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Defining the Construction Characteristics of Indigenous Boats of the Philippines: The Impact of Technical Change Pre and Post Colonisation

by

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Thesis for the degree of Master of Philosophy

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ABSTRACT

HUMANITIES FACULTY

Maritime Archaeology

Thesis for degree of Doctor of Master of Philosophy: Martin Roderick Stead

Defining the Construction Characteristics of Indigenous Boats of the Philippines: The Impact of Technical Change Pre and Post Colonisation

The thesis reviews the key construction characteristics of traditional vessels used by the inhabitants of the Philippines at the time of European colonisation in the sixteenth century. These included the use of carved rather than sawn wood, the use of outriggers, and the utilisation of dowel technology and the lashed lug technique to maintain hull stability. The social context of the local maritime culture is analysed, as is the relationship between the Philippine communities and the sea.

Prior to colonisation, the Philippines were involved in a trading network with other parts of Southeast Asia and particularly China. This thesis will review evidence of the interplay between indigenous technology and external influences from other parts of Asia. After colonisation the Spanish began the construction of European-style vessels using Philippine resources. The impact of this experience on traditional boat-building is traced.

The methodology used is an analysis of the relevant maritime archaeological sites and museum collections in the Philippines. This is complemented by an analysis of historical accounts by visitors, priests and colonial officials. The results incorporate the ethnographic studies of traditional boats still in use, carried out by the author. A tour of Southeast Asian sites was undertaken to put the Philippine results in context. The integration of the traditional style of boat building and imported technology to produce the modern Philippine banca is reviewed.

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DECLARATION OF AUTHORSHIP

I, Martin Roderick Stead, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

'Defining the Construction Characteristics of Indigenous Boats of the Philippines: The Impact of Technical Change Pre and Post Colonisation'

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work have been published as:

   Paper presented at the Asia-Pacific Regional Conference on Underwater Cultural Heritage, Manila, Philippines, November 2011, in association with Dr E. Dizon, 'A National Cultural Treasure Revisited - Re-assessing the 'Balangay'

Boat Discoveries'. Published in the 'Proceedings of the Asia-Pacific Regional Conference on Underwater Cultural Heritage 2011'

Article in Nautical Archaeology on 'The Balangay Boats Revisited' Autumn 2011

Article in Nautical Archaeology on 'Dating a Philippine Logboat' Spring 2014

Paper presented at the 2nd Asia-Pacific Regional Conference on Underwater Cultural Heritage, Honolulu, Hawai'i, May 2014, ' "All our vessels are rowed from within, these are paddled from without", Spanish and European Colonial Reception of Philippine Indigenous Craft'. Published in the 'Proceedings of the 2nd Asia-Pacific Regional Conference on Underwater Cultural Heritage 2014'

Paper presented at the IKUWA V conference in Cartagena, Spain, October 2014 '"Algunos indios bisayas que se han igualdado a los mismos españoles en saber disponer y labrar las maderas de cuenta para los naos" Philippine Ships and Shipbuilding in the Sixteenth and Seventeenth Centuries'. Published on-line in December 2016 in 'Actas del V Congreso Internacional de Arqueología Subacuática (IKUWA V)' : 924-933

Article in Nautical Archaeology 'Logboats of the Bikol Region' Autumn 2015

Paper presented at the ISBSA Conference 2015 in Gdansk on 'The Development of Philippine Logboats'. In press

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Definitions, Style and Abbreviations

In this document, italics have been reserved for book titles, ship names and Latin scientific names (except in the Glossary). Due to the numbers of words involved, words in non-English languages have not been rendered in italics. This includes ship and boat types in Philippine languages or Spanish.

Please note that the glossary is listed in accordance with the English alphabet rather than the Spanish or Filipino alphabets. Italics have not been used in the glossary.

Metric measurements have been employed generally, but Imperial measurements have been used when quoting from original sources.

Abbreviations:

Admiralty Guide	A short reference to the pamphlet: Admiralty Naval Intelligence Division (1944a), Native Craft and the Fisheries of the Philippine Islands. Taunton, British Admiralty
COD	Concise Oxford Dictionary
Ed	Editor
IJNA	International Journal of Nautical Archaeology
IKUWA	The Internationaler Kongreß für Unterwasserarchäologie (IKUWA), or International Congress on Underwater Archaeology
ISBSA	The International Symposium on Boat and Ship Archaeology
NAS	Nautical Archaeology Society
Pl, pl	Plate

Chapter 1 Introduction

The Philippines is a significant country in Southeast Asia and its importance is often overlooked. The seven thousand islands have a land area larger than the UK (Wernstedt & Spencer, 1967: 2-3). The population has now passed 100 million and this is the twelfth most populous country in the world (www.worldometers.info/world-population/philippines-population). Currently, Filipinos are the largest maritime community in the world, with over 400,000 people employed at sea, mostly in foreign flag vessels (www.adamsonphil.com).

This thesis will identify the key construction characteristics of traditional vessels used by the inhabitants of the Philippines at the time of European colonisation in the sixteenth century. Prior to colonisation, the Philippines were already involved in a trading network with other parts of Southeast Asia, particularly China (Hall, 2011: 29-36). This thesis will review evidence of the interplay between the indigenous technology and influence from these other maritime traditions in the construction of Philippine vessels (Manguin, 1984a: 197-212), both before and after the colonial settlement. After colonisation, the Spanish began the construction in the islands of European-style vessels using Philippine resources (Pineda, 1619). The Spanish galleon was a type of vessel developed in the sixteenth century, stronger, larger, safer and faster than earlier styles and designed for the needs of the growing Spanish empire (Picornell, 2012: 41). The thesis will assess the impact of this experience of building galleons and other European-style vessels in the Philippines on traditional boat-building.

1.1 Previous Approaches

Academic analysis of indigenous Philippine boat types and the local shipbuilding tradition has been rather limited. A recent thesis by Ligaya Lacsina, 'Examining pre-colonial Southeast Asian boatbuilding: An archaeological study of the Butuan Boats and the use of edge-joined planking in local and regional construction techniques', has helped to fill this deficiency (Lacsina, 2016). A most useful and relevant paper is W. H. Scott's *Boat Building and Seamanship in Classic Philippine Society* which draws on evidence from archaeological, linguistic and literary sources (Scott, 1981). A good summary of the available source data is available

in *Prehispanic Source Materials for the Study of Philippine History* from the same author (Scott, 1984).

There is an early ethnographic paper by José M. Hilario, *Boat Types in the Philippines* (Hilario, 1915). This mostly refers to boat types of the Spanish colonial period and is drawn largely from the Spanish documents included in the compendium of colonial papers in Blair and Robertson (1903-7). Another valuable early article is *Types of Watercraft in the Philippines* (Galang, 1941) published in the Philippine Journal of Science, which gives an overview of the vessels in use before the advent of modern materials.

Most of the recent academic work describes the Southeast Asian tradition more broadly, such as those by G.A. Horridge (Horridge, 1982), P.-Y. Manguin (Manguin, 1985, 2017) and S. McGrail (McGrail, 2001, 2015). These analyse the regional trends in Island Southeast Asia more generally. They do not usually address specifically the development of the indigenous vessels in the Philippines.

1.2 Research Question

The main question addressed by this thesis is what were the defining characteristics of Philippine indigenous boats, in terms of their construction, at the time of colonisation in the sixteenth century? This thesis will argue that those defining characteristics were:

- The use of carved wood rather than sawn timber (both in logboats and plank-built boats)
- The hulls were fastened predominantly using the dowel and lashed lug technology
- The boats used outriggers for stability (both in logboats and plank built boats).

The thesis will seek to demonstrate that these features were particularly suited to both the maritime environment of the Philippines, and the resource base available in the islands. The analysis will point to tentative conclusions on how and where these technical solutions were developed and subsequently modified.

However, we cannot divorce the technical design of these ships from the communities that created them. As Adams (2017: 21) argued "technology does not spring into existence of its own volition but because of the intentions and

actions of people, we can accept that the ways that things are designed, made and used are directly related to society". Therefore, we invariably need to analyse the maritime community within which these vessels were created and used. This is particularly important in the Philippines where the culture was heavily orientated to water transport and harvesting marine resources.

The nature of maritime communities was explored by Ransley (2011: 879-880) and include the social, economic and environmental context of local social groups, the relationship of the society with the sea and inland waterways and the broader concept of maritime space as understood in the local culture.

Westerdahl (2011: 733-754) traces the development of the concept of maritime communities as part of the maritime cultural landscape from its German and Scandinavian roots and emphasises the cognitive aspects of those maritime communities, often expressed as ritual behaviour.

The willingness of the community to accept new ideas in shipbuilding through contact with other cultures is an important influence on the technical developments in the ships and boats used in the region, but also an important clue to the nature of the local society. This is explored by Fenwick (2006: 171-176) in the context of Venezuela and Micronesia.

The recent thesis of Fuquen Gomez (2014) on Colombia illustrates how this linkage between the boats themselves and the social context of the society that produced them can be demonstrated. She "considers these boats as an entry point into the life of the community and explores the technological and functional aspects of the watercraft, their wider context, and related social practices" (2014: abstract).

In the pre-colonial period the indigenous boat styles in the Philippines appear to have been slow to absorb influence from other Asian maritime traditions such as Chinese, Indian or Arab technology. This will be discussed in Chapter 9.

When the Spanish arrived in the sixteenth century they began to build ships in the European tradition in the Philippines using Filipino resources (Pineda, 1619), however the Spanish continued to build and use indigenous vessels (Alcina, 1668; 207). The thesis will analyse the gradual adoption of certain aspects of European technology in the construction of these indigenous vessels. The nature of these

changes and the motivation for innovations will also be discussed in Chapter 9. Apart from the Spanish control there also appeared to be a growing influence from the China coast on boat-building techniques, and this was most likely a consequence of significant immigration from China in the colonial period (Wickberg, 1962:273-285).

1.3 Present Approach

As previous academic research carried out relating to the development of Philippine boats has been limited (Dizon & Ronquillo, 2010), it is believed that this research will make a significant contribution to understanding the construction of indigenous craft in the Philippines and how this was modified by foreign influences before and after the colonial settlement.

The research will re-examine the earlier accounts by Spanish colonisers and priests, review more recent archaeological findings, study the accounts of early travellers and seek to test this information by comparison with current ethnographic sources. Parallels, contrasts and influences from other parts of Southeast Asia will also be considered. This will give a comprehensive view of the construction of indigenous boats and boat-building in the Philippines in the sixteenth century and some insights into later developments.

1.3.1 Origins of Philippine Maritime Culture

The Bellwood theory of Austronesian migration from Taiwan and Southern China (Bellwood, 1985: 107-117) suggests that the source of much of the culture of the modern Filipinos, and other users of the Austronesian languages, was a migration to the Philippines between 4,000 and 2,000 BC. If that theory is given credence, they must have come in some form of early boats or rafts as there has been no land bridge from Taiwan or the Chinese mainland in the recent past (see Chapter 2.2).

An alternative theory is that the cultural was influenced by migration from other parts of Southeast Asia which may have been more accessible, especially during the last Ice Age (Oppenheimer, 1998: 82). The Bellwood theory was developed originally based largely on linguistic factors, and the relationships between the Austronesian languages, as will be discussed in Chapter 3. This theory has been

challenged on the basis of genetic evidence (Soares, Trejaut, Loo et al, 2008; Capelli et al, 2001) which could lead to a modification of the understanding of the roots of Austronesian culture.

What ethnic groups the Austronesian-speakers found in occupation of the Philippines and the extent of the pre-existing maritime culture is largely unknown, however, there is no doubt that the cultural impact of the new arrivals was massive, as all the Philippine island populations ended up speaking varieties of Austronesian dialects and languages (Blust, 2009: 40).

1.3.2 Physical Environment

The environment of the Philippines is tropical and significantly different from that of China, the assumed origin of Austronesian culture in the Bellwood theory (Bellwood 1985: 107-117). The Philippines is an area of strong, year-round sunshine, and the surface water temperature of the sea is usually between 26° and 30° (Wernstedt & Spencer, 1967:40-45).

The chief characteristic of these waters is the abundance of shallow coral reefs (Jackson, 2006:157-159). There is a wind regime of steady dependable monsoon winds blowing from the northeast in winter and the southwest in summer (Wernstedt & Spencer, 1967:40-45). Typhoons are a sporadic but regular occurrence on a year round basis, which usually drive small boats to seek shelter (Jackson, 2006:22). Most of the marine areas between the islands are relatively sheltered water, but often with strong tidal currents, especially in constricted straits (US Coast and Geodetic Survey, 1906). There are also a number of lakes, primarily of volcanic origin, which were important centres of population with numerous local craft used for fishing and transport (Patanñe, 1996: 4). The US Coast and Geodetic Survey lists 59 significant lakes (1906).

The land environment in the islands is generally mountainous and was originally covered largely in dense tropical forest (Ooi Jin Bee, 1987: 11). Wood resources were extensive and of very high quality, but, by the arrival of the US administration in 1900 the forest cover had reduced to about 50% of the land surface. In the pre-colonial era there was an absence of wheeled transport or suitable pack animals, and most transport was by water (Scott, 1981: 23; Phelan, 1967: 112). This physical environment will be examined in detail in Chapter 2 to

see how these constraints were managed by the early Filipinos. Due to the difficulties of land transport, the importance of boats for both maritime communications and the harvesting of marine resources was considered paramount (Scott, 1981:31).

1.3.3 The Archaeological Tradition

Archaeologists prefer to rely on archaeological evidence to demonstrate the evolution of indigenous water transport; however, such evidence is very limited due to the natural transforms induced by the tropical climate and active marine borers (Srinivasan, 1968: 277-280). The limited maritime archaeological evidence will be reviewed, but has to be complemented by other sources of information.

There is a significant history of archaeological work in the Philippines, which has been dominated by American scholars, both during and after the US colonial period, such as H. Otley Beyer, Robert Fox and W.G. Solheim (Beyer, 1948) (Fox, 1967) (Solheim, 2006). A useful summary of the archaeological tradition in the Philippines is provided in a paper from Armand Mijares, 'Philippine Archaeology in Retrospect' (Mijares, 1998: 5-15). The early history of the islands will be summarised in Chapter 3, with a brief time-line of Philippine history for readers who are unfamiliar with local history.

The amount of research carried out on specifically maritime themes is limited. The current state of maritime archaeology in the Philippines is summarised in a recent paper by E.Z. Dizon and W.P. Ronquillo, 'Maritime and Underwater Archaeology in the Philippines' (Dizon & Ronquillo, 2010: 201-249). The work carried out has been limited due to budgetary constraints, and the Philippine government has been cautious about giving foreign experts access to maritime sites without close supervision by the National Museum.

The discoveries of archaeological evidence for pre-Hispanic, indigenous marine vessels are especially limited. One rare example is a logboat illustrated on the Manunggul Jar, a funerary ceramic from Palawan in the National Museum (Figure 1.2). Unfortunately the dating of this spectacular find is still uncertain, although the National Museum in Manila considers this to be late Neolithic and dating from about 890 to 710 BC (National Museum Collections website at www.**nationalmuseum**.gov.ph).

In recent years a number of shipwrecks have been discovered in Philippine waters, (Brown, 2004: 42-55; Orillaneda, 2000; and Lacsina, 2011). They are mostly trade vessels, often with extensive cargoes of Chinese or Southeast Asian ceramic export wares, but several of these sites are unpublished. Most of the wrecks are in the style of Chinese junks or western designs; however at least two were vessels apparently built in the Southeast Asian native tradition (Dizon, personal communication). These wreck sites will be discussed further in Chapter 6.

1.3.4 Historical Accounts

The Philippine languages had their own script of Asian origin. Not many examples survived the Spanish conquest and no information of relevance for maritime history has been identified from this source (Reid, 1988: 216-218).

The Chinese historical records describe Chinese voyages to the Philippines in the pre-colonial period and tribute relations with the civil authorities, particularly the Sultanate of Sulu (Scott, 1984: 65-77). There are also references to piratical raids by natives of the Philippines on the Chinese coast. Some of the early texts are ambiguous but there are clear descriptions of the Philippines from the Sung Dynasty onwards (960-1278 AD). Many of these references were retranslated by Scott (1984: 65-77).

There are numerous written accounts by European authors who visited or settled in the islands. These include Pigafetta's chronicle of the Magellan voyage. Another valuable account is Antonio de Morga's *Sucesos de las Islas Filipinas* published in Mexico (de Morga, 1609). A particularly useful text for boats is Fr Alcina's unpublished memoir *Historia de Las Islas e Indios de Bisayas* (Alcina 1668: especially Part 1, Book 3, Volume 3). Alcina had both built and sailed boats constructed in accordance with the indigenous tradition.

Most of these documents are in Spanish and can be found in the Spanish archives, notably the Archivo General de Indias in Seville. A series of these papers are translated into English and reproduced in Blair & Robertson's collection of documents, which runs to 55 volumes (1903-7).

A number of visitors of other nationalities wrote about the islands, such as the English travellers, William Dampier and Thomas Forrest. As many of these were

professional sailors they often had extensive and informed comments on the boats and marine traditions they encountered (Masefield, 1906; Forrest, 1779).

1.3.5 Ethnological Studies

Local fishing and water transport in the Philippines is dominated today by the 'banca', which is a plank-built boat and appears to be an adaptation of the indigenous styles. Originally the banca was sailed or paddled, but today most are motorised. The typical banca of today has a double outrigger and a narrow plank-built hull. There are also a number of studies available of boat-building in the traditional style from the recent past, such as a study by Nimmo in the Sulu Sea (Nimmo, 1990).

Logboats are still produced in the traditional manner in the Philippines and studies of the communities which still utilise these vessels can give useful insights into the original designs. The ethnological studies of logboats carried out for this thesis will be discussed in Chapter 5.

One useful source is a report by the British Naval Intelligence Division in 1944, *Native craft and the fisheries of the Philippine Islands* (Admiralty Naval Intelligence Division, 1944a: 80-112). This by-product of the Second World War records the variety of indigenous craft in use in the 1930s, when they still primarily used sails and traditional materials. This report is anonymous but must have been prepared by an expert in the local craft used in the Philippines.

1.3.6 Linguistic Evidence

Much of the work on the origin of the Filipino people has been based on the linguistic record. There are a range of languages and dialects in the Philippines which are all part of the Austronesian language family. This language family links Bahasa Melayu, Bahasa Indonesia, the Polynesian tongues and languages from Madagascar to Taiwan. One important source of evidence for the historic maritime culture is a number of early dictionaries between Spanish and the principal Philippine dialects, such as Pedro de San Buenaventura's *Vocabulario de la Lengua Tagala* (Pedro de Buenaventura, 1613). These dictionaries contain many nautical words and expressions which illustrate the maritime culture of the

traditional society and have been included in the glossary and the database of boat names, attached as Appendices A and B.

1.3.7 Comparison with Other Southeast Asian Evidence

There are some similarities between the maritime history of the Philippines and certain areas of eastern Indonesia (particularly the Moluccas). As a result, areas of Indonesia such as the Moluccas, Sulawesi, and Bali can be considered to have a similar maritime tradition as the Philippines (Horridge, 1978). The famous eighth-century carvings of outrigger boats at Borobudur in Java have some common features with Philippine boats of that period (Figure 1.3) (Petersen 2006).

Due to migration, similar double outrigger vessels can be found across the Indian Ocean in Madagascar, Sri Lanka and as far as the African coast (McGrail, 2001: 291-293). Mainland Southeast Asia is geographically much closer, but does not appear to share the same boat-building culture as the double outrigger is largely absent in that zone (Horridge, 1978: 3).

It can be shown that vessels from China, Vietnam and Thailand visited the Philippines frequently in the pre-colonial phase for trading purposes (Hall, 2011: 325-335). The limited evidence of cross influences from those different traditions will be analysed in Chapter 9.

1.4 Basic Boat Design

As Muckelroy wrote in his *Maritime Archaeology* "in any pre-industrial society...a boat or (later) a ship was the largest and most complex machine produced" (Muckelroy, 1978: 3). This was certainly the case in the Philippines where maritime transport was the key form of social interaction and boats were the largest artefacts produced. The functions of the indigenous vessels included raiding, slave trading, and fishing as well as general transport and communications (Scott, 1981: 23-30).

According to the Spanish colonialists, in the sixteenth century the boats used in the islands fall into two broad categories, logboats and plank-built boats (de Morga, 1609). However, there are certain characteristics which can be considered common to these two categories. They both used timber carved with adzes and axes.

There was also an important group of extended vessels, which were essentially logboats with extra strakes or washboards. This design was important in fitting out logboats for use with sails by extending the freeboard.

1.4.1 Plank-Built Boats

The larger vessels were plank-built boats and these fell into various classes differentiated by role and size (Alcina, 1688: 167-195). These vessels were all powered by paddles, oars or sail and usually a combination of those. The planks were hand carved and not sawn, as the saw does not seem to have been in use in the Philippines (Scott, 1994).

The usual method of fixing the planks together was by the use of circular dowels fitting into the edges of the strakes. The size of these dowels was about 2 to 3 cm in diameter (Pigafetta, translated by Stanley, 1874: 76).These dowels were also used to fix the strakes to the stem and stern posts. The stem and stern posts were frequently indented to facilitate the seating of strakes and these has been referred to as 'winged' stems and stern posts. This is illustrated in Figure 6.1 and is described in detail in Lacsina (2016: 186-188).

The boats were lashed together using carved lugs, called tambuko, on the inside of the planks, and series of ribs or frames, called agar, as is discussed in Chapter 6. This framework of ribs together with transverse thwarts created a strong hull shape suitable for open water use.

Horridge coined the phrase the lashed-lug design for this style (Horridge 1982). He argues that the key features of this tradition were:

- the shell-first construction on a keel or dug-out foundation
- edge-dowelled planking of hardwood carved to shape
- lugs carved in situ in transverse rows across the inside of the boat
- flexible frames placed in tension to compress the planks together
- transverse thwarts lashed down to the lugs and rib-ends to squeeze the hull.

According to Alcina (1668: 167-195) all the larger plank-built craft in this indigenous tradition had similar construction techniques. The construction

process of the plank-built will be discussed in detail in Chapter 6, and this relies heavily on the description of Alcina.

Most of these vessels used the edge-pegged dowel technology and lash-lug techniques to fasten the hulls, using a shell first construction technique (Scott, 1981: 5-6). The most important archaeological discoveries have been the boats found in Butuan in northern Mindanao. These were a series of plank-built, edge-pegged boats discovered in 1976 and later years. In a paper presented in 2011, the author (with Dr E. Z. Dizon) urged the re-excavation of this site to fully record and document the vessels found in Butuan (Stead & Dizon, 2011). Current excavations by the National Museum began in 2012 and are proceeding. Two new vessels have been uncovered to date, one of which appears to be similar to the earlier boat discoveries (personal communication with M. J. Bolunia). At the same time, further analysis has been carried out on other boats discovered on this site and a radical reappraisal of the original dating has been undertaken (Lacsina, 2016).

These boats from Butuan have been associated by Scott (1981) and Peralta, (1980) with the 'balangay' boats described by the early Spanish explorers, particularly Pigafetta, the chronicler of the first visit by Magellan (Pigafetta, 1969 edition: 31-39). This identification is discussed further in Chapter 6, below. There was a separate class of 'caracoa' boats. These were narrow, plank-built boats with double outriggers, built as people carriers, and widely used for raiding and trading (Scott, 1981: 5-6). As they were lightly built they rarely survive as shipwrecks or in archaeological sites. According to Fr. Alcina all these vessels were highly effective in crossing shallow reef areas and were very fast when sailed or paddled (Alcina, 1668: 207). The caracoa vessels were used by the Spanish in the colonial period in cooperation with Spanish-designed vessels, especially for fighting dissidents and pirates (Scott, 1981: 31).

There is some evidence of a sewn-boat tradition in the Philippines, which survives in very limited cases in the archaeological record (Ronquillo, 2007; Scott, 1981). The most important class of sewn vessel to survive in use until recent years is the 'casco', a kind of lighter or houseboat widely used in Luzon in the nineteenth century (Manguin, 1985: 319-343).

1.4.2 Logboats

Logboats were the most numerous boats used in the islands when the Europeans first visited (de Morga, 1609). The Filipinos used the plentiful supplies of quality timber to produce large numbers of these vessels for use in lakes and rivers as well as on the open sea. These boats were used for harvesting marine resources, a key part of the Philippine diet, then and now. As the terrain was very difficult in the Philippines, due to the mountainous landscape, largely covered in thick forest, boats and especially logboats were often the normal method of local communication and inter-action between social groups (Alcina, 1688: 197). These logboats were often extended by the use of additional wash strakes.

The Europeans were familiar with logboats as they were common in Europe, Africa and the Americas. The Spaniards usually used the terms canoa or piragua for these vessels in their documents, although both these names come from the Caribbean (Blair and Robertson, 1904: Index).

1.4.3 Other Vessel Types

Rafts were not widely reported in the Philippines in Spanish sources at the time of colonisation, apart from platforms for fishing. This is, perhaps, surprising, due to the plentiful sources of bamboo, which is a particularly fine raw material for raft construction.

Other types of boat construction are rare in the Philippines. There are no traces yet found of skin boats in the archaeological record, nor accounts from early visitors of such vessels. This is, perhaps, not surprising as there were no large quadrupeds to supply skins for this purpose in the pre-colonial era. There were some small deer and wild water buffalo, but cattle, horses and domesticated water buffalo all appear to be later imports (Scott, 1994).

Also there are no accounts of reed bundle or basket boats in use, although examples are known from Vietnam and Indonesia (McGrail, 2001: 294). Even bark boats seem to be absent from the Philippines, although, as noted in Chapter 8, bark was used as a material for washboard extensions. This apparent absence of bark boats is surprising as there are reports of bark boats in neighbouring Sarawak, notably the salui lowid, of about 7 metres in length. The bark of three species of *artocarpus tamaran* was used for these essentially temporary vessels

(Nicolaisen & Damgård-Sørensen, 1991: 120). These tree species also grow in the Philippines, but there are no known references to their use for complete bark-built boats.

1.4.4 Outriggers

What was a novel feature for the European visitors was the use of outriggers, a defining characteristic of these Philippine boats. This use of outriggers is largely limited to areas influenced by the culture of the Austronesian-speaking people in the Pacific and the Indian Ocean (Horridge, 1978). The distribution of the use of double outriggers in Southeast Asia is illustrated in Figure 1.7. Whilst the logboats used on rivers and lakes sometimes did not mount outriggers, they were usual on sea-going vessels to maintain lateral stability.

The standard outrigger, or katig, consisted of two floats which were connected to the hull by two or more booms. They were usually built in bamboo, but wood could be used for this purpose. The use of a single outrigger was also common and this facilitated the working of nets whilst fishing (Admiralty Naval Intelligence Division, 1944a: 80).

The construction of outriggers needs to address the height difference of the gunwale and the sea. Sometimes curved booms are used to bridge this gap or vertical mounts at the ends of the booms (see Chapter 8 for a review of these connection methods).

1.4.5 Motive Power

The indigenous vessels used mainly paddles. Numerous paddlers were deployed to give extra speed by sitting on the outriggers (de Morga, 1609: 252-253). As the boats were usually designed to be paddled, the freeboard was kept very low (Alcina, 1688: 163). Where the freeboard was higher in heavier vessels, particularly cargo-carrying hulls, and where the vessel beam was wide enough, then oars would be used (Admiralty Naval Intelligence Division, 1944a: 100-101). Sculling over the stern has also been reported, but was not seen during the recent fieldwork (Admiralty Naval Intelligence Division, 1944a: 98).

Most of the vessels used sail power at least part of the time. The sail rigs usually used a tripod mast rather than the European pole masts (Figure 1.4). This made

the mast easy to rig and unrig. The sail plan of the vessels was usually a kind of lug sail or oceanic sprit sail, and the sail types are discussed in Chapter 8.

1.4.6 Boat Nomenclature

The traditional boat styles have a large number of local names, of which some 130 have been listed with brief descriptions in the database, which has been prepared in the course of this research and is attached as Appendix A. Unfortunately there is a degree of ambiguity and repetition about the names recorded, as there are many languages and dialects in use in the islands. The Appendix A entries are linked to the literary sources, but often the specific Philippine dialect or location is unclear. A recent analysis indicates a total of 167 languages in use (Blust 2009: 54). A number of boat types thus have varying names in different parts of the Philippines. Also the same name can be used to describe widely contrasting vessels in different parts of the archipelago. Certain names can have a generic meaning in some areas and a very specific definition elsewhere. For example there was a barangay vessel in use in Luzon which is very different in style to boats with similar names elsewhere in the Philippines (Ronquillo, 2007: 210). Therefore literary references to boat types have to be used with particular caution. This problem was recognised by Fr. Ignacio Alcina in the seventeenth century when he said "there were so many types and varied sizes, and even names. Each one has its own and they are almost innumerable" (Alcina, 1688: 197)[1]. He was referring specifically to logboats, but a similar confusion was present in plank-built boats.

One of the most challenging aspects of this study is that we have a long list of boats types from the early accounts, but with very limited archaeological evidence of the differences between the different classes. This makes it difficult to compare the design and hull structure of the different types of vessels both archaeologically and historically, and with the boats types that survive today. As a result we often end up with a list of boat names but without any clear differentiation between the various types.

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[1] Alcina's text reads '...de tantos y tan varios tamaños y aun nombres, que cada cual tiene el suyo proprio, que son casi sin número'

Figure1.1 Physical environment of the Philippines and major archaeological sites: M. R. Stead

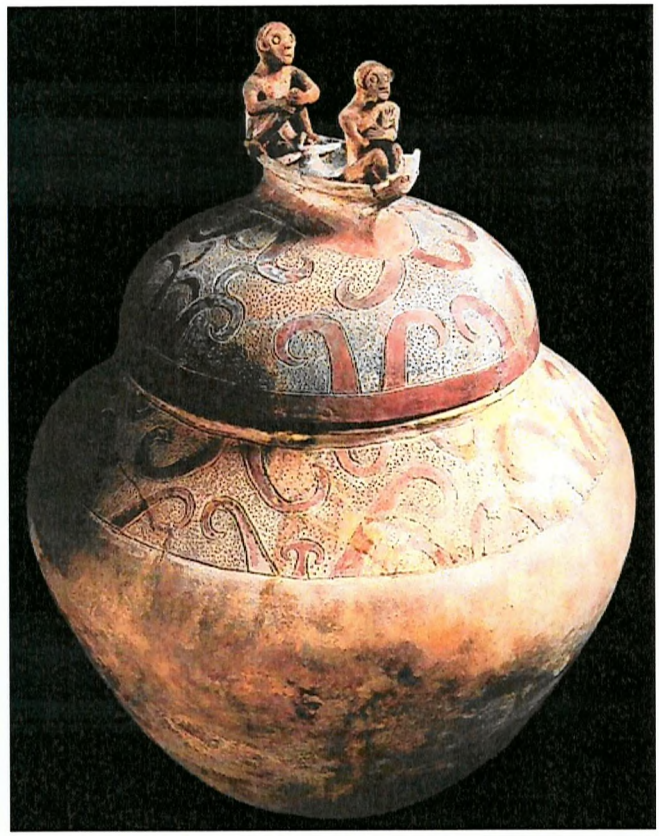

Figure 1.2 Manunggal Jar, from Filipiknow.net
downloaded on 10.1.2017

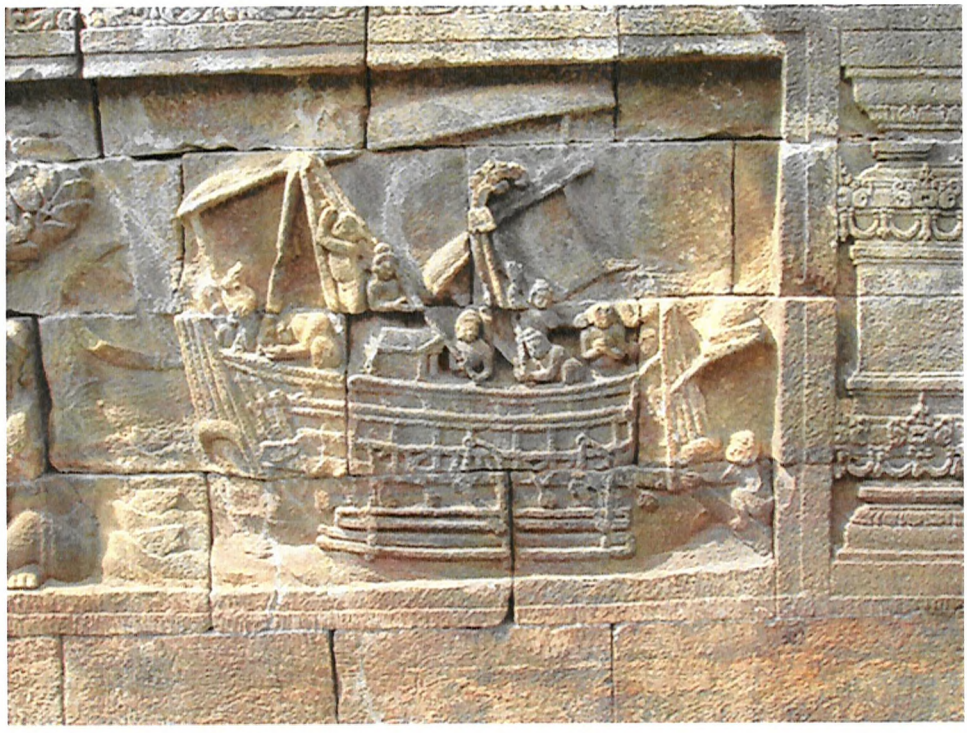

Figure 1.3 Outrigger vessel image from Borobudur (Panel Ib88)
photo: M.R. Stead

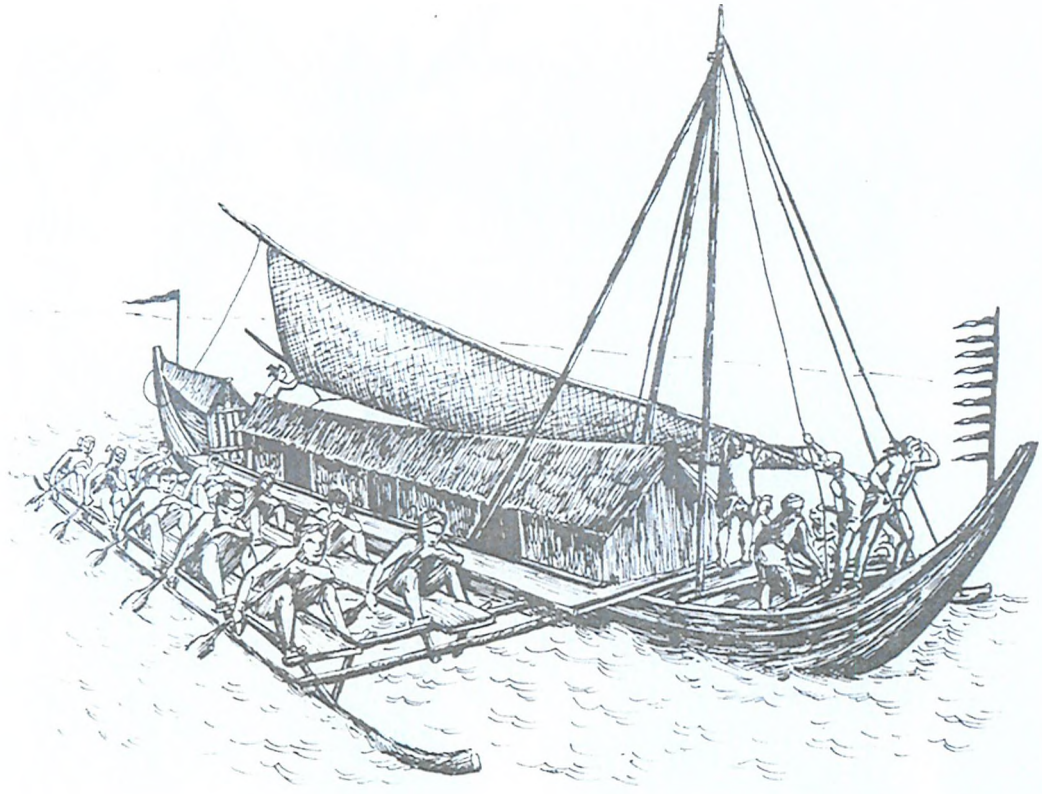

Figure 1.4 Reconstruction drawing of a plank-built boat by Rey Santiago, Courtesy of the National Museum

Figure 1.5 Typical modern banca, photo: M.R. Stead

Figure 1.6 Historic logboat found in Cebu. photo: M.R. Stead

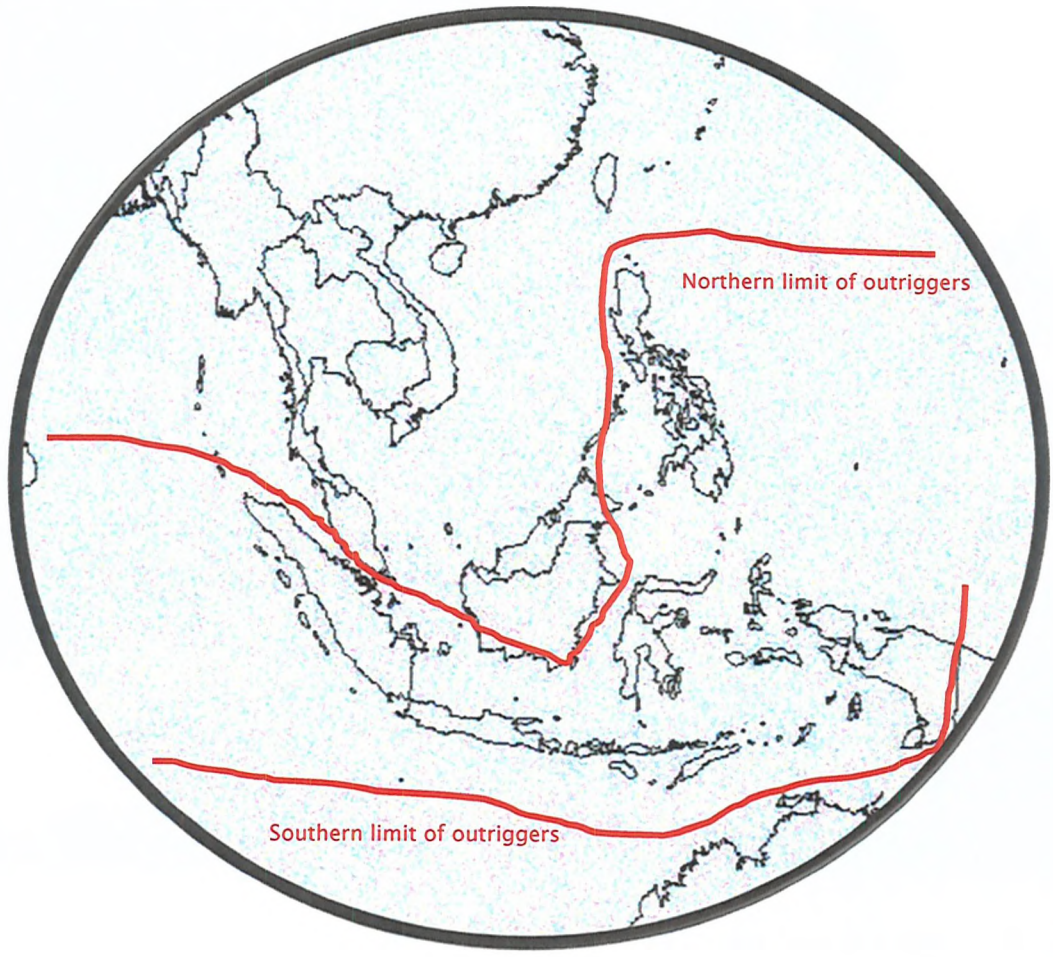

Figure 1.7 Area of double outrigger use in Southeast Asia,
after Horridge 1978 pp 3

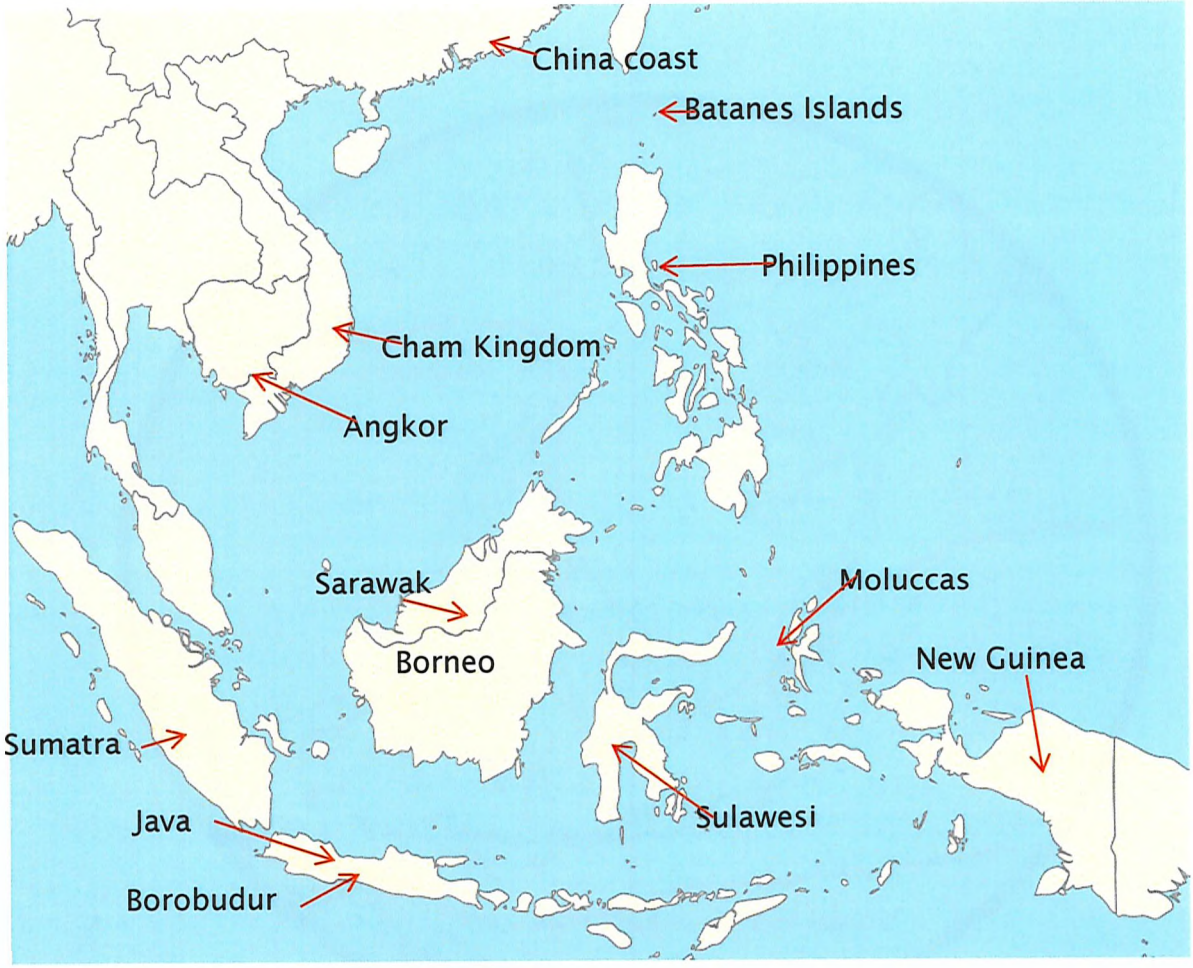

Figure 1.8 Location of places outside the Philippines mentioned in the text

: M. R. Stead

Chapter 2: Physical Environment of the Philippines

2.1 Size and Location

The Philippines is a widespread archipelago lying between the Pacific Ocean and the South China Sea between 4° north and 21° north. The main group of islands is about 1,600 kilometres long and 1,000 kilometres broad (Admiralty, Philippine Islands Pilot, 2004: 11).

The archipelago is composed of some 7,100 islands (Admiralty, Philippine Islands Pilot, 2004: 11). Only some 400 of these islands exceed 3 square kms in size. Eleven islands exceed 2,500 sq kms: Luzon, Mindanao, Leyte, Samar, Panay, Palawan, Mindoro, Negros, Bohol, Cebu and Masbate.

The length of the coastline has been calculated as 17,460 kms given the highly indented nature of the shoreline (Bureau of Fisheries, 1952).

The land area of the Philippines is 300,000 sq. kilometres and similar to the extent of the British Isles, including the Republic of Ireland. Two thirds of the area is made up by the islands of Luzon and Mindanao which are of a similar size, but Luzon is slightly larger (Admiralty, Philippine Islands Pilot, 2004: 11).

2.2 Geology and Geomorphology

Most of the islands are composed of predominantly sedimentary and metamorphosed rocks, but the west side of Mindanao is mainly volcanic in origin (Patanñe, 1996: 1-2). The mountains have significant intrusions of volcanic and plutonic rocks. The islands sit on the Philippine plate which is in collision with the Pacific Island plate. The subduction of the Pacific Island plate has created the Mindanao and Marianas trenches to the east of the islands, which contain the deepest marine areas in the world (Admiralty, Philippine Island Pilot, 2004: 20). As a result of this interaction between the plates, the Philippines is a very active volcanic zone. There are about fifteen active volcanoes at any one time. The most prominent ones are Taal, Mayon, Pinatubo and Hibok-Hibok (Figure 2.1). There are also frequent earthquakes, with at least one major earthquake event about

every fifteen or twenty years through the period of recorded history (Wernstedt & Spencer, 1967: 9-38).

The islands are predominantly mountainous, the highest peak being Mount Apo in Mindanao at 2,955m (Patanñe, 1996: 2). The rugged mountain chains were often real barriers to communications. It is notable that the Spanish colony did not effectively occupy much of the Mountain Province in Luzon and central Mindanao until the end of their colonial rule (Phelan, 1967: 140-144). The only large area of plains is in Luzon, where the Central Plain has an extension of 900,000 sq kilometres, which helps to explain the agricultural and economic dominance of that island. There are a number of smaller plains in Mindanao in the valleys of Agusan, Davao and Cotabato (Huke, 1963: 1-25).

Rivers tend to be short and are rarely navigable. The longest river is the Cagayan in Luzon which is navigable in small craft for 120 kms. The other major river systems in Luzon are the Abra, the Agno and the Pampanga. The Agusan and the Rio Grande are the largest rivers in Mindanao and are also navigable in small craft in the lower reaches (Bureau of the Census, 1905: 56).

There are a large number of lakes, and seven of these are over 3,000 hectares in size. The most prominent are Laguna de Bay, Taal and Lanao. These lakes were major centres of population and were used extensively for communication (Patanñe, 1996: 18). Many of these lakes are volcanic crater lakes (Figure 2.2).

A number of the Philippine islands have clearly been connected in the past to each other, at periods of low sea level particularly associated with Ice Age events, as they share a common shelf location (Oppenheimer, 1998: 82). However the existence and dating of land bridges remains controversial due to the tectonic nature of much of the Philippines. The existence of land connections to Asia via Borneo in the past was demonstrated through the documented remains of elephants and rhinoceros on Philippine islands, even though these are now extinct. In particular, the existence of possible land bridges from Borneo to Sulu and Mindanao were likely during the Pleistocene given the shallow water in that area. However these land bridges appear to have had little impact on recent human population migrations and the current coastal configuation has been relatively stable since the end of the last glaciation (Austria, 1977: 7-13). The

implication is that recent human immigration movements required suitable marine craft.

The island of Palawan sits on the Sunda continental shelf and evidence from the fauna and flora indicates a close connection with Kalimantan (Borneo) (as seen on the map in Figure 1.1). In the past there have been periods with a landbridge present to facilitate such interchanges, as confirmed in a recent study, although the last connection was probably in the Middle Pleistocene (Robles et al, 2014: 76-96). The earliest extensive homo sapiens remains in the Philippines have been found in Palawan which was relatively close to Kalimantan and hence to the Asian mainland in glacial periods of low sea levels, even when no land bridge was present.

The other islands (excluding Palawan) have been classified as part of the biogeographical region of Wallacea, which is an area of transition between the Asian biosphere and the Australian biosphere (Bellwood, 1997: 6-8). Some experts treat the Philippines as a subgroup of Wallacea, seperate from the Indonesian islands such as Sulawesi and the Moluccas (Vallejo, 2011 : 27-41).

2.3 Climate

The climate is tropical throughout, but with influence from seasonal monsoon winds because of the proximity of the Asian continent. The North East monsoon (the amihan) blows from October to April and the South West monsoon (the habagat) blows from May to September (Patanñe, 1996: 10) (Figure 2.5). The monsoon effects are felt noticeably where the coast is exposed to the monsoon winds, and especially to the northern end of the archipelago, where the mountains create a rain shadow in the North East monsoon. The monsoon effects are less prominent in the south which has a more typical equatorial climate (Air Ministry Metorological Office, 1937).

In the open sea off Luzon the North East monsoon is typically force 3 to 5 on the Beaufort scale but can freshen to gale force. The South West monsoon is usually less strong, about force 3 to 4 in the open sea, but is often associated with sharp line squalls (Admiralty Philippine Islands Pilot, 2004: 28-29).

The effects of the monsoon can be strongly influenced by local topography and the coastal aspect. Land and sea breezes can be strong and, at times, mask the normal monsoon winds (Admiralty Philippines Island Pilot, 2004: 29).

The weather can be severely affected in the Philippines by typhoons or 'baguíos'. About 13 typhoons per year are experienced in the general area of which about 7 cross the islands. Some three of four typhoons per year are severe in their effects bringing very high wind speeds and torrential rain. They can be experienced in all months, but are rare in January to April (Jackson, 2006: 22). The mean track of these typhoons is from the Pacific moving north east over the islands. Luzon is the island most affected and typhoons are rare in the south around Mindanao. The mean speed of advance of typhoons is about 10 knots (Admiralty Philippine Islands Pilot, 2004: 32).

Temperatures are tropical throughout, except where tempered by altitude on the higher peaks. Diurnal and season ranges are small. The average temperature in Manila is 27°C and this is typical for the islands as a whole. However Luzon can be affected by cooler weather in the winter months when the mean temperature can fall to an average of 18°, but this affect is limited further south. Mean relative humidity is high, typically 80% to 85%, although in the winter months on the western shores of Luzon it can fall to below 75% (Wernstedt & Spencer, 1967:40-45).

Rainfall is generally heavy with coastal stations reporting between 46 inches (1,175 mm) and 157 inches (3,997mm). The amount and seasonality of rain is varied due to the effects of the monsoon and the aspect of the land. On the western fringes of the islands, particularly Luzon, Palawan, Mindoro, Negros and Panay there is a dry season from January to April. On the eastern fringes of the archipelago there is no real dry season, but rather more rain falls during the North East Monsoon. In Mindanao there is typically no dry season and the climate is largely equatorial. (Wernstedt & Spencer, 1967, 46-59).

2.4 Sailing Conditions

There are large areas of protected waters between the islands which make, in general, for easy maritime communications. A key feature is the extensive area of shallow coral reefs, usually fringing reefs along the shores. However, there are

also numerous isolated coral heads and seamounts, which are dangerous for navigation, particularly for deep-draught vessels (Jackson, 2006:157-159). This is one factor in the design of indigenous craft, which were built to be able to cross shallow reefs and work off beaches rather than docks (Figure 2.4).

Seawater temperatures are high and relatively stable between 26° and 30° year round. This reduces the need for protection of the crew from cold spray. The use of crew members to paddle traditional vessels by sitting on outriggers reflects these relatively benign conditions (Figure 2.6). However the strong sunshine does require the provision of shade for the crew on longer marine trips (Alcina, 1668: 189). Underwater visibility is usually good so that reefs can readily be located in calm water when the water is less than twenty metres deep.

The sea waters around the islands have a significant problem with marine molluscs such as the teredo worm (*teredo navalis*) and crustaceans. The protective coatings available before colonisation, and the choice of resistant timber, were not adequate to stop this menace (Srinivasan, 1968: 277-280).

Communications between the eastern coasts and the rest of the archipelago are complicated by the lack of navigable passages to and from the Pacific. There are just two main routes, the San Bernardino Strait to the south of Luzon and the Surigao Strait north of Mindanao (see Figure 1.1 for the map of these routes). The San Bernardino Strait was the preferred exit of the Manila galleons in the colonial period both in-bound and outward bound (Fish, 2011:350). The Strait is complex and subject to strong tidal currents, which was the cause of a number of casualties in the days of sail. The Surigao Strait is rather broader and safer, but lies well to the south. These choke points have long had major strategic significance. The battle of Leyte Gulf in the Second World War, one of the largest sea battles ever fought, was dominated by these two gateways to the Pacific, and took place predominently in the Surigao Strait as the Japanese fleet sought to sail out into the Pacific (Bateson, 1968: 349-357). There is also a small exit between Samar and Leyte called the San Juanico Strait, but this narrows to only two kilometres broad and is crossed by a bridge. This is not much used by commercial traffic.

In the protected waters between the islands the winds are usually relatively light. The wind directions are fairly predictable due to the effects of the monsoon as

discussed above. The biggest problems are caused by sporadic typhoons and monsoon squalls.

There is a frequent pattern of tsunami waves due to earthquake activity offshore. However these are often mitigated by the shelter effect of the numerous islands. The effects are mostly felt in the immediate coastal area and are less of a problem further out to sea (Admiralty Philippine Island Pilot. 2004: 20).

Visibility at sea is usually good with limited sea fogs. The main periods of poor visibility are associated with rain. As the major islands are usually intervisible, navigation is mostly just pilotage, rather than deep-sea course-finding out of sight of land (Scott, 1981: 18).

There is a general westerly current from the direction of the Pacific known as the Equatorial Current which runs at about one knot, and this reflects the trade winds. This is very variable in both speed and direction because of the layout of the islands. It only becomes a navigational problem where the land configuration concentrates the current as in the overfalls (turbulence caused by water flow over shallow reefs) in the Isla Verde passage between Luzon and Mindoro. When the westerly current strikes the eastern shores of Luzon it tends to flow north, but south of Leyte it tends to flow south and was sufficiently strong to influence navigation in the days of sail (Admiralty Philippine Island Pilot, 2004: 26).

On the eastern coasts the tidal movements are semi diurnal with a spring tidal range of approximately 1.5 metres. In the rest of the archipelago the tidal regime is diurnal and the spring range is about one metre. Therefore the tidal affects can largely be discounted except where the islands tend to funnel the tidal streams. The US Coast and Geodetic Survey mentions in particular the strong tidal streams found in the San Bernardino Strait and the Isla Verde Passage where tidal streams can reach 3 to 4 knots (US Coast and Geodetic Survey, 1906).

The North East Monsoon can generate significant swell off the east coasts, but in the lee of the islands this is moderated. In the South West Monsoon the swell is less noticeable (Admiralty Philippine Island Pilot, 2004 :26).

One area with a rather different physical environment is the region of the Batanes islands, which lie to the north of Luzon between that island and Taiwan (see map in Figure 1.1). Here the weather and sea temperatures are rather colder due to

the more northerly latitude. The sea tends to be stormier with higher swells. The impact of these differences on the local forms of boat, due to this more difficult environment, are described in Chapter 6.5 below.

The Visayan islands are in a more protected marine environment, which allowed more frequent and easier interaction, as compared with more remote and difficult areas such as the Sulu Sea, and the Batanes islands. This may help to explain the differences in boat types in these areas.

2.5 Flora and Fauna

At the time of colonisation the islands were heavily forested. The tropical forest of the Indo-Malasian Archipelago is a mixed evergreen, *Dipterocarp* rain forest with an exceptionally high range of species, which Walker, referring specifically to Indonesia, has labelled "the most complex terrestrial ecosystem in the world" (Walker, 1980: 21). Single stands of one species are rare and there is a wide spread of tree species. Some 665 native tree species used for timber were noted by Ahern in the Philippines in his review of the forests at the time of the American colonisation (Ahern, 1901:12). The forests are far from uniform as the mix of species is influence by altitude and by rainfall, particularly the seasonality of rainfall in areas most affected by the monsoon winds (Figure 2.5).

In the sixteenth century almost all of the islands were forested. As the population increased more land was cleared for agriculture. The use of shifting cultivation meant that many areas were converted into secondary jungle or areas of cogon grass (Pelzer, 1945). The commencement of the building of Spanish galleons in the islands was a heavy drain on the timber sources, especially around the port areas such as Cavite. At the time of the American conquest about half the territory was still covered in forests (Ahern, 1901: 11). Since then extensive commercial forestry has degraded much of the forest so that the resources are now limited (Kummer, 1992).

As noted above, the flora and fauna in the Philippines represent an intermediate area between the Australian and Asian biospheres (Vallejo, 2011: 27-41). The number of large mammals is very limited, but includes wild buffalo (tamarao), red and brown deer, binturong, civet cats, lemurs and one genus of monkeys.

The coastal waters of the Philippines are home to one of the richest and most diverse coral communities. There are fringing reefs around most of the islands as well as extensive patch reefs, banks and shoals offshore (Jackson, 2006: 157-160).

Figure 2.1 Mayon, one of many active volcanoes, photo: M. R. Stead

Figure 2.2 Bulusan, volcanic crater lake, photo: M. R. Stead

Figure 2.3 Typical Filipino forest, from www.thetravelworld.com downloaded on 10.1.2017

Figure 2.4 Fringing reef, from www.calvintang.com

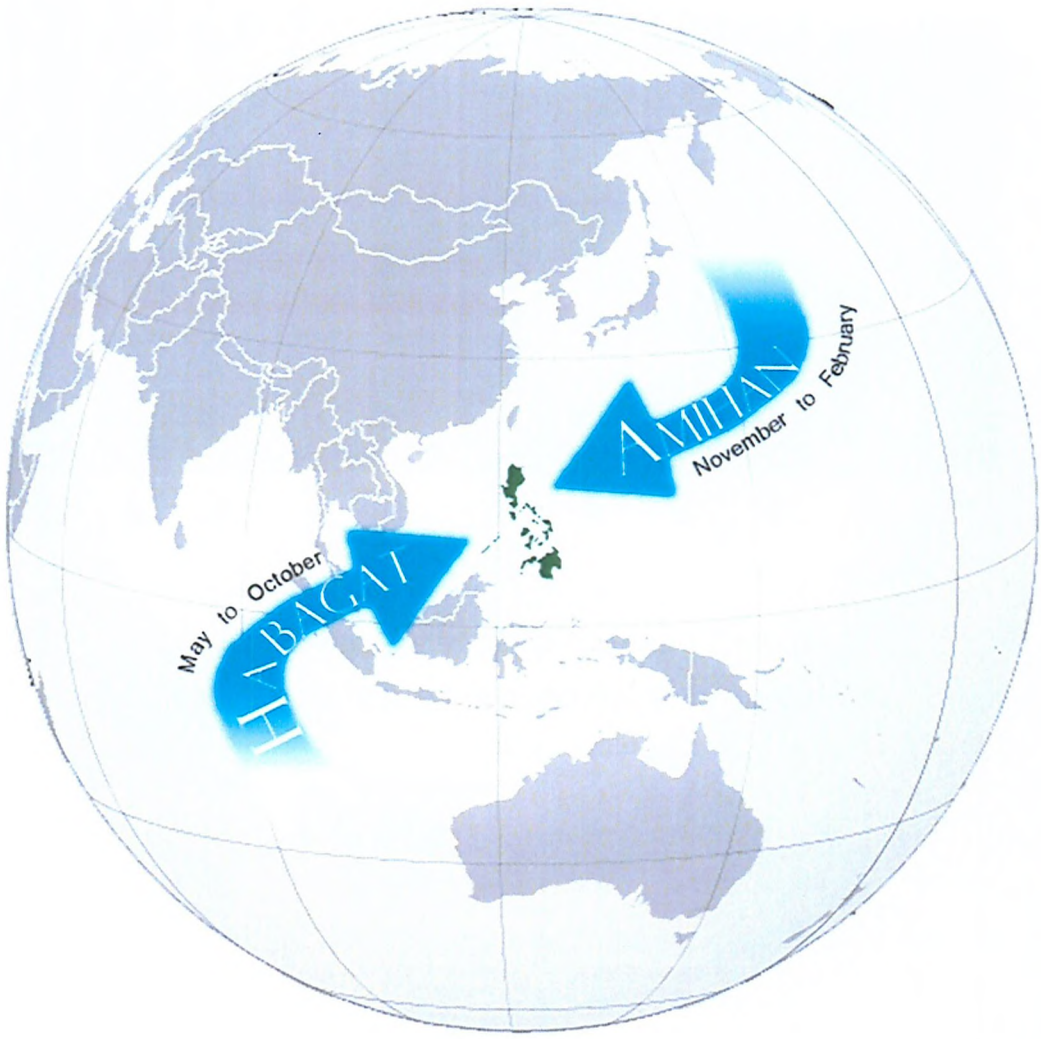

Figure 2.5 Monsoonal wind direction: Adapted from Jaime B. Veneracion 'Agos ng Dugong Kayumanggi Isang Kasaysayan ng Sambayanang Pilipino' showing the traditional names for the prevailing monsoon winds in Tagalog; downloaded from www.goodreads.com on 15/3/2017

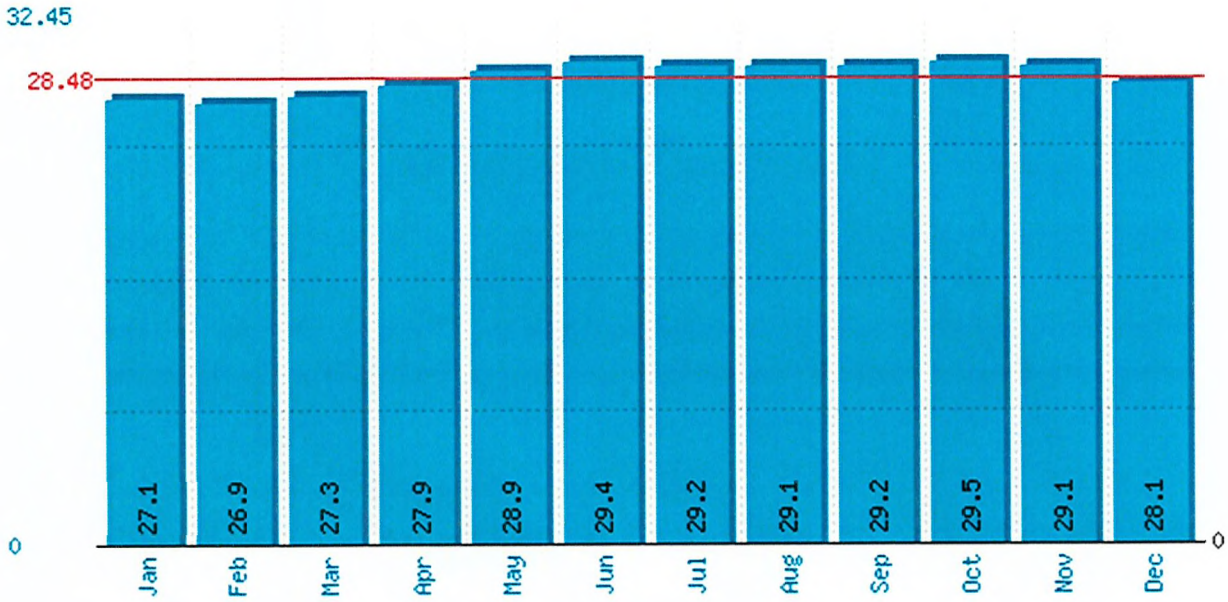

Figure 2.6 Sea temperature in Southern Luzon,
http://www.seatemperature.org/public/chart
downloaded in 2015

Chapter 3: The People and Maritime Culture of the Philippines

For readers unfamiliar with Philippine history, this can be divided into a pre-historic period up to the sixteenth century, the era of Spanish colonial activity, a period of US rule from 1900 to 1945 and an independent state thereafter.

The earliest hominid discoveries in Island Southeast Asia were the the fossils of homo erectus in Java (Indonesia). These discoveries, initially by Eugene Dubois in the nineteenth century, were dated to two million years old (Curtis, Swisher & Lewin, 2000: 215-236). Recent discoveries of a further hominid, apparently descended from homo erectus, homo floresiensis, indicates a late survival of this species on the island of Flores in Indonesia (Morwood et al, 2004). The oldest evidence to date for homo sapiens in island Southest Asia appears to come from the Niah Caves in Sarawak (Malaysia), where the earliest material has been dated to 40,000 BP (Figure 3.1) (Bellwood, 1997 :84). The Leang Leang caves in Sulawesi (Indonesia) were excavated by Dutch archaeologists in the 1950s and recent analysis gives a date of up to 40,000 years BP for these sites also (Domínguez 2014) (Figure 3.2).

3.1 Archaeology of the Pre-Colonial Philippines

In the Philippines the earliest homo sapiens discoveries were at the Tabon Caves in Palawan (see Figure 1.1), which were discovered by a team led by Robert Fox in 1962 (Fox 1970). This site is believed to date from up to 30,000 BP (Bellwood, 1997: 189). The skeletal remains at the Tabon Caves have been dated from 20,000-22,000 BP.

Paleolithic stone tools of the pebble and flaked tools styles consistent with the Indo-Malaysian tradition are found widely in the Philippines, particularly flaked stone tools dating mainly from up to 40,000 BP but these are difficult to date (Bellwood, 1997: 171).

The earliest known Neolithic sites in the Philippines date from about 4,000 BP. These are marked by the introduction of pottery, mainly a simple red-slip ware. Bellwood suggests a marked cultural break with the preceramic societies,

commencing by 2,000 BC in the Philippines (Bellwood, 2005: 137). Other aspects of the Neolithic package including early agricultural products, such as rice, tubers and domesticated animals, have proved very elusive. The most likely scenario is that agriculture and the use of rice spread south from China, but the evidence from the Philippines is scarce. However, traces of rice cultivation have been noted from 3,700 BP (Snow, et al, 1986).

The prevalence of shifting agriculture, with regular relocations to newly-cleared fields, seems to be one reason that archaeological sites in the Philippines appear to have been short lived. This is an effective strategy for raising crops under tropical conditions, especially where there is no use of the plough. This approach is used until today in the less developed parts of the Philippines (Peltzer, 1945: 365-369). The only sites with a build up of occupational layers seem to be the few port settlements (Fox, 1977a: 352-358).

Metal smelting appears to have arrived in the Philippines about 2,500 BP. Copper, bronze and iron working seem to have arrived within the same time frame. Copper and bronze seem to have been used initially more for jewelry and adornment rather than for tools and weapons. Iron was used for those practical implements. The arrival of metals was described by Fox as follows "there is,..., no real evidence for a Bronze Age or Copper Bronze Age in the archipelago, a development which occurred in many areas of the world. The transition, as shown by recent excavation, was from stone tools to iron tools" (Fox, 1968). Copper ore is very plentiful in the Philippines, but tin for bronze making may have been imported (Landa Jocano, 1998: 121). The evolution of early metal usage in the Philippines, particularly iron, was analysed by Dizon in a paper for the National Museum (Dizon, 1983). The earliest examples of metal artefacts may be a relic of trade relations with other areas of Southeast Asia, where metal smelting began at an earlier stage (Francisco, 1977: 296-302). The introduction of metals was most important for the development of more effective tools, particularly the bladed Filipino bolo, (a kind of machete), which became the tool and weapon of choice (Peralta, 1977:324-329) (Figure 8.18).

3.2 Ethnicity

The ethnicity of the majority of the Filipinos has been described as Southern Mongolian phenotype (Figure 3.3) (Bellwood, 1997:70). Recent genetic studies have confirmed the wide connections with other Southeast Asian populations (Soares et al, 2008). In the colonial period there has been more recent immigration of Chinese and European settlers, and even an Indian admixture as a result of the British invasion of the seventeenth century with a sepoy army (Fish, 2003: 195).

A key feature of the origin myth of many Filipino groups was the belief in recent immigration by boat from other parts of Southeast Asia. Many Filipinos believe that the 'barangay' political unit was a remnant of this immigration, and that it was consciously modelled on the boat crews and the nautical command structure (Scott, 1994 : 4-6). These traditional stories of recent immigration no doubt influenced the thinking of Otley Beyer, the pioneer American anthropologist and archaeologist. He propounded a 'wave theory' of different migrations into the Philippines in an attempt to explain the varied social and linguistic differences within local society (Beyer, 1948). This theory has largely been discounted by modern anthropologists, who see many common threads running through the Philippine communities and are sceptical about the differences being attributed to recent, pre-colonial immigration (Landa Jocano, 1998: 37-78 and Scott, 1994: 10-12). One theory suggests that there was a significant migration from the area of the South China Sea as a result of flooding at the end of the last Ice Age (Oppenheimer, 1998: 78-9).

The small minority population of Aetas (or Negritos) appear physically different from the rest of the Filipinos as they are smaller in stature and darker in colour. They have been described as a relic population of Australo-Melanesian origin, and this analysis was accepted by Bellwood (Bellwood, 1997: 73).

The linguistic complexity of Philippine society, in which some 167 languages and dialects were spoken, is a key feature of the traditional Philippines (Blust, 2009: 40). Linguistically all the indigenous languages in use today are largely derived from the Austronesian language family.

Ironically, the Spanish came to refer to the original inhabitants of the islands as 'indios' as in America and called the residents of Spanish blood, Filipinos. The term Filipino was later extended to all residents of the islands, partly as a result of the American invasion (Landa Jocando, 1998: 55).

In recent times there has been a very significant admixture of Spanish and English vocabulary to Philippine dialects (Aspillera, 1993: xii). The Philippine government is making strenuous efforts to establish one local language, Tagalog, as a national language. Tagalog was the language of the Manila area and has a significant number of Malay loan words. This Malay influence does support the theory of a regional trading network in the pre-colonial era labelled as the 'Nusantao' (Solheim, 2006: 55-56). The Philippine languages also demonstrate some influence from Sanskrit, with some 284 words noted in early Tagalog dictionaries, perhaps introduced through the use of Malay as a regional lingua franca (Aspillera, 1993: xi).

3.3 Religion

The Philippine population shared a traditional basic religious philosophy, although differentiated by terminology in the different linguistic dialects (Scott, 1994 :217-42). The features of the traditional religion included an overall deity figure, under various names, and a plethora of minor gods and spirits who could intercede on behalf of the individual. There is limited evidence for influence from Hinduism or Buddhism in Philippine society (Hontiveros, 2004: 20-23). When the Muslim missionaries arrived in the fifteenth century and the Spanish Christian missionaries in the sixteenth century, the Filipinos faced the switch from a polytheistic religion to a monotheistic one. One reason that a majority of the Filipinos adopted Christianity rather than Islam may be the acceptance of the Christian saints by the new converts. Those saints could be interpreted as the equivalent of the earlier polytheistic belief system and take on the role previously occupied by the spirits. In the colonial period the nominal adoption of Catholicism certainly produced a synthesis of traditional beliefs with the teachings of the Church (Phelan, 1967: 72-89; Scott, 1994 : 77-93). Meanwhile other areas such as Sulu and parts of Mindanao remained loyal to Islam.

3.4 The Development of Philippine Society

The pre-conquest society was dispersed mostly in small settlements along the coasts, the rivers and lakes. Politically the population were organised in small kin groups referred to as barangays (Scott, 1994: 4-6). The lack of effective cooperation between Filipino groups was partly due to the distances, language differences and tribal rivalry between the different settled areas. Interaction between these local groups had largely been through trading relationships or raiding for slaves or other booty. Land was plentiful and labour short, so that there was very limited competition for resources (Junker, 1999: 57-58). Society was highly stratified with a number of separate classes. Representatives from the more affluent class are illustrated in Figure 3.3 showing an extensive level of gold jewellery on their persons There were also many slaves in various classes due to capture in raids, falling into debt or by birth (Scott, 1994; 133-135). This role of slaves was common throughout the archipelago, but not necessarily a permanent condition for individuals.

In terms of technology, there was a very similar level of development in different regions and classes, so that the metal processing technology, the tool kit, the ceramic traditions and the weaving technology were comparable throughout the islands (Patanñe, 1996: 54-61). This technology seems to have been similar in other areas of Island Southeast Asia, perhaps through the influence of trade (Forrest, 1779).

3.5 Contacts with Other Societies

There is little written evidence of contacts with other Asian societies before the arrival of the European colonialists apart from several references to the Philippines in Chinese sources. These relate specifically to trading voyages and tribute relations with the civil authorities, particularly the Sultanate of Sulu. There are also references to piratical raids by natives of the Philippines on the Chinese coast. The early texts are often vague and the locations mentioned are difficult to identify. In these Chinese texts the references to the Philippines date from the Sung Dynasty onwards (960-1278 AD). The most useful texts have been translated by Scott (1984: 63-78). The early tribute missions to China from Sulu, Butuan and other trade centres are described in Chapter 9. The firmest evidence of these early contacts is in the trade goods found in Filipino settlements and in

graves, particularly Chinese ceramics (notably in the Otley Beyer collection in the Ayala Museum in Manila). However there is no evidence of large-scale Chinese immigration or technical skills transfer until the colonial period.

Southeast Asia was profoundly influenced by Indian culture, with early evidence of Indian influence in Funan (Cambodia) in the first century AD (Coedès, 1967: xv). This influence was extended through much of mainland and Island Southeast Asia in later years. The impact on the Philippines seems to have been more limited. As mentioned above, the Philippine languages do exhibit Sanskrit linguistic influence but how this occurred is far from clear. There were a number of local scripts developed in the Philippines, called baybayin in Tagalog, which clearly owe much to the South Asian models, but the literary evidence in these scripts is very limited (Scott, 1984: 52-62).

Artefact evidence of cultural influence from these Indian traditions is largely limited to the local gold jewellery where there are a number of pieces with Hindu or Buddhist themes in the gold collection of the Ayala Museum in Manila (Villegas, 2013). Most notably there is a gold Buddhist or Hindu statue found in Agusan and now exhibited in the Field Museum in Chicago (Figure 3.4) (Hontiveros, 2004: 22).

There is no evidence of megalithic monuments in the Philippines, which are relatively common in Indonesia, nor are there any traces of stupas or other monuments associated with the Indianised kingdoms of Southeast Asia. One exception to this lack of evidence is the Laguna copper plate found in Luzon. This inscription is engraved in a version of old Malay with Javanese influence. It contains a date which translates into 900 AD. The text refers to the extinguishing of a debt transaction in gold (Potsma, 2008: 182-203).

The limited evidence in the archaeological record does indicate that contact with the Indianised proto states of Southeast Asia was remote and that the Philippines cannot be considered as an active part of the Srivijayan Empire in Sumatra nor the Majapahit Empire of Java. However it can be shown that vessels from China, Vietnam and Thailand visited the Philippines frequently for trading purposes in the late pre-colonial phase (Hall, 2011: 325-335).

In the late fourteenth century Islamic missionaries began to arrive from Malacca, seeking to convert the population to Islam. They achieved early success,

particularly in Mindanao and the Sulu Sea. Their exploits are recorded briefly in Arab language sources and the traditions are retained in the folk memory of the Muslim areas today, particularly in the Sultanate of Sulu (Saleeby, 1908: 159).

The first contact of Filipinos with Europeans was by Filipino traders in Malacca before the first European voyage to the Philippines (Pires, 1944 edition: 133-135).

The impact of these pre-colonial contacts on the Philippine indigenous boats will be discussed in Chapter 9.

3.6 The Colonial Settlement

The extent of our knowledge changes considerably after the first recorded visit by Europeans during the voyage of Magellan in 1521. Mainly as a result of the Spanish tradition of widespread documentation of their voyages, there are many accounts by European authors who visited or settled in the islands. These include Pigafetta's chronicle of the Magellan voyage which is particularly valuable in describing the state of the islands at that time (Pigafetta, 1874).

Most of these documents are in Spanish and can be found in the Spanish archives, notably the Archivo General de Indias in Seville. A series of these papers are translated and reproduced in Blair & Robertson's collection of documents, which runs to 55 volumes (Blair & Robertson, 1903-7).

After a number of exploratory voyages, a colony was established in 1565, initially at Cebu, and the capital was later moved to Manila in 1571. The settlement of the Philippines was relatively peaceful as the local population was small, scattered and politically disunited. The main Spanish influence was through the church as, after an initial use of force, the indigenous inhabitants accepted conversion to Christianity relatively quickly (Figure 3.6) (Phelan, 1967: 57).

The main threat to the colony came from rivalry with other European powers, the Portuguese, the Dutch and the British. The Dutch were the most persistent rivals but failed to win control despite several attempts. The British seized Manila in 1762 during the Seven Years War, but ceded the territory back to Spain. Due to the very small number of Spanish residents, the city was also vulnerable to attacks from Asian rivals such as China or Japan and from insurrection by the numerous Chinese immigrants (de Morga, 1609).

Spanish influence can be exaggerated as they initially only took over a portion of the archipelago and many areas retained their effective independence, particularly the Muslim areas to the south, which were frequently in open rebellion (Montero y Vidal, 1888). The map in Figure 3.8 shows the early settlements from which control was gradually extended over the whole archipelago. The different types of vessel that developed in the areas outside Spanish control will be discussed in Chapter 6.

The Philippines was effectively an offshoot of Mexico for most of the colonial period, and the benefit to Spain was mostly from the use of Manila as a trading entrepot with China. For 250 years the galleon trade with Acapulco was one of the most lucrative trade routes in the world, exchanging Spanish silver for valuable luxury trade items from China and the rest of Asia (Fish, 2011).

This trading network effectively ended with Mexican independence in 1821. In the nineteenth century the export of agricultural produce to the world grew rapidly through the agency of British and American trading houses. The main exports were sugar, manila hemp, sisal and tobacco (Legarda, 1999).

During the Spanish-American war in 1898 the United States conquered the Philippines, mostly for its strategic position. In doing so it had to suppress the Filipino independence movement through an extended guerrilla war (Wolff, 1992). Very few Americans settled in the Philippines but there was a profound cultural influence, particularly through education being provided to the masses in English (Figure 3.7). After the Japanese occupation, the Philippines achieved full independence in 1946.

3.7 Population

The current population of the Philippines exceeds 100 million. The calculation of the population of the Philippines in the pre-colonial period is very problematical. The literary accounts of the earliest visitors indicate that the population was small and widely scattered, and the only larger settlements were the trade emporia such as Manila, Cebu and Butuan (Fox, 1977:352-358). The earliest formal census was carried out by the Spanish in the sixteenth century, but this is of limited value as it was restricted to tribute payers in the areas controlled by the Spanish. Estimates of the total population in the sixteenth century are varied but range up to 1.5 million (Phelan, 1967:105-109; Newson, 2006: 3). One significant

difference from the Spanish experience in Latin America was that there was a more limited depopulation after the colonial settlement. This may be due to the previous contact of the population with the Eurasian continent through regional trade, which reduced the vulnerability to foreign diseases (Phelan, 1967: 156). Alternatively, Newson suggests that the small, scattered population was the main factor in this reduced death toll through illness (Newson, 2006: 3-20).

The Spanish arrivals were very limited in numbers and concentrated in Manila and Cebu. Apart from the arrival of Spanish priests many groups were left to their pre-conquest lifestyle. The adoption by the Church of preaching in the local dialects rather than Spanish reduced the incursion of the Spanish language and contributed to the continued fragmentation of Philippine society (Phelan, 1967: 157-160). The speed with which the use of Spanish declined after the American takeover demonstrates the limited penetration of the Spanish language and culture.

3.8 Maritime Culture of the Philippines

As the population of the Philippines in the pre-colonial society lived largely on the coastal margins or on the edges of rivers and lakes, the transport of goods and people was dominated by water transport. This was exacerbated by the absence of roads, wheeled vehicles or even pack animals until the Spanish introduction of horses, domesticated carabao (water buffalo) and wheeled vehicles (Scott, 1981: 23; Phelan, 1967: 112). Waterways and inter-island seaways were perceived more as a convenient linkage rather than a barrier. The exploitation of marine and fresh water proteins was also a key element of the food supply. Access to the sea was a gateway to the inter-island commerce. There was a lively trade in foodstuffs as well as more exotic commodities (Junker, 1999: 240-246). The downside of a life on the margins of the water was the vulnerability this created to raiders and slave traders, particularly in the Visayan Islands due the extended coastline (Fox, 1977a). This was a society dominated by boats, which were the largest and most important artefacts and investments of the community (Scott, 1981). The dominant form was the logboat carved from a single trunk, but the larger boats were all plank built vessels and these also utilised the outrigger to improve stability and as a means of keeping the draft very shallow to allow plank-built boats to sail over shallow coral reefs and to work directly off beaches (Scott, 1981).

Figure 3.1 Niah Caves excavation site, Sarawak. photo: M. R. Stead

Figure 3.2 Leang Leang cave paintings in Sulawesi, photo: M. R .Stead

Figure 3.3 Boxer Codex illustration of Visayan natives from 1590, from www.pinoy.culture.com downloaded on 10/1/2017

Figure 3.4 Golden image of Agusan,
downloaded from www.philippine-trivia.com on 10/1/2017

Figure 3.5 Fort San Pedro in Cebu - rebuilt in 1738, photo: M. R. Stead

Figure 3.6 Paoay church in Ilocos, photo: M. R. Stead

Figure 3.7 US colonial architecture, courtesy of National Museum

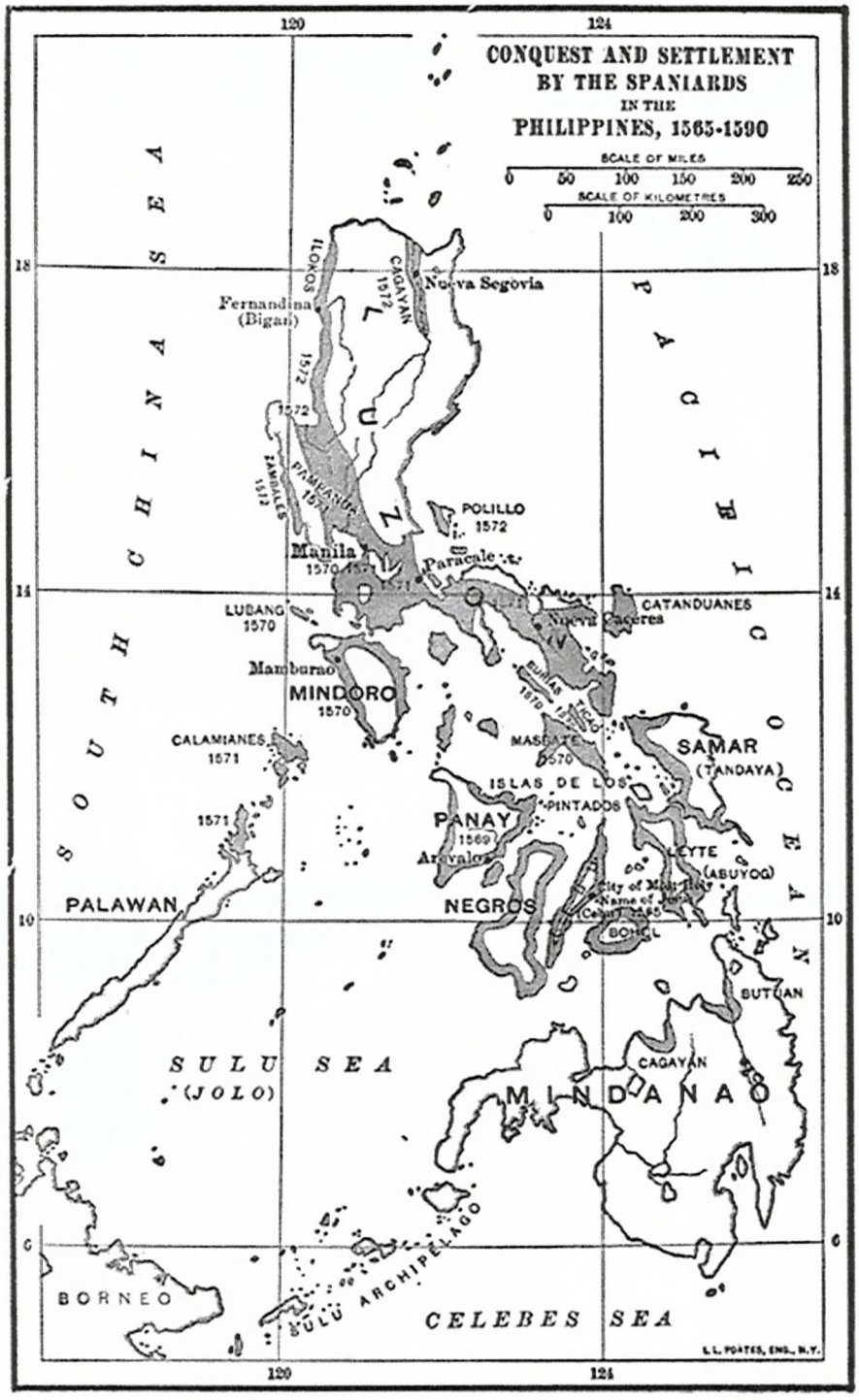

Figure 3.8 Early settlements of the Spanish in the Philippines after Barrow, *History of the Philippines*, 1905. The shaded areas show the areas of early Spanish influence and settlement.

Chapter 4: Theory and Methodology

4.1 Stasis and Change in Boat Design

This thesis utilises information from a variety of sources, which have been outlined in the Introduction, to analyse the defining characteristics of Philippine indigenous boats at the time of colonisation in the sixteenth century, in terms of their construction, and to identify the influences from other maritime traditions pre and post colonisation. It will seek to explore the relationship of the vessels with the social context of the local inhabitants and explore the ways in which these boats were used. The manner in which this research has been conducted is outlined in this chapter.

The main theme of the research is an analysis of the Philippine boats in the sixteenth century and how these reflected the maritime culture within which they were used and had been developed. The research also seeks to address how and why things changed before, during and after that period. As suggested by Adams (2013: 1) "an archaeological study of technology is necessarily a study of change and indeed of stasis, both being active processes involving a dynamic relationship with society". Crumlin-Pederson (1972: 216) asked a similar question "... just how a new material or a change in technique gains a footing in such a trade as boatbuilding". A list of suggested variables determining boat shapes was identified by Blue (2003: 335) in the context of traditional boats of South India. All these approaches will be considered in an evaluation of the Philippine boats and the influence of changes over time as reflected in this research.

This thesis argues that the construction style of indigenous craft at the time of colonisation was the result of the interaction of a series of drivers and constraints. The analysis follows the theoretical line of enquiry developed by Adams (2013: 23) on the reasons why vessels evolve and change over time (Figure 4.6). The drivers he identifies are the physical environment, the available technology, the influence of local traditions, the materials available for boat construction, the economic considerations and cost pressure, the purpose and utilisation of the vessels and the ideology, religion and social ideas of the local community. The results of this analysis will be discussed in the final chapter.

This thesis returns frequently to the interplay between these key factors, in explaining the vessel designs apparent in the sixteenth century, and later changes when new foreign ideas and technology became available after the colonial settlement.

4.2 Indigenous Vessels in the Landscape

The link between the physical landscape, the social environment and the design of boats is one of the enduring themes of maritime archaeology. The physical environment in the Philippines did create a relatively stable climatic background, against which the maritime tradition was developed (Wernstedt & Spencer, 1967; Solheim, 1999). This stability reflects the concept of the *longue durée* as recognised by Braudel in his historical analysis of the Mediterranean (Braudel, 1992), in which he argued that the environment had long-term influence in the development of culture.

This relationship between the cultural environment and landscape is tenuous, and has been the subject of considerable debate between archaeologists and geographers on a world-wide basis. The concept of a cultural landscape was developed by American geographer, Carl Sauer, in his paper 'The Morphology of Landscape' (Sauer, 1925), which saw culture as an agent in the creation of landscape. His work on landscape was based on German traditions of the nineteenth century. The 'New Archaeologists' gave a different interpretation by seeing cultural change as an adaptation to environment, and not the other way around, that is, landscape creates or at least influences culture. Julian Stewart was an influential theorist in this movement (Stewart, 1955). This approach was considered by the cognitive archaeologists, such as Bronowski, as too deterministic. Landscape was seen rather as a perception of reality, a mind map of the environment (Bronowski, 1973).

In analysing the maritime environment and its evolution, the conceptual framework of the 'maritime cultural landscape' as discussed by Westerdahl, is particularly valuable (Westerdahl, 1992, 2011). This seeks to link the littoral zone, the sea and navigable waterways to the development of coastal settlements and in the exploitation of the marine resources and the utilisation of the water as a means of human interaction and cultural contact. The maritime cultural

landscape of the Philippines is a key contributor to the development of Philippine boats.

4.3 Academic Literature Review and Interviews

The research for this thesis began with a review of the existing academic literature on the subject of Philippine indigenous vessels in order to acquire a base-line appreciation of the existing knowledge base in relation to indigenous boats of the region prior to undertaking the research.

As indicated in Chapter 1, there are no comprehensive works on the topic of Philippine indigenous vessels at the time of the colonial settlement. Most of the sources refer to Southeast Asian boats in general, rather than those specifically related to the Philippines. These include key papers by Horridge (1982), Manguin (1980) and more recently a thesis from Lacsina (2016). The most relevant materials specifically relating to the Philippines are from Scott, an expatriate historian in the Philippines. His papers on the Philippine traditional maritime culture and his account of the Philippines in the sixteenth century are particularly valuable (Scott, 1981, 1994). There are a number of articles and book sections which discuss specific aspects of the topic (Salcedo, 1998; Custodio, 1998). To supplement the paucity of the academic sources the author arranged to interview key writers on the maritime traditions in this area, including Adrian Horridge, Pierre-Yves Manguin, and Tom Vosmer (personal communications in 2016). In addition he met with present and former members of the Archaeological Division of the National Museum in Manila, including Dr Eusebio Dizon, Dr Wilfredo Ronquillo, Dr Mary Jane Bolunia, Dr Ligaya Lacsina, Bobby Orillaneda and Rey Santiago who have all written or contributed to relevant papers on aspects of the development of indigenous vessels (Dizon, 2010; Ronquillo, 1987; Bolunia, 1995; Lacsina, 2011; Orillaneda, 2011; and Cuevas & Santiago, 2004). These discussions aimed to address critical issues which are still unresolved, such as the site formation processes in Butuan.

4.4 Historical Literary Sources since the Sixteenth Century

In view of the limited information available from other evidence, an extensive review of literary sources has been carried out. This analysis of secondary sources has a number of practical drawbacks, not least the need to understand the context and the motives of the author for drafting the original paper or book.

There is a very extensive collection of Spanish documents in the archives in Spain, particularly in the Archivo General de Indias in Sevilla (Figure 4.6). There are frequent references to boats, but rarely are there any detailed descriptions. Particularly valuable sources are books published by Spanish colonial officials, such as de Morga (1609), or priests, such as Ignacio Alcina (1668), Pedro Chirino (1604), Francisco Colín (1663) and Francisco Combes (1667).

As mentioned in the Introduction, the policy of the Catholic church was to preach to the Filipinos in their own languages and this led to the preparation of a number of dictionaries between Spanish and the local languages for use by foreign priests (such as Pedro de San Buenaventura, 1613, for Tagalog, and Sanchez, 1711, or Mentrida, 1841, for dialects of Visayan). The maritime vocabulary included in these dictionaries also gives many clues as to the maritime culture of the earlier pre-colonial societies.

Other valuable source for descriptions of local craft is the visits of European seamen, such as Dampier (1697), Forrest (1779) and Pâris (1841)

All this base-line data will help to formulate and test the understanding and interpretation of the nature of the indigenous craft in the development of the thesis.

4.5 Theories of Development of the Indigenous Boat Types

Most of the previous analysis of the boats in Southeast Asia and Oceania has been dedicated to seeking to explain the dating and sequence of the technical developments such as the use of outriggers, double canoes and dowel technology, and to identify any possible exchange or import of technology from elsewhere. Surveys and analysis have usually been across the region, quoting examples and styles from a number of different traditions, such as the work of Pâris (1841), McGrail (2001, 2015) and Haddon & Hornell (1936-9). This has tended to minimise the differences between the various regions of Southeast Asia.

One limitation of much academic analysis is that it has concentrated on the structural aspects of Philippine boats and has often neglected to document the relationship between the boats and the social context within which they have been constructed (Folkard, 1906; Hilario, 1915; Doran, 1981). Muckelroy (1978:

4) argued that the functional analysis, how the vessels were employed, and the cultural implications of the relationship between the communities and their vessels are an essential part of the analysis. This thesis will seek to retain that link to the social context in which the vessels were constructed in order to understand some of the ship and boat building decisions and techniques which were chosen, and how they changed over time.

James Hornell was one of the most influential early writers on the traditional boats of Asia and Africa. His considerable corpus of work was summarised in his *Water Transport* published in 1946. This was a general discussion of traditional craft, but many of his ideas were based specifically on his experience in South and Southeast Asian areas. His idea that the development of logboats into extended logboats and plank-built boats have been accepted in this thesis. but a number of his detailed judgements, noted below, are no longer supported in this analysis.

Hornell had no doubt that the origin of the logboat was the bark canoe, later copied in carved wood (Hornell, 1946: 181-189). There is no real evidence to support this conclusion, which will be examined in detail in Chapter 9. Hornell (1946: 187) suggests that the first logboats may have developed in southern Asia, especially the Malay archipelago, where, he says, "the dugout canoe attains its highest and most elborate development and the greatest multiplicity of forms". Whilst accepting the multiplicity of forms in this region, there is little real evidence to support this conclusions about the origins of logboats. As in the case of bark canoes, the two ends of the vessel are the most problematical features in crafting the log boats and they need to be fashioned so that they are closed off in a watertight manner. A logboat is potentially exposed to rot in the extremities, or splitting. Hornell (1946: 190) describes the wide range of styles utilised to carve the timber to achieve a waterproof stem and stern; sharp, pointed, perpendicular, rounded, sheered, curved, raked or bifid.

Hornell notes the early development of transverse bulkheads as a solution to this problem of closing off the logboat hull, at one or both ends, quoting the Tondanao Lake in Northern Sulawesi for examples of an early transverse style (Hornell, 1946: 190).

Hornell argued that the extension of the logboat by the addition of washstrakes to increase the freeboard led to the development of the extended logboat, using

extra strakes, and finally to the plank-built boat as discussed in Chapter 6 (Hornell, 1946: 187).

Hornell suggests the original hull fastenings of plank-built boats were sewn fittings, either single stitch or running stiches. He considers that the original plank-built boats were subject to stresses and strains that caused the adoption of lashed ribs or frames in order to stabilise the hulls. Hornell notes the lugs used on plank-built boats and refers to them as cleats, but this terminology was not widely adopted (Hornell, 1946: 188, 208-9).

This analysis of the origin of the plank-built boat has been widely accepted, both overtly, and by implication, by many later writers on these themes as referred to below (Sopher, 1977; Manguin, 1985; Horridge, 1982) and has been accepted as a working hypothesis for this thesis.

Hornell referred to the dowel technology as treenails, although treenails can be used to fix strakes directly to large ribs, as in Figure 10.2, which can cause some confusion in the terminology. He did not address in depth the sequence of the development of dowels in lashed-lug and sewn vessels, which has become a fruitful source of later debate.

Hornell did discuss the role of the outrigger, both single and double, and the distribution of the double canoe, at length in his analysis (Hornell, 1946: 253-271). He suggested the rowing or punting platforms (sponsons) on many traditional vessels were a possible source of the development of outrigger platforms. He thought that the origin of all these developments was the continental part of Southeast Asia, on the great rivers of Burma, Thailand, Laos and Vietnam. He considered that these innovations would have developed on internal waterways and not on the open sea. There is very little evidence to support this analysis and this part of his theoretical model has been largely abandoned by later writers (Doran, 1981: 47; Sopher, 1977: 194-218).

Hornell developed his ideas more extensively with A. C. Haddon in their monumental *Canoes of Oceania* (Haddon & Hornell, 1936-39). This work is a comprehensive review of canoes and outriggers in Oceania. Although the data does not specifically cover the Philippines and Indonesia, Volume 3 does review much of the early literature on the development of canoes and outriggers in Island Southeast Asia and the Pacific as a whole. Haddon and Hornell concluded

that the raft was the "first definitely constructed appliance for traveling on water" and that various types of raft are found throughout the area (Haddon & Hornell, 1936-9: 13). The most basic raft was formed of three pieces of timber, or more, and usually an odd number of strakes, with the central log, usually the longest. The forward edge was often wedge-like and the stern square. These can be very stable, especially with cross timbers fitted, and can support a sail and centreboards.

Haddon and Hornell suggest that the double canoe could have evolved directly from a raft. These double canoes were very important in historical times in the Pacific, particularly for ocean passages, but are not commonly reported from the Philippines (Haddon & Hornell, 1936-9: 19).

There has been a long debate over the relationship between single and double outriggers, particularly in terms of which developed first (Horridge, 1978). Haddon and Hornell concluded (vol 3, 15-19) that there was no clear evidence of a sequential development from one to the other, but they do claim that the single outrigger gives a better maritime perfomance at sea.

Doran (1981: 47) explains the rather confused discussion of the development sequence between double canoes, single outriggers and double outriggers as a result of significant differences of view between the two authors which can be traced in their earlier, individual writings.

Haddon and Hornell quote the early work of Friederici, who sought a typological development of traditional boats in Island Southeast Asia by tracing similarities in canoe terminology in the region (Friederici, 1914). These terms include the well-known wangka or waka, as an Austronesian root word for canoe, but he also traced terms such as prahu, biduk, gubang, lepa, tene, pelang, rakit and kiato which occur and reoccur as names of types of vessel in Island Southeast Asia . Freiderici sought to argue that these linguistic clues pointed to migrations from mainland Southeast Asia to the archipelago. The linkages between these terms is largely accepted today, but his migration theory is now often discounted (Landa Jocano, 1998: 37-78).

David Sopher made a useful contribution to this debate on the evolution of Southeast Asian craft in his work on the Bajaus or sea nomads (Sopher, 1977: 194-218). Sopher supports the Hornell theory of logboats being the basis for the

development of plank-built boats, as least in Southeast Asia, in contrast to the Chinese coast and parts of India where he considers the local vessels developed from rafts (Sopher, 1977: 193). He points out that outriggers are not found anywhere on the mainland shores of Southeast Asia and so he cannot support Hornell's view that the outrigger was invented on the mainland.

Sopher records the extensive evidence for sewn vessels in Indonesia and the widespread use of the bifid bows (such as in the vinta of the Sulu Sea). He ascribes the bifid bows tentively to the use of plank extensions on traditional logboats (Sopher, 1977: 196). He also describes the widespread use of pandanus leaves in traditional mat sails, often using bamboo battens to help hold the sail in shape (Sopher, 1977: 202).

Ecoma Verstege is was quoted by Sopher in describing the building of plank-built boats in Billiton, Indonesia, using dowels to hold the strakes together and then reinforced with hardwood treenails hammered into the ribs (Ecomo Verstege, 1876: 201-211). A similar technique is still being used in the Bugis shipyards of Sulawesi, see Figure 10.1 and Figure 10.2.

Doran made his comments on the debate over the evolution of boats and canoes in his *Wangka, Austronesian Canoe Origins* (Doran, 1981). He acknowledges the contribution of Hornell and Haddon to the subject, but begs to differ on the evolution of these craft. Using a rationale of technical improvements over time, he argues that the double canoe would be the oldest, followed by the single outrigger and finally the double outrigger (Doran, 1981: 71-72).

On sponsons of wood or bamboo, Doran tends to favour the view of Hornell that these were widespread in Southeast Asia and may represent an early form of the double outrigger (Doran, 1981: 86-87). He further concludes that the symmetrical bow and stern design reflects the use of shunting rather than tacking. The conclusions of Doran on the typology of boats in the Indo-Pacific are very tentative. He suggests that double canoes could predate the Austronesian cultural influence. He considers that the sequence of development was rafts, bark boats, the single outrigger, then the double outrigger (both using tacking before shunting). Doran considers, on rather thin evidence, that Vietnam, may be the source of the outrigger and that Sulawesi is likely to be a key centre of boat development in the archipelago because of the multiplicity of forms present

there. He discounts the effort put in by Hornell on the typology of outrigger connectives as he sees no clear pattern there (Doran, 1981: concluding chapter).

Adrian Horridge is a natural scientist, but he has written extensively on the traditional boats of Indonesia and the Philippines. His main area of interest was the structure of plank-built boats (Horridge, 1978,1982 and 2008). He was particularly interested in the lashed-lug technique and the use of dowel fittings to connect strakes. Horridge argued that the ability to create dowel fittings depended on the development of metal tools, particularly the spoon bit, known in the Philippines as the lukub (Horridge, 1982: 32-33). Therefore, he argued that the plank-built boats of the era before metal tools were available, were likely to be sewn boats, as the narrow holes needed for sewing boats were much easier to drill than the extensive holes needed for fitting dowels.. In a recent interview (Cambridge, 2015) he indicated that his views had been modified on this point and that he considered that dowel holes could have been drilled without metal technology using sharp gravel or hardwood tools, although he did agree that this would be very time consuming.

One of the most influential writers on the evolution of Southeast Asian boats is Pierre-Yves Manguin (1980, 1985, 1993a, 1993b, 1996, 2009, 2010, 2017). He has done extensive research on early boats in Indonesia and Southeast Asia in general. He argues that the sewn boat technology did predate the dowel technology and indicates the first millenium AD as the probably date of the change. He refers to the early wreck discovery at Pontian in Malaysia (Evans, 1927; Gibson-Hill 1952) which appears to demonstrate the use of sewn boat technology with both dowels and the lashed-lug ribs. Manguin summarised the existing knowledge of the use of sewn boat technology in Southeast Asia in a paper included in a conference report on *Sewn Built Boats* published as BAR 276 (Manguin, 1985).

He also discusses the evidence from Chinese written sources of the first millenium on large vessels used to trade in Southeast Asia, which were referred to as 'kunlun bo' and were reported to reach 600 tons (Manguin, 1993b: 261-262). Manguin considers these as likely to be Southeast Asian in origin and manning, but no examples have yet been found in the archaeological record. The recent discovery of a larger vessel at Butuan (number 9) which appears to be fastened by large tree nails, as noted in Chapter 6.2.5, may yet turn out to be of this class

(but has not yet been adequately published). Manguin has recently re-presented his views on these topics (2017, in press)

The earlier theories of the developments in Southeast Asia are summarised by McGrail in his recent *Early Ships and Seafaring* (McGrail, 2015:90-128). He endorsed the Bellwood theory of Austronesian migration, but suggests the early ships were log rafts or boats of basketry or bark. He suggests that early locked mortice and tenon joints or even locked dowels as in some of the Butuan boats could be an echo of Mediterranean culture. McGrail concluded from the review of evidence from the region that the earliest plank-built boats were probably sewn vessels later using a lashed-lug structure to assist in maintaining structural integrity (McGrail, 2001: 305). He dates this change from sewn vessels to the first millenium AD. This remains one of the key issues in the development of Philippine boats.

These historical theories as to the sequence of boat developments are of critical importance in understanding the boat development in the Philippines and will be tested in the thesis, where possible, by examining the Philippine evidence in detail.

4.6 The Analysis of Archaeological Sites

The key resource for any maritime archaeological thesis is the review of the sites and the evidence of the ships and maritime artefacts found therein. There are a number of important maritime archaeology sites in the Philippines (Dizon & Ronquillo, 2010), but with regard to shipwrecks, in view of the natural 'N transforms' (Schiffer, 1987: 7), particularly the ferocity of the depredations of marine crustaceans in the warm tropical waters of the archipelago, underwater shipwrecks rarely preserve much of the original timber. Most of the remains are the ballast and cargo of the shipments rather than the vessels themselves. Many of the most impressive finds are from the colonial period, or represent Chinese or Southeast Asian junks trading to the Philippines. There are two underwater sites which appear to be traditional Philippine vessels, the Gujangan wreck and the San Isidro wreck, which are described further in Chapter 6. The limited remains of the hulls of these wrecks do contribute to our knowledge of the construction processes.

The most important maritime site is on the foreshore area in Libertad Barrio, Butuan City in Northern Mindanao (Peralta, 1980). This site was discovered fortuitously some forty years ago and is probably, to date, the most extensive maritime archaeological site in Southeast Asia (see location on Figure 6.4). This is an area of foreshore which has preserved the wooden remains of at least ten indigenous plank-built vessels due to burial in estuary silts. The site was partially excavated from 1979, but not well documented, and the results are analysed from the National Museum records in Chapter 6. The author (in association with Dr Eusebio Dizon) presented a paper in 2011 pressing for the further excavation of this site by the National Museum (Stead & Dizon, 2011). A budget for this activity was approved and work has been undertaken since 2012 under a programme led by Dr Mary Jane Bolunia of the Archaeology Division of the National Museum. Also within the original paper of 2011 was the suggestion to re-test the C^{14} results from the earlier investigations and carry out species identification work on the timber. This has been subsequently carried out by Ms Ligaya Lacsina of the National Museum. The results are reflected in her thesis published on-line in 2016 (Lacsina, 2016) and discussed in more detail in Chapter 6.6.

At a number of other sites historic logboats have also been discovered and these are assessed in Chapter 5. It is notable how few of these logboats have been described or preserved, which is probably a reflection of the common attitude in the Philippines and elsewhere in Southeast Asia that these are not historically important since they continue to be constructed up to the present day. A notable exception was a logboat identified in Rosales, Central Luzon (Figure 4.2). The author commissioned a programme of C^{14} tests on this logboat as part of this research which demonstrated that this dated from the time of the colonial settlement.

In the context of relatively few examples of vessels in the archaeological record we have to be cautious about extrapolating the evolution and typology of boats from such limited evidence, which may be overturned by finding further examples in future. Adams traces such an oversimplified case in the decline of the mortise and tenon joints in European shipbuilding. The timeline of this evolution was reassessed as further examples disrupted the original sequence (Adams 2013: 68).

4.7 Iconography

Apart from written descriptions, foreign authors often provided illustrations of the local craft such as those from Forrest (1779) (Figure 7.1 and 7.2); Pâris (1841) (Figure 7.5); and Röding (1798) (Figure 7.6). Sometimes these representations were rather fanciful, as in the example from Stevens (1711) illustrated in Figure 4.3.

These images are particularly valuable where we have no surviving archaeological examples of craft, such as the caracoa, as these pictures can illustrate the often unclear written descriptions of these extinct boat types.

There are a number of models of Philippine craft to be found in foreign museums. These can be useful as three dimensional representations, but to be of real value they must be accurate representations of the original, which is often difficult to assess. Interesting examples are provided by the casco in the Musée Quai Branley, Paris (Figure 6.20), a banca model from the Pitt Rivers Museum in Oxford (Figure 5.9) and a caracoa (kora kora) model from the Tropenmuseum in Amsterdam, thought to be from Sulawesi (Figure 7.7).

4.8 Ethnographic Surveys

Maritime ethnography has been defined as the study of contemporary maritime cultures and their materials, through first hand observation (Blue 2003). The relevance for this research is the use of the concept of analogy, where the results of ethnographic survey can assist in the analysis of archaeological material.

McGrail (2002: 15) refers to maritime ethnographic research as the description and analysis of the material, technological and social aspects of present day or recent vessels. Documentation of surviving traditional-style vessels, he argues, provides a baseline for future historical research on the development of these vessels and can assist in the analysis of archaeological evidence. He stresses the need to record the context of the boat, its location and the pattern of usage of the vessel and the need to interview the boat users in order to understand the social context of the vessel and the way of life of the maritime community. McGrail (2002: 10-23) suggests a methodology for boat recording and the documentation of the social context of the vessel, which was applied in the research for this thesis.

The analysis for this thesis will seek to compare surviving examples of logboats in the Philippines with the evidence from the early descriptions in Alcina and other literary sources, in order to assess the similarities and differences to original logboat design. Research visits to communities still using logboats in Northern Mindanao, Negros and the Bikol region of Luzon, undertaken by the author for this thesis, are discussed in Chapter 5. These locations were chosen because of reports that traditional logboats were still being constructed there. These surveys included photographing, measuring, recording and drawing the surviving logboats, including interviews with the owners/ users of these logboats in English, Tagalog and Visayan. The surveys were carried out by the author and his team, and can give useful insights on timber selection, construction processes and design features. There are also some interesting examples of logboats to be found in local ethnographic museums such as the Butuan Regional Museum, a branch of the National Museum and in the Silliman Museum in Negros. These examples have been recorded by the author, but there is usually limited information on their age or origin.

4.9 International Comparisons

In order to study the similarities and differences of indigenous boat traditions in Eastern Indonesia a number of sources have been consulted on Indonesian vessels, which share many features with the Philippines. These include the works of Horridge (1978, 1981, 1982, 1986) and Petersen (2000, 2006). Visits to suitable sites and museums in Indonesia, particularly in Jakarta and Makassar, were undertaken to compare and contrast the construction techniques with those of the Philippines.

In the case of mainland Asia there are clear differences in the design and technology of indigenous craft. In seeking to clarify and explain these different traditions in China, Vietnam and Cambodia, the works of Manguin (1984a), Needham (1971), Pietri (1949), Worcester (1966) and the modern translation of Zhou Daguan (2007) have been consulted. Visits were arranged to Vietnam and Cambodia to study archaeological evidence of local boat types. In examining these vessels from neighbouring territories, the analysis helps to define what is different about Philippine vessels.

4.10 Database

To cope with the complexity of boat types noted in the text, and as part of the research, a database of Philippine boats was created giving over 130 names of Philippine vessel types (Appendix A). As explained in the Introduction these names are confusing as they include boats of a similar design from different islands and in various languages. To help to tie down this ambiguity a database has been created to link these names to their original sources and to synonyms.

A glossary of maritime terms in the principal Philippine languages, Spanish and English has also been attached as Appendix B.

4.11 Integration

This thesis will seek to apply the theoretical model of Adams to the evidence from the Philippines, from the sources outlined above, to give a comprehensive view of these indigenous vessels of the sixteenth century in order to address the research questions as discussed in Chapter 1.2. This research will also illustrate the special features of the maritime culture of the Philippine islands and seek to place the technical features of boat design in the social context within which the vessels were used, and thus to explore the relationship of the Filipino communities with their vessels and the maritime environment.

Figure 4.1 Butuan site re-excavation, photo: M. R. Stead

Figure 4.2 Rosales logboat, photo: M. R. Stead

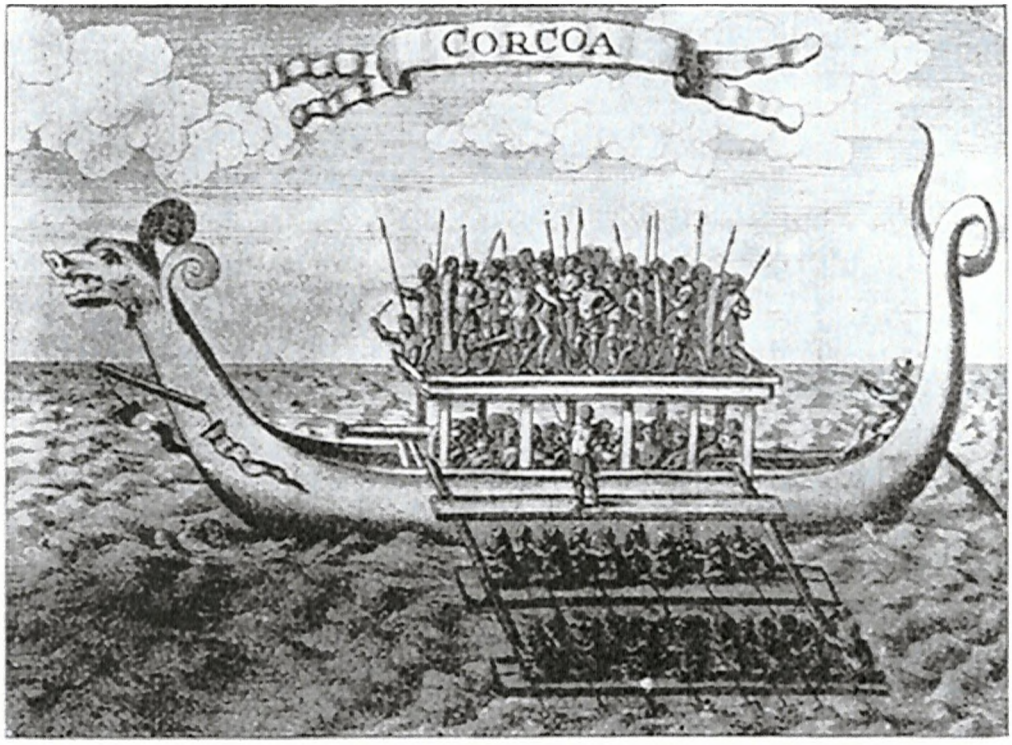

Figure 4.3 Caracoa from Stevens *Collection of Voyages and Travels*, 1711

Figure 4.4 Modern ferry in the traditional style at Mindoro, photo: M. R. Stead

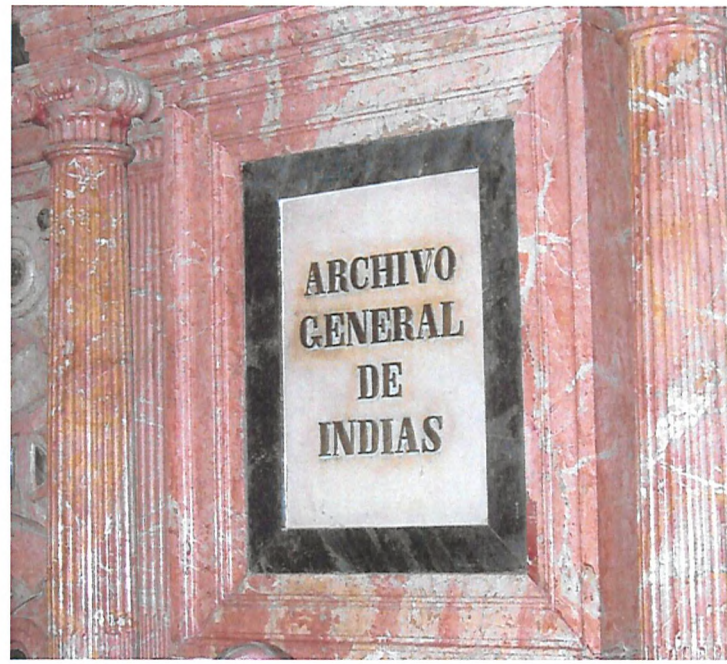

Figure 4.5 Archivo General de Indias in Seville, photo: M. R. Stead

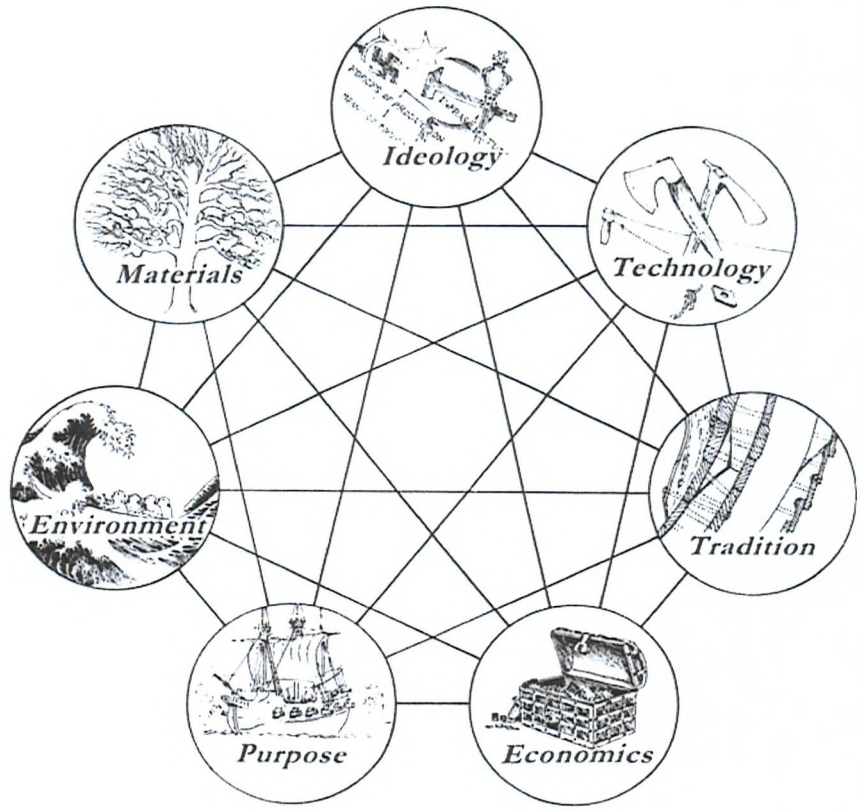

Figure 4.6 Analytical drivers, after Adams, J. 2013

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Chapter 5: Logboats

5.1 Terminology

The logboat is a vessel constructed by the excavation of a tree trunk to create a simple boat which floats by the displacement of water. The terminology used internationally to refer to logboats is diverse and this kind of vessel is often referred to as a pirogue, dugout, logboat, monoxylon or canoe.

The French word is pirogue, which is a loan word from the Carib language of the Caribbean, and the Spanish equivalent was piragua (*A Dictionary of the World's Water Craft,* ed. by the Mariners' Museum, 2001: 457-459). This name has been adopted into English as pirogue, but is not widely used. The French usually refer to a pirogue monoxyle, as a vessel built from a single piece of timber. The Arawak name in the Caribbean for a similar vessel passed into Spanish as the canoa, which became in English, canoe (*A Dictionary of the World's Water Craft,* ed. by the Mariners' Museum, 2000: 110-115). This terminology is widely used around the world for a logboat. All the terms based on pirogue or canoe in the European languages clearly post-date the discovery of America, but came to be applied widely, and often retrospectively, in Europe, Africa and Asia.

A common English term is the dugout, which is a clear description of the process of carving such a vessel out of a single piece of wood. This is often extended in English to the phrase, dugout canoe. The German term, einbaum, refers to a single log being hollowed out.

A clear definition of a logboat has been given as 'a craft fashioned from a log by hollowing out the centre to make it lighter and more buoyant and to provide a place to sit or stand' (*A Dictionary of the World's Water Craft,* ed. by the Mariners' Museum 2000: 184).

The logboat, both in the Philippines and world-wide, is usually hollowed out by carving timber with adzes, axes or other cutting tools of stone, shell, bone, ivory or metal. Some descriptions refer to the use of fire for burning out the centre of the log, but actual examples of that practice are rare (De Bry, 1590; Greenhill. 1971: 111).

One problem is to distinguish logboats from similar artefacts in the archaeological record. There are examples of coffins, cooking troughs, sledges or irrigational channels which could be mistaken for logboats (McGrail, 1978: 19). In the Philippines there is a trough for storing harvested rice, palay, which could also be confused with a logboat. McGrail suggests that if the artefact satisfies two or more of the following attributes; is found in or near a watercourse, or associated with nautical or fishing gear, one end or both trimmed to boat shape, with inner fittings typical of a logboat, over 3 metres in length, or with bark and sapwood removed, it is likely to be a logboat (McGrail, 1978: 19).

5.2 The Development of the Logboat

In view of the widespread pattern of logboat finds around the world, it is likely that the logboat has a long history of use and development.

Hornell argued that the most varied collection of logboat styles can be found in the Malay Archipelago, and this could be evidence of the antiquity of this tradition in Island South East Asia (Hornell, 1946: 187). He suggested that the logboat is probably a development from a bark boat tradition (Hornell, 1946: 186-189) and that traces of transverse ridges and ribs, without any structural role, may be the vestigial remains of a framework design for a bark boat.

Many logboats in the Philippines do have buttresses without any apparent structural requirement. A similar phenomenon is noted in the Indian Ocean huri, where it is described as a false frame (Blue et al., 2017). The Philippine users believe that this adds structural strength to the vessel (interviews with fishermen in Agusan, 2014) but this view was challenged by Hornell. In the huri Blue et al. (2017) report a similar debate in that the users claim a structural value that is challenged by ship scientists. The difference between them is that the false frame in the huri extends across the floor of the boat, whilst the buttress in Philippine logboats is present only on the sides of the vessel.

The evolution of the logboat into the plank-built boat, by a process of extension by the addition of timber strakes, was also propounded by Hornell (1946: 189-195). This idea seems to have achieved broad support amongst later writers as a reduced logboat often appears as a keel at the core of a plank-built boat (Johnstone, 1988: 51; Greenhill, 1995: 101; McGrail, 1987: 67).

In several parts of the world the logboat is still in daily use and is considered as a contemporary vessel type. In the Philippines they are often not viewed as particularly antique and the archaeological record of logboats has often been neglected as a consequence.

There have been many attempts to develop a typology of logboats, such as the work of Cyril Fox (1926: 131-144), based largely on UK and European archaeological examples. His system was based on style rather than size and covered initially five groups and three divisions of technical sophistication. This classification was further extended by McGrail, based on a wider pool of examples, but was still based mainly on European vessels (McGrail, 1978: 13-88). McGrail and built up a data base of examples in which the Fox categories were noted.

It is difficult to draw a consistent story of logboat development from the multiplicity of examples from around the world and Fry warns of the dangers of trying to use typology as a basis for dating, based on his work in Ireland (Fry, 2000: 8-9). Carbon dating and dendrochronology are the most reliable means of dating logboats, but dendrochronology is largely limited to temperate, developed areas where established timber ring sequences have been identified.

5.3 Design Features of Logboats

The logboat is carved from a single timber using an axe or adze. A challenge is to control the depth of wood remaining on the hull during construction. The design can incorporate holes drilled in the wooden hull to guide the builders in the depth of wood remaining during the construction. This hole would need, of course, to be plugged before the launch of the logboat. The holes would usually be filled using a treenail, often of a different timber (McGrail, 1978: 31).

There is frequently a risk of a split in the ends of a log during the construction process. Therefore, in many examples, there is a plank transom inserted at the stern or at the bow or both to minimise this danger.

In some areas the logboat was expanded by the use of heat, steam or soaking. This is most practical when the hull has been reduced in thickness to make the remaining wood more flexible. The intention was to increase the carrying capacity of the logboat or to make it more stable in the water (McGrail, 1978: 18).

McGrail records that internal fittings could be added to preserve the extended shape. A Southeast Asian example can be seen in the Khmer pilan boats illustrated at Angkor Wat in carvings from the twelfth century AD (Figure 5.1). This process is described by Zhou Daguan, a Chinese traveller to Cambodia in that period (Zhou Daguan, translated by Harris, 2007: 78). The use of heat to expand log hulls has been reported from Borneo, with the intention of improving stability by increasing the sheer in the sides and improving the resistance to rot and insect attack (Nicolaisen & Damgård-Sørensen 1991: 62-65).

There are examples in some cultures of double canoes created by binding two logboats together with connecting planks or a framework. This would increase the carrying capacity, the stability and the seaworthiness of the vessel. These double canoes were frequently used in Polynesia, but have largely disappeared from most of their original range, apart from modern replicas built in Hawai'i (Hornell, 1946: 263; Doran, 1981: 24-29; Johnstone, 1988: 48-9).

The stability of the logboat has been improved in many areas by the addition of a single or double outrigger of wood or bamboo. Whilst this is typical of Island Southeast Asia, examples can be found within the Pacific, the Indian Ocean and the East African coast (Doran, 1981: 29-30).

Rather than a true outrigger, in some areas a supporting timber was lashed to each side of the exterior of the logboat comprising of one or more poles or bamboos, and referred to as a sponson. McGrail identifies two types, a surface-level addition to increase lateral stability, or an added timber higher up the hull. When fitted above the waterline these could be intended as rubbing strakes, to add lateral strength to the hull, as spray deflectors, or to add stability when deeply laden. See Figure 5.2 for a Philippine illustration of this technique from Pâris, although it is not clear in this view of the purpose of this addition (McGrail, 1987: 71).

The capacity, freeboard or stability of logboats can be increased by adding additional strakes of wood to expand the hull. McGrail considered as logboats only those examples where a single additional strake had been added on each beam. Any more than a single strake and he classified the vessel as a plank-built boat (McGrail, 1978: 2). This is an arbitrary but useful practical distinction.

Most logboats are paddled from within the hull. Rowing is less common due to the width of the hull being too narrow for oars (McGrail, 1987: 206). The oar is a lever with a fulcrum on the boat hull and needs a suitable oar length in-board of the tholepins or rowlocks to row effectively (McGrail, 1987: 211-214). This constraint can be overcome by adding scull extensions for the oars to increase their effectiveness, as in modern rowing sculls. It is, however, notable that Figure 5.2 does show a banca in Manila Bay being rowed vigorously.

The speed of logboats when paddled, rowed or punted depends on a series of factors including the number of crew, the cargo, and the conditions as well as the hull structure. A series of experiments in Ireland indicated speeds of between 1.5 and 3 knots as the likely performance (Fry, 2000: 22-23).

Where sails were used for propulsion a single lug sail or stay sail was the most usual form, but, in the Philippines, complex sail plans have been developed for a logboat hull (see Figure 5.16). The use of sail in a logboat is a challenge to the lateral stability, and sails are often to be found in association with outriggers in the Philippines.

5.4 Construction of the Logboat

The construction of logboats using tools of stone, bone or shell (such as the giant clam, *tridacna gigas*), was very time consuming. All these tools are reported as used in the Philippines at the time of colonisation (Scott, 1981).

The construction of a full size logboat could take years. In New Zealand the construction of a Maori war canoe with only stone tools required two years of work (Best, 1925: 36-119). Experimental archaeology in the UK has demonstrated that building a logboat in oak with stone tools is feasible as long as the oak is green, although this is a laborious process (Goodburn, personal communication, 2014). He also recommends storing a partially finished logboat underwater to retain the moisture to allow easy working. Treating a finished logboat with paints resins or oils is reported in some locations to protect and preserve the craft (McGrail, 1978: 34).

The introduction of metal tools of copper, bronze or iron made this carving a much more efficient process, particularly in hardwood trees. Hurault quotes a time commitment of 17 man-days in Guiana to build a 4 metre to 8 metre logboat using metal tools (Hurault, 1970: 73).

In the original classification of logboats by Fox (1926: 131-144), he refers to five groups as a basis for world-wide analysis:

1. A rectangular punt or trough, with a square transverse section and square ends in plan
2. A rounded bow and square stern, widest at the stern
3. Both ends rounded or pointed in plan and elevation
4. Spoon shaped with semi-circular transverse section
5. Pointed bow and square stern

Fox added further comments on special features such as beaks (a raised bow or stern projection), wales (a strengthening timber along the sides), ribs (protruding ribs or buttresses inside) and transverse bulkheads (Fox, 1926: 131-144). This analysis is valuable in defining the category of Philippine logboats which fall mainly into category 3.

A process of trial and error no doubt produced a traditional design in each culture depending on local environmental conditions and local needs which generated a multiplicity of forms around the world. Stability requires that the centre of buoyancy should be higher than the centre of gravity. This will tend to create a self-righting tendency. An increase in beam and a reduction in draft will tend to aid stability. To maximise cargo capacity a full log would be preferred with a tumblehome on the side walls. A half log would give a maximum beam and lower draft and thus improve stability. A raised sheer line at the bow and stern, and a broader beam in the centre of the craft would tend to improve the manoeuvrability and speed. A rounded or pointed end will give least resistance and may make the vessel easier to work off a beach. An expanded hull through heat or steam will widen the hull and increase stability, but will tend to reduce the freeboard amidships and may require an extra strake to be added (McGrail, 1978: 94-108).

The operational life of the logboat would reflect the usage and operating conditions and whether the boat was stored out of the water when not being used. McGrail quotes lifespans of 2 to 100 years (1978: 92). Tropical hardwoods may have led to the achievement of rather longer operational lives, but Petersen quotes lives of only up to 20 years in Borneo (2000 :108).

5.5 Logboats in the Philippines

The logboat was the ubiquitous and standard form of local transport in the pre-colonial Philippines, both on the sea and on lakes and rivers. In view of the protected waters between the islands and the warm water environment, the logboat seems to have been used more extensively at sea than was the case in more temperate environments, where keeping dry would have been a more critical factor. These boats were also the usual means of harvesting marine resources, which was a major food source in the pre-colonial society. The traditional motive power was mainly sails and paddles. Steering oars were usually used, but modern logboats can have a central rudder attached. At sea, the use of outriggers was usual to maintain lateral stability.

The early texts such as de Morga and Alcina give a clear indication of the large number of logboats in use in the archipelago in the sixteenth century (de Morga, 1609; Alcina, 1688) however the accounts rarely include many details of their construction and role. It is not until Galang's article in the twentieth century that further details are available (Galang, 1941). There is a more comprehensive guide in the Admiralty Guide publication of 1944, but that is often unclear in distinguishing logboats from plank-built boats and extended logboats (Admiralty Guide, 1944a).

As logboats are a continuing presence in the island, they are rarely identified as historical objects in the archaeological record and preserved as such.

One of the earliest archaeological finds in the Philippines is the Manunggul Jar, a funerary ceramic from Palawan in the National Museum (Figure 1.2) (Dizon and Ronquillo, 2010: 203). This ceramic shows a model of an early logboat propelled apparently by a sail on a pole mast (now missing) and steered by a paddle. Dating was carried out only on associated finds, and remains uncertain, but the vessel is considered by the Museum website as being late Neolithic or from the early Metal Age, perhaps 2,800 years BP. This jar is believed to depict a soul being transported to the afterlife by a spirit boat, and illustrates the importance of logboats in the early cultural history of the Philippines. Many aspects of the funerary traditions illustrated can still be found in local ethnic groups today (Abrera, 2007).

There are a number of examples of historic logboats preserved in museum collections in the Philippines and abroad. A number of these examples are discussed below.

5.5.1 Rosales Logboat

In 2010 a large wooden artefact, believed to be a logboat, was discovered in Rosales, Pangasinan, on the island of Luzon (Figures 4.2, 5.3, 5.4). It was found on a small tributary of the River Agno, which is one of the larger Philippine rivers. The artefact is a worked timber tree trunk. The timber has been identified as bitaog or Indian laurel (*calophyllum inophyllum*). The timber is hardwood, but unlike some hardwoods in the Philippines floats naturally, both dry and wet. The tree can grow to a great age, which complicates the dating by C^{14} tests. The artefact has an estimated weight of over 5 tons. It measures 7.1 metres overall with a beam of 1.20 metres and an external depth of 0.75 metres. It is carved by hand from the core of a substantial tree. Adze marks can still be identified in the inner recess of the artefact.

The wood has recently been dated by the author using C^{14} analysis. The conclusion is that the calibrated age is between AD 1480 and 1650 with a 95% probability. This corresponds to the period during which the Spanish colonialists arrived in the area. The full report is attached as Figure 5.38.

The first assumption was that this was a log boat and it shares many aspects of the traditional log boat. One end has a shaped bow which narrows to a flat end 27cm wide at the deck level. The putative gunwale is raised at bow and stern by some 9 to 10 centimetres, as compared to the centre of the log.

The carved interior is mostly smooth, but there is a carved recess on each side of the hull, which appear to be fittings for a thwart.

What is surprising about this artefact, if it is indeed a log boat, is the fact that there is so much wood left in place on the trunk. The weight of the hull is such that it would be difficult to lift and carry in pre-colonial times. There were no domesticated pack animals available to pre-colonial society so in practice it would have been difficult to move other than by water (Scott, 1981: 23; Phelan, 1967: 112). One early theory was that it was a log boat which had been abandoned in a partially carved state. However, the careful finishing of the inner recess, the sharpened bow, the rounded stern and other construction details would argue

against this interpretation. If it is not a boat it could be a vehicle for storing play, newly grown rice, and for pounding rice. However the size of this artefact would imply that this would be impractical for such usage. The tentative conclusion, therefore, must be that it is a massive log boat for use on the Agno River for local transport (Stead, 2014: 12).

5.5.2 Logboat Recorded in Cebu

In 2014 an historic logboat was identified by the author in Cebu (Figure 1.6). This is mounted on the wall of the Yap-San Diego family house in Cebu City, which dates from the seventeenth century and is the oldest house in Cebu (Figure 5.5, 5.6). The boat is clearly antique, but of uncertain age and origin. As the vessel is mounted on the exterior wall it was not easy to take accurate measurements, but the overall length is 7 metres. As in many of these log boats there are internal buttresses left in the timber perhaps for lateral strengthening. Small holes were noted in the top of the hull structure which could have been to add a gunwale or a wash strake. No outrigger fastenings were visible. The wood species was not identified.

5.5.3 The Manila Bay Logboat

There is one historic Philippine logboat in a UK collection (Figure 5.7, 5.8). This logboat is recorded as being collected in the late 1940's by Commander Peter Roberts V.C. of the Royal Navy, when it was found drifting and abandoned in Manila Bay. It was subsequently donated to the Eyemouth International Sailing Association (EISCA) collection and is now owned by the University of Southampton.

The length of the carved hull is 5.70 metres and the beam at the widest part is 0.50 metres. The external depth is 50 cm at the central point. The thickness of the timber on the hull is 3 cm and this seems to be consistent, apart from at the bow and stern ends where there is a greater thickness of wood. The wood is not officially identified but appears to be red meranti (lauan) or similar.

The boat is double ended with a slight flattening of the bow and stern. The positioning of the mast step closer to the bow indicated the normal direction of travel. The ends of the internal cavity are rounded at the bow and stern. Notably, there are no internal ribs or buttresses. There are also no indications of holes in the hull to measure the depth of timber remaining in the construction process.

There is no evidence of the expansion of the boat by the application of heat or steam, nor of the extension of the hull by weather strakes being added. There is a carved mast step in the base of the boat fashioned from a projection of wood left in the carving process and the size of the socket is 4.5 cm square.

There is a shallow gunwale on each side of the boat in the central part of the hull (between the fittings for the outriggers), which is nailed to the carved logboat hull. This is approximately 5 cm wide and 4 cm deep. There are two recesses cut through the gunwale on each side just forward of the centre point of the hull (270 cm from the bow). These two holes are each 4 cm by 2 cm. The purpose of these two recesses is not clear although they may relate to the rigging of a sail.

Immediately above the mast step is a short deck fitting of 17 cm long running across the two gunwales. This decking has a circular hole to support a pole mast and is directly above the carved mast step in the hull. The mast fitting is 198 cm from the bow. No outrigger is in place as exhibited at present, but according to the notes provided by EISCA, the boat was equipped with a single outrigger when collected, but could have been rigged for a double outrigger. The outriggers in the Philippines are often removed in sheltered waters to facilitate the handling of fishing nets. There are two pairs of inclined timbers nailed to the hull which were presumably the supports for the outrigger beams. These structures are positioned 188 cm from the bow and 105 cm from the stern. Whilst the hull is clearly original, the additional timber fittings may have been modified or may be later additions.

5.5.4 Models from the Pitt Rivers Museum, Oxford

There are two models in the Pitt Rivers Museum in Oxford, which were collected during the HMS Challenger expedition to the Pacific in 1873-1876 (Figure 5.9). These are two similar representations of passenger bancas from the Pasig River, which were used as general ferryboats on the waterways of Manila. They are logboats with a single strake on each side, presumably to protect the passengers from spray. The unusual feature of these boats is that they have triangular-shaped outriggers where the outrigger bamboos are attached directly to the hull at the forward end but splay out at the rear end. This may well be a facility to ease the access to built-up docks which is always a problem for boats with double outriggers.

There is an illustration of a similar passenger banca by Folkard (dating from the late nineteenth century), but that example has supporting timbers lashed to the sides as sponsons similar to the drawing in Figure 5.2 rather than the splayed outriggers (Folkard, 2006: 484).

This kind of logboat with a protective sunshade roof is described by Wilkes as used as a harbour tender in the mid-nineteenth century (Lurcey et al, 1974).

5.5.5 The Dumagete Logboat

In the Siliman University Museum in Dumagete City on Negros there is an ethnology collection which includes an example of a typical logboat of that province (Figure 5.10). This was a logboat with forward deck planking, a gunwale, a cutwater and a mast step. The Museum was not able to give a clear date or provenance, but it has been in the Museum for many years. The outriggers are shortened for display purposes. A number of current examples were noted in the port, but not recorded in detail (Figure 5.11).

5.5.6 The Butuan Museum Logboats in Agusan

In the Regional Museum in Butuan City, which is a branch of the National Museum in Manila, there are two logboats of uncertain provenance and age, but believed to be from Agusan. The first is a baroto or baloto and described by the Museum as a typical logboat in the local style. As there are no signs of outriggers it was probably for river or lake use. The length is 4.88 metres and the hull is 3cm thick, with an interior depth of 47 cm. The origin, date and wood species were not recorded by the Museum. The boat had six pairs of buttresses left by builders in the interior for lateral support. There is a mooring bar and one thwart and an appropriate paddle. There are no signs of this vessel being extended with an additional strake. There is an illustration of this logboat in Figure 5.12 and a drawing in Figure 5.13.

The other logboat in the Museum is a tango or bangsihan, a logboat base with washboards of woven and treated rattan. This extended log boat is 4.14 metres in length and is exhibited in the Museum as a style typical of the region. There is no evidence of origins, date, and no species identification of the wood. It is currently in store and so the measurements were not very easy to perform. The side panels are mounted on metal rods and appear to be fixed to the base with resin or glue. There is also an internal frame to give lateral support. This vessel

has a large pole extension of 38 cm on what is considered the stern, which was not observed in other logboats in this province. This logboat is illustrated in Figure 5.14 with a drawing in Figure 5.15.

5.5.7 Recent Descriptions of Philippine Logboats

There is a bewildering range of names for logboats in the Philippine languages, including baroto, bonggo', birao, bitok, bilog, balasiyan, gobang, junkun, pakarangan, sibidsibaran, pangue, pilang, onadaon, lampitaw, lunday, pinango, damlog and tilimbaw. The references for these and other names are annotated in the Appendix A. Often it is unclear whether these names represent different styles of vessel or are just synonyms. Each language group would often have separate name for each type of vessel and often a specific vessel could have a different, local name in each island. The Spanish colonial documents typically refer to the baroto as a generic label, and frequently use the foreign names of the canoa and the piragua, rather than the local names. In the collected documents of Blair & Robertson the name baroto has eleven references, the canoa has twenty one references and the piragua has four references (Blair & Robertson, 1903-7: Index). In the absence of many examples in the archaeological record in the Philippines there are a number of literary sources that give useful accounts of the various styles of logboats.

One of the best sources is a guide issued by the British Admiralty in 1944, *Native craft and fisheries of the Philippine Islands*. This was based largely on data collected in the 1930s(Admiralty Guide, 1944a)

In the Sulu Sea to the south of the Philippine chain the most common logboat was the vinta (Admiralty Guide, 1944a: 82-83). This is a logboat with a bifid bow and a double outrigger. The hull was frequently carved in an elaborate fashion. It was usually fitted with a lug sail slung between two booms and carried by a tripod mast (Figure 8.7). The length was typically 20 to 45 feet with a draught of 15 to 24 inches. The sail was often multi-coloured. This class of vessel is still used for fishing and general transport use in Sulu and is strongly associated with the Muslim community, but for security reasons no fieldwork was carried out in Sulu by the author since his visit in 1968.

In the Visayan areas of central Philippines such as Panay, Negros and Cebu (see map in Figure 1.1), the most common logboat was the baroto, also referred to as

the panagatan or bankerohan. This usually had a double outrigger with two sets of booms but did not usually support a sail (Admiralty Guide, 1944a: 96-97). The smallest size for a single occupant was typically 13 feet 6 inches long, with a beam of 16 inches and a depth of 19-20 inches. Often they had blunted ends and a raised sheer, but not usually a transom. The baloto or baroto in the Butuan Museum is an example illustrated in Figures 5.12 and 5.13.

In the central Philippines the banca or bangka (when used specifically rather than for boats in general) was a larger form of the baroto, typically over sixteen feet in length (Admiralty Guide, 1944a: 98-99). These were often up to forty feet in length and frequently used sails as well as paddles. The banca tended to have a narrower prow and stern than the baroto, but still retaining the rounded ends. The sheer was often more pronounced than in the baroto. Related vessels included the chinchorrohan, the sapiaowan and the dinalapang.

The boteng pamunuanan was a logboat carved as a replica of a European jolly boat. This included a transom stern with a western style rudder (Admiralty Guide, 1944a: 100-101). The kurikanan was a two person boat using paddles or sails in Mindoro and Batangas (Admiralty Guide, 1944a: 110)

There was a range of larger logboats used in the Visayas mostly for fishing. These included the sibidsibaran or pinanyo particularly associated with line trolling. These vessels usually carried a foresail and a spritsail. In the western Visayas were found the bilus, and the larger balandra, which are illustrated in Figure 5.16.

In Luzon the lunday or lunde was a small logboat without outriggers and used for inshore fishing or transport on internal waterways (Admiralty Guide, 1944a: 112).

5.5.8 Construction and Performance of Philippine Logboats

It is fortunate that there is a full description of the building of logboats in the Visayas from the memoirs of Father Francisco Ignacio Alcina from the seventeenth century (Alcina, 1688: 161-167). He calls the logboat the baloto (or balutu) and records that the Tagalog speakers would refer to the same vessel as a bangka (or banca). Alcina comments that "there are so many types and varied sizes, and even names. Each one has its own and they are almost innumerable" (Alcina, 1688: 197). He records that these logboats were used for fishing, hunting and inter-island visits. Often these vessels were light enough to be lifted and carried by a single individual. A larger version was called the bariga (Alcina, 1688:

199). They often had a very low freeboard and Spanish passengers, who were less careful of the balance, sometimes caused them to sink.

To build a baloto he records that the builder would select a standing tree and fell it carefully to fall on the selected side, to avoid manhandling the log. The construction team would strip the bark to a depth of two fingers in the greenwood log. A centre line was marked using a rope down the log (called a kutor or kutud) and this line would be a guide for the carving process. The team would trim off the top of the log leaving a higher outstanding portion to serve as the stern. The outer shape of the boat would be carved first including the narrowing at the bow and stern. Then they would hollow out the centre leaving certain protrusions called tambukos (lugs) to which are fastened ribs (agar). This same terminology is used for the ribs on plank-built boats. The objective according to Alcina was to leave a ladder of ribs in the logboat which strengthened the hull. Additional strakes could be added on each beam to increase the freeboard and these were fastened to the ribs. These extra strakes were referred to as timbaw and the expanded logboats were referred to as tinibaw. Alcina describes a kind of extended logboat from Bohol in the Southern Visayas, which used strips of dried bark. This bark was referred to as upak or dagpak, and was nailed to the sides as a washboard, using rattan as an edging material and bamboo nails. Another way of extending a logboat in a temporary fashion was by adding a layer of folded nipa palm fronds as a wash strake and this process was called dalupi (Alcina 1688: 201).

In finishing the carving of the boat Alcina records that the construction team used holes in the hull carved using an augur or boring bit, called a lukub. This employed a circular motion and a mallet or pakang. These holes allowed a clear management of the thickness of the timber in the finished boat.

According to Alcina, a typical baloto would be up to 9 metres in length with a beam of up to one metre. This represented eight to ten man-days of continuous construction time (Alcina, 1688: 167).

In large waves the baloto often flooded, but was easily bailed out when the crew jumped overboard to increase the freeboard. This even worked for the larger bariga due to the flotation provided by the outriggers (Alcina, 1688: 199).

It is notable that Alcina makes no mention of expanding logboats through the use of heat or steam, although this technique is widely used in Borneo (Petersen, 2000:87; Nicolaisen & Damgård-Sørensen, 1991: 62-65).

5.5.9 Timber Selection in the Philippines

Timber resources for logboat construction were plentiful prior to colonisation. Even today, despite the clearances for the galleon trade and recent industrial logging in the Philippines, it is still possible to find suitable standing trees in the forest.

Among the 3,000 species of tree in the Philippine forests were a large number of trees suitable for logboats. The preferred timber was frequently from the *shorea* genus. *Shorea* is a genus of about 196 species of rainforest trees in the family *dipterocarpaceae.* The genus is named after Sir John Shore, a Governor-General of the British East India Company in the eighteenth century. These species are found in the Philippines, Indonesia and Malaysia and individual trees grow to over 80 metres tall. According to Ahern the preferred species for logboat building were the tanguile (*shorea polyspermus*) the malaanonang (*shorea malaanonan*) and the lauan (*dipterocarpus thurifer*). Other trees which were particularly favoured were the balau (*shorea albida*), mayapis (*shorea palospis*) and the bitaog (*calophyllum inophyllum*) (Ahern, 1901: 98).

Confusion has been caused between these species by the application of the name lauan or Philippine 'mahogany' as a generic name by the lumber trade for a number of related species, including red and white meranti as well as balau. It is notable that a logboat constructed in Roskilde, based up on a typical design from Northern Borneo, was carved from red meranti (Nicolaisen & Damgård-Sørensen, 1991: 49). The Admiralty Guide referred to *shorea negrosensis* as the preferred species for logboats (Admiralty Naval Intelligence Division, 1944a: 96). This is referred to colloquially as malatabang or red lauan and is now on the red list of critically endangered species (as issued by the International Union for Conservation of Nature (IUCN)).

5.5.10 Tools for Building Philippine Logboats

In the National Museum in Manila there is a range of tools made from stone, shell, bone and metal. The metal tools are rarer as they could be melted down and reused (Dizon,1983). There is no doubt that the advent of metal tools in

copper and iron made a considerable contribution to reducing the time needed to manufacture a logboat. The tools used to excavate a logboat were, according to Alcina, a square axe, an adze (daldag) and a skewed adze (called a bikong). An augur or lukub was used for opening round holes. (Alcina 1688: 165).

5.5.11 Ethnographic Studies on Logboats

In order to supplement the evidence from other sources, a number of visits were made to sites where it was anticipated that traditional style logboats were still in use. These included areas of Luzon, Mindanao, Cebu and Dumaguete in Negros. The most productive visits were to Agusan in Mindanao in 2014 and to the Bikol Region of Southern Luzon in 2015, which are detailed more extensively below. The map in Figure 5.17 identifies the location of these studies.

5.5.12 Survey in Agusan, 2014

In 2014 the author carried out a survey at Lake Mainit, Agusan, in Northern Mindanao of the logboats currently used in this region.

This trip was arranged by Daniel Calo (former Director of Tourism in the Province). The lake is the fourth largest in the Philippines at 173 square kilometres and is located on the border between Agusan and Surigao. The lakeside town of Jabonga was visited, where there is a large range of logboats in use on the lake. Some of the logboats have outriggers, but most do not, as the lake is quite calm. With a flat bottom they are quite stable, and easier to work with nets without outriggers. A number of logboats were inspected on the lake shore of which two were recorded in detail. Each was made from a single log (from a variety of timber species) with a length of 4 metres to 7 metres. There is no evidence of the expansion of any of the log boats through the application of heat, steam or water. This is evidence of the plentiful supply of suitable logs of large radius, even today.

The construction and use of these logboats were discussed in an informal and unstructured manner with the local fishermen (Figure 5.18).

The modern logboats of Lake Mainit are normally constructed by the owners from fresh logs identified in the forest. They reported a value of approximately Pesos 2,000 or £30 for a used log boat.

The sides of the log boats are usually 2cm to 3cm thick. There are often pairs of buttresses left in the carving out process to strengthen the hull and provide a base for thwarts if required. A number of the log boats had mooring bars inset in the first pair of buttresses (see Figure 5.22).

Boat no 4 is a log boat recorded at Lake Mainit, of 5 metres LOA. It was built by the current owner, Ramon Torrino, from lauan timber cut in the nearby forest. It has a small triangle of decking at the stern. It usually carries up to three paddlers. It does not have outriggers. This vessel is illustrated in Figures 5.19, 5.20 and 5.21.

Boat no 5 is a similar logboat but rather wider in the beam. It is also constructed locally from a type of lauan. It measures 6.7 metre LOA with beam of 60 cm and a depth of 33 cm. There is no outrigger mounted. It is illustrated by a photo in Figure 5.22 and a drawing in Figure 5.23.

A recently constructed logboat with an extended bow, no. 6, is illustrated in Figure 5.24.

5.5.13 Survey in the Bikol Area, Southern Luzon, 2015

Drawing on the earlier experience from Agusan, during 2015 a further ethnographic survey was carried out by the author in the Bikol region of Southern Luzon covering the provinces of Camarines Norte, Camarines Sur, Albay and Sorsogon. The study covered some nineteen examples of logboats either still in use or recently abandoned (see Figure 5.26 for a detailed map of this area).

This study was supported through a John Starkie Ethnographic Award received in 2015 through the Nautical Archaeology Society to assist in the cost of research in the Philippines. Based on the experience from the earlier reviews, the owners and users would be interviewed about their logboats in a more structured interview process with set of questions in three languages. The questions (in English) are attached as Figure 5.36. The results are tabulated in Figure 5.35. Thanks are due to Roberto Geronimo, Prima Stead and Eleanor Templeman who helped on the survey interviews and translations.

The objective was to identify logboats still in use and to photograph and record a number of examples. The intention was to study the traditional approach to logboat construction in so far as this survives, as a guide to the original role and

construction of the logboats in this region. Key examples would be recorded and drawn. None of the boats identified used sails or outboard motors, and they all now employed paddles as motive power.

Few large hardwood trees survive in the area. The value of such trees as timber discourages their use for logboats. It is now often cheaper to build simple canoes in marine ply, sawn timber planks or fibreglass. Also, government policy is to prohibit the cutting of timber for this purpose. Most of the remaining examples are on rivers and lakes, as the preferred design for sea-going boats is now the plank-built banca, which is an evolution of the traditional design of indigenous plank-built boats. A number used outriggers (katig) to provide lateral stability, but these were often single outriggers rather than double outriggers.

The first area visited was Buhi Lake in Camarines Sur. In the recent past the most numerous boats here were logboats, but they have now largely disappeared to be replaced by fibreglass replicas approved by the government. One old and heavily-repaired wooden example was noted (Figure 5.25) but not recorded in view of its condition. The fisherman, Ricardo M. Atutubo, was interviewed by Roberto Geronimo and he described how his logboat had been replaced by a simple five-piece canoe in sawn timber from the lanipga tree (*toona ciliate).*

The bulk of the remaining examples were identified further south in Sorsogon, some five in the river at Donsol, one on the coast at Bacon, three on the river near Barcelona, three more on the beach at Barcelona and six on the volcanic crater lake of Busulan

At Donsol we saw five examples on the river bank and all very similar. One boat was still under construction. These logboats were used on the river rather than on the open sea, although they were close to the estuary. The owner, Jaime Lopez, was interviewed about his vessels. The logboats were built in tangid (*cananga odorata*), antipolo (*artocarpus blanco*) and talisa (*terminalia catalpa*) timber. The drawing of Donsol no. 2 is in Figure 5.28.

At Bacon in Sorsogon we saw one damaged and abandoned logboat which was recorded (Figure 5.29 and 5.30). This boat was built in pili wood (*canarium ovatum*), not much used for boat building. The owner, Antonio Duke, was interviewed. The Bacon no 1 vessel had clearly been expanded.

On the beach at Barcelona three more examples (Figure 5.32) were noted, built in lauan. Two local owners, Nalo Estrada and Jerry Folgosino, were interviewed by Roberto Geronimo.

At Rizal Beach near Barcelona, there were three examples in the river (Figure 5.32), all built in lauan. As they were all moored in the river and as the owner was absent we did not manage to record any of them, but did interview a neighbour, Diogenes Hermo, about the use of these vessels.

Finally at the Bulusan crater lake some six more logboats were noted. Two of them were being used for fishing and four more were drawn up on the shore (Figure 5.33). There was no opportunity to record these vessels or interview the owners. These were all very similar, and much more rustic versions with the bark and sap wood still in place. The timber was not identified.

These logboats in Bikol are remnants of a logboat culture which was once much more extensive. They were used only on rivers, protected waters or close inshore. They were mostly manufactured locally by their owners, apart from the boats at Barcelona which had been imported from Samar. For sea-going service, the logboats have largely been replaced by the plank-built bancas.

Wood supply is clearly an issue, apart from at Donsol, and may explain the importing of logboats from Samar, mentioned above. Some of the wood used, such as pili wood, was not usually considered as suitable for logboat construction.

The shapes and sizes were all reasonable consistent, with rounded ends at bow and stern, or a simple squared end above the waterline. The length overall varied between 3.50m and 5.00m, with a maximum beam of 0.40m to 0.55m. There was no trace of washboards being added to increase the freeboard, but a number of examples had a thin gunwale timber to protect the hull.

The logboats had relatively little sheer apart from at Bacon, where the bow and stern were more elevated - perhaps because of usage in the open sea. There were no traces of holes being drilled in the logboats to control the remaining thickness of timber, as had been reported by Alcina. Several of the boats had the buttresses of wood left on the inside of the hulls.

Several of the vessels had a single outrigger to improve lateral stability, but other examples had no outriggers in position. The boats at Lake Bulusan had single outriggers.

5.5.12 Further Study

It is clear from the colonial records that there was a large population of logboats used in the Philippines. Today, logboats continue to be built and used, but are rapidly disappearing due to a shortage of suitable timber and the evolution of cheaper alternatives (from interviews with boat owners in Bikol). There are very few examples preserved in the archaeological record and literary accounts give very few details about the construction and dimensions of those logboats.

In considering the available evidence on Philippine logboats, reviewed above, it is clear that the majority fall into Fox's third group in that they are largely symmetrical at the bow and stern, either rounded or pointed. Protruding 'beaks' at the bow or stern are relatively rare. Internal ribs left in the carving process are relatively common, although the rationale for these protrusions is not clear. Fitted transoms and internal bulkheads are relatively rare.

There has been little formal study of Philippine logboats carried out to date and there is a scope for further analysis especially in the provinces not visited in this research.

5.5.13 Conclusions from Field Studies

The ethnographic research visits have provided an important reference point for the studies of logboats in the Philippines. Are these modern logboats consistent with the logboat tradition in the Philippines? In view of the very limited archaeological discoveries, and the few details in the literary accounts of logboats at the time of colonisation, it is difficult to be precise. However, those logboats produced today seem to be consistent with the descriptions we have, particularly the account of Alcina (1688: 165-201). These modern examples also seem to be consistent with the examples in the ethnographic museums such as the Regional Museum in Butuan, although these museum logboats are usually of unknown date and origin.

The features which appear to have been retained relatively unchanged include the selection of timber species, although with the shortage of prime timber some less

suitable trees have been used at times. The tools used are little changed from the axes, adzes and jungle knives originally employed. The hull shapes appear to be similar to the sixteenth century originals. The most important survival is the continued use of outriggers, except in the most protected inland waterways.

Much has changed including the reduced use of sails, the introduction of motors, the introduction of small central rudders in some cases, and the disappearance of the extended logboat class. However, on balance, the study of the remaining logboats have helped to illuminate this account of traditional logboats in the Philippines.

