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

by

Martin Roderick Stead

Thesis for the degree of Master of Philosophy

March 2018
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.
Table of Contents

Table of Contents............................................................................................................. iii
List of Figures ................................................................................................................ viii
DECLARATION OF AUTHORSHIP............................................................................. xii
Acknowledgements....................................................................................................... xiii
Definitions, Style and Abbreviations........................................................................ xiv

Chapter 1 Introduction................................................................................................. 15
1.1 Previous Approaches .................................................................................. 15
1.2 Research Question ..................................................................................... 16
1.3 Present Approach......................................................................................... 18
1.3.1 Origins of Philippine Maritime Culture ............................................ 18
1.3.2 Physical Environment ............................................................................... 19
1.3.3 The Archaeological Tradition ................................................................. 20
1.3.4 Historical Accounts .................................................................................. 21
1.3.5 Ethnological Studies ................................................................................ 22
1.3.6 Linguistic Evidence ................................................................................... 22
1.3.7 Comparison with Other Southeast Asian Evidence .................................. 23
1.4 Basic Boat Design ......................................................................................... 23
1.4.1 Plank-Built Boats ..................................................................................... 24
1.4.2 Logboats .................................................................................................... 26
1.4.3 Other vessel Types .................................................................................. 26
1.4.4 Outriggers .................................................................................................. 27
1.4.5 Motive Power .............................................................................................. 27
1.4.6 Boat Nomenclature ................................................................................... 28

Chapter 2: The Physical Environment of the Philippines................................. 35
2.1 Size and Location .......................................................................................... 35
2.2 Geology and Geomorphology ...................................................................... 35
2.3 Climate ............................................................................................................ 37
6.4.4 Sewn Boats in the Philippines .............................................................145
6.4.5 Origin of the Sewn Boat Tradition ....................................................148
6.5 Regional Variations in Design .............................................................149
6.6 Evolution of the Modern Banca ...........................................................150

Chapter 7: The Caracoa and the Joanga ......................................................163
7.1 Caracoa ..................................................................................................163
7.2 Confusion of Names .............................................................................164
7.3 Description of the Caracoa .................................................................165
7.4 The Joanga or Juanga .........................................................................166
7.5 The Construction of the Caracoa .......................................................167
7.6 Sailing Performance of the Caracoa ....................................................169
7.7 How was the Caracoa different from the Balangay and Similar Planked Craft? ..........................................................170
7.8 The Role of the Caracoa in Pre-Colonial Society ...............................170
7.9 The Evolution of the Caracoa ..........................................................171
7.10 The Caracoa as the Ultimate Military Asset ....................................173

Chapter 8: Motive Power, Outriggers, Shipbuilding Tools and Raw Materials .................................................................179
8.1 Paddles and Oars ..............................................................................179
8.2 Sailing Rigs .....................................................................................180
8.3 The Outrigger .................................................................................182
8.4 Shipbuilding Tools ...........................................................................184
8.5 Raw Materials for Shipbuilding .......................................................186
8.6 Innovation in Tools and Equipment .................................................188

Chapter 9: The Influence of Other Maritime Traditions ..........................201
9.1 The Austronesian Connections .........................................................201
9.2 Early Contact with Southeast Asia ...................................................201
9.3 Influence from the Indian Subcontinent .........................................203
9.4 Contact with Arabic Traders, Sailors and Missionaries ..................204
9.5 Trade and Tribute Relations with China .........................................205
9.6 The Spanish Colony ................................................................. 206
9.7 The Influence of Chinese Immigration .............................. 209
9.8 The Impact of Foreign Influences .............................................. 210

Chapter 10: Conclusions and Interpretation of the Evidence .......... 219
10.1 The Application of the Adams Model ................................. 219
10.2 The Origins of Principal Characteristics of the Traditional Vessels in the Sixteenth Century ........................................ 220
10.2.1 Hand Carved Timber .............................................................. 221
10.2.2 Outriggers ............................................................................... 221
10.2.3 Dowel and Lashed-Lug Technology ..................................... 222
10.3 The Evidence from the Philippines ....................................... 224

Appendix A: Philippine Boat Names ........................................... 229
Appendix B Glossary of Terms .................................................... 237
Appendix C List of References ....................................................... 247
List of Figures

