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**SHIPS AND THE DEVELOPMENT OF MARITIME TECHNOLOGY IN THE INDIAN OCEAN.**

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## Chapter 5

## PRE - MODERN SRI LANKAN SHIPS

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### Introduction

There are many references to Sri Lankan ships in the historical records of Sri Lanka, as well as other countries. Yet, we have little idea of the appearance or structural characteristics of the early vessels. This paper, which tries to find an answer to these questions, is presented in two parts. Part 1 states the hypothesis and the path followed to test it. Part 2 describes the traditional ships that survived into this century. The inland watercraft, which are important

for a fuller appreciation of this subject, is not dealt with here as I have dealt with them at length elsewhere. (Devendra 1995: 211-238)

## PART I

### Hypothesis

All Sri Lankan ships and watercraft developed from two basic forms that evolved out of the interaction between the inshore maritime environment and the biological resources of the island. Shared cultural links with, and technological forms prevalent in, south India were the other parameters. When Sri Lankan vessels eventually ventured farther out into the ocean, these basic forms underwent further and greater modification to fit the new environment. Contacts with foreign ships calling at Sri Lanka and experiences gained by sailing in foreign waters, exposed Sri Lankan mariners to types of craft and technologies that had originated in different parts of the Indian Ocean (and beyond). Many useful and appropriate features thus encountered were adopted and superimposed on the original forms, which still retained their identities. However, due to an insufficiency of data, the sequence of evolution and the morphology of the most advanced ocean going vessels have yet to be determined and a methodology needs to be developed.

### Methodology

The first requirement was to gather all available references to details of construction. In many literary and historical works Sri Lankan ships are described but, for the purposes of this study, these could be accepted only if they were specific and credible. Some references (notably those of Onesicritus and Pliny) met these requirements. For example, Strabo quotes the former observing that the ships seen by him sailed badly 'since their sailing gear is inefficient and they are built without belly bolts on either side'; and the latter says 'The sea…is shallow, not more than six yards deep but in certain channels so deep that no anchors touch the bottom. For this reason ships have prows at either end so they do not need to turn about in the narrows of the channel' (Weerakkody 1997: 225). But even these had to be measured against both the hard evidence available (however meager), and an objective framework of reference, before being accepted. The preferred hard evidence had to be visual, graphic and three-dimensional *i.e.* paintings or carvings by competent and knowledgeable artists; models (preferably those made by seamen); technical drawings; drawings, by artists with an eye for detail which followed accepted conventions of technical drawing, or perspective; and early photographs. These were scarce in respect of ancient and medieval craft, but there was a surprising amount of material concerning the last two hundred years. Should a study of this material reveal some common and technologically feasible characteristics, they could be tested against more recently formulated models of the evolution of watercraft and analysis by structural characteristics. If the test proved positive, it could be assumed that the characteristics isolated were the product of a specific line of

development. Assuming that the line of development had been linear, the same characteristics could be expected to have been present in earlier craft. At this point, two alternatives needed to considered.

(1) If the craft studied were already technically advanced, their predecessors would have been less so, and the characteristics would appear in a less developed form.

(2) If there had been a lowering of standards and sophistication in technology and design, evidence would emerge of deterioration from a "high" to a "folk" technology.

The methodology adopted, therefore, was to (a) search for common characteristics, (b) analyze them, and (c) project the search backward in time from the known to the unknown. The results expected were to:

(1) formulate a typology of pre-modern and surviving traditional watercraft;
(2) define their basic characteristics ;
(3) investigate possible links between seagoing and inland watercraft (a much neglected field); and
(4) trace a possible evolutionary path.

## The Search

The starting point was a study of the models and drawings or paintings in museums, published technical drawings, and early photographs. The technical drawings were good, but few, notably those by Paris (1840?) and Edye (1834). The models were the best source as they could be studied in the round. Seamen, down the ages, made models of their own ships - a practice not confined to any one region or culture. These were, for the reason that they were built by sailors, very accurate. Old photographs were also objective representations, but most were in a poor state of preservation. Engravings, sketches and paintings were better preserved, but were likely to be less objective as the artists' unfamiliarity with ship construction led to unwitting misrepresentation of detail. Finally, there was the evidence from traditional ships that survived into this century and from yet surviving craft, though the latter are of the most basic kind. With this material I started my study.

Unfortunately, I was deprived of a very important and definitive piece of evidence. That was the "technical manuals". It may, perhaps, appear strange to use such a term about a pre-modern craft-technology, but they did exist in Sri Lanka. I am not aware whether they were actually written down on palm-leaf manuscripts, though that would have been a distinct possibility. (In India, Raut and Tripati, in 1993, cite a personal communication to say 'The Department of Archaeology, Govt. of Orissa, … collected a number of palm-leaf manuscripts mentioning the details of such as how to lay the keel, stern, stem, ribs and cabins. The manuscript also mentions the time to start the building work,

technical terms of each part and other details'). What did survive in Sri Lanka, till at least the 1930s, was the old oral tradition. All Sri Lankan learning and technology was passed down the generations via the apprenticeship system of training; either through a father-son link or the *Guru-Shishya Paramparawa* (teacher-pupil continuum). In the late 1930s, a group of Colombo schoolboys had gone on a field trip to Panadura, a coastal town 17 miles south of Colombo. There, they had visited a boat-yard where indigenous workmen were building 3-masted schooners using traditional technology. In the 1960s one of the group told me that he had questioned the master craftsman about the rules he followed as regards size, proportions, form, etc. In reply, the master-builder had recited a series of Sanskrit *Slokas* (Sanskrit was the language of science and technology in those days and *Slokas* are mnemonic verses) which laid down the rules by which a ship should be built. Even though some thirty years had lapsed, an attempt was made to retrieve this lost knowledge. There was a lead that one person (no longer living by then) had published it privately but, unfortunately, it had not found its way to the National Archives and I could not find it even among his personal papers. This lost oral tradition would, no doubt have answered many questions. In a *déjà vu* scenario, about ten years ago, I asked the same question in a traditional Arab Dhow yard. The answer was that there was nothing written down: the keel-log, which was the most valuable item, set the proportions. After its ends had been squared-off, its useable length determined the rest of the dimensions, with the design and proportions borne in the eye of the builder.

## Factors influencing design.

### 1.Navigating Coastal Waters

The basic form of purpose-built indigenous watercraft (as opposed to floats and rafts) emerges from an interaction of several factors, mainly the nature of the coastline, problems of navigating the inshore waters, and the materials available for construction. These factors have to be appreciated to understand the evolution of the craft. The basic problems faced in the Sri Lankan context were: comparatively shallow waters, shelving beaches, off-shore reefs, heavy surf close to land, and currents. Sri Lanka is a meeting, as well as a dividing point for the current systems of the Indian Ocean, between the Arabian Sea and the Bay of Bengal. Currents are strong, up to 5-6 knots, abrupt changes occur within short periods or distances, and the major current systems flow parallel to the shore while inshore currents may flow in an opposite direction. (*West Coast of India Pilot 1975: 20-21*)

To navigate these waters, the craft had to be of shallow draught and hardy construction with a bottom sturdy enough to withstand frequent abrasion in sandy shallows. The craft that emerged was the dual element form of the *oruwa* (the logboat and single outrigger configuration), which eliminated the need for a keel and also reduced the draught. The keel's absence helped the craft cross the reefs, and mitigated the effect of currents and the set of the sea. Being a shell-built monoxylon of sewn construction, the resultant flexible craft was able to cope

with the torque experienced in the heavy surf. Thus the dual element craft, whether logboat and outrigger, or the large twin-hulled beach seine fishing craft, (*madel paruwa*) were capable of dealing with most of the problems posed by the coastal waters.

However, the most important question for the smaller fishing craft, was that of making land, given the shallow waters, shelving beaches and a negligible tidal range. These craft did not “drop anchor” in most places, as there was no anchorage in the sense the word is understood in more northern latitudes. Instead, they were beached. With the dual element construction, with both elements being made of tough wood, the boats could easily be hauled up the beach. They did not keel over but stood upright on shore and the two elements (logboat and outrigger) gave them a bi-pedal stability. The booms attaching the two elements were convenient for the crew to manhandle the boat up the beach. In larger craft, beams placed athwartships and projecting outboard, also served this purpose. This feature is also seen in traditional Indian and Arab craft even today, though the deep-draught Tuticorin coasters do not have them. This is probably because they now call only at modern ports where they secure alongside piers.

There was another hazard the boats had to face: that of the sand spits that were constantly forming across the entrance to rivers and lagoons. These craft were equally at home in, and used along, the lower reaches of rivers and in the lagoons. In fact, many of the deep-water fishing fleets, depending on their size, sought shelter either just within the river’s mouth or inside the lagoon. Due to reasons dealt with elsewhere (Devendra 1993: 17-24), sand spits would form across the entrances, making it difficult for any but the shallowest draught vessels to cross over. Here, again, the round-bottomed logboats, with no keel to hamper them, could enter and leave the haven. (Note 1)

Constructional materials were easy to find in Sri Lanka. Unlike in the clusters of smaller islands in the Indian Ocean, Sri Lanka has an overwhelming wealth of timber resources. The south-west quarter of the island was, until a hundred and fifty years ago, widely forested and builders had a wide spectrum of timbers, with differing characteristics, to choose from. Accordingly, different timbers were selected for different parts of the craft. Vitharana (1992) in an exhaustive study of the surviving *oruwa* fishing craft, lists twenty-eight different types of wood used for eleven different parts of ship. Although iron was locally available and steel adzes were used to hollow-out the logboats, fastenings were not made of iron but of coconut fibre. These craft were all sewn with coconut-fibre rope and, as the coconut palm was found all around the coast of the island, there was no shortage of this material. Gunawardana (1990: 25-44), quotes al-Idrisi recording that Arab ships from Oman and Yemen used to come here to obtain rope, trunks of coconut trees for masts and timber for planking, as well as to place orders for ships which were constructed here. Coconut plantation for commercial purposes, possibly also for the production of rope, has been known from the early years of the Christian era; the first reference is an inscription from the reign of King Mahadathika Mahanaga (9-21 A.D.). That foreigners knew

about this is borne out by Aelian, (170-235 A.D) who says that '…this island in the Great Sea which they call Taprobane has palm trees wonderfully planted in rows, just as in lush parks the park keepers plant shady trees.' (Weerakkody 1997: 235)

## 2. The Ocean

The Indian Ocean is characterised by its alternating monsoons, the inter-monsoonal cyclones, the current systems prevailing, and the presence of many island chains, reefs and shallows. In the early historical period, oceanic sailing took place only in the more northerly waters. (Note 2). The Sri Lankan ships that first ventured into the ocean were, presumably, larger versions of the fishing craft that evolved in inshore waters. Their development into something more seaworthy would have depended on the suitability of the base form for adaptation to the new environment and for the assimilation of features from other technologies. Sri Lankan seamen, ships or travellers have been referred to in many parts of the landmass that was the then-known world – Asia, Europe and Africa. (Note 3). Vajrabodhi in the 8th. century mentions 35 Persian ships in a Sri Lankan port but *en route* farther east (Gunawardana 1990: 36, citing Silvan Levi). He also cites Ibn Batuta in the 14th century mentioning a fleet of ' ''one hundred" vessels of varying size' belonging to the recently-emerged northern Sri Lankan kingdom of Ariya Chakkravarti in an Indian port (1990: 38). Indian Ocean Rim countries were joined by economic, social, religious and political ties. Sri Lanka was aware that it was one country in a complex of peoples and cultures. The country itself, from very early times, was home to many peoples and religions. In fact, this awareness extended to all the coastal communities around the Ocean, which led to the early navigation of this Ocean.

## 3. Cross-pollination between technologies

The question arises whether the basic form of the Sri Lankan o*ruwa*, and its sewn construction, proved viable for long oceanic passages. In the absence of any hard evidence of a ship built more than two centuries ago, it would seem necessary to accept that the voyages described above, were undertaken by such ships. This line of reasoning is given credence by the survival, into this century, of large sewn-plank, shell-built, two-masted, outrigger equipped cargo vessels. These, the y*athra dhonis*, are described below. They were used in this century between Sri Lanka, both coasts of South India, the Maldives and Malacca. They have the major characteristics referred to in relation to early inshore craft: coconut-fibre rope sewing, outrigger, double-ended configuration, and plank construction. The seeming contradiction is the substitution of planking for a dugout. An observation by Hornell (1946) however, provides a possible explanation:

> 'The final stage in the conversion of the dug-out into a fully plank-built boat is attained when the dugout under-body is reduced to a keel-like axial

> beam, with sides raised on its edges by numerous strakes of sewn-on planking. This was the method of construction employed by the Persian and Arab shipwrights down to the sixteenth century…and the Sinhalese coaster of the Gulf of Mannar (Hornell 1943, 43-6). In neither of these vessels were iron fastenings present. The whole of the planking was sewn together….' (The "Sinhalese coaster", according to Hornell's own reference, is the y*athra dhoni.*)

Phillips-Birt (1979: 11) gives a drawing of a 'section of an Indian canoe from Dawki with vestigial dugout base and reverse clinker planking above*'* which shows an entirely acceptable evolutionary stage, and reinforces Hornell's observation. His explanation is given further credibility by the large, punt-shaped, sewn-plank seining-boats, *madel paruwa* which are built upon a base of two vestigial dugouts. Kentley & Gunaratne (1987: 35-48) chose not to trace the evolution of this feature in their study of this craft, preferring to call them chine strakes 'as they locate the feature and implies that it runs longitudinally*'.* I have, however, argued elsewhere (Devendra 1995: 225) that this craft was a double-logboat-hulled craft 'that must be considered the end of the line of development of Sri Lanka's logboat culture*'*. This craft operates close inshore: the y*athra dhoni*, which made the quantum leap that Hornell describes, is an ocean-going one.

Finally, we have the bas-reliefs of ninth century Borobudur (Indonesia) which show detailed representations of the same class of ship. The only difference of note is the use of hinged, pivoted or detachable outrigger booms, placed near the waterline, in parallel with the surface of the sea, unlike the downward-curving flexible booms of the Sri Lankan ship, attached to the hull just below the weather-deck. Both types of ship, it is important to note, were the products of ship-building cultures characterised by logboats, sewn construction and outriggers. Whether one was derived from the other is open to debate but coincidence, as an explanation for the similarities, is untenable.

Sailing the Indian Ocean involved much more than building ships. Navigation, knowledge of the movement of stars and constellations, winds, currents, tides, the ability to know your position to some degree of accuracy were also needed. Presumably this knowledge was acquired through experience. But it is difficult to overestimate the value of borrowing and adaptation of foreign technologies and practices.

Among the many borrowed and adapted features were the fore-and-aft rig featuring Arab-Indian lateen sails and the rudder. Previously, Sri Lankan craft had square sails and were double-ended. They could not tack or effectively sail upwind. With the need to keep the outrigger to windward, the best that could be done was to "go about", changing the set of the sail. With the adoption of the fore-and-aft rig, there was the ability to tack, and "going-about" was unnecessary. With this new rig came the rudder and the double-ended craft acquired a fixed Bow and Stern. However, old practices die hard and even the last y*athra dhonis* did not adopt a transom stern (which would have been logical) but retained the

double-ended hull configuration. They also retained the outrigger, which was no longer essential. The effect of this mixture of constructional features on the sailing characteristics of the ship is discussed below.

As in the case of ship-building, navigation, reading of the stars, knowledge of tides, pilotage etc. appear to have been maintained and passed on by oral tradition. The knowledge resided in the master of the vessel (*navika*) or the sailing master (*marakkalehe*) of fishing communities ashore. Even as late as Dutch times, the Persian term for "pilot" (*sambandar*) was in use and later became a personal name "*Sahabandu*" which is yet in use: Indian texts, though, describe pilots and their knowledge in the early centuries of the Christian era. There is no evidence of maps or charts. Stars were known and recognised and Vitharana (1992) has documented fifteen names of stars used by the present-day fishermen. However, the knowledge has all but died out and his sources could not agree on the identity of the stars they were naming. As all deep-sea sailors have passed on, this is not surprising. We do know that the Sri Lankan ambassadors to the Roman Court of Claudius had commented on the different starscape over Rome, particularly remarking on the difference in the position of the Great Bear and Pleides, that Canopus was much brighter in the Sri Lankan sky, that the sun was always to the south and therefore shadows in the Roman latitudes always pointed north. (Weerakkody 1997:226-227). Coming, as they did, from a country where astrology was a serious study, this is not surprising: it is the loss of the application of the knowledge of the stars to navigation that is regrettable. Fishermen however have retained certain types of knowledge. Vitharana has documented twenty-four separate words to identify features of the sea, twelve to denote prevailing drifts, and twelve for different winds. Since the craft are small, only the specialist names for the master and the look-out are retained as well as one collective noun denoting the crew. Viewed against this background of lost knowledge it is comforting to note that the navigational knowledge of the Arabs, with whom we had much to do, has been documented competently. "Sailing the latitudes" by measuring the height above the horizon of Polaris, Arab sailors plotted the positions of places they were interested in. Combining latitude, dead reckoning and days run as data, they positioned themselves with sufficient accuracy to sail where they wanted and find their way back home, on a regular basis. Not maps but plotted positions constituted their charts. When these plots are superimposed on a Transverse Mercator's Projection, an acceptable degree of correspondence is shown (Tibbets: 1977). These maps also indicate the cross-oceanic routes – not mere conjectural lines, but actual bearings and distances between known and plotted points. Indian sources, too, are a yet insufficiently exploited mine of information, as no satisfactory attempt has yet been made to collate the material and chart courses. The attempt by Rao (1987) to plot Indian sea-routes, particularly between the east coast of India and south-east Asia is, thus, a good beginning. Chinese maps, such as those of Ma Huan, also show navigation using stars. Bellec (1997: 5-10) presents an interesting explanation of Ma Huan's guides to celestial navigation giving, as his example, the passage from Sumatra to Sri Lanka, using selected stars and constellations as guides. Not long after that the Gujarati pilot, Mu'allim Kanaka piloted Vasco Da Gama. This ocean, therefore, was a highway,

well traveled, with “signposts” and travel guides. Sailors, being both gregarious and pragmatic by the nature of their calling, are always on the look out for whatever is helpful to them, whatever the source. There was an ongoing cross-pollination of ideas and technology among them. They picked up from each other, by observation or other means, all the knowledge necessary to navigate the Indian Ocean. It is reasonable to assume that some of this common pool of knowledge was known to, and used by Sri Lankans, as they, too, were long-distance sailors.

This, then, was the ocean Sri Lankan ships and seamen sailed in. It cannot be claimed we were in control of the seas, or any part thereof, at any given time. But it is safe to assume that we were participants in a multi-user environment, and that our ships - in common with all ships that sailed this ocean - incorporated constructional features, adopted from various sources, that had been proved in blue-water sailing. These features, superimposed on the basic forms evolved in coastal waters, made these craft as suited as any other to undertake oceanic passages.

## Ship-builders, Shipyards and Ports

The next step was to identify the builders. Today, only fishing craft are built in Sri Lanka and there are no ship-builders left – at least, in the Sinhala-dominant parts of the country. Fishing craft are built by those who use them and most of whom belong to one caste. In India, there are yet many traditional craft built by traditional builders: they belong to the Hindu, Muslim and Christian communities. Among the Hindu (who are culturally most akin to Sri Lanka), they have been variously referred to as *mestris* (Kunhali1993: 57), *mestas* and a*charis* (Sunderesh 1993: 30), and *biswakaramas* (Raut & Tripati 1993: 52). The two latter names are specific to the artisan caste. In Sri Lanka, too, this caste is referred to by all the names above and it is tempting to believe that they were the builders of old. However, this was not so. Although the *achari* and *visvakarma* are names denoting the Artisan class, the *mestri* or *mesta* name is used by others to denote a master of his trade: the word is derived from Portuguese. In particular, the name is found among the caste to which fishermen of Sri Lanka belong. Also, one particular craft – carpentry – is carried on both by the artisan and that caste (as well as others). Probably the ship-builders then (as now) were from the people who used the craft. A clue that fits in with this is the family name, specific to this caste, of *Galappathi*, which derives from the technical term “to caulk”. Thus, in spite of sharing a similar caste system with India, here we come across a major difference.

In the Tamil-dominant north and the Muslim communities of the east, prevailing conditions have not favoured field research since the beginnings of my study. It was the Fishing caste of Jaffna who were the sailors of the north and in the areas dominated by them ships larger than off-shore fishing craft (the *Jaffna thonis* and the “v*attai / vattal*” – see below) were built. As in India here, too, ship-building activity was carried on by different communities. Johnston (1824: 537-

548), drawing on his experience of Admiralty laws prevailing in or about 1802 comments:

> 'The maritime laws and usages, which prevail amongst the Hindu and Mohammedan mariners and traders who frequent Ceylon, of which I made a complete collection while presiding in the Vice-Admiralty Court of that island, may be classed under four heads: First, those that carry on trade in small vessels between the coasts of Malabar, Coromandel, and the island of Ceylon; secondly, those which prevail amongst the Mohammedan mariners and traders of Arab descent between the coasts of Malabar, Coromandel and the island of Ceylon; thirdly, those which prevail amongst the Arab mariners and traders who carry on trade in very large vessels between the eastern coasts of Africa, Arabia, the Persian Gulf, and the island of Ceylon; fourthly, those which prevail amongst the Malay mariners who carry on trade between the coasts of Malacca, the eastern islands, and Ceylon.
>
> 'The first are in some degree modified by the tenets of the Hindu religion and by Hindu law. The second, the third, and the fourth are modified in a great degree by the tenets of the Mohammedan religion, and Mohammedan law.'

This source indicates the variety of shipping from Indian Ocean countries operating under indigenous legal systems even after this country came under British rule in 1796. British rule had been preceded by some 300 years of Portuguese and Dutch control of the maritime provinces. Even before this, the waning power of the central government had weakened the hold of the Sri Lankan kings on the major ports (and Jaffna in the north) which were controlled by foreign traders, who administered them according to their own laws. Major ports had, by then, become foreign enclaves. The "Galle Tri-lingual Inscription", indited in China with the date corresponding to 2 February, 1409, and set up in the port-city of Galle some two years later by Cheng Ho, is inscribed in Chinese, Tamil and Persian (in Arabic characters): a clear indication of the cosmopolitan nature of the city (Devendra 1990 c: 265). On the eastern coast, in Trincomalee, the site of an Arab settlement in an eminently suitable inlet (Nicholson's Cove) has been attested by the discovery of a graveyard containing tombstones bearing 13$^{th}$ and 14$^{th}$ century dates (Devendra 1990 a: 209-217). Johnston (1827) had already discovered one in Colombo, dated to mid 10$^{th}$ century. Ibn Batuta, visiting Sri Lanka in the 13$^{th}$ century, speaks of a "Prince of the sea", named Jalasti, who held sway over Colombo commanding a force of 500 Ethiopians. Jalasti has been variously described as a powerful trader and a pirate. Other pirates have also been written about.

In earlier times, however, when a strong central government had prevailed, laws administering ports and matters maritime were promulgated on inscribed tablets set up in the vicinity of the relevant ports. An inscription in Devundara (Dondra) in the South states (Paranavitana 1953 : 53-54):

> '….apart from the levying of such imposts as have been approved by the Maha-Pandithe, illegal imposts shall not be levied. To those coming from foreign countries, means shall not be afforded to avoid the payment of imposts and duties that are due, which they do by establishing places of business, corrupting royal officers by means of presents and keeping with friends the merchandise smuggled from their own countries…'

Another inscription, at Nayinativu in the extreme North, states (Indrapala 1953: 63-70)

> '…the foreigners should come and stay at Uratturai (Uratota), that they should be protected and that foreigners from many ports should come and gather at our ports; as we like elephants and horses, if the vessels bringing elephants and horses to us get wrecked, a fourth (share of the cargo) should be taken by the treasury and the (other) three parts should be left to the owner; if vessels with merchandise get wrecked, an exact half should be left to the owner….'

The *Culavamsa*, the continuation of the earlier *Mahavamsa* (historical chronicles that record Sri Lankan history from 543 B.C., the traditional arrival date of the Aryans to this country) carries a most illuminating account of the logistics of a punitive raid to Burma, stemming from a dispute involving the trade in elephants. The incident in question is supported by a contemporary inscription recording the grant of land and privileges to the leaders of the expedition. It makes reference to *Hatan Nav,* (lit. "Warships") but it is uncertain whether they were a kind of ship specially fitted out for war, or ships constructed for the expedition. The latter is more likely, following the *Culavamsa* description of their construction:

> '….gave the order without delay to make ready ships of various kinds, many hundreds in number. Now all the country round about the coast was one great workshop occupied with the building of the ships taken in hand. When within five months he had all the ships well built he assembled them…(at) Pallava-vanka…….he had provisions supplied for a whole year…..and abundant weapons of war such as armour……gokanna arrows…for defence against elephants, also different kinds of medicines preserved in cow-horns for dealing with venomous wounds caused by poisoned arrows…remedies for curing the poison of infected water…iron pincers for extracting iron arrow-heads, ….lastly also skilful physicians…*'*

This description, which indicates knowledge of the requirements for storing ship for an offensive action, is more important for the reference to the ships of various kinds being built on the sea-shore. It is a pointer to ship-building without the need for inland shipyards; to the ability to mobilize a large work-force capable of undertaking the building of a large fleet; and even to the possibility that the ships were of the outrigger-equipped and capable of being built on the beach – that they were, in fact, *yathra dhonis*. Even leaving room for

exaggeration, this account rings true in terms of the building of an expeditionary force. The account continues, and even records the loss at sea of the majority of the fleet. There are other, equally credible accounts of attacks by sea between local warring factions and other expeditions to intervene in south Indian politics. All of these indicate knowledge of naval strategy in offensive operations.

## Technology transfer

The ships that sailed the Indian Ocean were the products of technologies that evolved in their home waters. Still, all were sea-worthy craft. Within the Indian Ocean, several technology zones existed, namely:

The Dhow zone
The Sewn-boat zone
The Single outrigger zone
The Double outrigger zone
The Hybrid craft zone
The Shaped-log-raft micro-zone.

While the first four zones above are well known (Hornell 1946: unnumbered last page, and MacPherson 1990: 261-264), I have postulated the other two on the basis of research and interpretation. This differentiation into zones requires some explanation.

Dhow technology. Characteristics: carvel built plank boats, sewn with coconut-fibre rope, prominent rudder, forward raking mast carrying large Indo-Arab lateen sails on a long boom hoisted with a pulley attachment. Evolution and use: largely (but not exclusively) in the Red Sea, Arabian Gulf, west coast of India and generally in the Arabian Sea.

Outrigger technology. Characteristics: the monoxylon, or log-boat, as the main unit of construction (with or without plank extensions), very shallow in draught, with attached outrigger (single or double) in place of a keel, coconut-fibre rope sewn and fastened throughout, double-ended, with square or lug sails (later fore-and aft on larger craft). Evolution and use: originated in the South-East Asian seas and spread cross-ocean westwards to Sri Lanka, Madagascar and East Africa and eastwards to all the Pacific islands. Not found in the Indian sub continent until late. Hornell (1946) concludes, from an examination of the areas where the two forms are used, that the single outrigger is more seaworthy in open seas. He places the single outrigger to Sri Lanka and the Bay of Bengal islands (in the Indian Ocean) and to the Pacific Ocean islands, and the double outrigger to east Africa, Madagascar and South-East Asia. Phillips-Birt (1979:135) has hazarded 'that the single outrigger preceded the double outrigger, though for small craft and within the limitations of primitive technology the latter may not have been an improvement.' Hornell, however, had abandoned

this position, which he had earlier held, and said ‘There is now little reason to doubt that the double outrigger antedated the single type…” (1946: 268) I have, however, shown that in Sri Lanka, the double outrigger did not appear. (1995) As

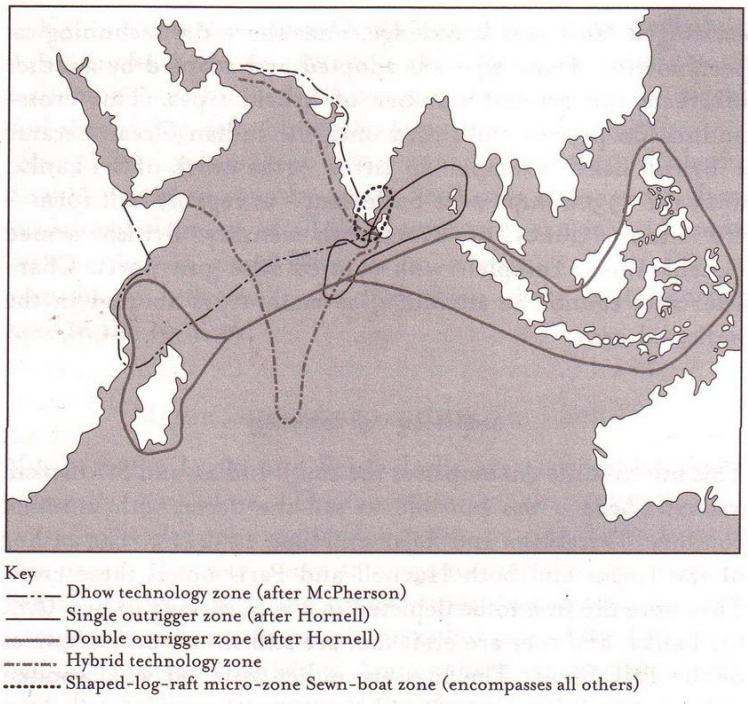


**Figure 5.1** Shipbuilding technological zones

the major country in the Indian Ocean to have been by-passed by the double outrigger, this country presents a strong argument against the double outrigger being considered a necessary predecessor to the single one.

Hybrid technology. This zone, which I proposed in 1990, covers the old Erythrean Sea and its limits are (subject to correction) the lands and seas referred to in the *‘Periplus of the Erythrean Sea’*. By definition, this is the area where East and West met and exchanged ideas and knowledge, and where the technological peculiarities of one type was adopted and adapted by another to create the greatest number of hybrid types. This cross-pollination process continued until the Indian Ocean became a “British Lake”. Example: In Jaffna in the north of Sri Lanka, until the 1930s ships were built that – as regards hull form - are almost clones of nineteenth century British armed merchantmen, complete with painted false gun-ports. Characteristics cannot be attributed as many types abound in the indicated area.

Shaped-log-raft technology. This micro-zone encompasses the south Indian and Sri Lankan waters, where it was possible to sail the ocean with minimal comfort (Thivakaran and Rajamanickam: 1992: 23. The author of the *Periplus* and both Hornell and Paris noted these craft. They were the first to be depicted in a rock carving in pre-C.E. Sri Lanka, and they are craft that are still in use on both sides of the Palk Strait. The logs are either fastened with wooden

pegs, or tied (not sewn) with rope, and can be sailed or (sometimes) used with a temporary, easily shipped outrigger. Unlike the dhow and the outrigger, this craft is extremely limited in its area of use, being confined to India and Sri Lanka only. A Sri Lankan chronicle, the *Sammohavinodani*, describes rafts that were sailed from the port of *Jambukolapattana* (commonly identified with Kankesanturai in the north) to the east coast of India in the second century B.C. These had three decks: the lowest was awash. The passengers occupied the second and the third carried goods. The passengers, it is said, were unhappy to sail in them as they appeared unsafe. From the description, it is a strong possibility that they were a precursor of the shaped-log-rafts of today.

Sewn Boat technology. This was common to all the above zones, but retained until late only in the outrigger and dhow zones.

Map.1 shows the Indian Ocean with all the zones marked on it. Sri Lanka is the only location which falls into five of the six technologies mentioned: dhow, sewn-boat, hybrid, outrigger and shaped-log-raft. Strangely, even dhow technology has not affected Sri Lankan ships to any appreciable extent. Only the double-outrigger zone by-passes Sri Lanka completely. Constructional elements of all these zones are seen in Sri Lankan craft, either in pure form or in admixture. This fact is, accordingly, reflected in the description of the craft recorded here in the typology.

## Major Differences within Sri Lanka

Northern Sri Lanka and South India are geographically and culturally very close. The antiquity of the cultural links prevailing today are a matter for debate outside the purview of this paper. However, there is no gainsaying that, in terms of fishing, chank fishing and similar aspects relating to making a living from the sea, the people on either side of the Palk Strait had many common activities. Among them was the type of craft used at sea. A case in point is the micro-zone of the shaped-log raft technology referred to above. On an even smaller scale is the use of two different types of small fishing craft used, the *oruwa* in the south of Sri Lanka and the *vallam* and the *kattumaram* in the north of the island as well as the south of India. Hornell (1943) was moved to comment on this phenomenon as follows:

> '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 degrees 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 correctly uses the word "catamaran" (from Tamil *kattu-maram*) to mean "log raft", and not in the corrupted modern sense of "double-hulled craft". It

is one of the forms of shaped-log rafts which I have grouped together as forming a distinct micro-zone. In Sri Lanka, Hornell's geographical differentiation is substantially correct: catamarans are largely used in the North and North-East of the island, with a diminishing scatter even as far South as the North of Colombo, and, on the East coast, diminishing south of Trincomalee. This type of craft is also used in South India, particularly in Kerala, Tamilnadu and Andhra Pradesh in the Southern part of peninsular India, and a wider variety of forms are in use. In Sri Lanka, there are but two: the smaller four log pegged rafts and the larger five to seven lashed rafts, which can be fitted with a sail and, occasionally, with an outrigger. In India, in addition to these, the rafts are also converted to virtual flat bottomed boats by the addition of vertically attached logs to provide a degree of freeboard, but constructed entirely of shaped logs, not planks. These craft, ranging from seven to twenty one feet in length and two to five feet. in breadth, are among the most primitive craft that sail even the coastal seas but, if their antiquity is taken as an index of a successful design, they have to be considered as having proven themselves. In Sri Lanka, a second century B.C. inscription at Duvegala, at Polonnaruwa, shows an inscribed picture of one (Paranavitana 1970: Pl.XXIX) complete with mast topped by a *Nandipada* (Taurine) symbol. (Note 4). It is likely that this represents a craft that was in use between India and Sri Lanka for more than two millennia. An alternate possibility is that here, as elsewhere, the full shape of the hull of a ship, rather than a raft, is shown in profile. This, however, is a supposition.

The other, or "dominant design", Hornell refers to is the logboat and outrigger craft, the *oruwa*, whose origins are lost in antiquity. Hornell's remarks concerning the Sri Lankan – Andaman Islands single outrigger have already been referred to. These craft differ from the double-outrigger in other ways, too. The larger, deep-sea craft particularly, but not solely are fitted with vertical plank extensions sewn onto the gunwale of the monoxylon. Thus there is a considerable difference in relative heights above water between the freeboard of the logboat and the outrigger float. This imparts a downward curve to the connecting booms, from the onboard ends to the outrigger ends. They are therefore curved and made of flexible wood. Unlike in the outrigger ships seen on the Borobudur bas-reliefs, pivots or hinges are not used at either end of the booms, the flexibility of the curved booms enabling them to cope with the vagaries of wave and swell. Neither are they removable. Horizontal booms are only used on inland craft, in some of which there are no vertical extensions.

## Results of the Search

The first phase of my study was to try to elicit common characteristics (Devendra 1990: 265-271). Using a model (Fig. 1) devised by Phillips-Birt (1979) as a control, I found the following:

*Most common features*

The logboat as the unit of construction

The use of the outrigger balance log

Hull of sewn plank
Shell-built hull of, carvel

*Evolutionary paths*

(1) Log – dugout – shaped log rafts
(2) Log – dugout – multi-hulled dugout – multi-hull, planked
(3) Log – dugout – dugout and planks – shell construction, carvel

*Hypothesis arrived at*

Pre-modern ships were carvel built of shell construction, using sewn-plank technology; hulls were double-ended, carried squares sails, and were fitted with outriggers. Even after the adoption of fore-and-aft rig and rudder after the ninth century, the outrigger continued to be retained and, in the smaller craft, even the double-ended form was retained.

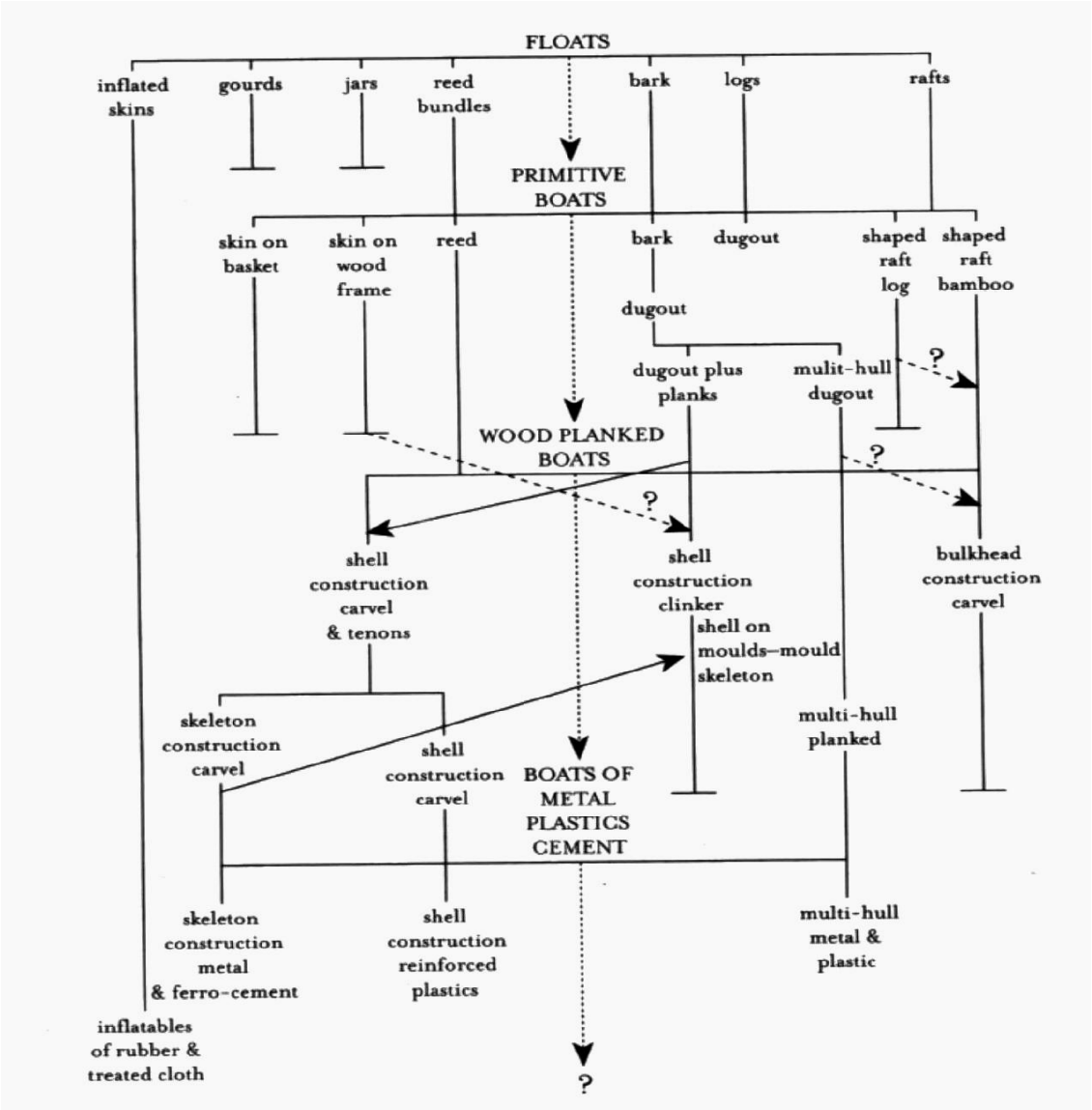


Figure 5.2 Evolution of constructional techniques

These points applied to both sea-going and inland craft. However, after an in depth study of inland craft, I came to the following conclusions.

1. The evolution of watercraft in Sri Lanka can be traced in sequence from the *oruwa* to the *paruwa* and the *yathra dhoni*. The base form is a double-log craft. Hornell has traced the evolution from dugout to keel log.
2. The *madel paruwa* (an inshore seining boat) and the *paruwa* (a river/canal cargo carrier) evolved independently to suit environmental and functional needs.
3. Earlier *paruwa* prototypes which were superseded by the river/canal *paruwa* which, in its last traditional form, was a hybrid: being, in terms of structure, influenced by Dutch/European barges – thus being skeleton built unlike other traditional craft, all of which are shell built.
4. The *paruwa* had its origin in the rivers of the southwest, consequent to the growing political and economic dominance, the demographic shift and the urbanisation of this region.

To analyse the craft according to structural characteristics use was made of another model (Fig.2). This test confirmed that all known Sri Lankan craft were either rafts (the minority) or shell-built boats (the majority) in which the reduction and construction processes were widely used, with the transformation process used more sparingly. Accordingly, they all fell into the categories C1, C2, C3, C4 and C6 of that model.

The other product of my search was a typology. It is deliberately termed "tentative" since new information continues to come in from time to time, particularly with regard to certain variations of craft types. First formulated in 1990, it has undergone several revisions. There is, now, reason to believe that no fundamental changes need occur, and that the information concerning new craft could be accommodated within the framework already drawn up. I am, however, still chary about making it definitive.

This tentative typology (*Appendix* ) however, is not the only, nor the first, to be attempted. Others have formulated similar classifications and it is possible to accept each of these as equally valid in terms of the parameters applied. The two that come most readily to mind are those compiled by Gerhard Kapitan, (1987: 137) and by the Sri Lankan Department of Fisheries in collaboration with UNDP and FAO(1994). There is a very good reason why these typologies differ from each other and mine: each has been formulated with a different purpose in mind. The Department of Fisheries' typology is a by-product of research into the gear, equipment and craft currently used by fishermen and it deals with mechanised craft as well. Kapitan, on the other hand, only deals with the vanishing types of traditional craft, which are still in use, and which he is striving to save for posterity, even as museum pieces. My own attempt is different in that it is concerned with the past and surviving craft are only studied to determine forgotten forms. I also place much emphasis on inland watercraft, a class that has not been specifically dealt with by earlier writers.

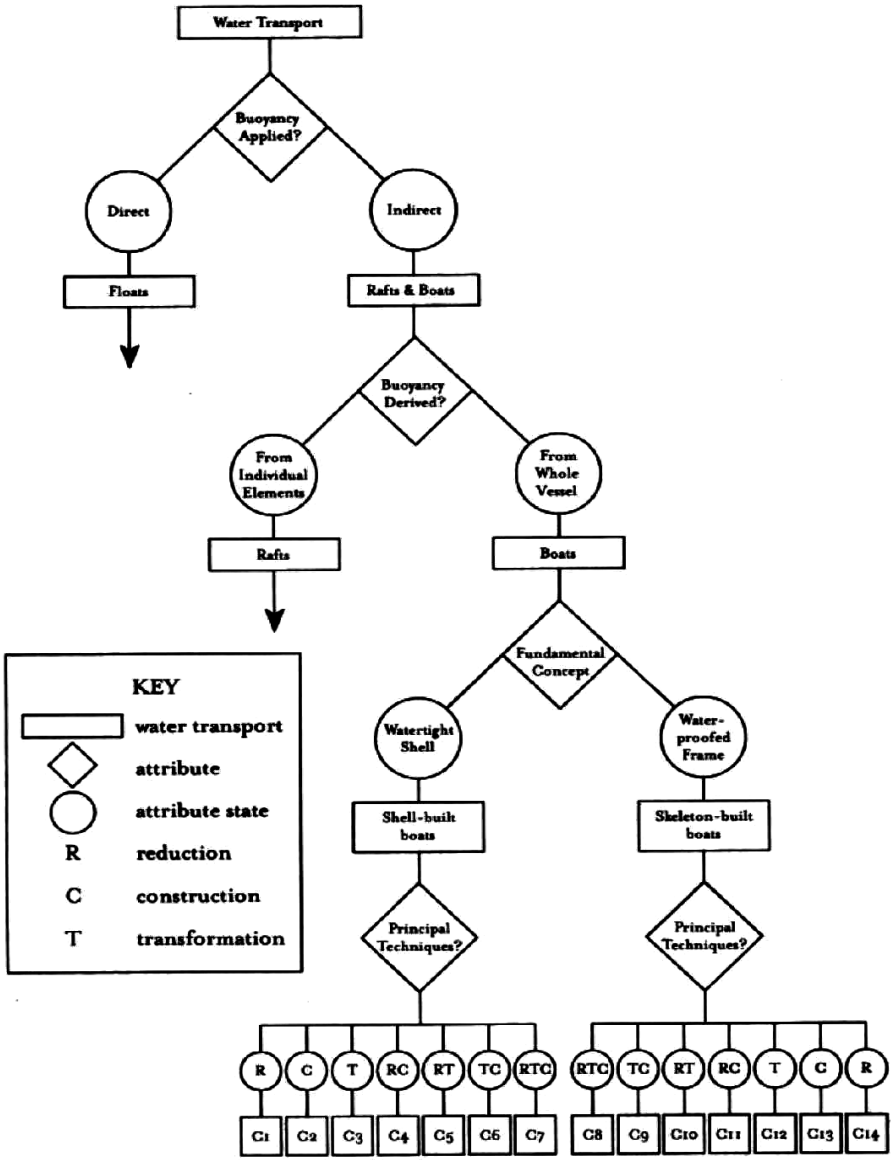


**Figure 5.3** Types of water transport

## PART 2 - Sri Lankan Ships

All of the foregoing provided only a framework of reference against which a particular description of a vessel could be judged credible, or not. Yet the exact appearance of the ships, their size, and types are questions that were left unanswered. Conflicting points of view had been advanced. In 1966, Toussaint (1966:4-5) wrote:

> 'The Sinhalese people never looked towards the sea and the navigators whom history records were always foreigners. The outriggers themselves

are of foreign origin, and it is not in Ceylon that we shall really comprehend the ocean's story'

Prof.R.A.L.H.Gunawardena and Yumio Sakurai (1990: 270-280), translating and commenting on an extract from a ninth century Chinese literary work, say the author of the original, referring to the ships from the Southern Sea which arrive each year at An-nan and Kuang Chou, states 'Among these, the ships from the Lion Kingdom are the largest, with stairways for loading and unloading which are several tens of feet in height.' Here we have two recent and very divergent views. On the basis of the research conducted, I believe that the first is too rigid, and that an open mind has to be kept on the latter. Before commenting further, it is necessary to describe the next step in my search, which revealed the morphology of the pre-modern ships that survived into the twentieth century.

## The Jaffna *thonis*

In the course of my quest for graphic representations I came upon Hornell's photographs of the Jaffna *thoni* (Fig. 3) which is a ship belonging to the hybrid technology zone I have referred to. This would more or less cover the old Erythrean Sea, spanning the waters between the west coast of India and the eastern shores of Africa, touching the northwestern coast of Sri Lanka and going southwards to the Maldives. In these waters Mediterranean, Arab, Indian and later, Portuguese, Dutch, French and British ships met and mingled. The Jaffna *thoni* is a fine example of this intermingling and cross-pollination. While basically a very South Asian craft in the way it is fitted out onboard, its lines are very reminiscent of European ships of a century or more ago.

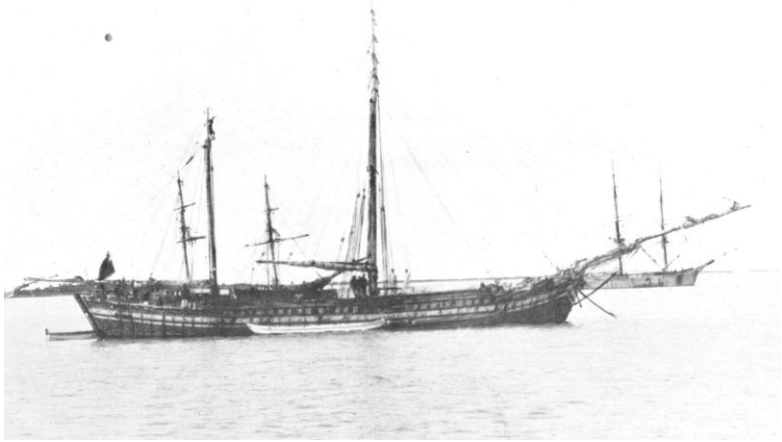

**Figure 5.4** Jaffna Thoni (Hornell)

Hornell , commented in 1943:

'The larger type of schooner is of purely European design. It diverges in no detail from the small wooden schooners employed in

> English coasting trade in the nineteenth century except in one detail. No Jaffna schooner would be considered shipshape unless a row of imitation square black ports were painted along each side, simulating the appearance of the gun ports of Armed East Indiamen of the eighteenth century.'

The European colonisers found, in this part of the world, the material and the skills to build ships to their liking. Initially, they modified certain smaller European designs to incorporate elements successfully proven in these seas. Later, large ships for the European were constructed in India. Gill (1993: 75) states:

> 'The India built ships traded with U.K. and between June and August, 20 such ships took rice from India and returned with cargoes. Then the English builders and owners protested. Before a select committee (1814) of the House of Commons (Chaired by Sir Robert Peel), John Hillman a builder expressed that India built ships will kill their industry. "An India built teak ship, after she had performed 6 cargoes is equal to one of ours after she has performed three "'

Phillips-Birt, speaking of tenth century Arab ships, (1979: 122) comments:

> '…the teak often used for planking the better craft is ideal for iron fastening, containing as it does an oil that preserves the metal, unlike oak, with its acid content, which attacks it.'

The technology transfer worked both ways, as the Jaffna *thoni* demonstrates. Earlier in the colonial days, the Maldivians picked up the lines of the Portuguese Caravels and built them late into this century. It is noteworthy that when Captain Allan Villiers was preparing himself to sail the *Mayflower II* across the Atlantic, it was on these Maldivian vessels and Arab dhows that he refreshed his small ship sailing skills. The point is that these designs continued to be used in the Indian Ocean long after they had been abandoned in the countries which gave them birth. In about 1802, Ceylon became a crown colony. The Chief Justice, Sir Alexander Johnston noted (1824) that, around 1802, he was informed by Muslim priests and merchants that, for some hundred years, they had been using Arab translations of Ptolemy. But, being in need, they had sold them to merchants who were sailing the Sri Lanka-South East Asian route. Shipowners of the Jaffna *thonis* were either Hindu or Muslim. There was only one point of difference, as far as design and decoration were concerned, which depended on ownership. In the Hindu-owned ships the sharply raked stem ends in an inwardly coiled ornamental head called a *surul* marked with three horizontal bars to represent the three ash-streaks that a Hindu wears on his forehead. Under this feature is the ship's shrine. Also, on either bow a neat *oculus* is nailed, to represent the eye of the god, who will guide the ship through the seas. The Muslim-owned ships do not have either of these features. To quote Hornell (1943) again:

*'*At each end of the vessel is a short decking, ending in each case in a high transverse breakwater, 2 ½ - 3 ft. in height, sloped towards midships. The waist is undecked but is covered by a penthouse roofing of palm-leaves overlaid by closely set palmyra-palm reepers or battens tied down with coir. The after decking is the longer; on it is a small cooking galley or rather firebox and several water breakers find accommodation. At the centre is a small hatchway. There is no poop.*'*

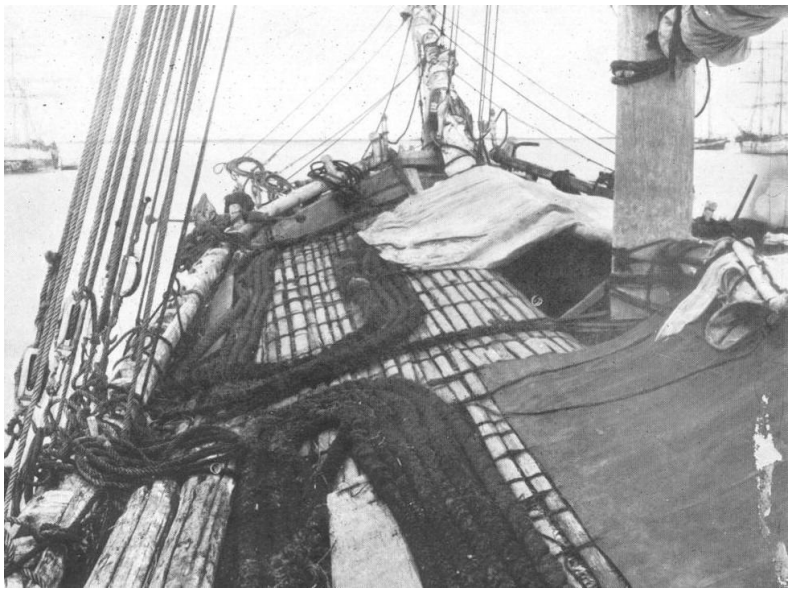

**Figure 5.5** Jaffna Thoni, views of bow from midships abd views of cargo stwage arrangement (Hornell)

This very same arrangement is found in the *yathra dhoni* (to which I refer below) the river/canal *paruwa* (the largest of the inland watercraft) and the Tuticorin coasters. In the latter tarpaulin sheets wrapped round the deck cargo have replaced the roofed penthouse. It will thus be seen that, notwithstanding the similarity to European craft, the interior was that of a typical Asian cargo ship (Fig. 4). The rig of the *Jaffna thonis,* however, is strictly nineteenth century British but with many more spritsails. According to records the last of these sailed in the 1930s and we cannot hope to see them again. Hornell's photographs are therefore invaluable. He has also given typical dimensions: length between perpendiculars, 100 ft.; beam amidships, 21 ft. 2 ins.; depth from gunwale to keel, 14 ft., carrying capacity, 100 tons. There is also a bad newspaper photograph of what is claimed to be the last one built and sailed. Named the "Annapoorani", she is supposed to have sailed for, and reached, England. Her whereabouts after that is not known. The photograph shows her in the Suez canal.

The *yathra dhoni*

Perhaps the most ancient type of indigenous sailing craft that we were able to research and reconstruct was the fore-and-aft rigged, outrigger-equipped *yathra dhoni* of Dodanduwa, a village about ten miles from Galle towards Colombo (Fig. 5). Till the 1930s, this was a port where these ships operated from, sailing largely to coastal ports of India and Sri Lanka, the Maldives and South East Asia. The find was, in every sense of the word, serendipitous.

**Figure 5.6** Yathra Dhoni model from Dodanduwa

Its existence was known, there was a published note by an eyewitness to the sailing of the last of its kind, but no research published in English, other than that and Hornell's. Paris (1840?), has produced a much superior description and drawings than Hornell and added that this craft was common to both Sri Lanka and the Coromandel coast of India: in fact, to judge from the rounded penthouse roof he shows (quite unlike the typical Sri Lankan ridged roof) the craft illustrated could have been an Indian one. All other details, however, tally. Hornell (1943) had noted them but had, by some strange chance, not seen them. He says the last of them were seen in 1903 and 1908, adding:

> 'Their survival, or rather their presence on the Ceylon coast until recent years, is of great ethnological interest in view of the representation of ships related to the outrigger design among the sculptures on the great Buddhist shrine of Boro Budur in Java, dating back to between A.D. 750 and 900'

There is a published photograph of one, (Fig.7) referred to as a "Calpentyn Coaster", where the author refers to it as a surviving type. In the *Mahinda College Magazine* of June, 1936, a Senior Former named N.A.W.Arthur Alwis, describes the final voyage of the last of these ships. He says:

'…it seems as if it was yesterday that I saw the last schooner of Dodanduwa lying in the harbour. However the ship…left her native harbour for Hambantota never to return. That was in the year One-thousand nine-hundred and thirty'.

He goes on to relate the story of the wrecking of the craft off the Maldives and the rescue and return of the crew years later. It is indeed puzzling why Hornell, who served in Ceylon, missed seeing these ships, though he has somehow produced a fine line drawing showing the craft in profile. He even says

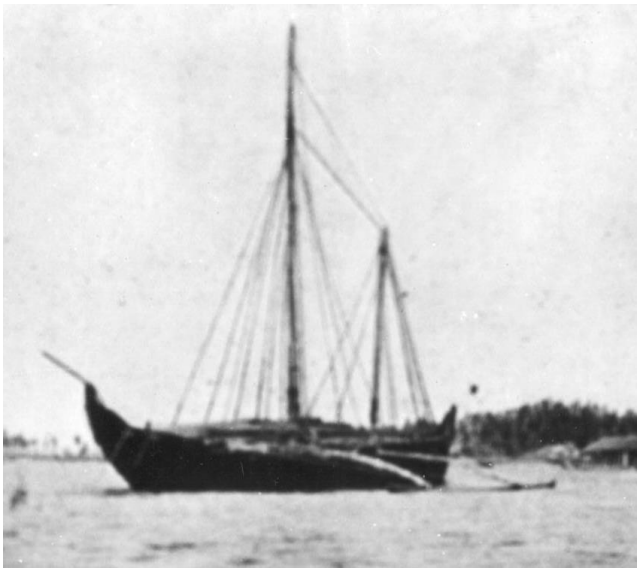

**Figure 5.7** Yathra Dhoni in port. (Lewis)

that the very memory of these ships is passing away. My own experience was completely the opposite. Not only had I heard of them and knew of much written and oral evidence of details in Sinhalese, but also I heard of a very faithful large model of one in a Buddhist temple at Dodanduwa. The senior monk came from a family which had owned these vessels and is a man with considerable interest in ethnography, oral history, and archival matters. He had preserved the model in a glass case, as it had been built by his father, while yet a child, around 1892 and was awarded a gold-medal at a Craft Exhibition. He allowed me to photograph the model and take it out of its case to make notes. However, I was later able to persuade him to lend it to the National Museums for an Exhibition held in connection with the UNESCO Expedition of the Silk Routes of the Sea in 1990.

In 1992, while co-ordinating a joint Sri Lankan-Australian Maritime Archaeology Project in Galle Harbour I found the model yet with the Galle Maritime Museum. We had with us Tom Vosmer of the Western Australian Maritime Museum, who used his skills to make the technical drawings of the model. He measured the model meticulously as essential raw data. The data was then tested on a Macintosh computer, which was able to generate an acceptable hull shape based on the data given in the form of a table of offsets. The computer-generated pre-fit lines were worked on to manipulate the hull shape to the best fit of the original measurements. This was done by using a “MacSurf” computer programme for boat design and analysis. He was thus able to take the lines off, make detailed technical drawings and arrive at the sailing characteristics of the craft (Fig. 7). My description of this craft, therefore, is not Hornell’s but Tom Vosmer’s (1993: 109-118).

> ‘The model examined and recorded appears to exhibit a hybrid of influences including, Arabian, Indian, local Sri Lankan traditions as well as Southeast and East Asian. As the model had been built by a boat-builder,

> it exhibited hallmarks of his care. For example, it was noted that the four hooked scarf joints in the keel-stem and stern-post were made exactly as they would have been on the real vessel. Other details were also done with attention to detail…In view of this attention to detail, it was thought the accuracy of the model, both in scale and detail would make a fairly reliable source for documentation.*'* (p. 111)

The size of the model studied is 150 cm long, 32 cm at the point of its greatest beam and 20 cm from keel to gunwale.

> 'The yathra are large outrigger craft, ranging to 100 ft (30m) in length but normally about 50-60 ft (15-18.3 m), carrying 25-75 tonnes of cargo usually averaging of 50 tons (Hornell 1943). Mukherjee mentions yathra dhonis as being about 60 ft. (18.3 m) in length with a beam of 15 ft (4.6 m). They are sewn craft, planked from domba (Callophyllum inophyllum), at least two inches thick (Vitharana, 1992:69). In recent times (the 50-100 years to 1930) the yathra dhoni was used as a coastal trader and for voyages to India and the Maldives. However the type appears to be of ancient lineage, with Pliny (AD 23-79) reporting "outrigger craft of large size west of Taprobane [Sri Lanka]"……..'(p 111)

> 'The yathra can be described as double ended, with slack bilges but full mid-sections. The forward sections are only just slightly more fine than the aft sections, displaying a subtle hollow entry at the bows. The forefoot is extended forward by a gripe attached to the keel-stem and there is also a skeg aft to which the rudder is fitted. Both these devices would be aids to lateral stability, helping to reduce leeway and balancing the helm while sailing. It should be noted that at least one drawing of a yathra (Hornell, 1943:44) does not show these additions. The form of the hull shows affinities with ancient Arab and Indian craft illustrated by Paris (1841)' (p 112)

Among a host of features described by Vosmer the following are particularly relevant. The use of an outrigger, he comments, as 'curious' as the hull rig configuration is stable, with hydrostatic analysis showing the hull form to be seaworthy even without an outrigger. He describes the rig as common to the Indian subcontinent, it being ketch-rigged with square-headed lug sails and a jib set on a short bowsprit. He considers the rudder as 'enormous by most standards' and reminiscent of some on Chinese Junks and draws attention to a much narrower one shown in Hornell's sketch. Concerning the cabin he notes that it is of a style common to Indonesian water. In Sri Lankan, cabins are known to be roofed with either 'cadjan' or split bamboo: Vosmer remarks the same practice prevailing in Indonesian waters. He also comments on the hatches, with slightly raised coamings along their sides, being located on the starboard side. The cargo handling gear, however, is clearly located on the port side,

I have referred to the comments on the Cabin and Hatches to show the similarity to the Jaffna *thonis* and river/canal *paruwas*: all three craft are large

**Figure 5.8** Yathra Dhoni. Structural details (Vosmer)

cargo carriers and the stowage arrangements are similar. The references to the rig, rudder and outrigger need more comment. In my searches I came upon two more *yathra* models. The first one is not traceable, but a photograph is available in the London Science Museum. It shows a well-constructed model, which conforms to the model we studied. The other, which I examined at the Museum of Mankind ten years ago, is much more interesting and revealing. It is described as a 'Cingalee model boat "Yathrawa" or "Dhoney", freight and passenger boat used between India and Ceylon'. It had originally been presented to a Museum in 1854. (The Museum staff was unaware to which museum it had been originally been gifted, or where it is now, as artifacts have, over the years, changed hands between museums.) It is a smaller craft, double-ended, showing sewing on the outside, with a single square sail amidships and no rudder. It is undecked and has two holes on the ship's side, aft, presumably for steering oars. It had a single outrigger, slightly abaft of midships on the starboard side, (unlike the Dodanduwa model, where it is on the port side) fitted in the same way as in the model we studied. The model is damaged and has a loose bundle of what looks like split-bamboo matting: probably the remains of the cabin roof. This model is interesting as its rig is different, there is no rudder and the vessel it is based on probably did not tack but went about by changing ends, as the outrigger fishing craft still do, or by manipulation of the square sail. The outrigger is firmly fitted, allowing of no change; it is, as mentioned, on the starboard side. It is suggested that this model shows an earlier configuration of the *yathra*, which later developed further with the introduction of more sophisticated rigging and a rudder. The older version probably survived into the nineteenth century as a smaller craft.

I do not intend going into the details of the analysis of the data that was carried out but will end this section with Vosmer's concluding paragraph:

> 'Hydrostatic analysis
>
> 'In view of the foregoing, a vessel of about 20 m in length was the size chosen for detailed analysis. The hull form of the yathra, with and without the outrigger, was analysed for stability, displacement, wetted surface, drag and powering requirements as well as cargo capacity for that size of vessel. The yathra hull alone was found to be reasonably stable as indicated by the transverse GM and RM figures (Garrett, 1987). The addition of the outrigger, however, increased the righting moment (RM) by

a factor of approximately 100. It also, of course, added to the drag created, and therefore powering requirements of the vessel.' (p 118)

The *battal*

The *battal* is included in the list of Sri Lankan ocean-going vessels, not because they were ocean going but to illustrate the multitude of influences that touched Sri Lankan shipping. The craft is essentially of Indo-Arab form, about 50-60 ft. long, completely undecked, with a single forward raking mast carrying a huge sail hoisted by means of a sheave atop the mast. It was in use among the Muslim villagers of Mutur, in Koddiyar Bay, just south of Trincomalee harbour. Till the mid-1970s they used to regularly ferry the rice harvest from Mutur to Trincomalee and were seen daily (Fig. 9). By 1988, however, they had disappeared. The area of Mutur, has been noted as "Matura" in Ahmed bin Majid al Najdi's treatise (trans. by Tibbets 1977). In Trincomalee harbour is a sheltered cove named "Nicholson's cove" since British times, which is the site of an Arab settlement about eight centuries ago: I had the good fortune to discover the site of its burial ground and rescue some gravestones (Devendra: 1970 and 1990 a: 212-213). Unfortunately, I was too late on the field to study the craft and that part of the country is yet not safe for researchers. Lionel Cassons (1964: 160) has a picture of an Arab *bum*, which is remarkably similar to the *battal*. To make matters more complicated, that word itself derives from the Portuguese *batel*, meaning 'small boat' and is used in various forms all over the Indian Ocean.

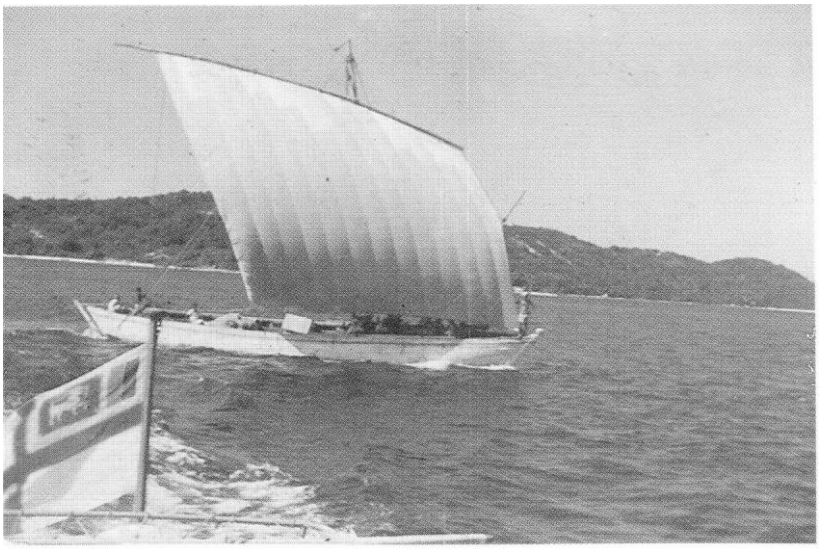

**Figure 5.9** Battal. (Mutur, Trincomalee)

The *vattai / vattal.*

The *vattai* or *vattal* is the Jaffna version of the *Battal*, as the name implies. These broad and beamy boats have the distinctive *surul* decoration and were generally painted a bright blue or green. Although the sail itself is smaller than

the Mutur *battal*, the mast arrangement is similar. Hornell (1943), who had seen many of this type in Jaffna, says:

> 'The single mast is stepped vertically, a little forward of midships. The rig is a short, broad lug, little removed from the original square sail. A rectangular two-sheave block is fitted horizontally on the masthead. Through one sheave hole runs the main halyard, man-handled without the assistance of any tackle; through the other peak is rove, running direct to the other end of the yard, where the end of a vang is also attached….This two-sheave pulley truck is a notable characteristic of these small dhonis….
>
> 'Whenever a pearly fishery is held in Ceylon waters, these local craft furnish the major part of the diving fleet; the divers like them best of all the craft available; their broad beam offers comfortable accommodation, the low freeboard facilitates diving operations and their light draft makes it easy to row them when the divers change their pitch in their search for a rich patch of oysters."

A very well-made model is available at the London Science Museum, where its catalogue description is 'Jaffna Dhoni (c,1800). Rigged model.' (Fig..10) Edye (1833) was not very impressed with the craft although he gives a very good drawing of one.

**Figure 5.10** Vattai/Vattal (Jaffna)

## Conclusion

Sri Lanka had its own indigenous ships. These underwent morphological changes from time to time through adoption of elements considered more appropriate, but the basic elements did not change. Hence, we can safely accept that the development was, by and large, linear, but that the process of development was considerably influenced by selective regional technologies. Chinese technology, for instance, had left no imprint here.

Seafaring was an ancient occupation and, although the ability to sail long distances was there, Sri Lanka could lay no claim to have been a major maritime power. Undoubtedly, the nautical tradition flowered and faded, with the highest levels of sophistication being reached in the twelfth to fourteenth centuries. Ironically, other Indian Ocean maritime nations were also experiencing the same phenomenon. In Sri Lanka, however, the rapid collapse of central power around the end of this period led to the maritime provinces coming under the control of foreign merchants and mariners. The link with seafaring became tenuous, even though the knowledge was not lost. The "high" technology had been reduced to a "folk" technology by the time the European powers established their power in the Indian Ocean. The point is succinctly set out by Gunawardana:(1986-87: 40)

> 'Thus the traditions of shipbuilding of an era long past did survive right into modern times, but in a vitiated and diminished form. It is abundantly clear that an involution had set in, pushing back the level of nautical technology in Sri Lanka to what it had been long before the eighth.'

The country's greatest claim to navigational history is that it still retains elements of ship design from all over the Indian Ocean – and even beyond – which may have disappeared from the countries of their origin. Sri Lanka is thus a palimpsest: layer upon layer of development and adoption can be traced and it is, indeed here, that the search for the history of the ocean could be best begun. I personally believe that the *yathra dhoni* of Dodanduwa is the oldest of the pre-modern craft that survived into this century.

The question then arises whether this claim to significance resulted from an exchange of technologies in a scenario where Sri Lanka played a pivotal role. It is suggested that its role was pivotal in a purely geographical sense only. Gunawardana (1986-87: 32) citing Cosmas, states about the sixth century: ' …the growth in importance the island had achieved as a pivot in a vast network of trade routes…'. But there is no evidence that it played a more positive, or catalytic role. While its position was significant in bringing together ships from both the eastern and western extremities of the ocean, similar scenes would have been played out in any of the major ports of the ocean.

The search for hard evidence of the form and structure of the most advanced craft built in Sri Lanka is far from over. How is it possible to reconstruct the ships described by a ninth century Chinese as 'the ships from the Lion Kingdom were the largest, with stairways for loading and unloading which are

several tens of feet in height'? Or overlook the possibility that the sewn-plank *khun lun* ships that visited China from the south - so large that they could not be set in motion by oarsmen without the aid of sails - were also from the Lion Kingdom? But, in spite of the details given, one cannot accept these accounts without the back up of hard evidence. Ibn Batuta, in the fourteenth century, found in Calicut, India, Chinese ships with four decks, with massive oars manned by ten to thirty each, to row the ships when the wind failed. The similarity of Ibn Batuta's observations to the two earlier quoted Chinese ones may not be coincidental, but a common way of describing unfamiliar craft. In terms of my own search techniques I have, regretfully, to consider these descriptions unproven.

On my own voyage of discovery, my ship has not come home. She has only cleared the bar and the voyage has just begun.

NOTES

1. In extreme cases, the entrance would be completely closed up, leading to the river waters backing up and forming lakes and lagoons. The coastline of Sri Lanka is dotted with these.

2. It is not possible to be definite when, or along what route, the south-east Asian outrigger ships reached Madagascar, although this occurred at some stage in the first millenium A.D.

3. These references are written ones but, for this paper, these (whether ancient or modern, primary or secondary) have served only as corroborating evidence, and what follows, therefore, is only a small sampling culled from references given by writers who have dealt with, in the main, trade and commerce :

China (Gunawardana & Sakurai1990: 277-281), (Pao-chang 1981:68-70,89)
North India (Nicholas 1990: 281)
South India (Nicholas 1990: 284-85)
Burma, (Geiger 1921: 76,11-35, 45-48)
Sri Vijaya (Kiribamune 1990: 186)
Egypt, (Goiten 1973: 185),(Codrington 1919: 83)
Rome (Malalasekera 1935: 630), (McCrindle 1901: 103, 105)
Persia; (Imam 1990: 173)
Thailand (Guruge 1990: 246)
Trading as an occupation: (Gunawardana 1990: 33, quoting from Sahassavattupakarana )

4. Prof. Sudarshan Seneviratna, commented in a personal communication, in 1987:

'The symbol depicting a vessel carrying a nandipada (taurine) symbol at the helm of its mast is engraved along with an early Brahmi inscription at

Duvegala in the Polonnaruwa District. The inscription records an endowment made by a Barata to the Sangha.

'The nandipada symbol is commonly found on the Early Historic coins of South central Asia. The vessel symbol (without the nandipada) occurs on the Proto Historic Black and Red Ware of Peninsular India as a post-firing graffti mark. During the Early Historic period a similar symbol is found on the coins of the early Pandyas and the Andhra Satavahanas.

'This type of vessel was used in the deltaic region of Peninsular India and it sailed along coastal sea-routes linking Peninsular India with Sri Lanka. It is known as the Negapattanam seven log – type boat and until recent times such vessels sailed between Negapattanam (in South India) and the north-west coast of Sri Lanka.

'The Baratas (Paratavar) are known to the early inscriptions and the texts as merchant-mariners, who conducted a lucrative luxury trade linking coastal areas of Penensular India and Sri Lanka. Their trade items included horses, gems, salt, pearls, chank, spices and paddy. The Baratas were ship-owners and they are known to have controlled port-towns during the Early Historic period.'

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## CAPTIONS FOR MAP AND FIGURES

Map 1: SHIP BUILDING TECHNOLOGY ZONES

*Key*

Dhow technology zone (after McPherson)
Single outrigger zone ( after Hornell)
Double outrigger zone ( after Hornell)
Hybrid technology zone
Shaped-log-raft micro-zone
Sewn-boat zone (encompasses all others)

Figure 1: EVOLUTION OF CONSTRUCTIONAL TECHNIQUES (Developed by the National Maritime Museum: reproduced by McGrail)

Figure 2: TYPES OF WATER TRANSPORT (Phillips-Birt)

Figure 3: *JAFFNA THONI* – overall view (Hornell)

Figure 4: *JAFFNA THONI* – views of bow section from midships and of cargo stowage arrangements (Hornell)

Figure 5: *YATHRA DHONI* : Model from Dodanduwa

Figure 6: *YATHRA DHONI* AT ANCHOR (Lewis)

Figure 7*: YATHRA DHONI*. Structural details (Vosmer)

Figure 8: *BATTAL* from Mutur, Trincomalee

Figure 9: *VATTAI / VATTAL* from Jaffna. `