Figure 5.1: Expanded 'pilan' boat from Angkor, photo: M. R. Stead

Figure 5.2: Side timbers on a Philippine logboat, from Pâris 1841: Manila banca Pl 75

Figure 5.3: Rosales logboat, port side, photo: M.R. Stead

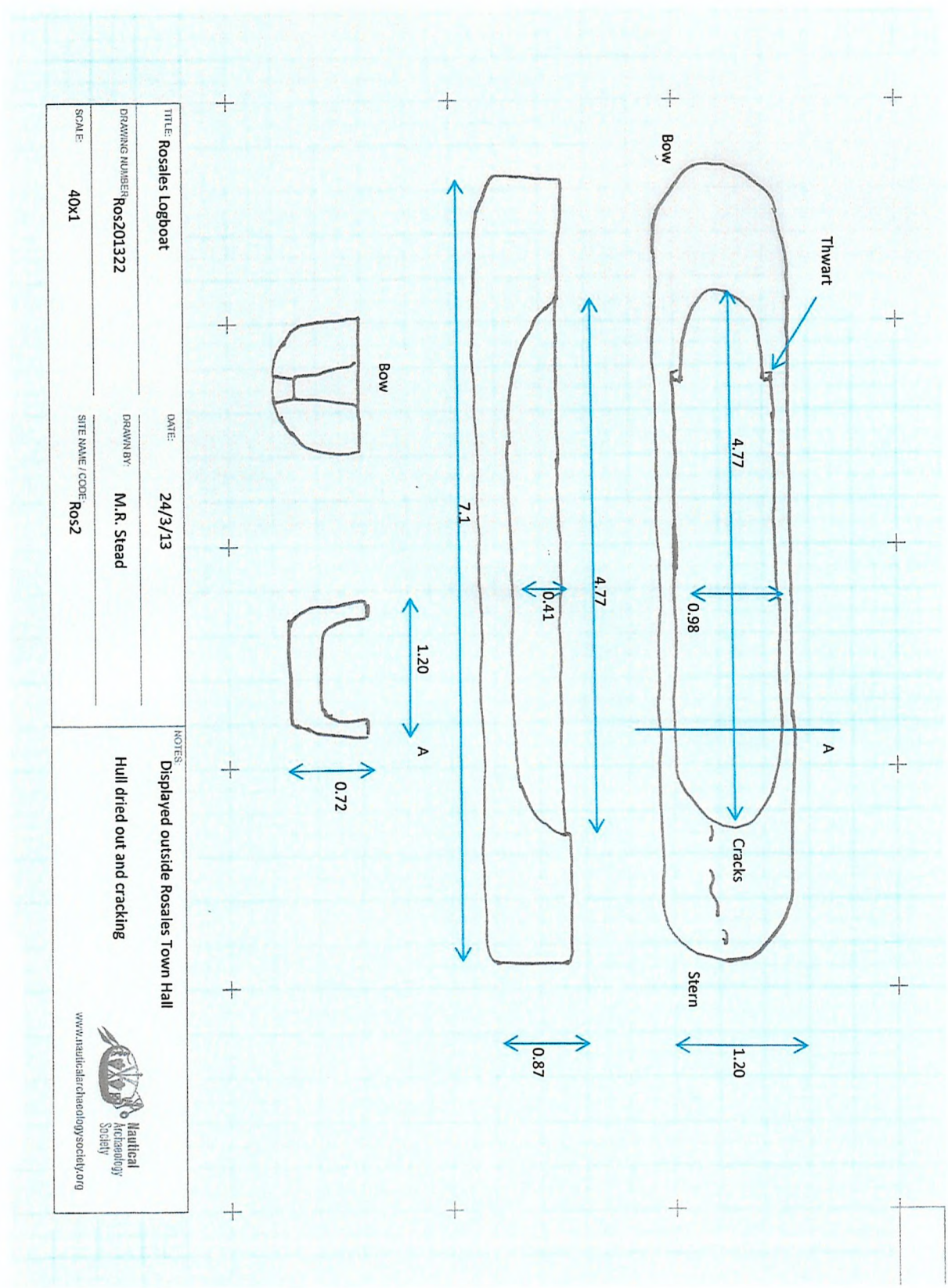


Figure 5.4 Rosales logboat drawn by M. R. Stead

Figure 5.5: Logboat in Cebu at Yap-San Diego house,
photo: M. R. Stead

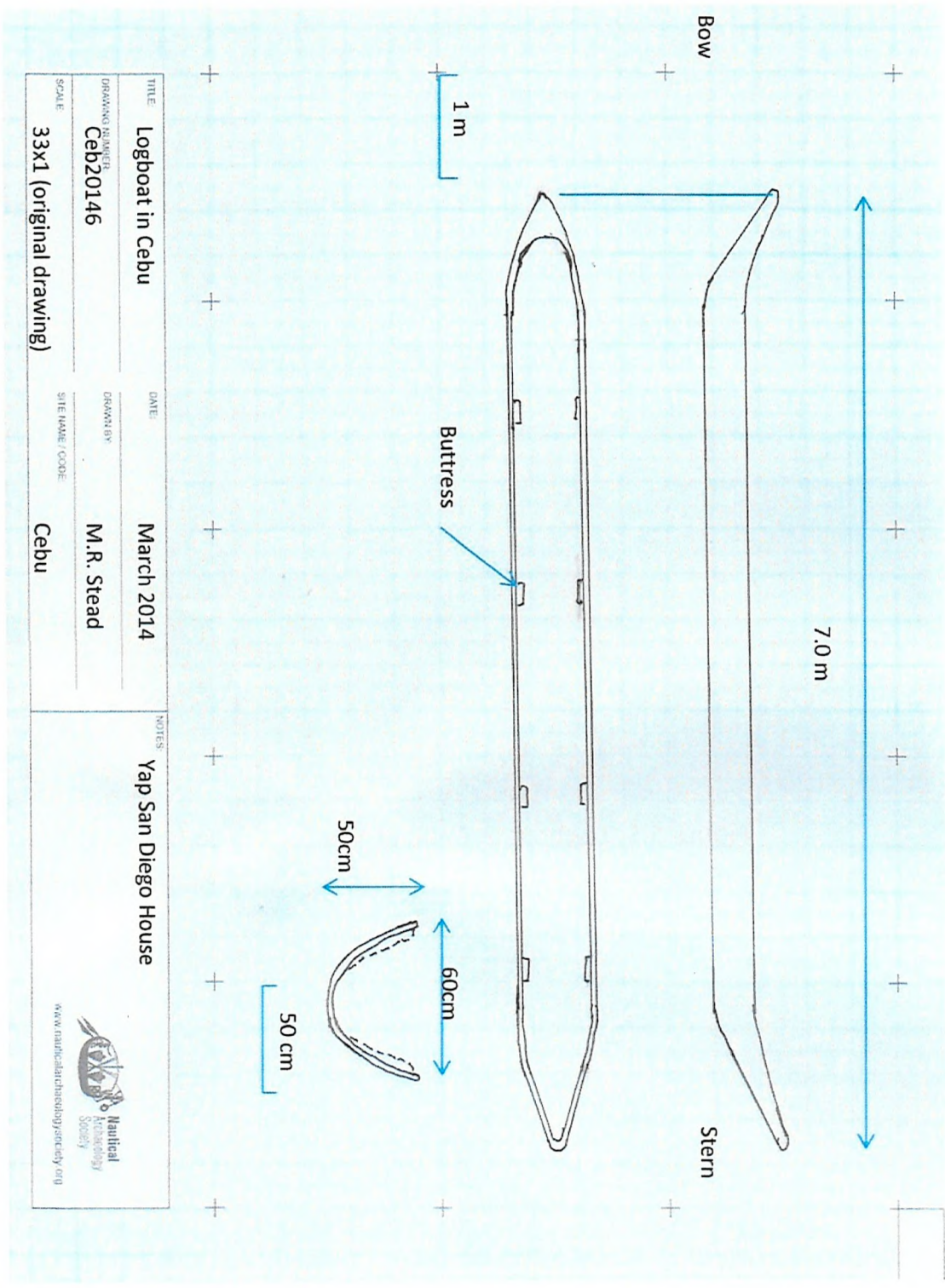


Figure 5.6 Logboat in Cebu at Yap-San Diego house drawn by M. R. Stead

Figure 5.7: Manila Bay logboat now owned by the University of Southampton

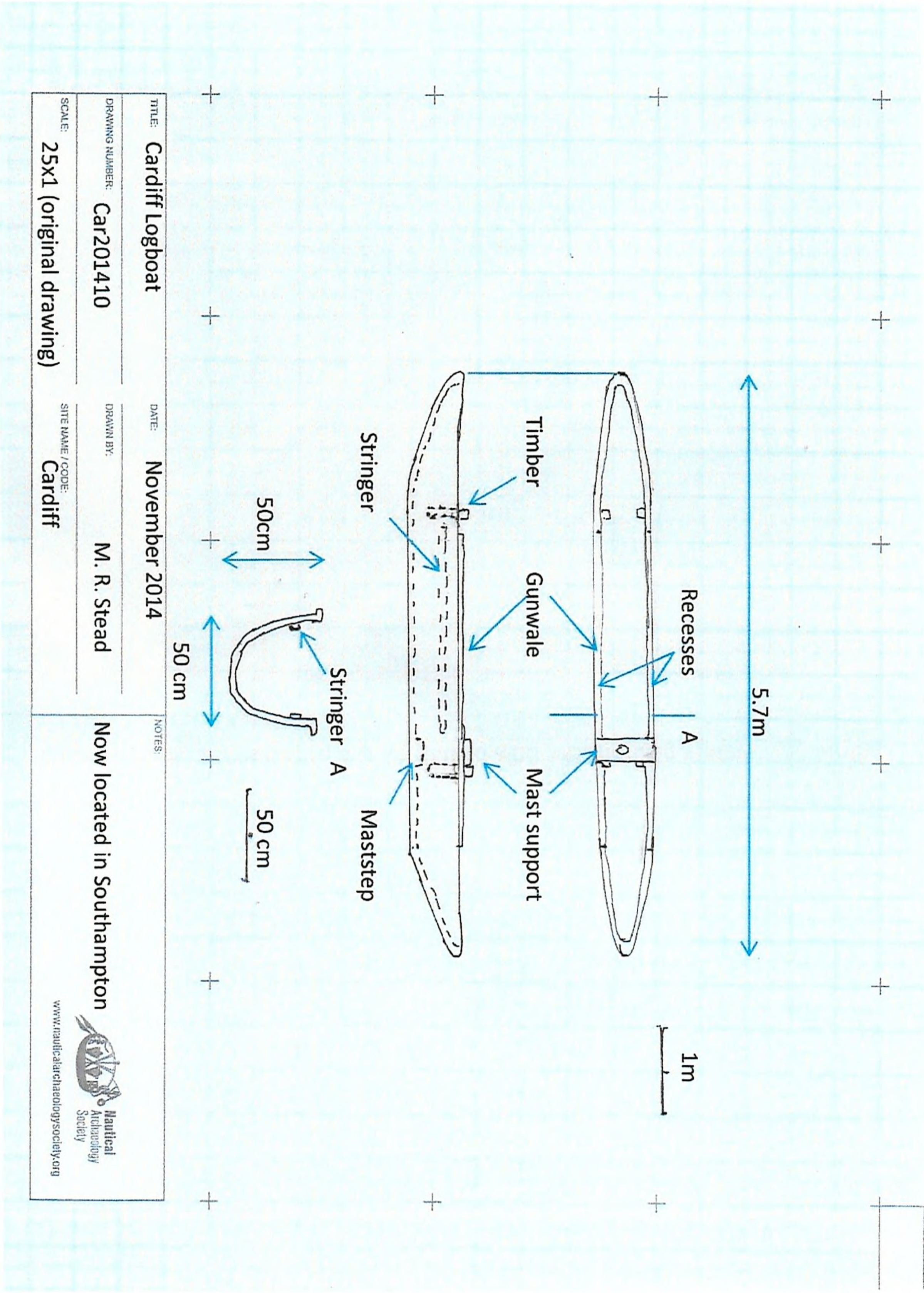


Figure 5.8 Manila Bay Logboat drawn by M. R. Stead

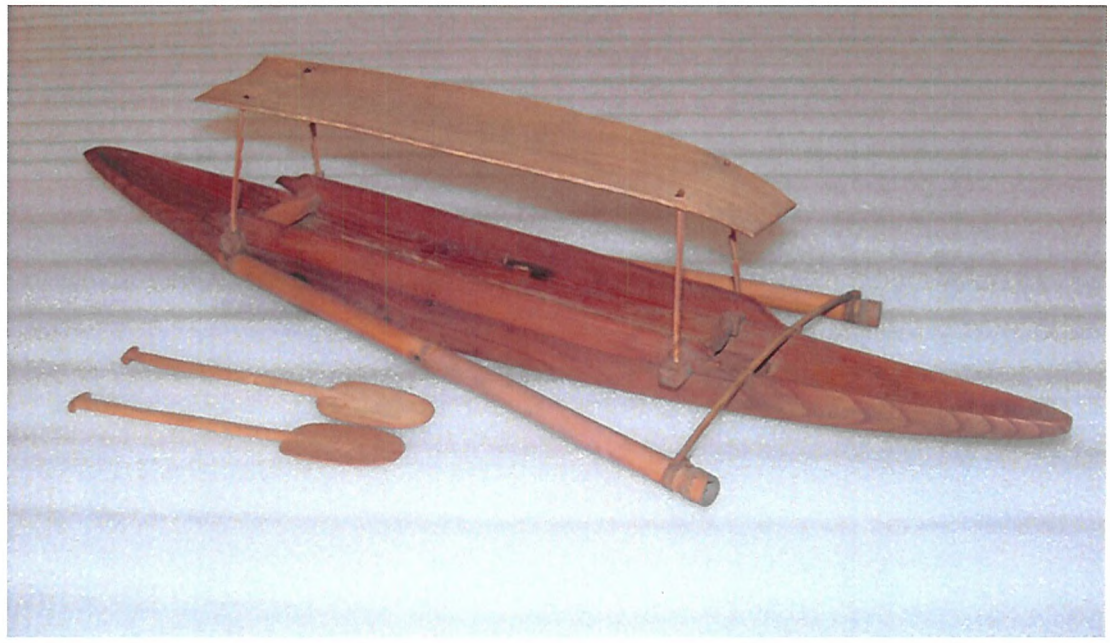


Figure 5.9: Model from Pitt Rivers Museum, collected by the HMS Challenger expedition, photo: M.R. Stead

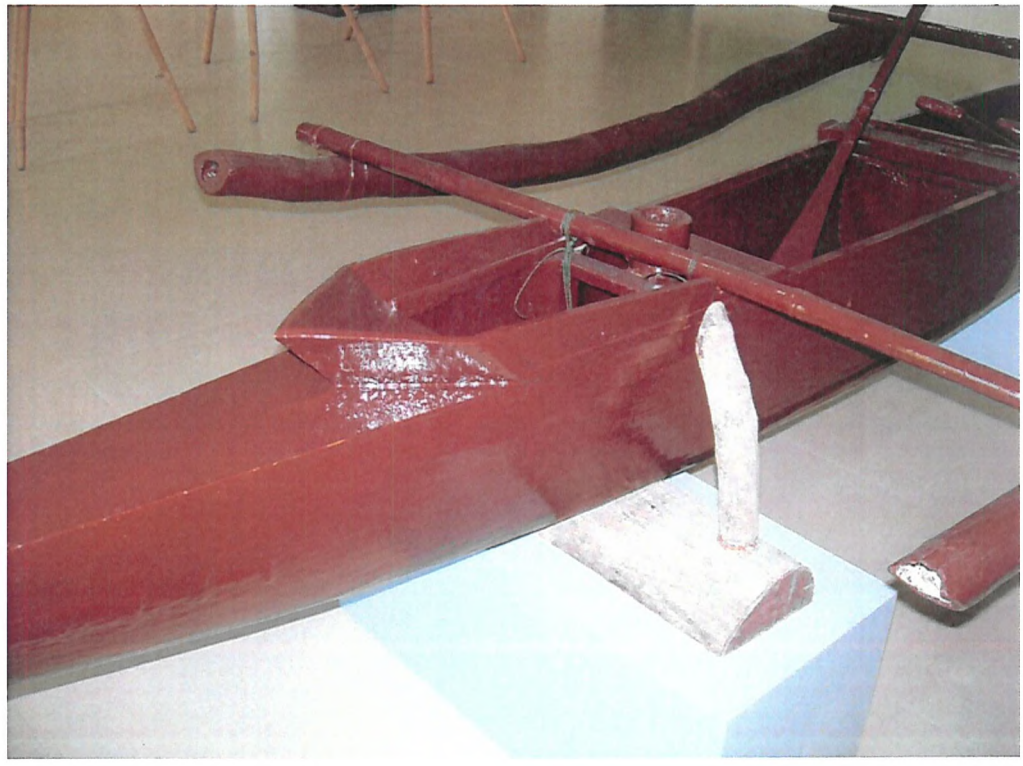


Figure 5.10: Logboat in Siliman University, Dumagete, outriggers shortened for display purposes, photo: M. R. Stead

Figure 5.11 Example of the Dumagete style of logboat on the beach in Negros, photo: M.R. Stead

Figure 5.12 Baroto in Butuan Museum, photo: M. R. Stead

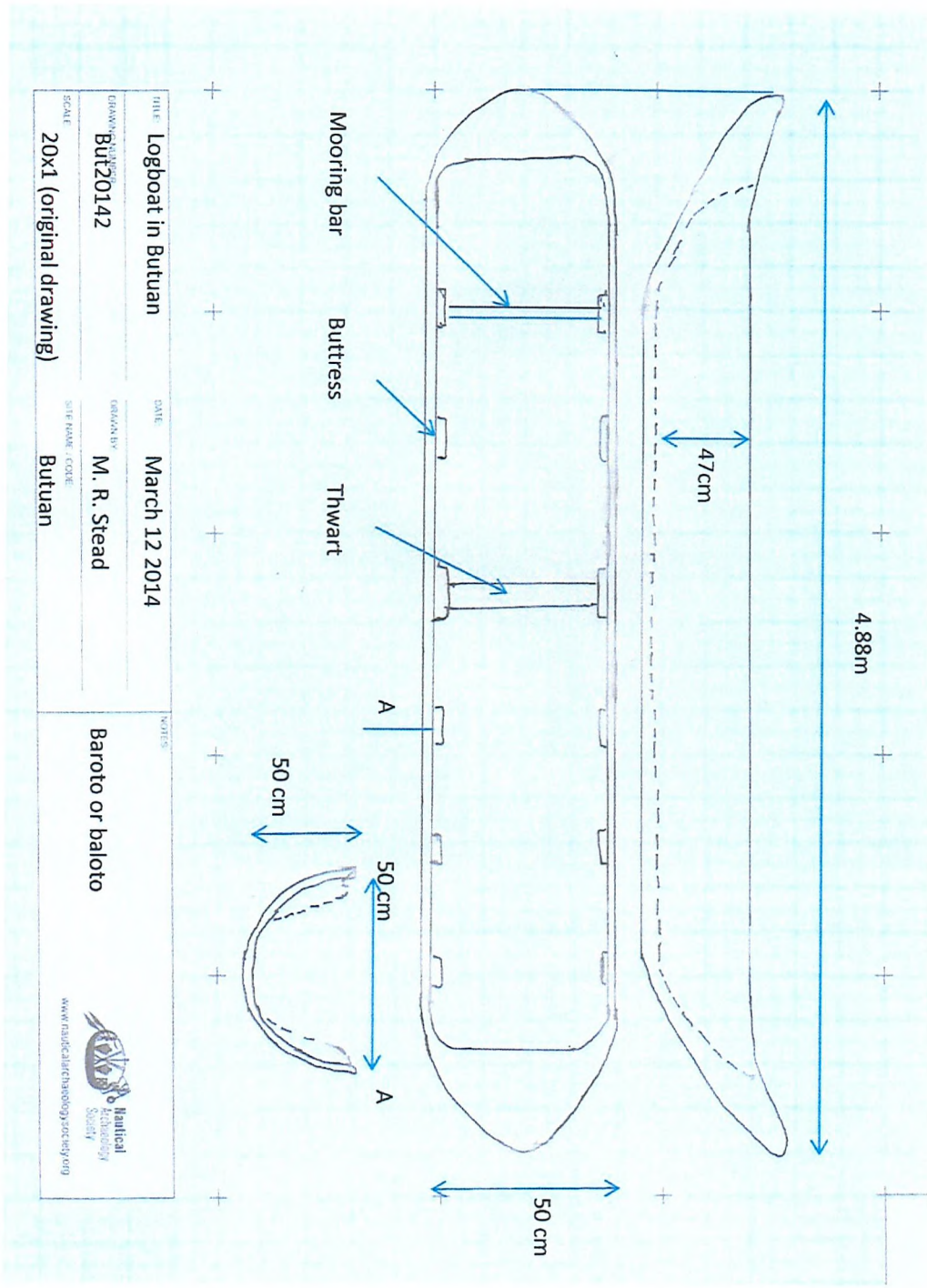
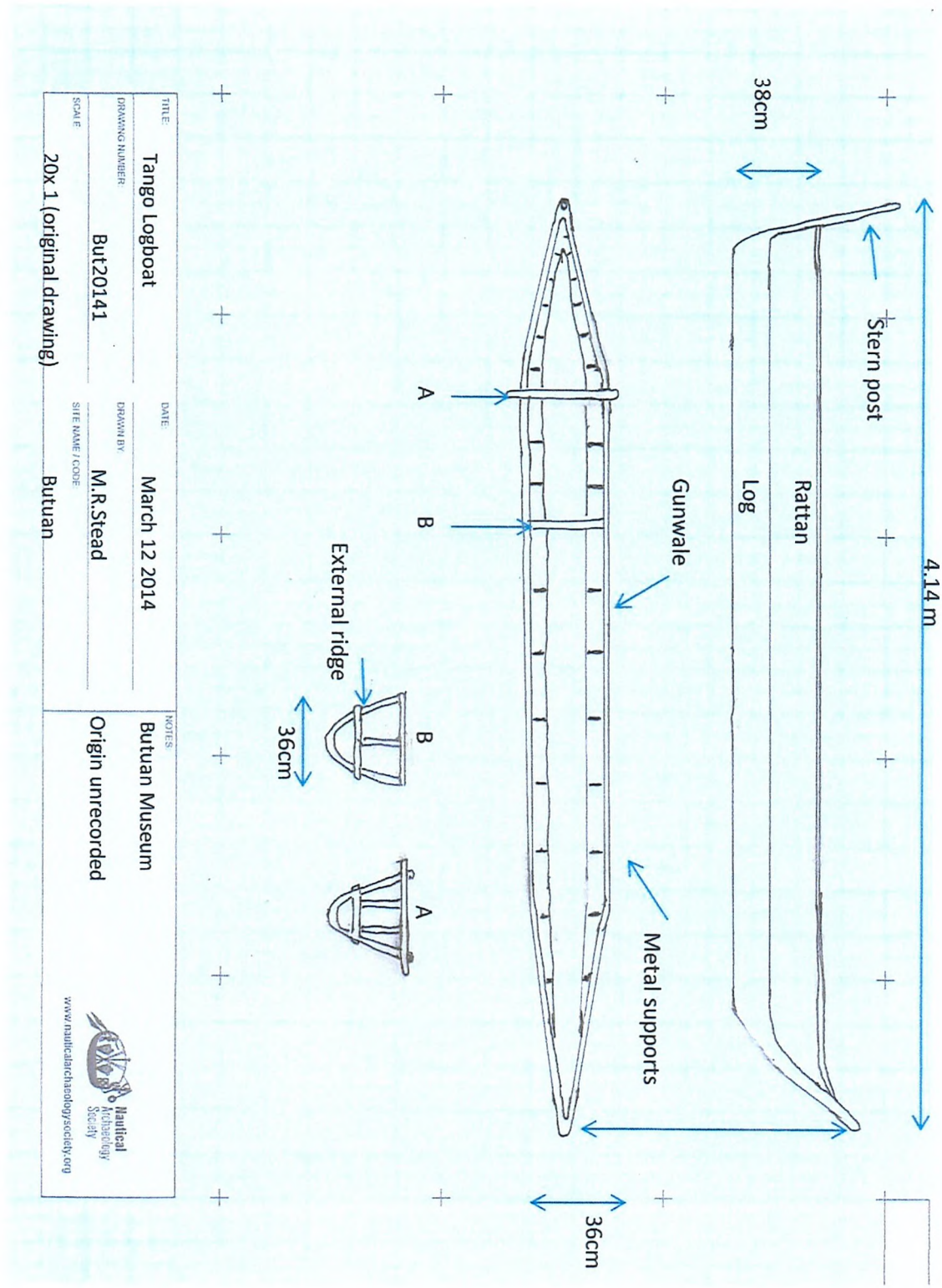


Figure 5.13 Baroto in Butuan Museum drawn by M. R. Stead

Figure 5.14 Tango in Butuan Museum,
photo: M.R. Stead



5.15 Tango in Butuan Museum, drawn by M. R. Stead

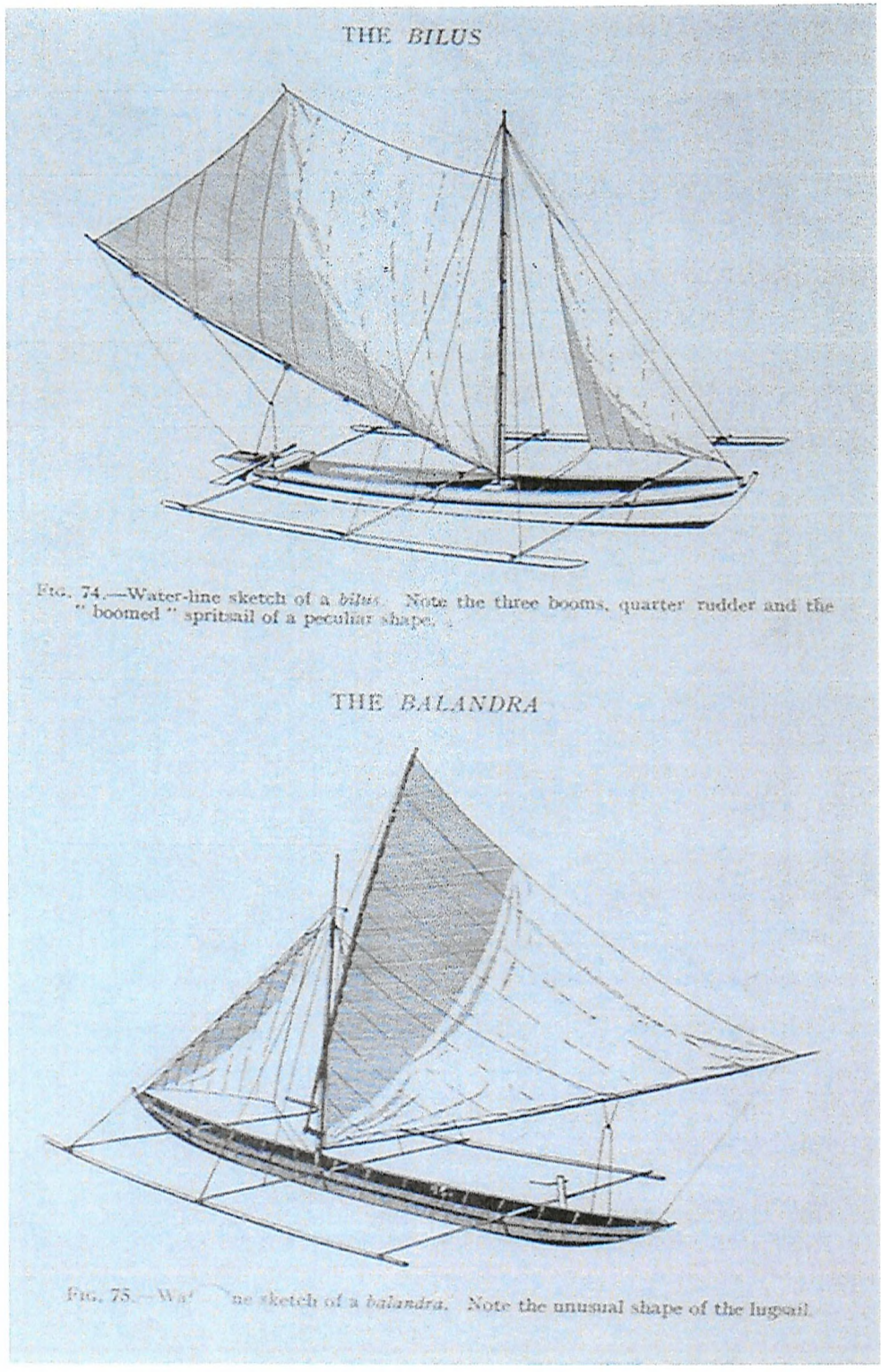


Figure 5.16 The bilus and balandra, Visayan fishing logboats
from the Admiralty Guide 1944 page 103

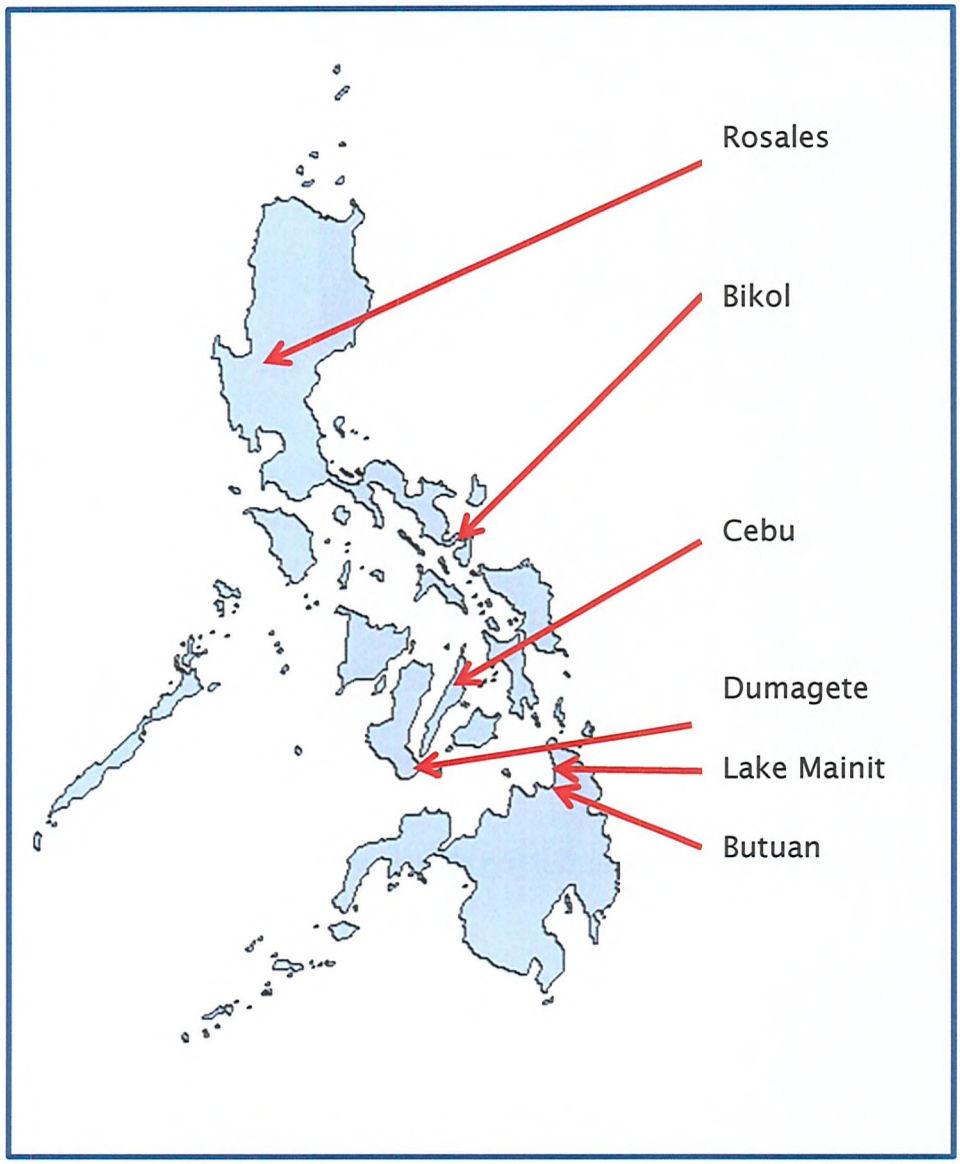


Figure 5.17 Locations of logboat studies: M. R. Stead

Figure 5.18 Members of the fishing community at Lake Mainit,
photo: M. R. Stead

Figure 5.19 Mainit No 4 being recorded with help from the owner,
photo: Mrs P Stead

Figure 5.20 Mainit No 4 discussed with the owner,
photo Mrs. P. Stead

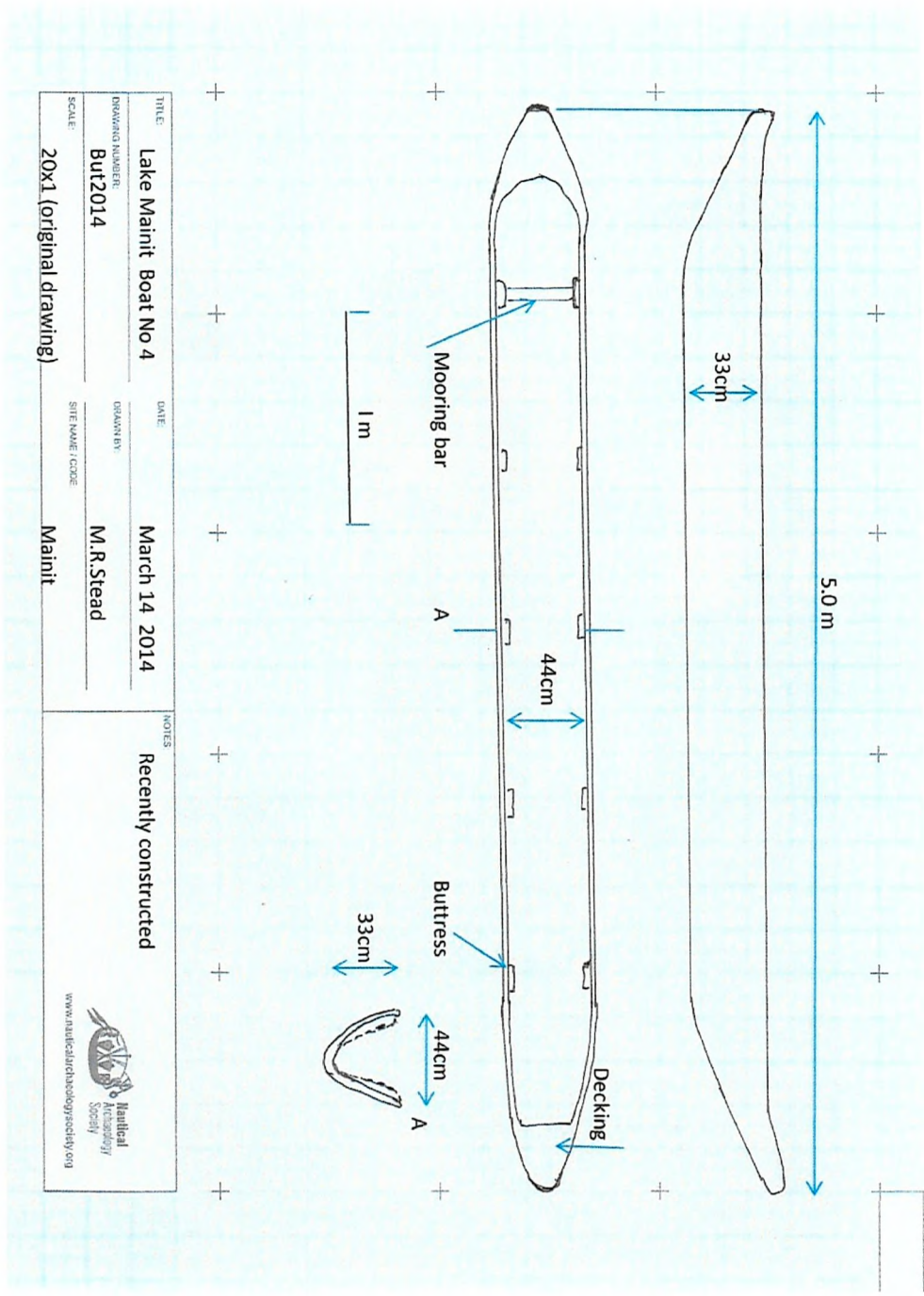


Figure 5.21 Mainit No 4, drawn by M. R. Stead

Figure 5.22 Mainit No 5, photo M. R. Stead

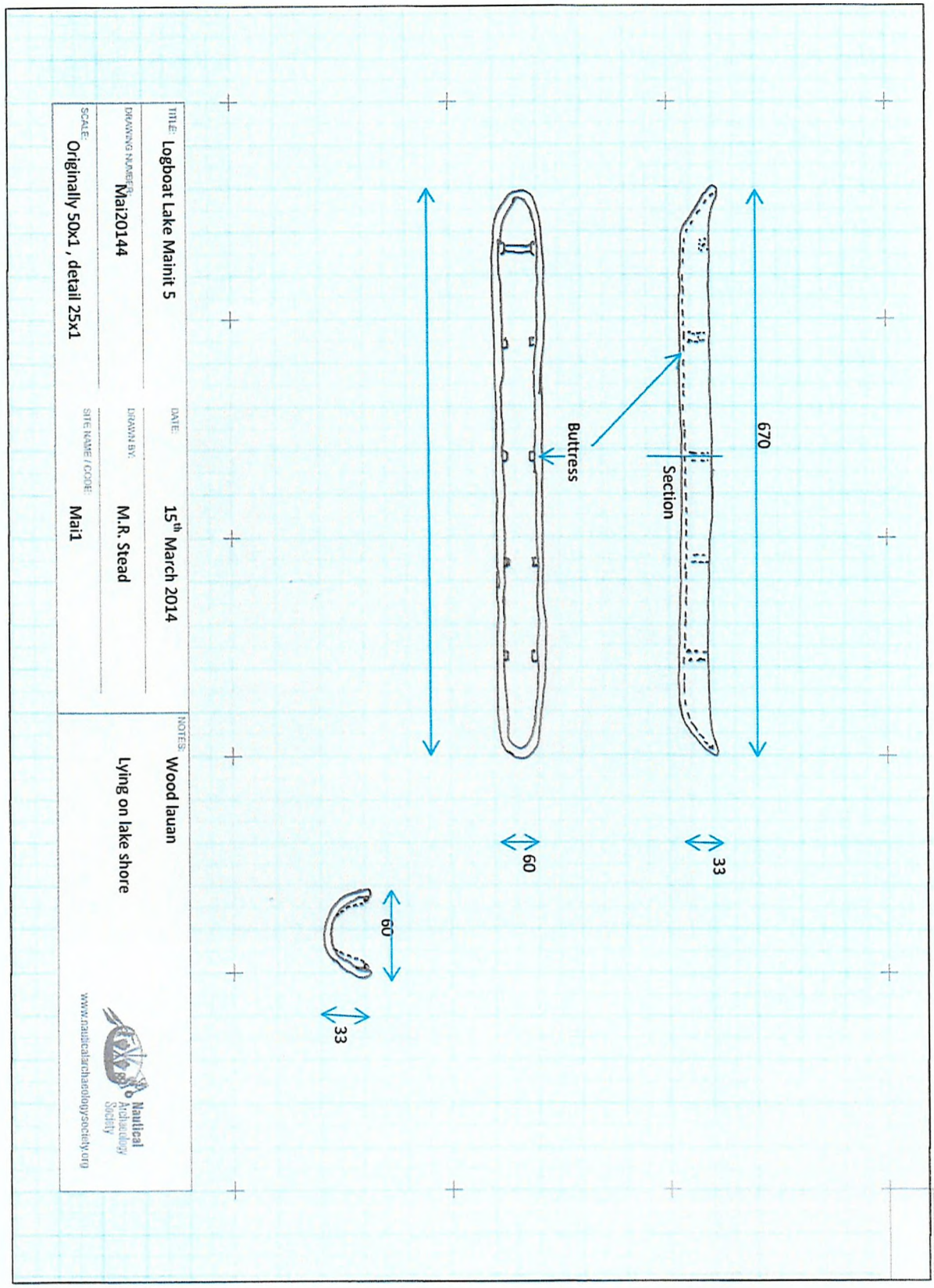


Figure 5.23 Mainit No 5, drawn by M. R. Stead

Figure 5.24: Boat No 6, recently completed logboat at Lake Mainit with extended bow, photo: M. R. Stead

Figure 5.25 Last surviving logboat seen at Buhi Lake, photo: M. R. Stead

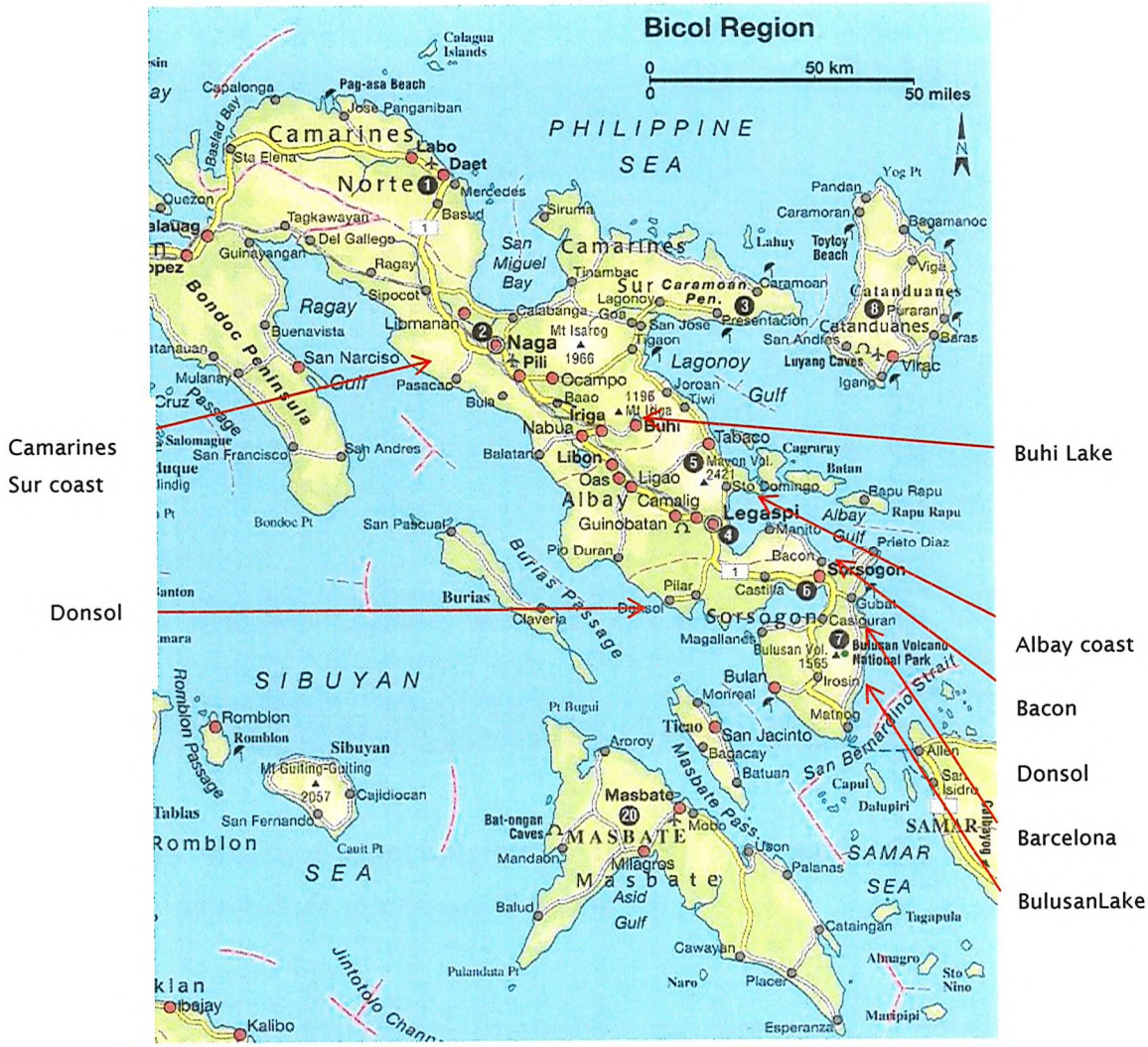


Figure 5.26 Survey Locations in Bikol, Southern Luzon

Figure 5.27 Donsol No 2 logboat, photo: M. R. Stead

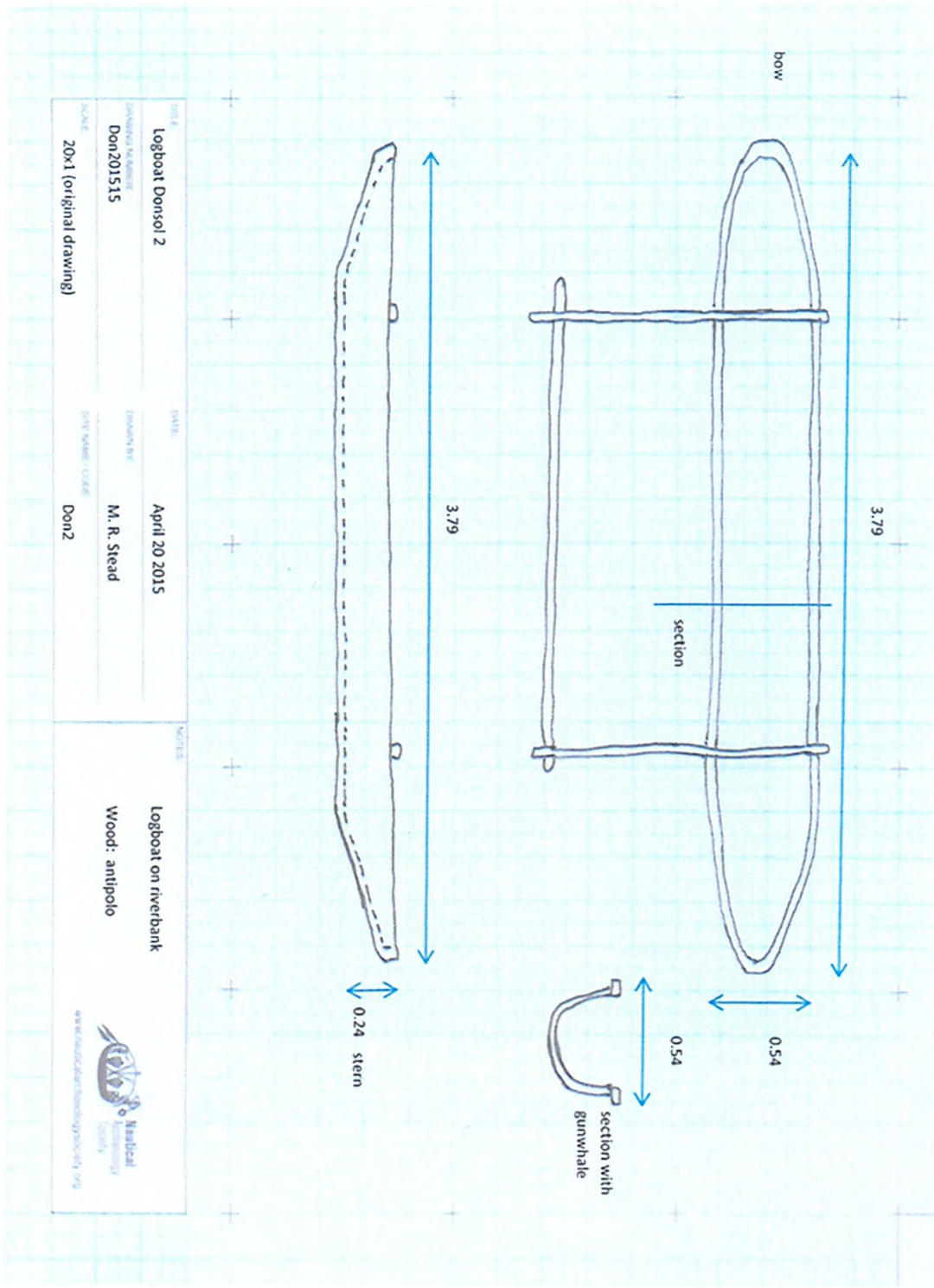


Figure 5.28 Donsol No 2 logboat, drawn by M. R. Stead

Figure 5.29 Bacon No 1 logboat, photo: M.R Stead

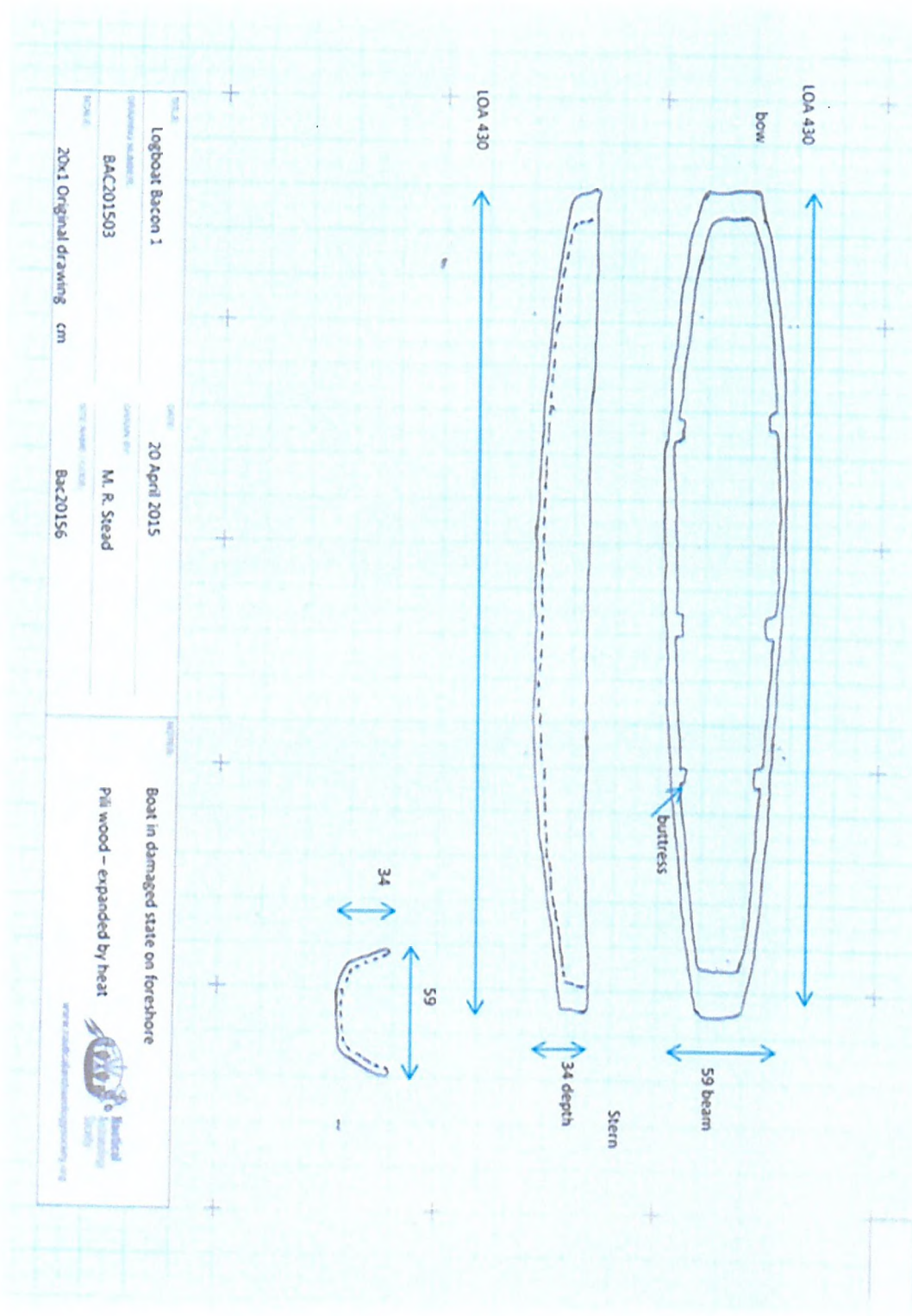


Figure 5.30 Bacon No 1 logboat, drawn by M. R. Stead

Figure 5.31 Barcelona No 2 and 3, photo: M. R. Stead

Figure 5.32 Rizal Beach No 3, photo: M.R. Stead

Figure 5.33 Bulusan No 4, photo: M. R. Stead

Name	Ricardo Atutubo	Jaime Lopez	Antonia Duka	Diogenes Hermo	Nilo Estrada	Jerry Folgosino
Location?		Donsol - riverside	Bacon – Banao Port	Barcelona River	Barcelona Beach	Barcelona Beach 3
Boat?	Not a logboat	Donsol 1 (2 and 3 similar)	Bacon 1 (2 similar)	Barcelona 1 (2, 3, 4, similar)	Barcelona 5	Barcelona 6
Is this your logboat?		Yes	Yes	No	Yes	Yes
Did you build it?		Yes	Yes	No	No	No
Where was it built?		Donsol	Banao Port	Samar	Samar	Samar
Where is it used?		In the river and estuary	In the bay	In the river	In the sea	In the sea
Wood species?		Tangid	Pili	Lawaaan	Lawaan	Lawaan
Cost to build?		P 1.000	P 3,500	P 9,000	P 8,000	P 10,000
Time to build?		One week	One week	I month (elapse time)	1 month (elapse time)	One week
Ease of obtaining wood?		Available up river	Easy	Available on Samar	Available on Samar	Available on Samar
Price if sold?		P 2,500	P 5,000	P 16,000	P 5,000	P 5,000
How old?		Two years	Six years	Five years	Five years	Ten years
How long will it last?		Long life if maintained	Needs repair	Ten years	Ten years	Long time if maintained
Usage?		Fishing	Fishing	Fishing	Fishing	Fishing, traps
How many passengers?		2 people	2 people	10 people	5 people	6 people
Single or double outrigger?		Single Katig	No katig	No katig	No katig	No katig
Outboard motor?		No motor	No motor	No motor	No motor	No motor
Sail?		No sail	No sail	No sail	No sail	No sail
Expanded?		Expanded by heat	-	Not expanded	Not expanded	Not expanded
Additional washstrakes?		No, but gunwhale	No	No	No	No
Tools?		Ax, adze	-	-	-	-
How stable?		Stable	Stable	Stable	Yes	Stable with katig

Figure 5.34 Interview results

Table of Historic Logboats as Observed in Museums and other Collections							
Name	**Location**	**Type**	**LOA**	**Age**	**Timber**	**Drawing**	**Photo**
Butuan	Regional Museum	baroto	4.88	?	?	Yes	Yes
Butuan	Regional Museum	tango	4.14	?	?	Yes	Yes
Rosales logboat	Rosales Pangasinan	'logboat'	7.1m	400 years	bitaog	Yes	Yes
Cebu logboat	Yap- San Diego house	logboat	7.0m	?	?	Yes	Yes
Southampton logboat	University collection	logboat	5.7m	80 years	lauan	Yes	Yes
Oxford models	Pitt Rivers Museum	Two models	na	150 years	?	No	Yes
Siliman University	Dumagete Negros	logboat	6.0m	?	?	No	Yes

Table of Logboats studied in the field in the Philippines

Name	**Location**	**Size**	**Timber**	**Outrigger**	**Drawing**	**Photo**
Mainit 4	Lake Mainit	5.00 x 0.44	Lauan	No	No	Yes
Mainit 5	Lake Mainit	6.70 x 0.60	?	No	Yes 5.xx	Yes
Mainit 6	Lake Mainit	na	Lauan	Yes	No	Yes
Buhi 1	Lake Buhi	na	?	No	No	Yes
Donsol 1	Donsol	3.74 x 0.44	Tangid	Yes	No	No
Donsol 2	Donsol	3.79 x 0.54	Antipolo	Yes	Yes	Yes
Donsol 3	Donsol	3.79 x 0.44	Talisa	Yes single	No	No
Donsol 4	Donsol	na	?	Yes single	No	No
Donsol 5	Donsol	na	?	Unfinished	No	No
Bacon 1	Bacon	4.30 x 0.59	Pili	No	Yes	Yes
Barcelona 1	Barcelona	na	Lauan	No	No	No
Barcelona 2	Barcelona	na	Lauan	No	No	Yes
Barcelona 3	Barcelona	na	Lauan	No	No	Yes
Rizal Beach 1	Barcelona	5.82 x 0.55	Lauan	No	No	No
Rizal Beach 2	Barcelona	na	Lauan	No	No	No
Rizal Beach 3	Barcelona	na	Lauan	No	No	Yes
Bulusan 1	Bulusan	na	?	Yes single	No	No
Bulusan 2	Bulusan	na	?	Yes single	No	No
Bulusan 3	Bulusan	na	?	Yes single	No	No
Bulusan 4	Bulusan	na	?	Yes single	No	Yes
Bulusan 5	Bulusan	na	?	Yes single	No	No
Bulusan 6	Bulusan	na	?	Yes single	No	No

Figure 5.35 Tabulated results of logboat studies

Questionnaire Used in Survey of Philippine Logboats

This is a survey of logboat use in the Philippines for a research project on Philippine traditional boats. The data will only be used for university research purposes. The questionnaire is totally voluntary, but we would be grateful for your answering a few basic questions.