Figure 1.1 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
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 downloaded on 15/3/2015
Figure 2.5 Monsoonal wind direction, www.goodreads.com downloaded on 15/3/2017
Figure 2.6 Sea temperature in Southern Luzon, http://www.seatemperature.org/public/chart downloaded on 20/3/2015
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 settlement of the Spanish in the Philippines after Barrow, History of the Philippines, 1905
Figure 4.1 Butuan site re-excavation, photo: M. R. Stead
Figure 4.2 Rosales longboat, 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
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, photo: M. R. Stead
Figure 5.6 Logboat in Cebu drawn by M. R. Stead
Figure 5.7 Manila Bay Logboat in Cardiff
Figure 5.8 Manila Bay Logboat drawn by M. R. Stead
Figure 5.9 Model from Pitt Rivers Museum, photo: M. R. Stead
Figure 5.10 Logboat in Siliman University, Dumaguete, photo: M.R. Stead
Figure 5.11 Example of the Dumaguete 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
Figure 5.15 Tango in Butuan Museum drawn by M. R. Stead
Figure 5.16 The bilus and balandra, Visayan fishing boats from Admiralty Guide 1944 pp 103
Figure 5.17 Location 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 my M. R. Stead
Figure 5.24  Mainit No 6, photo: M. R. Stead
Figure 5.25  Last surviving logboat at Buhi Lake, photo: M.R. Stead
Figure 5.26  Survey Locations in Bikol, M. R. Stead
Figure 5.27  Donsol No2 logboat, photo: M. R. Stead
Figure 5.28  Donsol No 2 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
Figure 5.34  Interview results
Figure 5.35  Tabulated results of logboat studies
Figure 5.36  English version of questionnaire
Figure 5.37  English version of consent form
Figure 5.38  Radiocarbon dating report on Rosales logboat
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 Linschoten 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 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 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: Mrs 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 2007pp 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
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 corocoro 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 corocoro, from Pâris 1841: pl 97
Figure 7.6: Drawing of a kora kora, from Röding, 1798
Figure 7.7: Kora kora from the Weber Collection, A4752 126cm x 26cm x 57cm courtesy of Tropenmuseum
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, from Admiralty Guide 1944 pp83
Figure 8.8  A boom rig on a nineteenth century pirate raider, from Mouleon, 1890
Figure 8.9  A sprit 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, National Museum, photo: M R Stead
Figure 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 (arenge pinnata), photo: M. R. Stead
Figure 8.20  Abacá, the raw fibre of Manila ‘hemp’ in the Sorsogon Museum, photo: M. R. Stead
Figure 8.21  Illustration of a sponson from Folkard 1906 pp484
Figure 8.22  Oceanic sprit sail in the Philippines, downloaded from http://indigenousboats.blogspot.co.uk/2011 on 7/7/17
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  Indonesian 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 lorchca in the Ayala Museum, downloaded on 10/1/2017
Figure 9.6  Drawing of a boteng pamunuanan, from 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 1609 from 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, one of the illustrations on the Velarde Map of 1743
Figure 9.15  Construction sites of Spanish Galleons in Bikol, downloaded from raffibanzuela.blogspot.com on 15/3/2017
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
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:

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 online 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


Original signed by M. R. Stead on 31st March 2018

Signed: ..............................................................................................................

Date: ..................................................................................................................
Acknowledgements

The support and encouragement of staff and colleagues at the University of Southampton are gratefully acknowledged, particularly Dr L.K. Blue, Dr R.J. Whitewright and Dr J. Ransley.

The staff of the National Museum of the Philippines were also particularly helpful, especially Dr E. Dizon, Dr M.J.A. Bolunia and Ms L. Lacsina. Altogether eight research visits were made to the Philippines amounting to some six months in country. This included site visits in Luzon, Cebu and Mindanao and ethnographic research in Agusan, Negros Oriental, Bikol, Cebu and Central Luzon.

Thanks are also due to the contacts and colleagues who assisted research visits to Indonesia (including Sumatra, Java, Bali, Sulawesi and the Moluccas), Cambodia, Thailand, Vietnam and Sarawak.

A Joan du Plat Award was received in 2013 and the proceeds were applied to the costs of C14 dating of Philippine wood samples. A John Starkie Ethnographic Award was received in 2015 to assist in the cost of research in the Philippines. The support of the Nautical Archaeology Society in facilitating these awards is gratefully acknowledged.

Thanks are also due to the staff of museums and institutions consulted in many countries. In the Philippines, these were the National Museum in Manila, the Ayala Heritage Museum, the Central Bank Museum, Fort San Pedro, the Silliman University Museum, the Regional Museum in Butuan, and the Museo Sugbo in Cebu. In the UK, institutions include the National Maritime Museums in Greenwich and Falmouth, the British Museum, the Pitt Rivers Museum, the Ashmolean, the Museum of Archaeology and Anthropology in Cambridge, and the Cardiff and the Eyemouth World of Boats. In Hawai’i the Bishop Museum was visited. In Spain, research was carried out at the Archivo General de Indias in Sevilla and the Maritime Museum in Cartagena. In France, the Musée National de la Marine and the Musée du Quai Branly in Paris were visited. In the Netherlands, the Rijksmuseum Volkenkunde in Leiden, and the Tropenmuseum and the Sheepvaart Museum were helpful. In Indonesia, the Museum Bahari and the National Museum were visited, as well as the Kota Museum and the La Galigo Museum in Makassar and the Siwalima Museum in Ambon.
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
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
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). 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.

---

1 Alcina’s text reads ‘…de tantos y tan varios tamaños y aun nombres, que cada cual tiene el suyo propio, que son casi sin número’
Figure 1.1 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 configuration has been relatively stable since the end of the last glaciation (Austria, 1977: 7-13).
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, separate 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 Meteorological 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°C, 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 Sutigao 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 Sutigao 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 predominantly in the Sutigao 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 prehistoric 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 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 Southeast 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](http://www.pinoy.culture.com) downloaded on 10/1/2017
Figure 3.4 Golden image of Agusan, downloaded from [www.philippine-trivia.com](http://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: 64)
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 elaborate 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 stitches. 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 performance 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. Friederici 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.
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 $^{14}C$ 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 $^{14}C$ 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
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, monoxyylon 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 monoxyyle, 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).

80
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:
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
ERROR: stackunderflow
OFFENDING COMMAND: ~

STACK: