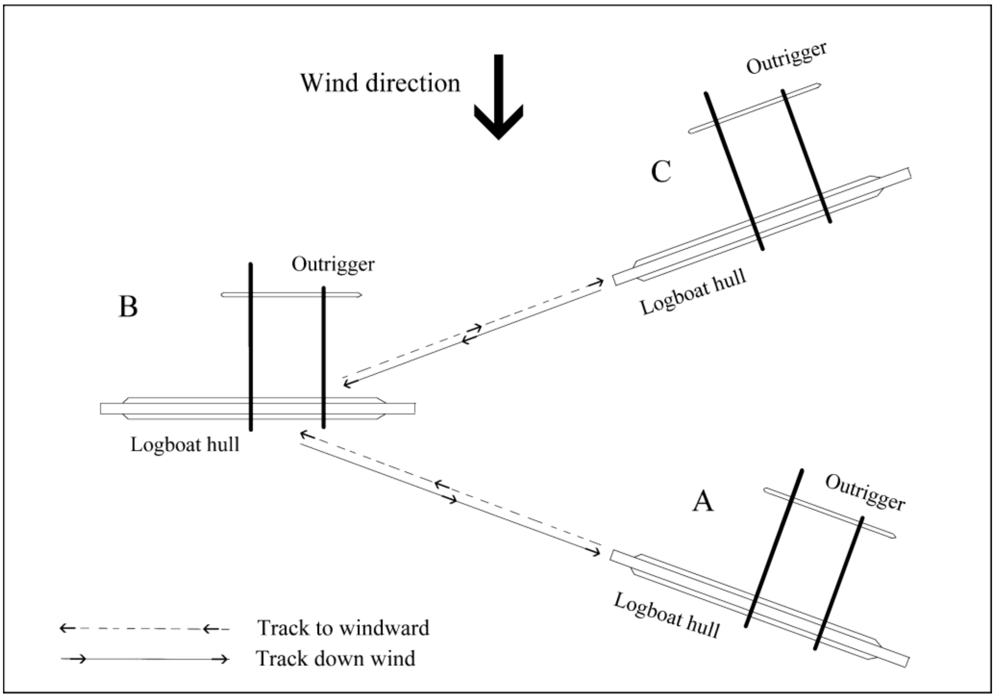


Fig. 7 'Shunting': the outrigger craft at A is close-hauled on the starboard tack; at B it lies broadside onto the wind while the crew reverse the rig and sail to change tack; at C it is now picking up speed close-hauled on the port tack. The same drill is used to change gybe when sailing downwind: at C the outrigger craft can be taken as sailing downwind with the wind on the starboard quarter; at B it lies broadside onto the wind while the crew reverse the rig and sail this time to sail downwind on the opposite gybe; at A it is now picking up speed with the wind on the port quarter. Throughout the operation the outrigger is kept to windward

Fortunately, given the scarcity of other evidence, Vitharana was able to draw on the oral evidence of men who knew these vessels in their youth. He also had available Hornell's informative article "Fishing and Coastal Craft of Ceylon", which included all too few pages on the *yātrā* (1943, 43–6). From this he was able to compile a detailed description of its constructional details, how it was handled and loaded, its crew requirements and the nature of its trade; he again emphasizes the importance of the traditional piloting skills of the *marakkalahe*.

The hull was constructed of sewn planks some two inches or more thick (5 cm), its length "ranging from 50 to 60 cubits, i e nearly 100 feet" (30 m), with a beam of 12 to 20 feet (3 7 m to 6.1 m). This is somewhat longer than the length assessed by Vosmer for the original of the Kum rakanda Vihara model: between 19 and 20 3 m (1993, 118) The rig consisted of two masts, with lateen sails on each and a foresail and a jib. The description of the way in which the outrigger booms were secured corresponds with that given by Hornell (1943, 45): the booms were slotted through holes in the uppermost strake on each side of the hull and locked by pegs keyed into them outside the hull. Vosmer, on the other hand, describing the Kumarakanda Vihara model, states that they "are lashed, and tensioned with a Spanish windlass arrangement to pegs at the positions where they pierce the hull" (1993, 113)

Vitharana states of the outrigger:

> The outrigger connected to the hull with the help of two booms was relatively small, but was able to prevent the hull from inconvenient rolling. In the event of storms when on voyages to other lands, its function would certainly have been vital.

Vosmer reports that hydrostatic analysis shows that without the outrigger "the hull was found to be reasonably stable", but unfortunately he does not publish his GZ (stability) curves He also states that "the addition of the outrigger increased the righting moment (M) by a factor of approximately 100" (1993, 118) This can of course refer only to initial stability. A study of the stability of a sailing *oru*, based on personal experience, suggests that the righting moment of the outrigger diminishes rapidly with increasing angles of heel to the point of disappearing entirely at *c.* 55° of heel:

> This means that in practice the *oru* must not be allowed to heel to the wind; once the outrigger float comes out of the water, capsize is inevitable (Grainge, 2011, 7–8).

The logboat hull of the *oru*, unlike that of the *yātrā* offers no inherent stability at all. Even so, this evidence would suggest, that, as for the *oru*, the contribution of the outrigger to stability of the *yātrā* diminishes in linear proportion to the angle of heel.

The evidence seems equivocal as to the presence of a deck. Hornell (1943, 44) attests that there is no deck, but refers to a thatched "penthouse roof" to protect the cargo; Vosmer (1993, 1114–15) states that, apart from a small poop and foredeck, the model has no decks; he refers to "a peaked [cabin] roof of split bamboo laths" with three hatches on its starboard side, an arrangement that would protect them from spray as the *yātrā* sailed along on the port tack. Vitharana gives no details, but at several points in his account of the *yātrā* he refers to the deck, including a reference to the outrigger booms "straddling the deck" It is of course always possible that some examples, perhaps the largest, were decked; others not.

Vitharana offers one detail of interest, not noted by either Hornell or Vosmer:

> A secondary rudder was placed in the region of the main mast touching the water on the starboard side, and was used only when sailing against the wind.

This is undoubtedly a lee board.

Dodanduva was the most significant port of call for the *yātrā*, with a dockyard where many of these vessels were built. Other ports of call included Galle, Taṅgalla, Hambantota and round the south coast to Batticaloa, and Jaffna and Mannar to the north. Goods transported included salt, salted fish, textile and food stuffs, such as polished white rice imported from Burma and Siam. Such coastal trade was vital in the days of primitive road systems for the supply and resupply of coastal and indeed inland communities. This phenomenon was not unique to Sri Lanka. Along the British coastline the same function was performed by Thames Barges, Norfolk Wherries and Humber Keels nd the phrase "carrying coals to Newcastle" as a description of pointless activity has its origin in the vital seaborne transport of coal **from** Newcastle upon Tyne to London.

With his study of Sinhala outrigger craft Vitharana made a signal contribution to the archaeology and ethnography of Sinhala maritime culture. It was the first research of any substance into a subject of huge significance for Sinhala culture and indeed for the study of watercraft worldwide. However, like all such first steps, it opens a door through which others may follow: Kapitän, for example with his comprehensive record in photographs and 11 drawings of the very many versions of the *oru* around the Sri Lankan coast (2009). But questions still remain for further study:

1 How are these craft sailed?

2 What are their performance data?

3 How are *oru* likely to evolve with the emergence of new materials, for example, glass fibre clones?

4 Can we demonstrate an evolution from the outrigger logboat *oru* to the outrigger plank-built ship *yātrā*?

5 Why did the *yātrā* retain its outrigger?

6 Can we learn more in detail of the pilotage skills of the *marakkalahe*?

Others may follow up these up. I myself have made a first stab at items 1 and 2 (Grainge, 2009; 2011).

But when all have had their say, *The Oru and the Yātrā* remains the detailed exploration of a boyhood fascination and a personal tribute to the culture in which that boy grew up. That is its true value.

Gerald Grainge

References

Grainge, G., 2009, „Thoughts on the sailing qualities of the *oru* – and some afterthoughts", in **Kapitän, G**., *Records of Traditional Watercraft from South and West Sri Lanka*, NAS MonographSeries No. 2 (BAR International Series 1931).

Grainge, G , 2011, „ ailing a inhalese Outrigger Logboat", *International Journal of Nautical Archaeology*. doi: 10.1111/j.1095-9270.2011.00314.x.

Hornell, J , 1943, „The Fishing and Coastal Craft of Ceylon", *The Mariner' Mirror*, **29.1,** 40–53.

Hornell, J., 1946, *Water Transport: Origins and early evolution*, Cambridge

Kapitän, G., 2009, *Records of Traditional Watercraft from South and West Sri Lanka*, NAS Monograph Series No. 2 (BAR International Series 1931).

Kentley, E., 2003, „The *Madel Paruwa* of Sri Lanka – a sewn boat with chine strakes", in **McGrail, S**. *et al*, (eds), *Boats of South Asia*, 167–184, London and New York.

McGrail, S., 1987, *Ancient Boats in N. W. Europe: The Archaeology of Water Transport to AD 1500*, London and New York.

McGrail, S., 2001, *Boats of the World from the stone age to medieval times*, Oxford.

Vitharana, V., 1992, *The Oru and the Yātrā: traditional out-rigger water craft of Sri Lanka*, Dehiwala, Sri Lanka.

Vosmer, T , 1993, „Boat ethnography: the *yatra* (*yātrā*) *dhoni* of ri Lanka", in Green, J and **Devendra, S**. *Maritime Archaeology in Sri Lanka: The Galle Harbour Project – 1992*, Kelaniya, 108–18.

Wijesekara, N.D., 1949, *The People of Ceylon*, Colombo.