This questionnaire will be translated into Tagalog and Visayan as well as being made available in English.

1. Is this your logboat? (baloto or bauto)
2. Did you build it?
3. Where was it built?
4. Where is it used? River, lake or sea?
5. Do you know which wood species it is made from?
6. How much did it cost to build?
7. If you made it yourself how much time did it take you?
8. How easy is it to get suitable logs for making logboats?
9. What would it be worth if you chose to sell it?
10. How old is it?
11. How long will it last?
12. What do you use it for? Fishing? Transport? Ferry?
13. How many people does it usually carry?
14. Is it usually rigged with a single or double outrigger?
15. Do you use an outboard motor for this logboat?
16. Do you use a sail on this logboat?
17. Was the boat expanded through the use of steam or heat? If so how?
18. Do you ever fit additional wash strakes to increase the freeboard?
19. What tools do you use in constructing the logboat?
20. How stable is your boat?
21. Do you have any comments on logboats from other islands in the Philippines?
22. Did your family always have logboats?

Figure 5.36 English version of questionnaire

CONSENT FORM *(FACE TO FACE)*
Version 2015/1: 23/1/2015

Study title: Ethnographic Survey of Logboats in the Philippines

Researcher name: Martin Roderick Stead
Staff/Student number: 22928871
ERGO reference number: 13579

Please initial the box(es) if you agree with the statement(s):

I have read and understood the information sheet (participant information sheet) and have had the opportunity to ask ☐

I agree to take part in this research project and agree for my data ☐

I understand my participation is voluntary and I may withdraw at ☐

Data Protection
I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be made anonymous.

Name of participant (print name).....

Signature of participant.....

Date.....

Tagalog and Visayan translations also to be used in the field

Figure 5.37 English version of consent form

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Dr. Roderick Stead

Report Date: 5/15/2013

University of Southampton

Material Received: 5/6/2013

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 348245 SAMPLE : CR0102013011 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (wood): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1480 to 1650 (Cal BP 470 to 300)	310 +/- 30 BP	-25.0 o/oo	310 +/- 30 BP
Beta - 348246 SAMPLE : CR0102013014 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (wood): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1480 to 1650 (Cal BP 470 to 300)	330 +/- 30 BP	-26.0 o/oo	310 +/- 30 BP

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

Figure 5.38 Radiocarbon dating report on Rosales logboat

Chapter 6: The Plank-Built Boats

6.1 Introduction

According to the accounts of the Spanish and other European visitors, the larger vessels in the Philippines in the sixteenth century were plank-built boats. We are particularly indebted to Fr Alcina for a detailed account of how these boats were built and sailed (Alcina, 1668: especially Part 1, Book 3, Volume 3). In the Spanish records these vessels were analysed into various classes differentiated by role and size, but these variations were not clearly defined and with the scarcity of archaeological material the various classes are not easy to distinguish. The military versions of the plank-built vessels, the caracoa and the joanga, will be discussed further in Chapter 7.

These plank-built vessels were all powered by paddles, oars or sail and usually a combination of those. As discussed below, the planks were hand carved and not sawn, as the saw does not seem to have been in use in the Philippines until introduced by the Spanish and by Chinese immigrants (Scott, 1994). Rather than bending the planks to the shape of the curve of the hull, the planks had to be carved into the appropriate shape by hand and eye, requiring a high level of skill in the carpenters. This carving into curved hull shape is known in Visayan as lubag (Alcina, 1668, Book 3: 169).

According to Alcina (1668) and de Morga (1609), the usual method of fixing the planks together was by the use of circular dowels fitting into the edges of the strakes. The size of these dowels was about 2-3 cm in diameter. The dowels were also used to fix the strakes to the bow and stern posts (Figure 6.1). The stepped indented wing stems, fore and aft, were used to seat the strakes and attach them to the stem and stern posts (as can be seen in Figure 6.1 and which will be discussed below).

The dowels were not adequate alone to hold the boat together, so the boat strakes were then lashed together using carved lugs, called tambuko, left for that purpose on the inside of the planks. Figure 6.2 shows a replica set of tambuko in the National Museum.

A series of framing timbers or ribs, called agar in Visayan, and thwarts, were lashed to the tambuko to create a strong hull structure. As noted in the

Introduction, Horridge coined the phrase the 'lashed-lug design' for this style (Horridge, 1978). He argued that the key features of this tradition were:

- the shell-first construction on a keel or dug-out foundation
- edge-dowelled planking of hardwood carved to shape
- lugs carved in situ in transverse rows across the inside of the boat
- flexible frames placed in tension to compress the planks together
- transverse thwarts also lashed down to the lugs and rib-ends to squeeze the hull.

The tradition of leaving tambuko in the planks was entrenched and vestigial tambuko are reported even in vessels when they have no function (Scott, 1981: 5). According to Alcina all the larger plank-built craft in this indigenous tradition had similar construction techniques based on the lashed-lug technique (Alcina, 1668: 167-195). The construction process of the plank-built boats will be discussed further below, and our understanding of this process relies heavily on the description of Alcina.

The most common types of plank-built boats appear to have been the balangay and the caracoa, the general cargo and raiding versions of this design (based on Alcina, 1866: 207, 202-203, and the number of times these vessels are mentioned in the early Spanish sources according to Blair and Robertson, 1903-7: index). Other plank-built boats built in a similar style included cargo vessels such as the virrey (virey, biray, takuli or bileg) (de Morga, 1609: 252-3). As we do not have detailed descriptions of these ship types nor archaeological examples it is difficult to specify how they differed.

6.2 Balangay Boats

Early European visitors to the Philippines reported and described the balangay boats. The first detailed reports were from the voyage of Magellan. The account of Pigafetta, the chronicler of this voyage, was translated and published by Lord Stanley of Alderley in the nineteenth century. Pigafetta records "we came upon two long boats, which they called ballanghai, full of men. In the largest of them was the king sitting under an awning of mats" (Pigafetta, 1874: 76). He also records a conference near Samar in the Visayas where Magellan landed "the

king... led us under a place covered with canes, where there was a ballanghai, that is to say, a boat, eighty feet long or thereabouts, resembling a fusta. We sat with the king upon its poop" (Pigafetta, 1874: 78).

The fusta was a kind of light galley from this period, used mainly in the Mediterranean, with a single mast, a lateen sail and up to 18 oars (Figure 6.3). Villalobos certified the receipt of a fusta, the San Martin, as one of six vessels provided for his voyage to the Philippines in 1542 (Blair & Robertson, 1903-7, vol. 2: 60).

The spelling of balangay took various forms in the early accounts, perhaps due to Pigafetta preparing his original account in Italian, with subsequent translations into French and Spanish. Most of the modern versions of his chronicle are based on French texts, such as the 1525 Paris imprint (which has been reproduced in facsimile by the University of Michigan). The word appears as balangay, barangai, ballanghai or barangay in various sources. There is no doubt that the etymological source of this word is linked to the expression in Tagalog, barangay, used for the smallest political unit of Philippine society, which is consciously modelled on a boat crew (Scott, 1994: 4-6).

Alcina uses the term barangay and described the vessel as follows "Barangay is what they call the next larger in size and proportion. The vessels bearing this name are the lightest that were used and are still being used by these natives here. They are built upon a square keel, adding boards for the side. They are completed with low sides suitable for rowing..." (Alcina, 1668: 200-203). It is unclear from the text what Alcina is comparing against, but this may refer to logboats.

Apart from Alcina there were frequent descriptions of these vessels in other early accounts, notably in the *Sucesos de las Islas Filipinas* of Antonio de Morga (de Morga, 1609: 190). He uses the term barangay or 'varangayes' and describes them as "certain quick and light vessels that lie low in the water, put together with little wooden nails. These are as slender at the stern as at the bow and they can hold a number of rowers on both sides".

These early accounts indicate that they were general purpose cargo-carrying vessels and widely used in inter-island trade. They were propelled by rowers or paddlers and by sail (Scott, 1981: 5-10).

The balangay has not survived to the present day, but a number of more modern types of plank-built wooden craft show some influence from this tradition. Many of the boats used as houseboats by the sama (or sea gypsies) in the Sulu Sea had similar features to the balangay in that they still used carved planks, dowel fittings and a frame to hold the strakes together (Peralta, 1980: 42, Nimmo, 1990).

6.2.1 Discovery of Examples of Balangay Boats in Butuan

No original examples of the balangay were known until a fortuitous discovery in Butuan City in Northern Mindanao uncovered about twelve plank-built vessels which were immediately identified as balangay boats (see Figure 6.4 for the location). These were immediately assumed in the Philippines to be the class of boat described by Pigafetta, and this identification has not really been challenged by subsequent writers such as Scott (1981), Peralta (1980) and Green et al (1995). However the article by Clark et al (1993: 143) preferred the nomenclature of Butuan boats to leave this identification open.

Archaeological materials were initially found near the estuary of the Agusan River in 1974 by the Butuan City engineers who were draining seasonal flood water from the low-lying land near the Masao creek. Excavation of fish ponds in the local area also produced evidence of ancient burials. These accidental discoveries were reported to Xavier University in Cagayan de Oro and a series of archaeological excavations were carried out from 1975 to 1977 by staff and students from Xavier University and Mindanao State University. A report on these excavations was prepared by Dr Linda Burton (Burton, 1977: 95-112). The sites revealed a number of burials with extensive grave goods, including porcelain items from the Yuan period (thirteenth to fourteenth centuries) and the Ming period (fourteenth to seventeenth centuries). A settlement area with middens was also located. The material culture excavated here included sherds, iron slag, ornaments and animal and marine remains.

The discovery of undisturbed burials, with valuable imported ceramics, caused a surge in illegal excavations to loot cemeteries in the area (personal communication with the staff of the Regional Museum in Butuan who participated in the original excavations). The activities of the pot hunters, using sounding rods and test pits, destroyed much of the archaeological potential of the area, but

turned up a number of timber boats preserved in the estuary mud and silt. As these had no commercial value they were reported to the National Museum.

It is not surprising that these vessels were discovered at Butuan as this was a well-known trading port in the pre-Hispanic era, and this area, called the Caraga, was an important source of gold (Scott, 1994: 164-165; Hontiveros, 2006: 15-19). The first recorded trade mission to China from the Philippines was despatched in 1001 AD from Butuan (Pu-duan in the Chinese sources). The Song Shi (Sung History) describes it as a small country with regular contact with Champa (ancient Vietnam) an established Chinese trade partner. The king of Pu-Duan was named as Kiling (Qi-Ling). (Scott, 1989: 3 and Appendix 1).

6.2.2 The Geophysical Environment of the Site

The Agusan River delta is an area of extensive deposition of sand and silt. The evolution of the estuary has been traced in detail by a geophysical report (Javelosa et al., 2002). The site where the boats were found is a waterlogged, marshy forest, mixed with coconut, banana and nipa palm trees exploited by local people (Figure 6.5). In some areas it has been cleared for fishponds, which will have destroyed the subsurface deposits. All the boats were found buried in one to two metres of silt, within a two kilometre radius around a paleo channel which survives as the narrow Masao Creek. The sites are some distance from the present channel which indicates that it was considerably wider at the date of hulking, or that it has subsequently changed its course. The high water table means that this is a difficult area to excavate, but this is, of course, the key to the preservation of the timber structures.

In the course of the excavations the subsoil was found to be in two basic strata. A higher clay layer of brown/black composition and a thickness of about 1.5 metres depth appears to have been laid down in a largely fresh water environment. The lower layer is an olive coloured silt-clay mix, which could have been laid down in a brackish or fresh water environment. The boats seem to have been found close to the interface of these strata. None of the sites was marked on the ground and it is difficult to correlate the excavation sketch maps to modern topographical maps. Even the memories of those who participated in the original excavations are unclear given the lack of landmarks in the marsh.

It is not clear the extent to which illegal pot hunting has disturbed and contaminated the sites as a large number of pits have been dug looking for ceramics. It is likely that the stratigraphy has been disturbed around most of the vessels, which would affect the reliability of a chronology based on stratigraphy and C^{14}dating of related deposits.

Most of the early information available is contained in unpublished excavation reports in the National Museum files (Abinion, 1977 and 1978; Alegre, 1976; Bautista, 1983 and 1988; Dizon, 1977; Peralta 1977-1980; Salcedo, 1976 and 1977; and Galpo, 1981, 1982 and 1983) The published accounts are more brief and incomplete, such as Peralta (1980).

6.2.3 The Boat Discoveries

A total of perhaps twelve hulks or wreck fragments have been reported in total. The first nine vessels were identified by serial numbers 1 to 9, and subsequently two further boats were reported (Cembrano, 1998: 4). There is some confusion between the early reports as the numbering has been duplicated and location of the sites was not properly recorded. A further vessel was discovered in the current excavation which was labelled as 9, despite earlier use of this number (personal communication with M.J. Bolunia, in charge of the recent excavations). All these discoveries (apart from the recent ship find) were accidental or due to the activities of illegal pot hunters. The original discoveries indicated without doubt that this was one of the most significant maritime archaeological sites in Southeast Asia from the pre-colonial era. The importance of these discoveries was recognised immediately and the early moves by the National Museum to excavate and conserve the first two vessels were commendable, even though the initial archaeological recording was not of a good standard (Peralta, 1980: 41-48). The importance of the discoveries was confirmed in 1986 when they were declared as 'National Cultural Treasures' by President Corazon C. Aquino under Presidential Proclamation No 86.

There are extensive displays on these vessels in the National Museum in Manila and in the Regional Museum in Butuan City. The first vessel is now the focus of the 'Balangay Shrine', a site museum situated where Boat No 1 was excavated.

Despite the prominence and fame of these discoveries, no proper excavation reports have been published to date on any of the Butuan boat discoveries,

although, as mentioned above, a number of unpublished notes are available in the archives of the National Museum with a series of excavation photographs and plot plans. The deficiencies of the original recording have been compensated in a recent resurvey of vessels 1, 2 and 5 by Lacsina and including a redrawing of the timbers, wood identification tests, carbon dating re-testing and model building, which are documented in her thesis 'Examining pre-colonial Southeast Asian boatbuilding: An archaeological study of the Butuan Boats and the use of edge-joined planking in local and regional construction techniques' (Lacsina, 2016) now available on line. This exhaustive work has repaired many of the deficiencies of the internal excavation reports and corrected a number of errors or inconsistencies in the original reports.

The initial excavations mostly took place over a generation ago and no site identification marks or landscape features are available to fix the sites exactly. The sites were in three groups in three separate properties. The site maps from the original excavations are essentially sketch maps, which are difficult to tie in to modern topographic maps. Whilst boats 1, 2, 4 and 5 are well located, it is not always possible to identify exactly where the other boats were discovered, and partially excavated, and where these vessels lie.

The first vessel (No. 1) was excavated in 1976, and, following conservation treatment with PEG, has been displayed in a glass case at the 'Balangay Shrine', a museum run by the National Museum, just next to the original discovery site (Figure 6.6). The plank hull was composed of a keel plank and three other strakes. The dowels were locked into place using hardwood nails and the hull was reported with a length of approximately 15 metres and beam of approximately 4 metres (Peralta, 1980: 43). A winged post element was found and is available for study. A portion of what appears to be a quarter rudder has been retained, but is of uncertain provenance. The original C^{14} dating of this hulk indicated a surprisingly early date of 320 CE, +/- 110 years (Ronquillo, 1987: 71-78) as the ceramics associated with the excavation seemed to suggest a much later date, but the depredations of the pot hunters may have disrupted the stratigraphy (Peralta 1980: 44). A paddle was reported from this site but has been lost (Peralta in an unpublished file note of 1976). There was surprisingly little analysis of the vessel, considering it was the first discovery, until the recent resurvey by Lacsina (2016).

The second vessel (No. 2) was discovered in 1977 (Figure 6.7). This vessel is of a similar size, about 14 metres long with a comparable design. This vessel was originally given a C^{14} date of 1250 CE +/- 90 years (Ronquillo, 1987: 71-78). The vessel has been comprehensively recorded by an Australian/Filipino team working in the National Museum in 1988, including a photo mosaic (Figure 6.9) and a plan drawing of the timbers derived from the photos (Clark, P., Green, J., Vosmer, T. and Santiago, R., 1993: 143-159). A winged keel element was found on this vessel. The dowels were not locked in contrast to vessel No 1. This survey was seriously hampered by being carried out with the remaining timbers in the National Museum long after the initial excavation. A series of hooked scarf joints were observed on these strakes. The boat is now exhibited in the National Museum in Manila in a partially reconstructed state (Figure 6.8), although currently disassembled as the display is rebuilt. A loose timber was reported from this excavation which may have been part of a mast (Peralta, 1980).

The third vessel (No. 3) was represented by only three planks and these suggested a rather smaller boat. This vessel was not excavated and was reburied. Boat No. 4 was discovered after damage from pot hunters. This vessel has recently been re-excavated by the National Museum. The choice of this vessel for re-excavation was due to this being considered the best preserved of the unexcavated vessels. This boat appears to be similar in design to vessels 1 and 2 (Figure 6.12).

Vessel No. 5 was probably the most intact and complete vessel excavated and is retained in Butuan in pieces. It is currently the subject of further conservation efforts (Figure 6.10). The hull had a length of 13 metres including a keel plank of 11.5 metres, indicated by a ridge instead of carved lugs (Lacsina, 2016). There were some seven strakes identified on each side of the keel and a winged stern. There were also some remnants of frame timbers. The dowels on this vessel were locked by hardwood pins. This vessel was originally dated to 990 CE +/- 70 years (Ronquillo, 1987: 71-78). A plan drawing of the timbers of this vessel from the National Museum archives is reproduced in Figure 6.11. This was drawn by Ronquillo and reproduced by Clark et al, (1993: 145).

Vessel No. 7 was partially uncovered in 1980 and showed severe deterioration of the planks. Samples were taken for dating but no results have been noted (Bautista, unpublished note dated 1980). Vessels numbers 6, 8 and 9 have not

been excavated. Subsequently two further vessels are reported to have been discovered, but have not been formally numbered (Cembrano, 1998: 4).

6.2.4 Site Formation Process

There remain major uncertainties about the site formation processes in Butuan. There is very little evidence from the excavations as to whether these vessels had outriggers and masts. This probably reflects the theory that they were hulks and such equipment would have been stripped. The lack of finds of shipboard equipment in the excavations would seem to support this interpretation. Even frame timbers are missing on most vessels, which may indicate scavenging for reusable timber from these hulls.

However, there is very little damage to the timbers from wood borers and crustaceans. If the vessels had been abandoned in a seawater or brackish environment it would be likely that the timbers would show considerable damage. Perhaps the environment was fresh water at the time or perhaps the vessels were rapidly covered with silt. An alternative explanation is that of a catastrophe overwhelming the port. However this cannot be reconciled with the spread of dating evidence of the excavated vessels (see the new dates suggested below) as such a catastrophe would produce wrecks of similar date. A discussion with the experts at the National Museum (Ronquillo, Dizon, Bautista and the author in 2014) did not resolve this debate. Perhaps the current excavation of boat No. 4 can help to clarify this.

6.2.5 Recent Site Re-Excavation

In 2011 there was a presentation to the Asia-Pacific Regional Conference on Underwater Cultural Heritage held at the National Museum in Manila by the author and Dr Dizon of the National Museum, which was subsequently published in the proceedings of the conference (Stead & Dizon, 2011). This paper reviewed the historical excavations at Butuan and urged the Museum to re-open these excavations. There was considerable concern that creeping urbanisation would seal the site and prevent further investigation. It was also considered that the dating of the boats was subject to severe doubts and that further C^{14} testing of the boats should be carried out, even though two of the vessels had subsequently been conserved with P.E.G. treatment.

Following this suggestion a further campaign of excavation at the site was carried out from 2012 around the site of boat no 4 and this vessel was rediscovered. It appears to be similar in size and style to boats no. 1 and no. 2.

The surprise was the discovery of a larger vessel underneath boat no 4. This vessel keel is built of narig (*vatica mangachapoi*) a timber native to Mindanao, but also common through Southeast Asia. This vessel has been identified as boat No 9, which is a rather confusing nomenclature given the earlier numbering system. The style of boat No. 9 is unlike the other vessels and uses treenails to hold the hull together. Potentially this is a newly discovered class of vessel.

A full publication of the results of the last few seasons is awaited from the National Museum as this could amplify knowledge of the site and its place in the development of these plank-built ships.

6.2.6 Re-Dating and Re-Evaluation of the Excavations

In association with this further excavation a series of C^{14} dating tests has been carried out by Lacsina of the National Museum on boats 1,2,4,5 and the new vessel 9 (Lacsina, 2016: 143-200). The results have now been published, and the dates produced are all in the range 698 to 974 AD. The results for boats no. 1 and no. 2 should be treated with caution as the vessels have been previously treated with PEG. Overall these results are completely at variance with the earlier dates, but are more credible given the much closer range of dates. This range is still too broad to justify a single date of wrecking for the examples found.

A report was also commissioned by Ms Lacsina on wood species identification from the Forest Products Research and Development Institute in Laguna. The results of this analysis show a wide range of timber used including manggachapul (*hopea sp.*), narig (*vatica sp.*), sangilo (*pistacia chinensis*), molave (*vitex parviflora*), narra (*pterocarpus indicuus*), alupag (*dimocarpus sp.*), malugai (*pometia pinnata*), toog (*petersianthus quadraticus*) and tambulian (*eudsidederoxylon zwageri*). These are species of hardwood timber common in the Philippines. The results of these tests have now been documented in her thesis which is available on line (Lacsina 2016).

6.2.7 Balangay Boat Construction

How closely do the Butuan boats resemble the balangay vessels described in Alcina, de Morga and other texts? With the exception of boat 9, there are clear similarities between the Butuan boats and the references in the Spanish texts (Pigafetta, 1874; Alcina, 1668; de Morga 1609). They are built with dowels and the lashed-lug technique. However they all appear to have a keel plank rather than a prominent keel projecting below the hull. The tambuko follow similar patterns between the vessels with a smaller lug design in the keel plank as compared to the main strakes. Boat no 5 has a raised ridge on the keel plank rather than tambuko. The length of the vessels varied between 10 metres and 15 metres. These vessels seem to have used consistently a wing end fitting for fastening the strakes to the bow and stern. The description of Alcina (1688: 200-203) seems consistent with these vessels, except that there is no mention of such a wing end in the Alcina account. The dates as retested all fall into the period of the seventh to tenth centuries AD, much earlier than these descriptions from the sixteenth century. Given this elapse of time during which we have no information, the correlation between the archaeological remains and the descriptions seem to be close. It is possible that other boat remains could be unearthed at Butuan to add to our knowledge of this tradition and perhaps bridge the gap in the sequence.

6.2.8 Replica Balangay Boats

Since 2009 there have been three separate replicas of balangay boats built in the Philippines by various ad hoc groups. A series of voyages were undertaken in Philippine and South East Asian waters with the first replica to demonstrate the seaworthiness of the design. The first vessel, illustrated in Figure 6.13, has been preserved in Manila and put on permanent display outside the National Museum. This was meant to replicate the design features of the Butuan boat. No outriggers were rigged during the experimental voyages.

6.3 Shipwreck Archaeology

A number of ancient wrecks have been found underwater off the Philippines. These include a few reported as resembling balangay boats (discussions with Brian Homan at Subic Bay and with E. Dizon). However none of the finds of indigenous, pre-colonial vessels have been adequately documented to date.

6.3.1 The Gujangan Wreck

This wreck was found off Gujangan Island in the Sulu Province of the Southern Philippines in 1998. This appears to have been a balangay similar to the Butuan boats. The limited wooden remains show the use of dowels and the lashed lug construction style and the size of the vessel is similar to the balangay boats. The Ming Dynasty sherds found on the wreck indicate a fifteenth or sixteenth century date (Brown, 2004: 42-55).

6.3.2 San Isidro Wreck

A boat wreck discovered at a depth of 42 metres off Barangay San Isidro, Zambales Province in Western Luzon in 1996 appears to be related to the balangay boat type (Far Eastern Foundation for Nautical Archaeology Report, 1996, which does not appear to have been formally published). There is no evidence of outriggers or means of propulsion. Only a small portion of the hull survives, but this does demonstrate small lugs for lashing the hull together. The use of dowels or battens indicates a typical shell-first construction. The wreck shows part of the keel with a scarf fitting for the strakes. There are reports that the strakes were sewn together using rattan and bamboo strips. The strakes also appear to show a kind of clinker-built style which is rare in the Philippines. The wood used was narra for the keel and molave for the planks, both native to the Philippines.

The cargo of this wreck was mainly Ming period ceramics which would indicate a sixteenth century date. There were also extensive remains of iron bars, presumably part of the cargo. There is no evidence of ballast so the cargo was probably sufficient to ballast the vessel. The excavators concluded that this was probably a local boat being used to distribute Chinese cargo through the islands). Apparently the Franck Goddio organisation is planning to publish a full report on this site but this has not yet appeared (personal communication from M-A Coignard of the Far Eastern Foundation in Hawai'i, 2015).

6.4 The Sewn Boat Tradition

This section will discuss the small group of plank-built boats in the Philippines which used the sewn style to hold the strakes together using pliable cord, withies or rattan.

Sewn vessels can be defined as vessels where the hull is secured by cord or flexible bindings which pass through holes bored for the purpose in planks (Manguin, 1985: 319). Prins in his *Handbook of Sewn Boats* (1986) reaches the conclusion that 'the distribution (of sewn boats) is, or once was, almost worldwide, the three classical areas have been the Arctic, the Indian Ocean, and the Pacific' (Prins, 1986: 19).

Prins suggests a classification of sewing techniques in order to organise the extensive data on this topic (Prins, 1986: 23-29). He divides the sewing technique into continuous, semi continuous and discontinuous, depending on the length of the stitching used. He further separates the threading technique into single, doubling back and looping. The hull structure can be either carvel or clinker style. The sewing can be the full hull or a partial cover only. In all Prins has identified sixteen permutations in sewing technique.

The sewn technique has clearly been used extensively around the Indian Ocean, especially in India and Sri Lanka. One of the contemporary examples is the Masula surf boat which has been widely used on the Indian coast (Kentley, 1996: 247-260; Vosmer, 1999) and is illustrated in Figure 6.14.

Manguin has pointed out that the technology of sewing planks together and the lashed-lug technique are rather similar in style and both can use dowel fastenings to attach the strakes together (Manguin, 1985: 333-335). Kentley suggests that dowels may have been introduced originally simply as pins to match up the planks (Kentley 1996: 254). In the Philippine vessels they were certainly an important structural tool to stop fore and aft movements in the strakes as noted by Alcina (Alcina, 1668: 173).

6.4.1 Sewn Boats in the Indian Ocean

The use of sewn boat technology has been a feature of ship technology for the construction of planked craft in the Indian Ocean from the earliest known vessel types. Casson, talking of sewn boat technology, indicates that "its particular home has been the Indian Ocean, where it was the boat-building technique par excellence right up to the end of the fifteenth century, when the arrival of the Portuguese brought in contemporary European methods" (Casson, 1995: 9).

The earliest known account of these vessels, probably from the first century AD, is in the *Peryplus of the Erythraean Sea* (Casson, trans. 1989: 15, 16 and 36). The use of the technique amongst the Arabs was described by Hourani in his classic account of Arab seafaring (Hourani, 1995: 92-97). The Al-Hariri illustration of a medieval ship from the *Maqamat Al Hariri* illustrates the sewn technique as used by the Arabs in the thirteenth century (see Figure 6.15) (Al-Hariri, 1237).

6.4.2 Sewn Boats in Southeast Asia

The subject of sewn boats in Southeast Asia is less well documented. The most useful summary is in Manguin's original paper from a conference held in Greenwich in 1984 (1985: 310-343) and his recent review of this topic (2017). Manguin reports that the stitching style in Southeast Asia uses individual, discontinuous fastenings contrasting with the continuous style used in Arab and Indian Ocean vessels.

The most extensive area for sewn vessels in Southeast Asia is Vietnam, which had a tradition of sewn boats (Pâris, 1841: 49-50, 46-47) which has now largely disappeared. These vessels seem to have been associated mainly with the Cham culture, an Austronesian group who inhabited the central coastal area of modern Vietnam. There are historical reports of a maritime cargo vessel using the sewn boat technology and known as the thuyên gia, or sinja, of up to 25 metres in length. This class was described by Sir John Barrow in 1793 as row-galleys, but appear to have disappeared thereafter (Barrow, 1806: 283, 319). Barrow reported that there was a fleet of 100 row-galleys in the forces of the King of Cambodia in 1800. Smaller sewn vessels have been used until recently on the Vietnamese coast such as the ghe-nôc and the thuyên song (Pietri, 1949: 17, 19). These had frameless, flat-bottomed hulls and were sewn from the inside with wooden wedges over the seams, but without dowels. There is also a tradition of sewn canoes on the rivers of Borneo using a series of individual lashings rather than a continuous sewn thread (Nicolaisen and Damgard-Sorensen, 1991: 66-76). There is a much earlier description of Sea Dyak sewn vessels in the same tradition from the nineteenth century (Horsbough, 1858: 36).

An interesting example from the Malay Peninsula is a vessel found at Pontian in Pahang, which was excavated in 1926 (Evans, 1927: 93-96). This vessel was dated to early in the first millennium AD and has both sewn boat fastenings and

ribs lashed to lugs projecting from the strakes (Gibson-Hill, 1952: 111-133). Manguin points out that the unusual feature of this vessel was to find dowels between the strakes with sewn timbers as well as ribs lashed to protruding lugs on the planks. The sewn tradition and the lash lug tradition were therefore combined in this hull (Manguin, 1985: 333).

In Sumatra there are two further sites with indications of sewn hulls combined with lashed ribs, at Kolam Pinisi and Sambirejo, both near Palembang (Manguin, 1993a). These examples also show evidence of treenail connections (less numerous than proper dowelled strakes) sewing of the timbers and a lash-lug framework.

In 2008 a boat was discovered at Punjulharjo in Java, dating from the seventh or eighth centuries AD which has some similarities to the Pontian vessel in that it shows dowel fastenings, a sewn hull and lugs for fastening ribs or frames (Manguin, 2009).

6.4.3 Sewn Boats in the Pacific

Archaeological traces of boats from Oceania are very rare (Hornell, 1932) and Hornell considered the oldest boat preserved from this region to be a sewn boat in the British Museum recovered from the Tuamotus in 1767. This canoe has a length of 3.90 metres and a beam of 0.69 metres (Figure 6.17).

McGrail (2001: 322) considers that the usual fastening for Pacific plank boats was a sewn hull, although some did use wooden pegs in the construction process. In most environments in Oceania the wood supply was very limited and care was exercised to minimise the amount of wood required. A particularly fine example of a sewn canoe is the mon from the Solomon Islands. Hornell describes a canoe very similar to the mon on Botel Tobago, an island off Taiwan which is close to the Batanes Islands of the Philippines (Hornell, 1922). This is a war canoe, and is a sewn vessel but supported by frames lashed in to provide lateral support (Hornell 1970: 208-209; Nicholson 1999: 12-13).

6.4.4 Sewn Boats in the Philippines

In contrast to the wealth of sewn boat evidence in other areas of the Indo-Pacific region, the evidence from the Philippines is much more limited and no evidence

was found of sewn boats still in use. There are various traces of the use of sewn boats in the Philippines summarised by Manguin in his original paper and updated recently (Manguin, 1985, 2017). An early Tagalog dictionary (Pedro de Buenaventura, 1613) is quoted in Scott's paper (Scott, 1981) and amongst many useful maritime words has a number of terms which appear to describe sewn boat construction, such as bitic and sisic, meaning to sew and caulk boats with coconut fibre, but this remains ambiguous.

The barangayan from the northern coast of Luzon (Aparri) is an example of sewn boat technology. This was sewn using rattan cord and was composed of five strakes, a bow timber and a transom stern. The timbers were caulked with coconut fibre (Scott, 1981: 339). This style seems to have disappeared as no examples have been found recently and none are known from the archaeological record.

A further example is quoted by Scott from the Dumagat minority in Camarines (Southern Luzon). He reports that they used to produce a small sewn vessel called a benitan in the early twentieth century. This was reported as usually nine metres in length, with sewn overlapping strakes. This type has now disappeared (Scott, 1981: 339).

The barangay (not linked to the balangay) is a plank-built river boat in the Cagayan Valley of Northern Luzon similar to the barangayan. This was originally a sewn boat with two floor planks and a single strake on either side (Figure 6.18). This is now built with sawn timbers and nails, but on traditional lines (Ronquillo, 2007).

The virey or virrey, which comes from a similar area of Northern Luzon, was used as a local cargo carrier in Ilocos into the twentieth century and has been identified as a sewn vessel, even though no examples survive today (Cuevas & Santiago, 2004).

The largest number of references is to a class of sewn vessels, the casco, which survived until well into the twentieth century and is reported mainly from Luzon. This was a kind of lighter used as a houseboat and an inshore cargo carrier in Luzon. It was also used to assist in loading and unloading cargo in Manila Bay (Pâris, 1841:67) It appears to have disappeared after the Second World War and there are no surviving examples and no known traces in the archaeological

record. However it seems to have been used extensively in the nineteenth and early twentieth centuries and there are numerous photos available. One photo found by the author in Fort San Pedro shows the casco in use in Cebu, which does imply a wider utilisation for lightering outside the core area in Luzon.

The origin of the casco is a mystery. The vessel has a Spanish name, which means generically a helmet or ships' hull, but there are no known references to this name in this context before 1800, and no local name is recorded. In the Spanish records there are numerous references to the gabarra, the standard Spanish term for a barge, but it is unclear if this category included the casco (Blair and Robertson, 1903-7: Index).

The casco was described by Pâris as 'a cargo vessel, which sailed on the lake (Laguna de Bai) and the Pasig River, which would only go to sea during the calm days of the North East Monsoon. Rectangular in shape, the bow alone is slightly elevated and the stern with a long rudder is flat; the frame is formed with large planks stitched irregularly with small flat lashings covered with white caulking: the extremities and the bottom corners are strengthened by knees carved into the hull and the top of the stern is sometimes a nailed down plank.' (Pâris, 1841: 67, translated by the author) (Figure 6.19). The Laguna be Bai and the Pasig River are both in Manila.

The casco is described in the early twentieth century by Skinner, an American doctor, in an article in an anthropological journal, which discussed a medical condition suffered by users of this vessel. The feet were deformed by the life style on board, with walking continuously on the bamboo platforms of the sponsons from which the casco was punted (Skinner, 1904: 299-302).He described it as two versions; one is a river boat between twenty feet and a hundred feet in length, and a larger sea-going version. There were seven pieces to this vessel, a bottom plank, four side strakes, a bow piece and a stern transom. These planks are cut as a single timber from a long tree, with no joints. The planks had bored holes about six to eight inches apart, each one an inch in diameter. The smaller planks were fixed to the bottom plank with rattan bindings. The upper strakes were broader and had an overlap over the lower planks. The stern piece was lashed in last. The holes were caulked with coconut fibre dipped in tar or pitch.

Skinner refers to the bamboo polling running boards or sponson platforms fixed on each side on bamboo cross members as the source of the medical problem.

The crew used these to punt the vessel in shallow water. There was usually a palm leaf covering to protect the crew and cargo. At the stern was a raised steering platform for the helmsman. The bugadores or boatmen used poles with a spike on one end to punt the vessel along.

The casco was also described by Fee in 1910 as "a lumbering hull covered over in the centre with a mat of plaited bamboo, which makes a cave-like cabin and a living room for the owner's family" (Fee, 1910: 44-45). She was impressed by the number of cascos in use in Manila and described them as being moored ten deep along the Pasig River.

One of the best sources on this craft is a model which is preserved in the Musée Quai Branley in Paris. This model is described as a 'sampan de Manille' and was a gift from the French consul in Manila in 1887 to the Musée de l'Homme. A photo of this model appears as Figure 6.20. This model appears to be an accurate representation of the original based upon written descriptions and was analysed in depth by Manguin (1985). His account is very similar to Skinner's but he adds that the flat bottom and two side planks gave the vessel a double chine. There was no frame but there were two transverse rattan braces near the bow and stern transoms and a pair of transverse thwarts. The bottom thwarts were fixed to lugs similar to the lashed lug design, but without the frames. There are close similarities to the ghe-nôc and the thuyên song of Vietnam (Pietri, 1949: 17, 19), which had frameless, flat-bottomed hulls and were sewn from the inside with wooden wedges over the seams, but without dowels. The lack of antecedents in the Philippines and the similarities with Vietnamese types suggests that this may be an imported design in the nineteenth century, but there is no clear archaeological or archival evidence to confirm this.

6.4.5 Origins of the Sewn Boat Tradition

There has been a considerable debate as to whether this sewn boat tradition was a parallel approach to the building of planked boats, or if this was a style which preceded the lashed lug/dowel technology.

Manguin argues that the sewn boat was an earlier style, which was largely replaced in the Philippines by the lashed-lug/dowel technology (Manguin, 1985 and 2017). He stresses the similarity between the use of dowels and the sewn style which both require drilling holes in the strakes, although the dowel holes

are larger than the channels for sewing. The Pontian boat and the Punjulharjo vessel (discussed in Chapter 6.4.2) illustrated a mix of sewn boat, dowel technology and the lashed-lug approach in the first millennium AD.

Horridge and Petersen both suggest that it was the introduction of metal tools that permitted the development of dowel technology as it would have been technically challenging and very expensive in manpower to drill dowel holes using stone or shell tools (Horridge, 1982; Petersen, 2000: 124). However Horridge recently indicated that he considered drilling dowel holes with bamboo packed with gravel, or with special hard wood tools, as being a viable alternative to metal tools (Horridge, personal communication). The date of the introduction of metal tools in the Philippines was in the first millennium BC and the dates suggested by Manguin for the introduction of the dowel/ lashed-lug technology was in the first millennium AD (Manguin, 1993a :260). Therefore a simple typological development from sewn to dowel vessels as a result of metal tools being introduced is not convincing. A more convincing theory is that the dowel and lashed-lug tradition has a longer history in the Philippines than has been accepted in the past and that the replacement of sewn-boat technology has not been demonstrated. A definitive answer is only likely to be found if archaeological examples from the first millennium AD can be located.

6.5 Regional Variations in Design

Considering the design of plank-built boats as a whole, there is evidence of certain regional variations in the Philippine area even when the environmental conditions were similar in most of the Philippines. In Chapter 2.1 there was a brief description of the more difficult sailing conditions in the Batanes Islands, a northern archipelago with stronger winds, higher swell and colder water. A special range of boats were developed by the Ivatan people in this area as described by Dampier (1697: 101,102). These boats were robust, plank-built vessels, sometimes with a logboat base, and range in size from the tataya for one to four crew, the chinarem for seven crew, the faluwa (paluwa) for eleven crew and the chinedkeran for up to twenty eight crew. These boats usually did not have outriggers but did have central rudders because of the high swell. They are also notable as they use oars (rather than paddles), in addition to sails (Uj & Shaw, 2000). The tataya is described as a dowel/lashed-lug vessel (Cuevas & Santiago, 2004).

In the Sulu Sea to the south of the archipelago there are a different range of vessels. This may be a reflection of the stronger Islamic influence and much closer contact with areas further south, including the Moluccas and Brunei. There was a different style of houseboats in this area, such as the djenging, the lepa-lepa, lete-lete or kubu (Nimmo, 1990: 7). These are, however, structurally little different from the dowel/lashed-lug designs from further north, but there is much more decorative carving on display on these houseboats.

In the post-colonial period this area was less subject to Spanish control and a series of pirate or raiding craft were developed from the indigenous tradition, including the garay, the panco and the salisipan, and these were used in extensive raiding throughout the Southeast Asian region (Warren, 1981: 256-258) (Figure 8.8).

6.6 The Evolution of the Modern Banca

How much do the traditional styles of plank-built vessel survive in the modern Philippines? Little has been written on the development of the Philippine boats in modern times, which is surprising given the huge numbers of these vessels still in common use.

The most usual light craft used today in the Philippines is the banca, which reflects an amalgam of traditional Philippine plank-built boats with an admixture of European and Chinese technology. The term banca, in modern parlance, is mainly applied to boats having a narrow, v-shaped hull, like the traditional planked vessels, but now usually built frame-first using timber members or steel bolts and fittings. The hull can be built in metal, but where timber is retained the strakes are now sawn rather than carved timber, and the original dowel fittings have disappeared. The modern adaptation of the banca and the use of imported technology will be discussed further in Chapter 9 and the close similarity of the modern banca to the historic caracoa is illustrated in Figures 9.11, 9.12 and 9.13.

Outriggers of bamboo are still often utilised for these vessels to give lateral stability, which means they are more convenient when operated from a beach rather than a modern jetty.

The masts and sails have largely given way to fitted or outboard motors as a source of power. In the American period these came to be known as pump boats,

because of their noisy engines or perhaps because of the origin of the power unit (Gamsby, 2012). A pump boat is typically an outrigger vessel powered by a gasoline or diesel engine. Smaller vessels can be powered by the sort of small, single-cylinder engine used to drive a water pump. Larger ones can be powered by recycled car or truck engines. Pump boats remain a standard utility boat in the Philippines, used for nearly everything from inter-island transportation, to leisure and fishing. This name has now been adopted from English into the main local languages (Gamsby, 2012).

There is a photo essay on You Tube showing the construction of a modern banca on Malapascua Island, Northern Cebu (You Tube: A Filipino Pump Boat built on the beach by Evolution.m4v). The author carried out a research visit to Malapascua in 2017 to observe the construction of bancas (Figure 9.13) The builders still use lauan for the keel, tugas wood for the stem and stern and apitong for the framework (personal site interviews in Malapascua).

Thus the tradition of the pre-colonial vessels lives on in the Philippines, albeit with practical adaptations to the modern world.

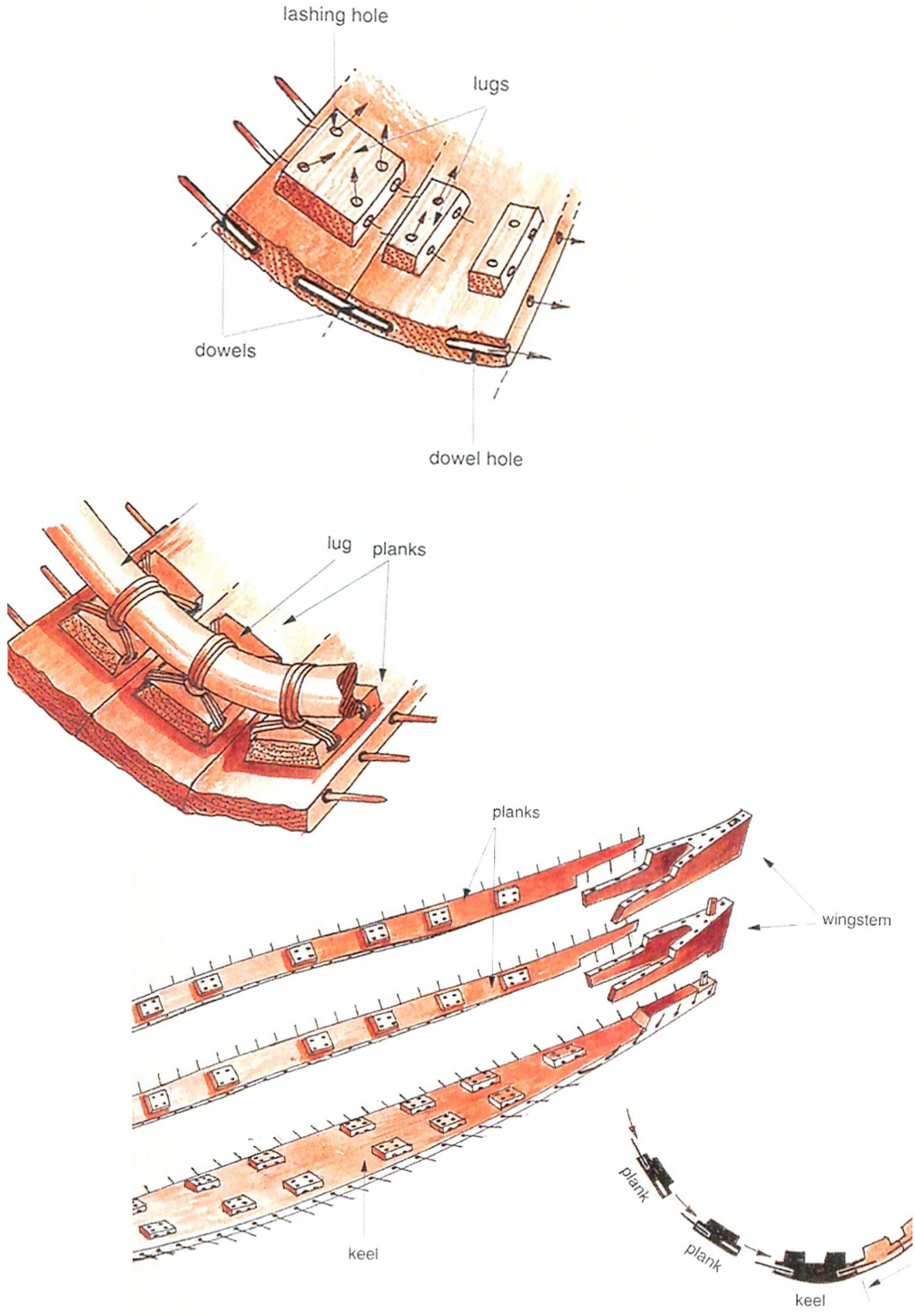


Figure 6.1 Plank-built construction, after Salcedo 1998

Figure 6.2 Replica tambuko in the National Museum, photo: M. R. Stead

Figure 6.3 Portuguese fusta, from Jan Huygen van Lindschoten 1595

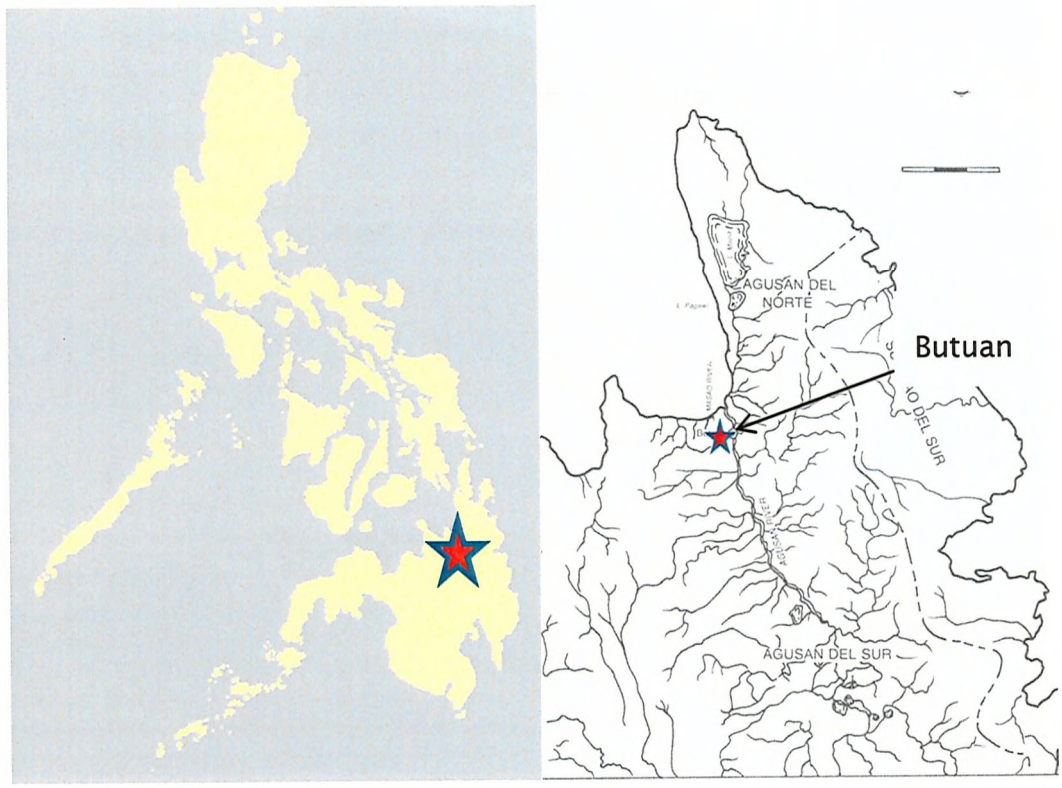


Figure 6.4 Butuan site location, after Ronquillo 1987

Figure 6.5 Site conditions at Butuan, photo: M. R. Stead

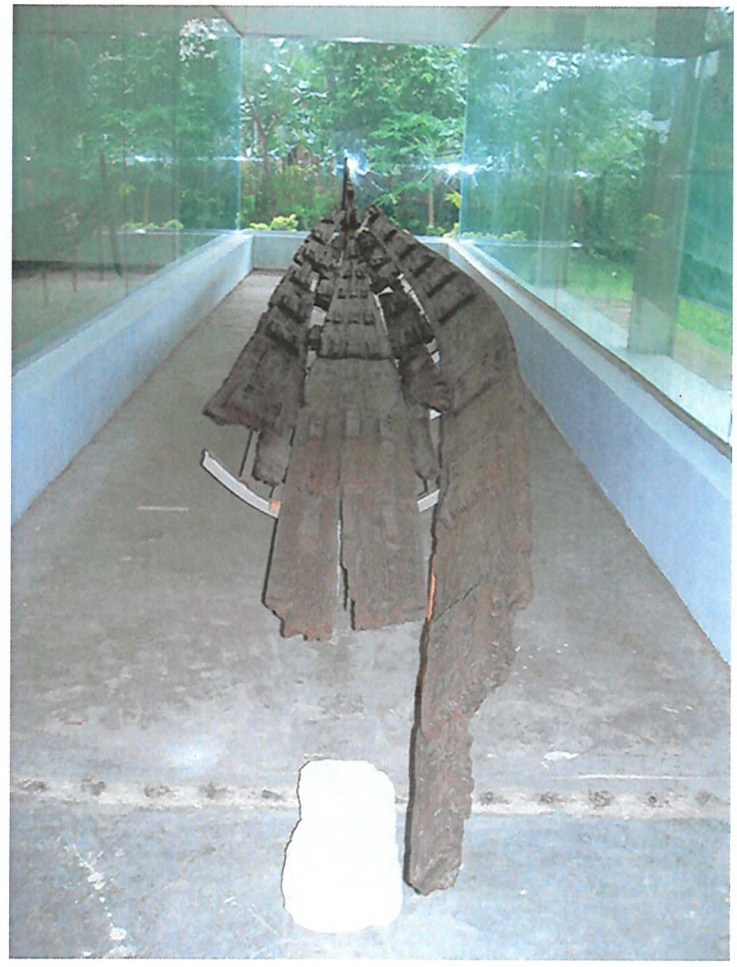


Figure 6.6 Vessel No 1 at the Balangay Shrine in Butuan, photo: M. R. Stead

Figure 6.7 Vessel No 2 under excavation, courtesy of National Museum

Figure 6.8 Vessel No 2, partially reconstructed and on display in the National Museum, photo: M. R. Stead

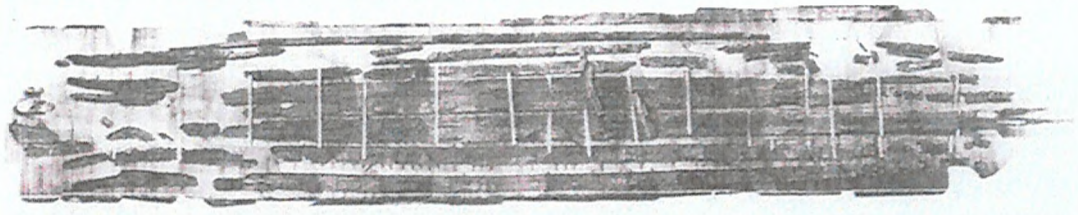


Figure 7. Photomosaic of Butuan Two in the National Museum. (Photograph: P. Clark.)

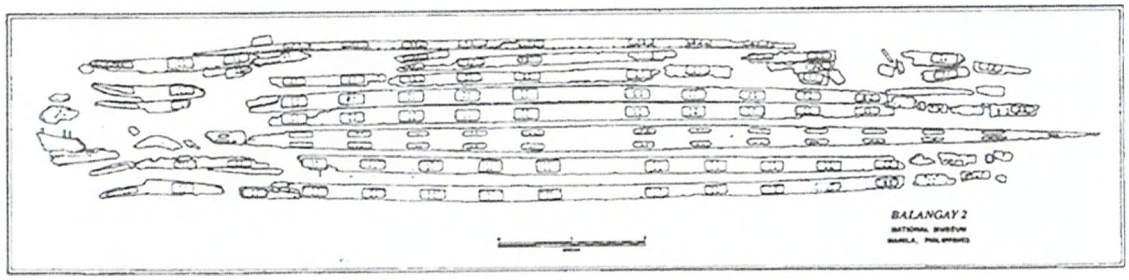


Figure 8. Tracing of the photomosaic of Butuan Two. (Drawing: P. Clark.)

Figure 6.9 Vessel No 2 photomosaic and plan, from Clarke et al., 1993

Figure 6.10 Vessel No 5 as stored on site, photo: M. R. Stead

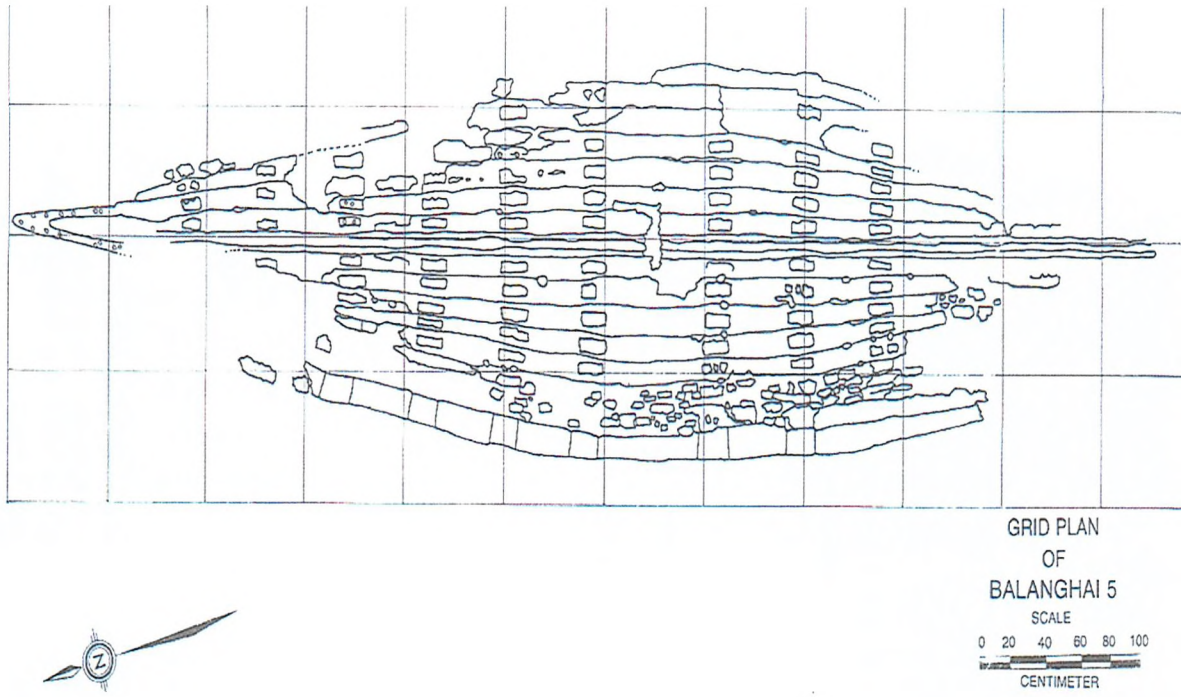


Figure 6.11 Vessel No 5 plan, after Ronquillo

Figure 6.12 Vessel No 4 under excavation, photo M R Stead

Figure 6.13 Replica balangay boat at the National Museum, photo: P. Stead

Figure 6.14: Masula sewn boat from the Indian Coast, model from the National Maritime Museum Collection, Greenwich

Figure 6.15 Illustration of a sewn boat in the Maqamat of Al Hariri of 1237

Figure 6.16 An exercise in Arab sewn ship techniques in Oman Maritime, photo: M. R Stead

Figure 6.17: Canoe recovered by HMS Dolphin in 1767 from the Tuamotus, British Museum Collection

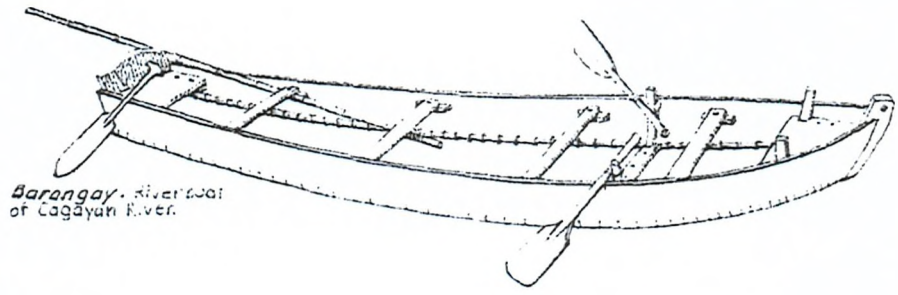


Figure 6.18 Drawing of barangay, from Ronquillo 2007 pp 210

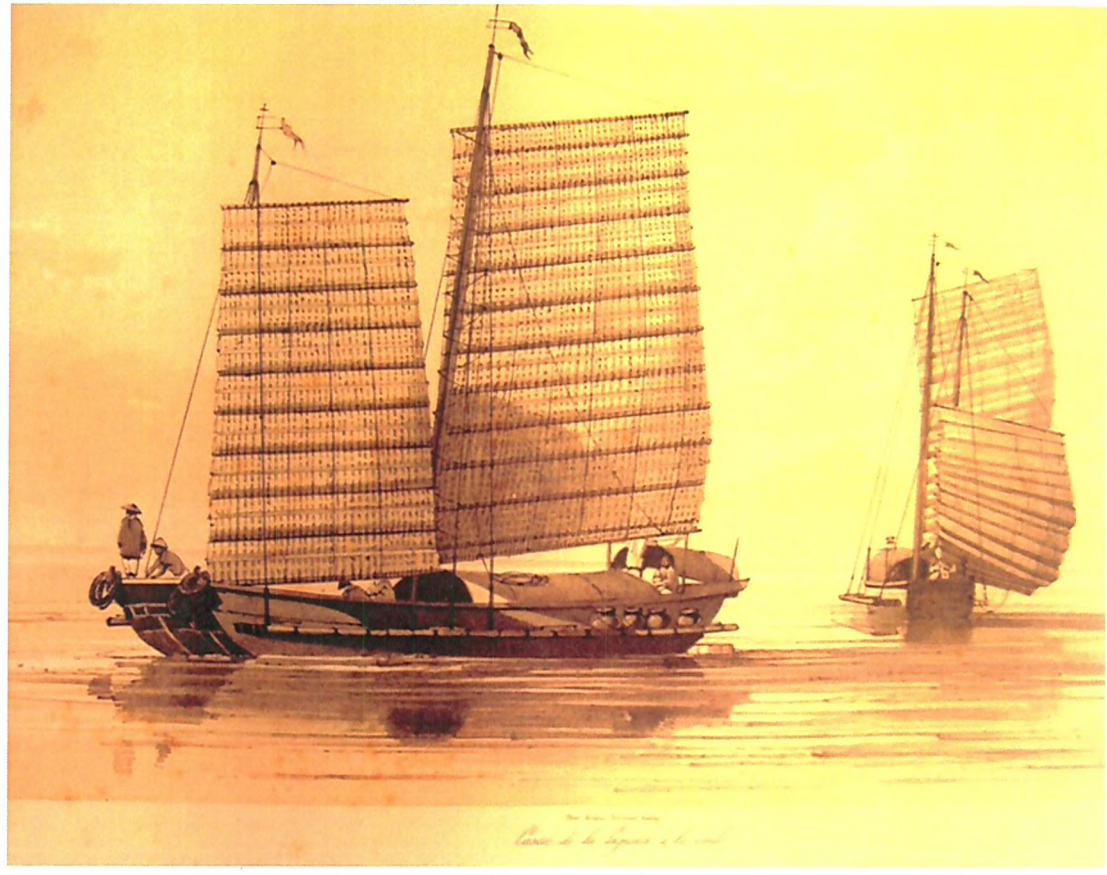


Figure 6.19 Cascos under sail near Manila, from Pâris, 1841: pl 73

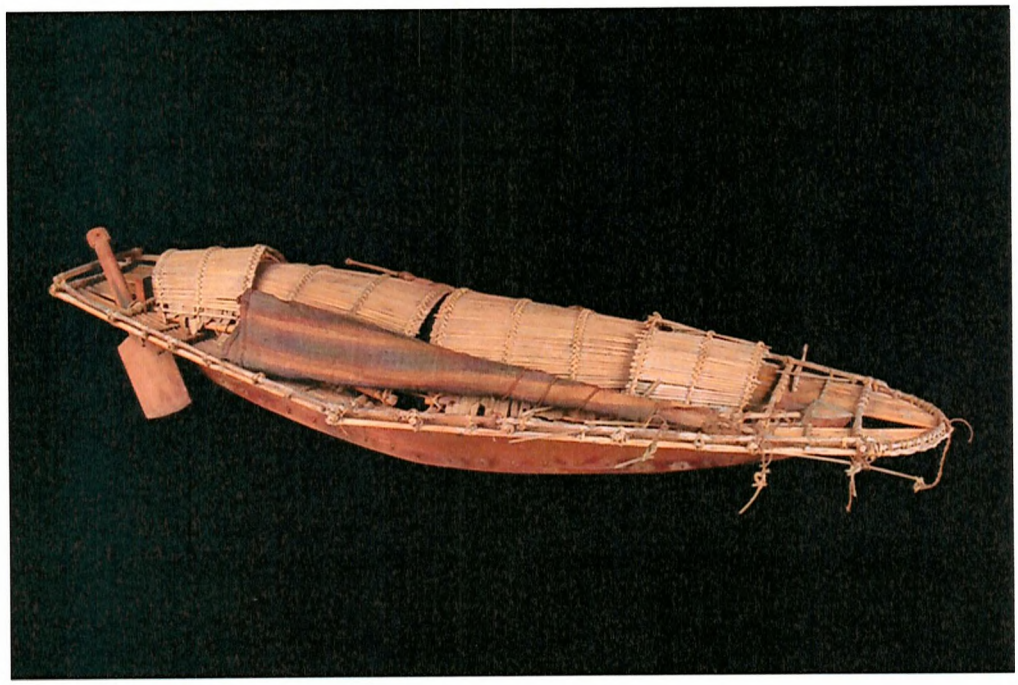


Figure 6.20 Model of a casco in Musée Quai Branley, Paris

Chapter 7: The Caracoa and the Joanga

This Chapter will describe the military versions of the plank-built boats. This relies mainly on the literary accounts and iconography as there are no known examples in the archaeological record.

7.1 Caracoa

Caracoa is the name employed in the Spanish sources for an indigenous vessel widely used in Island Southeast Asia up until the 19th century. The key features of these vessels from contemporary accounts indicate a plank-built vessel of up to twenty five metres in length, which could be rowed or paddled (Scott, 1981: 4). They normally carried up to two tripod or bipod masts, usually with an oblong lug-style sailing rig (de Morga, 1609: 252; Forrest, 1779: 23; Dampier, 1697: 230; Alcina, 1668: 167; and Pâris, 1841: plates 98-103).

They were similar in design to many other plank-built boats, characterized by the use of dowel technology to join the hull planks together, and what Horridge called the lashed-lug technique to bind the hull (Horridge, 1978: 40). The vessels were shallow draft and used a double outrigger, usually with platforms for additional paddlers on the outrigger booms. The boats typically used steering oars over the quarters. Often there was a thatched shelter over the hull, or a central fighting platform and protruding galleries for the fighting men. These vessels, with a double outrigger, were identified throughout most of Island Southeast Asia, as far as New Guinea, but concentrated in the Moluccas and the Philippines (Horridge, 1978: 3). No examples of these craft survive until the present day. Certain archaeological information on vessel construction can be found from the vessels discovered at Butuan in Mindanao, which have been widely accepted as balangay vessels (see Chapter 6). However, although Alcina considered that these were a related class of ships, it remains far from clear how the caracoa differed from the balangay boats, although the Spanish documents do differentiate between the two.

Current knowledge of the caracoa is based mainly upon iconography, such as the representations in Figure 7.1 and 7.2 from Thomas Forrest (1779, plate 4 and plate 12), and a large range of written descriptions, largely from European visitors

and colonisers, such as de Morga (1609: 252). Reconstruction and analysis of these vessels relies on these second hand accounts.

Whilst there is a range of sizes indicated and an array of different descriptions, contemporary usage seems to indicate that this was a single class of vessel, but with some local variations. This Chapter will discuss, based on these secondary accounts and iconography, our knowledge of the construction of these vessels, the sailing qualities of these craft, their role in the pre-colonial society, the evolution of the design, and the way in which they were used by the European colonial powers as patrol vessels and naval auxiliaries.

7.2 Confusion of Names

The *Sailor's Word Book* (Smyth, 1867: 163, 426) refers to the caracoa as 'a proa of Borneo, Ternate and the Eastern Isles; also called caracol by early voyagers'. The proa or perahu is defined by Smyth as a Malay war vessel. He also labels this class of vessel as a korocora, defined as 'A broad-beamed Molucca vessel, with a high stem and stern, and an outrigger. It is common among the Malay islands'. In transliterations of the original Malay, related versions of the name in other Austronesian languages, and the rendering of the word in various European languages, there are a multiplicity of related forms. The *Dictionary of the World's Watercraft* (Mariners Museum, 2000: 119, 329) records in addition corocoro, caracara, caracole, caracor, caracora, caracore, caracoro, caracoure, corecore, coroquora, curra-curra, karacoa, korakora, karakor, karakore, kora, and korkor. Sanchez de la Rosa refers to the alternative usage of karakua in the Visayan language of the Central Philippines (Sanchez de la Rosa, 1914). Admiral Pâris refers to these ships in French as corocore (Pâris, 1841: 23).

The Spanish documents from the colonial period in the Philippines consistently refer to these vessels as the caracoa, and Blair & Robertson list 117 references to the caracoa in their compendium of sources from the Spanish archives (Blair & Robertson, 1904: Index). Retana points out in a note that this word does not appear in early Tagalog or Visayan dictionaries, but the word exists in both Spanish and Portuguese dictionaries. He suggests that caracoa may be a Portuguese rendering of an Austronesian word (Retana comments in Martínez de Zúñiga, 1803: ii, 513).

7.3 Descriptions of the Caracoa

Francisco Alcina, writing in the Philippines in the latter part of the 17th century, refers to this class of vessel as a caracoa (Alcina, 1668: 207) and, as noted above, this was the usual name in Spanish for this vessel. Alcina comments that these vessels were traditional in the Philippines and were widely used in his time. He says the caracoa 'closely resembles the brigantines of Spain although (the caracoa) is larger in size'. He records that this is due to the outriggers, paddling seats on the outrigger booms and the fighting platforms, which were features of the caracoa and increased the apparent size of these vessels. He notes that "for these islands they are the best ships or vessels and the most suitable for war fleets. These people used them in ancient times when, as infidels, they went out to plunder other enemy islands" (Alcina, 1668: 207).

William Dampier, the English adventurer, during his voyage in the 17th century, describes this type of vessel as used by the Sultan of Mindanao. He describes how the boats were rounded like a half-moon, due to the prominent stem and stern posts. He noted the outriggers designed for deploying additional paddlers when needed (Dampier, 1797 ed.: 230).

Forrest gave a particularly clear description in a footnote to his account of his eighteenth-century voyage in Southeast Asia (Forrest, 1779: 23) "A corocoro is a vessel generally fitted with outriggers, having a high arched stem and stern, like the points of a half moon. They are used by the inhabitants of the Molucca islands chiefly, and the Dutch have fleets of them at Amboyna, which they employ as guardacostas. They have them from a small size, to above ten tons burthen; and on the cross pieces which support the outriggers are often put fore and aft planks, on which the people sit and paddle, beside those who sit in the vessel on each gunnel. In smooth water they can be paddled very fast, as many hands may be employed in different ranks or rows. They are steered with two commoodies (broad paddles), and not with a rudder. When they are high out of the water, they use oars, but on the outriggers they always use paddles".

Forrest was well acquainted with the corocoro as he acquired two small ones, the *Banguey* and the *Borneo* to escort his proa galley on his

voyage to the Moluccas and New Guinea. The *Banguey* measured 18ft (5.5 metres) keel length with a beam of 8ft (2.4 metres), and carried a crew of 14 men. In Figure 7.2 is one of his drawings of a corocoro under way.

Admiral Pâris described four examples of what he called the corocore (Pâris, 1841:23 and following). One he had observed himself at Manado in Sulawesi (Figure 7.3). This vessel was beached and apparently undergoing repairs. In his commentary he notes that no use was made of iron in this vessel and that the planks were lashed to the frames. He also records an example observed at Dorey in New Guinea which was 17 metres length overall with a beam of 5 metres. He indicates that there was space for two banks of oars each side of the hull by using side panels of bamboo.

The other two vessels in this category were included by Pâris in his volume based on accounts from the voyages of two other captains, Duperrey and Francine. The corocore recorded by Duperrey was at Coupang in Sulawesi during the voyage of the *Coquille* (Duperrey, 1825). This was 11 metres length with a beam of 2.5 metres. The one recorded by Freycinet was at Pulao Pinang (Guébé) and was 45ft in length (13.7 metres) with a beam 7 to 8 ft (2.14 to 2.45 metres) (Freycinet, 1839).

Hornell mentions the kora kora, in his *Water Transport* and refers to the description of Dampier, noted above (Hornell, 1970: 259, 264-266). He describes the kora kora of Island Southeast Asia as having the appearance of a freak design, which he considers is a reflection of its origins as a river boat of peninsula South East Asia. He suggests the original development of the outrigger was on the Irrawaddy, the Salween or the Mekong, and particularly mentions the Burmese rice boat as a model. There is no real evidence for these assertions as there is no apparent tradition of the use of outriggers in mainland Southeast Asia (Horridge, 1978: 3).

7.4 The Joanga or Juanga

The joanga was a larger size version of the caracoa and typical of the Moluccas, Mindanao and the Sulu Sea. A description of the joanga is contained in a paper by de Bobadilla which describes a naval battle against rebels in 1638, "they were all embarked in a fleet of caracoas, which are oared vessels much used in Filipinas, carrying from fifty to a hundred rowers apiece. There are larger ones called

juangas, and carry from one hundred and twenty to one hundred and thirty rowers". (de Bombadilla, 1639).

Argensola in his *Conquista de las Islas Malucas* of 1609 talks of the caracoa of the Philippines being similar to the juanga of the Moluccas but being differentiated largely by the elevated stern and prow timbers in the Moluccas, (Argensola, 1609: 24).

Pâris (1841: plate 103) describes one of these juanga as observed in the Moluccas, drawing on information from the earlier voyage of Pagès. He refers to this vessel in French as a buanga (Figure 7.4). The drawing of this local vessel shows a total of 74 rowers on each side in three banks, rather similar to a classical Roman trireme, but with a further 18 paddlers on the outrigger platform. Taking the two sides together this would give a total of 184 crew engaged primarily in powering the vessel. This vessel was drawn as 32.5 metres long with a beam of 5 metres, and with only two booms to support each outrigger (Pâris, 1841: plate 103).

7.5 The Construction of the Caracoa

The best source for a description of the construction of these vessels is the work of Francisco Alcina (1688:159-195). He described the building of local plank-built ships in generic terms. He then discussed the balangay, the biruk and the caracoa, after stressing that these plank-built boats were all constructed in a similar way. Alcina claimed to have built more than twenty of these planked craft. He reports that the caracoa was used for raiding and warfare and built in a style to accommodate a large crew (Alcina, 1688: 191).

The construction began with carving a single curved keel timber with a stem post and sternpost attached. Since the keel and strakes were each cut from a single tree, the length of these craft was limited by the size of timber they had available. There is some variation between the sources about the maximum lengths available and the distinction between a caracoa and a joanga. Scott suggested Spanish sources indicated lengths of up to 25 metres for the caracoa (Scott, 1981: 4). The joanga seen by Pagès had a length of about 32.5 metres.

The two end timbers, the stem and stern posts, were essentially symmetrical. The strakes were carved with an appropriate curve to create the desired hull shape.

Protrusions (tambuko) were left on the inner plank sides on which to lash the frames (agar). Hard wood dowels were used to fix the strakes to the keel and to each other. The freeboard on the caracoa was usually low to allow paddling. The edges of the strakes were fitted using a marker to score the edges (sugi) to facilitate a snug fit. The joints were then caulked with palm material (baruk).

To make the hull watertight, the planks of the hull structure were bound together for a period with rattan under stress. The dowels were then locked by hard wood nails to keep the structure firm. Thus there were no irons nails used, although iron and other metals were available and used for tools.

Usually the hull was fitted with double outriggers (katig) to maintain stability. The outrigger booms also supported fore and aft platforms which could be used for banks of paddlers or fighting men, called daramba. As a result the vessel could carry three, four or even five rows of paddlers on each side, so as many as 200 men could paddle at the same time in the largest vessels.

Pâris has provided us with a nineteenth century drawing of the hull of the Coupang corocore in Indonesia as seen in Figure 7.5. This shows a pole mast and a heavy mast-step, which is surprising as a tripod or bipod mast without a large mast-step were more usual. This may be due to the adoption of European-style ship construction techniques from the Spanish, where a pole mast and heavy mast step were usual.

In the centre of the ship was placed a platform called the burutlan which was above the level of the paddlers and could be used as a fighting platform, a place to store light cargo or a convenient location from which to work the sails. Further narrow platforms were sometimes added on each side, called pagkiray, specifically for fighting men. Scott reports that there was a social distinction between the picked warriors who manned the fighting platforms and those who paddled and worked the ship (Scott, 1981: 17).

The vessels usually had an awning of palm leaves which could be rigged against sun or rain. This was useful to protect the crew in the tropical conditions. The caracoa carried one or two masts, usually erected as a tripod or bipod, so no strengthened mast-step was normally required. The masts could be dropped to the deck when not needed (Alcina, 1668: 193). The sails were stretched between top and bottom bamboo booms. The sail was generally wider than it was high.

The steering was provided by a single or double steering oar lashed to the hull. These features can be observed in Forrest's illustration in Figure 7.1.

7.6 Sailing Performance of the Caracoa

These vessels were very light and of limited draft. This facilitated working the vessels from a beach. It is difficult to berth a vessel with outriggers against a dock. Modern bancas with double outriggers normally have to be moored head-to on docks and load freight and passengers over the bow, as can be observed today at the port in Batangas City.

It was usual to remove the caracoa from the water when not in use and store them onshore under a woven palm canopy, as described by Pigafetta in relation to a balangay during the Magellan voyage (Pigafetta, 1874:78). This would protect the hull from attack by marine borers, but the vessel had to be propped up to minimize the attacks of termites whilst onshore (Scott, 1981: 8).

The great advantage of the limited draft was to allow the vessel to cross shallow coral reefs, which would have destroyed larger European-style vessels (Scott, 1981:7). The caracoa were very fast sailing on a reach or a run and could plane with a following wind. However they did not perform very effectively in heavy seas as the outriggers would alternately sink beneath the waves and impede the vessel (de Morga, 1609: 177). In a cross wind they would be difficult to keep on course as the caracoa did not have a deep keel and we have no evidence of leeboards to prevent leeway slippage. Therefore the caracoa would have had difficulty in beating to windward (Alcina, 1668: 191).

The caracoa performed very well under paddle. Alcina records that the paddlers who were trained to this life could paddle all day at speed (Alcina, 1668: 205). Large caracoas, such as the joangas, with a higher freeboard could have used oars rather than paddles for the crew in the hull, as opposed to those sitting on the outrigger platforms. The use of oars was apparently more common in the balangay or birok, where the crew size would probably be smaller.

Alcina records a balangay as traveling at speeds of 9 to 14 knots on a day-long trip using a mixture of sail and paddling (calculating from specific trips recorded by Alcina in Spanish leagues converted into knots) (Alcina, 1668: 211). The world's best rowing performances in the modern era (over a short course) are

about 10 knots. The typical speed of a Spanish galleon under sail was up to 6 to 10 knots.

Scott describes the caracoa as "intended to carry warriors at high speeds before seasonal winds through dangerous, reef-filled waters with treacherous currents, on inter island raids and high profit ventures..." (Scott, 1981: 7). However in contrary winds or heavy swell the performance was much poorer. De Morga records that in a pursuit of the Dutch in 1600 the caracoas could not keep pace with the Spanish vessels due to choppy conditions and had to be left behind (de Morga, 1609:177).

7.7 How was the Caracoa different from the Balangay and Similar Planked Craft?

So how does the caracoa differ from the balangay and other traditional plank-built ships? Without any archaeological examples to work from it is difficult to demonstrate in detail. The caracoa is from the same family of vessels as the balangay and, according to Alcina, all of these vessels were built in a similar way. In his description de Morga refers to the caracoa (and other types: the lapis and tapaques) as larger than the standard balangay boat or virrey and carrying a larger crew (de Morga, 1609: 252-3). These writers are explicit that the caracoa was a separate style of vessel. It was designed to carry little cargo, but a maximum number of paddlers and warriors. It was distinguished by the platforms for fighting men to use in action. It was intended to be faster and this may explain the double sails and masts reported in some cases.

7.8 Role of the Caracoa in Pre-Colonial Society

There was extensive local raiding activity in the Philippines, especially slave capture, as manpower was short in an under-populated archipelago, but land was plentiful. The caracoa was the vessel of choice for this raiding activity (Junker, 1999: 382-385). This continuous warfare was referred to as mangayaw in the various Philippine languages (Scott, 1994: 154-155). It was not unlike early Viking voyages, in which a chieftain would set sail with his crew, often without a clear idea if the journey was for trading or raiding.

The caracoa was a resilient vessel and could manage long distance and international trips, at least in good weather. The Chinese sources talk of their

coast being raided by 'rafts' from the Philippines, which according to Scott are likely to have been caracoa with multiple banks of paddlers on the outriggers (Scott, 1981: 17, quoting Chao Ju-kua). The later attacks by Muslim groups on the Spanish colony were a continuation of this tradition into the colonial era (Warren, 1981: 154-156). Kidnapping for ransom was an important feature of these raids (Scott, 1981:27). The ransom price was an important badge of rank and reflected the role in society of the victim.

The use of fighting platforms on the caracoa indicated that this vessel could be used for interdiction on the high seas, using warriors with personal weapons, and was not used just to transport a raiding party for a land battle. One problem was that these vessels could not easily mount heavy cannon and so were usually restricted to light or swivel guns. Therefore they were not really a match for a European vessel in a fleet action. When Legazpi took Manila in 1571 and converted it into the Spanish base in the Philippines, there was a sea battle in Manila Bay with twenty or thirty local vessels, mainly caracoas. These mounted one or two culverins each. The Spanish defeated this fleet without difficulty (Anon, 1572, Relation of the Conquest of the Island of Luzon, translated by Blair & Robertson 1903 to 1907, vol.3: 156-7). Forrest (1779: 23) reports the caracoas being fitted with small brass swivel guns, called lantaka, in the late eighteenth century.

The caracoa was the largest and most sophisticated artefact belonging to most coastal communities and had a huge symbolic value as a token of leadership. The roles of the crew reflected their social status in the local kin group (Scott, 1981: 15-17). There are reports in Alcina of human sacrifice at the initial launching of a caracoa by placing a human body as the last roller in the ceremony (Alcina, 1668: 193-5). There is also an account from Bohol in Scott which related how a whole crew of 70 was sacrificed to accompany a chief in a boat burial (Scott, 1981: 17).

7.9 The Evolution of the Caracoa

Alcina (1688: 207) specifically mentions that Spanish authorities continued to construct caracoa in the seventeenth century for military use. The rowers and sailors would be Filipinos, but the soldiers would normally be Spanish. The same arrangement can be noted on the Manila galleons which carried many Filipino sailors. He comments that the caracoa was a more comfortable means of travel in

the Philippines than the Spanish ships due to many being fitted with a thatched palm roof (Alcina, 1668: 189). However, he notes that the Spanish made the caracoa vessels heavier and more substantial than previously, so that they were often unable to catch dissident vessels built in the lighter, traditional style (Alcina, 1668: 207).

These caracoa were used for carrying dispatches, defence against pirate attacks from the Sulu Sea and for major assaults on pirate bases. A manuscript, thought to be by Pedro Gutierrez S.J., describes a typical example of the use of the caracoa to repulse pirate attacks from the Muslim south (Gutierrez, 1637). This raid was by four Muslim juangas and their repulse by Spanish-led caracoas is also recorded in Montero y Vidal (1888: 162).

The caracoa remained in service into the nineteenth century for raiding and piracy by dissidents in the Sulu Sea area and from bases throughout Island Southeast Asia. The vessels gradually lost their outriggers, became wider in the beam and adopted oars rather than paddles (Horridge, 1981: 4-7). The Spanish established fully effective control in this area only when they had deployed steam vessels (Orosa, 1923: 25).

Figure 7.7 shows an interesting model of a kora kora in the Tropenmuseum in Amsterdam. This comes from Sulawesi, probably from the nineteenth century, although the precise provenance is now lost. It has a tripod mast, canopy, fighting platform and steering oars of the caracoa, but lacks outriggers and appears to be more heavily built than earlier caracoa.

Forrest reports the use of the corocoro by the Dutch for coastal patrols against the smuggling of spices, as noted above (Forrest, 1779: 23). Caracoa were even used by the Spanish against the Maranao tribes around Lake Lanao in Mindanao in 1639, by transporting them overland as components and reassembling them at the lake (Scott, 1981: 10).

The caracoa seems to have fallen out of use in the nineteenth century. One of the last voyages recorded in a caracoa was by Wallace, the famous naturalist, in 1859, when he rode on a government-owned vessel from Bacan to Ternate in the Moluccas. He describes this as a kora kora of 4 tons burthen, with twenty rowers (rather than paddlers), a thatched canopy, a low freeboard, and double outriggers at 5 feet (1.6 metres) either side of the hull. There was a tripod mast and a mat

sail. He complained about the constant drumming, used to keep the rowers in time (Wallace, 1869: 358).

The lashed-lug building technique seems to have disappeared in the Philippine, but Horridge reports of a late survival in the form of a prahu belang using this technology in Aru (Indonesia) recorded in 1977 (Horridge, 1981: 51-54).

7.10 The Caracoa as the Ultimate Military Asset

In the period before European colonization in the Philippines, in the Moluccas and in much of Island Southeast Asia, the ownership of the caracoa was the key to political prestige, to successful attacks on neighbours and the possibility of defence against raiders. If the tribal or kin group did not have such vessels they had to ally themselves with a stronger group that did. Scott summarises this role for the caracoa "as the key to the political scene in the 16th century Philippines, those who had them dominated those that did not" (Scott 1981: 31).

The military role of the caracoa survived until the nineteenth century as it was so fast and effective in its home waters, both as a pirate vessel and as an auxiliary for the European fleets. However this class of vessel will remain something of a mystery until we can identify examples in the archaeological record.

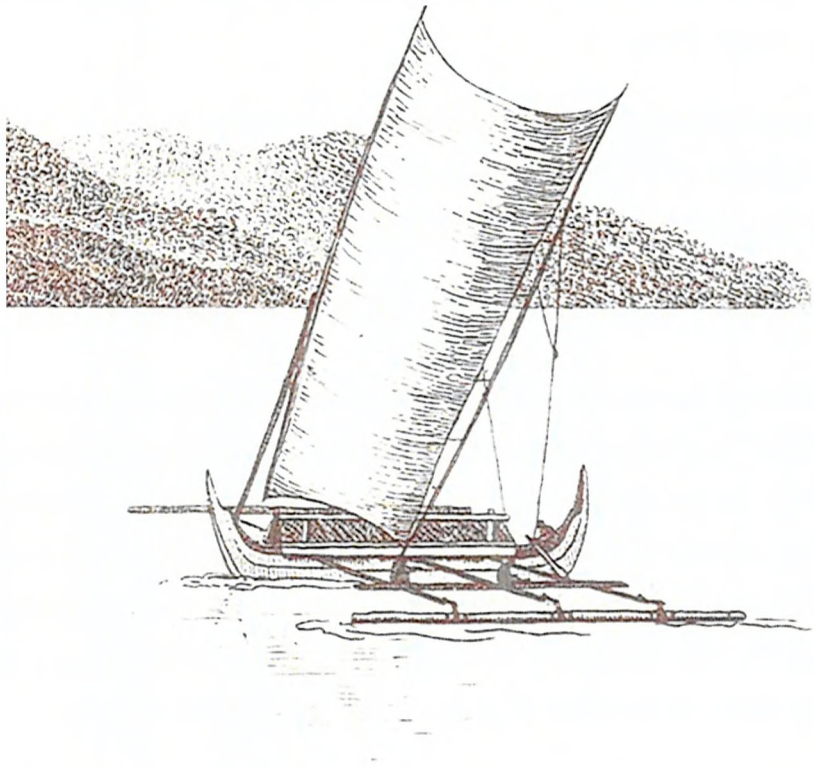


Figure 7.1: Illustration of a corocoro, reproduced from Forrest, 1779: pl 12

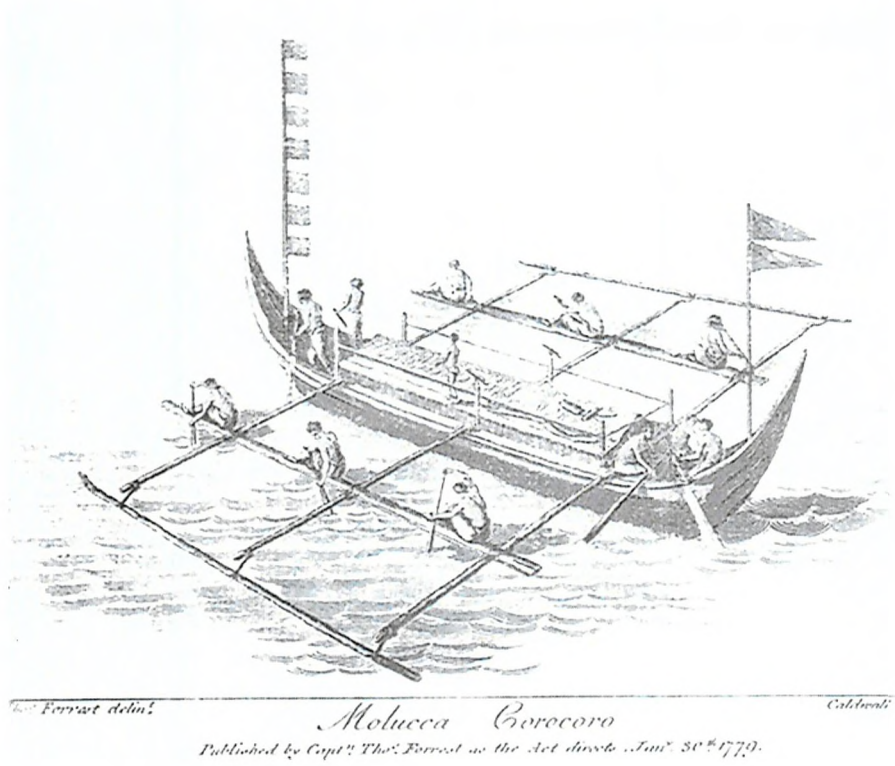


Figure 7.2: Corocoro paddling into the wind, from Forrest, 1779: pl 4

Figure 7.3: View of a corocore on the beach at Manado in Sulawesi, from Pâris. 1841: pl 98

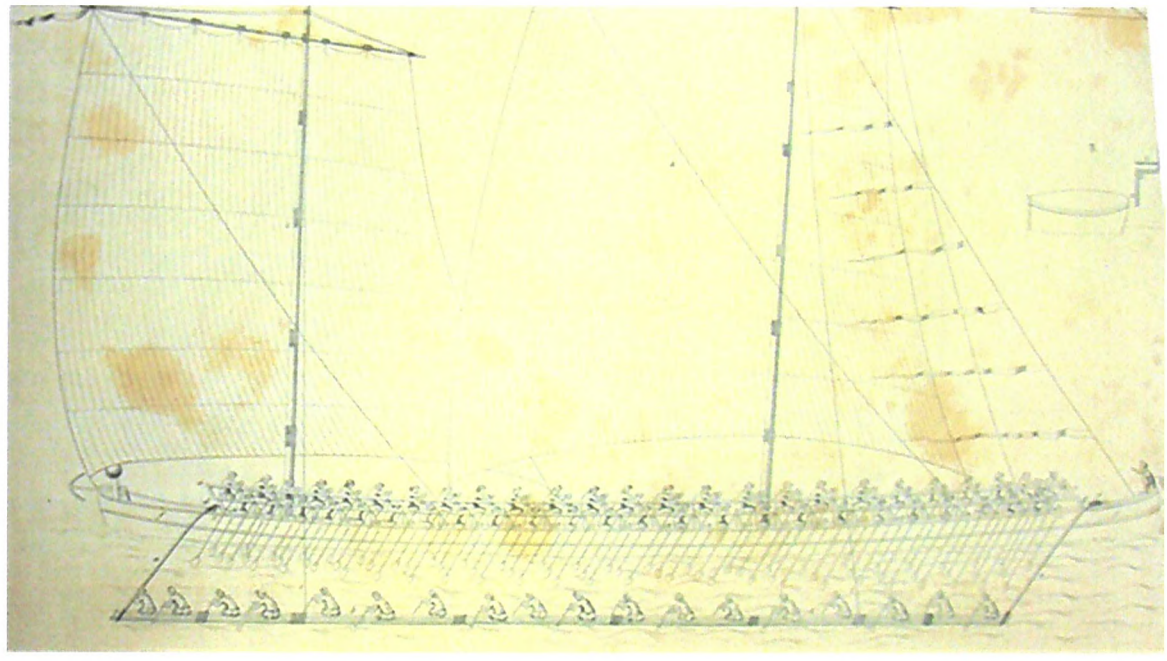


Figure 7.4 Buanga as sketched by Pagès and included in Pâris, 1841: pl 103

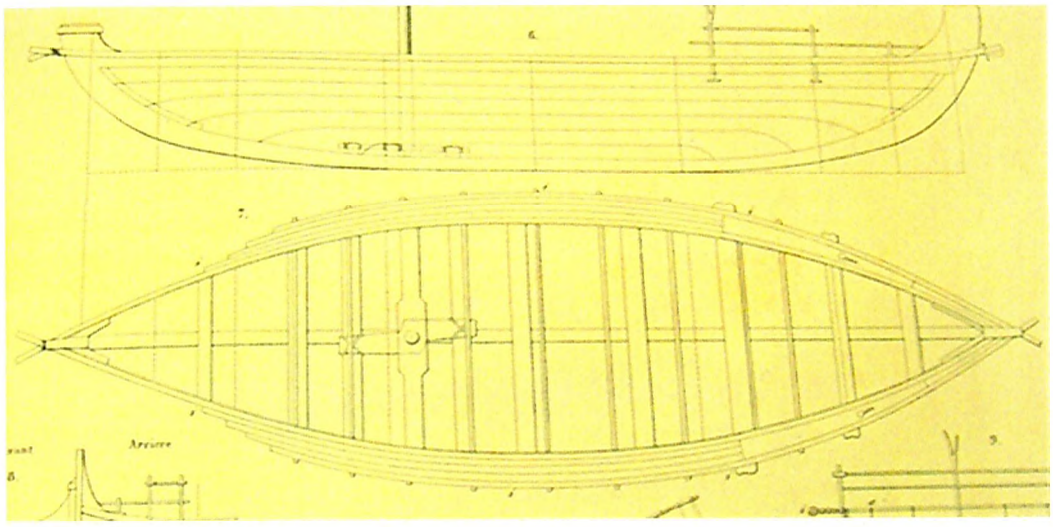


Figure 7.5: A detail of the plans of the Coupang corocore to show the mast step and pole mast, from Pâris, 1841: pl 97

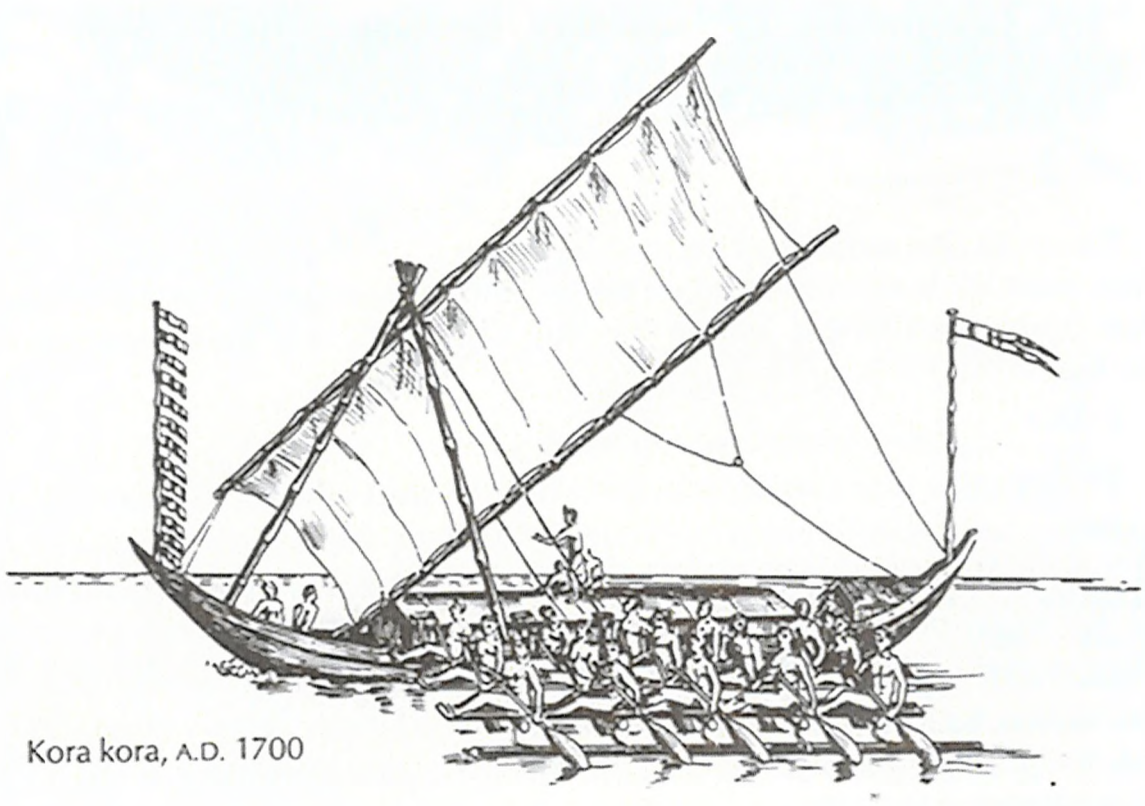


Figure 7.6: Drawing of a kora kora (caracoa), from Röding, 1798

Figure 7.7 Kora kora model from the Weber Collection, A4752
126cm x 26cm x 57cm, courtesy of Tropenmuseum

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Chapter 8: Motive Power, Outriggers, Shipbuilding Tools, and Raw Materials

8.1 Paddles and Oars

In the Philippines in the sixteenth century, the indigenous vessels, whether logboats or plank-built boats, were mostly powered by paddles. The classic paddle, the bugsey or bugsay, was about 1.00 metres to 1.20 metres long, usually with a cross-bar handle (Figure 8.1) (Scott, 1981: 16; Alcina, 1688: 203). Various styles are illustrated in Figures 8.2 and 8.3. The design was leaf-shaped and they were intended for semi-continuous use on a longer trip as well as short journeys. De Morga refers to these paddles in Spanish as bucceyes, an adaptation of the Filipino term, bugsay (de Morga, 1609: 252).

Logboats had a small number of paddlers, but in the larger plank-built vessels they had up to six banks of paddlers on the sides of the vessel and on platforms across the outriggers (de Morga, 1609: 252-253). Alcina notes that crews could reach two hundred paddlers (Alcina, 1668: 191). The disadvantage of paddles is that they required a low freeboard, which made the boats more likely to be swamped (Scott, 1981: 9). Alcina commented on the willingness of local crews to put to sea with only a few inches of freeboard (Alcina, 1688: 163).

Oars were used on larger vessels, particularly cargo-carrying hulls with a higher freeboard and a wider beam, and these were described as gaor or gaut by Alcina (1668: 203). The blade was carved from a separate piece of wood and had a plate-like rounded face (Figure 8.4). The rowers tended to face the stern as in most European vessels and there was usually a single oarsman to each oar. They used tholepins on the gunwales to achieve leverage. These were often set at an angle to avoid losing the oars and were reported as different from European-style rowlocks (Alcina, 1688: 205). De Morga referred to these oars in Spanish as gaones, an adaptation of the Filipino expression (de Morga, 1609: 252). Forrest commented that on corocoro (caracoa) "when they are high out of the water, they use oars; but on the out-riggers they always use paddles" (Forrest, 1779: 23).

Soon after the conquest, European-style oars with long, slender blades were introduced by the Spanish, but these were often too heavy for Filipino crewmen to

use for extended periods. These oars were called gayong, galong or gayung in the Philippines (Alcina, 1688: 205).

Steerage was provided by single or double quarter oars. These were broad-bladed paddles, which were referred to as commoodies by Forrest, although this was a foreign phrase of unknown origin and not a Filipino expression (Forrest, 1779: 23) (Figure 8.6). Doran notes that quarter oars were common in the Philippines (Doran, 1981: 85-86). Scott comments that the major advantage of quarter oars is that they could be raised easily when crossing shallow coral reefs (Scott, 1982: 8). The larger vessels, such as the joanga, could carry up to four quarter rudders (Alcina, 1688: 213). These quarter oars and paddles used for steering these traditional vessels were gradually replaced by western style axial rudders, however large examples of these steering oars are still in use today in Sulawesi in the pinisi (see Figure 8.5 for an example of these from Makassar harbour), although they seem to have disappeared in the Philippines.

One of the features of traditional craft was that they were often double ended so that they could reverse course easily under paddles or oars by the crew simply rotating in their seats. This would require the quarter rudders or steering oars to be relocated at the new 'stern'. This practice is noted in Pigafetta (1969 edition: 30) and Scott (1981: 8) particularly in relation to battle tactics.

8.2 Sailing Rigs

Sails were the main motive power for longer trips in logboats, extended logboats and plank built boats. The masts commonly used were a simple pole mast, a shear leg structure of two masts lashed together, or a tripod arrangement (Scott, 1981: 16). These masts could be built in bamboo or wood, but a key feature was the ability to drop sail speedily, as none of these designs was very effective in beating to windward. In adverse winds, the crew would usually revert to paddles or oars (Scott, 1981: 16).

The sails were originally mats of various local vegetable fibres, leaves or woven palms called gaong, buri, nipa or gonot. Pigafetta reports the use of woven leaves in sail construction (Pigafetta, 1969 edition: 30). The use of native cotton for sails was being adopted at the time of the Spanish conquest and it is not clear if this was a Spanish technique or predated the Spanish arrival (Reid, 1988: 90). Local cotton was produced in Ilocos (where it was known as abel). It appears to

have been used originally mainly for clothing. De Morga confirms that it was already used for sails by the Filipinos in local craft by 1609 (de Morga, 1609: 252).

The most common sail design in the Philippines appears to have been a rectangular lug sail with a bamboo boom at the top and bottom. This style is referred to in Malay as the layar tanja, and is described by Doran as a rectangular boom lug (Doran 1981: 40). This sail design is seen in an illustration of Forrest from the eighteenth century (Figure 7.1) and more recently in the vinta as used in the Sulu Sea (Figure 8.7). Figure 8.8 shows this sail adapted for use in a nineteenth century raiding ship from the Sulu Sea. This was usually a low aspect sail with the width larger than the height and was referred to by the Spanish as lutaw, after a group of badjau or sea gypsies from the Sulu Sea (Alcina, 1668: 193). The running rigging consisted of a simple block and tackle, called a bognoson, for raising sail and a set of braces at the yard ends (Forrest, 1779; 42). This was the rig which was adopted by Severin for his replica called the *Prahu Kalulis Alfred Wallace* built in the Kei Islands and used in his *Spice Island Voyage* (Severin, 1997: i).

The mast used was a kind of tripod with three legs or a two leg variant. This avoided the need for a large mast step, and could be quickly raised and lowered for use with sails. This can be seen rigged in Figure 1.4, 7.6 and 7.7. The tripod had one leg forward and one leg on each beam. This sail plan was often duplicated by the simple expedient of installing two triple tower masts.

In the smaller logboat designs in the Philippines (and the Sulu Sea) two designs of sprit sail were utilised, what Doran labelled as the common sprit (boom) sail and the oceanic sprit sail (Doran 39-42). The common (boom) sprit is seen in Figure 8.9 and is a rectangular shape with a central crossing boom. The oceanic sprit sail is a simple triangular sail as illustrated in Figure 8.22. Both these sails tended to use a single pole mast.

The traditional sails could trim up to about 60° off the headwind as compared to about 45° in a modern Bermuda rig yacht (Severin, 1997). The vessels could tack or gybe to change tack whilst beating to windward. An alternative procedure, widely used in Austronesian vessels, was to reverse course by shunting - in which the vessels was laid across the wind, the sail reversed and the bow and stern switched. Whilst this was well used in the Pacific and the Indian Oceans it seems

to have been less common in the Philippines (Doran 1981: 36-38). This shunting technique was described by Dampier in Guam (Dampier, 1697, 1937 edition: 207).

As will be seen in Chapter 9, there was a relatively rapid adoption of foreign-style sail plans, especially in the larger vessels. Many vessels were adapted to a foreign fore and aft design or a Chinese-style batten lug sail, which soon became standard sail types for Philippine local vessels (Figure 6.19). The simple sprit sails as used on the log boats have survived until today, although they are now often replaced by inboard or outboard motors.

8.3 The Outrigger

What was an unusual feature for the initial European visitors was the use of outriggers, a defining characteristic of these indigenous Philippine boats. This use of outriggers (and the double canoe rigged as a catamaran) is largely limited to areas influenced by the culture of the Austronesian-speaking people in the Pacific and the Indian Ocean (Horridge, 1978: 3). Pigafetta and Dampier were amongst the earliest writers to describe the outrigger (Pigafetta, 1969 edition: 30, 98; Dampier, 1937 edition: 207 and 230).

In Figure 1.7 a map of the distribution of the double outrigger design is illustrated after Horridge (1978). This shows that the Philippines lie within the area characterised by the double outrigger. This zone extends to the Moluccas and to Southern Indonesia, but the design is not found today in much of the Kalimantan area or the Malay Peninsula.

Outriggers were usual on sea-going vessels to maintain lateral stability in heavy weather (de Morga, 1609: 252). They also provided additional buoyancy, especially where a vessel with a low freeboard was swamped. Alcina describes how, after such a swamping, the crew would leave the vessel so that they could bail it out whilst swimming (Alcina, 1668: 199). Scott also points out that the outriggers were useful in allowing doubling up the rowing crew in emergency, and would facilitate manhandling a vessel in and out of the water efficiently (Scott, 1981: 8).

In some areas a single outrigger was used, but in the Philippines both styles were found. If under sail a single outrigger vessel must have the outrigger to windward, otherwise the vessel rapidly becomes unstable (Doran, 1981: 36).

The standard double outrigger, or katig, consisted of two floats which were connected to the hull by two or more booms. They were usually built in bamboo, but wood could be used for this purpose. There are various styles of fixing the outriggers to the hull. The main purpose of the outrigger was to provide lateral stability to a shallow draughted vessel. The outrigger usually just touched the water intermittently and was pointed upwards in the direction of travel to avoid digging in to the swell. De Morga describes the outriggers as "besando el agua" meaning just "kissing the water" so as not to impede the paddling and avoiding any capsize (de Morga, 1609: 252).

The outrigger booms frequently had platforms for the use of additional teams of paddlers when speed was necessary (Figure 1.4). The additional paddlers would inevitably be wetted frequently by seawater, which limits this practice to tropical waters. This led Dampier to comment "and thus as all our Vessels are rowed from within, these are paddled from without" (Dampier, 1937 edition: 230).

The construction of outriggers needs to address the height difference of the gunwale and the sea. There were multiple styles of connection which could be used to bridge this vertical gap to the booms that were often associated with a particular island, group or culture. There appears to be no standard terminology for these connections and Horridge (1986: 41) refers to them by the locations in Indonesia where he saw examples. The most common style in the Philippines was the use of curved booms of wood or bamboo with the floats attached. This style has been shown in Figure 8.10 and labelled for this analysis as the 'bent arm'. Figure 8.11 shows the connection with an additional piece of timber labelled here as the 'elbow' connection. Figure 8.12 illustrates a further style called here the 'bamboo collar'. Horridge illustrates some eight styles of outrigger connections, mostly from Indonesia (Horridge 1986: 41).

There are two models in the Pitt Rivers Museum in Oxford, which were collected during the HMS Challenger expedition to the Pacific in 1873-1876 (Figures 5.7 and 5.8). These represent passenger banka from the Pasig River, which were used as general ferryboats on the waterways of Manila. They are logboats with a single strake on each side, presumably to protect the passengers from spray. The

unusual feature of these boats is that they have triangular-shaped outriggers where the outrigger bamboos are attached directly to the hull at the forward end but splay out at the rear end. This may well be a facility to ease the access to built-up docks. Recent examples of triangular outriggers have been reported from Negros (Ms T. Andersen, personal communication), but no photos were available.

Rather than a true outrigger, in some areas a supporting timber or bamboo platform was lashed to each side of the exterior of the boat, comprising one or more poles or bamboos. This is described as a sponson and Doran (1981: 86-87) suggests that the sponson may have been a model for the development of the outrigger.

McGrail identifies two types of sponson: single log attachments, a surface addition to increase lateral stability or buoyancy, and, alternatively, an added timber higher up the hull. When fitted above the waterline the latter could be intended as rubbing strakes, to add lateral strength to the hull, as spray deflectors, or to add stability when deeply laden (McGrail, 1987: 71). See Figure 5.2 for a Philippine illustration of this equipment from a drawing by Pâris. There is a drawing of a more recent example in the work of Folkard (1906: 484) in Figure 8.21.

In some cases a sponson of several poles or bamboos was added as a paddling, punting or rowing platform affixed to the sides to assist in working the vessel. As an example, the Philippine casco frequently had such a poling platform (Skinner, 1904: 1-3).

Outriggers do survive today in the Philippines in most modern bancas and even in quite large ferries as illustrated in Figure 4.4.

8.4 Shipbuilding Tools

The tools used for shipbuilding were similar to the regular tool sets for the Filipino carpenter. The available tools can be associated with three main periods. Prior to 500 BC, when metal tools first appeared in the Philippines, the tools were made from stone, including jade, from shell and from wood. After the arrival of metal tools a much more varied tool set became available. Following the European settlement, a new and extended tool set was introduced showing Chinese and European influence.

In the National Museum in Manila there is a range of tools made from stone, jade, shell, and bone from the pre-metal age. A particularly fine example is an adze (daldag or daras) (Figure 8.13). This adze was cut from basalt and is the largest example found in the Philippines (36.4 cm, and 9.8 cm, by 4.5 cm). The tool, which is dated to the Neolithic period on stylistic grounds, was found in Luzon in the 1930s, but unfortunately the provenance details were lost due to wartime action. It is assumed to have been mounted on a haft. Another fine example is a shell adze made from the giant clam (*tridacna gigas*) and illustrated in Figure 8.14. Similar tools were the axes (palaku or palatio), hammers (masu), knives and chisels (paitor or tigib). Carving the dense hard woods with stone or shell tools to produce a logboat would be an immensely slow excavation process. Strakes for plank-built boats would have been produced by splitting logs and hand carving. As these tools were very resilient they are relatively plentiful in the archaeological record.

Due to the expense and rarity of metal tools when they came into use (from about 500 BC) there was a long transitional period when stone tools continued to be used. It is unclear the extent to which they were still in use at the time of the colonisation. The metal tools are also rarer as they could be melted down and re-forged. Iron and copper were relatively common ores in the Philippines but tin was rare and had to be imported for bronze casting (Dizon, 1983).

The metal tools which did survive are often heavily corroded, such as the knives in Figure 8.15, which come from burials in Negros. There is no doubt that the advent of metal tools in copper, bronze and iron made a considerable contribution to reducing the time needed to manufacture a boat. Apart from the axe and adze there was a skewed adze (called a bintung), a spoon bit (kalog), and the drill or awl (abluwang) (Scott, 1994: 56). An augur or lukub was used for opening round holes in the hull. (Alcina 1688: 165). A selection of replica tools of the Metal Age from the National Museum is shown in Figure 8.17.

One new addition in the Metal Age was the Philippine bolo or jungle knife (Figure 8.18). This became an indispensable tool for agricultural use which could also double up as a weapon. The bolo was particularly valuable in cutting bamboo, a vital raw material for houses as well as boats. There were several styles of bolo for different purposes differentiated by weight and curvature; the common type

was the dohong or dayopak, with the tuwad for heavy woodwork and the bantok for horticulture (Scott, 1984: 55).

Another development was the patuk, a kind of metal adze used in carving boats and boat timbers. Figure 8.16 shows a replica patuk. This tool could be adjusted to serve as an adze or an axe (Salcedo, 1998). It is not clear when this tool came into use.

The impact of the Spanish colonisation, and the large scale immigration of Chinese labour post that colonisation, introduced a new toolkit into the Filipino shipyards, particularly the saw (lagari) and the plane (saiyo) (Scott, 1994: 56). The saw was particularly important as it facilitated the switch from hand-carved to sawn strakes. The saws included hand saws and the two-man pit saw. The saw and the plane demonstrate differences between the Spanish and Chinese designs, (Worcester, 1947). Another important innovation was the use of nails and other metal ship fastenings from the sixteenth century, which became cheaper than the traditional dowel technology. The impact of these technical changes on Philippine shipbuilding will be discussed further in Chapter 9.

8.5 Raw Materials for Shipbuilding

At the time of the colonial settlement the Philippines had extensive reserves of native forests with a wide range of high quality tropical hardwoods. De Morga commented "this wood is suitable for houses and buildings as well as for constructing large or small boats. There are in addition many stout, straight trees which are also light and pliant and can be used for making masts for ships or galleons" (de Morga, 1609: 253-254).

Among the species of tree in the Philippine forests were a large number of trees suitable for shipbuilding. These are listed in Chapter 5.5.7 (Ahern, 1901: 98). Whitford gives a list of some twenty species of timber particularly appropriate for shipbuilding, but his list differs in detail from that of Ahern, which illustrates both the huge range of suitable timber available and the confusion of varied local names given to particular trees in the Philippines (Whitford, 1911; 38).

Confusion has also been caused by the application of the name lauan or Philippine 'mahogany' as a generic name by the lumber trade for a number of related species, including red and white meranti, as well as balau. It is notable

that a logboat constructed in Roskilde, based up on a typical design from Northern Borneo was carved from red meranti (Nicolaisen & Damgård-Sørensen, 1991: 49).

The Admiralty Guide referred to *shorea negrosensis* as the preferred species for logboats (Admiralty Guide, 1944: 96). This is referred to colloquially as malatabang or red lauan and is now on the red list of endangered species.

A report was commissioned by Lacsina on wood species identification in the Butuan site excavations from the Forest Products Research and Development Institute in Laguna (Lacsina 2016). The results of this analysis show a wide range of timber listed in Chapter 6.7 above.

One of the most valuable materials for ship construction was bamboo, which was plentiful. Bamboo served as an excellent material for tripod masts, outriggers, and sun shades to protect the crew. It was easy to work with the traditional jungle knife, the bolo.

The cordage used in the indigenous boats for running and standing rigging was usually the fibre of cabo negro, or gamu in Filipino, from the sugar palm (*arenga pinnata)* (Figure 8.19). This tree is called kaong in Tagalog and hidiok in the Bikol region. Coconut fibre was noted as another source of cordage, as well as caulking material when treated with pili oil (Pigafetta, 1969 edition: 33).

Cordage was also produced locally from abacá, which became known as Manila 'hemp' (Figure 8.20). Pineda reports in 1619 that abacá was by then the preferred cordage for standing rigging due to its higher tensile strength (Pineda, 1619, translated in Blair & Robertson. Vol 18: 177). Abacá (*musa textilis*) is a relative of the banana family and is native to the Philippines. It is particularly found in Bikol in southern Luzon. This fibre was used in pre-colonial society mainly to produce coarse fabric rather than cordage (Sievert, 2009: 8-14). In the Spanish period it was used to produce Manila 'hemp' rope, although this name was misleading as it contained no hemp. This was one of the best natural fibres for marine rope and became a major export commodity in the nineteenth century (Sievert, 2009:18-20).

8.6 Innovation in Tools and Equipment

At the time of the Spanish colonial occupation there was a distinct maritime culture in place in the Philippines, which had a comprehensive set of local tools and technology, including paddles, oars, sailing rigs, steering oars and cordage. After the settlement these were the subject of rapid change due to foreign influence, including a new toolset, different sailing rigs, the introduction of central rudders and even new designs of paddles and oars. The one aspect which was not subject to major change was the outrigger which survived largely unchanged and is still widely used today in local craft.

Figure 8.1 A traditional bugsey or bugsay at Cebu, photo :M. R. Stead

Figure 8.2 Examples of Philippine paddles in Butuan Museum, photo: M. R. Stead

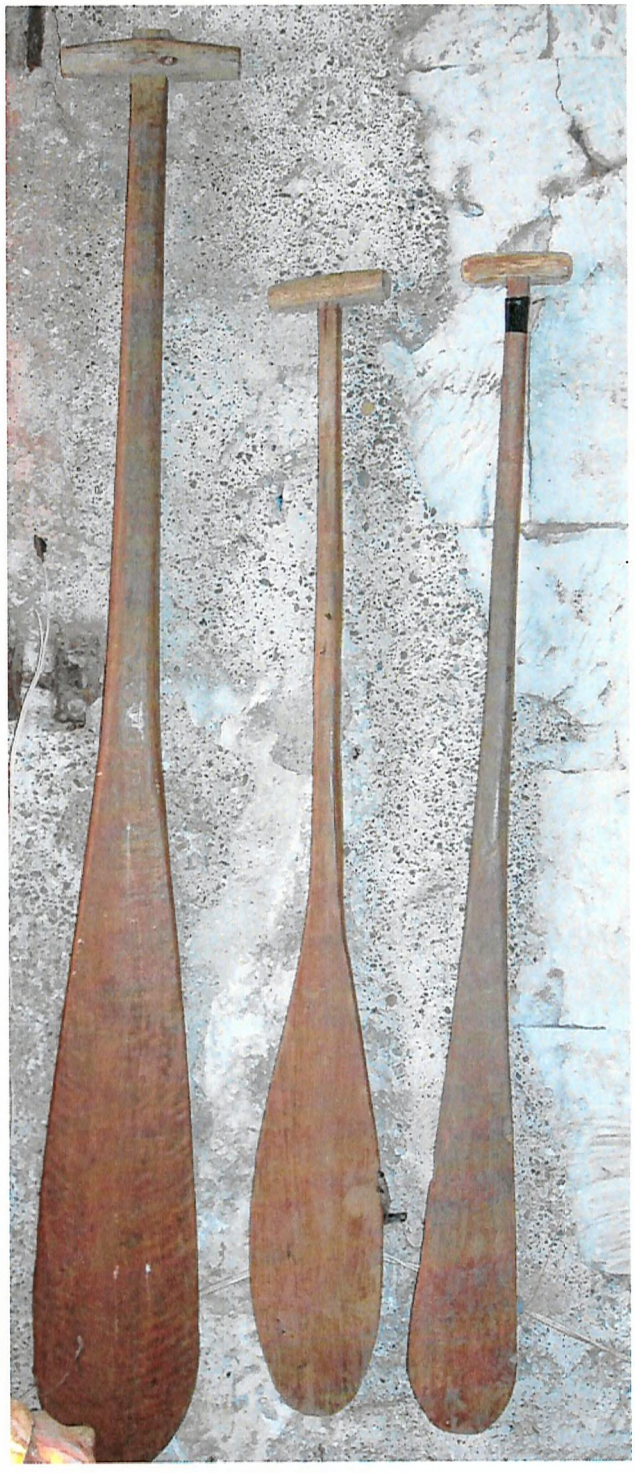


Figure 8.3 Collection of traditional paddles in Fort San Pedro, Cebu, photo: M. R. Stead

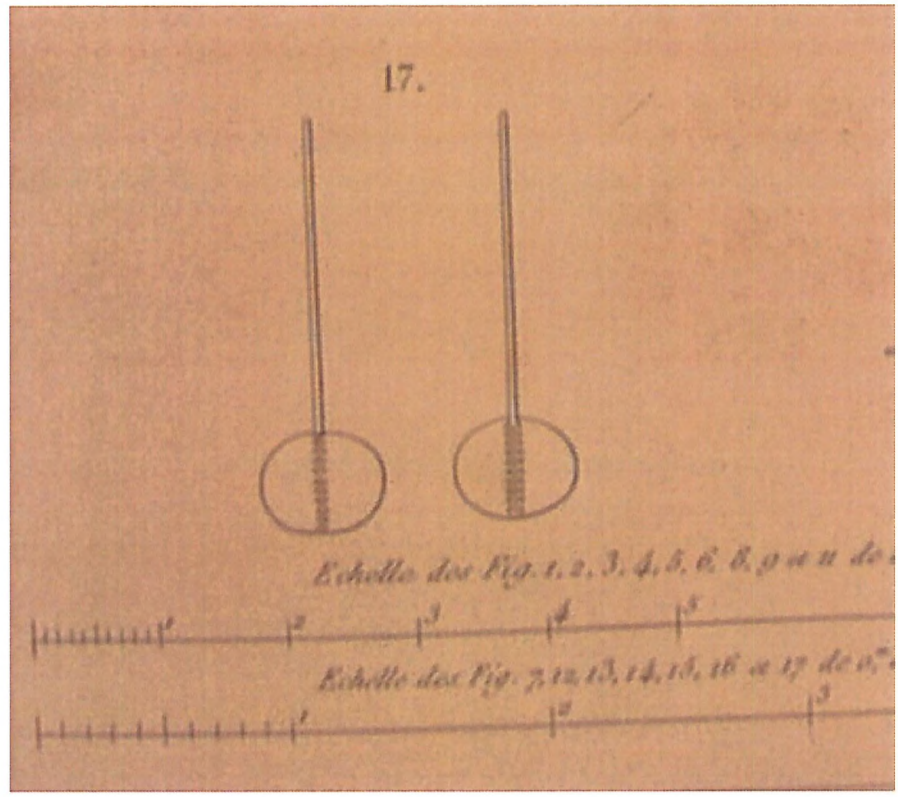


Figure 8.4 Drawing of two gaor (oars), from Pâris, 1841: pl 104

Figure 8.5 Large steering oars still in use in Sulawesi, photo: M. R. Stead

Figure 8.6 Replica steering oar on balangay boat, photo: M. R. Stead

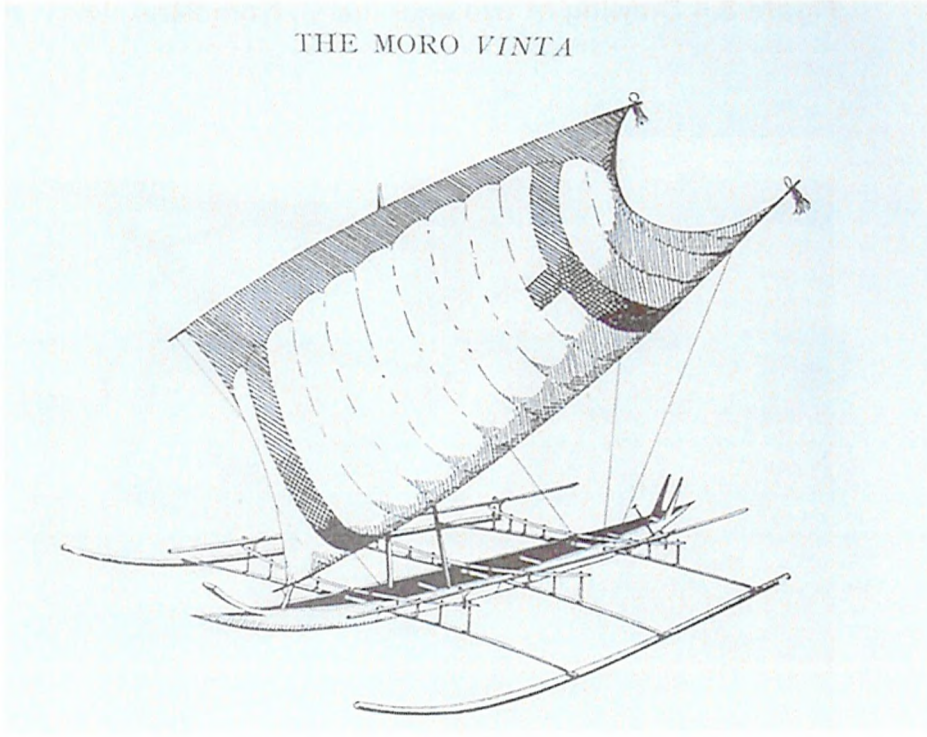


Figure 8.7 A boom rig on a Moro vinta, Admiralty Guide, 1944 pp 83

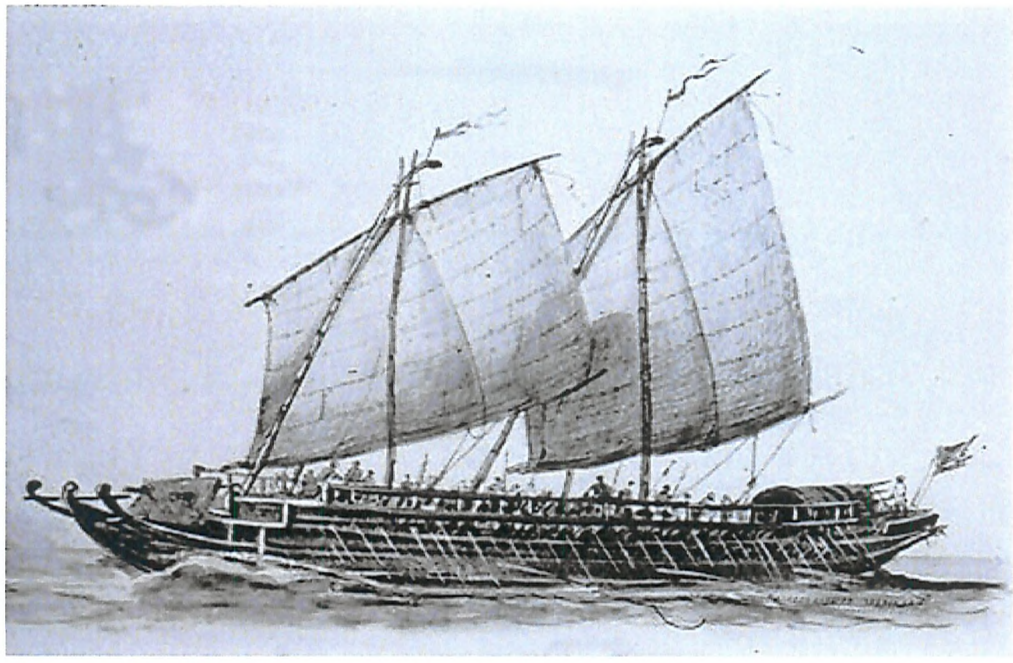


Figure 8.8 A boom rig on a nineteenth century pirate raider, from Mouleon, 1890

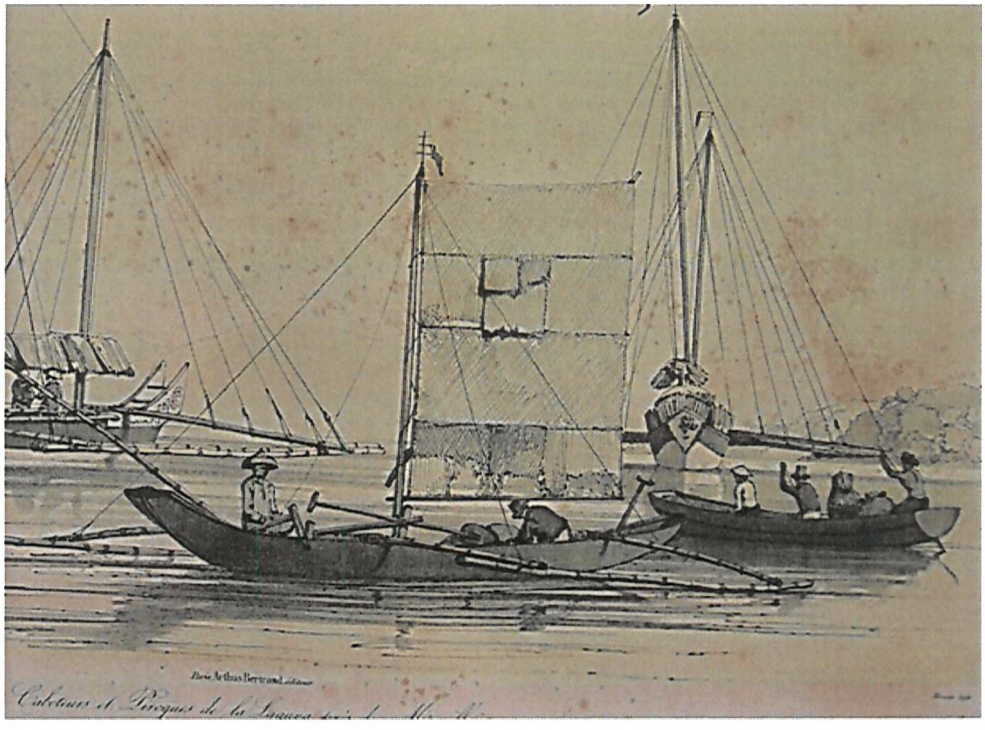


Figure 8.9 A sprit boom sail, from Pâris, 1841: pl 71

Figure 8.10 The 'bent arm' outrigger connection, photo: M R Stead

Figure 8.11 The 'elbow' outrigger connection, photo: M R Stead

Figure 8.12 The 'bamboo collar' outrigger connection in Ambon, photo: M. R. Stead

Figure 8.13 Stone adze from Luzon, National Museum, photo: M. R. Stead

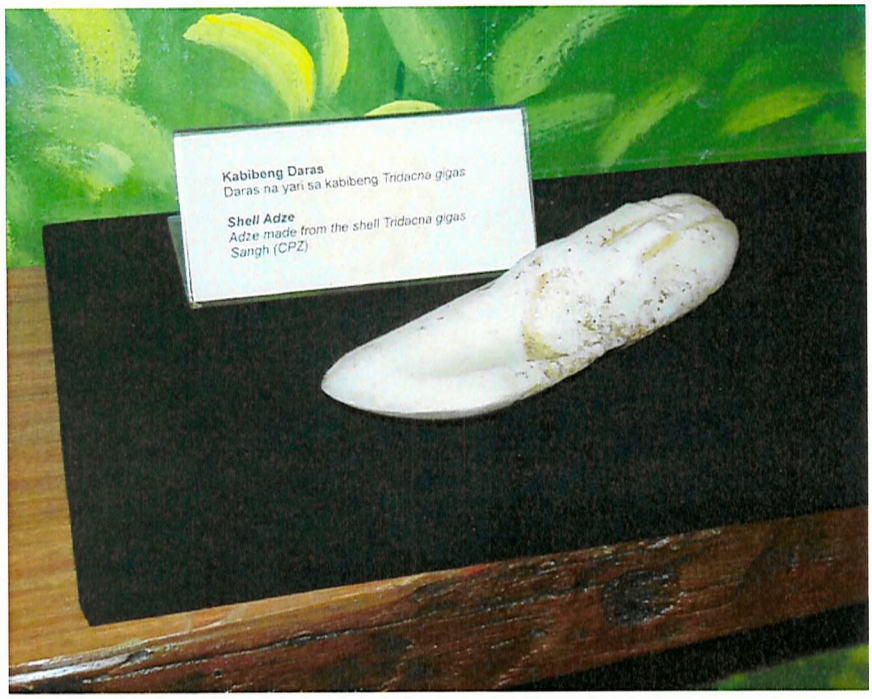


Figure 8.14 Shell adze manufactured from *tridacna gigas*, photo: M. R. Stead

8.15 Metal tools from Negros burials, Silliman University, photo: M. R. Stead

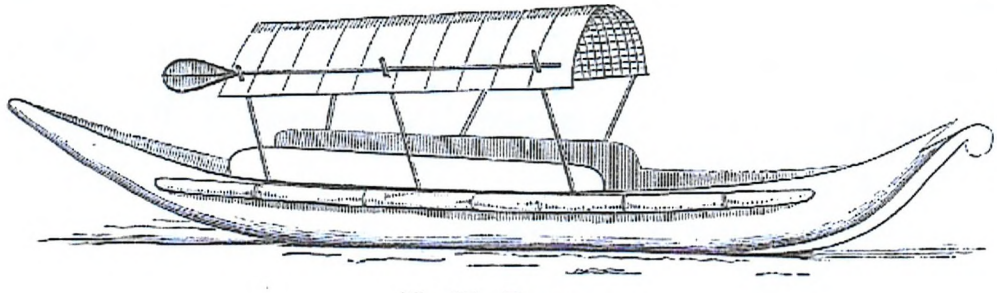
Figure 8.16 Replica patuk, from 'The Ingenious Filipino Boat' by Salcedo C. G. in Kasaysayan, The Story of the Filipino People: 224

Figure 8.17 Replica Metal Age tool kit, National Museum, photo M. R. Stead

Figure 8.18 Nineteenth century bolo, Naval History & Heritage Command, Washington, downloaded on 10/1/2017

Figure 8.19 'Cabo Negro' from the sugar palm (arenga pinnata), photo: M. R. Stead

Figure 8.20 Abacá, the raw fibre of Manila 'hemp', in the Sorsogon Museum
photo: M. R. Stead



Manilla Banca.

Figure 8.21 Illustration of sponson from Folkard, 1906 pp 484

Figure 8.22 Oceanic sprit sail in the Philippines downloaded from http://indigenousboats.blogspot.co.uk/2011 on 7/7/17

Chapter 9: The Influence of Other Maritime Traditions

9.1 The Austronesian Connection

Early European visitors noted the close linkages between the maritime traditions of the Philippines and the areas further south in Eastern Indonesia, especially with Sulawesi and the Moluccas (Pigafetta, 1969 edition: 89-131, Argensola, 1609: 24). This is particularly demonstrated by the descriptions of plank-built boats in the Moluccas, which are very similar to the boats built in the Philippines (Jacobs, 1971: 241; Forrest 1779: 23). This was discussed in detail by modern writers such as Horridge (1978: 39-48). The traditions in common include boat hull designs, outriggers, shared sailing techniques as well as styles of oars and paddles. In the plank-built boats there is shared technology in strake fastenings by dowels and the lashed lug technique (Horridge, 1978, 1982). A number of images from the Buddhist stupa of Borobudur in central Java (Figure 1.3) illustrate the similarity of the boat building tradition in Java to that of the Philippines in the eighth century AD in respect of outriggers, steering oars and rigging (Petersen, 2006; Manguin, 2010). In Chapter 10, it will be suggested that the technical similarities, especially between the Philippines, the Moluccas and Sulawesi, indicate that many aspects of these shipbuilding traditions were developed in Island Southeast Asia.

9.2 Early Contact with Southeast Asia

As mentioned in Chapter 3.5, early trade with other maritime cultures in Southeast Asia is demonstrated and documented by the survival of trade goods from 1,000 BC onwards (Solheim, 2006: 3). This must have been largely through maritime trade due to the absence of land bridges at this time (as discussed in Chapter 2), but traces of the ships used for this trade remain elusive in the archaeological record (Manguin,1993a). Early markers of this trade have included the distribution of similar styles of jade earrings and pendants across the region (Bacus, 2004: 263). The wide range of discoveries of the Sa Huynh-Kalanay pottery tradition particularly in Vietnam and the Philippines are a further link between Island Southeast Asia and the continental areas (Solheim, 2006: 3). From the first millennium BC, the highly identifiable dong son drums from Vietnam

demonstrate that widespread regional trade did take place and must have included maritime contacts. These drums have been found distributed throughout Malaysia and Indonesia, to the south, but no examples have yet been found in the Philippines (Highham, 1996: 102-129).

Manguin has argued that these trade goods were transported in early Southeast Asian trading vessels (Manguin, 1996). These were substantial, reportedly of up to 500 or 600 tons, but no good archaeological examples of vessels of this type have yet been found. There are descriptions of a Southeast Asian jong, junk or junco in the accounts of early travellers (and an illustration from De Bry in Figure 9.9) (Manguin, 1980, 1993b, 1996). However the extent of Filipino involvement in building or operating these large jongs is unclear. Manguin has argued that there was a degree of cross fertilisation between the Chinese junk and the Southeast Asian jong to produce a melded tradition in the South China Sea (Manguin, 1984a, 1993b). Here again there is no immediate evidence in the Philippines for this tradition.

There is an interesting piece of hearsay evidence reported in the *Suma Oriental* of Tomé Pires (1512-15), written before the Spanish arrival in the Philippines. Pires interviewed in Malacca a few traders from the Luções, an ethnic group believed to be from Luzon. They were reported to live some ten days sail beyond Borneo and to trade mostly through Brunei. He reports that they had just two or three jongs at the most. This is probably the first recorded meeting of Filipinos with Europeans. If taken at face value this report suggests that the jong was not widely used in the Philippines in the sixteenth century (Pires, 1944 edition vol. 1: 133).

The best early evidence of boats from Cambodia is provided by the forty images of boats included in the carvings of Angkor Wat, mainly from the twelfth and thirteenth centuries (Coe, 2003). On the walls of Angkor Thom, a twelfth century temple complex at Angkor is the depiction of a naval battle between the Khmer and the Chams on the Tonle Sap, using plank-built, oared vessels (Figure 9.7). The images also include a range of 'pilan' logboats. A Chinese visitor, Zhou Daguan, visited Angkor in the late thirteenth century and describes the boats in use (Zhou Daguan, translated by Harris, 2007: 78). The plank-built boats were carved, not sawn, and used iron nails. Referring to the pilan logboat, he describes how they were carved and then expanded using heat. The bow and stern ends were sealed by drawing and fastening the sides of the vessels together. These

pilan vessels were rowed or paddled rather than sailed according to the images in Angkor and the Chinese text. The use of carved wood (not sawn) is similar to the Philippines, but not the use of nails. There are no indications of outriggers on the images, nor are outriggers mentioned in the text of Zhou Daguan.

The conclusion is that maritime trade existed with other parts of Southeast Asia for two millennia at least, but, with the exception of the related maritime culture of Eastern Indonesia, traces of foreign influence on Philippine boat development from these trade partners are very difficult to identify.

9.3 Influence from the Indian Subcontinent.

The arrival of Indian cultural influences in South East Asia are evident from the first century AD, if not before (Coedès 1968). Hindu and Buddhist influence in the art and architecture of the region provide the main evidence of this spread of South Asian culture into Southeast Asia, mostly from the fifth century AD. The Philippines seems to have played a much more limited role in this contact compared to Indonesia or mainland Southeast Asia (Bacus, 2004: 272-273). However, there is some evidence of a knowledge of Buddhism and Hinduism through jewellery found in the Philippines (Villegas, 2013), particularly the image in Figure 3.4 found in Agusan near Butuan (see Figure 1.1). It has been suggested that the trade links with India may have preceded this religious influence on Southeast Asia (Manguin, 1996:182-3). Wolters considers that the agents for this trade were likely to be Southeast Asian residents and not just Indian traders (Wolters, 1967: 230-233).

The cultural impact of India in the Philippines has left few traces and it is likely that the influence was felt indirectly through Indianised states such as Srivijaya or Majapahit (Francisco, 1977). Classical sources give literary evidence of trade contact through India to the Mediterranean world, however, Indian ports were reported as key trade intermediaries (Sitwell, 1984: 146-7). Roman coins have been found in Cambodia at the site of Funan, but these are not sufficient evidence of direct trade contacts (Sitwell, 1984: 140-141). Literary evidence of the early spice trade in cloves to the Roman Empire is found in Pliny to confirm these early trade links, as the clove was only found in the Moluccas, but this cargo was probably passing through the hands of various intermediaries in India as the Roman sources indicate that the source of the spices remained a mystery (Pliny,

1968 edition). Ptolemy gives a reasonably accurate account of Southeast Asian geography, but becomes rather garbled when discussing the Chinese coastline (Sitwell, 1984: 149-150). The trade in Indian glass beads is also a useful early marker of trade contacts with the sub-continent (Fox, 1977b). The Philippines did import such beads from India but the trade route may have been indirect.

The influence of Indian boat design on Southeast Asia is unclear. The panels of Borobudur, mentioned above, show some ten images of boats, in the illustration of the Buddhist stories, but all seem to be modelled on Southeast Asian traditions rather than Indian types according to Manguin(2010). Therefore the direct influences of Indian contacts on local boat design remain obscure.

9.4 Contact with Arab Traders, Sailors and Missionaries

The later years of the first millennium AD was a period of peace and prosperity over much of Gulf Region with the Umayyad caliphs and later the Abbasids in control, whilst Tang Dynasty (618 to 906 AD) unified much of China. Persian and Arab sailors were in close contact with India and began to sail all the way to China. The Arabic and Chinese sources for this period have been summarised effectively in Hourani's classic account of Arab trading in the Indian Ocean (Hourani, 1994: 61-79). These sources indicate direct voyages to China from the late seventh century onwards. Canton and Tongkin are identified as the principal Chinese ports, each with substantial foreign trading communities. An example of an Arab sewn vessel is illustrated in Figure 6.15. The Arab sources describe the route through the Malacca Straits, touching Vietnam and passing through the Paracel Reefs (the 'Gates of China'). Despite this proximity, there is no identifiable reference to the Philippines as a port of call and no evidence of direct influence over ship design. In 878 AD the foreign community in Canton was massacred in the rebellion of Huang Ch'ao and there were other political disruptions in the area of the Arab Gulf. These events seemed to have constrained direct voyages. When Ibn Battuta visited China in the fourteenth century there was still a significant Muslim community there, but the trade from India to China was by then dominated by Chinese junks (Ibn Battuta, Hakluyt edition 1994, vol. 4: 894).

The Arab vessels engaged in this trade have been interpreted as sewn vessels with lateen sails (Agius, 2002). However, the similarities between Arab and Indian

vessels are close in the first millennium and it would be difficult to distinguish the two traditions (Flecker, 2000).

As was discussed in Chapter 3, from the fourteenth century onwards an Arabic influence is recorded after a number of Islamic missionaries visited the future Philippines from the Malay Peninsula and converted many people to Islam, particularly in Sulu, Mindanao and the Manila area (Saleeby, 1908: 159). This influence was probably indirect through regional centres of Islamic culture such as Malacca and Brunei. The type of vessel used for these contacts is unknown but was probably a Southeast Asian boat type. The cultural impact of the religion and the adoption of the Arab script were profound in those areas, but there is no clear evidence that this directly influenced shipbuilding and maritime technology (Nimmo, 1990).

9.5 Trade and Tribute Relations with China

There has been a long and close trading relationship between China and Island Southeast Asia (Scott, 1989). From the early Tang Dynasty (seventh century AD) evidence of trade relations with China are demonstrated from the ceramic trade goods found in the Philippines (Brown, 1989). The identity of the traders has not been proven. This trade relationship became more pronounced during the Sung Period (960–1279) from the evidence in Philippine sites. There is a reference in the Sung Histories of a visit from traders from Ma-Yi to Guangzhou in 982, which is considered by Scott (1989:1-3) to relate to early Filipinos.

The first tribute visits to China from the Philippines were from Butuan in 1001-1003 (Hontiveros, 2004). Other tribute missions are recorded from Luzon/ Mindoro from 1373 and 1405, from Sulu in 1417 and from Magindanao in Mindanao (Scott, 1989). The Chinese interest was to obtain exotic tropical produce such as spices, aromatic woods, trepang, beeswax and tropical hardwoods, in exchange for Chinese metal products and luxury goods, including silk and porcelain (Reid, 1988, 1993).

It is possible that many of these early contacts in the first millennium were established by Filipinos, but in later years the larger trading vessels were Chinese junks (Hall, 2011: 332-333). These concentrated their trade on the emerging trade emporia in the Philippines such as Manila, Cebu, Sulu and Butuan, with local

distribution of trade goods handled by Filipino vessels. This may be due to a fear of the uncharted coral reefs between the Philippine islands (Hontiveros, 2004).

The Chinese had a very distinct maritime tradition (Needham, 1971; Worcester 1947, 1966). There is little early evidence of logboats in China. However, a recent article by Huisheng (2016) has identified examples of the logboat on the central Chinese coast.

The traditional style of Chinese junk was characterised by transom stems and sterns, sawn timbers, flat bottoms with no keels, iron fastenings for strakes and frames, bulkheads for watertight compartments, multiple layers of planking, batten sails and single axial rudders (Manguin 1984). An early image of a junk from the temple complex of Angkor Thom in Cambodia is illustrated in Figure 9.8. Needham (1971) considered that this was a Chinese junk, due to the axial rudder.

Despite this close contact with the Chinese and visits to China on tribute missions there is little evidence of technological interchange with the Philippines. Local boats continued to use dowels rather than nails, and carved rather than sawn timber (Scott, 1981). After the founding of the Spanish colony there was a profound impact on local shipbuilding from China but this appears to be the fruit of Chinese immigration permitted by the Spanish (de Morga, 1609: 315).

9.6 The Spanish Colony

The early Spanish exploration of the Philippines in the sixteenth century was motivated by the ambition to seek an alternative route to the Spice Islands though the Pacific and challenge the Portuguese control of the Moluccas. However, at the same time the Spanish also discovered a healthy demand and favourable exchange rate for silver in China, which was being produced in large quantities in South America. A new trade route from China to the Americas and Europe through Manila provided an economic basis for the Philippine colony (Agoncillo, 1975: 27-42).

Alcina suggested the local vessels were very well adapted to conditions in the Philippines (Alcina 1668: 207). As a result, after the founding of the colony, the Spanish colonial authorities continued to employ boats built in the local tradition for communications, local trade and in seeking to suppress maritime raiders from

the areas not under colonial control (Scott 1981: 1-38). This tendency to use traditional vessels in the administration of the Spanish colony continued into the nineteenth century. The Spanish recognised the skills of the Filipinos as carpenters and shipbuilders. Initially they were employed on ship repairing after the ravages of the long voyage from Mexico, but with the plentiful supplies of timber and other materials available, the construction of European-style ships in the Philippines began at an early date. The most important source for early Spanish shipbuilding in the Philippines is a paper by Sebastián de Pineda of 1619 titled, 'Relación hecha por el... en cosas tocando a las Yslas Filipinas...' translated as 'Philippine Ships and Shipbuilding' (Blair & Robertson 1903-7, Vol. 18: 169-188).

One local trading vessel built to a Spanish design was the *San Diego*. This was a patache, a two-masted vessel used mainly for inter-island trading (Desroches, J. P., Casal, G., Goddio, F., 1997). The vessel had been built in a yard on Cebu in 1590 and had a hull length of 57 feet (rather larger than the usual patache). When the Dutchman, Oliver Van Noort, blockaded Manila in 1600, this vessel was pressed into service under the command of de Morga. It sank whilst attacking the Dutch fleet south of Manila (Fish 2011: 219-248). The wreck was excavated in the 1990s by a joint expedition of the National Museum and the Frank Goddio organisation. The artefacts from this wreck are on display at the National Museum in Manila (Desroches, Casal & Goddio, 1997). The top of the wreck had been destroyed but the bottom timbers of the wreck was well preserved, including the keel, the rudder, rib, knees and futtocks. A total of ten different native Philippine trees species were used, which confirmed that the ship was built locally, but to a totally Spanish design. The keel and planking were mainly bitaog, known in English as Indian laurel (*calophyllum inophyllum*) and referred to by Pineda as palo maria. The keelson was of calumpit (*terminalia edulis*). The rudder was carved in betis (*azaola betis*) another timber reputed to resist shipworm. Some of the stringers were identified as apiton (*dipterocarpus grandifloras*) (Ahern 1901: 22, 36, 37, 41). The caulking was coconut fibre impregnated with the oil of the pili nut tree, as used in Filipino vessels (Fish 2003: 237).

The trading lifeline of the Spanish colony was the long-distance route to Acapulco in Mexico, which commenced at the founding of the colony. This was a distance of some 8,000 to 9,000 nautical miles across the Pacific. This regular trade continued for 250 years from 1565 until 1815 and depended on the galleon, a

large, rugged ship developed in the sixteenth century to maintain links with the Spanish colonies (Fernández Vial & Fernández Morante, 2013). The usual size of these galleons was up to 2,000 tons, up to 200ft in length and up to 50ft on the beam (Fish 2011, 156-162) (Figure 9.1).

The shipbuilding industry required large numbers of Filipino workers. Massive amounts of labour were needed for cutting and transporting the timber for the ships, estimated as up to 2,000 trees per galleon (Fish, 2011: 129). The construction also required an extensive labour force in the yards and forced labour was used, although the labourers were usually paid. In addition, many skilled tradesmen were needed, who were frequently drawn from the Chinese artisans who had settled in the Philippines. (Pineda, 1619: 174). According to Pineda it was cheaper to build ships in the Philippines than in Mexico or Spain .Shipyards were constructed at a number of locations, especially at Cavite near Manila. Cavite was the port for servicing the galleons and was a protected anchorage, where they could be loaded and unloaded (de Morga, 1609:254). However the location of these yards was based on the availability of materials, especially timber, and a local labour force. A sheltered, suitable beach was also a key requirement. Pineda refers to galleons having been constructed in Marinduque, Mindoro, Masbate and Camarines (Pineda, 1619: 174). The range of the Bikol construction sites are illustrated in Figure 9.15. A few of the galleons were built in Mexico and in locations in Asia, but the majority were constructed in the Philippines (Pineda, 1619: 169-188). In 1679 an order was given for all future ships for the Manila-Acapulco trade to be constructed in the Philippines (Schurz, 1939: 196). There are no accurate numbers of the galleons built in the Philippines, but Fish indicates the total was in the hundreds (Fish, 2011: 160).

A number of smaller European-style vessels are recorded as being in use in the Philippines during the Spanish colonial period including the pontin, the pinnace (pinaza), the schooner (goleta), the shallop (chalupa) the scow (chalana) and various styles of galley, including the fusta. These are all mentioned by Gallang (1941: 291-306). A number of these vessels were illustrated on the margins of the Velarde Map of the Philippines of 1734 and were analysed by Horridge in the Brunei Museum Journal (Horridge, 1986a). One of the numerous sketches from the map is attached as Figure 9.14. Apart from the difference in size, the Spanish ships and galleons used a different technology from the traditional Philippine boats. They were built

using frame-first construction and massive timber components joined by metal fastenings and fittings. The Spanish also introduced a new toolkit, particularly the saw and plane, and metal fastenings for the hull. The Filipinos were thus exposed to a number of innovations that were adapted by local shipbuilders for use in Philippine indigenous vessels. The use of iron nails as ship fastenings, referred to by de Morga, showed the early adoption of this technique in indigenous craft (de Morga, 1609: 253). The European central rudder was also introduced for local craft. Sails were made from local cotton canvas (abel) produced in Ilocos (Figure 9.2) as reported by de Morga (1609: 252). The European-style oar was adopted for rowing according to Alcina (1668: 205). The sail plans of local craft began to use European-style sails, as well as traditional sails, often with fore and aft sails raised on a pole mast as illustrated in Pâris (1841: plate 93) and in the Admiralty Guide.

An example of this new synthesis was the boteng pamunuanan from the Visayas, particularly Negros (described in the Admiralty Guide and illustrated in Figure 9.6). This was a logboat, but finished in a European jolly boat style with a central rudder and European oars.

9.7 The Influence of Chinese Immigration

As we noted in Section 9.5, the trade contact with China for more than 500 years prior to the Spanish settlement had led to very little interchange in shipbuilding technology. After the Spanish colonisation in the sixteenth century, large scale migration from China began with the consent of the Spanish authorities. These settlers were based mostly in Manila where they provided commercial and skilled trades which were often alien to the native tradition. The importance of this inflow to support the economic development of Manila was recognised by the Spanish authorities. As many as 20,000 Chinese were reported as resident in Manila by 1600 (de Morga, 1609: 315). The Chinese introduced a number of skills to the Philippines and were particularly important in the production of ironwork for the shipyards, where they supplied most of the blacksmiths. Much of the raw iron was imported from China (Pineda, 1619).

The Chinese influence on local boats was not well documented, but the Chinese junk was used widely in the colony and for trade with China (Galang, 1941:299). The Chinese did introduce the champan (or sampan) and the bancon for local

trading. These were open boats 12ft to 15ft long, which were often sculled in the Chinese style.

The Chinese style of batten sails also began to appear in Filipino waters as illustrated in the picture from Pâris (1841: pl 73) of cascos sailing in Manila Bay with batten sails (Figure 6.19). The casco was a kind of light barge, which appears in the eighteenth and nineteenth century particularly in the Manila Bay area. The shipyards eventually began to produce vessels which combined the Filipino, Chinese and European styles of ship construction. An example of this was the lorcha, which combined a European style hull with Chinese-style batten sails and appears to have been widely used in the Philippines and in China. According to Galang it was common in the Visayas (Galang, 1941: 300). It was also mentioned by de Morga as in use on the Chinese coast (de Morga 1609: 137). The hull shape was very similar to the Filipino batil, a small merchant ship from the Visayas (Figure 9.5).

9.8 The Impact of Foreign Influences

From this review of contacts with other maritime traditions, we can see a contrast between the slow rate of technical change prior to the arrival of the Spanish colony and the very significant changes thereafter. Prior to the sixteenth century the traditional boat-building styles were maintained and it is difficult to identify direct innovations due to foreign influence.

From the sixteenth century the impact of working in the Spanish shipyards and working alongside the recent Chinese immigrants had a significant impact on the technology used to build traditional vessels. The range of vessels used in the colonial period included ships of European, Chinese and local inspiration. This wider range of vessel types was reinforced as a result of economic developments during the nineteenth century and the introduction of steam-driven vessels. Under the American colonial regime in the twentieth century diesel engines replaced sails even in smaller vessels built in the indigenous tradition, as discussed in Chapter 6. 18.

Figure 9.1 The replica galleon, the *Andalucía*, at Manila, from fundacionnaovictoria.org downloaded on 10/1/2017

Figure 9.2 Abel weaving in Vigan, from www.vigancity.gov.ph downloaded on 10/1/2017

Figure 9.3 Logboat with western rudder and engine

photo: M. R. Stead

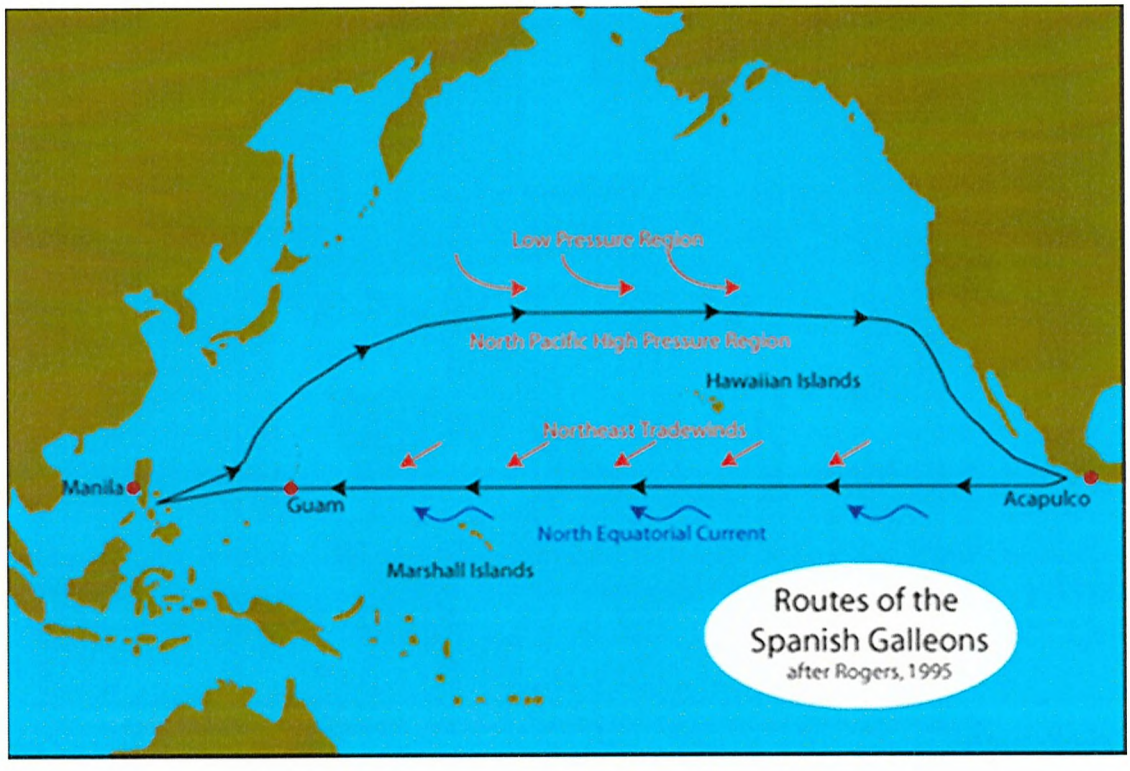


Figure 9.4 Routes of the Spanish galleons after Rogers, 1995

Figure 9.5 Model of lorcha in the Ayala Museum, downloaded on 10/1/2017

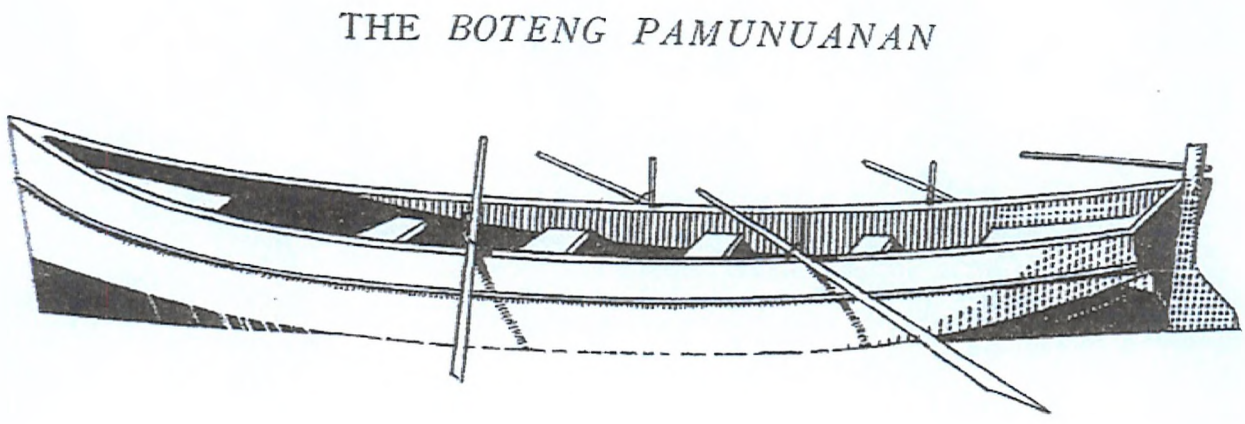


Figure 9.6 Drawing of a boteng pamunuanan, from the Admiralty Guide, 1944

Figure 9.7 Khmer vessel at Angkor Thom, photo: M. R. Stead

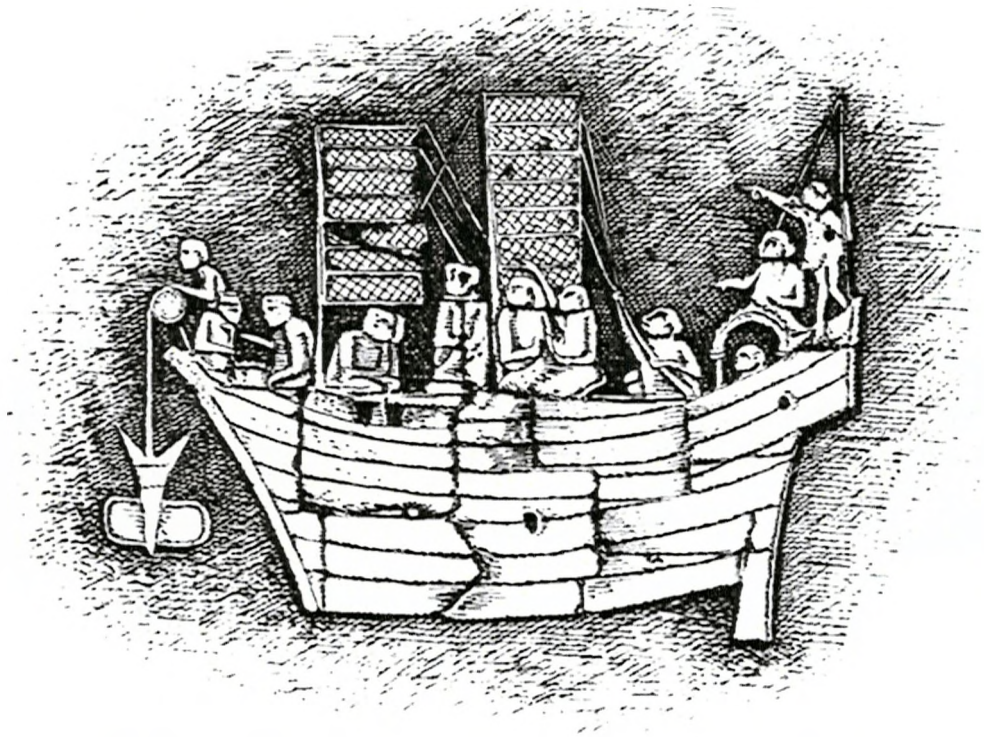


Figure 9.8 Chinese junk carving at Angkor Thom, from drawing in *Blue Book of Coastal Vessels – South Vietnam* 1967: 11

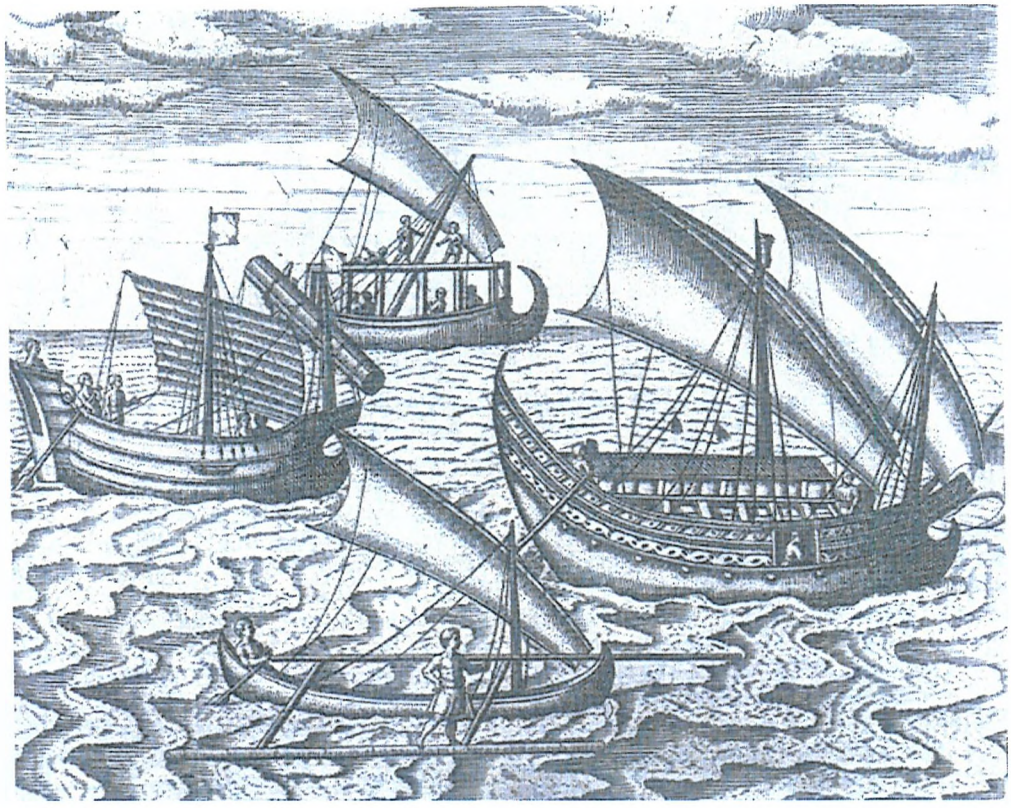


Figure 9.9 Ships of the Banda Sea, illustrated by De Bry 1590. The jong is identified as the vessel on the right.

Figure 9.10 Banca in Dumagete with western rudder and inboard engine, photo: M. R. Stead

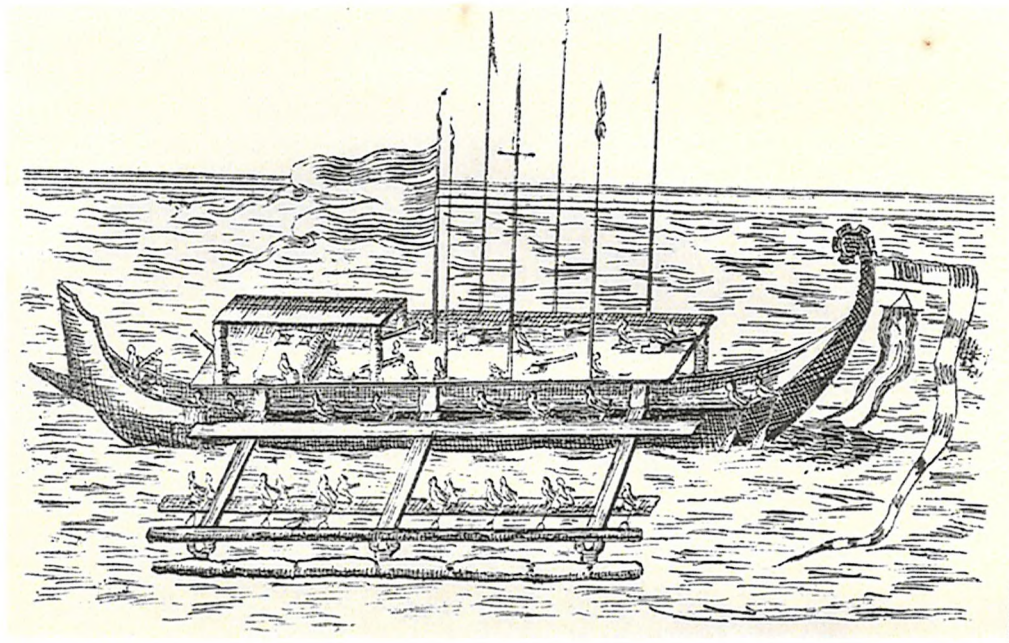


Figure 9.11 Caracoa (Kora Kora) as printed in Amsterdam and included in *The Voyage of Sir Henry Middleton to Bantam and the Maluco Islands 1604-6* (1856 edition)

Figure 9.12 A modern banca - an amalgam of traditions - Negros,
photo: M. R. Stead

Figure 9.13 Modern banca under construction at Malapascua Island, photo: M. R. Stead

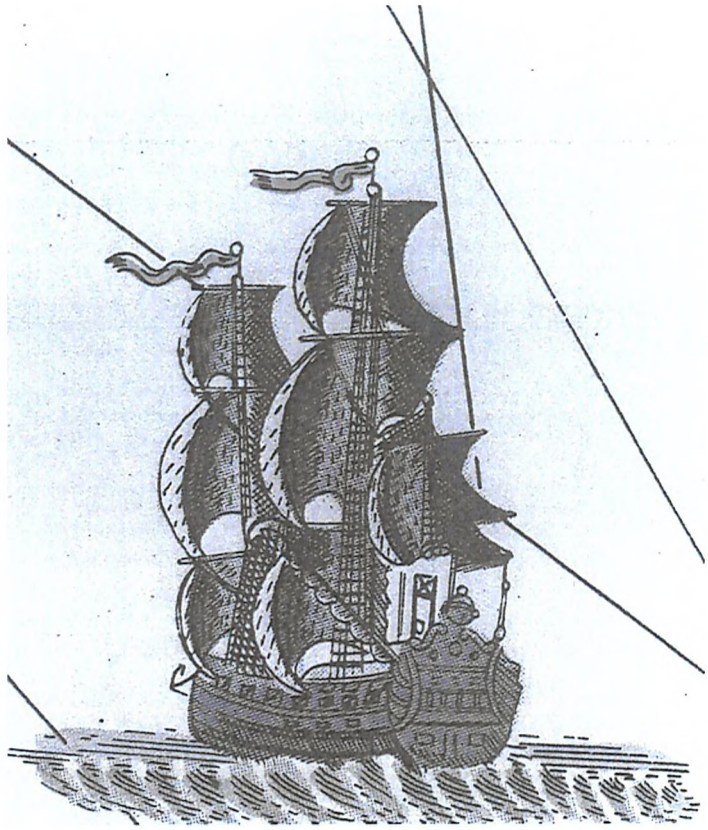


Figure 9.14 Patache, a marginal illustration on the Velarde Map of 1734

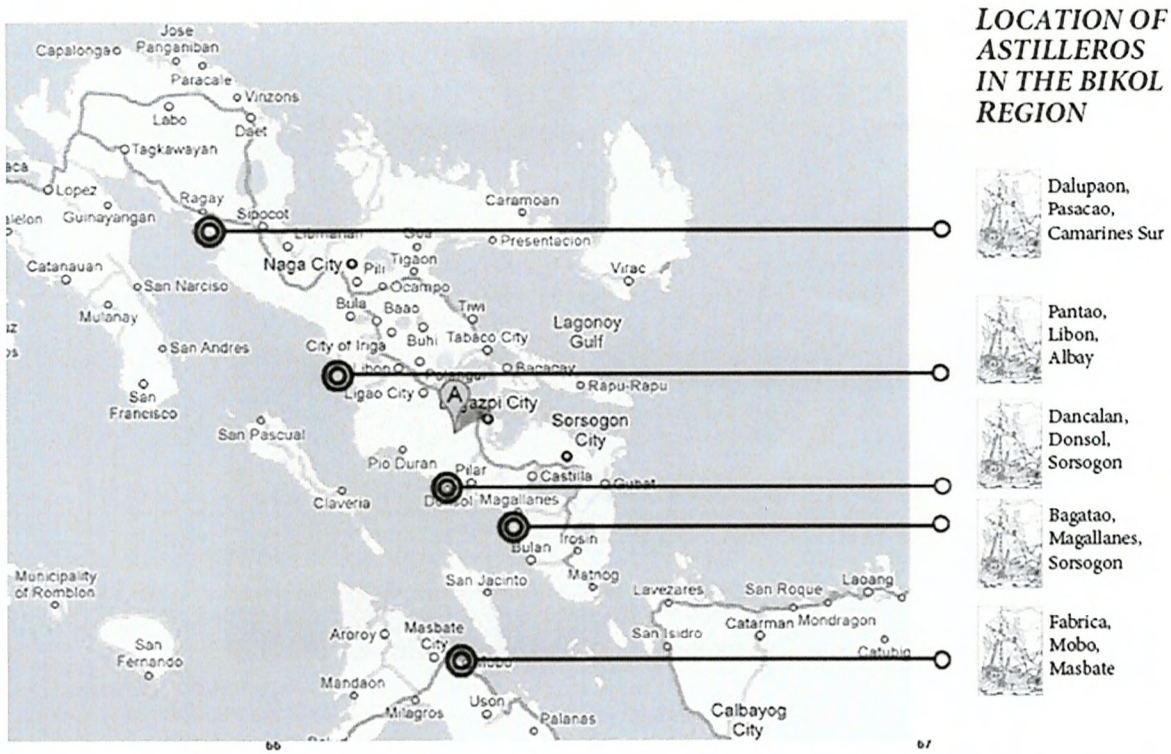


Figure 9.15 Construction Sites of Spanish Galleons in Bikol

raffibanzuela.blogspot.com/2013/07/bikol-in-galleon-times.html

Chapter 10: Conclusions and Interpretation of the Evidence

10.1 The Application of the Adams Model

The defining characteristics of Philippine indigenous boats in the sixteenth century have been identified in the course of this thesis by an empirical review of the archaeological and historical evidence. This analysis was carried out assisted by the theoretical model of Adams discussed in Chapter 4.1 (Adams, 2013: 23). That model helped to identify the drivers that influenced the development of boat and ship construction in the pre and post colonial period. The drivers Adams considered for ship development were the environment, material availability, ideology and social mores, technology and skills, local tradition, the economic considerations and the purpose and role of the vessels. The network of cross-influences between these drivers was illustrated in Figure 4.6.

The most immediate influence would appear to be the physical environment, including the geophysical and climatic features, such as the archipelago of islands and the dominant role of the coral reefs in the Philippines. As a direct result of the physical environment, the forests provided a vital resource base in terms of timber, cordage and sailcloth, which were a key factor in ship design, construction and propulsion.

A further influence was the technology available, as expressed in the local tool sets which included tools in wood, stone, shell and metal, which appear to have been little changed since the start of the metal age some two millennia previously (Scott, 1981).

The functionality of the boats, what they were needed for, was likely to be largely influenced by the social environment. The fragmented local communities show a long tradition of commerce, raiding, and slave trading by boat, which would have been key influences on the design of the vessels (Junker, 1999: 339-343). The conceptualisation of the lowest units of social organisation in Tagalog society as a 'barangay', a community overtly associated with the symbolism of a ships' crew, illustrates this close relationship (Patanñe, 1996; Scott, 1994). These barangay were feudal relationships rather than kinship or territorial groups in that people could switch allegiance to other barangay freely unless they were constrained by

outstanding debts. Moreover the Philippine class system was closely related to the various roles in a vessel's crew. The warriors who stood on the deck with weapons were the most senior group of society, the upper class, whilst the seamen and paddlers were of a lower social rank (Scott, 1981).

A further factor to consider is to be found in the social mores and religion of the people. The boat had a profound importance in the Philippines as a symbol of the independence and power of a social group and its leaders. The ship was more than a means of transportation, but an embodiment of the barangay (Abrera, 2007). The importance of the ship as a symbol was confirmed by the examples of human sacrifice at the moment of an initial boat launching, described as a kind of dedication by Alcina , as discussed in Chapter 6 (Alcina, 1668: 193-5).

The final factor was the economic driver, in the shape of the manpower needed to fashion the ships from carved timber. Labour was always in short supply in the Philippines due to low population numbers. This was one of the reasons why slave trading was so important (Junker 1999: 339-343). The huge investment of time in building traditional vessels meant that foreign technology might be considered attractive if it could offer cheaper, less labour-intensive vessels. This was demonstrated by the rapid adoption of cotton sails, iron nails and the use of sawn timber after colonisation (de Morga, 1609).

10.2 The Origins of the Principal Characteristics of the Traditional Vessels in the Sixteenth Century

The first research challenge for this thesis, as outlined in Chapter 1.2, was to identify the principle characteristics of these indigenous vessels in the sixteenth century at the time of the Spanish arrival, which defined the special character of Philippine vessels.

The second challenge was to identify the relationship of these vessels to the social context of the Philippines and how they reflected the life style, technical skills and belief systems of the local inhabitants.

In this conclusion the thesis will seek to identify the origin of these defining characteristics and re-examine and challenge some of the existing theories of their origins, which were outlined in Chapter 4.

10.2.1 Hand Carved Timber

The most striking feature was the use of hand-carved timber for both logboats, expanded logboats and as strakes for plank-built boats. This hand carving was a time-consuming technology, very wasteful in wood, and reflecting the sizeable wood supply in the forests of the Philippines at the time. This approach also required a highly skilled team of carpenters to carve the rounded shapes of the hull by hand and eye out of the original timber. The comments of Zhou Daguan, a Chinese traveller to Cambodia in the twelfth century are pertinent. He criticised the shipbuilders of Angkor for using the hand-carved approach, as in the Philippines, and the consequent wasteful use of timber in producing a single logboat or just two strakes from a single tree, as compared to the frugal Chinese (Zhou Daguan, translated by Harris, 2007: 78). The key question is why the Filipinos did not adopt the saw and the plane from the Chinese in the pre-colonial period, despite close trade relations over many centuries. The use of sawn timber could have produced a cheaper and speedier approach to the building of plank-built boats. We can speculate that the Filipino were more comfortable in retaining the hand-carved timber for plank-built boats in the pre-colonial period despite the labour inefficiency that this implied. This would have allowed them to retain the shell-first construction method with which they were familiar.

The retention of hand-carving for the logboat was more understandable as the potential savings from the use of sawn timber were more debateable. The fact that the Filipinos continued to use logboats hand-carved from a single trunk, even after they had adopted sawn timber for plank-built boats after colonisation, does tend to confirm this point. In the Sulawesi shipyard of Tana Beru visited during the fieldwork (Figure 10.1) the Indonesian carpenters use sawn timber for plank-built boats, but still produce logboats, when needed, in the traditional fashion.

10.2.2 Outriggers

The second key feature in these Philippine indigenous vessels was the use of outriggers (either single or double) to maintain lateral stability, especially at sea and whilst using sails. There is a special term in Visayan, kiyakiya, to describe the rolling of a vessel which was not equipped with outriggers, this clearly illustrated this particular function of the outriggers.

The origins of the outrigger are still uncertain. As noted in Chapter 4, Hornell (1946: 253-271) suggested that the it may have been developed on the rivers of mainland Southeast Asia, despite any clear evidence of this tradition being available today. A more credible theory is that it was developed in Island Southeast Asia. If we accept the Bellwood theory of Austronesian migration (1985: 107-117), when they migrated into a broader maritime world they had to adapt their canoe tradition to a new marine environment. There is as yet no hard evidence for this theory and it will be difficult to find archaeological confirmation due to the flimsy nature of bamboo and wood outriggers. This may become available as more indigenous shipwrecks are discovered offshore.

The outrigger permitted the Philippine craft to maintain a very limited draught, which was needed to cross the extensive areas of shallow coral. The use of double-hull canoes could also achieve this improved stability, but appear to have become less common in the Philippines by the sixteenth century (Haddon & Hornell, 1936-9: 19). No examples were found during the fieldwork for this thesis although there was a recent experimental voyage by James Wharram in replica double canoes from Bohol, in the Visayas, to the Solomon Islands (Wharram, dvd of the 'Lapita Voyage', 2009) .

The outrigger style allowed the use of a complex sail plan on a very simple logboat hull by running shrouds to the ends of the outrigger booms as illustrated in Figure 8.9. The use of outriggers also facilitated the use of multiple ranks of paddlers or rowers to increase the operational speed of plank-built boats. The buoyancy provided by the outriggers, especially in bamboo, allowed these vessels to survive even when swamped by waves over their low freeboard. The outriggers were also useful to facilitate the manhandling of boats for storage out of reach of the marine borers as discussed in Chapter 8 (Scott, 1981: 8).

10.2.3 Dowel and Lashed-Lug Technology

The third key feature of Philippine vessels was the use of the dowel and lashed-lug technology to bind together the hulls of extended or plank-built boats. The dowel technology was used predominently to limit horizontal shear, as discussed in Chapter 6, but also contributed to maintaining hull integrity, particularly where the dowels were locked in place using hardwood nails.The lashed-lug technique was the principle method to maintain the hull integrity by lashing ribs and

thwarts to the carved lugs on the individual strakes. Together with other framework timbers, this could create a strong web of lashed timers as described by Horridge (1978: 39-47).

The most controversial aspect of boat development in Island Southeast Asia was the process and timing of the possible evolution of sewn boat technology into a later dowel technology with the use of the lashed-lug frames in the first millenium AD (Manguin, 1993a :260; Horridge, 1978: 48, ; McGrail, 2001: 305). The archaeological record is far from complete, but Manguin used the example of the Pontian boat from Malaysia, which showed a mix of dowels and a sewn hull, to argue this case.

It is not clear what the technical advantages were of such a change in the context of the Adams model (2013: 23). To justify such a major design shift there would have to be clear advantages from such a change in design in the view of local shipbuilders, or a significant cultural change. There is, as yet, no evidence that the new design came from elsewhere and it seems to have been a local development.

Also it is difficult to argue that the adoption of dowel fittings and the lash-lug style were necessarily simultaneous, as the Pontian boat demonstrates the use of dowels in a sewn boat (Gibson-Hill, 1952).

The argument of Horridge (1982: 1) was that dowel fittings are only realistic with the use of metal tools to drill the timber and fit the dowels. Some flint experts (such as John Lord, in a personal communication) consider that drilling is possible using pre-metal tools but they accept that it is very time consuming and may be impractical. Horridge has modified his view on this issue as discussed in Chapter 6 (Horridge, personal communication).

One theoretical possibility is that these two features of boat construction date from the earliest days of the Austronesian colonisation of the Philippines and that the switch from sewn vessels, if indeed it happened at all, occurred sooner than the first millenium AD, This is a challenge for further research but would require further archaeological evidence to reach a clear conclusion.

10.3 The Evidence from the Philippines

This thesis has sought to give priority to Philippine evidence and examples and a key task is to review the evidence from the Philippines in the light of the various theories of the development of boats in the region which were outline in Chapter 4. The problem is that we are seriously affected by a shortage of archaeological evidence and many aspects of the technology which have disappeared.

The use of dowel technology for fitting the strakes of plank-built boats, which was the standard practice as reported by Alcina (1668: 167-195), now seems to have died out in the Philippines. However dowels are still in use for this purpose in Sulawesi (see the photo in Figure 10.1 from the Tana Meru boatyards there). This reflects the description of traditional boatbuilding at Billiton in Indonesia (Ecoma Verstege, 1876: 201-211). The use of the lashed-lug approach for securing the hull has also largely disappeared in the Philippines and has been replaced by the use of ribs or frames using metal fastenings or nails. Here again the traditional shipyards of Sulawesi do still use timber treenails for fixing the strakes to internal frames as shown in Figure 10.2.

The use of sewn boat technology has apparently disappeared completely in the modern day Philippines. It was still in use in the early twentieth century for building the casco barges as discussed in Chapter 6.4.4. These casco sewn boats seem to have arrived suddenly in the eighteenth century although there are no archeological or literary reference to date this introduction. The earliest evidence seems to be the illustrations from Pâris (1841: pl 73). The casco may represent an import from China or Southeast Asia rather than a local tradition. Other examples of sewn boats were relatively rare in the post colonial era, although examples from areas such as Northern Luzon were noted in Chapter 6.4.4 (Cuevas & Santiago, 2004).

One of the most challenging questions remains; how did the traditional styles of logboats and plank-built boats observed in the Philippines in the sixteenth century develop in the pre-colonial world? Accepting the theory that the Austronesian-speaking people spread to the Philippines from China and Taiwan, and then later to the rest of Island Southeast Asia (Bellwood, 1985: 107-117), then the Philippines could have been the location where they were first called upon to adapt to the warm tropical water and the ubiquitous coral reefs. Further

opportunities for change were provided by the local resource base in the Philippines, which had an extensive availability of top class timber, bamboo, rattan, and natural fibres such as cabo negro, abacá, and coconut fibre. Native cotton was available to be adopted as sailcloth in addition to the more traditional woven pandanus leaves.

It is likely that the exposure to this different climatic reality and resource base could trigger significant changes in boat design in adapting to this new environment. The linguistic analysis of Doran suggests that the concept of the canoe was already an essential part of this early Austronesian cultural package and could serve as the basis for developments such as the introduction of outriggers (Doran, 1981: 19). The development of outriggers was probably a Southeast Asian development given the historic range of this equipment (Horridge, 1978: 3).

McGrail in his *Boats of the World* (2001: 289) comments on Island Southeast Asia that it is an archipelago with many intervisible islands where "it ... seems more likely, on theoretical grounds, that this region, rather than China to the north, would generate innovations both in boatbuilding techniques and in methods of propulsion and navigation, notwithstanding China's long coastline and three large river estuaries".

Doran argued that the likely centre of innovation was Sulawesi due to the multiplicity of boat types found there in later years (Doran, 1981: 21). However due to the more northerly location of the Philippines, this was most probably an earlier staging point in the migration and an opportunity for regional adaptation and change (Horridge, 1978: 4). These Austronesian migrants could have adapted their boat designs to the new tropical environment in the course of this migration and before arriving in Sulawesi, but the time frame for this development must remain speculative.

An equally valid case can be made, therefore, for the Philippines as being the key location for innovation and developments such as the outrigger, dowel technology and the lashed-lug technique. The Philippines can be considered as a potential crucible within which the Austronesian canoe could flourish, and be adapted to the tropical environment. Such developments could have subsequently influenced boat developments in the wider Austronesian-speaking area.

The area which shows evidence of Austronesian cultural influence, stretches from Island Southeast Asia, to Oceania (as far as Easter Island), to the Indian Ocean, and eventually to Malagasy and the African coast (Petersen, 2006).

This hypothesis, of innovation and development in the Philippines, is very difficult to prove without more extensive, dateable archaeological discoveries, but remains a convincing logical case, and consistent with the view of McGrail (2001: 289) as noted above. We rely on further archaeological evidence and analysis of the process of development of Philippine indigenous boat-building to prove this hypothesis.

Figure 10.1 The use of dowels for fitting strakes in a traditional shipyard in Sulawesi, photo: M. R. Stead

Figure 10.2 The use of treenails in a traditional shipyard in Sulawesi, photo: M. R. Stead

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Appendix A: Philippine Boat Names

Name	Description	Alternative Names	Source
Adjong	All foreign vessels with high freeboard, from Malay jong		Scott 1994: 63
Armadahan	Single outrigger fishing boat		Filipino Heritage: 717
Balandra	Boat with double outrigger and 3 booms, quarter paddles, one mast		Galang 1941: 292
Balangay	Edge pegged, plank built boat on a large keel. Barangay also used as generic term	Balanghai, balanguai,	Scott 1994: 62-63 206,
Balasian	A small but strong boat seating 5	Balasiyan, damlog	Scott 1990: 206
Balsa	Raft of logs, planks, bamboos, used as ferry		Naval Int 1944(a): 110
Baluto	House boat, now obsolete, heavily carved, also referred to as kubu		Nimmo 1990: 19-20
Bancon	Boat with three pairs of oars of Chinese origin		Galang 1941: 292
Banka or bangka	Dugout or extended logboat, larger than baroto. Also used as generic name.	Bangka, banca, vanca	Naval Int 1944(a): 98
Bankerohan	Heavier version of baroto		Naval Int 1944(a): 97
Barangay	Plank built on a logboat base		Cuevas & Santiago 2004: 7
Baranquilla	Small banca		Martinez de Zúñiga 1893: 512
Baroto	Dugout for 1 to 10 people, outriggers 2 booms, flat bottom. Can be extended	Baloto, boloto	Naval Int 1944(a): 96
Bariga	A larger version of the Baloto		Alcina 1688: 199
Basnig	Motorised fishing boat with double outriggers, mast with support lines to	Basnik	Filipino Heritage: 718
Batel	Sailing boat with oars and rudder, European style, flatish rounded bottom		Naval Int 1944(a): 110
Batil	Double ended cargo boat. Rudder, 2 masts, double outrigger		Naval Int 1944(a): 108

Bawuto	Log boat smaller than bilog	Scott 1994: 206
Benitan	Small sewn boat of Dumagat people	Scott 1981: 339
Bidar	V shaped hull	Naval Int 1944 (a)
Bigniday	Similar to prao, large banka Biguiday, biniray	Galang 1941: 294
Bilalo	Double outrigger boat used as ferry.	Pâris 1841 pl 69,70
Bileg	Sailing boat	Naval Int 1944(a): 110
Bilog	Logboat	Scott 1994: 265
Bilos	Baroto with bark washboard	Scott 1994: 62
Bilus	Dugout, larger than sibidsibaran, 3 booms Bilis	Naval Int 1944(a): 102
Binabeng parao	Curved stem, rudder, sheer forward	Naval Int 1944(a): 104
Binitan	Boat of Catanduanes	Galang 1941: 294
Bira-bira	Small fishing vessel	Roces 1977: 627
Biral	Small double outrigger canoe, logboat. Sometimes without outriggers	Green et al 1995
Biray	Large vessel or frigate. Can include caracoa. Also large vessel in Cagayan	Scott 1994: 206
Biroco	Double outrigger Viroco, virocco,biroko	Filipino Heritage: 518
Boggo'	Logboat, double ended, can have single plank extension, single or double Birau, bitok	Nimmo 1980: 29
Boteng pamunuanan	Dugout with European style hull, 5 oars or 10 paddlers, tiller and rudder	Naval Int 1944(a): 100
Calalud	Small vessel with oars or sails	Martinez de Zúñiga 1893: 513
Camanomi	Similar to a Korakora, outrigger, sails, paddles	Jacobs 1971
Canoa	Generic name for dugout for 1-2 people	Naval Int 1944(a): 110

Carabela	Galley	
		Martinez de Zúñiga 1893: 513
Caracoa	Sleek, double ended cruiser, fighting deck or shelter, bugsay or gaor	
	Corocoro, korekore, karakoa	Scott 1994: 206
Carangail	Raiding ship	
		Galang 1941: 295
Carayas	Fishing raft	
		Pâris 1841 pl 75
Casco	Small native lighter using for cargo handling, Pâris indicated bamboo beams,	
		Naval Int 1944(a): 110
Chalana	Large flat-bottomed lighter	
	Scow	Naval Int 1944(a): 110
Chalupa	Light open boat of Spanish origin	
	Shallop	Galang 1941: 295
Champan	Boat of Chinese origin	
	Sampan	Galang 1941: 295
Chinchorrohan	Larger bangka	
		Naval Int 1944(a): 98
Chinedkeran	Large rowing boat, 12-4 oars per side	
		Hidalgo1996
Cho	Small sailing vessel with sails of rushes	
		Galang 1941: 296
Dalakit	Wooden raft	
		Scott 1994: 265
Dapang	Sailing boat with outriggers,	
		Naval Int 1944(a): 83
Daya	Flat open boat, developed into champan	
	Paya	Scott 1994: 62-3
Dinalapang	Boat with rounded prow, tiller and rudder	
		Naval Int 1944(a): 90
Djenging	Houseboat, log boat plank extensions, outriggers, carved, antique houseboat	
	Balutu, kubu	Nimmo 1990: 14
Falua	Small open boat with oars or sails.	
	Faluca, felucca, faluwa	Galang 1941: 296
Funea	Small clinker-built rowboat of Japanese origin	
		Galang 1941: 297
Fusta	Small galley with lateen sails of Mediterranean origin	
		Galang 1941: 297
Gakit	Temporary bamboo raft	
		Scott 1994: 265

Galizabra	Vessel with lateen sails, of Arabic origin	Galang 1941:297
Garay	Classic pirate ship from Sulu, 40-60 oars, outriggers	Orosa 1923
Gobang	River dugout	Naval Int 1944 (a): 122
Goleta	Two masted, fore and aft rigged trader. Schooner	Galang 1941: 298
Guilalas	Similar to casco or barangay	Galang 1941: 298
Janga	Small armed raft-like vessel	Galang 1941: 299
Joanga	Large version of caracoa Busanga (French), lanong,	Pâris 1841
Junco	Chinese vessel of bluff lines, high poop, rudder. Junk	Galang 1941: 299
Junkun	Dugout with plank extension, ribs in larger vessels	Nimmo 1980: 29
Kalulas	Large craft with paddles and sails, but no outriggers. Twenty to fifty rowers.	Jacobs 1971
Kinalawong	Canoe of 5 pieces in Cotobato City	Scott 1992: 339
Kudastre	Cargo vessel with outriggers and 3 to 4 booms. Tinabla	Naval Int 1944(a): 106
Kumpit	Motor launch, planked and edge-joined, transom stern Kapuan, temper,	Green et al 1995
Kupit	Large vessel for trade in Luzon Kopit	Scott 1994: 206
Kurikanan	Small, speedy craft with outrigger, sails and paddles for 1 or 2	Naval Int 1944(a): 110
Lakafuna	A large size Korakora 'like a galleon'	Jacobs 1971
Lampitaw	Small boat	Galang 1941: 299
Lancan	Small boat	Galang 1941: 299
Lepa lepa	Plank built, sometimes double outrigger, 2 booms, quarter rudder, elbow Pakoer, lepa, lipa, pidlas	Nimmo 1990: 7
Lete lete	Plank boat, double ended, prominent bow and stern posts, small cabin, long	Naval Int 1944 (a): 74

Lipa	Houseboat - no outriggers but quarter paddles, spatulate stern	Naval Int 1944(a): 84
Lorcha	Cargo vessel, no outriggers	
	Palowa	Naval Int 1944(a): 108
Lunday	Dugout without outriggers for inshore or rivers	
	Lunde	Naval Int 1944(a): 112
Malo	Large trader, with rattan washboards	Scott 1994: 206
Mangcuerna	Small boat used for carrying merchandise. Oars	Naval Int 1944(a): 112
Njonjau	Small perahu used for fishing	Jacobs 1971
Olan mesa	Flat bottomed plank built boat, sternpost higher, double outrigger with 2 booms	Naval Int 1944 (a): 80
Onadaon	Light baroto	Naval Int 1944(a): 97
Ontang	Small raft for fishing	Nimmo 1980: 31
Orembai	Plank built boat, double ended, high sheer stem and stern	Naval Int 1944 (a): 88
Pakarangan	Beamy, extended logboat, paddles, quarter rudder	Naval Int 1944(a): 122, 130
Palowa	General cargo boat, no outriggers	Naval Int 1944(a): 108
Palungan	Dugout to be filled with offerings	Nimmo 1880: 31
Paluwa	Wooden boat with rounded bottom	
	Tataya, chinedkeran	Uy & Shaw 2000:61
Pamukatan	Extended logboat, one strake, narrow hull	
	Pamatulakan	Naval Int 1944 (a)
Panagatan	Light baroto	Naval Int 1944(a) 97
Panco	Vessel for pirate raids. Very fast, up to 200 men.	Galang 1941: 300
Pangue	Small boat for use in rivers	Galang 1941: 301
Parao	Larger version of the Balandra, 2 masts, bowsprit outriggers with 3 or 4 booms	
	Prahu, perahu, parau,	Naval Int 1944(a): 104
Parcado	Large 2 masted outrigger coaster with nipa cabin	Naval Int 1944(a): 112

Pasalap	Double outrigger sailboat	Filipino Heritage: 717
Patache	Spanish style vessel Patax, pataxie	Valdeverde Map
Perahu	Generic name for cargo ship - two masts, oars Prau, proa, parao	Dictionary of the World's Watercraft: 443
Petta	Plank built canoe, seven pieces or more	Green et al 1995
Pilang	Extended logboat, bifid bow, outrigger, up to 4 booms Pilan, pelang, tonda'an	Nimmo 1980: 18-19, 30,
Pinanyo	Dugout, one man, quarter paddle, 3 booms Sibidsibarab	Naval Int 1944(a): 100
Piragua	Dugout Pirogue	Pâris 1842 âl 71,72
Pitsuya	Plank-built boats with bamboo rafts each side, pushed by tinguines (bamboo)	Naval Int 1944(a): 112
Ponten	Stout coaster of European design - 80-130 tons Pontin	Naval Int 1944(a): 112
Rorehe	Large galley with fifteen to thirty rowers and six to ten warriors	Jacob 1971
Salisipan	Classic raiding and pirate vessel	Warren 1981: 256
Sapiaowan	Boat without outriggers, 14 paddles, quarter paddles, flat bottom	Naval Int 1944(a): 98
Sapit	Plank built boat with keel and rudder Sappit	Naval Int 1944 (a): 122
Saraboa	Fishing raft Salambao	Galang 1941:302
Sata	Large, heavy barge used for lime, rocks etc.	Scott 1994: 206
Seberan	Sailboat with double outrigger	Filipino Heritage: 717
Sibidsibaran	Light baroto Pinango	Naval Int 1944(a): 100
Sikayan	Five part canoe	Green et al 1995
Small bangka	Outrigger boat	Pâris 1841 pl 74
Soma	Chinese vessel for merchandise trade with China	

		Galang 1941: 302
Taculi	Cargo boat using oars	
	Takuli	Naval Int 1944(a): 112
Talangkas	Light, swift vessel, points well	
		Scott 1994: 206
Talisay	Small boat made of Talisay wood	
		Galang 1941: 302
Tango	Logboat with rattan washboards	
		Butuan Museum
Tapak	Plank built boat with dugout keel and nipa washboards	
		Scott 1994: 206
Tapaque	Large roomy vessel for cargo or general use	
	Lapis	Galang 1941: 303
Taratana	Spanish vessel	
		Galang 1941: 303
Tataya	Carvel hull with 3 oars each side	
		Naval Int 1944(a): 112
Tempel	Motor launch, planked and edge-joined with transom stern	
	Temper	Green et al 1995
Tilimbaw	Logboat with added washboard	
	Yahit	Scott 1994: 62
Tinabla	Cargo vessel. Solid wooden bulkheads	
		Naval Int 1944(b): 106
Tuguli	Small tender for proas	
		Galang 1941: 303
Vilox	Lighter	
		Naval Int 1944(a): 112
Vinta	Sailing boat with bifid stem and stern, often carved	
	Pilang	Naval Int 1944(a): 82
Virey	Inshore vessel, double outrigger, sewn vessel	
	Biray, viray, garay	Naval Int 1944(a): 112
Virocco	Light vessel made in Catanduanes	
	Biroco	Galang 1941: 304

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Appendix B: Glossary of Terms

Word or phrase	Language	English meaning	Reference
Abacá	Tagalog, Bikolano	A plant of the banana family for clothing, Manila hemp	Sievert, 2009
Abay	Tagalog, Visayan	Ships in convoy	Mentrida, 1637
Abel	Ilocano	Local cotton piece	Panganiban, 1973
Abluwang	Visayan	Drill or awl (abluwang)	Scott, 1994: 56
Agar	Visayan	Ribs for lashing plank-built boat strakes	Alcina, 1668, 3, 8, pp 165
Amidships	English	Middle of vessel, longitudinally or transversely	Steffy, 1994
Anay	Malay, Tagalog	Termites which eat timber	Alcina, 1668, 3, 9, pp 183
Apal	Visayan	Derelict vessel	Mentrida, 1637
Aramay	Visayan	Outer layers of log, prone to worm infestation	Alcina, 1668, 3, 8, pp 169
Arribada	Spanish	Vessel forced to return to port of departure	Crossley, 2011, pp 150
Arrufo, arrufadora	Spanish	Sheer	Velázquez, 1970, pp 593
Awil	Visayan	Anchor offshore	Mentrida, 1637
Axial rudder	English	Central timber to control direction	Steffy, 1994
Baguio, bagyo	Tagalog	Typhoon	Vicassan, 2006
Bahi	Visayan	Plug of palm wood used for dowels, *arnis escrima*	Alcina, 1668, 3, 8, pp 171
Baklag	Visayan	Human sacrifice by using a body as a roller	Alcina, 1668, 3, 9, pp 193
Baligya	Visayan, Tagalog	Trading in foodstuffs by sea	Mentrida, 1637
Bangga	Visayan	Ships in battle	Mentrida, 1637
Bapor	Spanish	Port, left side looking forward	Velázquez, 1970, pp 494

Barayong wood	Visayan	Euphoria didyma Ponce, Ponce, Maurillo, 1991, pp 18
Baruk, baroc	Visayan	Material for caulking the planks Alcina, 1668, 3, 8, pp 175
Batten	English	A small spar, usually bamboo to extend the leech Worcester, 1966 pp 133
Beam	English	Transverse measurement of a ship at its widest Dear & Kemp, 2005, pp 38
Bintung, bingkung,	Visayan	Twisted adze Alcina, 1668, 3, 8, pp 167
Boga, bugadores	Spanish	Rower, crew Alcina, 1668, 3, 10, pp 199
Bolo	Tagalog	Jungle knife Scott, 1944
Botong	Visayan	Slave trading by boat Mentrida, 1637
Bow	English	Forward part of the vessel, where strakes curve inward Steffy, 1994
Braza	Spanish	Six feet, one fathom Velázquez, 1970, pp 97
Bugnusan,	Visayan	Long rope used as a halyard, associated block and tackle Alcina, 1668, 3, 9, pp 193
Bugsay, bugsey	Visayan	Paddle or oar. Five or six palmos long, blade pointed Alcina, 1668, 3, 10, pp 197
Bukag	Visayan	Heart of a log, prone to rot or split Alcina, 1668, 3, 8, pp 169
Bukavi	Visayan	Waterspout Alcina, 1688, 2, 13, pp 266
Bungalos	Visayan	Boat channels or routes Mentrida, 1637
Bung-bung	Visayan	Delayed by adverse winds Mentrida, 1637
Buri	Tagalog	Palm fibre from corypha gebanga Scott, 1981, 16
Burutlan	Visayan	Platform in centre of vessel for fighting or working sails Alcina, 1668, 3, 9, pp 187
Cabo negro	Spanish	Fibre of the sugar palm used to produce cordage, Scott, 1981 pp3
Calafatear	Spanish	Caulk a hull Velázquez, 1970, pp 91
Caulk	English	Drive fibre material into planking seams Steffy, 1994
Clinker	English	Construction with outer planks overlapping Steffy, 1994

Commoodies	Unknown	Large steering paddles Forrest, 1779
Cordage	English	General term for ropes and cables Steffy, 1994
Cordaje	Spanish	Cordage Velázquez, 1970, pp 144
Cuaderna	Spanish	Frame timber Velázquez, 1970, pp 259
Dagdag	Hiligaynon	To jettison cargo Mentrida, 1637
Dalabay	Visayan	To paddle or row with the sail pulling Mentrida, 1637
Daldag, daras	Visayan	Straight adze Alcina, 1668, 3, 8, pp 167
Dalupi	Tagalog, Visayan	Washboards of nipa palm fibre Alcina, 1668, 3, 10, pp 201
Dapak, tapak	Visayan	Sheathing of a ship hulk Mentrida, 1637
Dapiya, dalapiya,	Visayan	To be wrecked Mentrida, 1637
Daramba	Visayan	Platforms on katig for paddling, rowing or fighting Alcina, 1668, 3, 9, pp 189
Daya, paya	Visayan	Flat, open boat Scott, 1994 pp 63
Depth	English	Vertical height between bottom of keel and gunwale Dear & Kemp, 2005, pp 587-8
Dongon	Visayan	A local wood, heretiera litorales, used for barangay boats Scott, 1981 pp 3
Dowel	English	Cylindrical piece of wood to align two strakes Steffy, 1994
Draft or draught	English	Vertical height between bottom of keel and waterline Dear & Kemp, 2005, pp 177
Dukot, dukton	Visayan	First strake above the keel Alcina, 1668, 3, 8, pp 169
Embocadero	Spanish	Strait of San Bernadino Alcina, 1688, 2, 13, pp 267
Estribor	Spanish	Starboard Velázquez, 1970, pp 631
Filipinos	Spanish	Originally meant Spanish settlers, now all inhabitants Crossley, 2011,
Frame	English	Transverse timber or timbers to shape of hull Steffy, 1994
Futtock	English	Middle frame timber Steffy, 1994

Gamu, kaong,	Visayan, Tagalog	Fibre of sugar palm, arenga pinnata Scott, 1981, 1994
Gaong	Visayan	Woven sail Scott, 1981, pp 16
Garboard strakes	English	Plank next to the keel Dear & Kemp, 2005, pp 235
Gaut	Tagalog, Visayan	Long oars like a plate Alcina, 1668, 3, 10, pp 203
Gayung, gayong	Tagalog, Visayan	European style oars Alcina, 1668, 3, 10, pp 205
Genol	Spanish	Futtock, a frame timber Scott, 1981, pp 16
GRT	English	Gross registered tonnage. Traditionally 1 grt = 100cft Dear & Kemp, 2005, pp 587-8
GT	English	Capacity-derived index for measuring ship sizes Dear & Kemp, 2005, pp 587-8
Gunwale	English	Upper edge of vessel side Steffy, 1994
Hagukun	Visayan	To reduce windage by lowering sail and awning Mentrida, 1637
Halum	Visayan	Dark water indicating shoals Mentrida, 1637
Hamgir	Visayan	To sail following the coast Mentrida, 1637
Hampil	Visayan	To anchor on the beach Mentrida, 1637
Hampil	Bikolano	Joint partnership for raiding Marcos de Lisboa, 1618
Hanglar	Visayan	Rollers used to launch a ship Alcina, 1668, 3, 9, pp 193
Hinakay	Visayan	To pay freight or passage money Mentrida, 1637
Hog	English	Drooping strain on the ends of a hull Steffy, 1994
Hooked scarf	English	Scarf joint with angular ends offset to lock the joint Steffy, 1994
Ipil	Visayan	A kind of sticky resin given off in sealing the dowels Alcina, 1668, 3, 8, pp 177
Jeme, Geme	Spanish	Distance from the end of thumb to end of forefinger Velázquez, 1970, pp 396
Kakas, Katkat	Visayan, Tagalog	Awning blown away Mentrida, 1637
Kalog	Visayan	Spoon bit Scott, 1994

Karankan	Visayan	Overfalls Alcina, 1988, 2, 13, pp 261
Katig, Kates,	Visayan, Tagalog	Outrigger and outrigger floats Alcina, 1668, 3, 8, pp 169
Kawas, hawas	Visayan	To disembark or unload cargo Mentrida, 1637
Kayang, cayang,	Visayan	Folding sun roof or rain protection of palm leaves Alcina, 1668, 3, 9, pp 189
Keel	English	Main longitudinal timber of a hull, the backbone of hull Steffy, 1994
Keelson	English	An internal keel to give longitudinal strength Steffy, 1994
Kibang	Visayan, Tagalog	Divining by boats rocked by the diwata Mentrida, 1637
Kilikili	Visayan, Tagalog	Adding buoyancy by lashing additional bamboos to hull Mentrida, 1637
King plank	English	Central strake of a hull without a keel Steffy, 1994
Kiyakiya	Visayan	Rolling of a boat without outriggers Mentrida, 1637
Knee	English	Angular timber to reinforce a joint Steffy, 1994
Kutor, kutod	Visayan	Line to mark centre of a log to be dug out Alcina, 1668, 3, 8, pp 163
Lagari	Visayan	Saw Scott, 1994
Laka	Visayan	When tambuko are broken off Mentrida, 1637
Lamba, lumba	Visayan	A race between boats Mentrida, 1637
Lampitaw	Visayan	A scouting or despatch ship sailing at speed Mentrida, 1637
Langpas	Visayan	To sail at top speed, whilst lightly loaded Mentrida, 1637
Lantaka	Tagalog, Malay	Small brass cannon Vicassan, 2006
Lawig	Visayan, Tagalog	To drop anchor Mentrida, 1637
Lawigan	Visayan, Tagalog	An anchorage Mentrida, 1637
Lawigon	Visayan, Tagalog	Anchor cable Mentrida, 1637
Layar tanja	Malay	Tilted rectangular sail Doran 1981: 40

Legua	Spanish	League, 8,000 Spanish yards, 3 nautical miles Velázquez, 1970, pp 407
Llaveta, batangan	Visayan, Ilocano	Framework for mounting outriggers Alcina, 1668, 3, 9, pp 183
LOA, length	English	Entire length of a boat or ship including fittings Steffy, 1994 pp 253
Locked dowel	English	Dowel locked in to position with a hardwood pin Scott, 1981 pp5
Lolan	Visayan	Cargo in hull Mentrida, 1637
Lombo	Visayan	To replace damaged timbers of the hull Mentrida, 1637
Lu-aw	Visayan	Small boat putting out to sea Mentrida, 1637
Lubag	Visayan	Carved curvature of planks Alcina, 1668, 3, 8, pp 169
Lug or cleat	English	Projection used for lashing ribs. Tambuko COD, 1982
Lug sail	English	Rectangular, four cornered sail COD, 1982
Lukub, lokob	Visayan	Augur or gouge with twisted point Alcina, 1668, 3, 8, pp 165
Lunor	Visayan	Second strake above the keel Alcina, 1668, 3, 8, pp 169
Lutau, lutaw	Visayan	A simplified sailing rig Alcina, 1668, 3, 9, pp 191
Luting	English	Caulking, especially of clinker built vessel Steffy, 1994
Luyan	Visayan	Rising and falling on the waves Mentrida, 1637
Makilas	Visayan	Speed of a ship Mentrida, 1637
Mamamilit	Visayan	Human sacrifice on launching a caracoa Mentrida, 1637
Manga de agua	Spanish	Waterspout Alcina, 1988, 2, 13, pp 266
Mangiyaw,	Visayan Tagalog	Marine piracy, raiding and guerrilla war Alcina, 1668, 3, 8, pp 161
Maso	Tagalog	Hammer Pilipino-Ingles Diksyunaryo
Mast step	English	Mortise cut in keelson or blocks assembled to seat mast Steffy, 1994
Mástil	Spanish	Mast Velázquez, 1970, pp 394

Metacentre	English	Intersection of line through centre of gravity, buoyancy Steffy, 1994
Mortise and tenon	English	Union of timbers, projection (mortise) in cavity (tenon) Steffy, 1994
Nipa	Tagalog	Woven palm, nypa fruticans Scott, 1981, pp 16
NRT	English	Net registered tonnage, excluding non-cargo space Dear & Kemp, 2005, pp 587-8
Oenques	Spanish	Shrouds Velázquez, 1970, pp 598
Oray	Bikolano	Bulk loading of rice in a hull Scott, 1981, pp 24
Oway	Visayan	To pull a boat along a waterway with rope Mentrida. 1637
Padaloman	Tagalog	Chinese compass. Scott, 1981, pp 18
Paito, tigib	Tagalog	Chisel Pilipino-Ingles Diksyunaryo
Pagkiray	Visayan	Narrow fighting platforms on each side as 'eyebrows' Alcina, 1668, 3, 9, pp 187
Pakang, pacang	Visayan	Mallet Alcina, 1668, 3, 8, pp 165
Palaku, palatio	Tagalog	Small axe Pilipino-Ingles Diksyunaryo
Palmo	Spanish	Measure from thumb to small finger extended Velázquez, 1970, pp 475
Pamuta,	Visayan	Wooden nails to seal the dowels, 'to close the eyes' Alcina, 1668, 3, 8, pp 177
Panday	Tagalog, Visayan	Craftsmen, blacksmith Alcina, 1668, 3, 10, pp 199
Patuk	Tagalog	Shipbuilding tool Salcedo, 1998
Pilan	Khmer	Cambodian logboat, expanded Zhou Daguan, 2007 pp 78
Pilpil	Visayan	To drift Mentrida, 1637
Polang	Visayan	To be lost with all hands Mentrida, 1637
Popa	Spanish	Stern Velázquez, 1970, pp 684
Powat, limpowat	Visayan	Pitching Mentrida, 1637
Proa	Spanish	Bow Velázquez, 1970, pp 76

Quilla	Spanish	Keel Velázquez, 1970, pp 355
Rabbet	English	Grooves cut in timber for seating joining timber Steffy, 1994
Rattan	Various	Rotan in Malay, cane native to the Philippines. Scott, 1981, pp 4
Recateado	Spanish	To race boats with bets Alcina, 1668, 3, 10, pp 211
Rib	English	Small transverse member to stiffen outer skin of hull Steffy, 1994
Romba	Visayan	To race boats Alcina, 1668, 3, 10, pp 211
Saiyo	Visayan	Plane Scott1994
Sag	English	Distortion of hull by improper loading Steffy, 1994
Sagaysay	Visayan	To row at a forced speed Mentrida, 1637
Sakay	Visayan, Tagalog	To travel by water Mentrida, 1637
Sakayan	Visayan, Tagalog	Boat or ship (generic) Mentrida, 1637
Sangbat	Visayan	To pick up survivors Mentrida, 1637
Sangiya, hangiya	Visayan	Hauled out on the beach with stern in water Mentrida, 1637
Sangkap	Visayan	To equip a ship with a full crew Mentrida, 1637
Sawali	Visayan, Tagalog	Wash strake of woven material such as rattan Mentrida, 1637
Scarf	English	Overlapping joint to connect two timbers Steffy, 1994
Sheer	English	Longitudinal sweep of a vessel's sides Steffy, 1994
Shroud	English	Rope to steady a mast to the hull Steffy, 1994
Shunting	English	A sailing technique, reversing direction without tacking Doran, 1981: pp 86, 87
Sibir	Visayan	Indications of a clear channel Mentrida, 1637
Sibug	Visayan	To row or paddle backwards Mentrida, 1637
Sigaksak	Visayan	To run aground on a reef or sandbar Mentrida, 1637

Sobre-quilla	Spanish	Keelson Velázquez, 1970, pp 356
Soga	Spanish	Rope, rigging Alcina, 1668, 3, 9, pp 193
Somlol, sompong	Visayan	To row or paddle into the wind Mentrida, 1637
Sponson	English	Exterior supporting timber on hull, or poling platform COD, 1982
Sprit sail	English	Small square sail, usually with a diagonal boom Smyth, 1867
Steering oar	English	Oar used to steer a small vessel from stern or side Steffy, 1994
Stern	English	After end of vessel Steffy, 1994
Straits of Arian	English	Spanish expression for NE Passage Crossley, 2011
Strake	English	Plank or series of planks running from bow to stern Steffy, 1994
Stringer	English	Longitudinal timber fixed to inner hull or frames Steffy, 1994
Sugi	Visayan	Tool to mark the strakes to achieve a tight fit Alcina, 1668, 3, 8, pp 173
Sukmur	Visayan	Down by the bow Mentrida, 1637
Tadic, tadikan	Visayan	Vertical poles for mounting the outrigger floats or katig Alcina, 1668, 3, 9, pp 183
Talulura	Visayan	A fine rattan or bamboo used to fasten the strakes to ribs Alcina, 1668, 3, 9, pp 181
Tambuko, tamboco	Tagalog, Visayan	Thicker portion of plank or dugout for fastening ribs Alcina, 1668, 3, 8, pp165
Tampiyok	Visayan	Head wind Mentrida, 1637
Thwart	English	Transverse plank to seat rowers, support masts Steffy, 1994
Tikyaob	Visayan	To capsize Mentrida, 1637
Timbaw, timbao	Visayan, Tagalog	Additional strakes added to a log boat Alcina, 1668, 3, 8, pp 165
Tinimbaw	Visayan	Extended logboats Alcina, 1668, 3, 8, pp 165
Tokor	Visayan	To put a ship in dry dock Mentrida, 1637
Tolot, solosor	Visayan	Following wind Mentrida, 1637

Glossary

Toway, tomoway	Visayan	Captain Mentrida, 1637
Transom	English	Athwart ship member to strengthen the hull Steffy, 1994
Treenail	English	Rounded hardwood piece driven through timbers Steffy, 1994
Tugas	Visayan	Hardwood used for stem posts, molave, vitex pariflora Alcina, 1668, 3, 8, pp 169
Tumblehome	English	Inward curvature of a vessels upper sides Steffy, 1994
Ulat	Visayan	To raise a sail Mentrida, 1637
Upak, dagpak	Visayan, Tagalog	Bark used for washboards Alcina, 1668, 3, 10, pp 201
Usus, osos	Visayan	A process of tightening the hull by lashing Alcina, 1668, 3, 8, pp 169
Utao	Visayan	To display captives for ransom Scott, 1981, pp 27
Vara	Spanish	Yard, 835.9 mm Alcina, 1988, 2, 8, pp

Appendix C: List of References

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